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e-Learning, e-Education, and Online Training

8th EAI International Conference, eLEOT 2022
Harbin, China, July 9–10, 2022
Proceedings, Part II

Part 2

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Preface

We are delighted to introduce the proceedings of the 8th European Alliance for Innovation (EAI) International Conference on e-Learning, e-Education and Online Training (eLEOT 2022). This conference brought together researchers, developers, and practitioners around the world who are leveraging and developing e-educational technologies as well as related learning, training, and practice methods. The theme of eLEOT 2022 was “New Trends of Information Technology and Artificial Intelligence in Education”.

The technical program of eLEOT 2022 consisted of 111 full papers, which were selected from 226 submissions following at least three single-blind reviews per paper, including two invited papers in oral presentation sessions at the main conference tracks. The conference tracks were as follows: Track 1 – Information Technology Promoted Teaching: Platforms and Systems; Track 2 – Artificial Intelligence-based Educational Modes and Methods; Track 3 – Automatic Educational Resource Processing; and Track 4 – Educational Information Evaluation. The technical program also featured two keynote speeches, which were “Mining the interesting patterns to aid the education system”, to focus on the advantages of using pattern mining models for knowledge discovery and pattern analysis, as well as how pattern mining helps to improve the effectiveness of studying/learning in an education scheme, by Jerry Chun-Wei Lin from Western Norway University of Applied Sciences, Norway, and “Machine Learning based Small Bowel Video Capsule Endoscopy Analysis: Challenges and Opportunities”, presenting a detailed comparative and critical analysis of existing research methodologies for small bowel capsule endoscopy and evaluating these methods based on the aspects considered significant by clinical experts such as population study, bias, data split type, validation method, and prospective nature of the experiments, by Irfan Mehmood from University of Bradford, UK.

Coordination with the steering chair, Imrich Chlamtac, was essential for the success of the conference. We sincerely appreciate his constant support and guidance. It was also a great pleasure to work with such an excellent organizing committee team for their hard work in organizing and supporting the conference. In particular, we are grateful to the Technical Program Committee who completed the peer-review process and helped to put together a high-quality technical program. We are also grateful to Conference Manager Kristína Havlíčková for her support and to all the authors who submitted their papers to the eLEOT 2022 conference.

We strongly believe that the eLEOT conference provides a good forum for all researchers, developers, and practitioners to discuss all science and technology aspects that are relevant to e-learning and e-education. We also expect that the future eLEOT conferences will be as successful and stimulating as this year’s, as indicated by the contributions presented in this volume.

March 2023

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Contents – Part II

Contents – Part I

IT Promoted Teaching Platforms and Systems

Automatic Educational Resource Processing

An Auxiliary Recommendation Method for Online Teaching Resources of Ideological and Political Courses in Colleges Based on Content Association

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Abstract. The rapid growth of network teaching resources brings more learning opportunities for people, but also makes it more and more expensive for users to find the resources they need, and users often get lost in a large number of resources. In view of the problem of low coverage of existing teaching resource recommendation methods, this paper studies a resource recommendation method of online ideological and political courses based on content correlation. In this method, word frequency-inverse document matrix (TF-IDF) is used to mine the keywords of ideological and political teaching resources, and the user interest description matrix is established, and the content correlation degree is calculated by cosine similarity. Top-k online teaching resources of ideological and political courses in universities that are most similar to the target customer's interest description vector are selected based on the correlation degree and recommended to the user. The results show that the accuracy rate and coverage rate of the proposed method are higher than those of the collaborative filtering and utility-based methods, indicating that the proposed method has better performance.

Keywords: Content association · Ideological and political courses in universities · Online teaching resources · Auxiliary recommendation method

1 Introduction

The Internet provides many development opportunities for modern education and a new platform for ideological and political education for college students. Higher education must actively seize the Internet as the main position of ideological and political education, improve the ideological and political education environment for college students, and improve the effectiveness and influence of ideological and political education. College students are the main audience of the mass media. Internet provides sufficient ideological and political education resources for college students, extends the time and space of ideological and political education, and speeds up the modernization process of ideological and political education. However, the phenomenon of the integration and

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confrontation of various ideological trends is gradually increasing, all kinds of information about ideological and political education can easily covered by a large number of network resources, especially the obvious trend of decentralization and fragmentation of educational resources, information overload has become a serious problem facing college students' ideological and political education, and the access to educational resources is deeply disturbed. A large number of irrelevant resources seriously interfere with the accurate selection of ideological and political education resources needed by college students. Personalized recommendation system becomes an important tool to solve this problem. It can effectively recommend students according to relevant algorithms by mining their needs or interests.

At present, there are two commonly used recommendation methods, namely collaborative filtering recommendation and utility-based recommendation. The former is based on the technology recommended to users by the data of neighbors. At the present, collaborative filtering algorithm has been studied the most and applied the most widely [1]. Collaborative filtering recommendation is to help users find preferences that they are interested in, that is, to find a group of users with similar interests, and then recommend the preferences that these users are interested in to the user. Of course, the content that a user does not like can also be used in the same way to generate recommendation results. Collaborative filtering recommendation method based on content filtering, it is not recommended by direct analysis content, but through the analysis on the user's interest in numerous users find similar to those of the target customer groups, and then use these similar crowd evaluation of some information, and the quantitative data for the target users for some information on how to be fond of, finally, a similarity calculation and ranking are carried out, and the recommended results of ranking according to similarity are given. In the latter utility-based recommendation, project features (attributes) are used as background data, user utility functions are extracted based on multi-attribute utility theory to describe user preferences, utility functions are used to calculate the utility of each project to users, and projects with high utility are recommended to users [2]. Utility based recommendation system has the characteristics of no cold start, sparse problem and sensitivity to user preference change.

The two algorithms mentioned above have their own disadvantages. The former requires the user interest database to be large enough, otherwise those resources with a small number of favorite users cannot be fed back to target users as recommendation results. The latter requires users to enter utility functions, which limits the use of utility-based recommendation systems, which are currently used in a few auxiliary calculations. To solve the above problems, a content-based online teaching resource recommendation method for ideological and political courses in colleges and universities is proposed. This method uses the word frequency-inverse document matrix method (TF-IDF) to mine the keywords of ideological and political teaching resources, and calculates the content relevance through cosine similarity. Based on the correlation degree, the top-k online teaching resources of college ideological and political courses with the most similar description vector and the target customer's interests are selected and recommended to the user. The algorithm idea of content-based recommendation is to decide whether to recommend a project by comparing the similarity between the user's preferred project and the unknown project through reasonable use of project content. This study aims to improve the accuracy of online teaching resource recommendation for ideological and political courses in colleges and universities.

2 Online Teaching Resources of Ideological and Political Courses in Colleges and Universities are Recommended

With the continuous development of network technology and information technology, the application of the Internet is becoming more and more extensive, becoming an important way for people to obtain resources and knowledge. According to the 38th Statistical Report on Internet Development in China, as of June 2016, the number of Internet users in China has reached 710 million, an increase of 21.32 million compared with the end of 2015, with a growth rate of 3.1%. Among them, the number of online education users has reached 117.89 million, with a growth rate of 7% in half a year. The huge demand of online education promotes the development of education informationization. Compared with the traditional teaching mode, network teaching has gradually become a new and widely used education mode with its flexible and convenient learning mode. Teachers can obtain rich teaching resources through network teaching, and students can effectively reduce the burden of books, which is a beneficial supplement to the traditional teaching mode. With the continuous development of information education, teachers and students have become more and more dependent on network teaching mode and network teaching resources, and its application has become more and more extensive. At the same time, a large number of teaching resources have been published on the Internet, providing rich resources for learners and bringing convenience to the learning process of users. However, with the rapid increase of the number of teaching resources, it is more and more difficult for users to find the teaching resources they really need, and it takes more and more time, which leads to the so-called "teaching resource overload" and "information trek" phenomenon.

There are some problems in obtaining resources by using traditional information search technology, such as low accuracy and more redundant information. In addition, there should be a general demand direction when conducting information search. However, in many cases, users cannot clearly express their needs or do not know their specific needs. Therefore, traditional search technology has become more and more difficult to help users find information that is really useful to them. The successful application of personalized recommendation technology in the field of e-commerce provides a new way to solve this problem. Personalized recommendation is applied to the teaching resource platform to provide personalized services for users [3].

The earliest recommendation technology is content-based recommendation. This method does not consider users' evaluation of resources, and mainly relies on artificial intelligence, mathematical statistics and other knowledge to obtain users' interest preferences from the representation of resources used by users. The basic idea is to extract users' interests with specific characteristics and attributes, classify them according to the similarity of project attributes, and then analyze and recommend them based on users' historical records. It can be divided into heuristic methods and model-based methods. In the recommendation process, content-based recommendations do not need to reference other users' behavior records. Therefore, it can effectively avoid the "cold start" and "sparsity" problems in collaborative filtering technology. The advantages of recommendation based on content association are simple and fast, and the results can be interpreted, which can form a unique recommendation method for each user. Compared with collaborative filtering methods, content association methods have the advantage of solving information sparsity faster. It makes up for the disadvantage of low content retrieval efficiency due to sparse information.

The recommendation based on content association first needs to extract the content features of the project. Then, the user's interest model is established. The interest model is learned from the content characteristics of the user's past preference. Finally, the similarity between the user's interest model and the project to be recommended is compared. See Fig. 1 below.

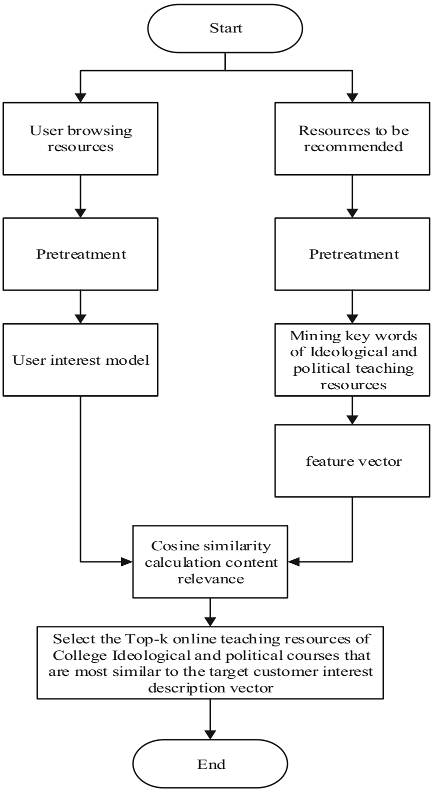

Fig. 1. Basic flow of recommendation method based on content association

2.1 Explore the Key Words of Ideological and Political Teaching Resources

For online teaching resources of ideological and political courses recommended, keywords are extracted as features of recommended projects, and keywords model is constructed as description information of projects, which is the first step of content-based recommendation method [4]. For online teaching resources of ideological and political courses, mining project features is a difficulty in content-based recommendation, but it is also the key to the effectiveness of the algorithm. Since the label has the characteristics of complete classification and concise description, the choice of label as the feature description of the project can extract the characteristics of the marked project from the perspective of user preference, and can also appropriately reflect the interests and demands of users. In order to better describe the project, this paper first extracts several general attributes of the project. Then, on this basis, different attributes are refined to obtain the different project features of each attribute. The same project features are included in the same project attributes. Here the attributes of the project and the corresponding attributes of the project are retrieved from the project tag.

As for the online teaching resources of ideological and political courses in colleges and universities, this paper will first preprocess them. After word segmentation and part-of-speech tagging, it will remove the stopped words, calculate the weight and build a vector space model.

Word Segmentation and Part-of-Speech Tagging

In order to facilitate the construction of user interest model and enable the computer to better recognize, calculate and process the text information read by human beings, text preprocessing has relatively difficult problems, such as how to mark the part of speech of participle and so on. These problems seriously affect the construction of interest model. At present, there are only three word segmentation methods reported in literature. One is mechanical method, which is relatively rigid and not flexible enough. The other is the statistical method, the statistical method is relatively flexible, especially in the era of big data has great advantages; There is an artificial intelligence method, this method has intelligence, has a high accuracy and so on. The most advanced artificial intelligence method is the NLPIR word segmentation system developed by the Chinese Academy of Sciences, which is mainly based on the part of speech of the feature word identification and word segmentation.

Stop Using Words

Verbs, nouns, adjectives, and many words in a phrase often used, but in the actual process of recommended found that many of these words and phrases are has nothing to do with user interest degree, namely the user interest does include the words in the article, but all other articles, also contain these words, through these words cannot find articles of interest to the user. For example, “can”, “very good”, “will” and other words often appear in online teaching resources of ideological and political courses in colleges and universities, as well as in other resources. It is impossible to find articles that users are interested in using these words as feature words, so such words need to be removed [5].

Even after processing data, the feature space established is very large. In the high-dimensional feature space, there will be some noise data, text content irrelevant to the text topic, etc., which are words that do not contribute to the recommendation. Filtering out these uncontributed contents by feature extraction can speed up the calculation and improve the calculation accuracy. Therefore, after the preprocessing of text content information, it is necessary to reduce the dimension of text vector space. Feature selection is one of the most effective methods for dimensionality reduction in text vector space, including chi-square statistics, information gain, word frequency and inverse document matrix. This paper uses TF-IDF method to explore the resource keywords of ideological and political teaching.

TF-IDF is widely used in feature extraction. TF represents the number of times a specific word appears in the current document, which can be used to describe the content of the document. The TF-IDF algorithm uses the product of TF and IDF value as a measure of feature weight. The larger the product, the greater the weight of the entry and the stronger the ability to distinguish documents[6]. Through the above description, when calculating the TF value, due to the inconsistency of the length of each article, it is often necessary to use the word count of the document to standardize it; when calculating the IDF value, in order to avoid the feature words that need to be calculated in the corpus, usually it will be processed by adding 1, formula (1) and formula (2) are the calculation formulas of TF and IDF.

$$TF_i = {}^{m_i}\!/_{M} \tag{1}$$

$$IDF_i = \lg\left({}^{|N|}\!/_{1 + |N_i|}\right) \tag{2}$$

where, m_i represents the frequency of occurrence of the characteristic word i in online teaching resources of ideological and political courses in colleges and universities, M represents the total number of words in online teaching resources of ideological and political courses in colleges and universities. N represents the total number of online teaching resources of ideological and political courses in colleges and universities, while N_i represents the total number of online teaching resources of ideological and political courses in colleges and universities including the characteristic word i.

Each online teaching resource of ideological and political courses in colleges and universities contains many featured words, and different featured words have different contributions to the recommended content. Such words have a relatively large contribution to the recommended content, while some words have a small contribution to the recommended content. Therefore, the total contribution of recommendation information needs to be calculated, that is, the role of different feature words in text recommendation needs to be calculated by using relevant formulas. The value of the weight of the featured word represents the contribution of the featured word, that is, the weight of the featured word is directly proportional to the success of the recommended content. Therefore, the calculation of this weight value is very important [7]. Thus formula (3) can be obtained.

$$\zeta_{ij} = TF_i \cdot IDF_i \tag{3}$$

Based on the above calculation, each resource can be represented in the form of a keyword - weight vector space model. Using the vector space model, each different feature word is represented by the independent dimension of the feature space, and formula (4) is obtained.

$$Y_i = (\zeta_{i1}, \zeta_{i2}, ..., \zeta_{is}) \tag{4}$$

where, Y_i represents the spatial vector of text information of online teaching resources of ideological and political courses in colleges and universities; s represents spatial feature dimension, that is, the number of different feature words.

3 User Interest Description Matrix

After extracting the features of the project, the next step is to build the user's interest model. The interest model can also be said to be the interest vector representing the user's interest, which is composed of project attributes and project features contained in the attributes. So for users, what kind of items can be used to build their interest model? At this point, user-item scoring matrix comes in handy. To establish the user interest model, it is necessary to count the user's favorite projects and extract their signature features [8]. This liking can be reflected in the user's specific rating of the project. Next, the construction method of user interest description matrix is discussed.

User interest description matrix is an intuitive description of user interests and preferences. In this matrix, the abscissa represents the online teaching resources of ideological and political courses in colleges that can be recommended, the ordinate represents the user, and the value in the vector represents the learner's preference for ideological and political resources. In this algorithm, the value comes from two sources:

(1) Rating data (T): Users can rate academic resources with scores ranging from 1 to 5. A higher score indicates that the user likes the resource more, that is, the resource benefits the current learners more.
(2) View but not rated (browse but not T): Many learners are unwilling to give the displayed score. In order to avoid the matrix being too sparse, the values in the matrix are integrated with the browsing information of users. For the two theme categories visited and rated most by current users, f_i^G in the matrix is the score of i on the G online teaching resources of ideological and political courses in colleges and universities obtained by formula (5), where $\overline{f}^G$ is the average score of G online teaching resources of ideological and political courses in colleges and universities in this theme category.

$$f_i^G = \begin{cases} T, & if \quad T \neq 0 \\ \overline{f}^G, & 0 < T \leq 1 \\ 0, & T = 0 \end{cases} \tag{5}$$

The current user's rating of a resource in another topic category is the average score of the resource. According to the above formula, the user's interest description matrix can be obtained by analyzing the network log file.

4 Content Correlation Degree Calculation

When calculating the similarity of the content relevance of online teaching resources for college ideological and political courses, the most commonly used centralized methods are usually based on TF-IDF and vector space models. TF-IDF is used to represent the weight of feature words, and the vector space model of feature words is used to represent documents. Information. After that, the distance between the vectors is often used to indicate the similarity of the documents. Common methods for calculating vector distance mainly include inner product, cosine similarity, and Jaccard coefficient [9]. Here, cosine similarity is used to measure the content relevance of online teaching resources of ideological and political courses in colleges and universities.

Cosine similarity is also called cosine similarity, which evaluates the similarity of two vectors by calculating the cosine of the angle between them. Cosine similarity draws a vector into a vector space based on coordinate values, such as the most common two-dimensional space. The formula is as follows:

$$\cos(Q1, Q2) = \frac{\zeta_k^{Q1}\zeta_k^{Q2}}{\sqrt{\left(\zeta_k^{Q1}\right)^2\left(\zeta_k^{Q1}\right)^2}} \tag{6}$$

where, $\cos(Q1, Q2)$ represents the content correlation between $Q1$ and $Q2$ of online teaching resources of ideological and political courses in colleges and universities; ζ_k^{Q1} represents the weight of keyword k in the online teaching resources $Q1$ of ideological and political courses in colleges and universities; ζ_k^{Q2} represents the weight of k in online teaching resource $Q2$ of ideological and political courses in colleges and universities.

Cosine similarity is to calculate the included Angle between two online teaching resource vectors of ideological and political courses in colleges and universities, which is also one of the conventional methods to calculate the similarity of two documents. The larger the similarity value is, the smaller the included Angle is, the greater the similarity is and the stronger the correlation degree is [10], so the resource is closer to the interest of the target user. Finally, top-k online teaching resources of ideological and political courses in universities that are most similar to the target customer's interest description vector will be recommended to the user.

5 Simulation Test and Analysis

5.1 The Test Environment

Normal University School is a large-scale free open education platform for K-12 education developed by the National Digital Learning Engineering and Technology Research Center of Central China Normal University. It aims to gather high-quality course resources offered by domestic first-class educators and provide personalized education resources and teaching management for k-12 learners. Education is currently in suzhou area, part of the pilot schools in xiamen, and including the first middle school of the affiliated high school of middle school in hubei province, the first third of the affiliated high school of middle school, and wuhan experimental foreign languages school, part of the key school widely put into use, such a great learner behavior data for this study to lay a solid foundation. This paper make full use of learners in the process of using normal university school of learning behavior data, combined with the feature of platform curriculum resources content attribute, and according to the situation of student registration and student status information for learners of demography characteristic information as the basic data source, design based on content associated auxiliary method recommended college ideological instruction course online teaching resources.

5.2 Sample Set

Affiliated to central China normal university to carry out the education of information technology curriculum reform experiment, in suzhou at the beginning of a medium, high schools, one middle school attached to the small and medium-sized, early, third, fourth and fifth xiangyang city middle school such as 10 schools as the object of experimental research, including 1000 students as recommended users, 1000 education course online teaching resources as the recommended sample, used to test recommended method, Sample distribution is shown in Table 1 below.

Table 1. Sample distribution table

Category	Number
Category 1	4540
Category 2	5442
Category 3	4544
Category 4	3504
Category 5	5770

5.3 The Evaluation Index

In this paper, the method for assessing the accuracy of the recommendation algorithm is mainly the related evaluation index system, these measures mainly include the recommendation accuracy and recall rate, coverage and novelty, use these indicators to evaluate the accuracy of the recommendation algorithm is relatively accurate, and the evaluation index and the current recommended indexes system, The following is a detailed introduction of the above recommended accuracy rate.

Forecast Accuracy

Forecast accuracy, according to the three words of accuracy, the information that can be learned is whether the information predicted by the system is accurate and to what extent, this needs to be expressed by prediction accuracy. The greater the value of the prediction accuracy, the more accurate, and vice versa, the actual recommended content can be roughly divided into four types: recommended read; recommended unread; not recommended read; not recommended unread. There are a lot of information on the website, which can be roughly divided into four categories, namely TU, which means unread information is recommended; TR, which means read information is recommended; FR, which means information that has been read but not recommended; FU, which means neither read Taking the information that is not recommended, according to the four kinds of information, the method recommendation accuracy rate D calculation formula (7) is as follows:

$$D = \frac{\sum_{i=1}^{n} P_i}{n} \tag{7}$$

Among them,

$$P_i = \frac{TP}{TR + TU} \tag{8}$$

Coverage

The coverage rate reflects the ability of the recommendation algorithm to discover unpopular resources. The higher the coverage rate, the better the recommendation algorithm can recommend some unpopular resources to users. Let R_u be the recommendation list of the recommendation system to the user u, then the coverage of the recommendation system is defined as formula (9).

$$C = \frac{UR_u}{|A|} \tag{9}$$

In the formula, U is the user collection, A is the item collection, and the coverage is between (0, 1].

Method Test Results

Using the research method, the recommendation method based on collaborative filtering (reference [1]), the recommendation method based on utility (reference [2]), multi-node information resource recommendation method (Reference [4]),the samples given in Table 1 are recommended to 1000 students, and then the recommendation accuracy and coverage rate are calculated based on the recommendation results. The results are shown in Fig. 2 and Fig. 3 below.

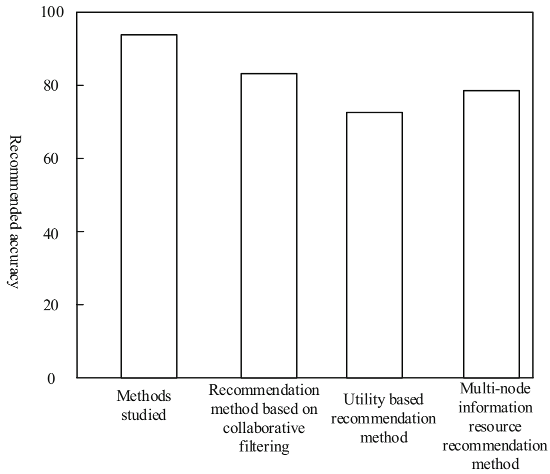

Fig. 2. Recommended accuracy rate

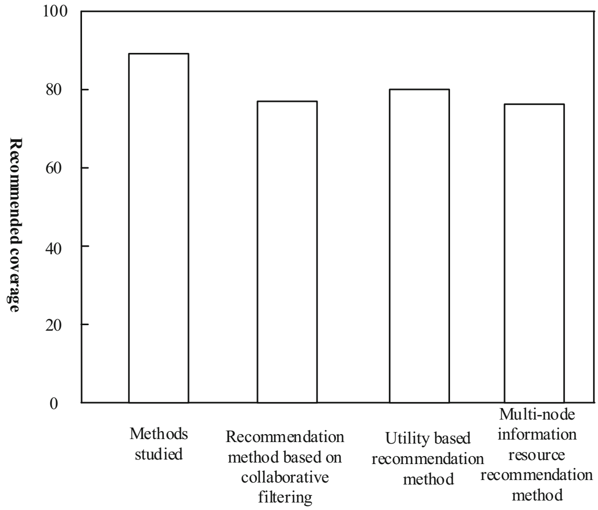

Fig. 3. Recommended coverage

It can be seen from Figs. 2 and 3 that the recommendation accuracy and coverage of the recommended method studied are higher than those of the collaborative filtering-based recommendation method, the utility-based recommendation method, and the multi-node information resource recommendation method. Rate. It shows that the proposed method has better performance.

6 Conclusion

In summary, with the vigorous development of information technology, the Internet is not limited by time and space, and can share rich and high-quality educational resources. It has gradually become a new path for college students' ideological and political education. However, the frequency of knowledge update is accelerating, and there are many online education resources. Traditional learning resource query and search methods can no longer meet the needs, and the information overload makes college students lose their way. Design and develop a personalized and accurate recommendation system for ideological and political education resources, identify resources that meet the individual needs of college students from the massive network resources, and obtain the best learning path and ideological and political education effects. To this end, this article conducts research on the method of supporting the recommendation of online teaching resources for college ideological and political courses based on content association. After testing, the accuracy of the research recommended method is proved. However, how to solve the cold start problem is not covered. Therefore, it is necessary to further use data mining technology to effectively alleviate the impact of the cold start problem. In the process of development and application, it is also necessary to dig deeply into learner characteristics and learning behavior data to improve the accuracy and intelligence of resource recommendation.

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Design of Multiple Interactive Sharing System for Electric Power Subject Course Resources

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Abstract. In the process of resource transmission, the existing multi-interactive sharing system does not take encryption measures, which leads to poor security and incomplete information transmission. Therefore, focusing on the teaching resources of electric power discipline, the optimization of multi-interactive sharing system is realized from three aspects: hardware, database and software. Improve the communication network structure, modify the teaching course resource collector, microprocessor, resource memory, collector and other equipment components, and complete the hardware system optimization through circuit modification and connection. A systematic database of teaching resources of electric power specialty is established. Constrained by the multi-interactive sharing protocol, the course resources of electric power discipline are compressed and added to the transmission queue by data encryption to complete the uploading task. After searching and downloading resources, the system finally realized multiple interactive sharing functions. Through the system test experiment, the loss rate of shared packets is less than 2% of the total resources, and the sharing time is less than 8000 ms.

Keywords: Special subject teaching of electric power · Teaching course · Teaching resources · Multiple interactive sharing

1 Introduction

Individuals and businesses who use electrical appliances want to reduce energy consumption as much as possible while achieving their goals. The knowledge of electric power is closely related to the real life, and the examination of electric power knowledge is the focus of the physics major. Put the basic knowledge of physics in a real and vivid situation, and test the students' ability to analyze and solve specific problems by using the knowledge they have learned. Electric power is not only an important but also a difficult point in physics teaching. It not only integrates the previous Ohm's law, the knowledge of series and parallel circuits, but also some mechanical knowledge. It also integrates the experimental phenomena and theoretical contents, and involves the use of quantitative calculation and physical research methods. Through consulting materials,

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communicating with experienced physics teachers, analyzing the physical examination questions of provinces and cities in recent years, and combining their own two years of teaching experience and many years of extracurricular physics teaching counseling. Most students find it difficult to learn this part of the power, especially when there are two kinds of circuit in series and parallel, students are more easily confused, it is difficult to grasp the current work is the process of electrical energy into other forms of energy, the solution of the problem requires the repeated use of the power formula and Ohm's law formula, more difficult.

In order to improve students' understanding and application level of electric power and relevant physical knowledge, many universities have set up special subject courses of electric power online. In order to improve the teaching quality and make full use of the existing teaching resources, a multi-interactive sharing system is designed and developed for the subject teaching resources. Educational curriculum resources are all kinds of conditions and materials that can be used in teaching activities. Can promote the teaching activity better development. The sharing of teaching resources is based on the network environment, not for profit, teaching resources to network users, other network users can download and use the network environment of teaching resources, but also can upload local education resources.

The teaching resource sharing service system in foreign countries is more developed and has more perfect functions, which not only greatly saves manpower and material resources, but also narrows the differences of teaching resources in different regions, so that students in every place can get equal opportunities to receive education. For example, Share My Lesson in foreign countries is an excellent teaching resource sharing site, which is written in JavaScript and uses SSH development framework to share teaching resources and provide better education for students. It not only provides high-quality resources such as teaching videos and courseware, but also provides case analysis for teachers, provides reference for different teachers, finds shortcomings and improves teaching quality. At the same time, set the scoring evaluation function, and constantly improve the system and improve the course quality by collecting user feedback.

Although China University of Petroleum has established online library and digital campus teaching resource sharing service systems, the functional realization of these systems still needs to be improved. The front-end interface is written in original HTML, which is easy to cause code redundancy. The database software adopts old version databases such as SQL Server 2008, which leads to unreasonable design of some functions, which is not conducive to information search. On the one hand, the resources shared by these resource sharing service systems established by China University of Petroleum are limited in quantity and single in type, only courseware and papers and other materials, and lack of dynamic resources such as classroom videos and case explanations, which have limited reference value. At the same time, most of these resources are kept by third-party websites such as HowNet and VIP, which are easily restricted by network and other factors. On the other hand, these resource sharing service systems have poor user interaction. Generally, they only provide resource downloading, but do not provide user interaction methods such as resource evaluation and online discussion, which makes the user experience poor and increases the difficulty for users to use [1, 2].

According to the current research situation of MIMS, there are many problems in the current system, such as low interaction efficiency, low sharing security and so on. Therefore, it is necessary to optimize the MIMS for the teaching resources of EWP subject, which is helpful to further improve the openness and flexibility of teaching, realize the MIMS in the teaching process and improve the teaching efficiency and quality.

2 Design of Multiple Interactive Sharing Hardware System

The hardware modules of the system can be divided into data acquisition, power conversion, data flow control and data flow transmission according to the structure, and divided into analog circuit and digital circuit. Independent power supply is adopted, that is, analog board corresponds to analog power supply and digital board corresponds to digital power supply. The analog circuit module mainly includes multi-channel signal selection, signal conditioning and ADC A/D conversion, while the digital circuit module includes MCU control of data flow, FPGA acquisition and processing of signal, memory design and data transmission interface circuit. In order to solve the problems existing in the existing system, some hardware components are modified and optimized.

2.1 Design of Teaching Course Resource Sharing Network

From the angle of network construction, an efficient and reliable data transmission strategy is designed. The data reliable transmission network structure block diagram is shown in Fig. 1.

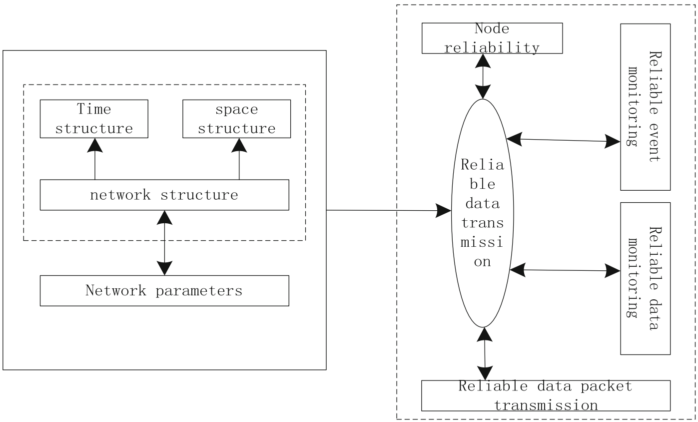


Fig. 1. Network structure of teaching course resources sharing

Network structure is mainly composed of time structure and space structure, and its model is usually expressed by network parameters. Different network structure determines the properties of network parameters, and the different values of network parameters will make the network structure have different performance in node energy saving and system data reliable transmission. Therefore, in the case of the traditional communication network to add intelligent gateway, while ensuring the security of data communications, improve the efficiency of data transmission network.

2.2 Microprocessor

The S3C2440 A16/32 bit LSI microprocessor is selected to replace the traditional microprocessor. The optimized controller is based on the ARM920T core, which adopts a new bus architecture. It provides a series of complete system peripherals, including IIC, SPI bus interface camera dedicated interface and LCD display interface. The corresponding peripheral interface will be connected to complete the corresponding software driver code can be. The normal operation of all the devices in S3C2440A controller depends on the control of MCU, and the data transfer between each module is also transmitted through MCU. The SAA7113H internal register of S3C2440 is configured by IIC bus. S3C2440 uses IIC interrupt mode to improve the efficiency of data processing [3]. In IICCON, the IIC bus control register that enables the bus to respond, and the IIC bus clock source is PCLK/16 that enables the IIC to send and receive interrupts. IIC bus control status register IICSTAT, IIC bus data output enable, when writing to SAA7113H data, select the main send mode, when reading from SAA7113H, select the main receive mode.

2.3 Electric Power Subject Course Resource Memory

The NADN Flash Memory used by the system is MT29F8G08, and the data of the chip is stored in the Memory Cell in the form of bit. The internal structure is divided into two pieces. Each part is divided into 1024 modules, each piece is divided into 128 pages, and each page contains 4320 bytes. I/O of the chip can be used as address transmission, data transmission port and instruction transmission, and the write controller in the chip can control the programming and erasing functions. The 3.3V voltage source is used, the data bus port is connected to the FPGA, and the control port is connected to the MCU. When/WE is effective, the data is stored through the control of the single chip, and when/RE is effective, the stored data is read from memory.

2.4 Data Receiver

Teaching course resources are collected, compressed and transmitted through data collection, data compression and data transmission. Finally, the data is received by the data receiving end and uncompressed and displayed by software through PCI bus, or stored directly [3]. The controller FPGA2 of the receiving end controls the functions of data receiving, data bus conversion and data forwarding. The entire data receiver hardware consists, as shown in Fig. 2.

The equipment shown in Fig. 2 can be used to receive the special course resources of assigned electric power.

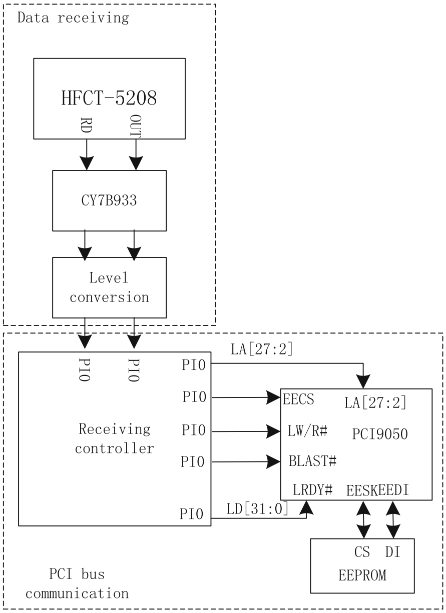


Fig. 2. Data receiver hardware connection diagram

2.5 System Circuit Design

Power Supply Circuit

The power input of the system can be supplied through the power socket and USB, but at the same time, only one of the interfaces can be used for power supply, not both of them, as shown in Fig. 3.

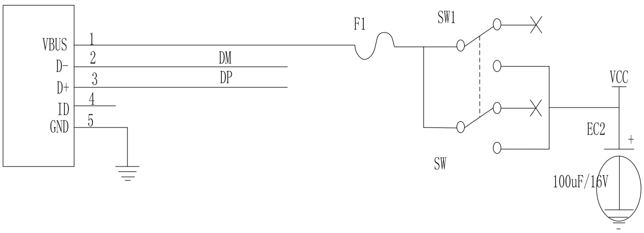


Fig. 3. Power circuit diagram

In Fig. 3, J1 is a USB -powered interface, F1 is a self-healing fuse, SW1 is a key switch, SRV05–4 is an integrated transient suppression diode, is a surge protection device, 5V operating voltage, and protects 4 I/O high-speed data lines. As a part of the power supply system, the performance of power supply plays a very important role in the whole system [4]. In order to solve the problem that all kinds of chips in the design system need different power supply, the system designed four power supply, 1.2 V, 3.3 V, 2.5 V, 2.8 V power supply, the chips used are 1117–1.2, 1117–3.3, 1117–2.5, 1117–2.8, four chips are LDO power supply chips, which can provide stable and reliable power supply. At the same time, 4 layers of PCB are used in the design of PCB, and independent power supply layer and GND layer are reserved, so that the power supply of the whole board has very good stability.

Reset Circuit

In order to eliminate the jitter, the system can run normally, the special reset chip MAX811 is used in the design of reset circuit, which is mainly used for key reset, power-on reset and voltage power monitoring. MAX811 is a special reset chip produced by MAXIM company. It contains 4 pins, low power consumption, high circuit stability and supports manual reset. The reset circuit diagram is shown in Fig. 4.

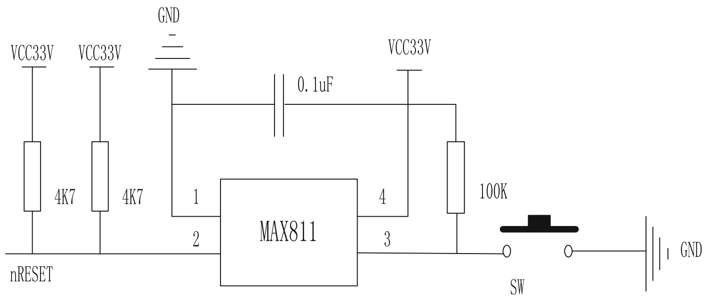


Fig. 4. Reset circuit diagram

Reset is realized by means of Fig. 4 circuit after system failure or completion of a resource sharing [5, 6].

Touch Interactive Display Circuit

Use a TFT-LCD LCD with touch-screen capabilities. TFT-LCD is the thin-film field effect transistor LCD, TFT liquid crystal display technology uses active matrix to control each individual pixel. In order to accurately control the color and brightness of each pixel, a switch similar to the “shutter” is installed behind each pixel. When the “shutter” is open, the optical fiber penetrates in, and after closing, the optical fiber can not penetrate. LCD utilizes this characteristic. TFT-LCD has the advantages of high speed, high contrast, high brightness display screen information, low power consumption and other comprehensive advantages.

3 Database Design of Multiple Interactive Sharing System

The database structure needs to save many kinds of information in the system, and forms a detailed data dictionary by saving the basic data, data structure and processing the data. Based on the analysis of data and system survey, various entities and their relationships that can meet the requirements of the system are designed. Among them, entities contain a variety of specific information, through the connection with other entities constitute the flow of data [7–9]. The data table in the backstage database of the system is the source and basis of the operation of the function module of the teaching resource sharing system in the foreground university. There are four data tables in the database, including user information table, resource information table, notice information table and share information table. Different data tables correspond to different sub-modules of the system, which store all the data needed by the teaching resource sharing system in detail and adopt the relational database MySQL to manage. The result of constructing the database table is shown in Table 1, taking the resource information table of electrical power subject teaching as an example.

Table 1. Electrical power subject course resources information table

Field name	Field description	Data type	Data length	Is it empty?	Initial value
Res_id	Resource id	int	12	N	NULL
Res_name	Resource name	char	30	N	NULL
Res_time	Upload time	Varchar	14	N	NULL
Res_source	Resource source	Varchar	20	N	NULL
Res_content	Resource content	Varchar	2000	N	NULL
Res_size	Resource size	char	8	Y	NULL
Res_Path	Resource upload path	Varchar	200	Y	NULL

The same can be said for other information tables in the database. Finally, the database table will be constructed according to the logical relationship between the data to join, facilitate the interaction between the data and updates. In addition, all data in the database need to be backed up to avoid the impact of system downtime on data.

4 Software Function Design of Multiple Interactive Sharing System

With the support of hardware and database, the optimal design of the software function of the multiple interactive sharing system is completed.

4.1 Set up Multiple Interactive Sharing Protocols

In the communication network environment, in order to ensure the security of resource sharing, the Internet protocols needed are: user datagram protocol and real-time transmission protocol/real-time transmission control protocol. TCP in Subscriber Datagram Protocol is a connection-based protocol that provides connection-oriented services, but must go through "three handshakes" to establish a connection and provide reliable, sequential, and non-repetitive data transmission. In the optimization design system, the real time of the transmission protocol is required to be very high, and the whole data can be synchronized between the two sides of the communication. Because the TCP protocol adapts to the situation that the request of data transmission is more accurate, the request of real-time is lower. Therefore, TCP is finally chosen as the transport protocol. Although TCP is the transport layer protocol of choice for the design of the system, the delay and jitter of the data are unavoidable in the transmission. In the actual transmission, the inter-network communication protocol is required to be able to deal with these conditions, analyze and control the received data and give corresponding feedback. Transport Layer Protocol TCP has to be transplanted because of its own characteristics, and does not have these conditions. In addition, the system designed will send image information, or audio information is too large, which exceeds the limit of packet size per time sent by TCP. Therefore, it requires us to transplant a network protocol and RTP/RTCP protocol based on the TCP protocol to deal with these problems. RTP protocol provides end-to-end transmission service for interactive audio and other data with real-time characteristics to realize streaming media synchronization service, and provides relevant information. The overall transport layer protocol hierarchy diagram is shown in Fig. 5.

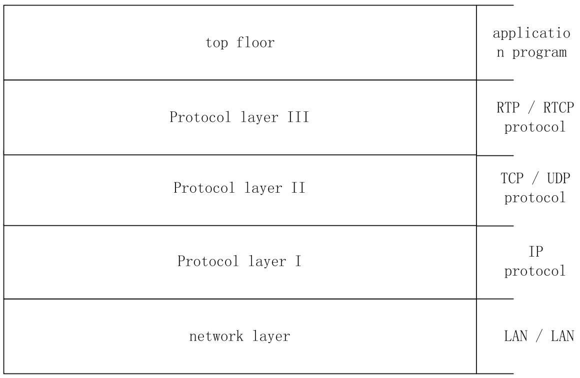


Fig. 5. Transport protocol hierarchy

The RTP protocol is located at the lower layer of the application and the upper layer of the TCP/UDP protocol and is generally considered as a sub-layer of the transport layer. The workflow of RTP protocol first receives information stream from the upper layer, then encapsulates it into RTP data group and sends it to the lower layer, then provides RTP and RTCP by the lower layer protocol. In addition, RTP does not provide reliable transmission service, so it is necessary to optimize the application program to ensure the reliable transmission of data.

4.2 Subject Teaching Resources of Compressed Electric Power

Generally speaking, the subject course resources of electric power to be shared include image, video, courseware, text and so on. In the process of resource compression, it is necessary to delete the duplicate information of text resources, and then compress the whole resources. Data deduplication is based on the redundancy of the data itself to detect the duplicated data in the data stream, transfer and store only the replica of the unique data object, and replace the other duplicated replicas with the pointer to the replica of the unique data object, which can not only eliminate the data redundancy in the file, but also eliminate the data redundancy between the files in the shared data set, thus effectively reduce the storage space of the data and reduce the data dimension. Use formula 1 to calculate whether there is information with high similarity in the resource.

$$sim = \sqrt{\sum_{i=1}^{k} (x_i - x_{i-1})^2} \tag{1}$$

In the formula, x_i and x_{i-1} are the front and back of the resource, respectively, and k is the total amount of the resource to be shared. If Formula 1 calculates to 1.0, then x_i and x_{i-1} are considered duplicates and one set of data needs to be deleted. For video and image data, considering the degree of de-correlation and the difficulty of implementation, 8X8 image matrix is usually used for DCT transform. Firstly, the original image or difference frame image is divided into a series of 8X8 blocks, and then each image sub-block is transformed by 2D discrete sine transform in order from left to right and down. The numerical definition of a positive transformation FDGT is given by the following equation:

$$F(u, v) = \frac{1}{4} f(x, y) \cdot \cos \frac{(2x + 1)u\pi}{16} \tag{2}$$

where $f(x, y)$ is the initial information of resources, u is the transformation scale, and the digital expression of negative transformation IDCT is:

$$G(u, v) = f(x, y) \cdot \sin \frac{(2x + 1)v\pi}{64} \tag{3}$$

where v is negative transformation scale. The coefficients obtained by DCT transform only concentrate the energy in the upper left corner, so that the correlation within the block is reduced, and the data is not compressed. In order to reduce the amount of data, DCT coefficients need to be quantified. The function of quantization is to discard the information in the image which has little effect on the visual effect, and quantization is many-to-one mapping, which is the root cause of the loss of DCT coding information. The coefficients of most high frequency components can be zero by setting different quantization steps for low frequency components and high frequency components according to the physiological characteristics of human eyes.

4.3 Encrypted Transmission of Resources of Special Courses on Electric Power

Mapping encryption is applied to the compressed teaching course resources. The encryption process can be expressed as follows:

$$h(x) = ux(1 - x) \tag{4}$$

where u is the mapping parameter and x is the resource compression result. Its inverse mapping is:

$$x = \frac{1}{2} \pm \frac{1}{2}\sqrt{1 - \frac{4h(x)}{u}} \tag{5}$$

The above mapping principle is used as the basic mapping in the encryption of subject teaching resources. The bifurcation parameters u and iteration parameter n of the map, as well as the word length N mentioned later, are used as the key of the algorithm. After the information is encrypted into ciphertext, it must be decrypted by the corresponding algorithm to restore it to the original. However, the Logistic inverse mapping is a one-to-many mapping, through which to restore the information, we must solve the mapping one by one problem. The problem can be solved successfully by using the method of discretization of fixed word length and adding perturbation term. Finally, the corresponding encryption vectors and decryption vectors are generated by the key. Then may carry on the original text encryption, the ciphertext decryption work. The transmission channel of the resources is selected and added to the transmission queue to realize the encryption and transmission of the resources of the special subject teaching courses.

4.4 Retrieval of Resources for Special Courses on Electric Power

All the resources uploaded to HDFS are stored in different DataNode nodes, and the corresponding index files are also generated. These index files are used for the retrieval of resources. In order to improve the speed and accuracy of retrieval, in parallel retrieval design, MapReduce is used to parallelize the search on multiple DataNodes, then the retrieval results are combined, encapsulated in a specific format and delivered to the user. Parallel computations are performed in a Hadoop cluster, from keyword segmentation to retrieval results, with calls to the map and reduce functions executed. Specifically, JobTracker in NameNode distributes the retrieval function to each DataNode when the retrieval request arrives, although the retrieval function is also designed based on map and reduce. Before performing the retrieval, the keywords entered by the user are word-broken and shared among the map/reduce functions in the form of global variables. During the retrieval process, each data node executes the business logic in the map, retrieves the results that match the keywords on the node, and each DataNode return calls reduce to merge the results, ranking the retrieval results according to the frequency of the inverted document. The formula for calculating the frequency of reversed documents is as follows:

$$idf_t = \lg \frac{N}{df_t} \tag{6}$$

where, N and df_t are the number and frequency of documents in the document set, respectively. Arrange the resources corresponding to the calculation results of df_t from large to small, and return the final retrieval results to users.

4.5 Realize Multiple Interactive Sharing Function of Teaching Curriculum Resources

In accordance with the above process, users can search keywords into the system, and according to the retrieval process results. Users can select the appropriate resources of the subject course, start the download process, and use the communication network to convert the shared resources to local resources. In addition, teachers and users can process, compress and encrypt the resources of special subject courses, and upload them to the database of the system, so as to realize the multiple interactive sharing function.

5 System Testing

In order to test the interactive sharing function and running performance of the designed multi-interaction sharing system of the subject course resources, the system test experiment is designed.

5.1 Build System Development and Operation Environment

The client-server mode is adopted in the system deployment. The service application and the database which store the business data are deployed on the server, and the clients access the service application through the browser. The system does not need to specially install the client service procedure, saves the system deployment cost. The system uses Microsoft's Windows 7 operating system and Microsoft. Net Framework v3.5 sp1 class library framework as the server program running support environment, and adopts Microsoft SQL Server 2008 database management tools to realize the storage and operation of business data.

5.2 Prepare Multiple Interactive Shared Task Instances

The test task of the system is set up from two aspects: uploading resources, searching resources and downloading resources. The data required to be uploaded are different contents and sizes in the process of task setup. Therefore, 50 resource samples were prepared and numbered in the experimental environment, and different clients were selected as the resource sources, resulting in 20 shared task instances. After completing the task of uploading teaching curriculum resources, the task of searching and downloading was carried out, and the number of the tasks was 50.

5.3 Setting up System Test Indicators

The security and interactive timeliness of multiple resource sharing were tested in this experiment. The specific quantitative test indexes were resource packet loss and interactive sharing time. The numerical results of resource packet loss were as follows:

$$loss = W_{\text{upload}} - W_{\text{download}} \tag{7}$$

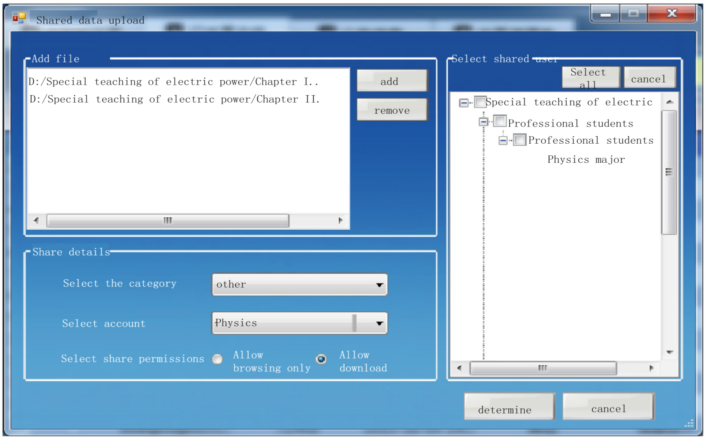
In formula, W_{upload} and W_{download} for the user before uploading download after the resource size, the calculation of the larger, the more resources in the interactive process of the loss of packets, that is, the system security is worse. In addition, the formula for calculating the time spent on interactive sharing is as follows:

$$T = \begin{cases} t_{\text{retrieval}} + t_{\text{download}}, \text{tasks} \in P \\ t_{\text{compress}} + t_{\text{transmission}}, \text{tasks} \in Q \end{cases} \tag{8}$$

In Formula, tasks is the interactive sharing task to be executed, and P and Q are resource downloading and uploading task sets respectively. $t_{retrieval}$, $t_{download}$, $t_{compress}$ and $t_{transmission}$ respectively correspond to the retrieval time, download time, resource compression time and transmission time. The larger the value of T is, the lower the timeliness of the system is proved. In order to ensure the application value of the design system, it is required that the loss of packets should not exceed 2% of the number of samples and the interactive sharing time should not exceed 8000 ms.

5.4 System Test Process and Result Analysis

Sample instances of the prepared multiple interactive shared tasks are fed into the design system one by one to get the output of the system running, as shown in Fig. 6.



(a) uploading the resources of electric power special teaching cour

(b) Downloads of resources for special course on electrical power

Fig. 6. Result of multiple interactive sharing system

Extracting the resource information in Fig. 6 and comparing it with the size of the prepared shared data sample yields test results that reflect the security of the system's interactive sharing, as shown in Table 2.

Table 2. System interactive sharing security test results

Shared task number	Data size before sharing/GB	Get actual data size/GB
1	11.83	11.82
2	6.45	6.43
3	2.79	2.79

(*continued*)

Table 2. (*continued*)

Shared task number	Data size before sharing/GB	Get actual data size/GB
4	5.82	5.82
5	13.44	13.41
6	10.28	10.25
7	9.32	9.31
8	6.75	6.75

Substituting the data in Table 2 into Formula 7, it is concluded that the average value of shared packet loss is 0.125 GB, accounting for 0.187% of the total samples, less than 2%, which meets the security requirements of the system. In addition, by uploading and downloading the time-consuming statistical results of the two shared tasks, the test results reflecting the timeliness of the system are obtained, as shown in Fig. 7.

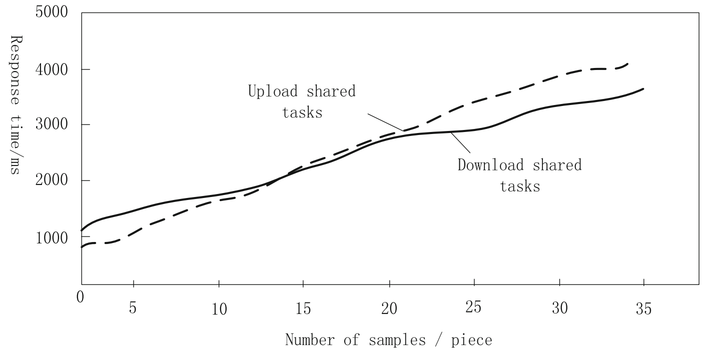


Fig. 7. Test results for timeliness of multiple interactive sharing system

As can be seen from Fig. 7, there is no significant difference between the two shared tasks. The maximum upload time is 6400 ms and the maximum download time is 7100 ms, both lower than the default, that is, the timeliness meets the design and application requirements.

On the basis of the above experiments, taking the systems of references [1] and [2] as comparison systems, five different types of attacks are designed in the process of file transmission, and the sharing performance of different methods is verified with the packet loss rate as the index. The results are shown in Fig. 8 below:

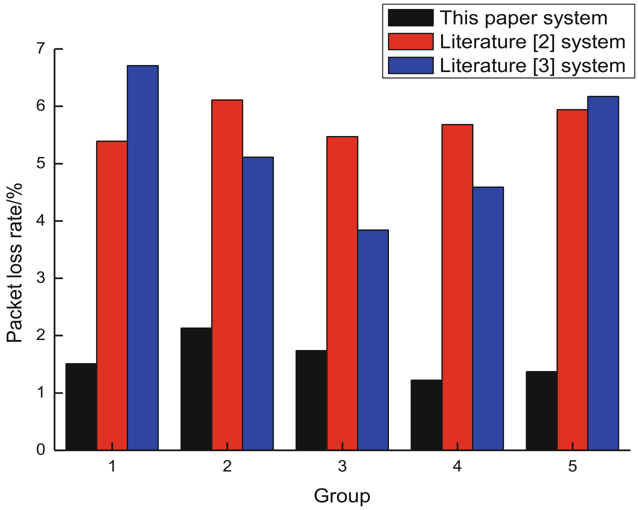


Fig. 8. Packet loss rates of different systems

According to the analysis of Fig. 8, the average packet loss rate of the system in this paper is 1.59%, and the highest is only 2.13%, while the average packet loss rates of the systems in reference [1] and reference [1] are 5.72% and 5.28%. It can be seen that the system in this paper transmits through encryption protocol, which greatly reduces the packet loss rate and improves the security of system interaction and sharing.

6 Closing Remarks

As an important content of physics specialty, special subject teaching of electric power is of great significance to cultivating students' physical thinking. But the electric power on-line special topic teaching platform has broken through the traditional teaching way in time and the spatial limitation, and obtains the widespread application in the physics specialty. Through the design and development of the multi-interactive sharing system, the encryption protocol is added in the process of data transmission, which makes the data transmission more secure. Experiments show that the system can effectively reduce the possible data loss in the sharing process and improve the sharing efficiency.

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In Depth Mining Method of Online Higher Education Resources Based on K-Means Clustering

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Abstract. The existing online higher education resource depth mining methods do not segment transactions, resulting in a long time of resource mining. In order to mine resources more quickly, an in-depth mining method of online higher education resources based on K-means clustering is designed. The cloud computing framework MapReduce is used as the operation framework of mining algorithm, and Weka is used as the data mining tool; Preprocess the data and segment the transactions in data mining to reduce its granularity and facilitate the mining; Based on K-means clustering, an online higher education resource mining algorithm is designed to realize the in-depth mining of online higher education resources. The test results show that the SSE, DB and XB values of the design method are small, and the s values are large; The average running time of 10, 20 and 50 runs on each data set is short; After adding 3 gb dirty data, the clustering accuracy is still high, which shows that the design method has good mining performance, can improve the efficiency of mining resources, promote the innovation and development of education and industry, and realize the deepening application of big data in education.

Keywords: K-Mean clustering · Anomaly point detection · Online higher education resources · MapReduce · Resource in-depth mining

1 Introduction

With the development of web and Internet, human society has entered the era of information interconnection. The arrival of this era makes education face new opportunities and challenges. In the traditional way of education, teachers are usually used as the center, teaching materials as the core, and students focus on the predetermined place at the predetermined time for unified teaching and explanation, that is, the form of "teachers, teaching materials and students". The rapid development of modern society and the rapid renewal of knowledge have put forward higher requirements for people. Fixed school study for several years can not solve the new situation that may appear at any time in

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work. Lifelong learning is the only way to keep up with social progress in this environment. The traditional concept of lifelong learning is that people must first go to school, then work, and then stop working to continue to go to school. Therefore, continuing education and making money to support their family are always a pair of contradictions. However, this situation will really become history because of the maturity of online education.

The booming modern distance education takes learners as the core, is not limited by time, space, distance and various knowledge groups, takes quality education and flexible and diversified personalized development as the educational goal, uses modern educational means to transmit the content in the form of data through the network, and learners through video, audio, pictures Accept the required knowledge by means of words, etc. At the same time, they also accept students' questions in the above form and give replies. In modern distance education activities, the combination of virtual campus and actual school is often used to enhance the interaction of e-learning. For example, online teaching, virtual experiment, online course production, educational agent tools, etc. make students feel as if they are on campus. In addition, collaborative learning and team learning are highlighted in learning, which reflects the management of students' learning behavior and intelligent network course management. Obviously, the network has built a communication bridge between educational resources and students, so that students can choose real-time or non real-time education, which solves the need of continuous learning to a great extent. Like traditional education, practice, homework and examination are also important links of distance education. After years of teaching practice and application, a large amount of useful information has been accumulated on the existing distance education websites, but these information are scattered, messy records and huge data, so it is difficult to find the law directly from them and improve the teaching effect.

In recent years, with the development and maturity of data mining technology, people can find valuable information from a large number of existing cumulative data by using data mining technology. At present, data mining technology is widely used in biomedicine, financial data analysis, e-commerce and other fields, and has achieved good results. In the field of distance education, data mining technology has gradually attracted people's attention. With the development of distance education, how to improve the intelligence of distance education environment has become a more and more urgent need. Combining data mining technology with the field of distance education, establishing teaching feedback through the analysis of existing data and truly realizing personalized education and training will be a beneficial attempt for intelligent distance education.

Reference [1] simply and effectively describes the educational resources in the form of labels, and efficiently classifies the messy and huge educational resources in the Internet, so that users can easily browse and obtain the information of educational resources and improve the utilization of educational resources; This paper studies the label generation method of multi feature fusion, combines the characteristics of Chinese text, adds TF-IDF weight and location information weight on the basis of textrank algorithm, considers the information of words in the corpus and the location information in the article, generates labels including corpus information and location information, and forms a label generation algorithm of multi feature fusion. Reference [2] analyzes that deep mining and utilization of network resource information have become more important issues in the era of big data. In the face of complex and diverse data, mining effective information to make the data produce value. This paper discusses the efficient data mining algorithm and application based on big data.

Therefore, an in-depth mining method of online higher education resources based on K-means clustering is designed. Designed the operation framework of mining algorithm based on cloud computing framework, and use Weka as a data mining tool; In the data preprocessing, the resource transaction is creatively segmented to reduce its granularity, facilitate mining and reduce mining time; Based on K-means clustering algorithm, a resource mining algorithm is designed to complete the deep mining of online higher education resources.

2 Design of Deep Mining Method for Online Higher Education Resources based on k-mean Clustering

2.1 Mining Algorithm Operation Framework and Mining Tool

Take the cloud computing framework MapReduce as the running framework of mining algorithm [3]. Map reduce is one of the core technologies of cloud computing. It provides a concise and elegant solution for parallel data processing. Its main purpose is to enable large-scale cluster systems to work in parallel on large data sets and perform parallel operations on large-scale data. The core idea of map reduce parallel computing framework is divide and conquer, which decomposes computing tasks into two steps, called map and reduce respectively: there are many maps, and each mapper processes a part of the decomposed tasks in parallel; Reducer is responsible for merging part of the output of map. Reduce can be one or more [4].

Mapper establishes contact with reducer. The key is to use the functions defined on (key, value) pairs. Mapper's input is (key, value) pairs on one domain, and its output is a linked list of (key, value) pairs on another domain.

Map(k1, v1) $\rightarrow$ list(k2, v2).

The map function processes all input data in parallel and generates a series of (K2, V2) pairs for each input (K1, V1). The map reduce framework collects all (K2, V2) with the same K2 to form a group, and distributes all groups to the reducer according to certain rules. Each group will be applied to the reduce function to generate 0 or more values.

Reduce(k2, list(v2)) $\rightarrow$ list(v3).

Educational data mining is inseparable from the assistance of various data mining tools. There are mainly two kinds of mainstream mining tools: commercial and open source. Behind commercial tools, they generally have strong technical support, and have the characteristics of complex operation interface, comprehensive documents and so on. However, these commercial software are expensive and complex to operate. The most prominent problem is that there is no source code, which is difficult to meet some professional users for professional application analysis. Weka is an open source data mining tool. Its long-term use has made it a sudden rise in mining software. Its development platform is java language. Therefore, Weka system has a wide application prospect [5].

Weka has the advantages of simple operation and powerful function, and integrates the main algorithms such as classification, association analysis and clustering. The main advantage of the software is to provide an interface mechanism. Developers can also add their own algorithms to Weka according to their real application requirements. At the same time, Weka is also very flexible. The software can also be embedded in other Java application development for redevelopment. At the same time, the powerful software help document is also provided by Weka software, which is easy to use. It has a large number of users. The team development members won the highest award issued by ACM SIGKDD International Conference in 2005, which is a worthy honor in the field of data mining.

2.2 Data Preprocessing

The data preprocessing part mainly completes two tasks: data preprocessing and segmentation of transactions in data mining to reduce their granularity and facilitate mining.

The data preprocessing process is mainly composed of normalization processing, outlier detection, data cleaning, data integration, data conversion, data specification, data reduction, discretization, generation of concept layer times and data classification. Data reduction and noise data processing are necessary steps in the preprocessing process of data mining.

The formula of normalization treatment is as follows:

$$x^* = \frac{x - x_{\min}}{x_{\max} - x_{\min}} \tag{1}$$

In formula (1), x^* refers to the data normalization processing result; x is the original data; $x_{\min}$ is the original data minimum value; $x_{\max}$ is the maximum original data value.

In the process of outlier detection, the distance based method is used to detect: the distance based outlier detection generally judges whether it is an outlier according to the nearest neighbor of the data object. The basis for judging outliers is: in dataset s, if O is an outlier, O must meet that there are no more than m neighbors within its distance D. as shown in Fig. 1, the number of neighbors within D of point O is 4. If M $\leq$ 4, point O can be defined as an outlier.

In the process of outlier detection, the distance based method is used to detect: the distance based outlier detection generally judges whether it is an outlier according to the nearest neighbor of the data object. Specific test schematic diagram is shown in Fig. 1:

As shown in Fig. 1, the basis for judging an outlier is that in dataset s, if O is an outlier, O must meet that there are no more than m neighbors within its distance D. as shown in Fig. 1, within the range of D of point O, the number of neighbors is 4. If M $\leq$ 4, point O can be defined as an outlier.

The process of data cleaning is as follows:

The original data is usually incomplete and inconsistent. In the process of mining, the nature of a large part of the data is noisy. Data cleaning is a process to fill in the default missing value and determine the outliers, so as to obtain the consistency of the results. When dealing with noise, ignore method and fill method are generally selected, depending on the situation [6]. When there are few missing values, we use the filling

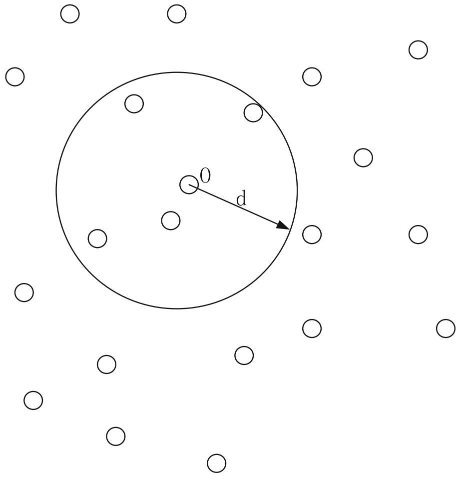

Fig. 1. Outlier detection based on distance

method. When there are large-scale missing values, we usually use the ignoring method. The neglect method is generally divided into box method, clustering method, regression method and man-machine combination method to deal with noise value. Box dividing method – divide the data into several parts and put them into the box, change the values in the box, and define the values to be changed by using the intermediate value, mean value and boundary value in mathematics; Clustering method – using clustering analysis method, the ultimate goal is to eliminate noise and find outliers; Regression method – in order to eliminate noise, the regression method mainly uses linear regression and multilinear regression; Man machine combination method – in order to help the computer identify outliers, setting threshold is one of the characteristics of man-machine combination. Artificially set a threshold and establish a standard, and then use transformation to achieve data consistency.

The process of data integration is as follows: each independent department must manage their data, which leads to the independence and long-term separation of data management, which is easy to lead to the phenomenon of "data island". In the process of data mining, we can't directly use two-way heterogeneous data sources together, so we need to integrate data. Data integration refers to solving the problem between two or more data sources that have ambiguity about the data structure, being merged or stored in a stable structure (such as data warehouse), realizing the exchange of data through applications, effectively solving the problems of data distribution and heterogeneity, and disclosing the table structure, primary key, table, coding meaning, etc. There are two methods of data collection, one of which is physical integration, which gathers a single source of data from various sources; The other is logical integration. This data extraction method provides a virtual view, but the data does not change the original physical location [7].

The process of data conversion is as follows: data conversion is to standardize the data, convert the data into a form suitable for data mining by means of smooth aggregation, data generalization, normalization and attribute construction, and realize the semantic consistency of different data sources. In data preprocessing, the longest time is the data conversion part. In the conversion structure, we can find the best way to ensure the synchronization of data from traditional data storage to data warehouse. Smooth aggregation is to remove the noise in the data and summarize and aggregate the data; Data generalization is to use concept stratification and replace the underlying original data with high-level concepts; Normalization is to scale the attribute data to a small specific interval; Attribute construction refers to the construction of new attributes from existing attributes.

The process of data specification is as follows: complex data analysis of large-scale database content often takes a lot of time, which makes such analysis unrealistic and infeasible. Using the method of data specification, on the premise of ensuring data integrity as much as possible, reduce the scale of mined data, and the final results will not be too different. Therefore, Data reduction is an important step to improve the quality of the whole mining plan.

Dimension reduction, quantity reduction and data compression are regarded as three methods of data specification. Among them, analysis method, transformation method and selection attribute method are common methods of dimension reduction. Analysis method and transformation method plan the data source into a relatively small environment, while selection attribute method reduces the data scale by selecting relevant attributes and excluding irrelevant attributes. The reduction of this method is mainly to use parameters, express the smaller data with formal representation, and obtain non parameters to replace the original data. Therefore, the basic operations of data reduction processing include: deleting columns, deleting rows, and reducing the number of values in columns.

The specific method of data reduction is to use the induction method of decision tree to classify and induce the initial data to obtain an initial decision tree. All attributes that do not appear in the decision tree are considered irrelevant attributes. Therefore, deleting these attributes from the initial attribute set can obtain a better attribute subset.

Processing flow:

(1) Create a node N;
(2) If all samples in this node belong to the same category C, then return N as a node and mark it as category C;
(3) If attribute_ If the list is empty:
    Return N as the leaf node and mark it as the category with the largest number of categories in the sample contained in this node:
(4) From attribute_ List select an attribute with the greatest information gain test_ attribute,
(5) And mark node N as test_ attribute;
(6) For each known value ai in the test attribute, prepare to divide the sample set contained in node N;
(7) Test according to conditions_ attribute = a; a corresponding branch is generated from node N to represent the test condition;
(8) Set si to test_ Attribute = a: the sample set obtained by the condition;
(9) If si is empty, the corresponding leaf node is marked as the category with the largest number of categories in the sample contained in the node;

Otherwise, mark the corresponding node as generate_decision_Tree (s;, attribute_list, test_attribute) returns the value.

The basic learning strategies of the above decision tree are described as follows:

(1) At the beginning of the decision tree, it contains all the training sample sets as a single node;
(2) If the samples of a node are of the same category, the node becomes a leaf node and is marked as the category;
(3) Otherwise, the algorithm will use the information entropy method as heuristic knowledge to help the appropriate attributes, so as to divide the sample set into several subsets;
(4) Each value of a test attribute corresponds to a branch to be created, and also corresponds to a divided subset;
(5) Each subset obtained corresponds to a decision. Once an attribute appears in a node, it can no longer appear in the subtree node generated after the node.

The so-called discretization is to replace the initial data with the concept of value range or higher level. Using concept level can help to mine pattern knowledge at different abstract levels. Discretization technology can help reduce the number of values of a continuous attribute by dividing the value range of the attribute field into several intervals. A label can be used to represent the actual data value in an interval. In the classification mining based on decision tree, the discretization of reducing the number of attribute values is a very effective data preprocessing step.

The data classification process mainly includes two steps:

Step 1: build a model to describe the categories or concepts of consistent data sets. The model is obtained by analyzing the contents of each data row in the database.
Step 2: use the obtained model for classification operation.

The steps of transaction segmentation are as follows:

The transaction recognition segmentation algorithm used in segmentation is the maximum correct answer algorithm, which can identify semantically meaningful transactions.

(1) Data acquisition;
(2) Transaction identification: use the segmentation algorithm to convert the acquired data into transactions with smaller granularity, so as to facilitate the later data analysis using the data mining algorithm.
(3) Transaction segmentation.

2.3 Deep Excavation of Resources

Based on K-means clustering, an online higher education resource mining algorithm is designed to realize the in-depth mining of online higher education resources.

For the sensitivity of K-means algorithm to the initial clustering center, you can usually select multiple groups of different initial center values, execute the algorithm many times, and then select the best result. Obviously, if the number of initial cluster centers is less, the optimal solution can not be guaranteed; If the initial clustering center is selected more times, it will increase the amount of calculation, so an improved algorithm is proposed. The K-means clustering algorithm based on support vector machine does not depend on the selection of initial values, and the initial values are randomly selected. Therefore, the K-means clustering algorithm is improved according to support vector machine, and an online higher education resource mining algorithm is designed.

The implementation process of the algorithm is shown in Fig. 2:

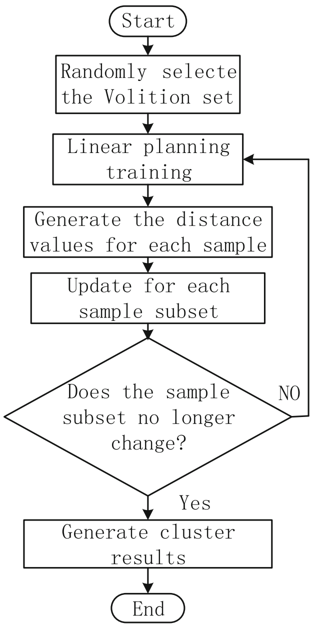

Fig. 2. Flow diagram of the algorithm

1. Randomly select k voronoy sets A_k, as follows:

$$A_k=(a_1, a_2, ..., a_k) \tag{2}$$

In formula (2), a_k represents the first Volonoi set; A_k is a subset of the original sample set with b sample points.

2. Training each sample subset with support vector machine under linear programming;
3. k distance values are generated for each sample according to the results of step 2, and each sample subset is updated after comparison and reclassification;

   4 Clustering results were generated if each subset of the sample was no longer changed in step 3;

4. If in step 3, each sample subset is no longer changed, the clustering result is generated;
5. Otherwise, go to step 2 to continue training.

There are three important problems different from K-means in the algorithm:

1. The purpose of the algorithm is not to obtain the minimum error, because the voronoy set is not based on the calculation center point;
2. Due to parameter limitations, not every sample must be divided into various types;
3. The center in the feature space may not be expressed directly, but can only be expressed implicitly.

3 Experimental Test

3.1 Test Environment

This paper tests the designed in-depth mining method of online higher education resources based on K-means clustering. The test environment is as follows: in the experiment, two different computers are used: M 1: Intel (R), Core (TM) i3–8100 CPU and 4 GB RAM Santa Clara, CA, USA; M2: (Intel (R), Core (TM) i5–7400 CPU and 8 GB RAM) ◦Use Matlab (Matlab 2017, Math Works, Natick, MA, USA) to realizethe clustering algorithm.

3.2 Training-Mining Dataset

The UCI database standard dataset was selected for the algorithm experiment, and a total of five datasets were selected.

Specific information for the five datasets is shown in Table 1.

Table 1. Specific information for the five datasets

Data set	Data scale (GB)	Number of data categories (kind)
1	125	3
2	196	2
3	752	4
4	158	5
5	338	6

In the experiment, the cluster number has been determined in advance, and the initial cluster center is randomly selected. For the selection of the kernel function, it is generally based on experience, so in the experiment, the Gaussian kernel function with magnifying the tiny features of the sample is selected.

Table 2. Results of the SSE, SSR, DB, and XB tests

Data set	SSE	SSR	DB	XB
1	1.32647	8.20120	1.32651	2.30211
2	1.30254	7.21545	1.65233	2.02447
3	1.12001	9.12401	1.54204	2.30265
4	1.02014	8.02301	1.30212	2.01476
5	1.30201	8.02014	1.20120	2.03247

3.3 Mining Performance Test

The performance of the design method was analyzed and evaluated from three aspects: SSE (Error Sum of Squares), SSR (Regression Sum of Squares), DB (Davies-Bouldin Index), and XB (Xi e-Beni Index).d

The test results are specifically shown in Table 2.

According to the test results of SSE, SSR, DB and XB, the SSE, DB and XB values are small; SSR values are large, indicating that the performance of online higher education resources is strong.

The results of the four tests were Nemenyi Test-tested, and the test results are shown in Table 3.

Table 3. Results of the Nemenyi Test test

Serial number	Item	Pr
1	SSE	0.0221
2	S	0.0201
3	DB	0.0362
4	XB	0.0415

Table 3 presents the Nemenyi Test test results of SSE, S, DB and XB, using 0.05 as the threshold for significance evaluation, and showing significant differences for SSE, S, DB and XB, indicating that the mining performance of the design method is effective.

3.4 Excavation Time Test

Take the current mainstream method reference [1] method and reference [2] method as the control group, and take this paper as the experimental group for comparative experiments. Ensure that the environment of the control group and the experimental group is consistent. Table 4 specifically tests the average mining time of the three methods.

Based on the average runtime test results in Table 4, the running time of the design method is less than 104512 ms, while the other two methods exceed 109252 ms, proving that the design method can achieve faster data mining.

Table 4. Average runtime test results

Data set	Average time of the method of this paper (ms)	Average time of reference [1] method (ms)	Average time of reference [2] method (ms)
1	102575	112363	107841
2	104512	114782	109252
3	103269	113566	116323
4	102589	111252	111246
5	103210	113629	111239

3.5 Robustness Test

The classification robustness of the three method was tested, and 10 GB of dirty data was added in each data set to test the clustering accuracy of the design method. The test results are shown in Fig. 3.

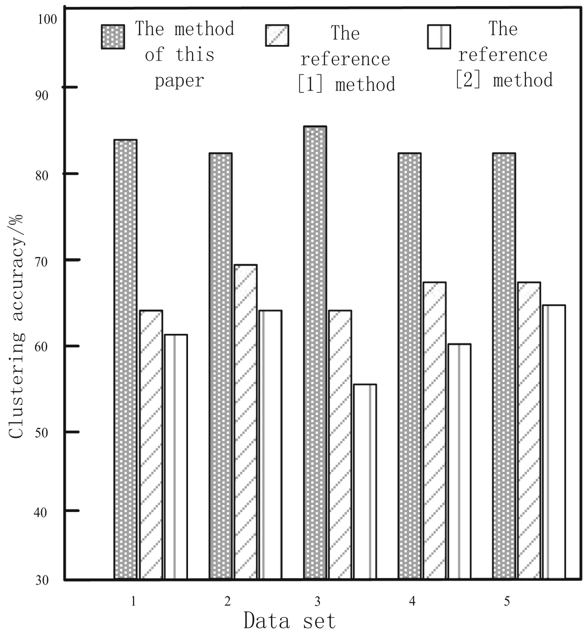

Fig. 3. Cluster accuracy test results

The clustering accuracy test result in Fig. 3 shows that after adding 10 GB of dirty data, the clustering accuracy of the design method remains high, above 80%, while the other two methods are below 70%, indicating the high robustness and robustness of the design method.

4 Conclusion

In social life, the application value of big data is reflected in: providing social science methodology, realizing data-based decision-making and promoting management revolution; Form a new paradigm of scientific research, support scientific discovery based on data, reduce dependence on experience and assumptions, and solve problems that could not be solved in the past; Form a new field of high and new technology, promote the in-depth development of Internet, Internet of things, cloud computing and other industries, and form a big data industry with data as assets; Create a new engine for economic development, change human thinking, production and lifestyle, and promote social change and progress.

In the field of education, the application value of big data can be summarized from three aspects: conceptual thinking, industry development and integration innovation. Concept and Thinking: as a new concept, big data's core values such as openness, sharing and collaboration will have a far-reaching impact and impact on the field of education; As a new thinking, big data guides education from deduction to induction, from "empirical thinking" to "relying on data to speak" intelligent teaching and evaluation. Industry development level: as a new driving force to promote the innovation and development of the education field and industry, big data can be used to answer educational phenomena that could not be answered in the past, solve educational problems that could not be solved in the past, realize educational research and practice that could not be practiced in the past, create new fields, new industries and new values, improve the education industry chain and build an education ecosystem. Integration and Innovation: as a new technology and means introduced into the field of education, big data innovates the teaching mode and promotes the reform and innovation of education through in-depth analysis and mining of massive data resources generated by learning environment, teaching process and educational decision-making. The mining of online higher education resources is an important research content. Therefore, an in-depth mining method of online higher education resources based on K-means clustering is designed.

MapReduce is used as the running framework of mining algorithm, and Weka is used as the data mining tool; Preprocess the original data and segment the transactions in data mining to reduce their granularity; Based on K-means clustering, an online higher education resource mining algorithm is designed to realize the in-depth mining of online higher education resources. The test results show that the average running time of the design method is short, has good mining performance, can significantly improve the efficiency of mining resources, promote the innovation and development in the field of education, and realize the deepening application of big data in the field of education.

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Online Education Resource Recommendation System of International Finance Course Based on Preference Data Collection

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Abstract. The traditional online education resource recommendation system for international finance courses has high recommendation error and poor accuracy. Therefore, this paper designs an online education resource recommendation system for international finance courses based on preference data collection. Obtain the online education resources of international finance courses according to the preference data collection method, mine the user's interest points from the user's behavior, build the user model module, realize the online education resources search of international finance courses through the search engine module, and take the IBM small server as the server of the online education resources recommendation system to effectively realize the online education resources recommendation of international finance courses. The experimental results show that the average absolute error of the design system is low, and has good recommended quality and stability, which can meet the initial design requirements of the system.

Keywords: Preference data collection · International finance course · Web application server · Online educational resources · Resource recommendation system

1 Introduction

After the outbreak of the financial crisis in 2008, national financial literacy education has received widespread attention from all over the world. They are aware of the close relationship between financial literacy and financial behavior and financial well-being. Scholars from all over the world also generally believe that improving the financial literacy of citizens is an important means to prevent financial risks. The imperfect financial literacy education will lead to the instability of the financial system, which will have a negative impact on the regional economy. Currently, financial literacy education is receiving extensive attention from the international community [1]. In 2018, the Organization for Economic Cooperation and Development took the lead in launching the benign communication and exchanges of financial literacy education among countries, and established an international financial education network. In 2013, the Minister of Finance of Russia, the host country of the G20, and the Secretary-General of the

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OECD jointly issued the "National Strategy for the Promotion of Financial Education." In 2011, the United States released the "Promoting the Success of the U.S. Economy: A National Strategy for Financial Literacy". After Australia issued the first "National Strategy for Financial Literacy" in 2011, it also released the "2014–2017 National Strategy for Financial Literacy". The core idea is Hope to improve the financial well-being of Australians by improving people's financial literacy [2]. At the same time, my country has also made some efforts to promote national financial literacy education. In 2018, my country's education research department first announced the full text of China's first "China Financial Literacy Education Standard Framework". According to my country's national conditions and student characteristics, it has made relevant requirements for the financial literacy of students at all stages from kindergarten to university. School education is an important platform for the promotion and implementation of financial literacy education. At present, domestic financial literacy education is still in the exploratory stage. As an important part of my country's education, colleges and universities have all aspects of financial literacy education training goals, curriculum systems, and teacher team construction. There are big problems. In general, it is an important and urgent task to develop financial literacy education in universities and comprehensively improve students' financial literacy. The comprehensive promotion of international finance courses in colleges and universities is an important means. At the same time, international finance courses need to be promoted not only in colleges and universities, but also in the whole society in order to improve the financial literacy of the whole society [3].

In order to reduce the recommendation error of the online education resources recommendation system for international finance courses, this paper designs an online education resources recommendation system for international finance courses based on preference data collection, which uses the preference data collection method to obtain the online education resources for international finance courses, excavates users' interests from users' behaviors, constructs a user model module, and realizes the online education resources search for international finance courses through the search engine module, This method can reduce the average absolute error of resource recommendation.

2 Design of an Online Education Resource Recommendation System for International Finance Courses Based on Preference Data Collection

2.1 Front-End Functional Module Design

In the front-end function module, it mainly shows the JS interface design of the main functions of the system, mainly including user login and registration, query and search, uploading resources, downloading resources, collecting resources, resource details and other interface design [4].

The design of the user login registration interface is as follows: in the user login interface, the user needs to enter the user name and password. The system also realizes the function of password retrieval. Then click to retrieve the password and jump to the password retrieval page to reset the user password. In the registration interface, you need to enter personal information, such as user name, password, name, date of birth, occupation, gender, education, interest and other basic personal information.

The design of query and search function is as follows: on the resource search page, when users enter keywords, the system will query and search according to the resource information stored in the background database. Return to the front-end interface in the form of resource icon + resource name + resource time. The sorting method starts from the resource with the highest time similarity.

The design of the resource details page is as follows: on the resource details page, the resource name, resource classification, discipline, resource size, resource type, resource format and resource keywords are displayed. In addition, after logging into the system, system users can click collection and save it to their favorites, and users can download the resource [5]. In addition, the most important function of users is the function of scoring and comment, which is an important reference standard when the system recommends personalized resources for users. The system will store the user's comments and scores into the user's comment database table according to the user's comment time. The data processing module in the system will store the user's comment information into the characteristic keyword database of the resource after word segmentation. In addition, the user's score will also be part of the characteristic matrix of the resource.

The design of the upload resource interface is as follows: in the resource upload interface, users need to enter resource name and resource profile, also known as resource description. All these contents are required. After the user confirms that the information is correct, click upload to enter the system administrator review stage.

2.2 Search Engine Module Design

ElaticSearch is an excellent open source search engine, which provides a large number of configurable options and is very flexible to use. It is precisely because of this that it needs to be configured and improved in a specific application scenario. For the resource search function, it is necessary to import teaching resource data from the resource database into ElasticSearch to build an index; when the user searches through keywords, the keywords must first be accurately segmented to obtain accurate search results. At the same time, considering that users may use Synonyms are used for searching, so the query of synonyms also needs to be supported; for ElasticSearch, the weights of search keywords appearing in each position are equal by default, but in actual educational resources, the importance of keywords appearing in the title and content is different. Therefore, the sorting needs to be optimized; finally, in order to facilitate users to quickly locate the required resources from the search results, the search results need to be highlighted in the design of the search engine module, mainly in data import, Chinese word segmentation and synonym query, Search result optimization and query result highlighting are four aspects of improvement and optimization [6].

Data import: The teaching resource data in the SQL Server database is used in the system. There are two ways to import the data in the database in ElasticSearch. One is to query the data in the database through query statements through programs, and then import the data into ElasticSearch through the indexing API of ElasticSearch; the other is Import via River. The second method is usually used, because there are often new and updated resource data changes in the database. The second method can easily update these changes to the index by defining a timestamp, and is compared to the first The way is simpler.

Chinese word segmentation and synonym query: ElasticSearch's tokenizer is extensible, you can customize the tokenizer. Just inherit its Analyzer class and implement the word segmentation logic in a custom tokenizer. After the custom tokenizer is implemented, both the indexed tokenizer and the query tokenizer are designated as custom tokenizers, and then the custom tokenizer can be used. In order to achieve a satisfactory word segmentation effect, an open source third-party Chinese word segmenter was selected. After investigation and comparison of various Chinese word segmenters, IK was finally determined to be used. IK Segmentation Tool is an open source Chinese word segmentation toolkit. It adopts the "forward iterative most fine-grained segmentation" algorithm and supports two segmentation modes, smart mode and non-smart mode. Smart mode is smart word segmentation, and non-smart mode is Fine-grained word segmentation, its word segmentation speed is as high as 80W characters/sec [7]. The tokenizer comes with about 27W thesaurus, and it also provides extensions for stop words and custom thesaurus, which can meet the needs of the subject. ElaticSearch does not enable synonym query by default. You need to configure the synonym query function in its configuration file elasticsearch.yml and add the synonyms used in each discipline to the thesaurus.

Search results ranking optimization: One way of optimizing the ranking of search results is to assign greater weights to important fields, so that search terms appear in these positions to get higher scores and rank higher in the results, making users more It is easy to find the resources you need. Sort the importance of the fields obtained through analysis and assign initial weights to them: Keyword (4.0) = Title (4.0) > Knowledge Points (3.0) > Introduction (2.5) > Discipline (2.0) = Sect. (2.0) = Grade (2.0) = Book category (2.0) = Textbook version (2.0) > Other fields (1.0). When the program is running, the weight of each field can be adjusted in real time according to the user's feedback to optimize the sorting of the search results.

Query result highlighting: ElasticSearch's default search results do not highlight matching keywords. In this way, when the number of search results is large, users will spend a lot of time looking for the resources they need from these results. Affect the user experience of the system. Therefore, referring to the practices of well-known search engines such as Baidu and Google, you can highlight the matching keywords in the search results, so that users can easily find the resources they are most interested in in a large number of search results, which can be greatly shortened The time the user finds the resource.

2.3 User Model Module Design

Based on preference data collection, the user model module is designed to further mine the user's interest points from the user's behavior, and a user interest growth model is proposed to better transfer the user's interest points, so as to lay the foundation for recommendation.

User data is the overall cornerstone of the operation of the recommendation system. The quality and comprehensiveness of the collected user data directly affect the establishment of the whole user model, the method of generating recommendation results and the quality of recommendation content. Two technologies for collecting user data are used in the user model module: one is explicit collection of user preference data, which requires users to directly participate in content evaluation, and the other is implicit collection, which enables the system to automatically monitor user behavior, collect user behavior and extract user preference data information [8].

Explicit collection: in this process, users actively submit their evaluation of resources to the system. Whether this technology can truly feed back users' points of interest requires users' active participation and sincere evaluation, rather than rough and arbitrary selection. This method is simple and can directly reflect the preference relationship between users and resources. There are two main ways:

1: Like \ don't like. This method can simply use the dichotomy mechanism to divide users into interest points and non interest points.

2: Score. Now many systems adopt discrete scoring method. Users can give different scores according to their preference for resources. In addition, you can also rely on the explicit feedback of users to collect the statistical information of users' evaluation of resources, so as to continuously adjust the quality level of resources, so as to form a resource level model more in line with users' needs. Explicit data collection in the module mainly uses the scoring level to collect users' interest in a resource. The scoring level is divided into five different levels (very dislike (- 2), dislike (- 1), no comment (0), like (1), very like (2)).

Implicit collection: in this process, the user does not need to participate directly, and the system will automatically collect the user's behavior. These behaviors mainly include user browsing behavior, user downloading behavior, user sharing behavior, user collection and attention behavior and user search behavior. This method reduces the user cost, and all influencing factors of collection behavior are controlled at the system end. However, it has to face a lot of redundancy and noise. How to brush out the information we really need is a challenge for this model. In addition, if the resources we recommend rank high, but the user has not taken action on this resource, it means that the user is not interested in this resource to a great extent. The implicit collection behavior in the module includes browsing behavior, downloading behavior, sharing behavior, collection and attention behavior and search behavior. The user's characteristics can be extracted from these user's behaviors, expressed as the user's positive and negative feedback indicators on resources, continuously optimize and adjust the evaluation and grade of resources, and extract the user's points of interest, Recommend the user's interest resource collection.

In the module, the user behavior in educational resources is abstracted into several disjoint categories.

New user behavior: a user starts her system life cycle, the user is unfamiliar with the whole system, and the habit of using the system is immature;

Generalized user behavior: a user has clear resource preferences, but her behavior this time is just a casual look, which may have nothing to do with her own interests;

Strong positioning behavior: the user has a strong demand for some resources and directly finds system resources through his habitual road strength. She is more concerned about the update and quality of these resources, but she is often not very concerned about other resources;

Pay attention to collection behavior: these users have a high degree of attention to the categories they pay attention to or collect. When such resources are updated, users with such behavior should be reminded at the first time through direct way.

The abstract classification of user behavior in educational resources can reflect users' preferences for resources and users' interests. No matter what kind of behavior the user takes, it corresponds to an abstract user behavior, which contains the user's behavior intention. User preference data can be judged according to user behavior [9].

Educational resources tag the online educational resource catalog of international financial courses in accordance with the educational resource classification system prescribed by the state, and use user behavior and basic user information to associate resources of interest to users to build user interest point models.

The formula for calculating the weight of user interest in the model is as follows:

$$w_i = \frac{\sqrt{\sum_{tf}^{n}\left[tf * In\left(\frac{N}{n}\right)\right]^2}}{tf * In\left(\frac{N}{n}\right)} \tag{1}$$

In formula (1), tf refers to the ratio of the frequency of the user's access to this tag to the frequency of the user's access in a day; n refers to the frequency of the total number of users who acted on that day; N refers to the number of users; w_i refers to the number of users corresponding to tag$_i$ interest.

Then the user interest model is expressed as the following formula using VSM:

$$T = \{(tag_1, w_1), (tag_2, w_2), \ldots, (tag_n, w_n)\} \tag{2}$$

This completes the construction of the user point of interest model.

2.4 Server Module Design

Based on the C/S architecture, the system has a public IP and domain name. Among them, the Web application server and the storage server are located in the same local area network, but are deployed on different physical machines, and both use IBM small servers.

Specific hardware configuration information is shown in Table 1.

Table 1. Specific hardware configuration information

Serial number	Category	Configuration details	Number
1	Web application server	i5–3690	2
2	Storage server	E5–2608	8
3	Switch	SDFHEFI34	1

This completes the design of the server module.

2.5 Database Module Design

The database module includes user information, learning style information, resource information and information of learners operating learning resources.

User information is provided by system users at the time of registration to obtain basic user information that has a significant impact on the resources recommended by the recommendation system, including user gender, user major, user age, user education and user occupation. The user information table in the module is shown in Table 2.

Table 2. User information table

Serial number	Column name	Significance	Type of data	Length
1	Profession	Indicates the occupation of the user	Int	6
2	Degree	Indicates the user's education	Int	8
3	Age	Indicates the age of the user	Int	12
4	Major	Indicates the professionalism of the user	Int	20
5	Gender	Indicates the gender of the user	Varchar	28
6	Password	User password	Varchar	16
7	UserName	Username	Int	8
8	UserId	User unique identification, automatic growth, is the key	Int	6

The information recorded in the learning resource table includes the basic information of the resource and the usage information of the resource. This information is used as a set of input scalars of the recommendation algorithm, which determines that the resource can be recommended to suitable learners. Therefore, each field of the resource information table must be scientifically designed, and the object model of learning resource information needs to be standardized and standardized [10]. This system combines the actual selection of LOM standards. In addition to recording basic information related to learning resources, such as the name of the learning resource, the detailed description of the resource, the storage address of the resource, the type and type of the resource, and the difficulty level, the data model established by this system also records The use of learners, such as the number of downloads of learning resources, the keywords of the resources, and the uploader of the resources. The meaning of each field in the table is shown in Table 3.

Table 3. Resource information table

Serial number	Column name	Significance	Type of data	Length
1	DownloadCnt	Total number of resource downloads	6	Int
2	Keyword	Resource keywords	8	Int
3	UserId	Resource uploader	6	Int

(*continued*)

Table 3. (*continued*)

Serial number	Column name	Significance	Type of data	Length
4	Level	Difficulty level	6	Int
5	Type	Resource Type	8	Int
6	Major	Resource category		Int
7	Location	Resource storage address	24	Int
8	Resource Description	Resource detailed description	500	Varchar
9	ResourceName	Resource Name	12	Int
10	ResourceId	Unique resource identification, automatic growth, is the key	24	Int

User interest This table records the user's use of learning resources. It mainly contains two fields, which respectively indicate whether the resource has been viewed and whether it has been downloaded. The meaning of each field in the table is shown in Table 4.

Table 4. User interest table

Serial number	Column name	Significance	Type of data	Length
1	Download	Mark whether to download resources	8	Int
2	Brower	Mark whether to browse resources	8	Varchar
3	ResourceID	Resource ID	8	Int
4	UserID	User ID	8	Int
5	InterestID	Unique identification of interest, automatic growth, is the primary key	12	Int

The database is the storage layer and persistence layer of the entire system.

Accordingly, the specific flow chart of the design system is given as shown in Fig. 1.

3 System Test

3.1 Introduction to the Experiment

The evaluation of recommendation system is an important measure of recommendation system. At present, there are two methods to measure the efficiency of recommendation algorithm in recommendation system; Online and offline evaluation methods. Online evaluation is a form of online survey or voting to obtain users' evaluation of the recommendation system services. Offline evaluation mainly uses the data in the system and statistical system data performance indicators to evaluate and measure the performance of the recommendation system. This experiment adopts offline evaluation, mainly including average absolute error, accuracy, recall, F value and other evaluation indexes.

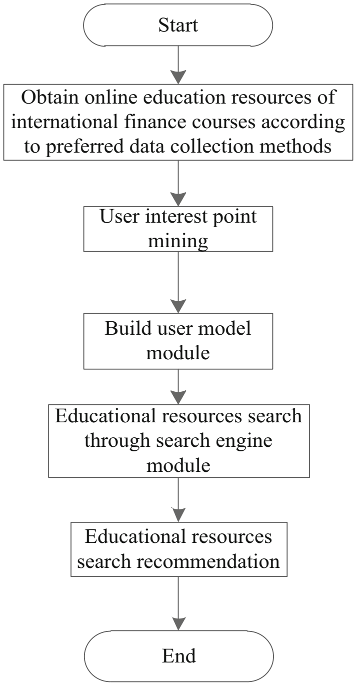

Fig. 1. System resource recommendation process

3.2 Sources of Experimental Users

Users mainly come from students studying international finance, and collect relevant data of 400 students.

3.3 Experimental Test

Test Items

The overall recommendation quality and system stability of the Online Education Resource Recommendation System of international finance course based on preference data collection are tested.

Evaluation Criteria

The evaluation criteria in the experiment are as follows:

(1) Mean absolute error (MAE).

The average absolute error is used to measure the performance index of the recommendation system, and is used to calculate the absolute average of the difference between the user's actual resource score and the predicted value. Assuming that the true value of a group of time series is $y = \{y_1, y_2, ..., y_n\}$ and the predicted value is $y = \{y_1, y_2, ..., y_n\}$, the average absolute error is expressed as:

$$MAE = \frac{1}{n}\sum_{i=1}^{n}\left|y_i' - y_i\right| \tag{2}$$

(2) In the fields of information retrieval and statistics, accuracy and recall rates are mainly used to evaluate the quality of the system. The application in the recommendation system is mainly to evaluate the quality of the recommendation results.

The accuracy rate P, the ratio of the number of correct resources in the retrieval result to the total number of retrieval results, is mainly used to measure the accuracy of the recommendation system. Recall rate R, the ratio of the number of related resources in the search result to the number of related resources in the total library, mainly detects the recall rate of the retrieval system. In the recommendation system, the higher the accuracy rate and the recall rate, the better. But the fact is that there may be contradictions between the two. For example, there is only one correct search result. At this time, Precision is equal to 100%, but the Recall value is low. If you adjust the recommended method now and return all recommended results, when Recall is equal to 100%, the accuracy is low. Therefore, at this time, a comprehensive evaluation index is needed to measure the quality of the recommender system, so a comprehensive evaluation index F is introduced. The higher the comprehensive evaluation index value, the more effective the recommendation result of the recommendation system is.

Analysis of Average Absolute Error Test Results

The average absolute error test results of different systems are shown in Fig. 2.

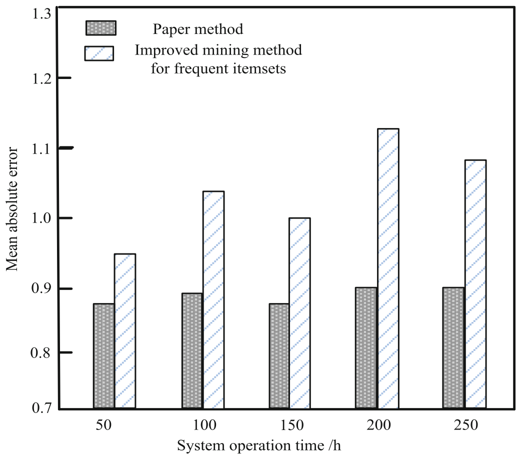

Fig. 2. Average absolute error test results

According to the analysis of Fig. 2, when the running time is 100s, the average absolute error of Resource Recommendation of the improved mining method of frequent itemsets is 0.95, and the average absolute error of Resource Recommendation of the design system is 0.88; The average absolute error of the design system is generally low, indicating that the overall recommended quality of the system is good. At the same time, with the increase of running time, the average absolute error region of the system is stable, which proves that the stability of the system is strong.

Analysis of Comprehensive Evaluation Index Test Results
The comprehensive evaluation index test results of different systems are shown in Fig. 3.

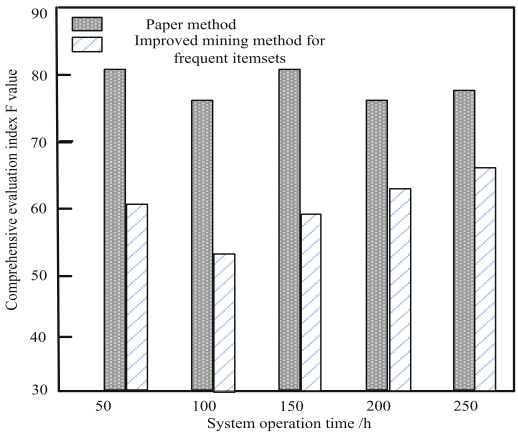

Fig. 3. Test results of comprehensive evaluation indicators

According to the analysis of Fig. 3, when the system running time is 50s, the F value of the comprehensive evaluation index of Resource Recommendation of the improved mining method of frequent itemsets is 60, and the F value of the comprehensive evaluation index of Resource Recommendation of the design system is 82; The above results show that the comprehensive evaluation index test value of the design system is high, indicating that the overall recommendation quality of the system is good. This is because the designed system uses the preference data collection method to obtain the online education resources of international finance courses, mine the user's interest points from the user's behavior, and effectively improve the comprehensive evaluation effect of resource recommendation.

4 Conclusion

This paper designs an online education resource recommendation system for international finance courses based on preference data collection. According to the preference data collection method, the online education resources of international finance courses are obtained, the user's interest points are mined from the user's behavior, the user model module is constructed, and the IBM small server is used as the server of the online education resources recommendation system to effectively realize the online education resources recommendation of international finance courses. The experimental results show that the designed system can effectively reduce the average absolute error, meet the personalized differences of learners, and achieve an efficient personalized recommendation service.

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Intelligent Sharing Platform of Agricultural Online Education Resources Based on Blockchain Technology

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Abstract. The conventional agricultural online educational resources intelligent sharing platform has the problem of unclear educational resources storage architecture, resulting in poor response performance of the sharing platform. Therefore, an agricultural online educational resources intelligent sharing platform based on blockchain technology is designed. Hardware part: select DSP as the processor, and then generate serial port, interrupt, PWM wave and other functions to the external port according to the instructions; Software part: build an agricultural online education database, fully tap the potential of information-based teaching, optimize the storage architecture of educational resources with blockchain technology, use smart contracts to encode and operate data, set permissions according to the type of users, and design the software data migration function of intelligent sharing platform. Experimental results: the average response time between the agricultural online educational resources intelligent sharing platform and the other two sharing platforms is 103.37 ms, 138.51 ms and 140.64 ms, indicating that the performance of the agricultural online educational resources intelligent sharing platform integrated with blockchain technology is more perfect.

Keywords: Blockchain technology · Educational resources · Agricultural online education · Intelligent sharing · Database Data storage

1 Introduction

Agricultural technology is the crystallization of the wisdom and labor of agricultural scientific research staff. It is a valuable strategic resource in the process of agricultural technology development. Most agricultural universities have built digital teaching resource platforms for teachers and students, and some courses are equipped with network courses in a comprehensive form, including test question banks, multimedia and digital literature resources to meet the basic needs of teaching, so as to assist in the deepening of teaching activities. With the efforts of agricultural technology researchers in agricultural college and the changes of external environmental conditions, the informatization level of agricultural college has improved rapidly. However, due to the deviation

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between the content construction and the consistency of disciplines and teaching materials, the lax requirements on the use of students and the inadequate publicity of relevant services, some services are not known by all teachers and students, which reduces the utilization rate of digital teaching resources to a certain extent. Therefore, in order to improve the real-time sharing ability of agricultural technology, it is necessary to build a strategic resource database in the process of agricultural technology research and development. In addition to professional and technical personnel, teachers are important participants in the construction of digital teaching resources in agricultural universities. They integrate digital teaching resources that are consistent with students' characteristics, have personal characteristics and can flexibly adjust the progress according to needs into teaching activities. As a key issue in the development of agricultural college, database provides support for scientific research and teaching and community services for agriculture, rural areas and farmers. Students prefer to use the multimedia courseware provided by teachers' courses for learning assistance, which can well match the rhythm of classroom teaching, be widely recognized by teachers and students, and receive better teaching results. During the construction of agricultural online education resource intelligent sharing platform, we can first carry out top-level design according to the teaching needs of the college, and scientifically grasp the design positioning of agricultural technology teaching resource database. Most agricultural universities give strong support to the construction and service of digital teaching resources, set up special policies to encourage teachers to use information software and hardware tools, and participate in the construction of digital teaching resources. We need to strengthen the collection of teaching resources, promote the reform of professional education in agricultural colleges, expand community training on agriculture, rural areas and farmers, strengthen the combination of higher education, secondary vocational education and technical training in agricultural colleges, and promote the construction of a national demonstration agricultural technology cultivation base. Teachers and students have a strong demand for specialty related characteristic digital teaching resource database, which provides a reference for the construction direction of digital teaching resources in agricultural universities in the future. Through database technology, data storage technology and fragment processing technology, a fully functional teaching resource database is finally developed around the realization of teaching resource database sharing, teaching service, social service and student learning service. After the construction of agricultural online education resource intelligent sharing platform is completed, it is of great significance.

Fan Ying and other scholars designed the online education curriculum resource sharing platform, which divides the user functions into two functional modules: teachers and students according to the user's authority differences. Combined with the working principle of the platform, online examination and other functions are realized, but the unclear storage architecture of educational resources is ignored in the design process [1]. Xie Xiaoyu and other scholars put forward the stage hybrid teaching mode of combining online and offline teaching according to the hybrid teaching theory and curriculum characteristics, but the problem of unclear storage structure of educational resources has not been properly solved [2]. Xu Chao and other scholars first expounded the important significance of blockchain technology, summarized the concept and basic characteristics of blockchain audit and the comparison and difference between blockchain audit and other audits, discussed the current research hotspot and research status of blockchain audit, and analyzed the logical application methods from four aspects: audit data quality, audit organization and management, audit process and risk control in the audit process, Finally, the strategy of vigorously developing domestic independent and controllable blockchain audit technology platform is proposed. However, there are great differences between educational resource sharing and auditing, so it can only be used as the theoretical reference of this paper [3].

Therefore, the intelligent sharing platform of agricultural online education resources needs to be further discussed. Based on the above research background, this paper uses the openness of blockchain technology and other advantages to design an intelligent sharing platform for agricultural online educational resources, in order to further optimize the sharing performance of educational resources and improve resource utilization.

2 Intelligent Sharing Platform of Agricultural Online Education Resources Based on Blockchain Technology

In order to meet the real-time needs of agricultural online education resource sharing, an intelligent agricultural online education resource sharing platform is designed from both hardware and software based on blockchain technology.

2.1 Hardware Design of Intelligent Sharing Platform for Agricultural Online Education Resources

The platform adopts "MCU + FPGA" as the core control mode. Generally, the communication between MCU and FPGA can interact with instructions according to the pre-defined communication protocol. The processor is the core of the control platform. Its main performance index is the processing speed, that is, the main frequency of the processor, that is, if conditions permit, choosing a processor with high main frequency will be very helpful to improve the performance of the control platform. For the port resource reconstruction function of the educational intelligent sharing platform, the MCU can send control instructions to the FPGA, and the FPGA can generate serial port, interrupt, PWM wave and other functions to the external port according to the instructions. Among the educational resources intelligent sharing platform products at home and abroad, the longest used processors are: single chip microcomputer, DSP controller and arm controller. However, the implementation of this control method is complex and does not highlight the advantages of "MCU + FPGA" platform. MCU itself is embedded with timer, serial port, external interrupt and other pin resources, while FPGA has more abundant wiring resources. Single chip microcomputer is a controller often used in traditional motion control. Its low cost, small volume and rich models are the advantages of single chip microcomputer controller. However, the main frequency of single chip microcomputer is generally very low, most of which are below 100 MHz, which limits the processing speed of processor chip and becomes the bottleneck of high-precision control. The whole chip of FPAG is composed of an array of programmable logic units separated by wiring resources and surrounded by programmable I / O units. The logic units arranged in the array are connected through the programmable internal wiring in the wiring channel, so as to realize the logic function. The circuit design shall follow the interface specification of external simulator, as shown in Fig. 1:

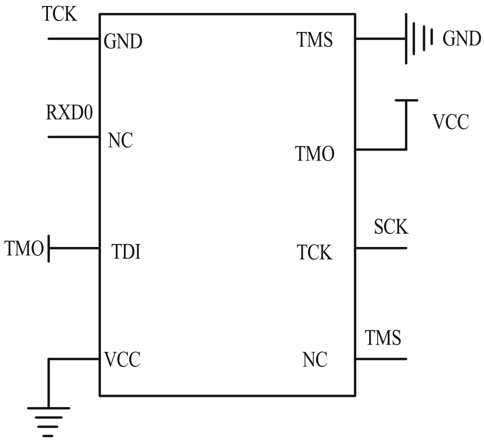

Fig. 1. Connection diagram of JTAG download and debugging interface

As can be seen from Fig. 1, the four test access port pins TMS, TCK, TDI and TDO on the interface are respectively connected to the corresponding pins of the single chip microcomputer. In addition, the interface also includes RST and VCC, which are respectively connected to the reset and power pins of the single chip microcomputer. The dominant frequency of ARM processor is very high. The dominant frequency of ARM9 processor can reach more than 300 MHz, and the arm processor can embed the operating platform. It is a very suitable processor for embedded platform. However, the arm processor has a large volume and can not be installed on a small circuit board. Although the dominant frequency of the arm processor is relatively high, it is not its advantage as a motion control processor, but its functions are relatively redundant. The programmable switch can control the segmented metal wires to connect in any way to form the signal lines required between logic units. With the development of technology, a variety of control chips exist in the market, among which the most widely used are AVR single chip microcomputer, 8-bit 51 single chip microcomputer, 16 bit tidsp and 32-bit arm. And the price of ARM processor is much more expensive than DSP, which will increase the cost of products. The main frequency of DSP is relatively high, up to 150mips, and there is a multiplier inside, so that DSP has unique advantages in data processing and can realize high-precision processing tasks. Among them, 51 because the I / O interface resources are few and the function is simple, it is usually only used in simple logic control equipment. It is obviously incompetent for the educational intelligent sharing platform that needs to be externally connected with many sensor components and actuators. In addition, there is another very important reason why DSP is selected as the processor: the RTW function of MATLAB supports the automatic code generation from MATLAB program to DSP program, which is also the design idea of the intelligent sharing platform of educational resources, which lays the foundation for the connection between the experimental platform and the hardware platform in the future. Therefore, DSP is finally selected as the processing chip in this paper. The DSP processor is a high-performance processor in the current control field. It has the characteristics of high precision, high speed and high integration. It provides high-performance solutions for different control fields. Based on the above description, the hardware design of agricultural online education resource intelligent sharing platform is completed.

3 Software Design of Intelligent Sharing Platform for Agricultural Online Educational Resources

3.1 Construction of Agricultural Online Education Database

In the process of agricultural technology teaching and research, teaching resources mainly include various teaching materials, teaching environment and related teaching support information platform. Database is the warehouse of data organization and management and the storage point of all data of the platform. Therefore, it is one of the key points of the platform design. Generally, teaching resources refer to the relevant contents that can promote teaching ability, improve teaching effect, help students complete learning plans and objectives, have strong available teaching value, and provide students with various learning services in the teaching process. In the web structure, the user's operation is completed by the background program using SQL statements to query, read and write the database. Therefore, in order to make the educational resource sharing platform provide smooth services for users, it is inseparable from a strong database. With the help of information technology, a shared database service platform for agricultural college can share high-quality agricultural technology teaching resources, provide high-quality teaching services for students, and strengthen the social service ability of agricultural college. The educational resource sharing platform adopts SQL server as the platform database management platform, and establishes personnel information database and teaching resource information database according to the framework design. The personnel information database is used to store the personal information of platform users, including teachers, students, students' credits, examination information, homework information, teachers' teaching information and other data. The teaching resource information database is used to store the video resources uploaded by teachers, history teaching video resources and various data documents. The classification criteria of data types of agricultural online education resources are shown in Fig. 2:

As can be seen from Fig. 2, the agricultural online teaching database is a new teaching service sharing platform, which can integrate the limited teaching resources of the agricultural college and provide teaching services for the school in the information platform operation service mode. And it can build the service content with high-quality agricultural technology courses as the fulcrum and virtual reality as the basic way. The agricultural online teaching database can fully tap the potential of information-based teaching and cultivate and transport a number of talents with high-tech application ability for the agricultural college, so that it can play a relevant role. Agricultural technology sharing teaching database can realize the integration of agricultural technology teaching services. Focusing on the development, design, integration and warehousing of agricultural technology teaching resources, it can build high-quality agricultural technology

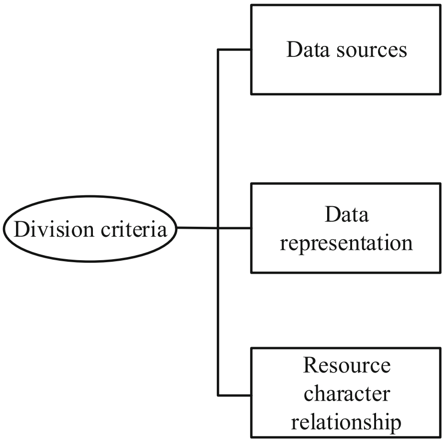

Fig. 2. Classification criteria of data types of agricultural online education resources

teaching resources service channels and agricultural technology R & D bases. The storage of data plays a vital role in the operation of the platform. The data generated by the operation of the platform needs to be persistent stored in the database. Build an open teaching environment characterized by diversified forms, strong interaction and connection with production practice, so as to meet the needs of agricultural technology learners to the greatest extent and serve the highly shared and open platform of agricultural technology teaching in agricultural college. The design of database is directly related to the operation of the platform. Therefore, in the platform design, it is necessary to design the structure of the platform data in detail, and model and classify the generated data types on the basis of fully understanding the needs of users. Based on this, the steps of constructing agricultural online education database are completed.

3.2 Blockchain Technology Optimizes the Storage Architecture of Educational Resources

In the blockchain, a block is a carrier for storing transaction summary information and a structural unit for data storage in the blockchain [4]. From the perspective of narrow sense (data), blockchain is a data structure that combines the generated data blocks into blockchain in chronological order, and ensures that the existing data can not be tampered and forged based on cryptography [5]. Each block includes block header and block body. The information in the block header is used to identify the block itself, the information summary of the previous block and the position of the block in the whole ledger [6]. From a broad (technical) perspective, blockchain is a new distributed infrastructure and computing paradigm that uses block chain data structure to store data, generates data based on distributed consensus mechanism, ensures data transmission and access security based on cryptography technology, and uses smart contracts to encode and manipulate data. Based on the above, the expression formula of data hierarchy is obtained as follows:

$$L = \delta \frac{\sum_{i=1}^{n} (1 - \alpha_i)}{G} \tag{1}$$

In formula (1), δ represents the size of the defined data element, α_i represents the simple data element, and G represents the aggregated data element. The block body is mainly used to store the transaction summary information and the Merkle tree used to verify the transaction information and ensure that the transaction cannot be tampered with. In a typical blockchain, data is generated and stored in the form of blocks, and each block records all events occurring in a period of time The structure of transaction information is divided into two parts: block header and block body. Teaching resources include curriculum system, teachers, learning materials, teaching equipment and teaching venues. The data storage form of educational resources has been determined. Next, consider the storage mode of educational resources. In view of data security, cost and other aspects, object-oriented storage is adopted. Teaching resources can support teaching activities according to the teaching course content and teaching completion, and can effectively carry out and make use of all useful teaching materials to form a set of conditions conducive to education and teaching. The object storage here refers to the storage of educational resources together with educational resource metadata, that is, the educational resources themselves and the attributes of educational resources need to be stored together. Assuming that the DC metadata standard is not unique, the expression formula for defining the data element set is:

$$H = \frac{(\varphi - \sigma)^2}{\eta} \tag{2}$$

In formula (2), η represents the theme element, φ represents the description element, and σ represents the source information description. Teaching resources can provide material information conditions for agricultural technology R & D and teaching. Generally, teaching resources include many kinds, including courseware, pictures, film and television, documents, cases, teaching materials, training base, enterprise R & D center, agricultural science and Technology Engineering Center, etc. Agricultural technology teaching equipment, teacher resources and teaching infrastructure. The platform uses a combination of two storage methods to store educational resources and their attributes in order to increase the reliability of the platform. Users can learn through the teaching resource database. In the process of agricultural technology learning, the traditional face-to-face learning form has been changed. Online communication, learning community discussion, question and answer discussion and other ways can be carried out in face-to-face form to ensure the autonomous learning process of agricultural college students, so as to ensure that students' learning is highly interactive. One is to directly write the data and the attribute information of the data into the storage structure of educational resources, and the educational resources are stored together with their original information. The other is to write the attribute information of educational resources and the storage location of educational resources into the database. These two methods complement each other. When one party has a problem, the other party can recover the relevant information. Enrich teaching forms through human-computer interaction and everyone interaction, improve students' learning initiative and further improve learning quality. Based on this, complete the steps of optimizing the storage architecture of educational resources.

3.3 Design Software Data Migration Function of Intelligent Sharing Platform

According to the needs of users, design functional modules such as data storage and background maintenance, and resource sharing service platform. Data management can store and access network file locations in real time, and record information records such as file attributes accessed by users. File location includes file ownership hierarchy and platform construction global file address, so that it can be called in time during data migration and access redirection. The intelligent sharing function of the whole education platform involves the management of educational resources. These functional modules support each other to form a flexible, convenient and high-capacity resource intelligent sharing service platform [7, 8]. File estimation can be carried out according to data resource access frequency, data capacity, read-write mode, creation time and other attributes, so as to feed back the access volume and activity of data files for data migration. The realization of user login function module is mainly based on web remote access technology. After the intelligent sharing platform of educational resources is built, it is first necessary to build a login module for the platform to facilitate the registration and login of new and old users, so as to use the resources of the platform. The judgment formula for judging whether the data is available is obtained:

$$\gamma = k\frac{1}{(s-w)^2} \tag{3}$$

In formula (3), k represents the resource set, s represents the data migration distance, and w represents the information concentration center. When network data is accessed by users, it is necessary to dynamically change the storage location of data resources according to the file valuation information to realize data migration, so as to allocate data with high activity and high contribution value to faster memory, so as to reduce user access time and improve data resources Hit rate. New users register by filling in relevant information. After successful registration, they can log in to the platform, and set permissions according to the user's type. Different user permissions can only see different interfaces and resources. Network data can provide users with transparent and distributed services. Therefore, no matter where users are, they only need to remember the logical address of data access. At the same time, users can also log in through third-party software, such as QQ, wechat or mobile phone number. The educational resource management module mainly involves the permissions of users on the platform, and different types of users have different permissions. If the physical address of the data changes, such as migrating to other places, the data can be found by using the data access redirection function. In the design of this paper, the intelligent sharing of the platform is mainly considered, and the users are set as ordinary users and administrators. When ordinary users use the educational resource platform, users have the rights to upload, view, share, delete and download their own resources. File monitoring can count the running status of the storage platform in real time, calculate the platform delay, storage space utilization, read-write ratio, file access hit rate, etc., and provide these auxiliary information to the migration control module. It has the permission to view, download and comment on the intelligent shared resources on the platform. Data migration can be placed in the relevant migration plan list to record the size, storage location, creation time and access frequency of migrated data. The platform administrator has the authority to review, upload, delete and intelligently share the resources of the whole platform, and can also configure the authority of a single user. At the same time, relevant algorithms are used to migrate data to the appropriate target location. The main purpose of data migration is to optimize data storage, and its key technologies include data classification, data placement and data migration. The functions that can be expanded in the later stage include online questioning and discussion, video teaching and classroom homework correction. Based on this, the software data migration function of intelligent sharing platform is designed.

4 Experimental Study

4.1 Experimental Preparation

The experimental preparation is as follows: deploy the contract to Ganache client with graphical interface. After the contract is successfully deployed, the blockchain returns the contract address and ABI, and set the network of metamask as Ethereum private chain network. Execute the test case under the Ethereum private blockchain network, import the private key of an account of Ganache client through metamask, open the front-end application page after successful import, and test the storage function of traceability data according to its test case. And deploy the software related to the swift storage node on Ubuntu (swift and keystone are components in the Folsom version of open-stack). Proxy server: run Ubuntu operating platform and deploy swift proxy server in the operating platform. The IP of the host packet is 10.18 110.20 its disk memory size is 3.5tb, the maximum average load is 2.46, the physical memory is 125.6G, and the switching space is 121.2G. The IP address of host server21 is 10.18 110.21, its disk size is 3.6TB, the maximum average load is 1.57, the physical memory is 125.6G, and the switching space is 125G. In the educational resource sharing platform, jemeter simulates the number of concurrent users, and can conduct auxiliary testing with the help of the performance testing tool jemeter to verify the platform's support for the number of concurrent users, response time and other performance. After the traceability data is stored successfully, enter the "obtain records" module of the front-end page to test according to the verification test cases of the traceability data to obtain the actual test results.

4.2 Experimental Results

Select swift based agricultural online educational resources intelligent sharing platform and cloud computing based agricultural online educational resources intelligent sharing platform for experimental comparison with the agricultural online educational resources intelligent sharing platform in this paper, and test the response time of the three platforms under different concurrent users. The experimental results are shown in Tables 1, 2 and 3:

Table 1. Number of concurrent users 100 response time (ms)

Number of experiments	Intelligent sharing platform of agricultural online education resources based on Swift	Intelligent sharing platform of agricultural online education resources based on Cloud Computing	The intelligent sharing platform of agricultural online education resources in this paper
1	68.26	78.44	56.33
2	81.63	76.31	61.20
3	77.98	78.56	57.14
4	82.51	79.46	58.20
5	83.62	82.07	56.91
6	77.22	81.60	54.27
7	74.53	83.66	61.22
8	81.05	79.58	56.17
9	86.30	82.04	52.09
10	85.21	83.16	53.49

Table 2. Number of concurrent users 500 response time (ms)

Number of experiments	Intelligent sharing platform of agricultural online education resources based on Swift	Intelligent sharing platform of agricultural online education resources based on Cloud Computing	The intelligent sharing platform of agricultural online education resources in this paper
1	125.61	122.08	82.54
2	118.33	119.74	91.05
3	121.03	120.33	89.64
4	122.56	124.61	88.51
5	123.48	122.15	83.60
6	119.67	123.69	82.79
7	120.55	121.08	83.16
8	123.69	122.54	79.58
9	122.55	123.48	78.22
10	119.47	119.67	75.08

According to Table 1, the average response time between the agricultural online education resource intelligent sharing platform and the other two sharing platforms is 56.70 ms, 79.83 ms and 80.49 ms; According to Table 2, the average response time

Table 3. Number of concurrent users 1000 response time (ms)

Number of experiments	Intelligent sharing platform of agricultural online education resources based on Swift	Intelligent sharing platform of agricultural online education resources based on Cloud Computing	The intelligent sharing platform of agricultural online education resources in this paper
1	216.31	211.77	169.55
2	208.14	225.60	172.88
3	226.49	223.88	163.44
4	213.54	212.49	175.26
5	206.88	222.46	169.20
6	211.04	219.38	173.49
7	209.33	221.57	169.55
8	216.34	223.69	172.06
9	211.04	220.55	181.33
10	220.95	213.69	153.22

between the agricultural online education resource intelligent sharing platform and the other two sharing platforms is 83.42 ms, 121.69 ms and 121.94 ms; According to Table 3, the average response time between the agricultural online education resource intelligent sharing platform and the other two sharing platforms is 169.99 ms, 214.01 ms and 219.51 ms.

Compare the transmission delay under different quantities of agricultural online education resources. The experimental results are shown in Fig. 3:

It can be seen from Fig. 3 that with the increase of the number of agricultural online education resources, the data transmission delay changes in a “U” shape. When the design platform transmits shared resources, the average data transmission delay is 0.39 s, the average transmission delays of the two comparison platforms are 0.61 s and 0.67 s respectively, and the design platform data transmission delay is shortened by 0.22 s and 0.28 s respectively.

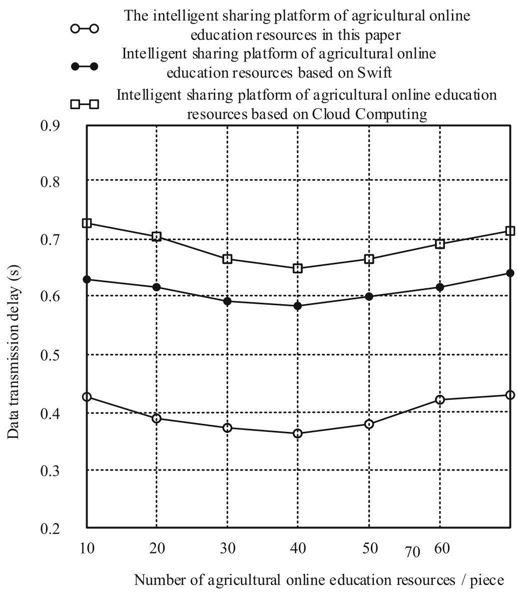

Fig. 3. Transmission delay under different quantities of agricultural online education resources

5 Conclusion

The intelligent sharing platform of agricultural online education resources designed this time improves the teaching quality of agricultural online education in the school, plays an important driving role and has remarkable social benefits. At the same time, the phenomenon of repeated purchase of resources and low-level construction investment by educational units at all levels has been reduced, and the overall economic benefits have been improved. Due to the limited research conditions, the article also needs to invest more research in the promotion of the platform.

Fund Project.
1. Heilongjiang Province Philosophy and Social Science Research Planning Project: Research on the Construction of Applied Undergraduate Universities in Heilongjiang Province under the Background of the “Double First-Class” Strategy (18EDE501);

2. The 2020 key topic of the “13th Five-Year Plan” of Education Science of Heilongjiang Province: Research on the Innovation and Entrepreneurship Development Mechanism of College Students in Application-oriented Colleges from the Perspective of Resource Synergy (GJB1320276);

3. General Research Project of Higher Education Teaching Reform in Heilongjiang Province: Research on Innovation of Applied Talents Training Model in Private Undergraduate Universities from the Perspective of Big Data (SJGY20200579);

4. The core course of Heilongjiang Oriental University “Introduction to Electronic Commerce” (1810505).

5. School-level scientific research project of Heilongjiang Oriental University: Research on the Construction of Agricultural Product Supply Chain Ecosystem from the Perspective of Blockchain Innovation Coupling (HDFKY210205).

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Economic Management Course Recommendation Algorithm in Smart Education Cloud Platform

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Abstract. The course recommendation algorithm fails to consider the impact of semantic correlation between course keywords on feature similarity calculation when modeling, resulting in low recommendation accuracy. An economic management course recommendation algorithm in intelligent education cloud platform is proposed. The text of economic management course is collected by web crawler technology, and the words are extracted by text word segmentation, removal of stop words and other preprocessing. Based on the word2vec model, the text word vector of economic management course is established to measure the similarity between words. The word vector clustering and TF-IDF word weight are used to represent the course features. Design the course recommendation algorithm, calculate the similarity between courses, and generate the course similarity matrix for course recommendation. The experimental results show that the recommendation accuracy of the economic management course recommendation algorithm designed in this paper is higher than 0.9% in the three aspects of course name, course overview and course objectives, and the maximum recommendation time is 5min, which has a good application effect.

Keywords: Wisdom education · Cloud platform · Economic management · Course recommendation · Recommendation algorithm · Education data

1 Introduction

With the rapid development of information technology and the popularity of the concept of educational informatization, intelligent education is also showing a rapid and vigorous development. In the development process of wisdom education, from the multimedia of teaching forms, to the network interaction of teaching methods, to the centralization of teaching management, and the demonstration of educational scientific research, it is necessary to establish a more concise, systematic, comprehensive, intelligent, flexible and rich basic environment of wisdom education which belongs to the field of education on the basis of the original educational information environment [1]. Based on this demand, the intelligent education platform came into being. The smart education platform provides a wealth of learning courses, and learners will make their own choices

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based on their own interests. A large number of online courses bring the problem of course selection. On the one hand, in the face of various types of courses, learners need to understand the course content through a lot of time to judge whether it really meets their personal learning style and learning needs. On the other hand, for learners without clear learning needs, it is difficult to find suitable courses only by searching and browsing. For the final wrong course, some learners will feel boring because the course does not meet their personal preferences, so they choose to give up halfway. Reducing the cost of course selection and providing personalized and diversified course services for learners, so as to improve the resource utilization of online courses, are the key problems to be solved in online education. At present, the academic community has made some research achievements in the research of curriculum recommendation algorithm. Yang Yazhi et al. Proposed an intelligent information recommendation model based on knowledge map [2]. By expanding and improving the unit model, the domain knowledge model is designed, and the knowledge map is dynamically updated to design the learner model architecture. They use Newton Raphson iterative method to obtain the cognitive level, define the achievement degree of information recommendation, and realize the intelligent information recommendation of the optimal path. Based on the end-to-end deep learning framework, Wu Hao et al. Proposed a multi task feature recommendation algorithm integrating knowledge map [3]. Embed the knowledge map in the task. The high-order relationship between potential features and entities is established through the cross compression unit between tasks, so as to establish the recommendation model. This method realizes the accurate recommendation of curriculum resources based on learners' goals, interests and knowledge level. Wang Suqin and Wu Zirui proposed an online course recommendation model based on LSTM network [4]. They extract the characteristics of learning behavior from the curriculum sequence learned by a large number of learners, and then predict the curriculum that learners will learn. The algorithm is proposed based on the timing between courses, so the accuracy of recommendation after classifying courses according to the closeness of the relationship between courses is higher. The above course recommendation algorithm has high quality in the recommended content and improves the praise of the platform. However, there are still some deficiencies in semantic analysis. The influence of semantic correlation between curriculum keywords on feature similarity calculation is not considered in modeling. Therefore, this paper designs an economic management course recommendation algorithm in the intelligent education cloud platform to recommend courses that meet both personal interests and teaching paths for learners.

2 Tconomic Management Course Recommendation Algorithm in Smart Education Cloud Platform

In order to ensure the quality of economic management course recommendation, the following will be analyzed from four aspects: economic management course text preprocessing in the intelligent education cloud platform, establishing the economic management course text word vector model, intelligent education cloud platform course feature classification and designing the economic management course recommendation algorithm.

2.1 Text Preprocessing of Economic Management Course in Smart Education Cloud Platform

Take the course navigation bar of smart education cloud platform as the entry point, visit the website in turn, extract the course information data, and then persist the extracted data. The structural features on the smart education cloud platform page mainly include the course opening time, class hours, teachers, colleges, etc. these structural features can not truly reflect the real content of the course, while the unstructured course details specifically introduce the course objectives, course overview, detailed course outline, etc. By browsing the course details, online learners can form a preliminary understanding of the course, and it can be seen that the course details can fully express the main contents of the described course. The data processed in this study is the text information representing the course. As the carrier of information, the text is not only the language used for human communication, but also the information storage form of natural language. However, to complete the information processing of natural language by computer, such as text understanding, classification, feature extraction, vector representation and other technologies, it needs to be transformed into a format that can be processed by computer, No matter what form of model is finally expressed in this paper, when it is transformed into machine language representation, the whole process of text representation is generally inseparable from the following three steps, namely text preprocessing, feature extraction and text representation [5]. The data crawling platform is used to obtain the data from the target website, so as to collect the data set required for this study. The workflow of web crawler is shown in Fig. 1.

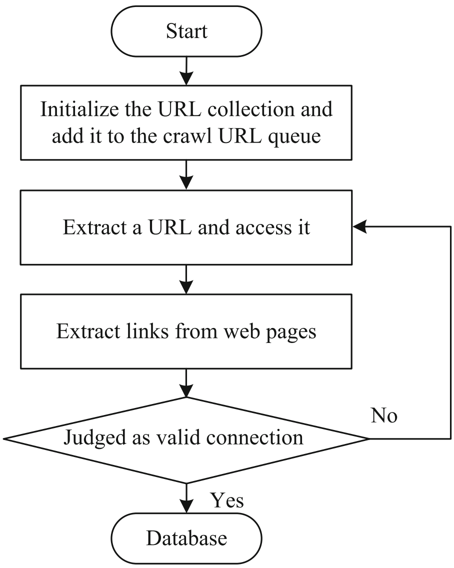

Fig. 1. Basic process of web crawler

First, you need to initialize the URL and load it into the URL queue, and then judge whether the URL queue is empty. If it is not empty, each URL is accessed and page information is extracted from the URL queue according to certain logic, and the target data in the page is stored in the database. At the same time, capture the hyperlink in the page and check its effectiveness. If it meets the requirements, add the hyperlink to the URL queue and wait for subsequent crawling. Repeat the above process according to the crawling mechanism until the URL list is empty.

In order to improve the validity and accuracy of text classification, we usually delete stop words in the process of text representation. When processing the course name information, reducing the frequency of stop words can effectively improve the density of course keywords, make the effect of course keywords more prominent and better represent the content information of the course. In the course of text content processing, select an appropriate word segmentation tool. After text word segmentation and removing stop words, representative nominal phrases can be extracted to form the key Thesaurus of the course. At the same time, the word frequency can be counted to count high-frequency words and mine the core vocabulary of the course, so as to lay a foundation for further characterizing the characteristics of the course.

2.2 Establish Text Word Vector Model of Economic Management Course

The learning method of smart education cloud platform is to copy the traditional teaching mode to the Internet, and conduct teaching and online learning in the form of network virtual team. The complete online learning process begins with learners' independent choice of courses and finally passes the assessment standards. The intermediate process includes online Q & A, discussion and course homework. Most courses take the course discussion and homework completion as part of the final grade assessment. For learners in the online learning process, the platform is open to some process behavior feedback information of learners, which can be viewed by visiting the learners' home page, mainly including course records, discussion records, certificate records and learning duration. The preprocessed text is vectorized by vector space model to complete the structured processing of unstructured information. Natural language is generally composed of words, words and sentences. Words are the most basic unit carrying semantics. Because the computer does not have the ability of language understanding like human beings, it can not directly recognize the meaning represented by each word in the natural language. Therefore, it is necessary to digitize the natural language and transform it into a format that can be understood by the computer. Word2vec word vector model is a language model that learns low dimensional word vectors rich in semantic information from massive text corpus in an unsupervised way. Word vector has the ability to express words and related information between words in quantitative form, that is, mapping words in natural language into a real vector. Word2vec word vector model maps words from the original space to a new low dimensional space, so that words with similar semantics are close in this space [6]. In the training process, the vector represented by the word one hot is input. The basic idea of one hot is to use two states of 0 and 1 to represent words as a vector of fixed digits. Only one of the digits of the vector is 1 and the rest are 0. The number of digits depends on the length of the dictionary. Low dimensional word vectors can be trained through word2vec. How word2vec obtains word vectors is a complex problem, but it can be simply understood as a black box process. This paper uses cbow, a word2vec basic model, to predict the probability of current words by using contextual words. This is a "many to one" training process. The input is the word vector corresponding to the context related word of a feature word, and the output is the word vector of a specific word. At present, there are still some deficiencies in the semantic analysis of curriculum recommendation algorithm. The influence of semantic correlation between curriculum keywords on feature similarity calculation is not considered in modeling. Word2vec word vector can be used to measure the similarity between words. Because the distribution of words with similar semantics in the vector space is relatively close, the semantic similarity between words can be expressed by calculating the spatial distance between word vectors. Therefore, word2vec word vector has good semantic characteristics. This text word vector method of economic management course promotes the computer's understanding of natural language, and lays a foundation for further mathematical modeling and semantic similarity calculation.

2.3 Classification of Curriculum Characteristics of Smart Education Cloud Platform

Based on the constructed economic management course text word vector model, the course features are extracted from the unstructured course detail description text during course recommendation and further processed. Further improve the recommendation quality by classifying the course features of the smart education cloud platform.

Document vectorization is to represent a document as a vector, mainly based on word vectorization. Then the construction of curriculum features based on word2vec word vector can be understood as the process of transformation from word vector to sentence vector. All courses are abstracted into word weight vectors with the same dimension for further processing. TF-IDF weighting algorithm is used for feature item weighting. TF-IDF is one of the commonly used technologies for text representation and feature weighting in the field of natural language processing. At the same time, it is also the object representation method commonly used in content-based recommendation algorithm, which has the advantages of intuition and easy interpretation [7]. Word vector clustering and TF-IDF word weight are used to represent course attribute features and user interest features. Clustering is to aggregate a pile of disordered data or text into multiple clusters according to its internal relevance to represent the characteristics of a certain type of abstract concept. Its main goal is to plan the texts with high similarity into the same category, and the texts with low similarity into different categories. TF-IDF algorithm comprehensively measures the importance of characteristic words to an independent text and the whole corpus to give different weight values to each word. Its basic assumption is that if a word appears many times in an article and is represented by TF weight value, it is likely to be related to the topic of the article. TF-IDF calculation formula is as follows:

$$\lambda(c) = \frac{N_c}{M_c} \lg \frac{B_1}{B_2} \tag{1}$$

In formula (1), $\lambda(c)$ represents the TF-IDF value of word c; N_c represents the number of times the word c appears in the text; M_c represents the total number of occurrences of all words in the text; B_1 represents the total number of texts contained in a corpus; B_2 represents the number of text containing feature item c. The feature vectors of each word extracted by word2vec are adaptively clustered according to the similarity of the features. This method does not need to set the number of clusters in advance, and can calculate the isolated words, increasing the robustness of the algorithm. After Chinese word segmentation and invalid word removal, we can get the keywords that can express the core content of the course. Through cluster analysis of the key words, we can get the clusters that can express the abstract concepts of the course. The calculation of cluster similarity is described by the mean value of the objects in the cluster, which is the "centroid" of the cluster. The cluster evaluation index is introduced to determine the optimal number of clusters. The index describes the similarity between objects in the cluster and the dissimilarity between objects in different clusters. The similarity and dissimilarity are measured by the dispersion matrix. The calculation formula of cluster similarity is as follows:

$$\alpha(u) = \frac{s_1(u)/(u-1)}{s_2(u)/(r-u)} \tag{2}$$

In formula (2), $\alpha(u)$ represents the cluster evaluation of the current cluster u; u is the current cluster; $s_1(u)$ is the trace of dispersion matrix under target clustering; $s_2(u)$ is the trace of the dispersion matrix between different classes; r is the number of clusters. The larger the value of the index, the better the clustering effect. For the clustering results, we complete the approximate classification process through the curriculum scoring matrix to determine the best grouping of target students. At this time, the members in the group are no longer the set of students, but the set of courses.

2.4 Recommended Algorithm for Designing Economic Management Courses

The major of economic management has its own professional training plan, which stipulates the courses that students need to learn during their stay in Colleges and universities, and has clear requirements for each course. Generally, the training plan divides the courses into four types: basic compulsory courses, general courses, professional elective courses and professional compulsory courses, and specifies the credits required for each course. After the vectorization of course attribute features and user interest features is completed, it is necessary to calculate the similarity between courses and generate a course similarity matrix for course recommendation. The specific flow of recommendation algorithm for economic management course is shown in Fig. 2.

In addition, the similarity between courses and users can also be calculated. Its function is to match the courses interested by users with the information of the course itself, so as to generate a potential course recommendation list. So as to recommend similar courses for users when they click and learn a course. The higher the recommendation, the more suitable the course is for the target students. It is a weighted average value combined with multi-dimensional characteristic factors. In the processing process, it is only necessary to execute once and save the preprocessed text and the calculated similarity matrix to generate a recommendation list according to the user's online behavior. This paper mainly uses cosine similarity to measure the difference between items by calculating the cosine value of the angle between two vectors in vector space. It focuses on

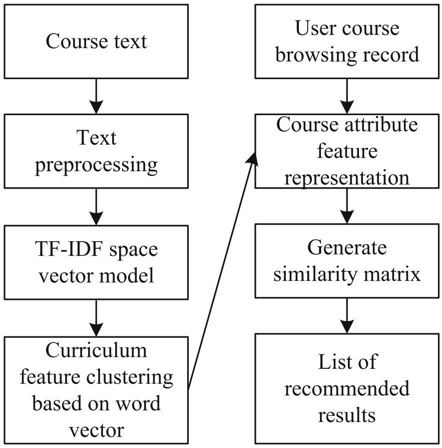

Fig. 2. Recommended algorithm flow of economic management course

the difference of vectors in direction, not the absolute distance in space. The calculation formula is as follows:

$$\phi(w_1, w_2) = \frac{\sum_{j=1}^{p} w_1 w_2}{\sqrt{\sum_{j=1}^{p} w_1^2}\sqrt{\sum_{j=1}^{p} w_2^2}} \tag{3}$$

In formula (3), $\phi(w_1, w_2)$ represents the cosine similarity of feature matching; j represents the feature serial number; p represents the total number of features; w_1 represents user characteristics; w_2 indicates course characteristics. Finally, the user interest is modeled according to the implicit feedback of users' online browsing behavior, the nearest neighbor courses are selected according to the course similarity matrix, and the recommendation list is generated according to the similarity weight. So far, the design of economic management course recommendation algorithm in smart education cloud platform has been completed.

3 Experimental Study

3.1 Experimental Scheme

The experimental data of economic management course used in this paper are from Mu course network, including learners' course selection record data, auxiliary information of all alternative courses and learners' relevant information. For the text data of economic management course required by the experimental research, this experiment collects the course data based on the scratch crawler framework. Through word segmentation technology, text keywords are extracted to construct the curriculum relationship model. The research uses offline data for training and testing. According to the actual learning concentration time of platform students, the data from March to June 2020 are selected as the experimental data set. Store the data in the database. This paper uses Mysql to store the data. The historical browsing data containing students' professional background information and personal related privacy information has been desensitized and other security processing. According to the user's online browsing course records, the model recommends a series of similar courses for the user, and assumes that the user has the same learning interest in other courses similar to the browsing course content, but is not interested in other courses that are very different from the browsing course content, which will produce four possible recommendation results. The purpose of recommendation is to help users lock their goals and recommend the content they may like. Therefore, the prediction accuracy is used as an index to evaluate the performance of the algorithm. The accuracy can reflect the recommendation ability of the recommendation system. According to the classification results, the accuracy formula of course recommendation can be obtained as follows:

$$\theta = \frac{A_1}{A_1 + A_2} \tag{4}$$

In formula (4), θ represents the accuracy of course recommendation; A_1 indicates the number of successful courses recommended; E indicates the number of unsuccessful courses recommended. This formula represents the proportion of the number of successful recommended courses in the total number of recommended courses. The so-called recommended successful courses are those similar to those in the recommended list and the user's actual selection.

3.2 Results and Analysis

Considering the characteristics of the economic management course recommendation algorithm in the smart education cloud platform, this paper considers using different types of text data such as course name, course overview and teaching objectives to conduct comparative experiments to observe the differences in the tendency of the same recommendation method to the data, so as to facilitate the performance of the same recommendation method on different data. After data analysis and processing, the final course name, course overview and course objective data sets contain 6058, 16934 and 17342 pieces of data respectively.

Among them, the course name is the most concise expression of the content semantics of the economic management course. The course overview text can not reflect the semantics of the content of the economic management course because it contains more miscellaneous economic management words. The course objective is to introduce the text vocabulary of the content of the economic management course, which has comprehensive characteristics. Therefore, in the three sets of text data sets, the course objectives contain the least word vectors, the teaching objectives contain the most word vectors, and the word vectors of the course overview are between the two.

The introduction introduces the knowledge map and LSTM network method, which has a good effect on the implementation of course recommendation. In order to realize the horizontal comparison between the optimal performance of different recommendation methods, this paper selects the curriculum recommendation algorithm based on knowledge map and LSTM network as the control group to compare with the algorithm designed this time. The recommended results of different algorithms on three text data sets are shown in Tables 1, 2 and 3.

Table 1. Recommended results of course names

Number of experiments	Accuracy of course recommendation algorithm/%		
	The course recommendation algorithm designed in this paper	Course recommendation algorithm based on Knowledge Map	Course recommendation algorithm based on LSTM network
1	0.914	0.782	0.747
2	0.892	0.763	0.708
3	0.883	0.754	0.719
4	0.916	0.788	0.746
5	0.902	0.729	0.723
6	0.928	0.716	0.732
7	0.896	0.742	0.724
8	0.882	0.725	0.751
9	0.901	0.731	0.765
10	0.913	0.727	0.722

According to the results in Table 1, in the course name data set, the accuracy of the economic management course recommendation algorithm designed in this paper is 0.903%, which is 0.157% and 0.169% higher than the course recommendation algorithm based on knowledge map and LSTM network respectively.

Table 2. Recommended results for course overview

Number of experiments	Accuracy of course recommendation algorithm/%		
	The course recommendation algorithm designed in this paper	Course recommendation algorithm based on Knowledge Map	Course recommendation algorithm based on LSTM network
1	0.894	0.744	0.743
2	0.897	0.788	0.782
3	0.915	0.766	0.764
4	0.906	0.722	0.692

(*continued*)

Table 2. (*continued*)

Number of experiments	Accuracy of course recommendation algorithm/%		
	The course recommendation algorithm designed in this paper	Course recommendation algorithm based on Knowledge Map	Course recommendation algorithm based on LSTM network
5	0.922	0.755	0.730
6	0.928	0.691	0.751
7	0.916	0.741	0.728
8	0.893	0.776	0.694
9	0.895	0.692	0.736
10	0.912	0.735	0.724

According to the results in Table 2, in the course overview data set, the accuracy of the economic management course recommendation algorithm designed in this paper is 0.908%, which is 0.167% and 0.174% higher than the course recommendation algorithm based on knowledge map and LSTM network respectively.

Table 3. Recommended results of course objectives

Number of experiments	Accuracy of course recommendation algorithm/%		
	The course recommendation algorithm designed in this paper	Course recommendation algorithm based on Knowledge Map	Course recommendation algorithm based on LSTM network
1	0.944	0.794	0.827
2	0.935	0.788	0.794
3	0.946	0.806	0.785
4	0.958	0.792	0.796
5	0.942	0.785	0.814
6	0.933	0.799	0.791
7	0.922	0.783	0.785
8	0.941	0.802	0.792
9	0.932	0.815	0.803
10	0.932	0.816	0.807

According to the results in Table 3, in the course target data set, the accuracy of the economic management course recommendation algorithm designed in this paper is

0.939%, which is 0.141% and 0.139% higher than the course recommendation algorithm based on knowledge map and LSTM network respectively. Based on the above results, the recommendation accuracy of the economic management course recommendation algorithm in the intelligent education cloud platform proposed in this paper is significantly higher than that based on knowledge map and LSTM network. The main reason is that this method preprocesses the text of the economic management course, reduces the impact of redundant text information on the accuracy, and improves the recommendation efficiency. And with the increase of the number of word vectors, the course recommendation algorithm designed this time can still maintain high accuracy, which can be understood as higher requirements for the quality of words to some extent.

Considering that the actual intelligent education cloud platform contains more course data, on the basis of accuracy test, verify the recommendation performance of this method from the aspect of recommendation time, and test the recommended completion time of the three methods based on the 16000 pieces of economic management courses. The comparison results are shown in Fig. 3.

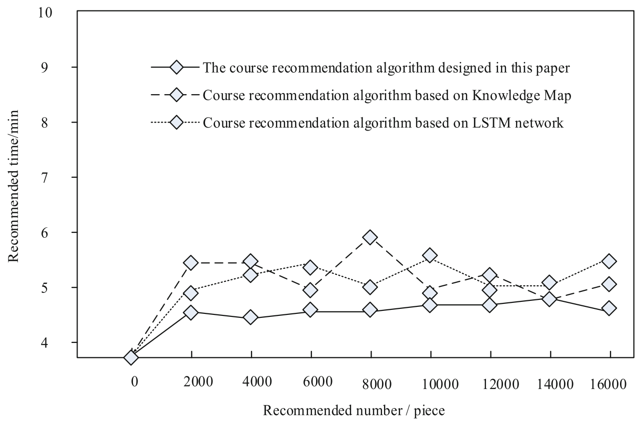

Fig. 3. Recommended time

By analyzing the data in Fig. 3, it can be seen that the maximum recommendation time of the economic management course recommendation algorithm designed in this paper is 5min, and the recommendation time of the course recommendation algorithm based on knowledge map and LSTM network is higher than 5min. Therefore, the economic management course recommendation algorithm designed in this paper has lower complexity and better recommendation performance.

4 Conclusion

Under the environment of "Internet plus", online education has become an inevitable trend in the world today. However, the massive information and course resources are not conducive to users' rapid positioning of the required courses. Most of the current online education platforms have the functions of static presentation of course information, navigation and retrieval, and can not provide personalized learning lists for different users. With the increasing number of relevant courses and learning resources, this method has greatly affected users' learning efficiency and sense of experience. Therefore, the recommendation system came into being, which can intelligently provide personalized learning results for different users. In this context, this paper proposes an economic management course recommendation algorithm in the intelligent education cloud platform. The algorithm comprehensively considers the word frequency and text similarity of the text, so the recommendation accuracy is significantly higher than the curriculum recommendation algorithm based on knowledge map and LSTM network. In terms of user modeling, the algorithm designed in this paper adopts the course browsing records or collection records of online learners, and does not involve the deeper user information mining such as learners' knowledge level. How to use more behavior data of online learners, such as online tests, homework completion, video viewing time and other information for user modeling, and provide "teaching students according to their aptitude" teaching services for online learners is the research focus and difficulty in the field of curriculum recommendation.

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Research on the In-Depth Recommendation Method of Grammar Topics for English Online Teaching

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Abstract. In the process of grammatical topic recommendation, affected by the dimension of word vector, there is a problem of low recommendation accuracy. To solve this problem, a deep recommendation method of grammar topics for English online teaching is designed. Based on the classification theory of learning outcomes, the dimensions of students' learning styles in English online classrooms were measured. It can accurately identify the characteristics of English grammar teaching and stimulate students' interest in learning. The DeepFM model is constructed by using English online teaching technology, the parallel parameters are optimized, and the deep recommendation mode of grammar topics is set. Experimental results: The accuracy rates of the proposed method for in-depth recommendation of grammar topics for English online teaching and the other two methods for in-depth recommendation of grammar topics are: 73.183%, 63.205%, and 63.258%, respectively. The experimental results show that the accuracy of the in-depth recommendation method of grammar topics has been improved after fully combining the English online teaching technology.

Keywords: Online teaching · Grammar topics · In-Depth recommendation · Learning style · Teaching objectives · Part-of-speech grammar

1 Introduction

The English online learning platform provides a very rich learning curriculum, and learners will choose their own courses based on their own interests [1, 2]. English grammar is the pulse that weaves the entire English language, and can be said to be the "skeleton" that supports the English language. It is the foundation of learning English and cannot be ignored. The sheer volume of online courses brings course selection problems. On the one hand, when faced with a variety of courses in various categories, learners need to spend a lot of time to understand the content of the course and judge whether it really meets their personal learning style and learning needs. In the teaching of English grammar, how teachers teach and how students learn has always been the focus

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of scholars' research. On the other hand, for learners without clearly defined learning needs. It can be difficult to find the right course just by searching and browsing. With the promulgation of the new curriculum standard and the continuous deepening of research, some achievements have been made in the teaching of English grammar.However, there are still some problems to be solved in practical teaching. For example, in English grammar teaching, the teaching methods are fixed, the atmosphere in the class is dull, the students' enthusiasm for learning is low, and the overall teaching effect is not objective. For the final choice of the wrong course, some learners will feel boring because the course does not meet their personal preferences, so they choose to give up halfway. This requires teachers to seek efficient English grammar teaching methods under the condition of constantly updating their own teaching concepts according to the actual teaching problems in teaching.

The recommended method is a technique to solve the difficult problem of selection in the case of information explosion. Through practical application in life, we can see the many benefits that the recommendation method brings to the platform and users. Based on the iterative update of science and technology, especially the rapid progress of multimedia information technology. Multimedia teaching, campus networks and various online courses emerge in an endless stream, and the online education market around the world is rapidly improving and developing by leaps and bounds. Due to the application of the recommendation algorithm, the user's selection time is reduced, the final transaction path is shortened, and the transaction volume of the e-commerce platform is greatly increased.

As early as the early 1990s, multimedia aids were introduced into English courses in our country. However, after practice, it is found that if there is no teacher's guidance, guidance and supervision, it is difficult for the online teaching mode to achieve ideal results only by students' self-consciousness. It shows that in English teaching, the important role played by teachers is irreplaceable. In the current online course recommendation research, the recommendation methods used by scholars are usually divided into two categories. One is knowledge path recommendation, which alleviates the "learning trek" problem by using structured knowledge paths, but does not fully consider learner interests. The recommended courses are reasonable in terms of difficulty and connection of knowledge points. But because of the lack of "personalization", it may not be accepted by the learners. As a result, scholars have also begun to explore the teaching mode of the coordination and integration of traditional teaching and network teaching, so that the two teaching modes can promote and complement each other. Thus, the online teaching mode was initially formed. The second category is recommendation based on learner interests, usually using classic algorithms such as feature engineering or collaborative filtering for course recommendation. The method of feature engineering is very dependent on the construction of features, and inappropriate features greatly affect the recommendation effect. The unique characteristics of the course domain are not considered in the recommendation process, that is, there is a logical connection relationship between courses at the semantic level of knowledge. Therefore, the recommendation results only consider the interests of learners, but learning gaps are prone to occur at the knowledge level, which violates the theoretical requirement that learning should be gradual. In order to improve the accuracy of English grammar topic recommendation, this paper proposes a topic depth recommendation method. This paper incorporates the theory of learning outcome classification and measures the learning style dimension. This can accurately identify the characteristics of English grammar teaching and stimulate students' interest in English learning. The DeepFM model is constructed by using the English online teaching technology, the parallel parameters are optimized, and the deep recommendation mode of grammar topics is set up to complete the accurate recommendation of English topics.

2 Research on the In-Depth Recommendation Method of Grammar Topics for English Online Teaching

2.1 Measuring Learning Style Dimensions

According to Kirkpatrick's four-level evaluation model, the learning effect should be evaluated separately from the four levels of reaction, learning, behavior and result. Therefore, when building a learner capability model, it is not only the effect of the user's completion of one-time learning, or the process of learning behavior that is considered. In addition, the behavioral changes of learners and the results of final learning should be included in the evaluation indicators. Teaching content analysis is a teacher's analysis of textbook knowledge, and on the basis of clarifying the difficult points, the teaching objectives and teaching design plans are determined. Combined with the classification theory of learning outcomes, learning outcomes include five aspects: intellectual skills, cognitive strategies, verbal information, motor skills and attitudes. Each unit in the textbook contains knowledge of grammar. When the teacher analyzes the textbook, he should clarify the characteristics of the grammar in the unit. According to different characteristics of grammar knowledge, the corresponding teaching material presentation forms are formulated. The reference value of this theory for constructing a learner's ability model lies in the inclusion of learners' emotional participation, learning strategies and motor skills and other dimensions to divide learning goals. It allows for a more comprehensive assessment of student learning outcomes. Due to the regularity and abstract nature of English grammar, it is not easy for students to understand. In the course teaching design, teachers can base on the existing cognitive structure of students. According to the degree of difficulty of grammar knowledge and the depth to be explained, analyze the problems that are likely to be encountered in the teaching process as much as possible, and reasonably choose the application method of the course. The three dimensions of learning ability are shown in Fig. 1.

As can be seen from Fig. 1, the three dimensions of learning ability mainly include: learning effectiveness, emotional attitude, and learning transfer ability. The first dimension is the learning effect category, which mainly examines the learner's ability to memorize, understand, and simply apply and analyze declarative knowledge. The teaching goal of English grammar, from the perspective of the humanistic characteristics of English courses, is to cultivate students' awareness of English grammar and to understand the cultural differences between China and foreign countries. The second dimension is emotional attitude, which mainly examines whether learners have the characteristics of self-direction, active learning, and peer mutual assistance. After a sufficient understanding

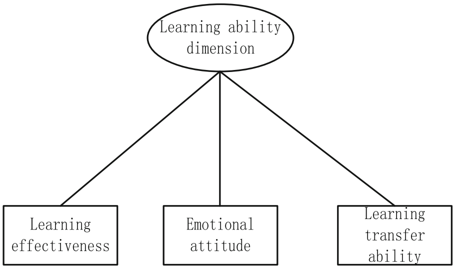

Fig. 1. The three-dimensional structure of learning ability

of students and textbook knowledge, it is time to formulate teaching objectives, and the teaching objectives of course-assisted teaching in this study are formulated according to three-dimensional objectives. From the two dimensions of investment and initiative, the evaluation is not only on cognitive investment, but also on the level of emotional investment, which can excavate students' learning enthusiasm and learning motivation level. Emphasizes the importance of the learning process of English language, the practicality of English grammar acquisition, the purpose of learning is application, and advocates allowing students to experience and understand in a real context [2–4]. Adopt teaching methods and methods that are conducive to improving students' learning efficiency, so that students can form a preliminary comprehensive language application ability and promote the development of their minds. The third dimension is the most abstract learning transfer ability, which mainly examines the learner's learning strategies, self-regulation, problem-solving ability, and creative thinking ability. It is a more abstract and advanced teaching goal. Emotional attitude affects learning ability and learning transfer, and learning ability and learning transfer can also react on emotional attitude. From the perspective of instrumental characteristics, it aims to cultivate students' basic application ability of applying English grammar and improve their communicative ability of English language.

2.2 Identify the Characteristics of English Grammar Teaching

Grammar is the law of weaving language. To learn a language, you must first understand its grammar rules. This is also true in the process of English learning. There are many kinds of grammar. From a historical point of view, grammar can be divided into prescriptive grammar and descriptive grammar. Prescriptive grammar can also be called traditional grammar. Prescriptive grammar tends to impose hard and fast rules on the use of language. Descriptive grammar, on the other hand, is often based on linguistic facts, objectively records linguistic facts, and systematically expounds the rules for generating sentences and understanding sentences. In the whole English learning, the importance of English grammar learning cannot be ignored. Descriptive grammar, on the other hand, is often based on linguistic facts, objectively records linguistic facts, and systematically expounds the rules for generating sentences and understanding sentences. In the whole English learning, the importance of English grammar learning cannot be ignored. English grammar is the expression of English language rules, the learning of English grammar knowledge, including verbs, prepositions, etc. In addition to the basic part-of-speech expression categories, it also includes 8 tenses that are difficult to understand, such as simple past tense, present continuous tense, and past perfect tense. From the perspective of the objects described by grammar, grammar can be divided into synchronic grammar and diachronic grammar. Synchronous grammar describes the language rules in a certain period, while diachronic grammar describes the changes and development of language rules. From the perspective of descriptive purposes, grammar can be divided into instructional grammar, reference grammar and linguistic grammar. Learning grammar is the foundation of learning English in the future. English grammar has the characteristics of general grammar. It is a very large and complex collection, and it is the rules and details of weaving language. Knowledge points are relatively boring, with stability, abstraction and regularity. Teaching grammar is a grammar written for the purpose of teaching [5, 6]. Reference Grammar is a grammar book that provides reference for teachers or researchers to teach, research, and learn grammar for students. Linguistic grammars are grammars written by linguists based on their understanding of grammatical concepts. Grammar teaching originated from the grammar-translation method, which is centered on grammar. Teachers teach in their mother tongue, focusing on explaining and analyzing sentence components and pronunciation, vocabulary changes and grammar rules. The learning of English grammar is the focus of English learning, but also the difficulty of English learning, and the foundation of learning English language well. Only by being familiar with the rules of English grammar weaving can we better grasp the communicative competence of the English language. English grammar teaching is mainly divided into six ways, as shown in Fig. 2.

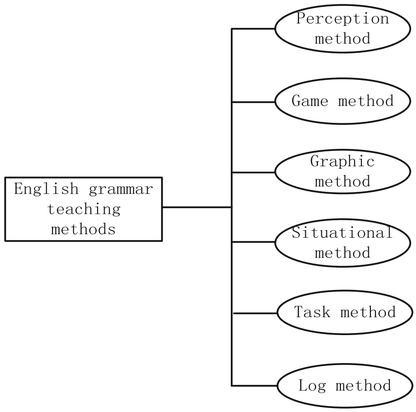

Fig. 2. English grammar teaching method diagram

It can be seen from Fig. 2 that the English grammar teaching methods are: perceptual method, game method, graphic method, situational method, task method and log method. In the whole process of English grammar teaching, English teachers should constantly discover students' interests, learning strengths and intellectual advantages, so as to timely determine the teaching methods and strategies that are most conducive to students' grammar learning. Secondly, in the process of implementing specific grammar teaching activities, English teachers should focus on identifying students' superior intelligence. Stimulate students' interest in English grammar learning through superior intelligence and help students build confidence. And through the superior intelligence "with the strong to lead the weak", to promote the development of students' weak intelligence to promote the all-round development of students. English grammar is scattered and orderly in the arrangement of textbooks, and the knowledge points are too many, too detailed, scattered and difficult to master. As a subsystem of the English language system, English grammar has the characteristics of systematic and specialization in the rules of weaving English grammar. For example, there are nouns, numerals and articles in the grammar knowledge of parts of speech, which is convenient for making a series of special courses on grammar knowledge. In the early stage of teaching a grammar project, teachers can use a variety of activities to make students with different intelligence combinations tend to perceive grammar in practice. In the middle and later stages of teaching a grammar project, teachers can allow students to practically apply the grammar in a variety of activities. In the consolidation or review stage of a grammar project, teachers can allow students to participate in different forms of summarization.

2.3 English Online Teaching Technology to Build DeepFM Model

Online education is based on deep learning and individualized activities. Multimedia communication is an important technical means for the relationship between teaching and learning, connecting teachers' teaching and students' learning. According to scholars' views, "online English teaching" in this article refers to a form of online education in which teachers and students are in different places, relying on information technology and media resources to carry out real-time English teaching. An accurate recommendation method should be based on the reasonable extraction of learner characteristics and resource characteristics, and the resource characteristics in learning software are more obvious. Based on technologies such as speech-to-text, text segmentation, keyword extraction, and text correlation calculation, the features of different resources can be effectively extracted. The study of English grammar emphasizes grammatical awareness and grammatical structure. The construction of English grammar knowledge graph is essentially to show the knowledge point network of English grammar for users, which helps to sort out the correlation and difference of knowledge points [7]. The extraction of learner characteristics involves the support of teaching theory. According to the learner's ability composition summarized above, the assessment of each learning ability in the grammar learning depth recommendation method is transformed into specific and measurable learner data. Through the extraction and cleaning of the learner's basic information and learning behavior data, data indicators that can be quantified and compared are obtained. At the same time, the graphical interface helps to enhance learners' motivation and attention.

In addition, the knowledge graph designed in this chapter will also become the data support for the English grammar topic recommendation method, which lays a good foundation for the construction of subsequent recommendation methods. The recommendation problem can be regarded as a classification prediction problem. In this chapter, the user's historical behavioral characteristics are used as input to predict the probability of a user clicking on a candidate item. In the case of very sparse data, the CTR prediction model can still estimate reliable parameters for prediction. Grammar is the foundation of learning English and is usually listed as the focus of English topic practice. However, the existing grammar question practice platform lacks intelligent processing of English questions, and most questions still rely on manual analysis by professional grammar teachers. The CTR prediction model can learn the implicit feature combination behind the user's click behavior, and cross-combine the original features to form new features. This is a common and effective feature construction method. The CTR prediction model can automatically learn the combinatorial relationship between features. Through the feature combination relationship, the potential connection of the user when clicked is learned, and the user expression ability of the model is improved. Therefore, there is an urgent need for a grammar recommendation method that can support the convenient classification of English grammar topics and related intelligent learning functions. So as to help Chinese English learners to better transform and develop grammar learning to online learning, efficient learning and intelligent learning. The FM model extracts feature combinations by taking the inner product of the latent vectors of each feature. Although theoretically FM can model higher-order feature combinations. But in fact, due to computational complexity, only second-order feature combinations are generally used. However, not all combinations of low-order features are beneficial to improve the predictive ability of the model. Some feature combinations that do not contribute to the prediction will also introduce noise and affect the prediction effect of the model. The prediction formula is as follows:

$$\hat{h} = \frac{p \cdot q}{(1+\eta)^2} \tag{1}$$

In formula (1), p represents the output of the model, q represents the low-dimensional density, and η represents the predicted click-through rate of the user. The "memory ability" of the FM model can recommend items of interest to the user based on the user's click history. The "generalization ability" of the DNN model can provide users with click history. But items that may be of interest, improve the diversity of the recommendation list. During the training process, the two models optimize their respective parameters in parallel, so as to achieve the optimal prediction ability of the model as a whole. The model output formula is:

$$L = \varepsilon + \sum_{r=1}^{n} \frac{r^2}{G} \times \phi \tag{2}$$

In formula (2), ε represents the global deviation coefficient, G represents the weight of the feature, r represents the weight of the combined feature, and ϕ represents the inner product of the latent vector. For English grammar questions, the categories of knowledge points to be examined are relatively fixed. If every time a learner uploads an English grammar question, it needs to be manually classified and entered into the question bank system, which will result in a waste of human resources. The nonlinear fitting ability of the neural network can automatically learn the high-order feature interaction DeepFM model, and replace the logistic regression of the wide part of the Wide&Deep model with FM. It can learn not only the "memory ability" of low-level feature combinations, but also the "generalization ability" of high-level feature interactions. At the same time, it also solves the artificial feature engineering problem of the wide part. Therefore, the recommendation method provides the learners with the function of item classification. After the learner inputs the English grammar topic information, the recommendation method will automatically complete the topic classification task based on the knowledge graph. The wide part requires a lot of manual feature engineering. The ability of FM to automatically learn feature combinations, generate new features, and effectively alleviate the problem of data sparsity. The DeepFM model mines original features, second-order feature combinations, and higher-order interaction features, respectively. After the topic classification is completed, the recommended method will return the classification results on the front-end page. At the same time, the topic will also be stored in the topic information table of the English grammar question bank. The entire model is learned by joint training, by splicing the low-order combinations and high-order feature interaction vectors output by the FM model and the DNN model. In this way, a user expression vector with stronger representation ability is constructed, and finally the predicted click rate is output through the fully connected layer.

2.4 Set Grammar Topic In-Depth Recommendation Mode

Since the deep recommendation method needs to analyze and study the historical data of users, it often plays the role of an application among different websites. In today's various websites on the Internet, we can see the deep recommendation method. The comment vector is used as the input word vector of the sentiment analysis neural network, which is generated by the word vector dictionary. The word vector dictionary includes high-frequency, common book review words. Therefore, most text vectors in book reviews can be found in them, and some low-frequency words cannot be found in the dictionary, and the corresponding word vectors are marked as 0. The final generated comment vector is in the form of key-value pairs, and a text sentence with user preference labels corresponds to a word vector matrix. The measurement of basic learning ability such as memorization and comprehension of declarative knowledge can be judged by counting the results of users completing staged tests. Suppose that each course e has a corresponding course feature λ, and its feature dimension is v. Then each set of triples in the set will be trained to learn a correlation probability, and the probability represents the correlation between the triple and the seed entity. This probability is calculated by the following formula:

$$M = \frac{\exp\left[\lambda^2\right]}{(v - e)^2} \tag{3}$$

Through formula (3), the interest of the learner is changed from the course collection to the knowledge graph centered on the seed entity and the relationship as the path. In learner comments, there are various subject evaluations, for example, there are evaluations on the subject of the course, and there are evaluations on a certain knowledge point in the learning content. In order to avoid complex multiple calculations for evaluation topics, this study adopts cluster analysis method to cluster evaluation topics [8–10]. A measure of emotional attitude abilities such as self-direction, active learning, and peer support. On the one hand, it can come from the self-assessed learning expectations, online time, learning frequency, and active status of the learning community (number of replies, likes, and shares) when users register. Excavate students' learning enthusiasm and learning motivation level. Finally, we add the learner's interest features in each layer of the seed entity corresponding to the course to obtain the learner feature D:

$$D = \frac{\sqrt{\left|T - z^2\right|}}{2} - \sigma \tag{4}$$

In formula (4), T represents the weight vector, z represents the activation function, and σ represents the learner's potential interest. In general, the prediction result of sentiment analysis can know the user's preference for the course, and to a certain extent can also rule out the false rating of the user. In these websites, the deep recommendation method mainly analyzes the user's behavior log, then builds the user's interest model, and finally processes it through the back-end. Provide each user with a personalized front-end page to improve user satisfaction. At present, in-depth recommendation methods are widely used and have good effects in the fields of e-commerce, film and television and small videos, in-depth book recommendation, and in-depth travel recommendation. Therefore, in the model proposed in this paper, the result of user sentiment analysis on the course is used as an indicator of course depth recommendation. At the same time, the feature of course review text is also used as an indicator for deep recommendation of customers. From the perspective of the internal algorithm of the in-depth recommendation method, the in-depth recommendation method mainly builds user portraits and predicts their preferences through statistical analysis of data such as purchase records, browsing records, click records, and stay time records of user groups. Using course review data is predictive analysis by a neural network that takes the corresponding low-dimensional vectors for a given user and item. The user and course item embeddings are pre-trained by a special representation learning model before training. However, when implemented into real applications, the system often indirectly predicts the items that users may like through intermediate attributes. There are currently three mainstream intermediate attributes. The first is to find out users similar to the deeply recommended users through the user's log files, and recommend items for them according to the preferences of similar users.

Through this method, the robustness and portability of recommendation are effectively improved. Exploration of the learners' learning habits and methods, problem-solving ability, creative thinking ability and other advanced learning abilities. The mining of these data requires preliminary model assumptions and verification, and the directions that can be advanced include: exploring the relationship between students' online duration and time interval and students' learning regularity. The second is to find out the items similar to the item by recommending the item that the user likes, and recommend it to the user. The third is to analyze the user's log to find out the common features of the items that the user likes, and find out the items with these features to recommend to the user. Whether there is a correlation between the number of resource collections, the average study time, the online interval and testing. The relationship between the number of high-quality reviews and learning outcomes, etc. In-depth and comprehensive measurement of the learner's ability from six dimensions helps to describe more detailed user portraits and provides a basis for mining similar users for vocabulary recommendation.

3 Experimental Study

3.1 Experiment Preparation

The experiment is carried out using the computing nodes of the college server cluster, and the entire cluster contains a 2U (U is the height unit) management node mu01. 8 computing nodes cu01-cu08 (each computing node is equipped with 1 dual-core NVIDIAK80 24G video memory GPU). 1 IO storage node oss01, 1 infiniband switch, 1 Gigabit Ethernet switch. The Python version language is selected, and the deep learning framework used is TensorFlow 1.13.1 version. CPU: Intel(R) i7-5200U 2.20 GHz, memory 8192 MB, video memory Intel(R) HD Graphics 5500. In this experiment, a total of 24,556 records of 521 questions from 1,664 students were collected. Each record contains 37 characteristic variables, 13 0–1 variables, 14 multi-categorical variables, and 10 continuous or ordinal variables. In order to reduce the impact of noisy data on the experiment by learners who choose fewer courses and over-selected (over-choice) learners. We only keep the course selection data of learners whose course selection interval is [10, 510].

3.2 Experimental Results

Select the learning resource recommendation method based on behavior analysis (method 1), the resource recommendation method based on collaborative filtering (method 2), and the in-depth recommendation method of grammar topics for English online teaching designed this time (the method in this paper), and conduct experimental comparisons. Test the accuracy of the three recommended methods under different word vector dimensions. The dimension of the word vector generally needs to be 50 dimensions and above, especially when measuring the linguistic characteristics of the word vector, the larger the dimension of the word vector, the better the effect. The higher the accuracy of the word dimension vector in this comparative experiment, the better the effect of topic recommendation. The experimental results are shown in Tables 1–4:

Table 1. Word vector dimension 100 accuracy (%)

Number of experiments	Method 1	Method 2	The method in this paper
1	78.115	78.311	93.505
2	79.612	79.515	94.166
3	81.223	82.199	93.588
4	82.060	83.022	92.067
5	79.133	84.912	94.105
6	81.009	83.015	95.228
7	82.155	78.510	94.313

(*continued*)

Table 1. (*continued*)

Number of experiments	Method 1	Method 2	The method in this paper
8	79.884	77.144	93.704
9	78.166	78.361	98.154
10	77.488	82.594	95.616

As can be seen from Table 1, the accuracy rates of the proposed method for in-depth recommendation of grammar topics for English online teaching and the other two methods for in-depth recommendation of grammar topics are: 94.445%, 79.885%, and 80.758%, respectively.

Table 2. Word vector dimension 150 accuracy (%)

Number of experiments	Method 1	Method 2	The method in this paper
1	65.165	64.310	76.388
2	64.101	63.487	73.616
3	63.249	64.532	75.945
4	68.166	65.464	74.661
5	64.102	66.588	78.316
6	66.316	67.299	77.124
7	68.599	65.231	78.506
8	67.244	66.122	76.448
9	68.779	65.829	77.622
10	69.750	63.484	78.333

As can be seen from Table 2, the accuracy rates of the proposed method for in-depth recommendation of grammar topics for English online teaching and the other two methods for in-depth recommendation of grammar topics are: 76.696%, 66.547%, and 65.235%, respectively.

Table 3. Word vector dimension 200 accuracy (%)

Number of experiments	Method 1	Method 2	The method in this paper
1	56.015	57.132	62.316
2	57.384	58.944	63.488
3	58.162	57.652	62.151
4	55.299	58.946	63.789

(*continued*)

Table 3. (*continued*)

Number of experiments	Method 1	Method 2	The method in this paper
5	56.784	57.265	62.501
6	55.468	55.461	63.468
7	56.911	56.308	62.147
8	55.672	55.647	63.759
9	54.284	56.827	64.522
10	58.022	55.145	65.488

As can be seen from Table 3, the accuracy rates of the proposed method for in-depth grammar topics for English online teaching and the other two methods for in-depth recommendation of grammar topics are: 63.363%, 56.400%, and 56.933%, respectively.

Table 4. Word vector dimension 250 accuracy (%)

Number of experiments	Method 1	Method 2	The method in this paper
1	49.645	48.154	52.364
2	51.120	49.618	59.816
3	48.677	50.307	57.312
4	50.299	49.552	56.464
5	49.337	51.462	58.206
6	50.204	52.909	59.447
7	49.288	49.364	61.164
8	51.249	52.161	59.821
9	49.676	49.207	58.416
10	50.377	48.316	59.265

As can be seen from Table 4, the accuracy rates of the proposed method for in-depth grammar topics for English online teaching and the other two methods for in-depth recommendation of grammar topics are: 58.228%, 49.987%, and 50.105%, respectively.

To sum up, the method in this paper has a better recommendation effect on English topics when the word vector dimensions are 100, 150, 200 and 250. As the dimension of word vector increases, the accuracy of topic recommendation gradually decreases. However, the recommendation accuracy of the method in this paper is always higher than 49.9%, which can reach the standard of topic recommendation. This paper measures the learning style dimension in the classification theory of learning outcomes. This can accurately identify the characteristics of English grammar teaching and provide a guarantee for the selection of recommended topics.

4 Conclusion

In this paper, the user's intentional courses are screened according to the course duration that the user has rated, and the negative power function of the time period in which the user has rated the course is taken as the penalty for time, which improves the effect of personalized course recommendation. By depicting the freshmen's social network and borrowing interest preferences from the side, the cold start problem of freshmen is effectively solved. We measured the dimensions of students' learning styles in English online classrooms, which can accurately identify the characteristics of English grammar teaching. The DeepFM model is constructed by using English online teaching technology, the parallel parameters are optimized, and the deep recommendation mode of grammar topics is set. The final empirical results also show that the method in this paper has qualitatively improved the course selection recommendation for freshmen. In future research, more data on student psychological testing needs to be collected to improve the comprehensiveness of the recommended method.

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Design of College Art Education Curriculum Resource Allocation System Based on Virtual Grid

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Abstract. The existing college art education course resource allocation system has the problem that the course resource allocation process is too cumbersome, resulting in too long network delay. A kind of college art education course resource allocation system based on virtual grid is designed. Hardware part: use an externally provided 1 GHz sampling clock to convert the communication channel analog-to-digital; software part: extract the performance characteristics of art education courses, change the identities of production subjects and dissemination subjects, enhance students' right to choose courses independently, and optimize course resource allocation process, Utilize the virtual grid design system node deployment function. Experimental results: The mean network delays of the resource allocation system for college art education courses and the other two systems are: 48.483 ms, 63.886 ms, and 64.842 ms, respectively, which shows that after integrating the virtual grid algorithm, the designed college art education courses The resource allocation system has better performance.

Keywords: Virtual grid · Art education in colleges and universities · Allocation of curriculum resources · Performance characteristics

1 Introduction

Configuration refers to a process and means to allocate limited resources to different purposes under certain conditions and realize effective combination with other resources to a certain extent. The allocation of curriculum resources refers to the planned and systematic combination of all relevant courses according to certain educational concepts and discipline and professional requirements, so as to undertake and complete the construction tasks of knowledge structure, ability structure and quality structure required by different talents. In fact, art education and aesthetic education in Colleges and universities belong to the same system. They both sing about beautification and strive to say art, but their starting points are different. Opponents believe that art education and aesthetic education are not a system. Aesthetic education is thinking and noble. Art education is a cultural problem based on the social conditions at that time. Its characteristics are

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practical, democratic and social. The allocation of curriculum resources in Colleges and universities means that on the basis of relying on local resources, the main body of the allocation of curriculum resources in Colleges and universities starts from the perspective of discipline construction and students' needs. According to a certain allocation mode, all relevant curriculum resources in Colleges and universities should be organically combined and reasonably allocated, so that the invested curriculum resources can be effectively utilized. However, due to the wide variety and complex structure of art education curriculum resources, it is difficult to allocate curriculum resources.

Scholar duanqiaoyu, taking Q village on the Loess Plateau as an example, summarized the development process of resource allocation of rural compulsory education, and summarized the performance characteristics of resource allocation of rural compulsory education, namely, from basic element equilibrium, static equilibrium and resource equilibrium allocation to non basic element equilibrium, dynamic equilibrium and effective utilization of resources, and put forward corresponding educational curriculum resource allocation, however, it ignores the cumbersome process of course resource allocation [1]. The scholar huangjianming, aiming at the unbalanced problem of curriculum resource allocation of e-commerce specialty, and taking the opportunity of visiting enterprises, proposed a curriculum reform project of Higher Vocational E-commerce Specialty Based on school enterprise cooperation, and studied the design, implementation process, evaluation and results of the project. However, he did not put forward an effective solution to the problem that the process of curriculum resource allocation was too cumbersome [2].

In order to solve the problems of long delay and poor rationality of resource allocation in the above traditional system, a virtual grid based art education curriculum resource allocation system in Colleges and universities is proposed and designed. Hardware part: adopt 1 GHz sampling clock provided externally to convert the module of communication channel; Software part: extract the performance characteristics of art education courses, change the identity of production subject and communication subject, enhance students' independent choice of courses, optimize the process of course resource allocation, and use the virtual grid to design the node deployment function of the system. Finally, the comparison and verification show that the system can shorten the delay and improve the rationality of resource allocation.

2 The Hardware Design of the Resource Allocation System for Art Education Courses in Colleges and Universities

According to the system function needs, this paper designs the hardware of the college art education curriculum resource allocation system. This subject adopts DC coupling input mode. In order to enhance the driving ability of VCM, the common mode voltage output by MXT2020 is fed back to the inputs of two measured signals through a voltage follower as the common mode bias voltage of input signals [3], so as to maintain the optimal analog-to-digital conversion performance of 1VIXT2020. I/O ports include seven 16 bit ports, PA, Pb, PC, PD, PE, PF and PG. Other peripheral interface pins are multiplexed with the pin functions of the I/O port [4]. Therefore, this topic uses the 1 GHz sampling clock provided externally, and uses the function of two-sided edge sampling of the analog-to-digital converter 1VIXT2020 to indirectly achieve the highest 2 GS/s real-time sampling rate. STM32F 103ZET6 core circuit has three different startup modes, which can be selected through pins boot0 and boot1, as shown in Table 1:

Table 1. STM32 power-on startup mode

Name	Mode selection	Describe
Boot mode select pin	BOOT0	User flash memory is selected as boot space
	BOOT1	
BOOT mode	System memory	System memory is selected as boot space
Instruction	Embedded SRAM	Embedded SRAM is selected as the boot space
Nested Vectored Interrupt Controller (NVIC)	Advanced control timers TIM 1 and TIM8	Temperature sensor
External Interrupt/Event Controller (EXTI)	SysTick timer	Serial wire JTAG debug port (SWJ-DP)
Universal Serial Bus (USB)	Universal Synchronous/Asynchronous Transceiver (USART)	RTC (Real Time Clock) and backup registers

It can be seen from Table 1 that the reset circuit design of the STM32 co-control processor in the system includes: power reset and manual button reset. A power reset occurs when the system power is turned on or off. The Q channel performs analog-to-digital conversion on the output signals OUT2+ and OUT2− of the channel 2 conditioning circuit [5]. An external 8 MHz crystal oscillator clock source is used to generate a high-speed external clock signal (HSE) to drive the system clock SYSCLK. The ADC configuration module is shown in Fig. 1:

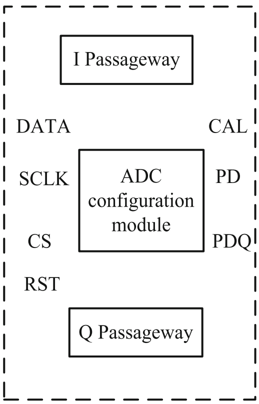

Fig. 1. ADC configuration module block diagram

It can be seen from Fig. 1 that the analog signal input from the two channels is converted by the two analog-to-digital conversion sub-cores inside 1VIXT2001. The data is separated according to 1:2 data and output in the LVD S level standard, so that 4 parallel channels are obtained. The 8-bit LUD S signal is then processed by the LVDS receiver inside the FPGA to reduce the speed of the high-speed data stream. The principle of analog-to-digital conversion circuit is shown in Fig. 2:

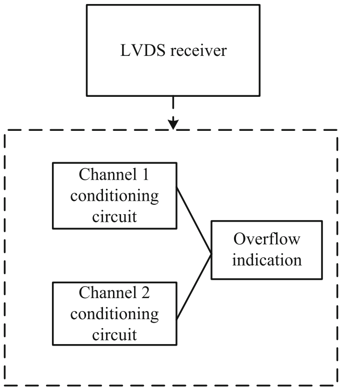

Fig. 2. Schematic diagram of analog-to-digital conversion circuit principle

According to Fig. 2, all functions of 1VIXT2001 are realized by writing control words to its internal registers through the SPI serial interface, including working mode configuration, input channel selection, data output format selection, voltage adjustment and phase adjustment [6]. There are two channels, I and Q. The I channel performs analog-to-digital conversion on the output signals OUT1+ and OUT1− of the channel 1 conditioning circuit. In addition, the reset signal RESET32 of the JTAG interface circuit of the STM32 unit and the manual button reset circuit are connected to the /NRST pin of the chip in parallel. When the system detects a low level on this pin, the system automatically resets.

3 Software Design of College Art Education Curriculum Resource Allocation System

3.1 Extracting the Performance Characteristics of Art Education Courses

The changes of the production of art education in Colleges and universities in the main body, content and form of expression, space-time structure and other aspects in the Internet era can have an impact on its communication links. In addition, teachers are in the front line of teaching and directly participate in the discipline construction, specialty setting and curriculum implementation activities of the school. They can deeply understand the internal laws of discipline construction and the actual needs of curriculum construction, and have more pertinence and purpose in resource allocation to ensure the satisfaction of students' diversified needs. First of all, due to the network media, the former audience can use the network to become producers, and decide to communicate by themselves to complete the transformation of identity. The production subject coincides with the communication subject, and realizes the diversification of roles at the same time. For colleges and universities, the diversification of decision-makers in the allocation of curriculum resources of art education in Colleges and universities is the premise and foundation for the effective allocation of various curriculum resources in Colleges and universities. Students, teachers, society and government all enjoy the decision-making power and supervision power of the allocation of art education curriculum resources in Colleges and universities. Secondly, the change of production content and form requires the presentation form of communication. Different production content and form require different display forms. What kind of communication form can attract more audiences and have a greater impact. The specific characteristics of college art education curriculum resource allocation are shown in Fig. 3:

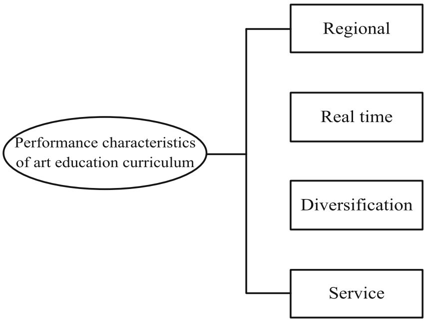

Fig. 3. Performance characteristics of the resource allocation of art education courses in colleges and universities

As can be seen from Fig. 3, the discipline construction and specialty setting of colleges and universities must fully investigate the local characteristic industries, resources and the actual needs of industrial and agricultural development, and set up characteristic majors and courses in this region. Establish cooperation with enterprises and institutions, carry out cooperative school running, jointly build practice bases, industry university research collaborative innovation, etc. Micro level refers to the allocation of educational resources in Colleges and universities. The study found that compared with the macro level and meso level, there is less research at the micro level, especially the research on the allocation of curriculum resources in Colleges and universities needs to be further strengthened.

3.2 Optimize the Course Resource Allocation Process

The allocation of higher education resources can be divided into three main levels: the macro level refers to the allocation of total social resources in the higher education system. Meso level refers to the allocation of higher education resources among colleges and universities at different levels. What kind of communication form can bring richer and more authentic artistic experience and meet the personalized needs of different audiences on the network are the challenges posed by production changes to the communication form. With the development of Internet media technology, communication subjects can use social platforms and application platforms for diversified communication. Local governments manage and supervise the allocation of art education curriculum resources in Colleges and universities mainly through financial allocation and the formulation of relevant policies and regulations. Moreover, the diversification of art education production in Colleges and universities in the Internet era does provide it with more choices, but the impact of technology on social development has always had both advantages and disadvantages. Local enterprises and scientific research institutes participate in the resource allocation activities of the school's art education curriculum through cooperation with colleges and universities, Co Construction of joint training bases, industry university research cooperation and other ways, so as to realize the practicability and scientificity of the curriculum and specialty, and promote the cultivation of students' practical ability and innovation ability. Through this process, we can effectively improve the scientificity and rationality of decision-making, minimize the imbalance of resource allocation, and improve the utilization of art education curriculum resources. According to the action principle of virtual mesh, when multiple regular polygons are close at a vertex, if the effect of close connection can be achieved, the seamless coverage can be realized, and the expression formula is:

$$\eta \frac{(\mu - 2) \times 180^\circ}{\mu} = 360 \tag{1}$$

In formula (1), η represents any integer, and μ represents the coordinate set of the monitoring area. From formula (1), the relational expression satisfied by the number η of regular polygons can be obtained, as shown in formula (2):

$$\eta = 2 + \frac{4}{\mu - 2} \times \frac{1}{2} \tag{2}$$

The meaning of variables in formula (2) is the same as that in formula (1). In addition, the mechanism of joint participation of multiple decision-making subjects is also reflected in the transformation from centralization to decentralization, which decomposes the centralized power of the school to various colleges, departments and functional departments, so as to avoid excessive concentration of power. Students are not only the direct consumers of curriculum resources, but also the object of curriculum resource allocation. They play an important role in curriculum evaluation activities. The determination of students' subject status can effectively enhance the autonomy and selectivity of curriculum, which is of great significance to improve the utilization rate of curriculum resources and strengthen curriculum construction. It can be said that in the resource allocation activities of art education courses in Colleges and universities, the establishment of a mechanism of joint participation of multiple decision-making subjects has important practical significance and practical value. The construction of this mechanism needs to clarify the three basic problems: the choice of participants, the choice of participation methods and how to affect decision-making. Further, it is necessary to clarify the object, quantity, degree, procedure and form of participation, and effectively supervise and evaluate the implementation process and results of decision-making. Clarify the constituent elements of college curriculum resource allocation, systematically analyze the existing problems from the perspectives of allocation subject, allocation object, allocation mode, allocation efficiency and allocation evaluation, learn from foreign advanced experience, and try to put forward some solutions. The system should first clarify its function, which is the core focus of the whole system development, and then analyze the needs of users and study the required teaching system under this framework. In addition to the overall design, detailed module design should also be carried out. In this process, we need to study each organic subsystem, that is, the corresponding sub module. The required functions can be added in time for later development.

3.3 Node Deployment Function of Virtual Grid Design System

As a common node deployment algorithm, virtual grid is widely used in some practical engineering problems. The sensing radius of a node is also called the coverage range or monitoring range of the node, which usually refers to the data range that can be monitored by sensors in the node hardware resources. In some special sensor networks, for example, the sensing range of ultrasonic and visual sensors is not a flat circular area, but presents a certain angle. Usually, a fan with a certain angle can be used to describe the sensing area of such nodes. Generally, the sensing area of a node is assumed to be a flat circular area with T as the radius, and T is the sensing radius of the node. Then the expression formula of the probability that the monitoring area is covered is:

$$\delta = 1 - \frac{(1 - T)}{\sum \alpha} \tag{3}$$

In formula (3), T represents the perceptual radius of the node, and α represents the half angle corresponding to the sector model. The limited hardware resources determine a small sensing range, and the size of the sensing area of a node has a great impact on the deployment of wireless sensor network nodes. Mathematically, the coverage rate is the ratio of the union of the area covered by all nodes to the area of the monitoring area, as shown in formula (4):

$$V = \frac{\bigcup_{j=1}^{i} T}{T_{ij}} \tag{4}$$

In formula (4), T has the same meaning as formula (3), i represents the coverage area of each node, and j represents the area of the monitoring area. On this basis, calculate the average moving distance of the node:

$$A = \frac{\sum_{j=1}^{c=1} L}{\phi} \tag{5}$$

In formula (5), L represents the total number of nodes in the monitoring area, c represents the moving distance of the node, and the meaning of j is the same as that of formula (4). Generally speaking, through investigation and research and the understanding of customer needs, the system is basically divided into the following functions, as shown in Fig. 4:

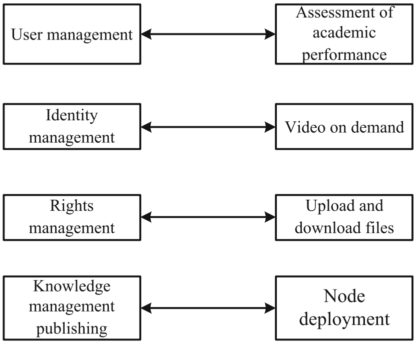

Fig. 4. Basic functions of the system

As can be seen from Fig. 4, the first is the general user management, identity management and authority management, and then the knowledge management release with educational characteristics, learning achievement evaluation, video on demand application, file upload and download, and node deployment function. The use case diagram describes the behavior of the main participants. The allocation of art education curriculum resources in Colleges and universities is a complex and systematic activity [7]. It mainly involves a series of decisions such as formulating allocation objectives, selecting allocation objects, selecting allocation methods, clarifying the combination mode of curriculum resources and time and space distribution, which requires the joint efforts of school administrators, teachers, students, experts and scholars and personnel at all levels of society. The network teaching platform should be open. As long as students and teachers who are interested in art education resources join this platform, they can smoothly access these information and participate in learning and application activities. If learners want to carry out some systematic learning (such as students learning a course), they should join it and register, and then they can realize score management. The system will feed back the learning situation of learners' knowledge units in time. Teachers are not only the essential curriculum elements in the curriculum construction, but also one of the main bodies of the allocation of curriculum resources of art education in Colleges and universities. They have the role of commanding, leading and dominating other curriculum resources. For the function of the system, online and offline data are necessary conditions for course resource allocation [8–10]. Teachers can provide relevant art education resources and use them as teaching aids to help students improve their learning plans. Here, the art education resource management platform based on virtual grid involves many aspects, in which learners' learning of educational resources is the most important part.

4 System Test

4.1 Test Preparation

This experiment is realized by Microsoft Visual C++ 6.0 programming. Running on a computer configured with AMD Athlon IIX4 640 3.0 GHz 2G memory CPU, the operating system is Windows 7. ASP will request a file with.asp as the secondary file name when the client releases the HTTP request, and the web server will respond to the request. Simulation data set Data1 This data set contains 10 pieces of data, and a smaller amount of data is used to describe the execution process of the algorithm and show the results of clustering and outlier detection. At this time, the applied file can be called and explained. When encountering any script compatible with ACT, VEX SCR and PTING, the ASP engine will call the corresponding script engine for processing. For example, if the database query, modification, etc., the application of ODBC data source is connected to it, and then through the database access component ADO to achieve specific database operations. The data set is used to verify the operation effect of the system.

4.2 Test Results

In order to verify the effectiveness of the system in this paper, the test is carried out in the form of comparative experiments. The reference [1] system, the reference [2] system and the system designed in this paper are selected for comparative experiments.

(1) System network delay

Test the network delay of the three systems under different packet sizes. The test results are shown in Tables 2, 3, 4, 5, 6 and 7:

Table 2. Data packet 16KByte system network delay (ms)

Number of experiments	Reference [1] system	Reference [2] system	This article system
1	6.331	6.948	4.366
2	7.482	7.553	5.102
3	8.119	8.266	4.687
4	6.584	8.369	4.337
5	7.559	7.554	5.201
6	8.263	8.339	4.515
7	7.996	7.206	4.636
8	8.334	8.113	5.122
9	7.692	7.585	4.993
10	8.320	8.224	5.206

According to Table 2, it can be seen that the mean value of network delay between the art education course resource allocation system in colleges and the other two systems is 4.817 ms, 7.668 ms, and 7.816 ms, respectively.

Table 3. Data packet 512KByte system network delay (ms)

Number of experiments	Reference [1] system	Reference [2] system	This article system
1	26.344	25.616	12.330
2	25.280	23.948	11.694
3	23.666	24.565	12.036
4	24.551	23.198	11.688
5	23.098	22.058	12.344
6	22.614	23.669	11.699
7	23.818	27.812	12.564
8	24.003	28.369	11.338
9	26.339	27.663	12.255
10	25.008	28.595	13.646

According to Table 3, it can be seen that the average network delays of the art education course resource allocation system in the paper and the other two systems are: 12.159 ms, 24.472 ms, and 25.549 ms, respectively.

Table 4. Data packet 2048KByte system network delay (ms)

Number of experiments	Reference [1] system	Reference [2] system	This article system
1	62.332	69.545	36.949
2	63.558	68.221	45.167
3	64.101	67.331	42.314
4	63.9449	65.206	39.215
5	64.117	66.313	41.006
6	63.878	65.288	42.365
7	62.099	64.912	41.995
8	63.544	65.003	42.331
9	62.006	64.887	45.106
10	63.494	66.313	44.778

According to Table 4, the mean value of network delay between the art education course resource allocation system in colleges and the other two systems is 42.123 ms, 63.307 ms, and 66.302 ms, respectively.

Table 5. Data packet 4096KByte system network delay (ms)

Number of experiments	Reference [1] system	Reference [2] system	This article system
1	81.954	83.074	65.008
2	82.113	82.188	64.212
3	83.009	81.230	63.822
4	84.112	82.664	65.212
5	82.116	83.083	66.778
6	83.307	82.447	63.058
7	83.063	83.511	62.551
8	82.579	84.175	61.058
9	83.155	82.156	63.449
10	82.099	83.114	65.231

According to Table 5, it can be seen that the average network delays of the art education course resource allocation system in this paper and the other two systems are: 64.038 ms, 82.751 ms, and 82.764 ms, respectively.

Table 6. Data packet 8192KByte system network delay (ms)

Number of experiments	Reference [1] system	Reference [2] system	This article system
1	98.978	99.645	72.645
2	96.358	93.587	69.365
3	97.255	92.106	76.338
4	96.547	93.558	74.515
5	95.287	96.337	73.205
6	94.689	98.264	74.156
7	93.997	97.505	75.488
8	92.588	96.164	76.191
9	93.497	98.369	77.322
10	92.578	95.211	78.245

According to Table 6, it can be seen that the mean network delays of the art education curriculum resource allocation system in this paper and the other two systems are: 74.747 ms, 95.177 ms, and 96.075 ms, respectively.

Table 7. Data packet 16384KByte system network delay (ms)

Number of experiments	Reference [1] system	Reference [2] system	This article system
1	114.369	105.616	91.225
2	108.314	112.314	92.316
3	106.148	116.255	92.515
4	113.455	113.646	93.488
5	112.499	105.544	93.616
6	109.155	108.616	92.484
7	108.711	107.361	93.625
8	105.209	112.484	94.677
9	114.318	116.325	93.582
10	107.226	107.331	92.601

According to Table 7, it can be seen that the mean value of network delay between the art education course resource allocation system in colleges and the other two systems is 93.013 ms, 109.940 ms, and 110.549 ms, respectively.
Rationality of system resource allocation

Taking the rationality of resource allocation as the experimental comparison index, this method is compared with the reference [1] system and the reference [2] system. The comparison results of Resource Allocation Rationality of the three systems are shown in Fig. 5.

By observing the comparison results of Resource Allocation Rationality shown in Fig. 5, it can be seen that the Resource Allocation Rationality of the system in this paper can reach more than 95%, while the Resource Allocation Rationality of reference [1] and reference [2] systems does not exceed 85%. Therefore, it shows that this system can realize the reasonable allocation of school art education curriculum resources.

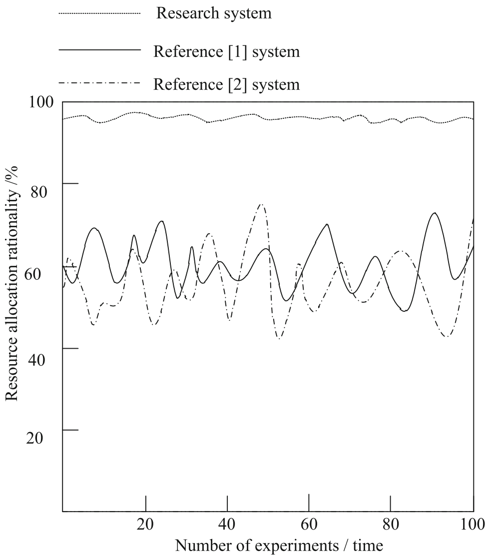

Fig. 5. Results of rationality of resource allocation

5 Conclusion

In order to reduce the network delay of resource allocation system and improve the rationality of resource allocation, a virtual grid based art education course resource allocation system in Colleges and universities is proposed and designed. The performance of the system is verified from both theoretical and experimental aspects. The system has lower network delay and higher Resource Allocation Rationality in the process of educational curriculum resource allocation. The use of virtual grid, which is convenient and fast, highlights the importance of art education curriculum resources in Colleges and universities. At the same time, it enriches the relevant academic literature. Due to the limited research conditions, the accuracy of the system has not been tested in detail in this paper. In the future, this deficiency will be continuously improved.

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Control Method of Input Information Amount of Intelligent Education Resource Database Based on Data Mining

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Abstract. The existing resource database input information control methods have the problem of complex data set block integration process, resulting in low control rate. Therefore, a data mining based intelligent education resource database input information control method is proposed. Identify the performance characteristics of intelligent education resource database, adopt a comprehensive and open architecture, block data with file granularity, optimize the data set block integration process, set the security range by using data mining, and design the input information control mode according to the needs of teaching and learning. Experimental results: the average control value of the input information control method of the intelligent education resource database is 69.388%, which shows that after fully combining the data mining technology, the proposed method is more effective and more efficient.

Keywords: Data mining · Intelligent education resource bank · Input information volume · Data blocking · Granularity division · Information control

1 Introduction

The smart education resource bank is not only a simple accumulation of various materials about education. In the final analysis, the construction of smart education resource bank is an educational problem. We must apply educational technology to serve education according to educational theory and educational practice [1]. With the development of large-scale online education applications, the number of users paying attention to online learning services is increasing, and there are more and more cross system heterogeneous education resources accumulated in the integrated learning cloud platform. Education service is the purpose of the construction of Smart Education Resource Bank: the construction of smart education resource bank is the infrastructure and manifestation of education, and the foundation of educational development and innovation. How to effectively manage the massive multi-source unstructured education resources, help all kinds of users quickly and easily find the required resources, and form teaching plans, test papers, counseling materials and other teaching contents is one of the key technical

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problems to be solved in the process of platform construction. The ultimate goal of the construction of intelligent education resource bank is to serve education and teaching, so its construction should highlight the characteristics of teaching service. Content is the core of the construction of intelligent education resource bank: the content here is not information garbage. It must be filtered and processed by professionals to make it have teaching ability. The traditional control of input information is generally based on keyword search. In large-scale online education applications, it is difficult to quickly find the teaching content required by users using keyword search education resources, and the efficiency is very low. Technology is the driving force for the development of intelligent education resource bank: the application of modern education technology has greatly enhanced human's ability to collect, process, analyze and apply educational information. The problem of educational resources is a social problem that seriously affects the quality of education. The whole society should also pay attention to the construction of intelligent education resource bank. The integration of resources according to a certain educational model and the application of technology in line with the laws of pedagogy and psychology under specific educational needs are the driving force to promote the construction of intelligent education resource bank.

Hu Xiaorong et al. [2] constructed a four-tier shared resource platform based on intelligent education in the form of modular components. Through the establishment of intelligent ecological shared resource database at DAAS layer, shared lifelong learning resources are provided for learners. At the same time, smart teaching service, smart management service and smart education learning circle service have been established at SaaS layer to provide learners with more effective interactive communication and smart learning methods. Finally, the optimal allocation and efficient sharing of educational resources are realized, but in this process, the problem of too complex data set block integration process is not solved.

Zhang Qiming et al. [3] aimed at the problems of insufficient total teaching resources, poor quality of some resources, complex teaching application and so on. Through investigation and analysis, we further clarify the construction logic of intelligent education resource database, improve the construction and application quality of resource database, but ignore the problem that the data set block integration process is too complex.

Therefore, the amount of information entered into the intelligent education resource database needs to be continuously improved. In order to optimize the control effect of input information, this paper proposes a data mining based intelligent education resource database input information control method. The amount of input information is controlled from four aspects: identifying the performance characteristics of the intelligent education resource base, optimizing the data set block integration process, setting the security range for data mining, and designing the input information control mode.

2 Control Method for Input Information of Intelligent Education Resource Database

2.1 Identify the Performance Characteristics of Smart Education Resource Base

The research on the theoretical level of wisdom education is "forced" to follow the path of technology within the framework of technology [4]. The technical specification of educational resources construction takes the metadata specification of learning objects as the core, and establishes an extended attribute set according to the characteristics of different types of educational resources. In addition, in the classification of resources, many smart resource databases do not consider whether the classification of their resources is conducive to use in teaching and learning, which makes the practicability of the resource database poor. The construction of educational resource database can have four levels of meaning, as shown in Fig. 1:

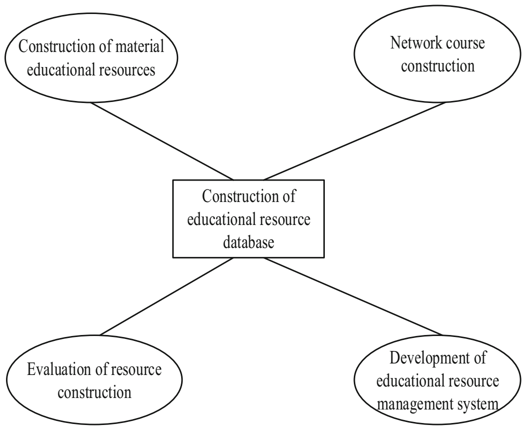

Fig. 1. Construction structure of education resource database

As can be seen from Fig. 1, the construction of intelligent education resource database mainly includes the construction of material education resources, the construction of network courses, the evaluation of resource construction, and the development of education resource management system. In the understanding of the nature of wisdom education, it is generally believed that it has the dual attributes of education and technology. From the dual perspective of education and technology, scholar Yang Xianmin analyzes the technical and educational characteristics of smart education. The educational characteristics are mainly reflected in the seamless integration and sharing of global educational resources, ubiquitous open on-demand learning, green and efficient education management, and scientific analysis and evaluation based on big data. The main technical features are: situational awareness, seamless connection, omni-directional interaction, intelligent management and control, push on demand and visualization. At the same time, each educational resource database system should not become an information island. Only by adopting a comprehensive and open architecture can we achieve maximum information exchange and resource sharing. The construction of material educational resources can be divided into eight types, as shown in Fig. 2:

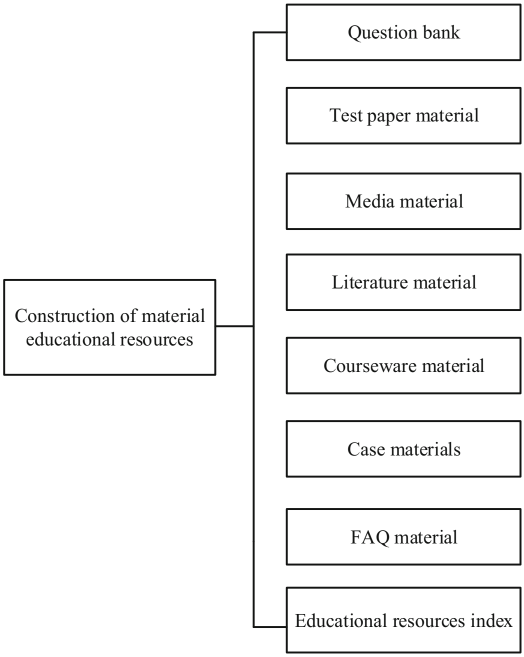

Fig. 2. Schematic diagram of construction classification of material educational resources

As can be seen from Fig. 2, the construction of material educational resources is mainly divided into eight categories: test question bank, test paper materials, media materials, literature materials, courseware materials, case materials, common problem materials and educational resource index. Therefore, in the process of building educational resource database in this paper, we should classify and build resources according to the discipline nature and characteristics of resources, so as to find the required educational and teaching resources conveniently and quickly, so as to realize the optimization of teaching. Network curriculum construction is the comprehensive integration of various educational resources according to the requirements of subject knowledge system and network teaching.

The resource construction evaluation is completed through the excellent educational resources obtained through evaluation and screening. The intelligent education resource database is not a closed information warehouse, but a dynamic and open information collection center. Any resources conducive to school education and teaching should be easily and timely put into the resource database, and can be simply and conveniently obtained and processed by teachers. In these four levels, the construction of network courses and material educational resources is the foundation, the focus and core of standardization. The third level is the evaluation and screening of resources, which needs to standardize the evaluation standards. This requires the intelligent resource database system to be fully open and can accommodate various forms of educational resources. The fourth level is the construction of tool level. The specific contents of network courses and material resources are ever-changing, and the forms have their own characteristics. The corresponding management system must adapt to the changes of this form and make full use of their characteristics. The resources for the construction of technical specifications of educational resources mainly include media materials, question bank, test paper materials, courseware and network courseware, cases There are 9 documents, FAQs, resource directory index and online courses. Based on the above, complete the steps of identifying the change characteristics of the intelligent education resource database.

2.2 Optimize Data Set Block Integration Process

The granularity of data division is mainly byte, data block and file. Integration mode: for the resource database containing application system, it is difficult to integrate by using heterogeneous resource management system method. The current mainstream de duplication strategies are based on the data block level. The core data set of smart education resource base is shown in Table 1:

Table 1. Core data set of smart education resource base

Serial number	Name	Describe
1	Title	Title assigned to the resource
2	Key Word	Keyword description of resource content
3	Author	The primary author who created the resource content
4	Identification	A reference to a resource in a given text environment
5	Relationship Description	Relationship between current resources and related resources
6	Coverage	Extension and coverage of resource content
7	Jurisdiction	Copyright information owned or granted by the resource itself
8	Edition	Version of intelligent teaching resource library

It can be seen from Table 1 that the basic function of educational resources is to ensure the normal progress of teaching activities, and has the function of supporting teaching and improving educational effect. From the perspective of the essence of resources, Professor Peng Shaodong defines educational resources as: "educational resources refer to the internal and external factors and conditions in the material, energy and information of support, promotion and education." In this way, after logging into the newly established heterogeneous educational resource integration platform, users can directly obtain the relevant resources in the above resource databases through the unified navigation information or retrieval tips of the platform, so as to achieve unified retrieval, unified browsing and unified evaluation. There are two kinds of blocking algorithms with block granularity: fixed length blocking algorithm and variable length blocking algorithm.

The fixed length block divides the target file into data blocks with the same size according to the preset length. If the last data block does not meet the specified size, fill the empty data to the specified length. On the integration platform, the classification of the above three data integration methods is transparent to users. No matter what kind of resources in the resource database, after logging in to the newly established education resource integration platform, users can carry out unified retrieval, unified browsing and unified evaluation of all resources to be integrated through the unified navigation information or retrieval tips of the platform. Then the high reliability hash function is used to calculate the data fingerprint of each data block, and then the data fingerprint is compared with the stored data block fingerprint database. In the unified user interface, users cannot perceive the similarities and differences of the resource library where the resources are located. By investigating the resource types of each resource library, the resources of the resource library to be integrated are divided into three categories: teaching auxiliary resources, books and periodicals. If the same data fingerprint is detected in the fingerprint database, it indicates that it is a redundant data block. The system will no longer store it, but only point the block to the address of the existing data content. If the same data fingerprint is not retrieved, it indicates that it is a non duplicate data block. At this time, write the data block to the storage system and write its data fingerprint to the fingerprint library. Based on this, complete the steps of optimizing the data set block integration process.

2.3 Setting the Safety Range of Data Mining

According to different mining objectives, data mining technology can be divided into classification mining technology, clustering mining technology, association rule mining technology and outlier mining technology [5, 6]. In the input information, the management layer is the core of the whole knowledge element base system, which is mainly responsible for the daily management of the underlying database. Only users with corresponding permissions can carry out this level of operation. This layer is responsible for material warehousing, replacement, deletion, attribute setting, making backup and other related management functions. Due to the continuous updating and expansion of the material library, various teaching resources need to be temporarily stored and uploaded. The steps of data mining include: determining mining objects, preparing data, establishing models, data mining, result analysis and knowledge application. Some of the above steps may be repeated in the implementation process. According to the technical principle of data mining, the measurement formula of probability information is:

$$l = \frac{1}{\beta}\sum_{n=1}^{m} - \lg(\beta n) \tag{1}$$

In formula (1), β represents the normal number and can be determined when the unit is selected. m represents a random event set, and n represents the probability of occurrence of event n. The input information management layer also has a function, that is, to evaluate and manage the backup resources to decide whether to add the corresponding knowledge elements and teaching resources provided by teachers and learners. If they cannot be stored in the library, relevant processing shall be carried out. This function is very important. It determines the quality and data volume of knowledge element base and material base, as well as the refresh rate and access times of knowledge element base and material base. Different information entry steps require the participation of different professionals, mainly business analysts, data analysts and data managers. The query layer is the web page dynamic generation layer of query results. The implementation scheme of this layer is very important. Its efficiency directly determines the quality of metabase. The input information control function of the query layer is to display the relevant materials of the knowledge elements to be queried on the web page in the form of summary or other excerpts, and get the corresponding teaching content in the form of text, graphics, images, sound, animation and video through links, so that teachers and learners can query, visit and download through the Internet. Data mining is an emerging technology across multi-disciplinary fields. Even if the data in the target data set is not very rigorous structured data, data mining can be carried out [7]. Secondly, the final form of data analysis results obtained by data mining is not conservative. The result form can be a highly logical mathematical expression or a visual display result that is easy to be understood by ordinary users. On the basis of formula (1), the function expression formula used to measure the uncertainty when the set is continuous is defined:

$$T = \frac{1}{-\lg \beta(y) g(y)} \tag{2}$$

In formula (2), g represents the information entropy of an event, y represents the amount of measurement information, and β has the same meaning as formula (1). Among them, association rule data mining mainly focuses on finding the association between two random transactions hidden in the vast data ocean. Data mining technology can be divided into three categories: statistical analysis, knowledge discovery and other types of data mining technology. The essence of data mining is to operate algorithms from a large number of noisy, uncertain and fuzzy real business data, and finally find the data knowledge that has not been recognized or can not be clearly recognized and has a certain practical meaning. Of course, billing management and security management are also involved in this layer. The application layer is the active role in the whole system. It obtains the required content related to knowledge elements from the database server through the Internet and downloads it to the local computer [8, 9]. And rely on some front-end tools and applications used by users, such as courseware generation system, collaborative inquiry learning system, etc., according to the needs of teaching and learning, constitute teachers' teaching content or Learners' learning content, and then teachers or learners publish their own teaching resources to the Internet, which can be shared by other teachers or learners. Based on the above description, the steps of setting the security range using data mining are completed.

2.4 Design Input Information Control Mode

From the perspective of the development process of input information control in the construction of educational resource database, it can be divided into three stages. The resource database system in these three stages presents different technical characteristics. Educational resource pool refers to the collection of various resources on education and teaching. Input information is the movement state of things and the way of state change itself. Therefore, it does not involve the meaning and utility of these states. It is the most abstract and basic level. It adopts the architecture of controlling the amount of information input, and is based on the interaction between three roles (service provider, service registry and service requester). The interaction involves publishing, searching and binding operations. Input information only studies various possible states of things' movement and the relationship between states. Shannon's definition of information belongs to this level. It studies various possible states of things' movement and the relationship between states from the perspective of probability and statistics. Therefore, it is probabilistic grammatical information. In the case of discretization, the expression formula of probability space is:

$$\begin{bmatrix} P \\ Q(\eta) \end{bmatrix} = \begin{bmatrix} e_1 & e_2 & \cdots & e_\eta \\ Q(e_1) & Q(e_2) & \cdots & Q(e_\eta) \end{bmatrix} \tag{3}$$

In formula (3), P represents a priori probability, Q represents the probability of any element, η represents the set of elements in the sample space, and e represents the probability measure value. Formula (3) can better solve the problem of information transmission such as communication engineering. These roles and operations work together on the service component of educational resources: service software module and its description. Based on the existing distributed heterogeneous educational resource database system, the service provider provides educational resource services, and registers the description information of Web services in the service registry or sends it to the service requester. Input information is the specific meaning of the motion state and mode of things. Due to the interference in the channel, the amount of inbound information obtained by the resource library is mutual information. The expression formula is:

$$R = \lg \frac{1}{s(\eta_{ij})} - \lg \frac{1}{s(i|j)} \tag{4}$$

In formula (4), s represents the average information of the source, i represents the disorder measurement information entropy, and j represents the order measurement information entropy. This is to study the relationship between various states and entities, that is, to study the specific meaning of information. The service requester retrieves the education resource service description locally or in the service registry, then binds the education resource service and invokes the web service. Pragmatic information is the utility of the movement state and mode of things and their meaning to the observer, or relative to a certain purpose. This is to study the relationship between the movement state and mode of things and users, that is, to study the subjective value of information. In the process of calling the service, the service requester passes parameters to the service according to the unified metadata structure. The mapping processing logic in the education resource service software module can realize the transformation between the metadata structure and the existing resource database data structure. The final operation results are returned to the service requester with a unified metadata structure, so as to control the amount of input information in the educational resource database.

3 Application Test

3.1 Test Environment

In order to verify the application effect of the input information control method of the intelligent education resource database, the application test is carried out. The hardware configuration is CPU: Intel (R), Celeron (R) CPU2 40 GHzstepping01Memory: 1048256 k.HD: ST380817AS 80G SATA. Network environment: l0 M LAN, Huawei router and switch. Software configuration: Microsoft Windows Server, standard, JDK, Tomcat. The whole smart education resource base mainly involves the client, web server, application server, file server and database server. Various servers are in the form of clusters. Each cluster contains multiple nodes. Redis, HBase, hive, zookeeper, mysql, etc. are deployed on different nodes to interact with each other and jointly complete massive and highly concurrent file read / write access requests.

3.2 Test Results

The input information control method of intelligent education resource base based on ant colony algorithm and the input information control method of intelligent education resource base based on genetic algorithm are selected for application test and comparison with the input information control method of intelligent education resource base in this paper. Test the control rates of the three control methods under different data scales, and the calculation formula is as follows:

$$k = \frac{f - u}{f} \times 100\% \tag{5}$$

In formula (5), f represents the size of the total uploaded files, and u represents the size of the files actually stored by the system. The test results are shown in Figs. 3 and 4:

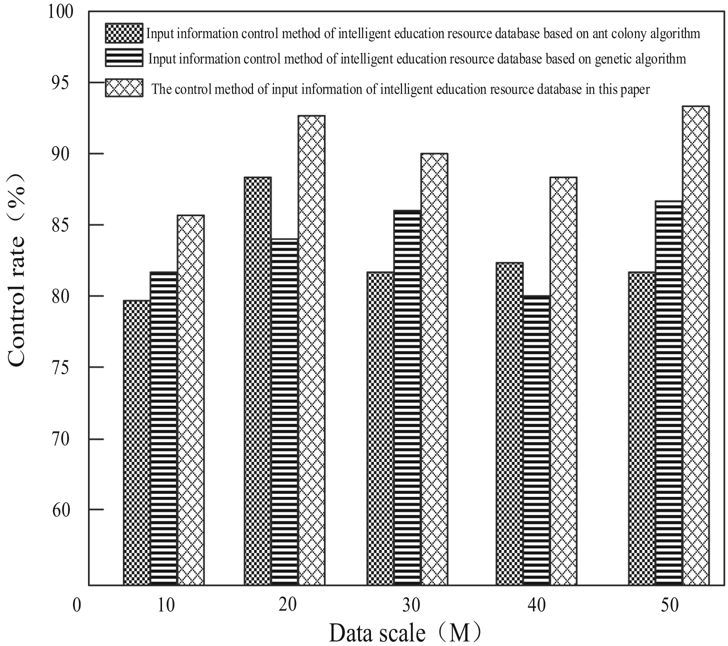

Fig. 3. Data scale 50m control rate (%)

According to the test results in Fig. 3 and Fig. 4, the control mean values of the input information control method of the intelligent education resource database and the other two input information control methods of the intelligent education resource database are 69.388%, 61.901% and 62.104% respectively. It is proved that for the large-scale collection of information resources, the control effect of the other two control methods on the amount of input information is not obvious. The possible reason is that the granularity of de duplication becomes larger by merging sub blocks. However, considering that the main resource of the resource library is a document class, the input information control method of the intelligent education resource library in this paper can effectively save storage space.

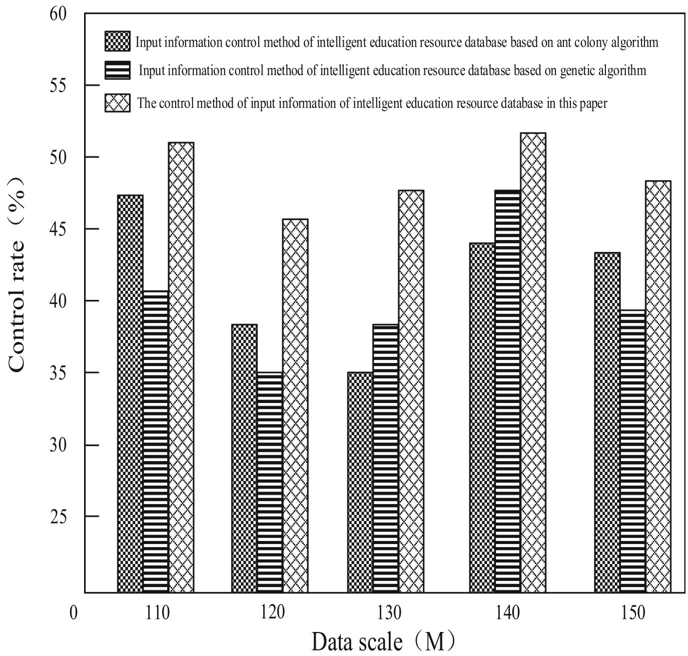

Fig. 4. Data scale 150m control rate (%)

4 Conclusion

This paper combines data mining technology with the construction of educational resource database, designs and realizes the control of input information, alleviates the problem of insufficient storage capacity of educational resource inventory at all levels to a certain extent, and can effectively reduce the operation cost of resource database. Limited by the research conditions, the audit process of educational resource database needs to be continuously improved in the future.

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Design of Multimedia Courseware Synchronous Display System for Distance Teaching

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Abstract. In view of the poor effect of courseware display in the current multimedia courseware display system, a multimedia courseware synchronous display system for distance teaching is designed. The component library is constructed by SQL Server 2000, and the navigation interface based on distance teaching is designed to reflect the friendliness of multimedia interactive system. Use the visual card editor to present the visual integration environment. The edited metadata file is transmitted to the multimedia of distance teaching through the editing subsystem. The multi-level virtual memory is used to control the remote access process through the unique identification of multimedia files. Calculate the maximum and minimum values in the information base, and judge whether the information is abnormal point information based on this. Use the information extraction method to edit the distance teaching courseware. Design the sending and receiving process of multimedia courseware information for complete transmission of information. Through the synchronous display function of courseware, it can be broadcast on demand by students. The experimental results show that the number of downloads of relevant theoretical articles, teaching courseware downloads and relevant website clicks of the system users are within the range of actual downloads, with an error of 0, and has a good display effect.

Keywords: Distance teaching · Multimedia courseware · Synchronous display

1 Introduction

Computer multimedia teaching demonstration system plays an important role in classroom teaching. These courseware have pictures and texts, sound and animation, and strong expressiveness. They not only attract students' interest in learning, improve their ability to acquire knowledge, but also effectively increase the amount of knowledge taught per unit time. An excellent teaching demonstration system is the product of the perfect combination of mature teaching contents, teaching ideas, teaching methods and advanced computer technology. However, in classroom teaching, the subjects of teaching are ever-changing, and the selection of teaching materials, teaching objects and teaching plans, and even the teaching style of teachers have great plasticity. The requirements for demonstration courseware will vary according to time, materials and

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teaching methods It varies from person to person, which will lead teachers to feel that the ready-made courseware is not applicable, on the other hand, they are afraid of the complexity of programming and do not get involved in courseware making. Because the use of programming language to write programs requires designers to be familiar with the programming language and have considerable experience in the development environment, using the production platform to develop CAI courseware has become today's trend.

At present, the popular courseware making platforms in the market generally have large application goals. When developing a certain kind of course demonstration system, they often can't find suitable tools and implementation methods, so they have to use the application program link function of the platform to link external executive files. In this way, they return to programming. With such a platform, teachers who don't understand programming won't use it. In order to enable teachers to participate in the production of courseware, there must be a number of "special tools" designed for subject teaching, with some teaching expressiveness and simple and easy to use. They should be a handy lesson preparation tool for teachers to focus on the design of teaching plan and the preparation of demonstration script, The demonstration courseware meeting specific requirements can be made without program design, and they can be modified at any time. Based on the above ideas, a courseware display system based on Box2D engine is developed. Taking "measuring average speed" as an example, this paper introduces the advantages of simulation courseware design and its application in teaching, and expounds the functional requirements of developing physical simulation courseware with Box2D engine to achieve the expected teaching goal [1]; The proposed design of courseware demonstration system based on MacOS X changes the traditional man-machine control mode and adopts remote control to operate the courseware, so that teachers have more time to interact with students [2].

However, the original files of the two systems are limited to sequential linear access, resulting in incomplete display results. Therefore, a multimedia courseware synchronous display system for distance teaching is proposed. The hardware adopts three-tier structure, and optimizes the navigation interface, visual card editor, subsystem and storage architecture. The software part edits the distance teaching courseware based on the information extraction method, and designs the multimedia courseware information sending and receiving process and the courseware synchronous display process. Finally, the performance test verifies that the design system has good performance.

2 System Hardware Structure Design

The synchronous display system of multimedia courseware for distance teaching adopts a three-tier structure, and the server uses Windows 2000 to build a web site. After making multimedia courseware, the system architecture is shown in Fig. 1.

As can be seen from Fig. 1, SQL Server 2000 is used to build component library and courseware library. Teachers in different physical locations make corresponding components locally, upload them to the component library of the server by FTP, and then log in to the site through the browser. After identity legitimacy verification, legitimate users fill in the correct component information [3]. Then, teachers who have permission to

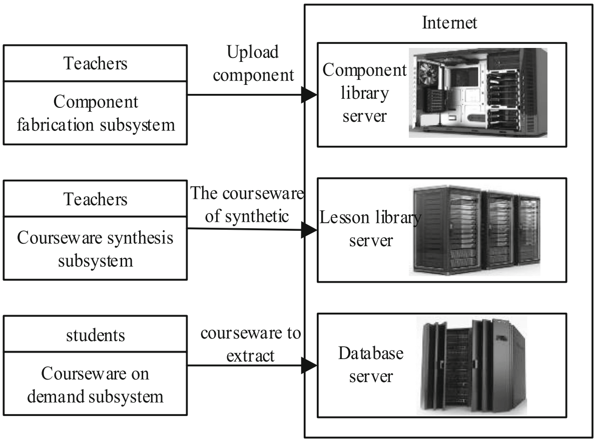

Fig. 1. System hardware structure

make courseware can access the component library and assemble the courseware through web pages. After the courseware is made, students everywhere can access the web server to broadcast the courseware on demand. The system not only provides students with a teaching environment similar to TV + VCD teaching, but also students can choose the teaching content, control the fast forward, backward and volume of the teaching content at will, and jump to the page they need at will [4].

2.1 Navigation Interface Design Based on Distance Learning

Navigation based on distance teaching is an indispensable function in any multimedia interactive courseware. It guides the audience to start or exit relevant modules and carry out various operations on the main object in the module by means of button click, voice prompt, animation guidance and so on. In this system, various design methods and skills are reasonably used to make the navigation operation based on distance teaching flexible, practical and aesthetic. It mainly includes navigation interface design, navigation button design and navigation prompt design, which fully reflects the friendliness of multimedia interactive system [5].

In order to avoid the fancy and cumbersome navigation interface based on distance teaching. However, at the same time, it can quickly realize the orderly navigation function. The visual elements irrelevant to navigation are eliminated in the design of navigation interface, so as to compress and reduce the reading process and burden in the navigation interface. According to the importance of interactive content based on distance teaching, combined with people's visual rules or observation habits, reasonably arrange the size, light and shade, position, etc. of various visual elements in the navigation interface, and strive to open the visual level, so as to read the most important content in a limited time [6, 7]. On the basis of not affecting navigation, try to make the interface look beautiful and exquisite [8].

In the design, a navigation interface corresponds to a Photoshop file. According to the pre conceived tone and composition, the background, title, main button and conventional button are designed and laid out respectively. In the design of the main navigation interface and the background of the navigation interface, in order to set off the foreground operation object and reading content, several pictures are used to synthesize a background picture to reflect the display theme. Moreover, the distribution of visual elements in the picture is uneven but not unbalanced, and the color contrast is strong but not harmonious, which can form a very suitable picture segmentation. The big three-dimensional character "tax" is still used as a part of the background to better reflect the theme.

2.2 Design of Visual Card Editor

The visual card Editor takes control as the center and uses a visual integrated environment, Provide: (1) a control library refined according to the teaching demonstration mode, especially the computer teaching demonstration mode, which has begun to take shape, which embodies most of the functions of DMaker. In addition, it also implements a group of global methods to complete some functions that do not need or should not be realized by control; (2) A visual card editor is used to visually design the relationship between the initial appearance of the card and control; (3) a programmer, which arranges and arranges the event response of control or project. At the same time, it also has the function of automatic generation, and automatically generates some motions in the form of wizard, such as track motion; (4) A player to play the demonstration project, and compile a project into an executable file that can be separated from the platform and run independently under window.

2.3 Editing Subsystem

The editing subsystem is the main body of the multimedia courseware synchronous display system for distance teaching. It mainly completes the establishment of cards, card links and card editing, and realizes the functions of text editing, graphic editing, voice editing and image editing. After editing various single media objects, it can generate new metadata files. Then, the single media object, window stream order and attributes of each window in the card are specified interactively through the card editor, and the performance effect is reproduced in real time to provide observation and modification. After the generated cards are stored in the courseware body, the system can sort, add and delete the chip stack. A card can also be reproduced and updated, and can be searched and retrieved according to its attributes. This establishes the relationship between time and space for single media objects, and provides a node creation means for generating hypertext. In the multimedia courseware synchronous display system for distance teaching, the connection between the card and the single media information file is realized through the window in the card, and the interconnection between the cards is mainly realized through the hot area in the card.

Edit the subsystem structure, as shown in Fig. 2.

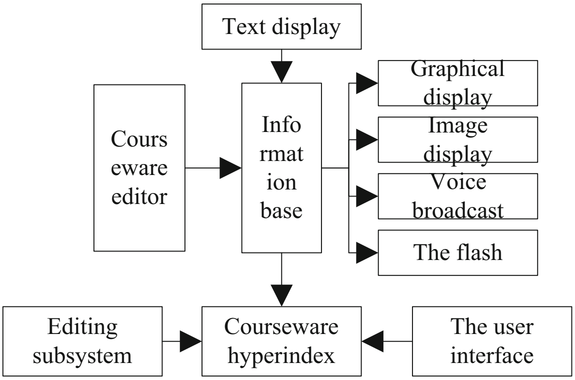

Fig. 2. Structure of editing subsystem

In order to strengthen the management of the object library and facilitate the query of the object library, the multimedia courseware synchronous display system for distance teaching requires users to log in to each information unit. The main contents of login include unit name, real name and link. The login content of the unit is stored in the courseware hypertext index.

2.4 Storage Architecture

The storage system is basically a multi-layer network file system. Logically, the upper multimedia courseware object access level does not care what protocol and architecture the lower media storage adopts. Therefore, the media storage system can adopt a variety of file systems or similar architectures. This is also one of the advantages of using hierarchical system structure in design. Because the network itself is a heterogeneous environment, the compatibility with a variety of heterogeneous systems is a very necessary and useful feature.

A two-layer multimedia file storage system is constructed based on the principle of multi-level virtual memory. The first layer is mainly hard disk, and the second layer is mainly CD-ROM and tape. In the first layer, most modern operating systems can cope with multi-level virtual storage systems backed by mass storage. In order to manage these large capacity multimedia files more effectively, multimedia metabase is introduced. When each media file of a courseware is made, the specially developed production software is used to process these multimedia files and use a specific algorithm to extract information. This process is called the registration process. Then metadata including length, file format and content summary can be obtained and stored in the metabase. Then the system gives the file name and storage path, records the registration time, and records the author name, version and other information entered by the user in the metabase. Finally, according to the specific situation of the operating system, record the specific access method, program path and parameters of accessing the file.

When the monitoring process of the media file access server receives the access request of the upper system, it first retrieves the metabase according to the unique identification of the multimedia file contained in the access request, obtains the description data of the media file, returns these description data according to the application layer protocol, and then according to the records in the metabase, Start the method and process of accessing media files and provide file access services; If the access method process has been started, pass parameters to control the file access process. Obviously, the upper courseware server may be physically on the same machine as the media file server, so you can directly use the system call provided by the operating system to access the files under the local path. More often, the courseware server and the media file server are located on different nodes of the network, so the data transmission between the media file access server and the courseware server needs to adopt specific network file transmission means.

3 System Software Design

3.1 Distance Teaching Courseware Editing Based on Information Extraction

The detailed process of information extraction is as follows:

Step 1: collect the abnormal data of distance teaching courseware extracted each time;
Step 2: when preprocessing the original information, the abnormal point information is included, and a kind of information is randomly selected from it. If the sum of the front and rear information exceeds 5 points, the performance of information selection will be reduced, and the information with information selection lower than 5 points will also make the information unrepresentative. Calculate the mean value $\lambda(x)$ of the five point information, and select the maximum value max $\lambda(x_i)$ and the minimum value min $\lambda(x_i)$ from the five point information; Judge whether the selected original information is outlier information according to the following formula:

$$f_1 = \max \lambda(x_i) + (\max \lambda(x_i) - \lambda(x_i)) \times 2.5 \tag{1}$$

$$f_2 = \min \lambda(x) - (\min \lambda(x) - \lambda(x)) \times 2.5 \tag{2}$$

when the mean value $\lambda(x)$ is greater than Eq. (1) or the mean value $\lambda(x)$ is less than Eq. (2), the original information at this point is not abnormal point information; on the contrary, the original information at this time is abnormal point information.

Select the information that is not abnormal point information from all the information, form it into an information set, and make it into card form. The card is the teacher's discourse in the teaching process and a dynamic view of blackboard writing and its auxiliary. The card corresponds to the display information and voice information of a screen in the computer system. Cards are logically composed of a group of overlapping cards Each window contains a single media object, such as a text, an animation, a voice, an image, etc. these single media objects express specific multimedia information according to the specific requirements of time and space in three-dimensional space. Each window has size and position attributes. The plane of the window corresponds to the blackboard, and the third dimension represents coverage.

Window is the unit in the card, that is, the smallest information unit in the courseware. It is the performance and synchronization between single media objects, as well as the carrier and performance space of single media objects. When the window can display objects, it is a real window, otherwise it is a virtual window. The relationship between background and foreground is set by window sequence and clear mode, and the reproduction method is given by the description of the corresponding single media object. Because the number of windows can be arbitrary, the card is a variable length data structure, and its identification is given by the card name and corresponding keywords. It should be pointed out that the card is only the index of the media object, which indicates how the system finds the original single media object from the library and organizes it into a multimedia object body, not including the single media object data itself. The courseware body is only a collection of cards and card indexes. The order of cards is meaningless. The courseware body can be reordered. Match retrieval and other operations, so as to facilitate the editing of courseware.

3.2 Multimedia Courseware Information Sending and Receiving Process Design

Multimedia Courseware Information Sending

The sending data module is one of the main modules of the system. It is mainly responsible for the communication between the client and the server. According to the different data sending formats, it can be divided into two sending methods: sending picture data and command data. At the same time, the server should also follow these two formats when receiving. The main reason for separating the command to send data from the picture is that the amount of data is different, and the receiving mode should also be different. Pictures can be received by multithreading, which can also improve the running speed of the system.

The first step of sending data is to establish a connection. After the connection between the client and the server is established successfully, the client first sends the number of pictures to the server, and then transmits the pictures one by one after the server confirms receipt. Generally speaking, the size of the pictures does not exceed 2m, so the pictures are directly converted into bytes and transmitted at one time. Similarly, at the server, First receive the number of pictures, and then use multithreading to receive each picture.

Multimedia Courseware Information Receiving

Receiving data is also an important module of the system. Its business process is determined by the process of receiving and sending data. From the analysis of the sending data module, it can be seen that the receiving data analyzes picture data and string data. The fundamental difference is that the forms of the two data are different. The picture data is byte stream data, and the string is also general character data, Therefore, it is necessary to parse when receiving to determine whether it is picture data or string data. It can effectively reflect the specific process of the client and server when receiving data, and also provide some ideas for the solution of the problem. Therefore, it needs careful analysis and design. On the one hand, the process of receiving data comes from the teacher's operation process, on the other hand, it is designed according to the specific language or operation scheme. In the process of analysis and design, it has been continuously improved, so that the whole process will not make mistakes. In addition, after receiving the data, if necessary, send the received confirmation information to the client, so that the client will not be waiting for a long time, so that some problems in development and unclear business process can be avoided during design.

3.3 Courseware Synchronous Display Process Design

The main function of courseware synthesis subsystem is to allow teachers to use the components in the shared teacher component library to synthesize multimedia distance teaching courseware according to the relationship and teaching order of teaching courseware. The program flow is shown in Fig. 3.

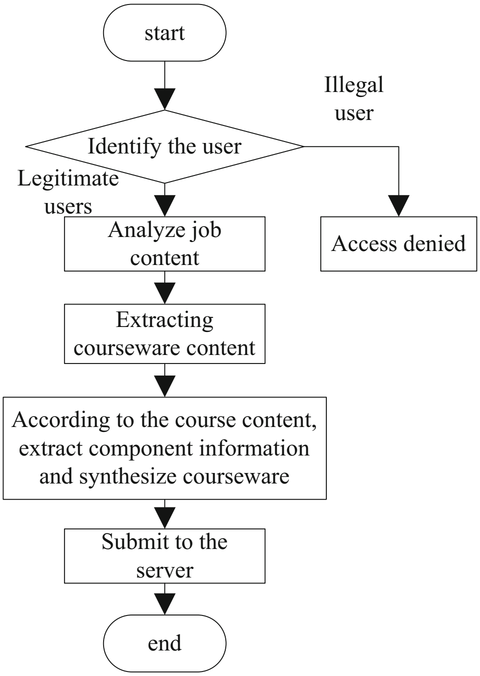

Fig. 3. Courseware synchronization display process

It can be seen from Fig. 3 that the courseware synthesis subsystem is completely based on the web, and there is no need to install any software on the client. The whole synthesis work is completed in the page displayed by the browser. In the courseware synthesis subsystem, ASP technology is mainly used to access the database through ASP and ADO technology, synthesize the components in the shared teaching component library into teaching courseware, and store the courseware in the teaching courseware library for students on demand.

When the system works normally, the client still keeps issuing courseware access requests and publishing the status table of the normally working courseware access agent. The purpose of this is: (1) if the published state is lost during network transmission, the next published state will be used as a substitute to make the system continue to work normally. Obviously, if the system is normal, the probability of losing the published state is very low. (2) If the status is lost all the time, it means that the network connection may be disconnected or the client may crash. In this case, the next received status release will enable the system to recover from the error.

In order to maintain the system operation status, maintain and limit the control information bandwidth, the detailed steps are as follows: when the courseware access agent works normally, each release status is taken as a new offset on the original offset, and its own software status table is updated and released as a new status. This process is called "update" process in soft state protocol.

In order to control the system bandwidth occupied by the publishing state of scacp protocol, the client and courseware access agent must be controlled to publish the state too frequently. On the other hand, if the time interval between two publishing States is set too long, when the system has an error, such as the client crashes or the courseware access agent crashes or the network connection is disconnected, the system delay for detecting and recovering from the error will rise. Obviously, a compromise must be made between these two factors.

When the control bandwidth is determined, when a session has m When a user listens, the time interval of publishing status can be calculated according to the length of publishing status:

$$T = S \cdot \frac{m}{W} \tag{3}$$

In formula (3), W is the control bandwidth of this session; m is the number of users; S is the length of published status data.Obviously, such an interval does not need to be very precise, because on the one hand, the user cannot know exactly how many users are listening to this "channel" at any time point. On the other hand, due to listening to the same "channel", the published state of each client is valid for other clients of the same session.

4 Experiment

In order to verify the rationality of the design of multimedia courseware synchronous display system for distance teaching, experimental verification and analysis are carried out.

4.1 Experimental Process

When creating or modifying a courseware, first enter the courseware name. If it is new, judge whether it already exists in the courseware library. If it does not exist, directly enter the courseware synthesis window; If it is modified, judge whether there is this courseware in the courseware library, and sometimes enter the courseware synthesis window to extract the existing information. The main window of courseware synthesis is shown in Fig. 4.

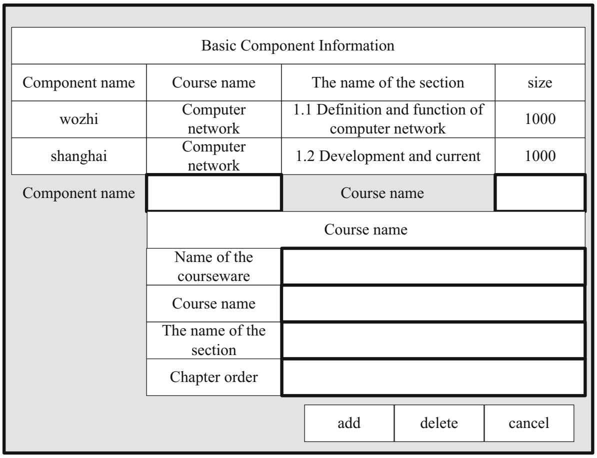

Fig. 4. Main window of courseware synthesis

When making a courseware, you can query the component information according to the combination of component name, course name and chapter name. The records that meet the conditions are displayed by page. According to the idea of componentization, courseware is composed of different components, which needs to associate different components to form a complete courseware. When accessing the courseware, you can link to the corresponding components through the component name.

Based on the main window shown in Fig. 4, it is calculated that the number of downloads of relevant theoretical articles learned by users ranges from 24 to 28, the number of downloads of teaching courseware ranges from 30 to 34, and the number of clicks of relevant websites remains above 20. Among them, the number and size of users' learning related theoretical articles, teaching courseware and related websites are 1200 MB, 2800 MB and 520 MB respectively.

4.2 Experimental Results and Analysis

The courseware display system based on Box2D engine, the courseware display system based on MacOS X and the multimedia courseware synchronous display system for distance teaching are used to compare and analyze the download of user learning related theoretical articles, the download of teaching courseware and the click of relevant websites, as shown in Fig. 5.

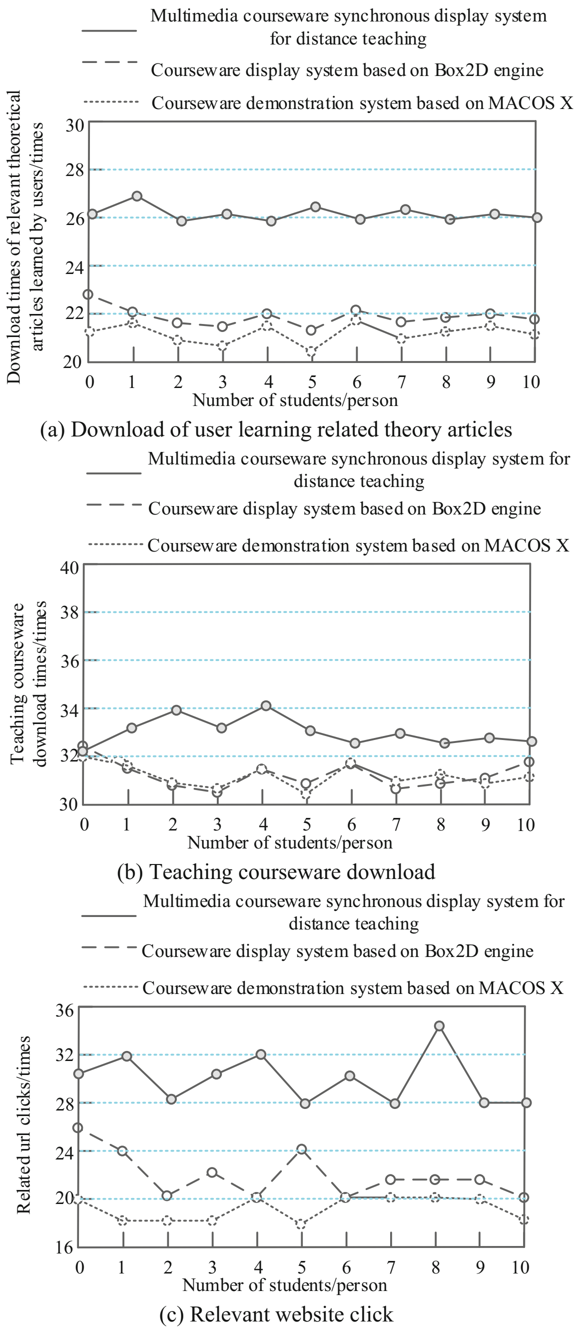

Fig. 5. Comparison of courseware usage of three methods

As can be seen from Fig. 5, using the courseware display system based on Box2D engine and the courseware display system based on MacOS X, the download of user learning related theoretical articles, the download of teaching courseware and the number of clicks on relevant websites are inconsistent with the actual situation. Using the multimedia courseware synchronous display system for distance teaching, the download of user learning related theoretical articles, the download of teaching courseware and the click times of relevant websites are within the range of actual download times, and the error is 0. This shows that the use of multimedia courseware synchronous display system for distance teaching has a good display effect.

5 Conclusion

Of course, there are still some shortcomings in this system. For example, the application of gesture on the mobile terminal is not mature and limited to the time relationship. In the future work, it needs to be continuously improved to make the whole system more humanized and enhance the robustness of the system.

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Design of Music Teaching Resource Sharing System Based on Mobile Terminal

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Abstract. In the social environment with the rapid development of information technology, the importance of educational technology in the field of education is becoming more and more prominent. Traditional music teaching methods limit the openness and extensibility of music classrooms to a certain extent, and have been unable to meet the current needs of big data. Therefore, it is necessary to design a new music resource sharing system based on the mobile terminal. The hardware part designs the MAC resource controller and the data controller, and the software part first designs the music teaching resource sharing architecture. Secondly, the music teaching resource sharing module is designed based on the mobile terminal, so as to realize the music teaching resource sharing. The system test results show that the designed music teaching resource sharing system has good performance and certain application value, which can be used as a reference for subsequent music teaching.

Keywords: Mobile terminal · Music · Teaching resources · Sharing system

1 Introduction

In recent years, the development of computer software technology has changed the way people work and live. In terms of teaching, the way people acquire knowledge is also undergoing major changes. The original single model of traditional education in the classroom is changing [1]. In particular, the breakthrough development of Internet technology in recent years has enriched and diversified the original online education model based on the B/S model. People gradually accept the mode of completing various learning tasks through the Internet. The development of mobile Internet technology has a profound impact on people's learning patterns. Now mobile payment, WeChat, mobile QQ and other applications have been closely related to life and work [2–4]. The Android-based music teaching system makes full use of the existing mobile Internet technology and network technology, and combines the characteristics of the music major. A comprehensive teaching platform integrating basic information management, student music homework management, music practice management, online classroom management, and information notification management is constructed on the mobile terminal. Through

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the teaching platform, it provides professional support for the teaching and learning of music majors [5]. It provides great convenience for distance learners through the mobile phone network. These are mainly reflected in the teaching and learning that can provide recipients with learning content, learning process and learning methods. This diverse learning mode not only satisfies the normal classroom learning. At the same time, it also allows learners to complete exercises or exam operations through the platform, so that the learning effect is better.

The online teaching and learning platform based on mobile terminals takes full advantage of the convenience and speed of the current hottest mobile Internet. It can complete learning tasks anytime, anywhere through a mobile phone, and is easy to carry. It can make full use of the learners' scattered time to complete learning and practice [6], ensuring the learning effect. The system has fully moved the traditional education model into the mobile platform, such as student homework, study exercises, online classes and teaching notices. It provides a traditional, efficient mode of learning and teaching. In addition, music teaching has strong professional characteristics, such as the need to identify sounds through musical notes. The system makes full use of the multimedia technology under the mobile terminal, provides a concise interface design and completes the teaching system in line with the music major. The music teaching system designed and researched by the thesis can be put into use in music teaching. The system allows learners to achieve comprehensive music learning through the functions of regular study, homework practice and information notification [7–9]. It puts learning in the music learning environment, changes the previous mode of only learning without practice on the Internet, and increases the learning effect. This system can be applied to other professional learning systems, and the functional model and dynamic model of the teaching and learning system researched in the thesis can be applied and promoted. The students' learning mode and practice mode can be used in similar online learning systems, which improves the learner's learning interest and increases the learning effect.

2 Hardware Design

The design of the music teaching resource sharing system based on the mobile terminal is optimized and improved from both hardware and software aspects. In terms of hardware, we use MAC resource controller and data controller to ensure data transmission performance. In terms of software, a mobile terminal music teaching resource sharing architecture is designed. Again based on the music teaching resource sharing module. In the case of ensuring the security of data and information, realize resource sharing.

2.1 MAC Resource Controller

The MAC sublayer protocol is a network interface layer protocol, which is mainly responsible for encapsulating the transmitted data at the network interface layer and decapsulating the received data at the network interface layer. While completing the sending and receiving of data frames, the sending and receiving of control frames can also be completed. In addition, in the MAC protocol, for Ethernet, a protocol called CSMA/CD is also included. The protocol specifies that each communication node is an independent network element. Before sending data frames to other nodes, it is necessary to monitor the state of the medium. This monitoring method usually transmits data in the form of broadcast. The MAC controller is composed of six parts: IP interface module, sending buffer module, receiving buffer module, flow control module, sending controller and receiving controller. It will complete the functions of data frame encapsulation, decapsulation, sending, receiving, address filtering and flow control at the network interface layer. Its composition diagram is shown in Fig. 1 below.

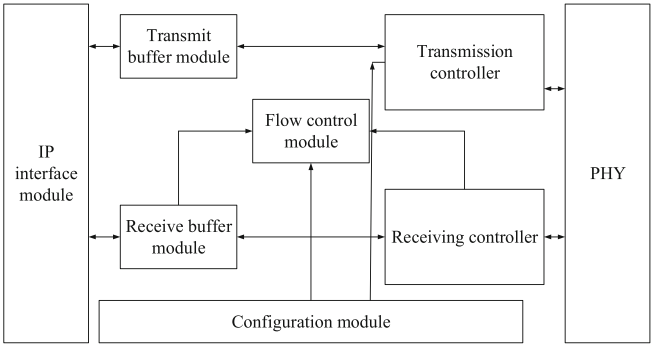

Fig. 1. MAC controller

As can be seen from Fig. 1, the MAC sublayer protocol is a network interface layer protocol, which is mainly responsible for encapsulating the transmitted data at the network interface layer and decapsulating the received data at the network interface layer. While completing the sending and receiving of data frames, the sending and receiving of control frames can also be completed. In addition, in the MAC protocol, for Ethernet, a protocol called CSMA/CD is also included [10]. The protocol stipulates that each communication node is an independent network unit, and needs to monitor the state of the medium before sending data frames to other nodes. This monitoring method usually transmits data in the form of broadcast. For each node in the network, when it is about to send a data frame. First of all, it is necessary to judge whether there is a carrier signal on the line. If it is in an idle state, that is, there is no carrier signal, it can be sent immediately. Wait if the channel is busy. For each node in the network, in the process of checking the state of the channel before sending data, if the channel is idle, the data is sent. If not free, just wait. In addition, if the channel is busy, the transmission task just initiated should be cancelled. The MAC frame structure is shown in Table 1 below.

As can be seen from Table 1, SSD: frame preamble, in general, 7 bytes of 0x55 should be continuously sent on the line to achieve a stable synchronization state. SFD: Indicates that the Ethernet frame starts to be valid, and its value is 0x5d. DA: destination address, 6 bytes in length, it indicates the destination node of Ethernet frame transmission in the network, different DAs represent different destination nodes. In addition, if the MSB of the DA field is 0, it is a unicast address. If the DA field is all 1 s, it is a broadcast address. If the DA field is not all 1 except the highest bit, it is a multicast address. SA: source address, 6 bytes long, it is the physical address of the device. Data and filling: this field is mainly used to indicate the data segment in the Ethernet frame. This field is

Table 1. MAC frame structure

Field name	Section number
Preamble	7
Delimiter	1
Destination address	6
Source address	6
Length/type	2
Data	0–1500
Filling	0–46
Check	4

encapsulated by the upper layer protocol, and the general length is between 46 and 1500. If the field length is insufficient, it needs to be filled to ensure the required minimum number of bytes.

CRC: Frame check code sequence field, which is very important in the judgment of data frames. Length/Type: This field is used to identify the protocol type of the datagram in the MAC frame, and different types correspond to different values. For example, when the value is 0x0800, it indicates that the frame is an IP datagram. When the value is 0x0806, it indicates that the frame is an ARP datagram. When the value is 0x8035, it indicates that the frame is a RARP datagram. Especially when the value is 0x8808, it indicates that the frame is a control frame.

2.2 Data Controller

The types and types of data contained in the music teaching resource sharing system are rich. In order to achieve effective control, a data controller is added to the system designed in this paper. SD secure digital memory card is one of the most widely used mobile storage devices. Data has the advantages of small size and light weight, large storage capacity, fast data transmission and high data security. In addition, the data controller has a simple structure and is easy to integrate, so that data is more and more widely used in mobile media equipment and consumer electronic products. Data has become the mainstream of similar storage products, and data controllers are an essential part of data work. With the replacement of data, the research and optimization of the data controller has high practical application value.

When the data controller is powered on, the extended data lines are used as input ports. They transmit data as data lines only after the SET_BUS_WIDTH command is sent. On the host controller side, when the data lines DAT1–DAT3 are not used, the host controller should keep them in input state. When the data controller is powered on, the CD/DAT3 pin will have a 50KQ pull-up resistor, which acts as card detection and mode selection. Host makes the card work in SD mode by driving this line to high level, if Host sets this line to low level, the card will work in SPI mode. When the user inserts the data controller into the card slot, the CD/DAT3 pin will be pulled high. The Host detects the card insertion by the change of the pin signal level.

In SDIO mode, when the DAT1 pin is not used for data transmission, it can be used as an interrupt output signal line. In SDIO mode, the DAT2 pin can be used as a read wait signal line. The working power of the data controller is provided by the SD controller. After the data controller is inserted into the card slot, the card is powered on and reset immediately. The Host can reset the card by powering it off and then on again. Therefore, each card has its own power-on detection circuit, so that the card is in a certain state after power-on. The card can also be reset by setting the GO_IDLE command. The data controller controller provides the CLK signal to enable the data controller and the controller to communicate and work together normally. Here the synchronous clock signal is the common operating clock of the data controller and the data controller controller. CMD is a serial command line with a bit width of 1 bit. The commands sent by the data controller controller to the data controller and the response of the card to the commands sent by the controller are all transmitted through CMD. The data communication between the card and the controller is realized through the 4-bit data line DATO–DAT3.

The fourth-generation SD memory card, the UHS-II card, has the same shape as the standard data controller. But the UHS-II card adds 8 pins for a total of 17 pins. The 1st to 9th pins are shared with the standard data controller. The standard shape and interface of the data controller are shown in Fig. 2.

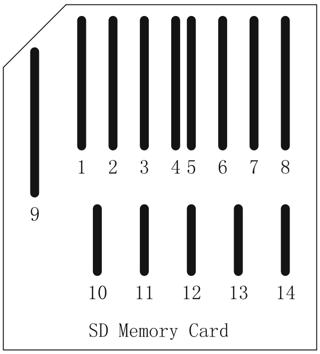

Fig. 2. Data controller interface

As can be seen from Fig. 2, the content of the RCA is the current operating address of the card, and the protocol stipulates that the register is all zeros in the initialization process of the data controller. After initialization, the current address of the card can be reflected through this register. In the process of data transmission, the data controller will distinguish the command sent by the Host through this address, so as to make a corresponding response. On the Host side, this address is the corresponding card. The Host selects the card that needs to be operated through this address, and idles the card that does not need to be operated. The contents of the RCA register can be changed by an instruction. A change command is issued by the Host, and the card generates a new address after receiving the command. The Host cannot assign a specific address to the card, and the operation of changing the address can only be performed when the data controller has no data transmission. When the multiple cards controlled by the Host have the same address, the Host can send a command to the card to make the card generate a new address and return it to the Host.

3 Software Design

3.1 Design Music Teaching Resource Sharing Framework

The practicality of a system is mainly reflected in the functions of the system. The proposed teaching resource sharing system is mainly to meet the needs of different roles in the education system in a certain area to share high-quality teaching resources conveniently and quickly. The vast amount of information gathered by integrating surveys. And combined with UML use case diagram to analyze and clarify functional requirements. The main roles of users in this system are mainly divided into system administrators and ordinary users.

The structure of teaching resource sharing system is mainly composed of hardware structure and software structure. The hardware structure of the system includes physical hosts running FTP server, database server and various application servers. The other is the PC running the client program. The software structure of the system is the architecture of the system. In the previous chapters of this paper, the reasons for the development of the system using the C/S architecture have been explained. In this system, a plurality of functional modules are included, and the client terminal provides the corresponding operation interface to the user in the form of application software. On the server side, split services, distributed deployment, and parallel processing are adopted. In order to speed up the server's response request and data processing speed, improve the server's operating efficiency. Except for the FTP server and the database server, the work on the server side is divided into independent application servers based on independent functions and distributed on different physical hosts. In this way, only one server has to respond to multiple requests at the same time and handle the overload of large amounts of data. The designed music teaching resource sharing architecture is shown in Fig. 3 below.

It can be seen from Fig. 3 that the demand analysis specification is organized according to the previous research information. The main business functions of the teaching resource sharing system client are as follows.

Quick and accurate sharing of teaching resources (add, modify, delete, authorize) Users can share local private files or newly created announcement information to certain users or groups on the platform according to their needs. And different users can be given different operation permissions to the unified shared file. At the same time, it supports batch sharing files, modifying shared users or permissions of shared records, and batch deleting shared records.

Real-time display of shared files or announcements and received shared files or announcements When users share files or publish announcements, the shared records can be automatically refreshed in real time. Shared file records include file name, file size,

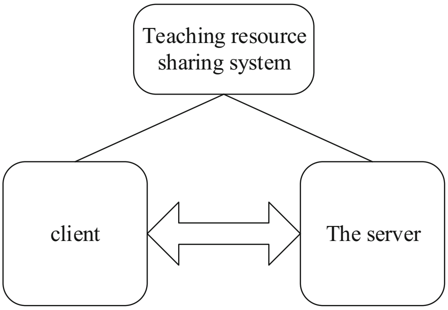

Fig. 3. Music teaching resource sharing architecture

sharing time and other information. Shared announcements include announcement subject, announcement summary, announcement time and other information. At the same time, the shared users can also receive new shared information in time. Shared files include file name, file size, sharer, sharing time, operation authority and other information. Shared announcements include announcement subject, announcement summary, announcement time, announcement publisher, reading status and other information. It can operate the corresponding permissions on the received shared files or announcement messages, and users can obtain authorization methods according to their own. Corresponding shared files enjoy different operation rights such as online browsing or downloading. The content of the announcement can only be read, and the attachments of the announcement can be downloaded. Download files support batch operations.

It can record and display the download status of the file requested to be downloaded in real time, including the file name, file size, save path, download time, download progress and status and other information. Support breakpoint resume function. Users can upload local personal files to the personal network disk of the system for storage, and can also download files from the personal network disk to the local. The resources on the personal network disk also support sharing and deletion operations. Users can download high-quality resources in the shared resource library to the local, or upload local resources to the shared resource library. But it needs to be approved by the administrator before it can appear in the shared resource library. Users can set default parameters for shared function modules according to their personal preferences. User preferences include size restrictions, sharing duration restrictions, and more. The main business functions included on the server side of the teaching resource sharing system are as follows.

Receive and process the user's request to upload shared resources, and organize and store the user's shared resources in an orderly manner according to certain resource organization policies. This article adopts the access control strategy to realize the access control to the shared resources on the server. We adopt a privacy data protection scheme to protect the security of shared resources. Receive and process user requests to browse or download resources. Provide services that support online browsing in C/S mode. Receive and process database read and write requests from clients.

3.2 Design Music Teaching Resource Sharing Module Based on Mobile Terminal

In a mobile communication device, the wireless transmission from or to the network is terminated and the capabilities of the terminal device are adapted to the part of the wireless transmission. Modern mobile terminals already have extremely powerful processing power, memory, hardened storage media and a computer-like operating system. It is a complete ultra-small computer system. Can complete complex processing tasks. Mobile terminals also have very rich communication methods. That is, it can communicate through GSM, CDMA, WCDMA, EDGE, 4G and other wireless carrier networks. Communication is also possible via wireless LAN, Bluetooth and infrared.

Mobile terminals can not only make calls, but also take pictures, listen to music, and play games. And it can realize rich functions including positioning, information processing, fingerprint scanning, ID card scanning, barcode scanning, RFID scanning, IC card scanning and alcohol content detection. It has become an important tool for mobile law enforcement, mobile office and mobile commerce. Some mobile terminals also integrate the walkie-talkie into the mobile terminal. Mobile terminals have been deeply integrated into our economic and social life. It can improve people's living standards, improve the efficiency of law enforcement, and improve the management efficiency of production. The reduction of resource consumption and environmental pollution and the emergency response to emergencies have added new means. This kind of intelligent terminal has been used in express delivery, insurance, mobile law enforcement and other fields in foreign countries. In recent years, mobile terminals have become more and more widely used in my country's mobile law enforcement and mobile commerce fields. A mobile terminal is a mobile communication terminal, which refers to a computer device that can be used on the move. Its mobility is mainly reflected in the mobile communication capability and portability. In a broad sense, it includes mobile phones, notebooks, POS machines and even car computers. But in most cases it refers to a mobile phone or a smartphone with multiple application functions. Therefore, this paper designs a teaching resource sharing module based on mobile terminals. The function module coefficients can be modulated by modules to improve the signal-to-noise ratio and power utilization. First, the function module coefficients need to be calculated, as shown in formulas (1) and (2).

$$d = \frac{\sqrt[3]{b}}{f} \tag{1}$$

$$D = \frac{d}{WQ} + \frac{d}{Q} \tag{2}$$

In formulas (1) and (2), b represents functional coefficient, f represents system integration, W represents standard deviation, and Q represents resource weight. This system is mainly divided into nine modules, namely system registration module, login module, RSS subscription module, tag module, download module, resource safe module, proxy server background module, database function module and FTP server function module. User Registration Module This module is responsible for the registration of new users. After the new user opens the teaching resource sharing system, click the register button. At this point, the system will pop up a registration form, and the new user will follow the prompts on this form. Enter your student ID or faculty ID number, password, and department and class for your account.

The user login module is used for users to log in to the main interface of the teaching resource sharing system. Registered users can log in only after entering the correct account number, password, and verification code. If one of them is incorrect, the system will prompt the user to enter the correct account, password or verification code. The RSS subscription module is divided into five sub-modules, including “User Channel Subscription”, “Custom Subscription”, “Online Channel Subscription”, “My Push” and “Missing Resources”. Both “User Channel Subscription” and “Custom Subscription” are system subscriptions, that is, the resources in the channel are all uploaded by system users.

In “User Channel Subscription”, users can view the resources of subscribed user channels, and can also add new user channels. After the user clicks Add, the consent of the RSS channel is required. After the channel agrees, the channel name will appear in the subscribed channel. When users click on the channel, they can see the latest resources pushed by it. A “custom subscription” means that a user subscribes to a specific content according to his or her individual needs, for example, a user wants to subscribe to resources related to a computer. Just enter a computer in the interface and the system will generate an RSS document about the type of computer. “Online channel subscription” is to let the user directly input the RSS source address of the channel in this module. In “My Push”, users are mainly allowed to manage their own resources, such as adding and deleting resources. In “My Missing Resources”, it mainly shows the user’s last offline to re-online. The main functions of the label module are: The first is to label the resources to be labelled. The second is the evaluation function. The third is to display some brief information of tagged resources on the interface. Finally, you can browse the selected resources.

In order to let users know clearly which resources have been downloaded and where they have been downloaded. The “My Downloads” module added by the system can gather the resources that the user has downloaded in this module, so that the user can check the download address. When a user uses the resource safe, he must first enter the correct password, so as to ensure that even if someone else logs in to a user’s account. However, without the password of the safe, the user’s private resources cannot be viewed. After the password is correct, you can add resources that need to be encrypted in this module, browse, download and delete resources stored in the safe online, and change the password of the safe.

The background proxy server mainly includes three servers, all of which are used WCF proxy servers, namely database proxy server, RSS generation server, and RSS parsing server. The database proxy server realizes the connection between the client and the database through it, and puts all the operation statements of querying, deleting, adding and modifying the database into the database proxy server. Instead of the client connecting directly to the database, it increases security. The RSS generation server is used to aggregate the content that the user is interested in according to the individual needs of the user, and generate RSS documents or when the RSS channel is updated. For example, when a user uploads new resources as a separate RSS channel, the system will call the RSS generation server. The latest 20 content items are retrieved from the database to generate RSS documents. The RSS parsing server is that when the user needs to get the push content of a certain channel, the user only needs to select the channel, and the system will trigger to call the server. First find the RSS document of the channel, parse the document after finding it, take out the content items in it, return it to the client and display it.

This system selects SQLServer2008 as the database, and the database name is "Teaching Resource Sharing System", which creates different tables for different modules. The FTP server is mainly used to store resources and RSS documents uploaded by users, and the server divides resources according to users. That is to say, each user has its own separate folder on the server, which stores its own resources and RSS files.

3.3 Sharing of Music Teaching Resources Based on Mobile Terminals

To realize the sharing of music teaching resources based on mobile terminals, it is also necessary to design a music teaching resource sharing database. Database design refers to constructing the optimal database schema for a given application environment. Establish a database and its application system so that it can effectively store data and meet the application needs of various users. In the field of databases, various systems that use databases are often collectively referred to as database application systems.

The teaching resource sharing system based on RSS technology needs to store the user's registration information, the subscription information between channels, the content items of the resource and so on through the database. This requires the database to meet the input and output of various data to the greatest extent. Through the analysis of the specific function modules of the system, the requirements in the database design are shown in the following contents.

User roles are divided into ordinary users and administrators, and their registration information is stored in the user information table. They are distinguished by the fields representing their identities, "User" for ordinary users and "Manager" for administrators. Ordinary users are divided into groups. Since a user can exist in multiple groups, for example, Zhang San belongs to both the computer group and the physical group. In order to meet this situation, another table is used to store all group names, and another table is designed to store the relationship between users and groups.

As a teaching resource sharing system based on RSS technology, the source of resources is each channel, so a table should be established to store these content items. Then create another table to store the subscription relationship between users and channels. Before a user establishes a subscription relationship with a user, a subscription request must be sent, so a table is designed to store subscription request data. After the user browses the resources in the system channel, in order to distinguish which ones have seen, the information about the resources that have been browsed is stored in the table. At the same time, the table can also record the tag name, brief evaluation, rating and other information data of the resource. When users label resources, they often use the same label. In order to facilitate the operation, the label names that the user has already posted are stored in a table, and the label names newly added by the user are also stored in the table, which improves the reuse of labels and facilitates the classification of users. In order to record where the resources downloaded by the user are stored and avoid repeated downloads, a special table is used to record the data.

A password is required before the safe can be used, and the information after the password hash is stored in a separate table. The key of the safe encrypted file is generated by MD5 hashing the user ID plus the local path of the resource. Therefore, a table is designed to store the user ID of the uploader of the resource and the local path of the resource. According to the above analysis of database requirements, a total of 10 tables are designed in this database management system. The tables are: user information table, which mainly stores the account, name, password, and identity of the registered user. The group name directory table mainly stores the group ID, group name, parent node of the group, and the location of the group. The grouping relationship table mainly stores the relationship between users and groups. Including user account, group name ID. The user channel information table mainly stores the resource information of each RSS channel. Custom channel subscription information table: mainly stores the custom channel information subscribed by the user. The online channel subscription information table mainly stores the online channel information subscribed by the user. The user channel subscription relationship table mainly stores the subscription relationship between user channels and user channels. Subscription request message table: When a user subscribes to a user channel, a request message needs to be sent to the channel. Tag relationship table, which stores tagged and untagged resource information. Tag directory table: This table stores tags created by different users. Safe password table, which stores the hashed value of each user's safe password. The safe resource information table mainly stores the uploader ID, resource name, and local storage path of each resource.

4 System Test

In order to test the performance of the designed music teaching resource sharing system, a related system test platform is built, and the system test is as follows.

4.1 Test Preparation

In order to ensure the reliable realization of various functions of the teaching resource sharing system, the functional modules and case systems of the developed software are tested. The system is tested according to black box and white box test methods. It is used to discover and various inappropriate judgments in the system development process, and to discover errors in software design. Among them, black box testing, also known as functional testing, only knows the input, output and system functions of the program without considering the internal logic structure of the program. White box testing, also known as transparent box testing, mainly tests the internal structure or operation of the application, rather than testing the function of the application. The test cases are described below according to the division of modules, as shown in Table 2.

The test cases listed in Table 2 are partial use cases, which can reflect the performance of the system. Therefore, subsequent system tests can be performed.

4.2 Test Results and Discussion

Select the above test cases for subsequent system testing, test the number of users who have passed the actual verification when different users log in, and perform regression testing. The test results are shown in Table 3 below.

Table 2. System use case

Use case number	Describe
Test function description	Run the login dialog to verify that the entered account and password match
Test case description	Can represent and cover all kinds of reasonable and unreasonable, legal and illegal, borderline and transboundary, and limit input data, operations, etc.
Test steps	Run the teaching resource sharing system, enter the account, password and verification code of the ordinary user, and enter the account, password and verification code of the administrator user
Expect output	If the account, password, and verification code are all correct, enter the system. On the contrary, it will prompt the user to re-enter, and the function modules of ordinary users and administrator users are different after entering the system

Table 3. Test results

Number of users	Number of users passed	Test results
10	10	Test success
50	50	Test success
100	100	Test success
200	200	Test success
500	500	Test success
1000	1000	Test success

It can be seen from Table 3 that the designed music teaching resource sharing system based on mobile terminal has good performance. Pass the test and meet the needs of music teaching resource sharing.

In order to further verify the performance of the system designed in this paper. We selected the reference [3] method and the reference [4] method as the control group and compared the system throughput of the three methods. In performance testing, throughput refers to the amount of data transmitted on the network per unit time, which is an important index to measure the network performance. In this test, gradually increase user traffic and compare the throughput of the three methods with increased user traffic as shown in Fig. 4.

Analysis of the above comparison results shows that when the number of user visits is small, the throughput rates of the three systems are all low. Among them, the throughput rate of the designed system is 5000 kb/s, the method of literature [3] reaches 10000 kb/s, and the throughput rate of the method of literature [4] reaches 13000 kb/s. It can be seen from the comparison that the throughput rate of the two comparison methods is higher than that of the system designed this time. The reason is that the two compared methods

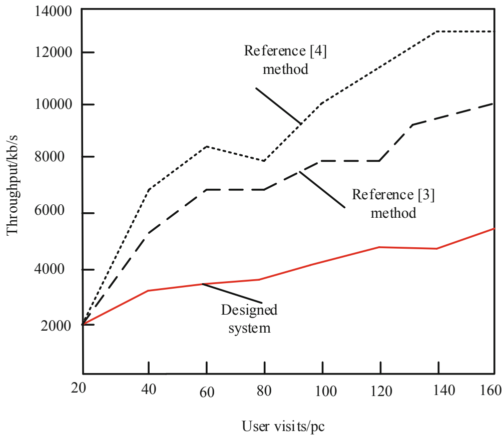

Fig. 4. Comparison results of the system throughput rate

will have a delay phenomenon when users access a lot, thereby increasing the response time, and the system designed this time can process the system access information in real time by designing the MAC resource controller and data controller, so as to ensure throughput rate.

5 Conclusion

In the research of the music distance teaching method, this paper completes the system function demand analysis and the non-function demand analysis. Finally, combined with the actual operation of the system, from the system security, maintainability, scalability and other aspects of non-functional analysis. In hardware, we use MAC resource controller and data controller to ensure the performance of data transmission. In software. Based on the mobile terminal music teaching resources sharing architecture. Third, based on the music teaching resource sharing module to achieve resource sharing. Based on the system function analysis, the system architecture is designed. Through the physical structure of the database model to complete the system database design. After the realization of system module function and test system, the implementation of system is verified by system test. Through the functional test and performance test, it shows that the system achieves the expected goal and can meet the needs of music teaching.

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Remote Sharing System of Chinese Educational Resources Based on Information Fusion

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Abstract. Traditional Chinese education resource sharing system has the problem of slow sharing speed. Therefore, this paper designs a remote sharing system of Chinese education resource based on information fusion. Hardware parts in system, we design a microcontroller, USB (CH376) extension module, communication module, keyboard interface circuit and LCD display circuit, the system software part, the design of system functions, the system resources are collected, and USES the information fusion method of resource integration, and puts forward the remote resources sharing process, To realize the remote sharing of Chinese education resources based on information fusion. The experimental results show that the researched system has fast sharing speed under single information query and multi-concurrent user query, and the accuracy of information query and resource sharing are both high.

Keywords: Information fusion · Chinese · Educational resources · Remote sharing · Expansion · Control

1 Introduction

In today's highly information-based society, the open sharing of high-quality teaching resources has become an increasingly common phenomenon of globalization. Countries around the world have successively carried out research on the co construction and sharing of teaching resources under the network environment, especially in some developed countries, such as the United States and Canada in the Americas, Britain and Germany in Europe, in addition, Japan The open sharing of teaching resources in Australia and other countries also has a good development. The construction and application of educational informatization in schools at all levels in China has lasted for many years. As the core work of educational informatization construction and application, educational resource construction has attracted more and more attention. However, due to many factors, such as lack of unified planning, insufficient funds, insufficient technical force and no corresponding mechanism, the construction and application of educational resource sharing system is extremely insufficient, In particular, high-quality educational resources are particularly insufficient. At the same time, the existing resource sharing system has some

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problems, such as slow sharing speed, lack of shared information and so on. Traditional data fusion refers to the information processing process in which multi-sensor data are automatically analyzed and synthesized under certain rules to complete the required decision-making and evaluation. Information fusion was first used in the military field. It is defined as a multi-level and multifaceted process of processing detection, interconnection, estimation and combination of multi-source information and data, so as to obtain accurate state and identity estimation, complete and timely battlefield situation and threat estimation. Based on this advantage of information fusion, a remote sharing system of Chinese educational resources based on information fusion is designed. The specific design ideas are as follows: Through the system communication module for resource collection, the information fusion method is used for resource fusion processing, and the resource remote sharing process is used to realize the remote sharing of Chinese education resources based on information fusion, effectively improving the accuracy of resource sharing.

2 Hardware Design of Remote Sharing System of Chinese Chinese Educational Resources

In order to realize the remote sharing system of Chinese educational resources, it is necessary to build a system framework, as shown in Fig. 1.

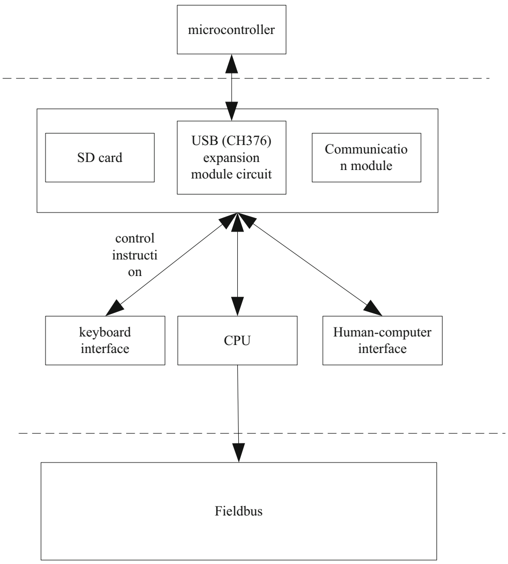

Fig. 1. System hardware framework

Details are as follows.

2.1 Microcontroller Design

As the core of the CNC system, the MCU must meet the requirements of high performance, low cost and low power consumption. This system selects the STM32F103ZET6 of the STM32F103 "enhanced" series as the main MCU. The STM32 series MCU is an ARM-based core launched by STMicroelectronics. A 32-bit microcontroller based on the Cortex-M3 [1]. The Cortex-M3 core is specially designed for low-power and cost-effective applications, and has outstanding advantages in terms of processing speed and energy efficiency. STM32 uses the high-density instruction set of Thumb-2, and the core of Cortex-M3 greatly reduces the storage requirements of the system, and the fast interrupt processing capability meets the high real-time requirements of control, making STM32 series MCUs based on the use of this core design. It can have superior cost performance and face a wider range of applications. The STM32F103ZET6 used in this system has the following functions:

The STM32F103ZET6 used in this system has the following functions:

(1) High performance on low dynamic power consumption:

   ① Adopt ARM 32-bit Cortex™-M3 CPU, achieve 1.25DMIPS/MHz on Harvard structure, and consume only 0.19 mW/MHz, which is 30% better than ARM7TDMI (0.95DMIPS/MHz, 0.39 mW/MHz);
   ② Single-cycle multiplication and hardware division [2];
   ③ Inseparable bit operations to achieve optimal access to RAM, I/O ports and registers;

(2) First-class peripherals: 1 μs dual 12-bit ADC, 4 Mbit/s UART, 18 Mbit/s SPI, 18 MHz I/O flip speed;
(3) Maximum integration: with reset circuit, low voltage detection, voltage regulator, accurate RC oscillator, etc.;
(4) Best code density: The Thumb-2 instruction set achieves the performance of 32-bit instructions with the density of 16-bit instructions (the ARM mode of ARM7TDMI reduces the code amount by 30% to 45%);
(5) Predictable running time: the interrupt controller is embedded in the kernel, the interval between interrupts can be at least 6 CPU cycles, and it only takes 6 CPU cycles to wake up from low-power mode [3];
(6) Improved debugging functions: serial single-wire debugging and JTAG, 2 data viewing points, 8 hardware breakpoints.

2.2 Communication Module Design

UART is a universal serial data bus for asynchronous communication. The bus has two-way communication and can realize full duplex transmission and reception. In embedded design, UART is used to communicate between host and auxiliary equipment, such as car audio and external AP [4]. Communication with PC includes communication with monitoring debugger and other devices, such as EEPROM. The serial port is used to transmit ASCII characters. The communication form uses three lines: ground wire, sending and receiving. Because serial communication is asynchronous transmission, it means that the port can send data on one line and receive data on another line. Others are used to shake hands, but not necessary [5]. The most important parameters in serial communication are data bit, baud rate, parity bit and stop bit. The two ports for passage should be configured, and these parameters must match:

(1) Data bits: Data bits are a measure of the actual data bits in communication. When the PC sends a packet, the actual data will not be exactly 8 bits, the standard values are 5, 7, or 8 bits, depending on the information to be transmitted [6]. For example, the standard ASCII code is 0 to 127 (7 bits), and the extended ASCII code is 0 to 255 (8 bits). If the transmitted data is in simple text (standard ASCII), each packet uses 7 bits of data. The packet referred to here refers to a byte, which includes start bits, data bits, stop bits and parity bits, but the actual data bits still depend on the selection of different communication methods.
(2) Baud rate: an indicator used to measure the communication speed, indicating the number of bits transmitted per second. For example, 100 baud means sending 100 bits per second. When referring to the clock cycle, it refers to the baud rate. For example, if the protocol requires a baud rate of 9600, then the clock is 9600 Hz, which means that the sampling rate of serial communication on the data line is 9600 Hz [7]. The baud rate can far exceed these values, but the baud rate is inversely proportional to the distance. High baud rates are often used to communicate between instruments that are relatively close together, a classic case being the communication between GPIB devices.
(3) Parity bit: This is a simple error detection method in serial communication. There are four verification methods: odd, even, low and high.
(4) Stop bit: used to represent the last bit of a single package. Typical values are 1, 1.5 and 2 bits. Since the data is timed on the transmission line, and each device has its own special clock, it is likely that there will be asynchronous communication between the two devices [8]. Therefore, the stop bit is not only used to indicate the end of transmission, but also provides the basis for transmission correction clock synchronization. The more bits applicable to stop bits, the greater the tolerance of different clock synchronization, but the slower the data transmission rate.

2.3 Keyboard Interface Circuit

Using a dedicated keyboard interface chip WH8280. The chip adopts SPI serial interface, provides keyboard interrupt signal, and is convenient to interface with the processor. Using a dedicated keyboard chip can realize the reading of the key code by interrupting, eliminating the need for cyclic scanning of the keyboard, saving the computing resources of the CPU, and saving a lot of task switching and internal semaphore processing time [9]. Because S3C44B0X has SIO interface, it can realize direct connection between keyboard chip and CPU, but this chip can only drive 64 independent keys at most, and the number of keys required by this CNC system is 86, so it must be expanded by two pieces. One of the chips is mainly used for address/data buttons (letters, numbers and symbols), and the other is mainly used for editing buttons and some control buttons. The chip select signal of the two chips adopts general I/O (GPIO), and the chip is gated and disconnected through the high and low levels of the GPIO port; the interrupt signal is connected to the external interrupts EXINT0 and EXINT1 of the S3C44B0X respectively, for them Assign different interrupt priorities, so that the address/data buttons and control buttons have different priorities, and the priority of the control buttons is higher than other buttons. By writing different interrupt service routines in software, the reading of the key code is realized. WH8280 is an intelligent display driver chip designed by Weihuang Technology Development Co., Ltd. It has SPI serial interface function and can drive 8-bit common cathode digital tubes (or 64 independent LEDs) at the same time. 64-key keyboard matrix, a single chip can complete all functions of LED display and keyboard interface. WH8280 has a decoder inside, which can directly accept hexadecimal code or BCD code, and has 2 decoding methods at the same time, and also has a variety of control commands, such as left shift, right shift, blanking, blinking, segment addressing Wait. WH8280 has chip select signal, which can easily realize more than 8-bit display or more than 64-key keyboard interface. Its characteristics are as follows:

Serial interface, which can directly drive LED without peripheral components;
Each bit independently controls the decoding/non decoding, blanking and flicker properties;
Cyclic shift right/cyclic shift left command;
With segment addressing instruction, it is convenient to control independent LED;
64 key keyboard controller, including de jitter circuit.
The WH8280 communicates with the microprocessor in serial mode. The serial data is sent to the chip from the DATA pin and synchronized by the CLK terminal.

3 Software Design of Remote Sharing System of Educational Resources Based on Information Fusion

The educational resources remote sharing system software analyzes the main function management of the sharing system through the sharing system, calculates the maximum matching degree of educational resources through information entropy, realizes the collection of educational resources, uses information fusion to realize resource fusion, abstracts the information source model into a meta group, and realizes the remote sharing of Chinese educational resources through information distribution.

3.1 Main Function Management of Shared System

First, administrator authority management. The system administrator can view member information, manage registered members, manage published teaching resources, query resource details, delete resources, and recommend and cancel resources according to the quality of resources.

Second, user authority management. For unregistered users, you can browse resource information and view resource details through the platform. At the same time, you can quickly find the required resources through information query service. For registered users, in addition to the functions used by unregistered users, they can also publish resource information through the platform, use the self built resource system and characteristic resource customization system of the platform, and manage member information and published resource information.

Third, the management of series resources is provided. Registered users can publish resource information here, update resource content on the local site at any time, implement the synchronous maintenance of shared platform resource directory and local site resources, and users have the right to maintain resource information.

Fourth, self built resources are provided and managed. Registered users can log in to the system to create their own digital teaching resource content. The system is simple to use and does not need users to understand programming or other network course construction technologies. Only through the plug-in function of the system, you can add various documents, forms, pictures, videos, etc. at will, and set the download function as needed.

(1) System background management: the background mainly includes four parts: system management, additional functions, resource management and other functions. The system management part is divided into five parts: website attributes, function settings, user management, personal resources and system initial. The additional functions include voting management, announcement management and friendship links. The resource management part is divided into resource management Special management, comment review and resource review. Other functions include returning to the home page, re login, instructions and exit management.
(2) Resource Management: teachers can add resource categories, classify each category, add resource information and resource content under each category, edit, modify and delete resources, and realize batch operation of resources. They can specify users' browsing permissions and share the finally generated teaching resources to certain users.

Fifth, quick login management, "quick login" is resident at the top of the page in a folding way. The function items are divided into: tool software, material library, famous teacher's hall, competition area (can initiate competition and work discussion) and online examination. This part is mainly used to solve the application of comprehensive resource optimization. After logging in, the user is authenticated. The tutor identity (including in-service teachers and enterprise tutors) can obtain all permissions of the module, including information uploading, editing, deleting, viewing, etc. the non tutor identity can only obtain some permissions of some modules. The specific login process of the quick login module is shown in Fig. 2:

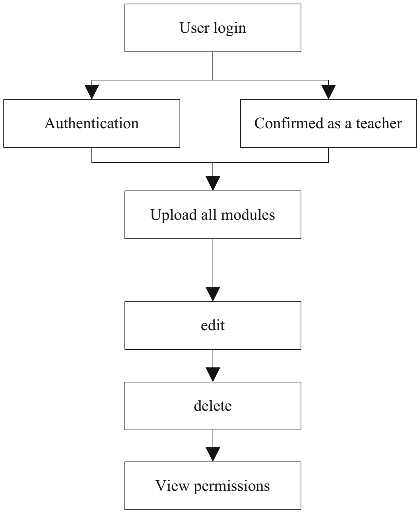

Fig. 2. Quick login process

1) Tool software mainly provides various tool software, and the functional items are view, upload, delete and download.
2) The material library mainly provides project materials in various formats. The functional items are to view, upload, delete, download and comment on the project and author information.
3) The class of famous teachers mainly displays the information of highly praised teachers, and the functional items are viewing, uploading, deleting, downloading and commenting on teacher information. Interact with middle school students in the "learning" section.
4) The competition area mainly provides all kinds of competition information at all levels. At the same time, it can also initiate competitions and discuss works. The functional items are viewing, uploading, deleting, downloading and commenting on competition information; Initiate competition, registration, voting, ranking release and work discussion.
5) Random test and online practice link in "learning" section management course exercise. The functional items are topic selection, testing, viewing answers and scores, and viewing user test records.

3.2 Collection of Educational Resources

The information collected in the educational resource sharing system has random variables, and there are duplicate data and redundant information, so it needs to be further processed. Information entropy is an uncertainty measure of random variables defined based on probability distribution or random variables. It can analyze the repetition degree of information and remove redundant information.

Assuming that X is a random variable, the probability when X takes the value of x is $p(x)$, and its degree of uncertainty is expressed as:

$$H(X) = -\int_{x} p(x)\log p(x)dx \tag{1}$$

In formula (1), $\int_{x}$ represents the data attribute parameter, and dx represents the relevant variable calculation factor of the x index.

Information entropy has nothing to do with the value of variable X, but is mainly related to the probability distribution of variable X, and:

$$H(X) = -E(\log p(x)) \tag{2}$$

In formula (2), $-E(\log p(x))$ represents the probability expectation parameter of x. If X is a discrete random variable.

On the basis of the above data redundancy removal, the similarity feature of the data is calculated, the processed vector coordinates are denoted as $x(x_1, x_2, \ldots, x_n)$, the coordinates processed by the rule base are denoted as $y(y_1, y_2, \ldots, y_n)$, and the information similarity $\lambda_i(i = 1, 2, \ldots, n)$ is expressed by the following formula:

$$\lambda_i = \sum_{n}^{1} \left(x_i^{*}\mathrm{y}_i\right) / \sqrt{\sum_{n}^{1} x_i^2} * \sqrt{\sum_{n}^{1} y_i^2} \tag{3}$$

Then it is processed by the pooling layer, and the output structure of the pooling layer is used as the input of the entire connection layer. Denote it as $X\{X_1, X_2, \ldots, X_n\}$, denote the sampling matrix as $r\left\{r_{1,1}, r_{2,1}, \ldots, r_{n,1}\right\}$, repeat the multi-layer convolution operation [10], and denote the output matching degree P_i as:

$$\begin{Bmatrix} P_1 \\ P_2 \\ \cdots \\ P_n \end{Bmatrix} = \begin{Bmatrix} X_1 r_{1,1} + X_1 r_{2,1} +, \ldots, +X_n r_{n,1} \\ X_2 r_{1,1} + X_2 r_{2,1} +, \ldots, +X_2 r_{n,1} \\ \cdots \\ X_n r_{1,1} + X_n r_{2,1} +, \ldots, +X_n r_{n,1} \end{Bmatrix} \tag{4}$$

After the above calculation, the maximum matching degree is obtained:

$$Max(P_i)\{i = 1, 2, \ldots, n\} \tag{5}$$

Based on the above calculation, the collected data is preprocessed to improve the accuracy of information collection.

3.3 Realization of Resource Sharing

Information fusion is to coordinate, optimize and comprehensively process the information from multiple sensors or multiple information sources to produce new valuable information in order to draw more accurate and reliable conclusions [11]. The information in information fusion includes data, signal and knowledge. The information fusion method is used to fuse resources, and the information source model is abstracted into a tuple, as follows:

$$Is = (M, L, R) \tag{6}$$

Among them, M represents the metadata model of the resource ontology, L represents the conceptual relationship collection, and R represents the Chinese Chinese educational resource collection.

Express the integration formula as:

$$(M_1, M_2, \ldots, M_n, K) \xrightarrow{\prod} M_d \tag{7}$$

In the above formula, M_1, M_2, M_n respectively represent the metadata model, M_d represents the metadata model, K represents the concept parameter, and $\prod$ represents an integration parameter.

After the above processing, the association relationship between resources is determined and resources are integrated together [12].

After integration, for resource sharing, the resources that need to be shared are recorded as A respectively, and the reception rate of the shared object node is expressed as:

$$R^A = \sum_{k \in A} \frac{n_k \rho_j}{\tau_k} \tag{8}$$

In the above formula, n_k represents the reception rate of the $_k$ data packet, ρ_j represents the transmission delay parameter of the $_j$ data packet, and τ_k represents the communication range of the $_k$ resource node.

Express the reception rate of the resource as:

$$R^k = \frac{n_k \rho_j}{\tau_k} \frac{\sum\limits_{l \in A} n_l \rho_j}{\tau_l} \tag{9}$$

In the above formula, τ_l represents the average acceptance rate of the $_l$ data node.

After the above processing, for information exchange, the standard information sharing scheme is that only one data packet is transmitted in each time slot, and the utility function is expressed as:

$$U(S) = A\left\{\frac{x(t)^2}{2} + \left[N - P(t) - \frac{1}{w}\right]\right\} \tag{10}$$

Among them, $x(t)$ is the information exchange parameter, N is the total number of information exchanges, $P(t)$ is the number of successfully transmitted data packets, and w is the probability of successful information transmission.

Based on the above process, for information distribution, the information distribution process is shown in Fig. 3:

Through information distribution, the remote sharing of Chinese Chinese educational resources is realized.

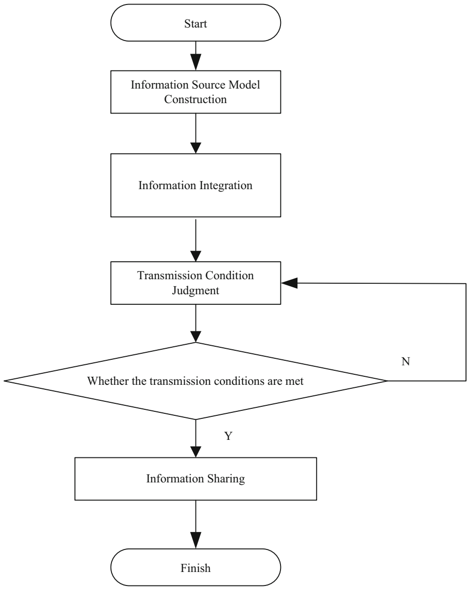

Fig. 3. Information distribution process

4 Experimental Comparison

4.1 System Test Environment

A host computer in the multimedia classroom of Chengde Medical College, the operating system adopts Windows XP SP3 system, and the perfect decoding player and the latest Adobe Flash Player Activex 10.3 plug-in are installed. By setting the Media Center mode of the perfect decoding player and setting the AVI decoder It is "the system comes with a decoder", and then the resource sharing system of Chengde College is installed; the network center can be connected to a database server of the campus network, and SQL SERVER 2003 is installed to store the user information of all teachers in the whole college.

In this part of the experiment, it is divided into two parts. In the first part, one is to simply verify the execution time of each operation, and the other is to compare the query time of information in the case of multiple concurrent data.

In the second part, it mainly verifies the accuracy of related information query and the accuracy of resource sharing. In this paper, information fusion, multi-sensor information fusion and this method are used for experimental verification.

4.2 The First Part of the Experimental Results Analysis

The comparison results of information query time are shown in Fig. 4:

Based on Fig. 4, it can be seen that the time gap between the research system and the other two platforms is small, but the query time of the research system is still less than that of the other two platforms.

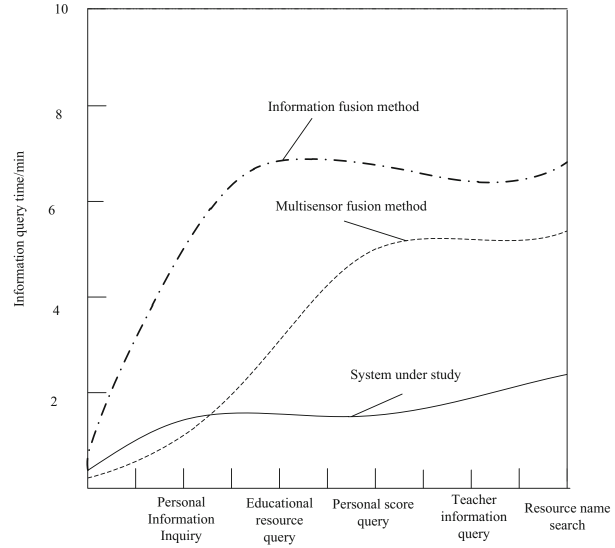

Fig. 4. Information query time

On this basis, the response of the proposed system and the previous system under multi-user operation is tested to test its stability. During the experiment, 100 users are simulated to operate the system or platform at the same time. The average response time curve of each operation is shown in Fig. 5:

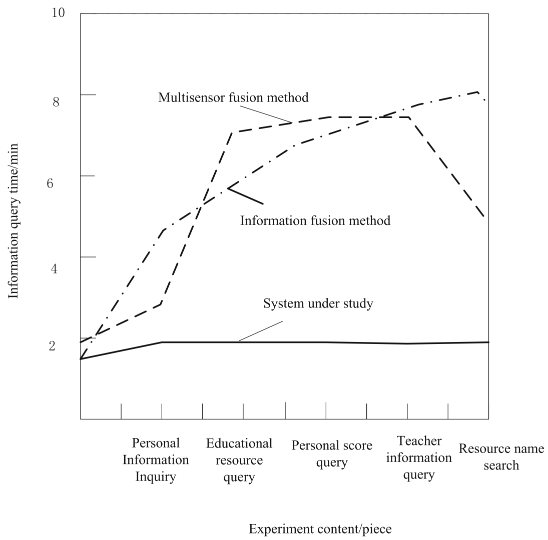

Fig. 5. Comparison of information query time under multiple concurrency

Based on the above figure, it can be found that the response time of the studied system is no more than 3 min in all things. Under the query of multiple concurrent users, the time is less, which is within the expected range. Therefore, it can be proved that the proposed system can also maintain a faster query speed in the case of multi-user query, and has better performance than the other two platforms.

4.3 Analysis of the Second Part of the Experimental Results

The query accuracy of the two systems on each information is compared in advance, and the comparison results are shown in Fig. 6:

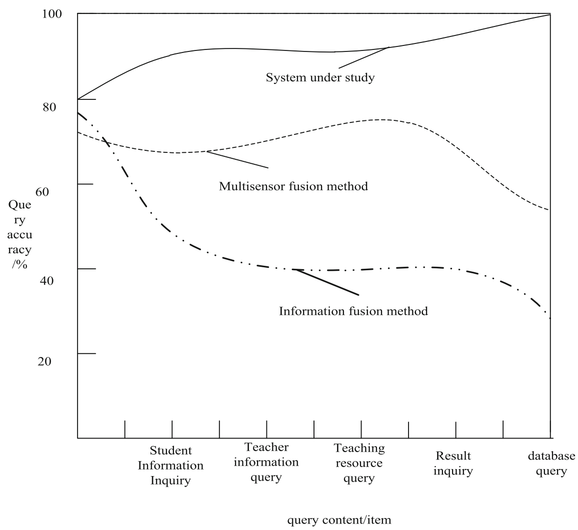

Fig. 6. Information query accuracy comparison

It can be seen from Fig. 6 that the system studied has higher accuracy in the query of various information, and can accurately query the information required by users, which is higher than that of the other two systems.

On this basis, the accuracy of resource sharing between the two systems is analyzed, and the results are shown in Fig. 7:

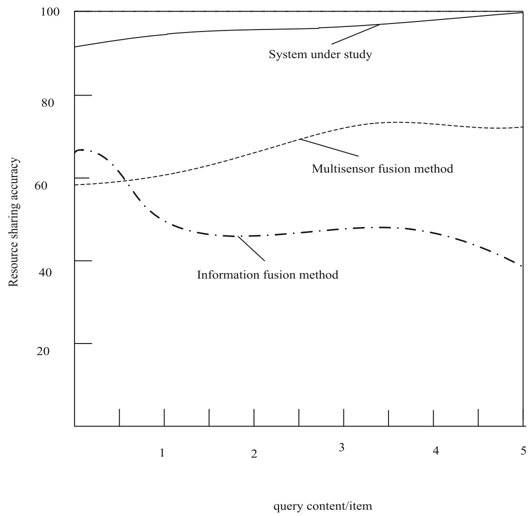

Fig. 7. Analysis of Resource Sharing Accuracy

Through the analysis of Fig. 7, it can be seen that the proposed system has higher accuracy in resource sharing than the other two systems, and can output the information required by users according to their needs.

5 Conclusion

To sum up, the remote sharing system of Chinese education resources based on information fusion has achieved good application results, improved the query speed and achieved the system design goal. At the same time, it is proved that the application of information fusion technology to information management can objectively, reasonably and scientifically deal with information sharing, which provides a scientific basis for the remote sharing of educational resources. Although this paper achieved a better query speed, the accuracy of information sharing needs to be further improved.

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Intelligent Education Information Resource Integration and Sharing System Based on Cloud Computing

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Abstract. In order to improve the integrated storage capacity and sharing security of educational information resources, this paper proposes and designs an intelligent educational information resources integration and sharing system based on cloud computing. The system hardware is composed of user management module, education resource management module, related education resource system integration module and system management module. The curriculum resource management module is designed with b/s architecture, namely browser/server structure. In short, the b/s structure can be divided into three levels: client software, application server, database server, etc. Through user management, educational resource management and related educational resource system integration, software research is realized. The experimental results show that the intelligent education information resources integration and sharing system based on cloud computing can effectively improve the storage capacity and the security of sharing.

Keywords: Cloud computing · Intelligent education · Educational informatization · Information resources · Resource integration · Sharing system

1 Introduction

Educational resource sharing has always been the focus of research in the education industry. It is expected that Internet technology will solve the problems of long cycle, large investment and equipment failure in the current process of educational resource sharing, and ensure the orderly, simplified and optimized development of educational resource sharing with unified standards, so as to make the information construction of colleges and universities develop orderly and healthily [1]. With the development of science and technology, the educational resource sharing system adopts a standardized and standardized way to analyze the relevant processes involved in educational resource sharing, and then reorganize the relevant services, so as to form a new educational resource sharing platform with richer functions. The technology and means of management information system are used to improve the chaos and paper leakage caused by insufficient

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informatization in the past educational resource sharing process [2]. However, due to the particularity of educational resource sharing and the complexity and uniqueness of the process, at present, due to the lack of special information systems, many domestic colleges and universities still use manual methods to share educational resources, which can not well realize the informatization and intelligence of university management, and seriously affect the integration and sharing of educational information resources [3].

Reference [4] proposes a teaching resource integration and sharing system based on gae cloud computing, which uses the advantages of Internet big data integration to reduce the cost of resource construction and improve the utilization of resources. Applying cloud computing technology to higher education can make education break away from the shackles of traditional education mode and improve the convenience of people's access to knowledge. However, the system can store less resources. Reference [5] proposes a mobile technology-based teaching resource integration and sharing system, which is designed and developed with b/s architecture and three-tier structure. The client adopts mobile Internet technology. It realizes users' access, operation, retrieval and sharing of resources. With the help of Alibaba cloud service technology, the server has built an unstructured data resource platform to realize the management of massive textbook data. However, the sharing security of this method still needs to be further improved.

In order to improve the capacity of teaching resources integration and sharing system and strengthen the security of sharing, an intelligent education information resources integration and sharing system based on cloud computing is proposed and designed. The integration and sharing system of intelligent education information resources is designed through cloud computing. From the perspective of system demand analysis, the necessity of system construction and the functional requirements of the system are analyzed from the perspective of business demand, functional demand and non functional demand. This paper introduces the overall design principles of the system, analyzes and introduces the system architecture design and function module design based on the overall design principles of the system, and finally analyzes the database design of the system.

2 Hardware Design of Intelligent Education Information Resource Integration and Sharing System Based on Cloud Computing

In order to facilitate the integration of all relevant educational resource systems, a unified "user management module" and "educational resource management module" are developed to cooperate with the "relevant educational resource system integration module". The functional structure of the whole educational resource sharing platform is shown in Fig. 1:

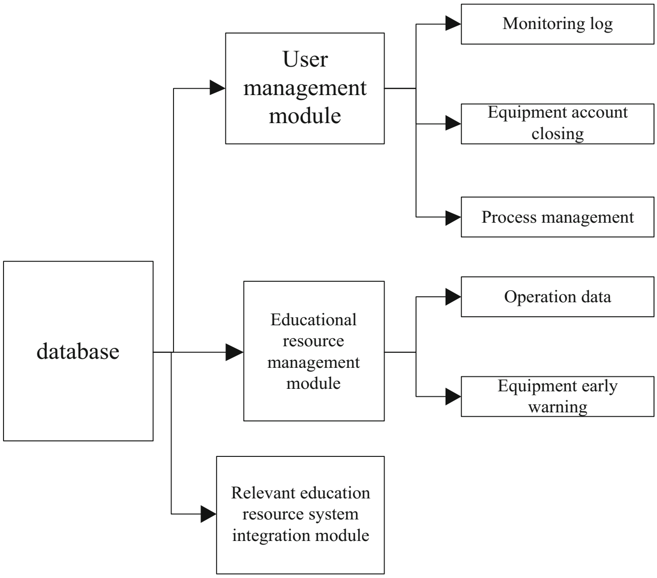


Fig. 1. Functional structure of the entire educational resource sharing platform

1) User management module

The user management module is used to manage the users of the whole educational resource sharing platform, provide authority management for the whole system, and the system provides single sign on function.

The user management module mainly includes user registration, user login, user information modification, user authority management and other parts and functions. In addition to regularly synchronizing the existing faculty information and student information in the school educational administration system and other systems, the user information also adds administrator related information and provides registration function, So that qualified netizens can use the whole educational resource sharing system after registering through the website, so as to promote the opening of educational resources, so that the educational resources of Chengdu normal university can be used by the broad masses of the society, so as to realize the real opening and sharing of educational resources and promote the learning of the whole people [6].

2) Educational resource management module

The educational resource management module is used to provide a unified management entrance. After integration, each previous educational resource management system can manage the educational resources owned by the educational resource management system through the previous management module, or through the educational resource management module provided by the whole sharing platform.

The educational resource management module mainly includes curriculum resource management, thesis resource management, book resource management, learning resource management and other functions. The educational resource information will regularly and unidirectionally integrate the information of various educational resources in each integrated educational resource sharing system into the sharing platform, So that the sharing platform can comprehensively manage the relevant educational resources in each educational resource system before integration. At the same time, similar to the user management module, the deletion of educational resources here will only physically delete the shared educational resources on the sharing platform, and will not affect the educational resources owned by the educational resource system before integration due to accidental deletion [7].

3) Relevant educational resource system integration module

As the focus of the entire educational resource sharing platform, the relevant educational resource system integration module integrates the school's educational administration system related to educational resources, the educational administration system of each college, the educational resource system of each college and other related systems, so as to truly realize the integration of the whole school. All systems related to educational resources are integrated to truly realize the educational resource sharing platform.

The educational resource management module mainly includes the functions of course resource management, dissertation resource management, book resource management and learning resource management, among which the educational resource information will regularly and unidirectionally share the information of each educational resource in each integrated educational resource system. Synchronized to the shared platform, so that the shared platform can comprehensively manage the relevant educational resources in each educational resource system before integration. At the same time, similar to the user management module, the operation of deleting educational resources here will only affect the shared educational resources. Physical deletion of resources on the shared platform will not affect the educational resources owned by the educational resource system before integration due to accidental deletion.

4) System management module

Student users and faculty users can modify their own passwords through the system, while administrators can modify their own and designated users' passwords through the system; At the same time, the administrator user can complete the functions of system language setting, school basic information setting and system section setting through the system management module, so as to complete the basic functions of system management.

Combining SOA (Service-Oriented Architecture), web service and ESB (Enterprise Service Bus) and other technologies and ideas, in order to better integrate the existing educational resource system, the college educational resource system logically divides the system into six layers, and this division method also fully considers the system The later scalability also facilitates the system to maintain low coupling and high cohesion characteristics, and its related educational resource system integration module architecture model.

2.1 System Single Sign-On Module Design

Single sign on is a popular solution for business integration among enterprises. In addition, its definition is mostly used in other specific systems. Users can access other mutually trusted systems only by logging in once.

In many businesses, there are usually many other business supports that provide a high level of management and quality to the business. Specifically, the implementation scheme is mainly shown in the figure below. When the user accesses the application system 1 for the first time, the user does not perform the login operation, so it will be introduced into the login operation interface (1); Provide the specific login information, and then verify the entered identity. If the verification result is passed, it will return an approved credential to the user, namely ticket C2; Again, when the user accesses other programs (3, 5), It will also take this ticket as a basis for its own certification. In addition, other application systems will give the ticket to other authentication systems for verification after receiving the request, and also check whether the ticket is valid (4, 6). If the authentication is obtained, the relevant user can access the application system 2 and the application system 3 without having to log in again. The system single sign-on module is shown in Fig. 2 below:

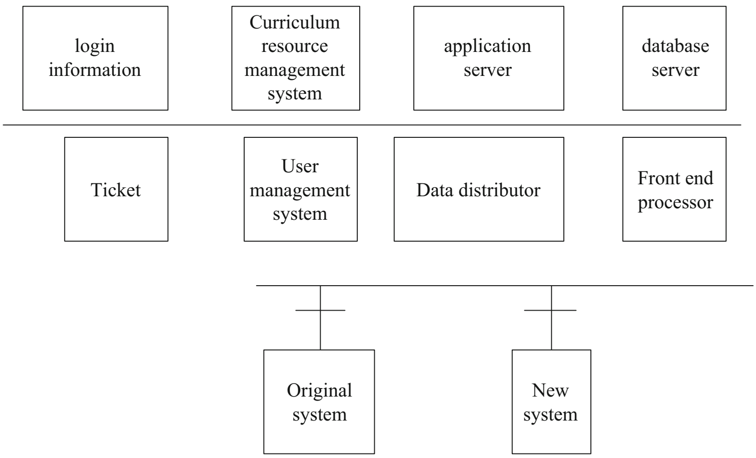


Fig. 2. System single sign-on module

From the above view, if you want to complete SSO(Single Sign On), you need to have the following functions:

1) All applications share the same identity authentication system: One of the prerequisites for SSO is to have a unified authentication system. The primary task of the authentication system is to save and verify the relevant login information; after passing the verification, the system will correspondingly generate a unified authentication mark (that is, the ticket), and return the mark to the corresponding user. In addition, the system will also verify the ticket and determine whether it is valid;

2) All application systems can provide identification and extraction of ticket information: if you want to realize all the functions of SSO and enable users to log in once, then you need to enable the application system to identify the relevant information that has been logged in [8]. In addition, the system is also required to identify the ticket or extract specific information, and on this basis, determine whether the user has logged in before, and then complete the single sign-on.
3) The system can accommodate two or more servers, and can be used for different products: if different authentication servers want to complete the higher-level single sign on mode, they need to exchange mutual authentication information and use a unified and common standard protocol.

In the educational resource sharing platform, the authentication service provided by the identity authentication service is called through the following interactive process, and its sequence diagram is shown in Fig. 3:

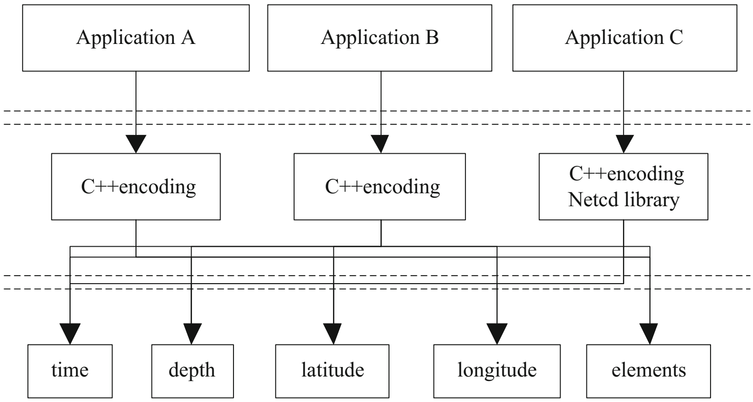


Fig. 3. SSO authentication sequence diagram

2.2 Educational Resource Management Design

The educational resource management module is used to realize the functions of managing new educational resources and maintaining existing curriculum resources. It includes several functional modules such as important resource management involved in the educational resource sharing system of Chengdu Normal University, such as courses, papers, books, experimental resources and learning. Its functional structure design and class diagram design are shown in Fig. 4 below:

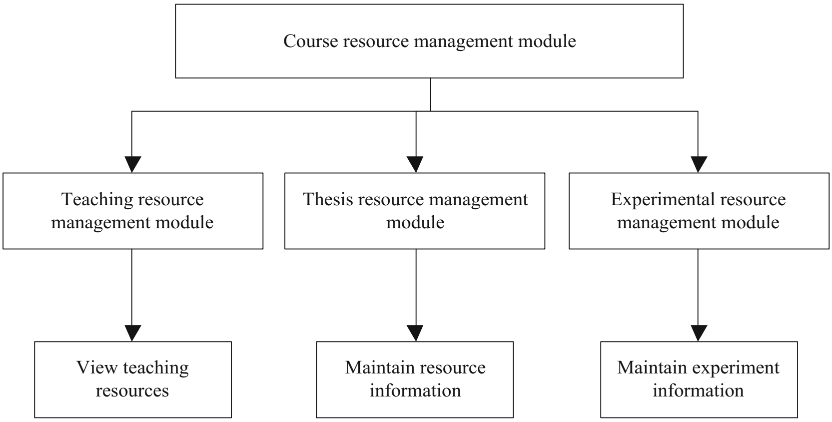


Fig. 4. Functional structure design and class diagram design structure

The educational resource management module is used to provide a unified management entrance. After integration, each previous educational resource management system can manage the educational resources owned by the educational resource management system through the previous management module, or through the educational resource management module provided by the whole sharing platform.

The educational resource management module mainly includes the functions of curriculum resource management, thesis resource management, query/experiment resource management and learning resource management. The educational resource information will synchronize the information of various educational resources in each integrated educational resource sharing system to the sharing platform regularly and unidirectionally, So that the sharing platform can comprehensively manage the relevant educational resources in each educational resource system before integration. At the same time, similar to the user management module, the deletion of educational resources here will only physically delete the shared educational resources on the sharing platform, and will not affect the educational resources owned by the educational resource system before integration due to accidental deletion.

The educational resource management module mainly includes two entity classes, the course resource description class and the course resource file class, which are mainly exposed by the CourceSource class; in terms of system function implementation, based on the MVC three-layer logical structure of the SSI framework, the system uses the CourceSourceAction, CourceSourceService and CourceSourceDao corresponds to the Action, Service and Dao layers of the system respectively. At the same time, it reduces the coupling within the module by means of interfaces and implementation classes [9].

Course resource sharing uses the Eclipse platform and is developed based on the lightweight SSI architecture, using three frameworks of Struts+Spring+ibatis. The SSI architecture enables seamless links between layers and supports responsive business components.

Therefore, all requests made by the relevant users will be processed by the server of the application program, thereby reducing the computer load of the client and reducing the expenditure and cost of system maintenance and upgrade. Logically, the B/S system structure is divided into three layers, including data persistence layer, business logic layer and presentation layer.

Data persistence layer: The main task of this layer is to directly operate on the database, and can add, modify, search, etc. data, which can be file systems, databases, LDAP, etc. It is mainly aimed at the operation layer of the original data, and also provides the relevant data for the logic layer and presentation layer of the business. The system can operate across databases.

Business logic layer: the main task is the persistence management of the system on the database. The operation for specific problems can also be understood as the operation on the data layer. It integrates various system services and engines, provides interfaces, realizes specific functions, and combines the operations of some data layers. These data not only include user management and related login, but also include the management system of user configuration.

Presentation layer: it is the outermost layer, but also the layer closest to the user. Its main task is to display data and receive some data provided by the user, so as to provide a platform for users to interact. It mainly realizes the collection, response and processing of customer website platform information. The main way is Web model. If its logical layer is perfect, no matter how the presentation layer is changed, the logical layer can provide good services.

3 Software Design of Intelligent Education Information Resource Integration and Sharing System Based on Cloud Computing

Through the analysis of the business needs of the educational resource sharing platform, combined with the investigation of the current industry related systems, and the actual situation and needs of the current educational resource sharing work of Chengdu Normal University, the educational resource sharing platform mainly includes several functional modules, such as user management, educational resource management and related educational resource integration management, to realize the related needs of the college's educational resource sharing management. The software function framework structure is shown in Fig. 5.

Of which:

1) User management: it provides and maintains the basic user system for the system. It is the basic component and basic module of the education resource management system of Chengdu Normal University, which is used to maintain the user system of the system. In order to maintain the user system of the education resource sharing platform of Chengdu Normal University, It includes functional modules from user registration to user login, to user information modification and user authority management.
2) Educational resource management: the educational resource management domain is used to manage the relevant educational resources of Chengdu Normal University. These educational resources include curriculum resources, papers, books, experiments and learning resources. The educational resource management module is mainly used to uniformly manage these educational resources.

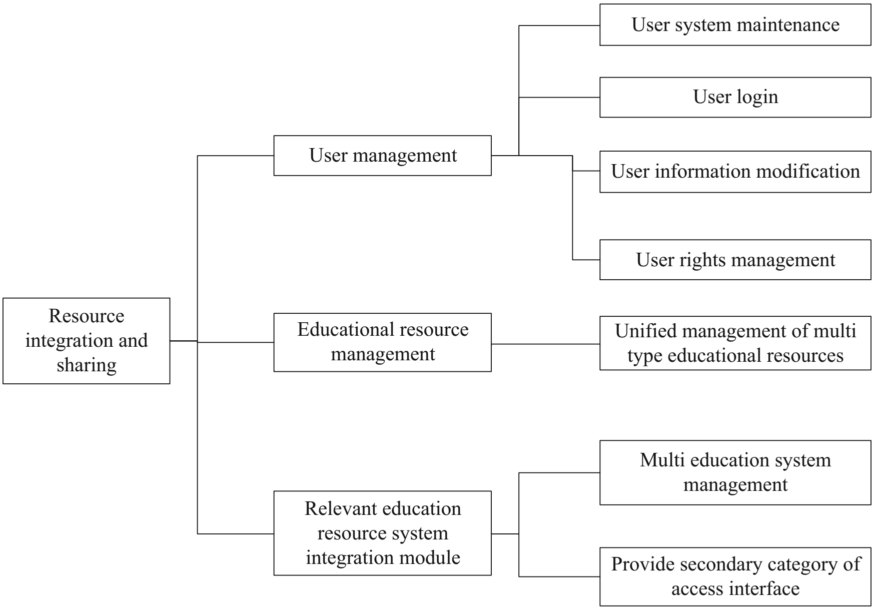


Fig. 5. Software function framework

3) Relevant educational resource system integration module: The relevant educational resource system integration module management domain mainly realizes the integration of existing educational administration systems, curriculum systems, curriculum resource systems and other teaching management systems through SOA and EBS technologies. The relevant educational resource system management domain mainly includes secondary categories that provide access interfaces.

In order to complete the management of educational resources for Teachers College of Education, the educational resource management functions of the Educational Resources Sharing Platform of Teachers College of Education mainly include curriculum resource management, thesis resource management and experimental resource management, etc. As well as experimental resources and other educational resources for management, including:

Course resource management is used to manage course-related resources, including the function of managing course documents, reference materials and other course-related resources. You can add course resources, view course resources, download selected course resources through the system, and at the same time Teacher users or administrators can maintain the information of course resources, delete or modify related course resources.

The paper resource management is mainly used for the comprehensive, unified and open management of the paper resources owned by the school, so as to better realize the value of the paper through the system and serve more teachers and students. The paper resources can be uploaded, viewed and downloaded through the system, and the corresponding paper resources can be maintained [10].

Experimental resources are mainly used to manage and maintain the existing experimental resources of the school, which is convenient to manage the experimental resources of the school through the system. Student users can view the experimental resources through the system, and make an appointment and borrow the experimental resources according to the course arrangement, Teacher users and administrator users can add or maintain experimental resources as needed. Information maintenance mainly includes the modification of experimental resource information, experimental resources that are no longer used off the shelf, et al. (Fig. 6).

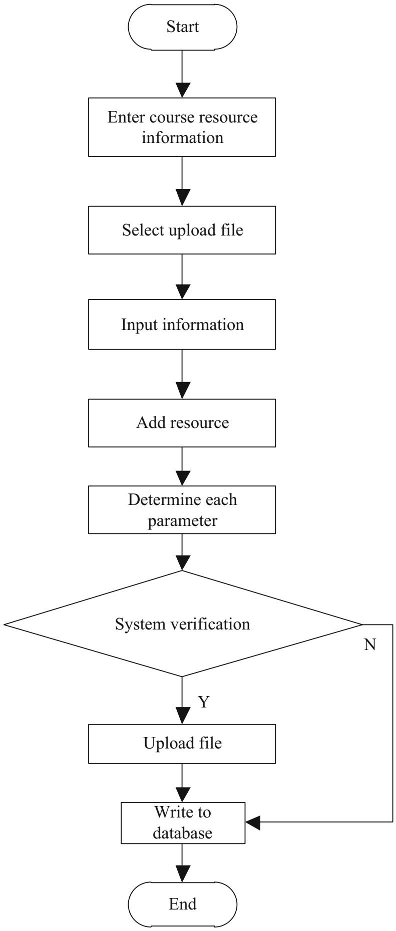


Fig. 6. Software process of intelligent education information resource integration and sharing system based on cloud computing

As shown in the above figure, in the process of adding educational resources, first fill in the relevant information of the newly added educational resources, then select the file of the educational resources to be uploaded, then enter the relevant details, and finally select the operation of adding resources. The system verifies the file format, size, input information and other relevant information. After passing the verification, the system uploads the file Then write to the database, and finally refresh the page to add educational resources.

As the focus of the entire educational resource sharing platform, the relevant educational resource system integration module realizes the reorganization of the existing system, uses the SOA technology to SOA and service reorganization of the existing system, and then rearranges it. The existing educational resources are integrated, so as to truly integrate all the systems related to educational resources in the whole school and truly realize the educational resource sharing platform.

The relevant educational resource system integration module mainly integrates other existing teaching management systems through SOA, web service and EBS and other technologies. For the various educational resource systems that already exist in the school, the SOA technology is used to achieve service arrangement and reorganization, and then re-externalize. Open, so as to realize the use of existing resources, through the combination of existing services, rapid integration to form new business services, faster resource sharing, and lower costs; relevant departments within Chengdu Normal University and colleges or teaching departments can According to their own needs, quickly complete the sharing of educational resources.

The integration of educational resources should quickly and conveniently complete the integration of other existing educational resources and existing systems, so as to realize the large-scale integration of the whole school's educational resource system. In the implementation process, the following technical problems need to be solved:

(1) Processing of existing redundant data

At this stage, the existing independent applications have produced a lot of teaching resource data in the process of system operation. There is great redundancy between these data, resulting in poor data consistency. How to better deal with the existing redundant data Providing highly consistent educational resource data for educational resource sharing platform is the first problem to be dealt with in educational resource integration.

(2) Handling of existing redundant functions

There are many existing educational administration systems and teaching resource systems in the school. There is a large part of functional redundancy between these existing systems. Many systems have similar functions and operate and process similar data. After integration, these similar data will be integrated into one. At this time, these similar functions will operate the same data from different levels, It is difficult to maintain the consistency of system data. How to integrate these redundant functions will also help to shorten the development cycle of the system.

(3) Treatment of reuse of existing systems

Based on the problems in 2), especially because many existing systems in the school are different from ten development platforms, development tools, actual operation environment and system architecture, the reuse of many systems is extremely difficult. How to quickly integrate the existing systems and form the final educational resource sharing platform is a major difficulty of the subject.

4 Experimental Studies

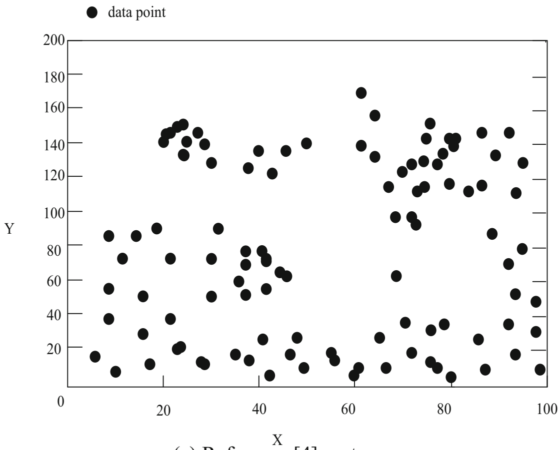
In order to verify whether the system studied in this paper is meaningful, this paper intends to conduct a comparative experiment to verify it. In order to achieve the purpose of the experiment, the control system used in this paper is an automatic selective sharing system of educational resources, and the experimental analysis of this paper is completed together. The experimental parameters are set as shown in Table 1 below:

Table 1. Experimental parameters

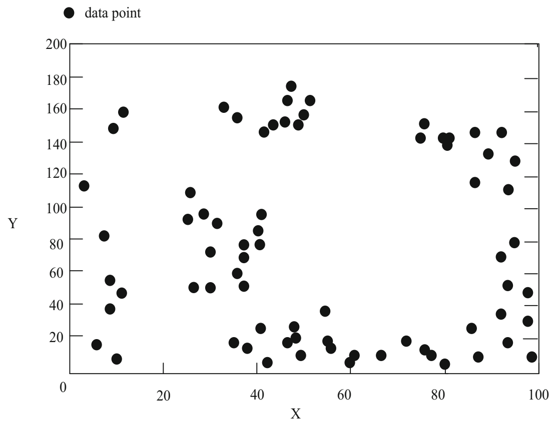
Project	Parameter
Hard disk	120 GB
Operating voltage	100 V
Working current	50 A
Operating system	Windows10
Operation time	10 min

In order to ensure the fairness and scientificity of the experiment, this paper randomly selects 20 young people with learning ability to cooperate to complete the experiment. The 20 young people are randomly divided into two groups to study the same knowledge on different educational resource systems (the learning knowledge will be the knowledge that the learners have never touched), and finally conduct an examination according to the learning content, The average test scores of each group of members are taken as the final test data results. The specific test process is that after the learners are divided into groups, they will study for 3 days, and the learning time on different systems is controlled at 3 h every day, and they will study at the same time period to avoid the interference of other factors. After three days, they will have two exams, finally fit the test results of each youth and make data settlement, The final result of this test is obtained.

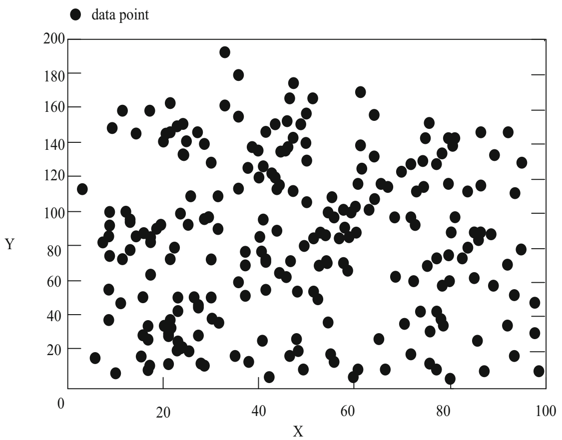
The experimental results of the amount of data stored in the shared system are shown in Fig. 7 below:



(a) Reference [4] system



(b) Reference [5] system



(c) Paper system

Fig. 7. Amount of data stored in the system

From the comparison results of the system storage data shown in Fig. 7, it can be seen that compared with the reference [4] and the reference [5] systems, the storage data of the system in this paper is significantly increased. Therefore, it shows that the designed system can effectively increase the storage data of the system.

The comparison results of shared system security are shown in Fig. 8.

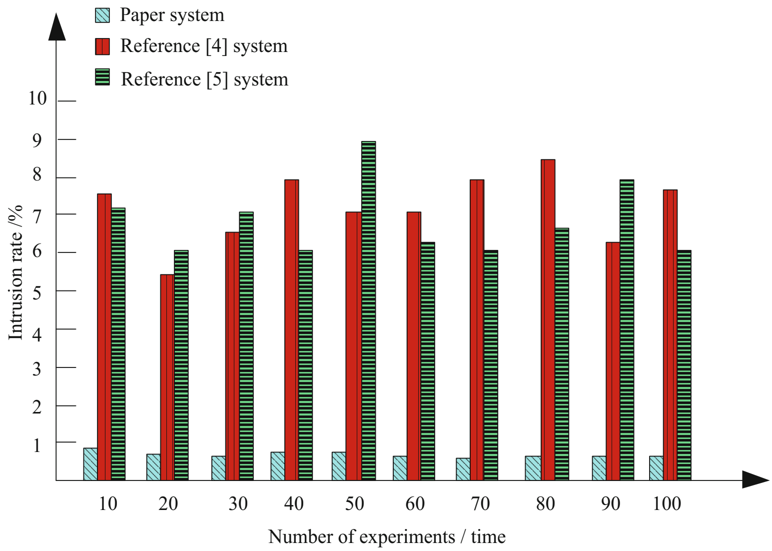


Fig. 8. Comparison results of sharing security

By observing the comparison of shared security shown in Fig. 8, it can be seen that with the increase of the number of experiments, the intrusion rates of the three systems have changed to some extent. Among them, the highest intrusion rate of the system in this paper is no more than 1%, while the highest intrusion rate of the systems in reference [4] and reference [5] is 8%–9%. Therefore, this system can effectively improve the security of resource sharing.

5 Conclusion

This paper researches closely with the business requirements of the college education resource sharing system, adopts software engineering technology, uses the prototype model, and completes the research and development of the entire platform through the steps of requirements analysis, outline design, detailed design, coding testing, and comprehensive testing. The system uses the Eclipse system and is developed based on the lightweight SSI architecture.

This paper takes the design and implementation of the educational resource sharing system of the college as the background, and mainly sorts out the requirements of the educational resource sharing system and the business process of the educational resource integration system, and solves the problem that the existing educational affairs system and the teaching resource management system of the college are not interoperable and resources are not connected. Common problems with sharing and information silos. In recent years, with the development of information technology, the integration and sharing of educational resources has become the focus of work in the development of educational informatization. At the same time, the integration of educational resources is also one of the "bottlenecks" restricting educational informatization in the information age. Due to the heterogeneity and tight coupling of the current development platforms and tools, a large number of educational resource systems cannot be interconnected, which hinders the sharing and integration of educational resources. The educational resource sharing platform emerges as the times require. The purpose of this system is to Better integration of the existing educational resource system to enable the orderly and healthy development of college informatization.

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Collaborative Filtering Recommendation Method for Online Teaching Resources of Elderly Care Specialty

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Abstract. The explosive growth of the number and scale of online education resources makes it difficult for learners of elderly care to obtain the online teaching resources they need in time. However, the traditional resource collaborative filtering recommendation method has the disadvantage of low recommendation accuracy. To solve this problem, this study proposed a recommendation method for collaborative filtering of online teaching resources in elderly care. The organizational form of online teaching resources for elderly care major was deeply analyzed, and then the learning behavior data of learners were collected and analyzed, and the preferences of target learners were calculated. Based on this, the BP neural network is used to construct the target learner preference model, and then the collaborative filtering algorithm is used to predict the score of online teaching resources, so as to realize the recommendation of collaborative filtering of online teaching resources. Experimental data show that compared with traditional methods, the proposed method has higher recommendation accuracy and recall rate, which proves the effectiveness of the proposed method.

Keywords: Nursing for the aged · Online teaching · Teaching resources · Recommend · Collaborative filtering · Recommended accuracy

1 Introduction

In recent years, with the increasingly severe aging situation in China, the state has formulated a series of social policies related to the elderly care, and vocational colleges all over the country have successively opened the elderly care service specialty. However, many problems have been exposed in the actual teaching practice. It is a very urgent task for the students who are about to embark on the nursing post to improve their professional ability [1].

With the popularization of computers and networks, the Internet has gradually entered people's daily work and life, changing the way people obtain information. The popularity of the Internet has made online learning more convenient, and online education has developed rapidly. The platforms for acquiring learning resources have

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increased and the types have become more diverse. In recent years, the development of online education is like fire, and various online education platforms such as NetEase Open Course and China MOOC Academy have also emerged in China [2]. E-Learning is digital learning, which mainly refers to an educational form that takes multimedia resources and information technology as the core and completes teaching and learning across time, space and regions through the Internet. Learners can complete course study, ask questions, upload assignments, download resources, etc. on the E-Learning platform; teachers can complete teaching tasks by uploading learning resources, recording audio and video, and online discussion and answering questions. Since the development of distance education in my country in 1998, it has experienced successive stages of correspondence, multimedia, electronic distance, interactive media, and interactive network teaching modes. In recent years, the progress of science and technology has made the user scale grow rapidly [3].

With the explosive growth in the number and scale of educational resources, ordinary learners may face difficulties in selecting learning resources. The resources obtained through traditional search engines usually have complex results and poor accuracy, which cannot make them satisfied. At the same time, although the current organizational structure of learning resources can meet the requirements of online learning, due to the proposal of personalized learning, learning resources also need to meet the needs of learners for resource structure and dynamics. Especially for the elderly care specialty, there are many online teaching resources and the specialty classification is more complex, which makes it difficult for learners to directly obtain the required online teaching resources and affects the online teaching effect of the elderly care specialty.

Under the above background, relevant scholars designed a series of collaborative filtering and recommendation methods for teaching resources, and applied cloud architecture, deep learning and other technologies. However, it is found in practical application that there is room for improvement in recommendation accuracy and recall rate of the existing methods. Based on the above analysis, this study designed a recommendation method for collaborative filtering of online teaching resources in elderly care. The design idea is as follows:

(a) On the basis of analyzing the organizational form of online teaching resources for elderly care major, the data of learners' learning behaviors are collected and analyzed.
(b) According to the learning behavior data obtained above, the preference of target learners is calculated to fundamentally reduce the recommendation error.
(c) Using BP neural network to construct target learner preference model.
(d) Combined with collaborative filtering algorithm to predict the score of online teaching resources, so as to realize the recommendation of collaborative filtering of online teaching resources.

2 Method Study

2.1 Analysis of the Organizational Form of Online Teaching Resources

The online education based on network is different from the traditional classroom education. Educators not only need to impart knowledge and supervise learning, but also need to provide learners with online teaching resources and environment. Learners need to think independently and explore actively, and have higher requirements for their consciousness and initiative. With the continuous development of online education and the proposal of personalized learning, there are new requirements for the content and form of teaching resources. It is necessary to organize teaching resources according to certain norms and standards to make them have structural characteristics, so as to facilitate learners to query, recommend and share teaching contents in a wide range [4]. Teaching resources refer to all resources that learners can use for learning in the learning environment of teaching system and online education, including teacher guidance, resource information, material content, multimedia equipment and technology. Through the standardized organization and modeling of teaching resources, it can meet the new needs of learners for dynamic and retrievable teaching resources.

The meta information model of teaching resources can better meet the requirements of online education for teaching resources. Its composition is shown in Fig. 1.

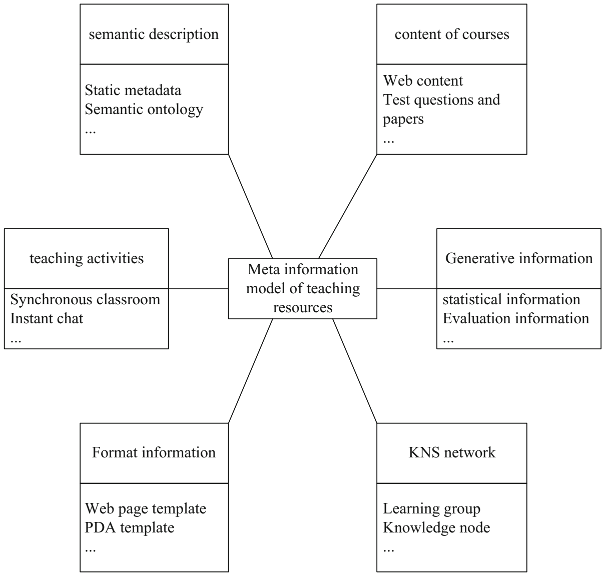

Fig. 1. Schematic diagram of the meta-information model of teaching resources

The contents of each part are as follows:

Teaching content: the core content of the meta information model of teaching resources and the carrier of knowledge content. It can adopt a variety of media formats and types, including web content, teaching audio and video, test papers and question answers. The teaching content integrates the learning materials according to its internal logical structure, which is relatively complete.

Semantic Description: descriptive information of learning meta content, including content theme, key points and other information, which can classify and retrieve learning meta content [5].

Format information: the learning element displays the required adaptation information on different terminals, and the terminal can better present and render the learning content by parsing the format information.

Teaching activities: teaching activities carried out according to the teaching content, including classroom synchronization, after-class discussion, online test, work display, etc.

Generative information: refers to the description records generated during the generation, improvement and use of meta information of teaching resources, such as historical version records, scoring and evaluation, activity records, etc.

KNS network: the association network between learning elements due to the connection of semantics and knowledge points.

Through the above process, the analysis of the organization of online teaching resources is completed, and the meta-information model of teaching resources is constructed, which lays a solid foundation for the implementation of collaborative filtering and recommendation of subsequent online teaching resources.

2.2 Calculating Target Learner Preferences

In order to provide learners with the required and appropriate personalized learning resources more accurately, it is necessary to start from the learners themselves, collect and analyze the learners' learning behavior data by the personalized learning system, and obtain the learning preferences of the target learners Online learning participation and resource score are used to calculate learners' learning preferences. Whether new students or old students, their own knowledge state generally exists. The current knowledge state of learners is obtained through the cognitive diagnosis technology of rule space model. The personalized learning system collects and analyzes learners' learning behavior data, which can effectively solve the problems existing in collaborative filtering recommendation.

Step 1: Learners - visualization of knowledge state

1) Teachers and teaching managers need to sort out the knowledge points in each chapter. There is a sequential, sequential and parallel relationship between these knowledge points, and then generate a knowledge point relationship diagram.
2) Create a knowledge structure diagram. The sequential relationship between knowledge points reflects the order of learning knowledge points, so there are different knowledge points. The knowledge structure diagram can be generated according to the knowledge point relationship diagram. In the knowledge state diagram, "1" represents that the students have mastered the knowledge point, "0" represents that they have not mastered the knowledge point [6]. The dynamic change process of learners' knowledge state also reflects the process from learners' never mastering knowledge points to their already mastering knowledge points.
3) On the basis of the knowledge structure chart, if the knowledge points are linearly sorted according to the comprehensive degree of students' knowledge points, and then coded, the knowledge state of learners can be quickly and effectively identified, and the knowledge state mastery degree of target learners can be obtained. Students at the same level can be regarded as a cluster, in which the knowledge state of learners

is the same, Therefore, similar learning resources can be provided for them, so as to improve the recommendation efficiency of learning resources.

Step 2: Learner-Participation Analysis.

Students' learning engagement refers to the time and energy learners spend in the classroom learning process, which can indirectly reflect the quality of classroom teaching and whether students have truly achieved deep learning. In the learning activities of students, whether it is the communication between students or the interaction between students and teachers, it is the interaction of thinking and the collision of ideas, which can effectively promote the effective communication between students and teachers and between teachers and students.

Online learning behavior data can directly reflect the learning status of students, providing a large amount of reliable data for analyzing learners' learning participation. On the one hand, the system will record data such as the online time, the number of logins, the number of discussions, the test score, the type and number of learning resources viewed, and the rating of the learning resources. Learning activities are mainly based on the number of students' discussions. Discussion means that students express their views and ideas on a certain issue, which can be raised by themselves or by other students. Therefore, the relevant discussion volume includes the following components: the number of main posts initiated, the number of replies to main posts, and the number of replies to other people's posts. The number of initiating main posts indicates that the student has a certain ability to find problems, and is willing to cooperate with peers to discuss the problem; students who reply to the main post can discuss the problem with the issuer. A value worthy of discussion; the number of replies to other people's posts means that the student can give his own views and opinions on other people's views, and can also close the relationship between students.

Step 3: learner resource scoring diagram generation

An important indicator of collaborative filtering for Learning Resource Recommendation is learners' score on learning resources, and the score data is not directly obtained by the scoring mechanism, but indirectly calculated through a series of learners' learning behavior data. Learners' online learning will produce a large amount of behavior data. Whether they like, discuss, download, collect and forward a learning resource can reflect the learners' preference for this learning resource to some extent. Give learners a certain weight to the behavior of learning resources, and get the behavior weight comparison table.

According to the behavior and action relationship of learners on learning resources, the score matrix of learners on the learning resources is further calculated, as shown in Table 1.

As shown in Table 1, the number of learners is *n*, the number of learning resources is *m*, and "*nm*" in the table represents the score of the *n* learner on the *m* learning resource.

The above process completes the analysis and calculation of the target learner's preference, and provides support for the subsequent construction and training of the target learner's preference model.

Table 1. Learner-resource rating relationship table

	R_1	R_2	…	R_{nm}
S_1	r_{11}	r_{12}	…	r_{1m}
S_2	r_{21}	r_{22}	…	r_{2m}
…	…	…	…	…
S_{nm}	r_{n1}	r_{n2}	…	r_{nm}

2.3 Construction and Training of Target Learner Preference Model

According to the above analysis and calculation results of target learners' preference, BP neural network is used to construct and train the target learners' preference model. The specific process is as follows:

BP neural network can make the input value approach the output value through nonlinear mapping, and has good generalization. Therefore, BP neural network is used to establish and train the attribute preference model of target learners. The main work is to train and learn according to the dual attribute scoring matrix, simulate the preference of target learners' attributes for the attributes of online teaching resources, predict the score and fill in the matrix after the preference model is trained to a certain accuracy.

The input layer of neural network is set as the characteristics of target learners and online teaching resources. The hidden layer is the preference of target learners for different characteristics of online teaching resources, and the output layer is the specific score value of online teaching resources [7].

Training steps of BP neural network:

Step 1: Set the initial sample set of the neural network BP_net(i), which is the data in the dual-attribute scoring matrix;
Step 2: Build the neural network BP_net(i), set the input layer data, the number of hidden layers, and the output layer data, and normalize them;
Step 3: Set the convergence error and the maximum number of iteration steps;
Step 4: Start neural network training;
Step 5: Determine whether the convergence error has reached the minimum value: if it has been reached, go to step 7; if it is not reached, go to step 6;
Step 6: Determine whether the number of iteration steps exceeds the set maximum number of steps: if it exceeds, go to step 7; if it does not exceed, go to step 4;
Step 7: The algorithm is terminated, the neural network BP_net(i) is saved, and the predicted score is output. Fill the predicted score into the score matrix, and at the same time, after the new score data is accumulated to a certain amount, the target learner attribute preference model needs to be retrained to ensure the real-time performance of the model.

The above process completes the construction and training of the target learner preference model, and prepares for the implementation of the collaborative filtering recommendation of subsequent online teaching resources.

2.4 Collaborative Filtering Recommendation of Online Teaching Resources

Based on the target learner preference model constructed and trained above, collaborative filtering algorithm is applied to recommend online teaching resources.

Collaborative filtering was proposed by Goldberg et al. Collaborative filtering is the most successful recommendation technology at present. Amazon.com is a classic system that adopts collaborative filtering recommendation. The idea of the collaborative filtering method is: since the automatic analysis of the content by the machine is incomplete and inaccurate, the messy and low-quality information can be filtered out according to the evaluation of the target learners themselves. Collaborative filtering recommendation algorithm can be said to use group intelligence to discover potential interests of users without analyzing product content and attributes. It has good field applicability and has received extensive attention from researchers. Wide range of applications. However, with the rapid development of the Internet and the explosion in the number of users and products, collaborative filtering recommendation technology also faces some problems to be solved, mainly including data sparsity, cold start, scalability, accuracy and diversity, dynamic and other issues [8]. It is necessary to appropriately improve the collaborative filtering algorithm in combination with the characteristics of online teaching resources of the nursing profession, so as to meet the needs of learners of nursing.

Most collaborative filtering recommendation algorithms are based on target learners' online teaching resource scoring matrix Q. Q is a matrix of order $m \times n$, where the rows represent target learners, the columns represent online teaching resources, and the value q_{ui} in the matrix is the target learner u is rating on the online teaching resource i.

The traditional collaborative filtering is called collaborative recommendation based on target learners. Its basic idea is that the score of target learners on target online teaching resources can be predicted by the score of similar target learners on target online teaching resources. Collaborative filtering based on target learners first measures the similarity between target learners. Those with high similarity are regarded as the nearest neighbors of target learners, and then predict the score of target learners on target online teaching resources according to the score of nearest neighbors on target online teaching resources.

At present, the traditional methods to measure the similarity between target learners mainly include cosine similarity and Pearson correlation coefficient method. According to the teaching needs of elderly care specialty, Pearson correlation coefficient method is selected, and its calculation formula is

$$Sim(u, v) = \frac{\sum \left(q_{ui} - \overline{q}_u\right)\left(q_{vi} - \overline{q}_v\right)}{\sqrt{\sum \left(q_{ui} - \overline{q}_u\right)^2}\sqrt{\sum \left(q_{vi} - \overline{q}_v\right)^2}} \tag{1}$$

In formula (1), $Sim(u, v)$ represents the similarity measure value between target learners u and v; $\overline{q}_u$ and $\overline{q}_v$ represent the average score value of target learners u and v, respectively.

The prediction formula of target learners' score on online teaching resources is

$$P_{ui} = \overline{q}_u + \frac{\sum Sim(u, v) \times \left(q_{vi} - \overline{q}_v\right)}{\sum Sim(u, v)} \tag{2}$$

There are two major problems in collaborative filtering based on target learners: data sparsity and scalability. The sparse data of the scoring matrix will make it difficult to find similar target learners and affect the prediction effect; The scalability problem refers to the sharp increase in the amount of computation due to the increase in the number of target learners and online teaching resources, which seriously affects the real-time performance of recommendation. Collaborative filtering based on online teaching resources can effectively solve these problems.

In most personalized recommendation systems, compared with the update of target learners, the update of online teaching resources information is slow, and the relationship between online teaching resources is relatively stable. Therefore, the similarity between online teaching resources can be calculated offline, and then the score can be predicted according to the similarity [9]. Sparse scoring matrix data has a much smaller impact on computing the similarity between online teaching resources than computing the similarity between target learners. In addition, the scoring prediction process is only a search process for similar online teaching resources, and the online calculation speed is fast.

Consistent with the above process, the similarity and rating prediction between online teaching resources are calculated, denoted as $Sim(i,j)$ and P_{ij}, respectively. It should be noted that the differences between online teaching resources need to be taken into account in the calculation of score prediction. The difference of online teaching resources is expressed as

$$dev_{ij} = \sum \frac{\left(q_{ui} - q_{uj}\right)}{|U(i) \cap U(j)|} \tag{3}$$

In formula (3), dev_{ij} represents the difference parameter of online teaching resources; q_{ui} and q_{uj} respectively represent the corresponding scores of online teaching resources i and j; $U(i)$ and $U(j)$ respectively represent the total score of online teaching resources i and j. result.

Then the calculation formula of online teaching resource score prediction P_{ij} is:

$$P_{ij} = \overline{q}_u + \frac{\sum dev_{ij}}{|Q_u|} \tag{4}$$

In formula (4), Q_u represents the online teaching resource scoring matrix corresponding to the target learner.

According to the calculation results of formula (4), the online teaching resources are sorted in descending order and recommended to the target learners of elderly care specialty from top to bottom [5].

Through the above process, the collaborative filtering recommendation of online teaching resources of elderly care nursing specialty is realized, which provides powerful help for the development and application of online education of elderly care nursing specialty.

3 Experiment and Result Analysis

In order to verify the application performance of the above-designed collaborative filtering recommendation method for online teaching resources for elderly nursing majors, the following comparative experiments are designed.

3.1 Experiment Preparation Stage

The collaborative filtering recommendation experiment of online teaching resources of elderly care specialty is completed on a PC. The hardware configuration and the software environment involved in the experiment are shown in Table 2.

Table 2. Experimental PC configuration table

Classification	Parameter name	Configuration description
Hardware	RAM	6 GB
	CPU	Intel(R) Xeon(R) E5507
	Hard disk	500 G
Software	Java	Eclipse
	Python	Python3.3
	Operating system	Win10

In the field of resource recommendation, there are many open datasets for researchers to study. Based on the open datasets, the improvement of recommendation algorithms is more comparable. Compared with datasets in fields such as e-commerce and video, in the field of online education, there are few open datasets due to the diversity of learning systems. Therefore, the research captures the user data of the TED website and the Ted Talks data, and opens it up to researchers to recommend resources for research in the field of online education. Due to space limitations, it will not be described in detail.

3.2 Analysis of Experimental Results

Based on the above experimental preparation, the recommended accuracy and recall are selected as the evaluation indexes, and the calculation formula is

$$\begin{cases} \Pr ecision(N) = \frac{\sum |R(u) \cap T(u)|}{\sum |R(u)|} \\ \text{Re}call(N) = \frac{\sum |R(u) \cap T(u)|}{\sum |T(u)|} \end{cases} \tag{5}$$

In formula (5), $\Pr ecision(N)$ and $\text{Re}call(N)$ represent the recommendation accuracy and recall rate, respectively; $R(u)$ represents the set of recommendation results; $T(u)$ represents the set of online teaching resources required by learners.

In order to avoid too single experimental results, the traditional cloud architecture based collaborative filtering recommendation method for online teaching resources (Existing method 1) and deep learn-based collaborative filtering recommendation method for online teaching resources (Existing method 2) are compared to complete performance verification together with the method in this paper.

The recommended accuracy data of different methods are shown in Fig. 2.

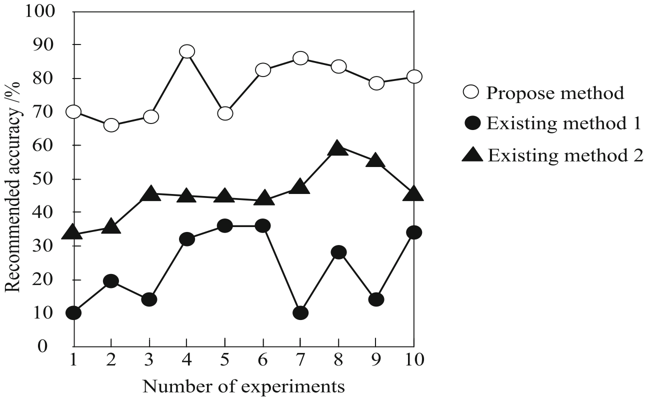

Fig. 2. Recommended accuracy data graph

As shown in Fig. 2, compared with the two existing methods, the recommended accuracy value of the proposed method is higher, and the maximum accuracy value can reach 88%. It can be seen from Fig. 2 that the recommendation accuracy curve of the proposed method is always above the two existing methods, highlighting the reliability of the proposed method.

The recommended recall rate data obtained through the experiment is shown in Fig. 3.

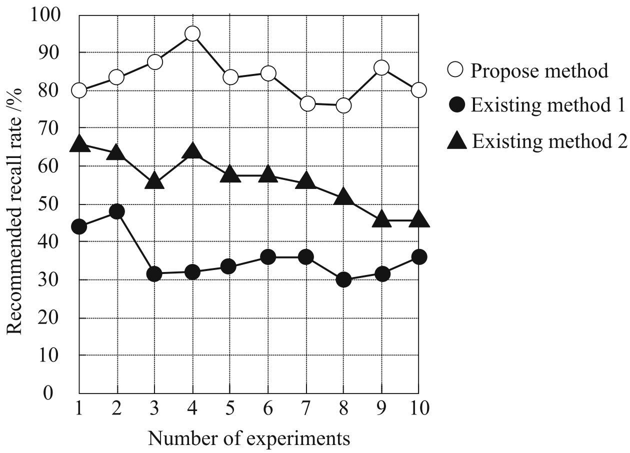

Fig. 3. Recommended recall data graph

As shown in Fig. 3, compared with the two existing methods, the recommended recall rate of the proposed method is larger, with the maximum value reaching 95%.

Under normal circumstances, the higher the recommendation accuracy and recall rate, the better the recommendation effect. The above experimental results show that the recommended accuracy and recall rate obtained by using the proposed method are larger, which fully confirms the effectiveness and feasibility of the proposed method.

4 Conclusion

According to old-age nursing discipline characteristic, this study puts forward the online teaching resources, collaborative filtering recommendation method based on the analysis of learners' learning behavior data calculate target learners' preferences, and then use BP neural network to build the target learners preference model, combining collaborative filtering algorithm to predict the score of online teaching resources, so as to realize resource collaborative filtering recommendation. This method greatly improves the recommendation accuracy rate and recall rate, provides more effective method support for collaborative filtering recommendation of online teaching resources, and also provides certain reference for related research on resource recommendation.

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Personalized Recommendation System of Ideological and Political Online Teaching Resources Based on Artificial Intelligence

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Abstract. In view of the poor effect of teaching information recommendation, a new personalized recommendation system of Ideological and political online education resources is studied under the support of artificial intelligence technology. The system hardware includes content recommendation module, project collaborative filtering recommendation module and user collaborative filtering recommendation module. In the system software part, the user's interest is calculated and the recommendation result is generated based on the browsing and visiting record data of the system user. The system performance test results show that the recommended performance of the designed system is significantly improved and can fully meet the use requirements.

Keywords: Artificial intelligence · Ideological and political · Teaching resources · Information recommendation

1 Introduction

In the modern society with the rapid development of information technology, the network has become the main platform for information exchange. All industries are improving their information level through the network to achieve access and sharing of information. However, while the network brings a lot of information, it also brings the problem of excessive growth of information, making it difficult for users to find the information they need from the huge network information, and it is also difficult for users to identify the information they need [1]. So artificial intelligence and recommendation engine appeared. The former helps users search for the information they need, and the latter can recommend resources to users according to their tastes and preferences. However, in most cases, it is difficult for users to express their needs, so it is necessary to have a recommendation system that can well understand the user's needs [2].

Reference [3] proposes an Online Teaching Resource Recommendation System Based on subject words. By using C/S architecture to build the recommendation system, the user's history records are obtained, and then the user's main subject words are extracted, matched with the current query keywords, and the recommendation results

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are generated. Reference [4] proposes a personalized teaching resource recommendation system. According to the different learning needs of different students, based on the personalized theory, the overall architecture of the system is designed, and the storage database and recommendation process of the system are optimized. Finally, suitable teaching resources are recommended to the system users. However, from the feedback of users, some users think that the recommendation results of the system are not very necessary.

In order to recommend teaching resources to learners, a personalized recommendation system for teaching resources is designed based on artificial intelligence technology to improve the recommendation performance of the system.

2 Personalized Recommendation System for Ideological and Political Online Teaching Resources

Aiming at comprehensively improving the recommendation performance of the system, the system is designed from both hardware and software. Based on the hardware architecture, the hardware part is designed with content recommendation module, project collaborative filtering module and user collaborative recommendation module; The software part calculates the user's interest in resources by processing the user's browsing data and preference data, so as to improve the reliability of resource recommendation.

2.1 The Hardware Structure Configuration of the Recommended System for Teaching Resources

According to the functional requirements proposed in the system requirements analysis, the search recommendation system adopts the BS structure based on the browser to design the hardware architecture of the recommendation system. Through the basic services provided by multiple modules, the recommendation function of the system is realized. The hardware architecture of the system is shown in Fig. 1.

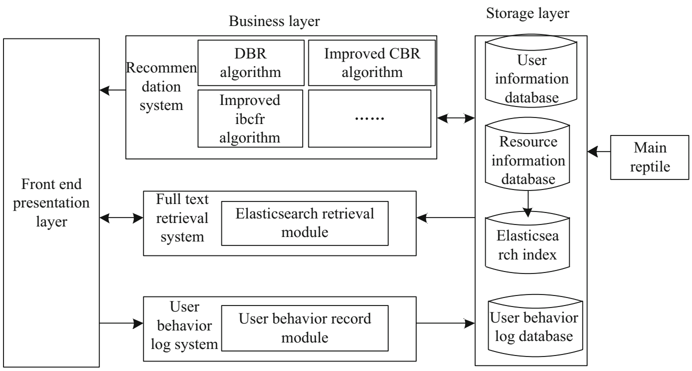

Fig. 1. System hardware device structure diagram

The system requires two main database servers in total, one for main and one for standby, and the two machine hot standby system. Under normal circumstances, the main database server is activated, which mainly provides data writing services for the system. The main database standby server is connected with the main database server and regularly tested [5]. Build the application framework of teaching resource system, as follows (Fig. 2):

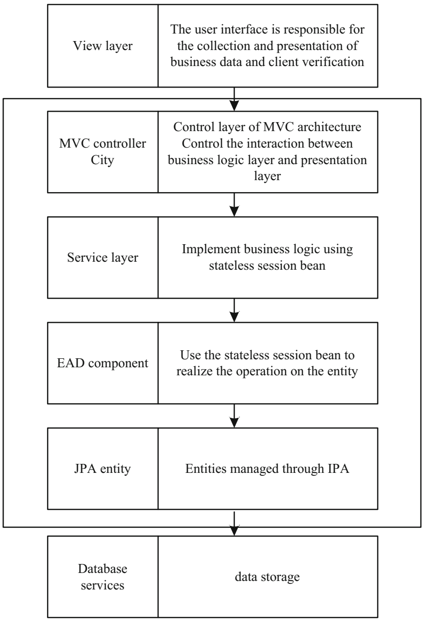

Fig. 2. Application framework of teaching resource system

When the server host is working, the host backup system is in standby state; After the host backup server finds that the host fails, the standby host will automatically enter the startup mode to provide the data writing function for the service shutdown to ensure the reliability of the system operation [6]. Since the reading of data is far more than the modification and writing of data, two or more read-only database servers are required. The read-only servers provide read-only services for the system. The data for artificial intelligence indexing and recommended data calculation come from the read-only servers [7].

2.2 Optimization of the Software Function of the Personalized Recommendation System for Teaching Resources

The main modules in the system are integrated to form the structural block diagram of the recommendation system, as shown in Fig. 3.

The similarity calculation is used to judge the similarity of learners or resources. Taking the resource item similarity calculation as an example, select the learners who

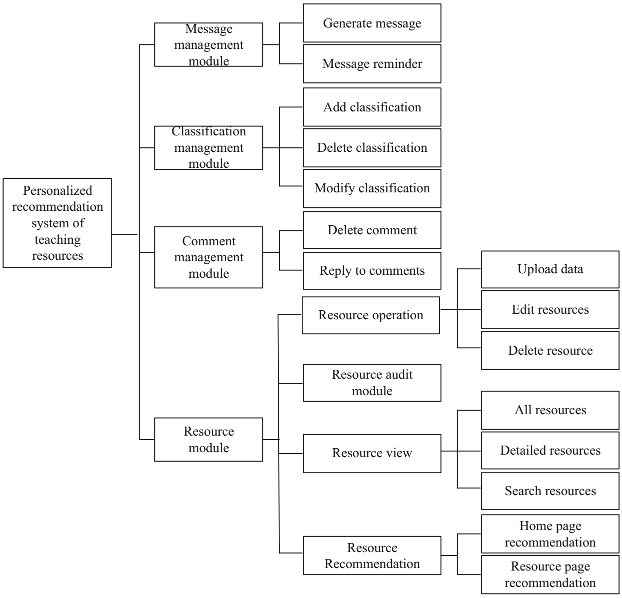

Fig. 3. System software function structure

have scored the resource items i and j, calculate the score vector $A_{u,i}$ of the learners, and obtain the calculation result of the similarity $\overline{A}_i$. From the above analysis, it can be seen that the basic condition for calculating the similarity is to select the rated learners. Remember that user set U is the user set that both commented on item i and item j, then the corresponding Pearson correlation coefficient calculation formula is:

$$L = \frac{j\sum_{ueU}\left(A_{u,i} + \overline{A}_i\right)}{t\sqrt{\sum_{uel}\left(A_{u,i} - \overline{A}_i\right)^2 - U}} - R_t \tag{1}$$

Among them, R_t is the user's rating of item t, if s indicates the rating of item $\vec{j}$ by user set $\vec{i}$.

The similarity calculation formula between project resources (x, y) can be expressed as:

$$\mathrm{sim}(x, y) = Ls\cos(\vec{i}, \vec{j}) - k\frac{\vec{i} \cdot \vec{j}}{m \cdot n|} \tag{2}$$

Among them, "·" represents the vector inner product, $m \cdot n$ represents the size of the scoring matrix. This is a commonly used formula for artificial intelligence to evaluate the similarity between vectors. User-based collaborative filtering recommendation is based on the user's item preference matrix to find neighbors that are similar to the current preferences. In general applications, the algorithm for calculating K neighbors is used.. Then, based on the preferences of these K neighbors as the current user's likes to recommend [8]. The input of this recommendation model is the user's preference matrix, the output is the degree of recommendation of the teaching resources to the user, and its output is used as the input of the neural network. The calculation method is to assume that there is a user preference matrix PM:

$$\begin{cases} PM = k[w_1, w_2, w_3, \ldots, w_n]^T \\ p_i = k\left[w_{i,1}, w_{i,2}, w_{i,3}, \ldots, w_{i,m}\right] \end{cases} \tag{3}$$

Among them, w_n represents user n is preference vector, and $w_{i,m}$ represents user i is preference for resource m. Using a similarity calculation method NS_i, the preference similarity $ns_{i,nk}$ between any two user data can be obtained. For user i, the preference similarity with all other users can be obtained, and the top k users with the highest similarity are taken as their neighbor users. The similarity calculation formula between the user i and its adjacent users can be written as:

$$NS_i = ns_{i,nk} - PM \sum p_i + \mathrm{sim}(x, y) \tag{4}$$

According to $ns_{i,nt}$ and $p_{nt,j}$, the recommendation degree of resource j to user i can be estimated as:

$$r_{i,j} = \frac{\sum_{t=1}^{k} ns_{i,nt} \cdot p_{nt,j}}{\sum_{t=1}^{k} sim(x, y) - 1} - u_{ij}E_{ij} \tag{5}$$

The construction process of user collaborative filtering recommendation matrix is as follows:

(1) Users can browse, download, and score resources;
(2) If the user has a download operation in the step, update the user's user download preference matrix u_{ij}, which stores the user's downloading of resources.

Among them, E_{ij} represents the download preference vector of user i, and the value is [0, 1]. The definition of the user download similarity calculation function is.

$$\delta = NS_i - \frac{\left|p_i \cap p_j\right|}{\left|p_i \cup p_j\right|} - r_{i,j} \tag{6}$$

where $\left|p_i \cap p_j\right|$ represents the size of the intersection of user i and user j is download resources, and $\left|p_i \cup p_j\right|$ represents the size of the union of user i and user's download resources. After the above calculation is completed, the system functional module diagram as shown in Fig. 4 is constructed. It can be seen that the functional module mainly includes two subsystems: search and recommendation. The search subsystem includes a keyword search module and a filter condition search module; and the recommendation subsystem is divided into similar resources Module, look and look module and resource recommendation module.

The keyword search module is mainly a function provided on the homepage and content browsing page for users with clear needs to quickly search for resources [9]. The user enters a search keyword in the search box, selects the type of resource to be

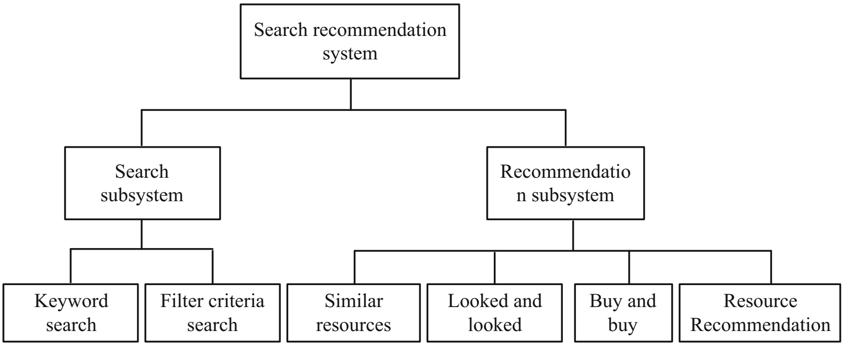

Fig. 4. Searching and recommending system functional modules

Table 1. Structural definition of keyword search interface

Type	Name	Alias
Parameters:	userId:String	User name
	keyword:String	Search keywords
	resType:String	Resource type
	currentPatge:ONT	Current page number
	Size:ONT	Number of displays per page
Return	ArrayLlist	Search result

searched, and then clicks the search button. The Elastic search server will return a list of matching resources according to the user's request. The structure of the keyword search interface is defined in the following table (Table 1):

When users score teaching resources, they will call the system to train the home page recommendation model [10], so that the home page recommendation results are closer to the user's preferences and the recommendation results are more accurate, so as to realize personalized recommendation, which is very helpful to improve the user's experience and find the teaching resources that users potentially like.

2.3 Personalized Recommendation of Resources

The principle of this design recommendation system is a recommendation algorithm for users to recommend items similar to the items they liked in the past. This algorithm uses the attribute characteristics and content data of the item to predict the correlation between it and user information, which is the development and continuation of information filtering technology. Each user is independent; It has good interpretability, no popularity preference, and new items can be recommended immediately. The disadvantage is that the cold start problem cannot be solved and the potential interests of users cannot be mined. The flow chart of the content-based recommendation algorithm is shown in the figure (Fig. 5).

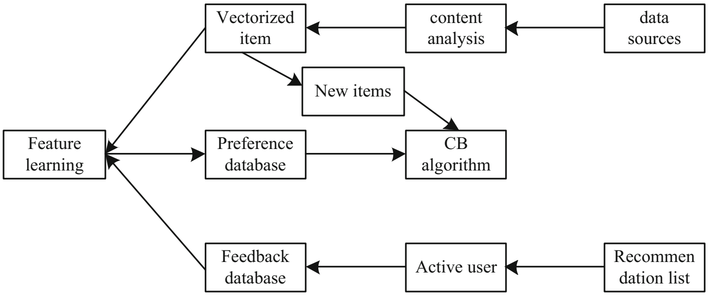

Fig. 5. Flow chart of content-based recommendation algorithm

The recommendation engine obtains the user model and resource model through offline calculation of historical data, user information and resource information, and then ranks the resources according to the resource attributes and user interests in combination with the online data. Based on this, a recommendation model is built, as follows (Fig. 6):

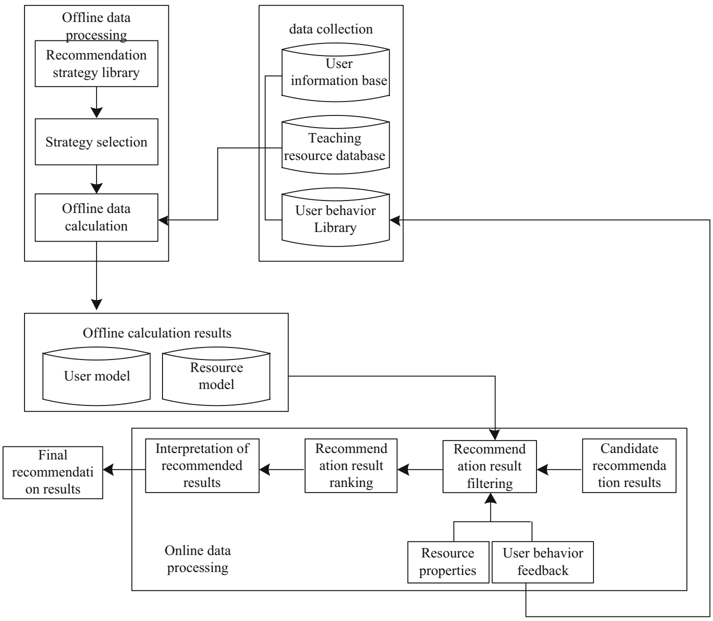

Fig. 6. Personalized recommendation system model

The user personalized recommendation module not only realizes the user personalized recommendation function, but also solves the cold start problem of new users. In this module, an artificial neural network based on global user operation habits is maintained. When a new user registers, the artificial neural network is copied to the new user's neural network recommendation module to make recommendations to the user. In the collaborative filtering algorithm based on artificial intelligence, the model is trained by using historical data, and the average scores of the rows and columns of the scoring matrix are weighted. At the same time, the corresponding α and β. The calculation formula of average weighted score is:

$$s_u = \bar{s}_u + \sqrt{Q\sum_{k=1}^{k}(\alpha p_i - \beta\delta_i)^2/Ka - NS_i} \tag{7}$$

In the formula: K is the total number of user ratings for item i, and a is the rating value of user k for unrated item i. The user's average weighted score Q is the sum of the user's average score and the average deviation of the user's scores relative to the average score of unrated items. Before the design of the recommendation system is launched, the system has already trained the homepage recommendation neural network and resource page recommendation neural network based on global user preference habits. As the first global neural network, this neural network can be calculated directly based on the input feature values. Recommendation results, so that after new users register, they can recommend resources to users without acquiring additional preferences, which solves the cold start problem of new users. When a new user performs an operation, this module will train its neural network according to the user's operation, so as to achieve personalized recommendation. This method can be called a two-step training method: by copying the global recommendation model as the new user's recommendation model, and then revising the recommendation model according to the new user's subsequent operations, so that the recommendation model is closer to the user's preference. The steps for selecting the recommended model preference are shown in the figure (Fig. 7):

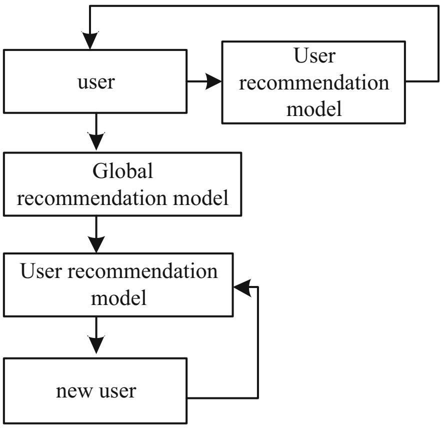

Fig. 7. Recommended model preference selection steps

A recommendation model based on artificial intelligence is maintained in the system. Therefore, when users score a resource, it will trigger the training of neural network twice. The first is the training of the user's recommendation model based on neural network recommendation module, and the second is the training of the global recommendation model based on artificial intelligence recommendation module. The course recommendation function module is divided into two sections. The first section is non personalized popular course recommendation. Popular recommendation is to select courses with high click through of the whole network to recommend to users according to the click through of users of the whole system; The second part is personalized recommendation. By analyzing the setting of user labels and historical browsing records, users are recommended courses that users may be interested in, and humanized design is added. In order to better clean the function of expressing course recommendation, the following table is used to explain the use case specification of course recommendation module (Table 2):

Table 2. Use case specification table for recommended modules of ideological and political courses under artificial intelligence

Description item	Details
Case name	Course recommendation
Role	Student
Preconditions	Students are not logged in to learn
Basic event flow	Students log in to the system and enter the home page; Show popular course recommendations at the top of the home page; Display the courses that the user is interested in in in the course selection position on the home page; Students take courses that are of interest after browsing the course and go to study
Abnormal event flow	Abnormal operation, no response

3 Analysis of Experimental Results

In order to verify the recommendation effect of the designed personalized recommendation system of Ideological and political online teaching resources based on artificial intelligence. The data of this experiment comes from the online learning platform, and 5GB data is selected as the sample data of this experiment.

In order to study the system performance, the existing resources are matched with the predicted resources according to the key attribute factors and other important characteristics of the resources, and similar resources are recommended to users according to the degree of resource matching. The performance comparison of common recommended methods is shown in Table 3.

According to user ratings, the experiment selected 5,362 users with more ratings and about 900,000 ratings data for 4625 resources by these users. The processed data includes user ID, resource ID, comprehensive rating, and rating time. Among them, the comprehensive score is calculated based on the user's scoring of resources and their implicit scoring behaviors such as purchasing, collecting, browsing, etc. The score range is 1–5. The main functional modules of users are user registration, login and personal center. User test cases and expected results are as follows (Table 4):

Table 3. Performance of personalized recommendation methods

Personalized recommendation algorithm	Advantage	Characteristic
Content based recommendation algorithm	Simple and effective	Attribute features are too detailed, limited to text features, and the recommended resources are relatively single
Collaborative filtering recommendation algorithm	It is suitable for filtering abstract concepts, and the recommended resources are relatively novel	Data coefficient, complex cold start problem
Paper method	It is applicable to data objects in various formats. The recommended resources are both targeted and relatively novel	–

Table 4. User test cases and expected results

Test module	Test case	Expected results	Does it meet expectations
User registration module	Duplicate user name; The password is less than 8 digits; The user name and password comply with the specification;	Prompt duplicate user name; The prompt password shall be at least 8 digits; Registration successful, enter the home page	Accord with
Login module	Unregistered user; Account or password error; Re input	Prompt user to register; Prompt password error; Log in to the home page	Accord with
User personal center module	View my courses; View my course order; View personal information; Change Password	Teachers and users enter the course interface published by themselves; View your own reserved courses; Enter the personal information interface	Accord with

The main functional modules related to the course are course release, course recommendation, course reservation, course Q & A and course scoring. The relevant test cases and expected results of the course are shown in the table below (Table 5):

The performance test results of different recommended methods are shown in Table 6.

Table 5. Course related test cases and expected results

Test module	Test case	Expected results	Does it meet expectations
Course release module	Enter course related information	Published successfully	Accord with
Course recommendation module	Not logged in; Logged in	Only popular recommendations; Personalized + popular recommendation	Accord with
Course reservation module	Not logged in; Logged in	Jump to the login page; Successful reservation, enter learning	Accord with
Course Q & A	The user has booked the course	Students ask questions or grade the course	Accord with

Table 6. Comparison of accuracy rate, recall rate and F1 value of different recommendation algorithms

	User-CG	Item-CF	CB	Paper method
Precision	0.652	0.765	0.725	0.908
Recall	0.523	0.621	0.615	0.825
F1	0.521	0.725	0.620	0.865

This article The optimal study of the method shows that the method in this paper optimizes the problems of cold start and long tail, and improves the accuracy rate, recall

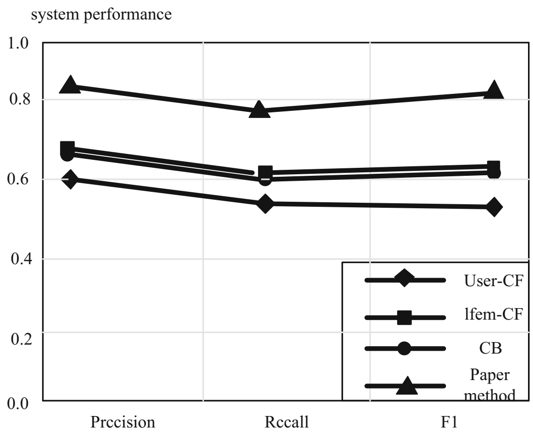

Fig. 8. System performance effect comparison test results

rate and F1 value. Therefore, the recommendation effect is better than the other three algorithms. The specific performance test results are as follows (Fig. 8):

The change of response time is shown in the figure (Fig. 9).

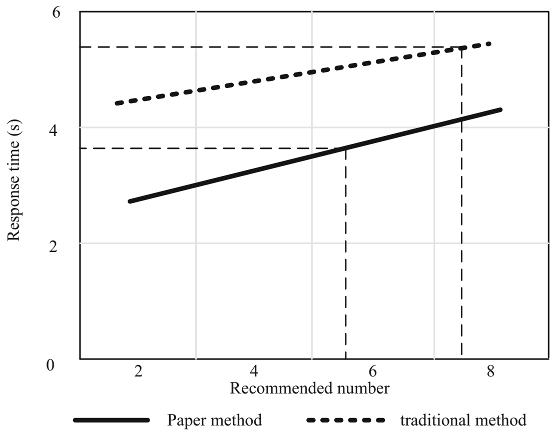

Fig. 9. System operation response time

The response time of calculating the nearest neighbor set in the target class is better than the response time of the calculation without clustering process. In the collaborative filtering recommendation algorithm, the number of recommendations will also affect the accuracy of the recommendation effect. In actual applications, the recommended number generally does not exceed 20. Figure 10 shows the curve change of the recommendation accuracy rate as the number of recommendations increases with and without clustering:

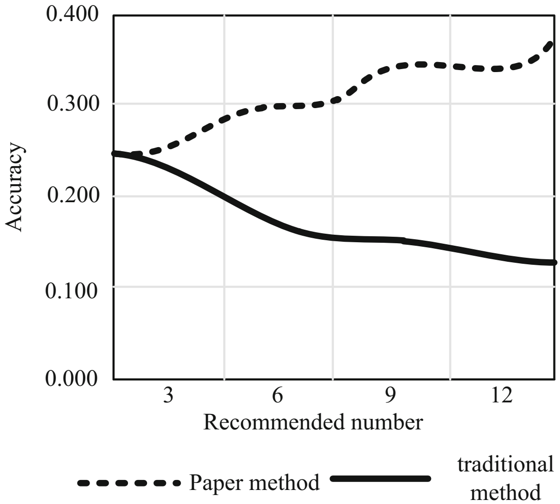

Fig. 10. System operation accuracy comparison test results

It can be seen from the figure that the recommendation accuracy based on artificial intelligence has obvious advantages, and the accuracy is also significantly better than the traditional method. It rises slowly with the increase of the number of recommendations. Therefore, the accuracy of the designed system is higher.

4 Conclusion

With the rapid growth of the number of e-learning resources, personalized recommendation system becomes more and more important in the process of directional recommendation of students' theoretical learning resources, experimental resources and case resources. Because learners are the core of the recommendation system, the more in-depth understanding and comprehensive consideration of learners' information, the higher the accuracy of Personalized Learning Resource Recommendation and the higher the degree of help to learners.

Fund Project. 1. Jilin Provincial Higher Education Association: Research on the Negative Effect and Governance of the "Internet Celebrity" Phenomenon on the Values of College Students from the Perspective of Convergent Media (Project No.: JGJX2020D472).

2. Jilin Provincial Higher Education Association: Research on the Construction Path of Ideological and Political Teachers in Colleges and Universities in Jilin Province during the "14th Five-Year Plan" (Project number: JGJX2020D494).

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Balanced Allocation of Ideological and Political Network Teaching Resources in Universities Based on Big Data Clustering

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Abstract. The balanced allocation of resources in network teaching can effectively improve the utilization of educational resources. Aiming at the poor effect of balanced allocation of ideological and political education resources in colleges and universities, this paper proposes a method based on big data clustering. This research has constructed the university thought politics network teaching resources database, realizes the teaching information collection and the classified storage. The large data clustering algorithm is applied to teaching resource allocation management. It optimizes the management model of ideological and political network teaching resources. Finally, the experimental results show that this method has high practicability and high efficiency in information allocation. This method can optimize the allocation structure under the condition that the total input of resource construction is relatively constant.

Keywords: Big data clustering · Ideological and political teaching · Resource allocation

1 Introduction

With the rapid development of science and technology, the educational mode of colleges and universities is also changing. The era of big data education promotes the updating of teaching concepts and the reform of teaching methods. This paper first summarizes the ideological and political education resources in the era of big data, and explains the current situation and problems of the allocation of ideological and political education resources in colleges and universities. On this basis, countermeasures are proposed for the optimal allocation of ideological and political education resources in colleges and universities, in order to give full play to the great efficiency of teaching resource allocation in the era of big data and effectively improve the effectiveness of ideological and political courses in colleges and universities [1]. Comprehensiveness of resource allocation is the primary characteristic of resource allocation of ideological and political education under the background of big data. Network education platform provides a wide range of data resources, the allocation of educational resources is difficult. In related studies, Sun proposed a system resource allocation method based on power iteration [2]. Taking the

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throughput of unloading process as the objective function, the optimal allocation of normal power is achieved by iterative optimization. At the same time, a heterogeneous network based on edge server is proposed to solve the problem of low energy efficiency and low resource utilization of edge server. Its resource utilization efficiency needs to be further improved. Wan et al. have developed a new formal model to characterize the dynamic process of knowledge diffusion in autonomous learning in multi-networks [3]. In order to guide learner autonomy, hybrid online learning can effectively expand the range of knowledge. It introduces learners' individual needs and educators' guidance, and further proposes an effective allocation algorithm of educational resources. But its resources construction investment funds to be further reduced.

In order to solve the problem of resource allocation, this paper puts forward a method of balanced allocation of ideological and political network teaching resources based on big data clustering. Big data technology integrates teaching subject and object with information technology, and data resources are shared and fed back among different universities in different areas. The change of ideological and political education information can be captured and analyzed to provide the basis and direction for the development and application of potential education resources.

2 Balanced Allocation of Ideological and Political Network Teaching Resources in Universities

Firstly, we construct the ecosystem structure model of data clustering resource allocation and the sharing model of data clustering resource. On this basis, the cost of single resource allocation and resource allocation efficiency are calculated. It also constructs the theoretical model of teaching information planning behavior and the use process of resource users, and allocates the teaching resources.

2.1 Construction of Ideological and Political Network Teaching Data Management Platform in Universities

Contemporary college ideological and political education resource view, marxist ideological and theoretical education resource view as the theoretical source, under the influence of the development of education system reform, the university ideological and political education resource view led by Marxist ideological and theoretical education, with Chinese characteristics. The formation of this idea has laid a solid foundation for the concept of resource allocation of ideological and political education in colleges and universities. The data clustering resource allocation ecosystem is a subsystem of education system, and its essence is the circulation and value increment of data clustering resource. In order to realize the sharing and application of data clustering resources, different configuration subjects interact and develop synergistically under the support of configuration ecological environment, thus forming an organism for the development, sharing, application, evolution and service of data clustering resources [4]. The ecological chain of data clustering resource allocation refers to the chain-dependent relationship among resource producers, transmitters, decomsolvers and consumers due to digital resource circulation in the information environment. The ecological chain of data clustering resources is the relationship of collaborative competition, mutualism, value appreciation and dynamic balance between different data in the process of resource transfer [5]. From the perspective of the subjects involved in resource allocation and their mutual relations, the data clustering resource allocation ecosystem structure model is shown in Fig. 1.

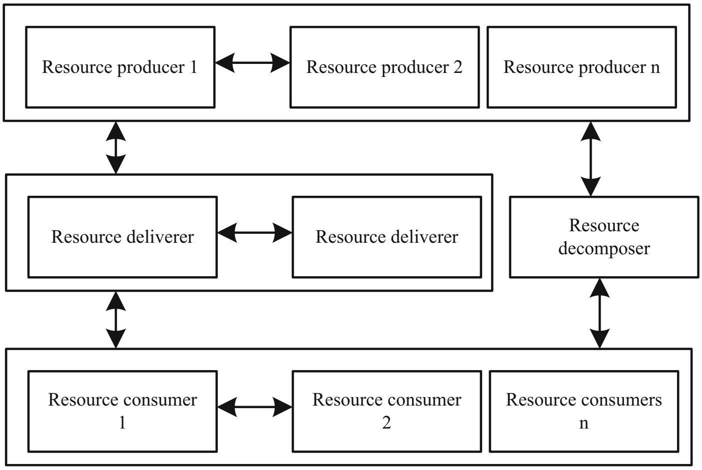

Fig. 1. Data clustering resource allocation ecosystem structure model

The cultivation mode of ideological and political talents in colleges and universities is in line with the concept of international talent cultivation. Students have a solid foundation, a wide range of professional backgrounds, and can adapt to employment in multiple fields. In particular, they have more advantages in further study, but there is still a certain gap with the recent requirements of domestic enterprises and units for talents [6]. The data management mode of ideological and political network teaching in colleges and universities can better adapt to the needs of the industry for security and technical personnel, but the employment field is limited. Combining the big data cultivation mode with the security cultivation mode, the sharing model based on data clustering resources is formed as shown in Fig. 2.

The value-added methods of data clustering resource allocation node mainly include accumulation of resources, enhancement of capacity, updating of technology, innovation of resources, improvement of quality, promotion of use and reduction of cost. The ecological construction of data clustering resources is not completed in a single development, but a continuous process of spiraling and cyclic iteration. The optimization process is shown in Fig. 3.

Combine teaching practice to maintain and update continuously to form excellent resources, and then the initial resources and peripheral resources are constantly integrated and melted to form better and more valuable core resources, and so on. The resource development process will constantly promote resource reorganization and content optimization to achieve continuous upgrading of resources. Thus, the availability and quality of resources are constantly improved, ensuring the vitality of resources in

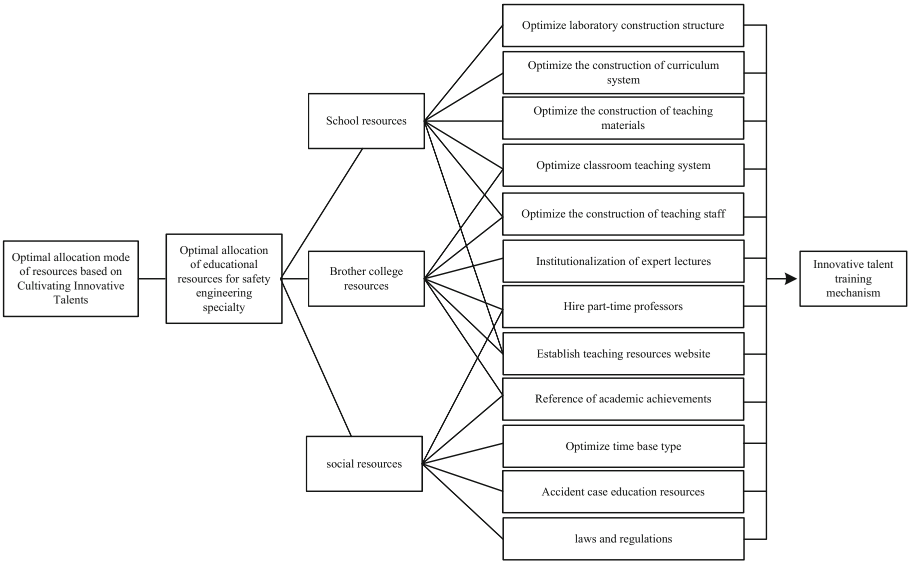

Fig. 2. Sharing model based on data clustering resources

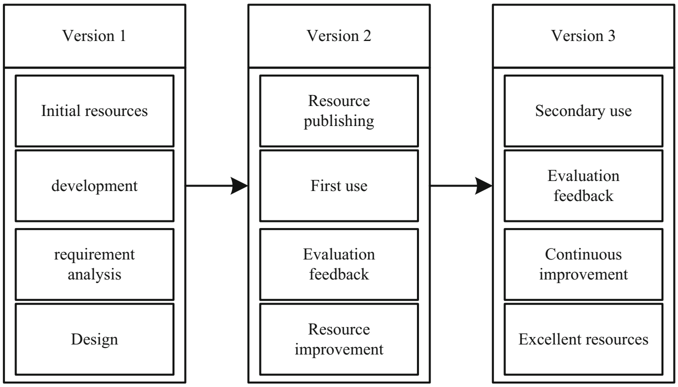

Fig. 3. Continuous optimization process of ideological and political online education resources

the process of survival of the fittest evolution [7]. Combined with the above research on the meaning of ideological and political education resources in colleges and universities and the actual situation of ideological and political education in colleges and universities, it is not difficult to get the meaning of ideological and political education resources allocation in colleges and universities [8]. The allocation of ideological and political education resources in colleges and universities refers to the internal relations of ideological and political educators according to the existing ideological and political education resources. According to the different situation of reasonable adjustment, coordination, in order to achieve the expected goal of ideological and political education in colleges and universities to ensure that the ideological and political education activities can be carried out.

2.2 Evaluation Algorithm of Ideological and Political Teaching Resources Allocation in Colleges and Universities

Education departments no longer allocate funds for the construction of basic education information resources to schools under their jurisdiction for dispersive use, but allocate them centrally and build basic education information resources. The strategy of dynamic adjustment and input of basic education information resources construction funds gives full play to the adjustment function of economic lever, which reflects a new idea of performance allocation driven by the benefit of information resources use. The problem of the separation between the construction and use of information resources is ingeniously solved by changing from the static input to the dynamic adjustment and optimization of information resources construction funds. It will greatly improve the allocation efficiency of information resource construction funds [9]. Based on this, information resource construction and allocation is optimized, as shown in Fig. 4.

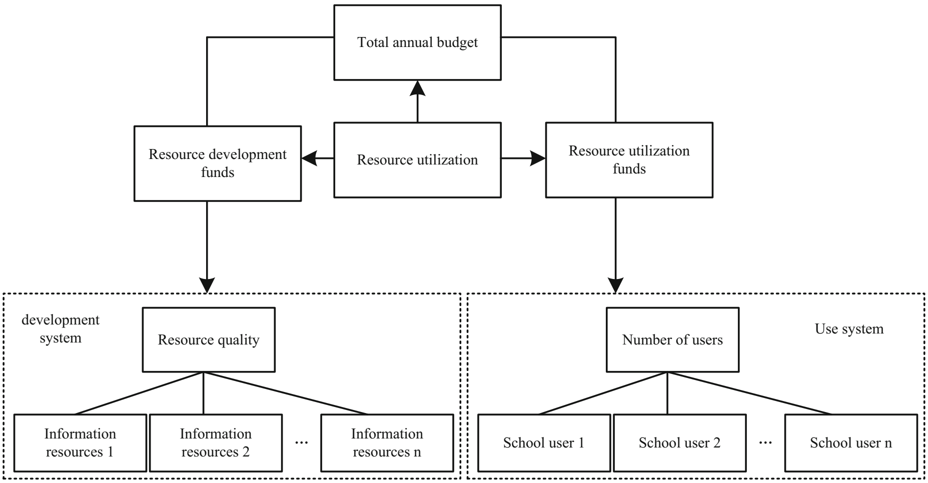

Fig. 4. Information resource construction and configuration process

The utilization rate of educational information resources determines the proportion between the allocation of information resources and the construction effect of information environment, and dynamically adjusts the allocation proportion of funds to achieve a virtuous cycle of "resource quality – user use" [10]. For the construction of information resources, users' utilization and evaluation of information resources directly determine the development expenses and profits of the information resources. The implementation of "resource quality - user evaluation - payment service mode, prompting resource development enterprises to constantly improve the quality of information resources research and development under the drive of profits. Based on the utilization rate of information resources, the competition mechanism of "survival of the fittest" in the quality of information resources is formed, so as to greatly enrich the quantity and continuously improve the quality of information resources. For the organizer of information resource utilization, the frequency of information resource utilization and the degree of evaluation feedback from school users are discussed. It is directly proportional to the information environment construction funds obtained by the school, which urges the school to actively organize its users to widely use high-quality information resources $f(C, E, P)$, stimulate the enthusiasm of teachers and students to use information resources, so as to improve the quality of teaching. The cost payable for a single resource within the settlement period u_r is expressed as:

$$M = f(C, E, P) - \frac{\sum_{r=1}^{S} u_r y_{ij}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{1}$$

The allocation rate y_{ij} of a single information resource depends on the cumulative point value v_i, the point exchange rate x_{ij} and the corresponding incentive regulation parameter C_i after the resource is used by users in a certain period. E can be expressed as:

$$E = \max \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} + \frac{F}{\sum_{i=1}^{N} C_i} - M \tag{2}$$

The conversion rate F is determined by the sum of points used by F, the total input of configuration information resources, and C_i, all resources in the database. In the formula, C is the cumulative integral value X_0 of a certain resource in the settlement cycle, and is a non-negative integer value X_0 with an upper limit. The upper limit is the product of the number of users of the resource and the maximum saturated integral set by the resource design standard, and is expressed as Y_0. By inserting the formula, the calculation of the allocation efficiency of a single resource within T can be obtained.

$$M_i = \frac{MF}{T \sum_{i=1}^{N} C_i} - C_i P_i - \frac{u_T Y_0}{E v^T X_0} \tag{3}$$

The excitation regulation parameter P_i in Formula (3) is formulated according to the accumulative integral of a certain resource and the average accumulative integral of resources in the library. The standard deviation of the accumulated integral of the resources in the library is used to delimit 7 grades. The use of educational information resources is a necessary link and the ultimate destination of information resources and services. To some extent, the improvement of the efficiency of the use of educational information resources is ultimately how to mobilize the enthusiasm of the majority of users. Motivation is for a specific goal, through internal or external stimulation, make people work hard, action, with motivation, promote behavior, the formation of power.

From the perspective of management, motivation means "to restrict people's various needs to varying degrees, so as to cause the change of their psychological state, so as to stimulate motivation and cause behavior, and through the reinforcement of motivation. To regulate and adjust "on behavior, people are engaged in a job because these as standard, or behavior can achieve their own day to satisfy his one need expectancy theory of American psychologist thinks, people take a certain action power depends on the value evaluation of the result of the action and possibility to achieve the result of evaluation. It can be expressed by formula (4):

$$M = V \times E - s/k|M_i - M| \tag{4}$$

Among them, V stands for motivation value, especially the intensity that can stimulate people's internal potential and mobilize a person's enthusiasm. s The value of achieving a goal to meet personal needs, also known as target valence. The higher the daily valence, the stronger the motivation. k stands for expectation value, which is the possibility of achieving a certain goal judged by an individual based on his own experience, reflecting the strength of his motivation to achieve the goal. According to the formula, the higher the probability of success, the stronger the motivation of the individual. The theoretical basis of the conceptual model of influencing factors of continuous use of educational information resources mainly comes from planned behavior theory, expectation confirmation theory and technology acceptance model. The theory of planned behavior is developed by psychologists on the basis of the theory of rational behavior. The instructional information planning behavior theory model makes a strict distinction between user's behavioral intention and behavior itself. User's behavioral intention is the personal will and tendency before the behavior occurs, while behavior

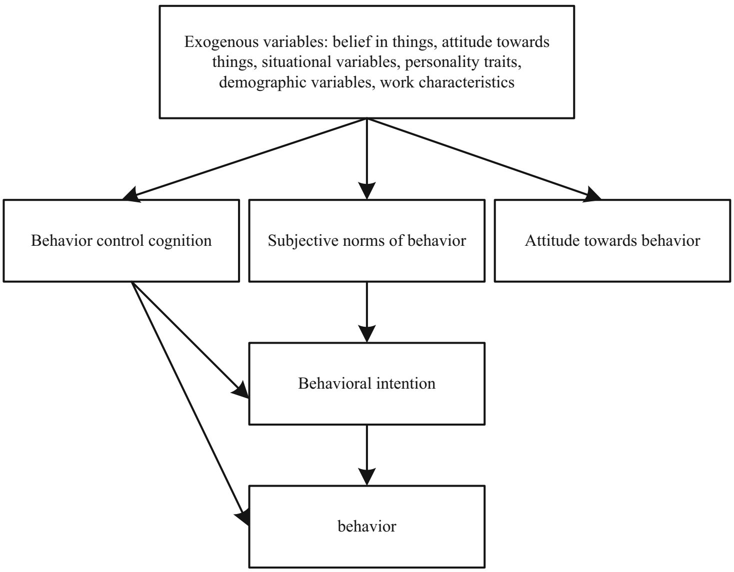

Fig. 5. Theoretical model of instructional information planning behavior

is the actual action generated by the former. The theoretical model of planned behavior is shown in Fig. 5.

Users can creatively understand the content of resources through thinking, and use the obtained knowledge creatively in teaching practice, so that educational information resources have greater value. In the process of using educational information resources, the quality of resource products and services, the user's own quality and ability, information environment and atmosphere have an impact on the user's use behavior. Like other products, the quality of information resources has an important impact on users' use behavior. Users always choose products and services with better quality and excellent service, and information resources with better quality promote users' enthusiasm in using them. Based on this, the user use process of educational information resources is optimized, as shown in Fig. 6.

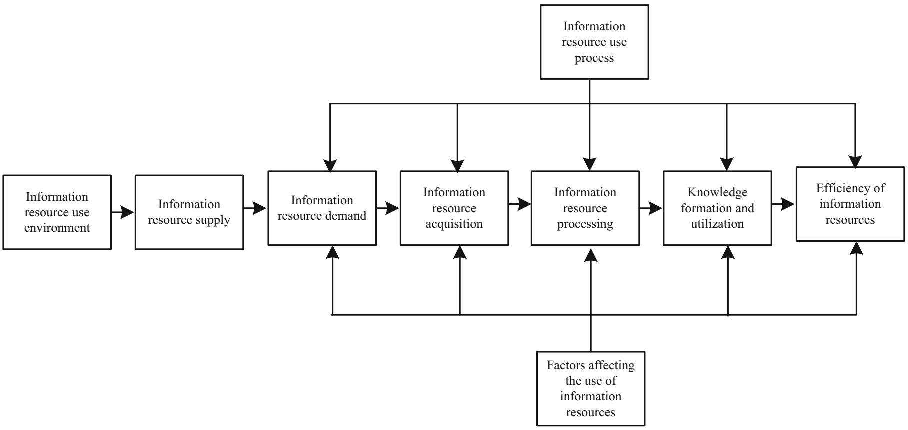

Fig. 6. User usage process of educational information resources

Personalized, innovative, practical and easy to use information resources will promote the use of resources by users. Users' own comprehensive ability and quality in using information resources can be reflected from the time and energy invested by users, information technology ability, usage habits, peer demonstration effect and other aspects. Users with high information quality have the ability to detect the demand for information resources, and can effectively search, evaluate and use them. The basic realization of school and class network infrastructure, computer hardware equipment connectivity, for users to use information resources to provide a strong guarantee.

2.3 Realization of Balanced Allocation of Ideological and Political Education Resources in Colleges and Universities

All kinds of resources in the process of ideological and political education practice must be coordinated. The coordination of various resources of ideological and political education in colleges and universities is a necessary condition to improve the effectiveness of ideological and political education in colleges and universities. In the actual ideological and political education activities in colleges and universities, to ensure the spatial consistency of various resources, we must ensure the linkage of educational main body resources, material resources, cultural resources, system resources, information resources and carrier resources. In order to realize the continuity of all kinds of resources in time, ideological and political education must be carried out in stages and hierarchies, so that the content of education can be easily accepted and absorbed. The establishment of the evaluation model of the allocation efficiency of information resources in digital education refers to the evaluation model of the validity of information resources allocation, which explains how to evaluate the allocation of information resources better. Based on the completed research and combined with some characteristics of digital education, some modifications were made to the model proposed by him to be suitable for the evaluation of information resource allocation of digital education, as shown in Fig. 7.

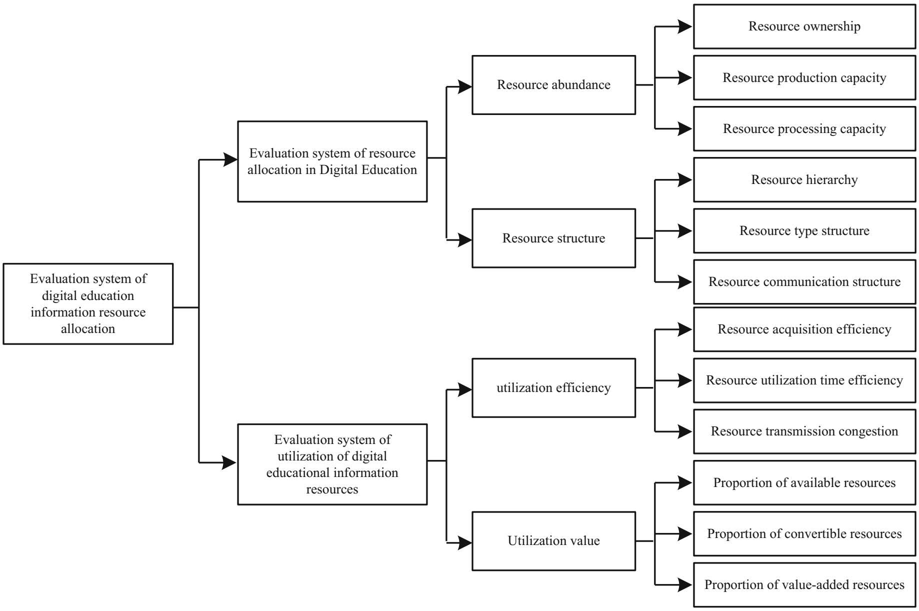

Fig. 7. Educational information resource allocation model

The whole system reflects the idea that the allocation is the foundation and the use of resources. Specifically, resource ownership refers to the total number of digital educational information resources, and resource production capacity refers to the number of newly added digital educational information resources every year. Resource processing ability refers to the construction level of digital educational information resource foundation platform, and resource hierarchy refers to the proportion of digital educational information resources facing different users and different price levels. The structure of resource type reflects whether the proportion of various types of digital educational information resources is reasonable, and the structure of resource transmission refers to the level of medium, means and efficiency of resource transmission. Resource acquisition efficiency refers to the frequency with which resources are utilized. The time efficiency of resource utilization refers to the total time efficiency of checking, obtaining and waiting for utilization, and the congestion degree of resource transmission refers to the adaptability of the number of network users and network information flow. The proportion of available resources refers to the proportion of total resources that can be found by users and have value, while the proportion of transferable resources refers to the part with strong pertinence and practicality. The proportion of value-added resources refers to the proportion of resources whose value can be expanded.

The internal allocation of cultural resources, teaching resources library adopts B/S architecture. Teachers can manage and use their own teaching resources through big data clustering. Students can participate in online classes organized by teachers through the Internet and choose to learn finished courseware, video streaming courseware or electronic books and electronic lecture notes. At present, ASPNET and JSP are the most competitive server-side development technologies based on big data clustering. Considering the actual situation of higher vocational colleges and the prospective examination of development technology, decided to use Microsoft's ASPNET technology for development because of the use of ASP.NET technology for development, in order to ensure that the computer can run well based on ASP.NET technology software application environment. Operating system environment:Windows 2008 Server (SP4) OrLater + Frameworks SDK11www Server:Intemet Information Server60 Database Server:MSSQL Server 2000 Client Browser version:IE50 and later Based on the above development environment, a teaching resource library with basic functions is constructed, as shown in Fig. 8.

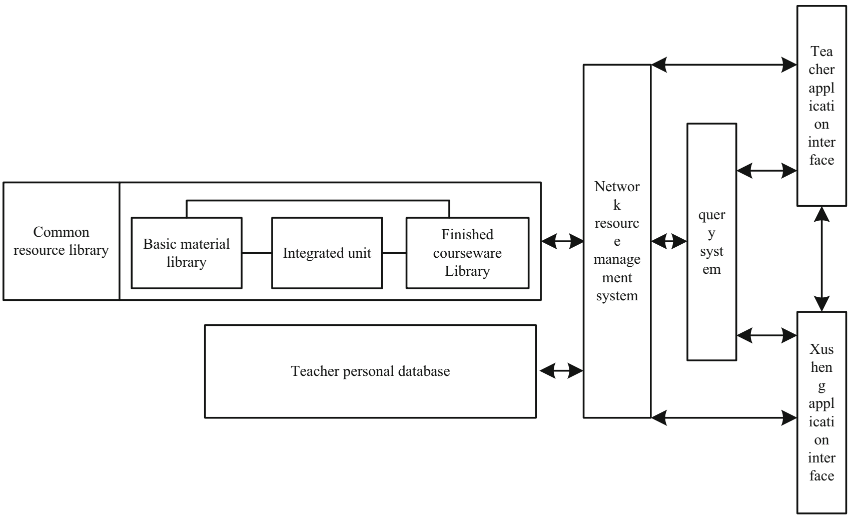

Fig. 8. Macro structure of scheme function

Teaching resources of the internal configuration first is its three levels, namely the system layer, material layer and spirit layer configuration, the system layer, material layer and spirit layer configuration process, the spirit layer in the core position, is the soul of campus culture, the system layer is the center of the campus culture level, concentration reflected the requirement to the educators; Material layer is the surface part of campus culture, which is the foundation of the formation of campus culture and the condition of forming the spiritual layer and system layer of campus culture. The configuration of campus culture also means the integration of different cultures, such as the learning and reference of different cultures on campus. Internal configuration of carrier resources. Abandoning the narrow educational resource construction thought that "educational resources can only be built by the education system itself" and bringing the educational resource construction into the market operation management, the process of educational information resource supply will evolve into a value-added service process from product design, development, sharing to use. In terms of technology, enterprises have the advantages of flexible market, high efficiency of technological innovation and development; the government has the advantages of fund guarantee and supervision and management; and schools play an obvious role in knowledge content, teaching design and use feedback. The quality and efficiency of educational information resource products can be guaranteed by giving full play to their functional advantages to achieve complementary and multi-win. Integrating the concept of public service outsourcing and based on the construction idea of "application driven, government dominated, enterprise development and active service", the "regional co-construction, sharing and exchange" mode of equitable allocation of basic education information resource services in the information environment is designed, as shown in Fig. 9.

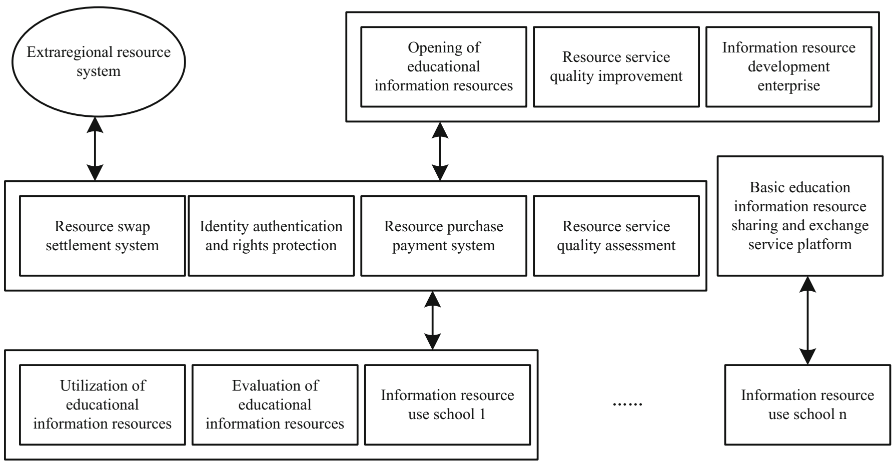

Fig. 9. Regional sharing and exchange mode of educational information resources

With the popularization of the network, many colleges and universities have fully realized the significance of the network for the ideological and political education in colleges and universities, and at the same time, strengthen the construction of campus website and develop campus website resources as much as possible. "Although the wish is good, in view of the reality, the construction of campus website of ideological and political education in colleges and universities attaches too much importance to their own characteristics and lacks the overall concept, which makes the allocation of modern resources of ideological and political education in colleges and universities scattered". On the whole, the problems of incomplete equipment and chaotic system control are quite prominent, and the goal of maximizing benefits by using limited resources has not been achieved. The network can not be interconnected, between the universities, their own 'network'. Therefore, the existing network resources should be rationally allocated to build a criss-crossing national ideological and political education network in colleges and universities, so as to achieve the goal of teaching resources allocation.

3 Analysis of Experimental Results

In order to verify the practical application effect of the balanced allocation method of ideological and political network teaching resources in colleges based on big data clustering (Method in this paper), an experimental study was conducted. The comparison method selected in the experiment is the video teaching resource management method based on cloud platform (Method 1), and the teaching resource management method based on knowledge diffusion in multi-network autonomous learning (Method 2). The purpose of the test is to verify the rationality and validity of the established model and verify whether the information and behavior obtained by the model reflect the characteristics and change rules of the actual system. Vensim PLE software provides model testing, dimensional consistency testing and reality testing to test the above models, determine whether the dimensions on both sides of the system dynamics equation match, judge whether the running results conform to the reality, and determine whether the model runs normally. Through detection, the performance of information configuration ratio, reliability and validity, resource management and other aspects of different methods

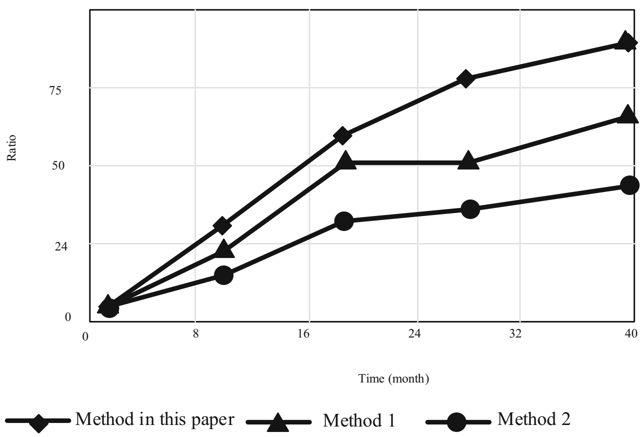

Fig. 10. Proportion analysis of information configuration

are verified. The experimental results of information configuration ratio are shown in Fig. 10.

Compared with the traditional methods, the efficiency of information allocation under the guidance of the proposed method is better than that of the two comparative methods. Further combined with the average variance withdrawal (AVE value), the variation of the measurement index variable can reflect the extent of potential variables relative to the variation of measurement error. If the variation of the measurement index variable explained by the potential variable is higher than that explained by the measurement error, the potential variable has a good operational measurement definition, and the measurement index can effectively reflect its potential variable, which has a good reliability and validity, as shown in Table 1.

Table 1. Test summary of factor load and reliability and validity of measurement indexes

Potential variable	Measurement index	Factor load	P value	Composite reliability	Ave value
Expected quality	A1	#	***	0.89	0.65
	A2	#	***		
	A3	#	***		
	A4	0.83	***		
	A5	0.85	***		
	A6	0.85	***		
	A7	0.90	***		
	A8	#	***		
	A9	0.76	***		
	A10	0.78	***		
Perceived quality	B1	#	***	0.83	0.52
	B2	0.75	***		
	B3	0.82	***		
	B4	#	***		
	B5	#	***		
	B6	#	***		
	B7	0.75	***		
	B8	0.86	***		
	B9	0.82	***		
	B10	#	***		

(*continued*)

Table 1. (*continued*)

Potential variable	Measurement index	Factor load	P value	Composite reliability	Ave value
Perceived value	C1	0.81	***	0.75	0.51
	C2	0.76	***		
	C3	#	***		

Note: # indicates less relevant. *** Represents $P < 0.001$.

The development of educational informationization depends on the amount of investment and investment structure. It is a good thing that the funds of educational informatization construction are increasing continuously, but the unreasonable investment structure of educational informatization will also lead to the abnormal operation of the information environment, the low efficiency of resource use, and then affect the overall development level of basic education informatization. The main influencing path of the quality satisfaction model of educational information resources is as follows: users' expectation of quality has a direct positive influence on perceived quality, perceived value and continuous use intention. Users' perception of resource quality directly affects users' perception of resource value. User satisfaction is directly influenced by perceived value and perceived quality, and has a positive and direct effect on users' continuous use of information resources. The total effect from the standardization of the structural model is shown in Table 2.

Table 2. Standardized total effect values of potential variables influencing each other

Antecedent variable post variable	Expected quality	Perceived quality	Perceived value	User satisfaction
Perceived quality	0.29	–	–	–
Perceived value	0.39	0.61	–	–
User satisfaction	0.21	0.65	0.42	–
Continuous use intention	0.52	0.21	0.12	0.35

The construction of hardware platform environment, the development of high quality educational information resources and the enthusiasm of users affect the benefit of educational information resources allocation. Environmental construction includes the number of computers per capita, the number of multimedia classrooms and network bandwidth. Resource construction costs include two parts: user development and purchase. The user's enthusiasm depends on the user's training and external motivation.

The frequency of use can be divided into download and access. When a user thinks that a certain resource meets his learning requirements and intends to reuse it for several times, download is generally adopted. Download also indicates that the resource plays its maximum utility, the resource accumulates the maximum integral value at a time. The number of visits is the way that users browse to know the quality of a resource or whether it is important to them, or because of misoperation or other reasons. If the browsing duration does not exceed the set time limit, it is counted as one visit and accumulated directly using the default value. The usage time is set for online learning users. Generally, the score is accumulated according to the ratio of the actual learning time to the total resource time. Based on the analysis of the forms of resources used by users, strategies for resource integration can be concluded, as shown in Table 3.

Table 3. Accumulative points of educational information resources

Integral item	Dimension	Statistic	Integral standard	Remarks
Usage times	Frequency	Downloads	P points/time	The same registered user will not be double counted
		Visits	2 points/time	If the duration is less than two minutes, it is recorded as an access
Service duration	Minute	Online duration	P/W integral/min	When $0 < w < 3$, it is not calculated
				When $3 \leq w \leq W$, the integral is: $P/w * W$
				When $w > W$, the integral is: P

When faced with different solutions, teachers always want to get the best result by setting different "resource usage ratio correction parameter" values. Realize the dynamic change of the allocation ratio between educational information resource construction funds and environmental use funds, as shown in Fig. 11.

According to the different stages of educational informatization development, the investment tendency will be different. For example, the lack of high-quality resources in the early stage of educational informatization construction will inevitably increase the cost of resource construction. When the quantity and quality of information resources reach a certain level, the use of high-quality resources in the resource bank will become the focus of investment. If the development of informatization is in a steady rising stage, the distribution coefficient between resource construction and environmental construction costs can be limited to a moderate range. If the regional informatization has a good development and the stock and quality of resource construction basically meet the needs of current users, the fund allocation system should be adjusted to the environment of resource use and the direction of motivating users. According to the development of a period of time, resources will be expanded and updated, equipment, platform maintenance, etc. Decision makers can carry out multiple model simulation, according to the

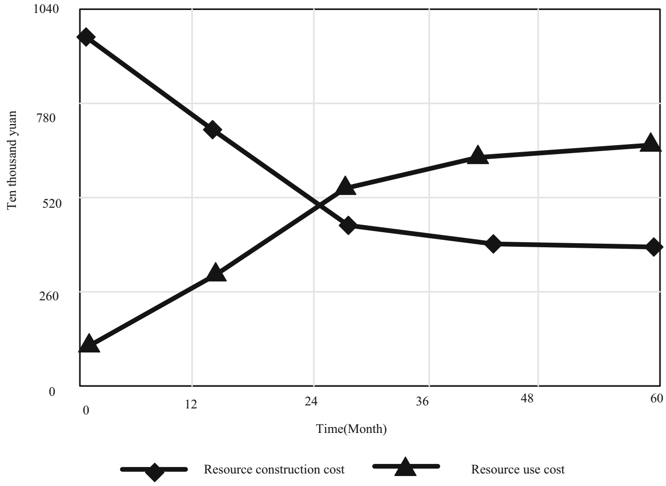

Fig. 11. Effect of dynamic management of educational resource allocation

prediction of resource investment benefit to dynamically adjust the coefficient of capital allocation. The decision makers of educational informatization construction can predict the bias of future investment only by adjusting the coefficient of investment allocation and making appropriate correction. In this way, we can optimize the configuration structure and get the best configuration benefit under the condition that the total input is relatively unchanged.

4 Conclusion

The ultimate goal of big data teaching resource allocation optimization is to realize the utilization rate of teaching resources, improve the sharing rate of teaching resources and enhance the effectiveness of ideological and political education. Therefore, the development of new carriers and the use of new technology is the direction of efforts can not be stopped. Teaching resources of the ideological and political work are implemented through a variety of media and carrier, so we should be independent research and development data or positive introduction of teaching resource management system or wisdom teaching platform, data platform as the carrier, integrate the resources of ideological and political education process, to achieve information sharing as the goal of effective allocation of resources: out of the innovative ideas as the lead, pay attention to the traditional teaching The integration of learning resources and network teaching resources, with new technology and new platform as the carrier of effective promotion of ideological and political education big data resource allocation optimization road.

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Research on the Balanced Allocation Model of Online Education Resources of Economics and Management in Colleges and Universities Based on Parallel Clustering

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Abstract. In view of the poor effect of the current balanced allocation of online education resources, this study proposes a balanced allocation model of online education resources of economics and management in colleges and universities based on parallel clustering. Firstly, combined with the principle of parallel clustering, an online education resource database is constructed to collect, analyze and store a large number of economic management teaching resources. Then build the information management platform and optimize the evaluation index of balanced allocation of educational resources. Finally, the experiment proves that the model in this paper has high practicability in the practical application process and fully meets the research requirements.

Keywords: Parallel clustering · Economics and management · Teaching resources · Resource allocation

1 Introduction

The balanced allocation of educational resources is an important way to achieve educational balance. It has become a consensus that the balanced allocation of educational resources in the stage of basic education can narrow the gap between schools, reduce the phenomenon of school selection and promote educational equity. However, many people doubt whether the equilibrium policy will exchange fairness at the expense of output efficiency [1].

In the stage of online education of economics and management in Colleges and universities, the society's pursuit of fairness is greater than efficiency. However, there is a strong efficiency orientation in senior high school, which is traced back to the great pressure of college entrance examination. The impact of educational balance policy on educational efficiency is not only a major problem related to the difficulty of implementing educational balance policy, but also a major theoretical and empirical topic faced by educational researchers.

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In the existing studies, a consensus has been reached on the measurement method of the balance degree of educational resource allocation. It is generally proposed and accepted to measure the difference of educational resources with statistical indicators such as coefficient of variation, and empirical calculation has been carried out [2]. For example, the model of balanced allocation of educational resources based on statistics theory and mathematical modeling. In these traditional methods, the effects of education resource allocation for education output, usually adopt the method of education production function to investigate the quality of students, peer condition, teacher level, the relationship between money and school students' academic achievements, its basic idea is: the student's individual ability, cognitive ability, the quality of teachers will have significant impact on student performance.

Based on the above analysis, starting from the actual cases of local government policies, this study discusses the differences in educational output before the change of educational resource allocation, and puts forward a new balanced allocation model of economic and management online educational resources in Colleges and universities.

2 Model Design

In this paper, we first establish an online education resource database based on the principle of parallel clustering, and store a large amount of economic management teaching resources in this database. Then, an information management platform is constructed to realize the balanced allocation of resources according to the field relationship of educational resource cloud on the basis of optimizing the evaluation index of balanced allocation of educational resources.

2.1 Online Education Resource Collection Model

The research on the allocation standard of economic and management online education resources in colleges and universities is not only a theoretical problem, but also a practical problem [3]. The allocation of economic and management online education resources in colleges and universities is directly related to the balanced development of economic and management online education in colleges and universities. At present, the differences in the allocation of economic and management online education resources in colleges and universities are reflected in regions, urban and rural areas, schools and groups. The existence of the above differences is an indisputable fact.

The purpose of this paper is to start from these actual differences and put forward what standards the government should use to allocate educational resources in order to narrow the above differences and achieve educational equity. Based on this, this paper constructs a framework for the collection of economic and management online educational resources in colleges and universities, as shown in Fig. 1.

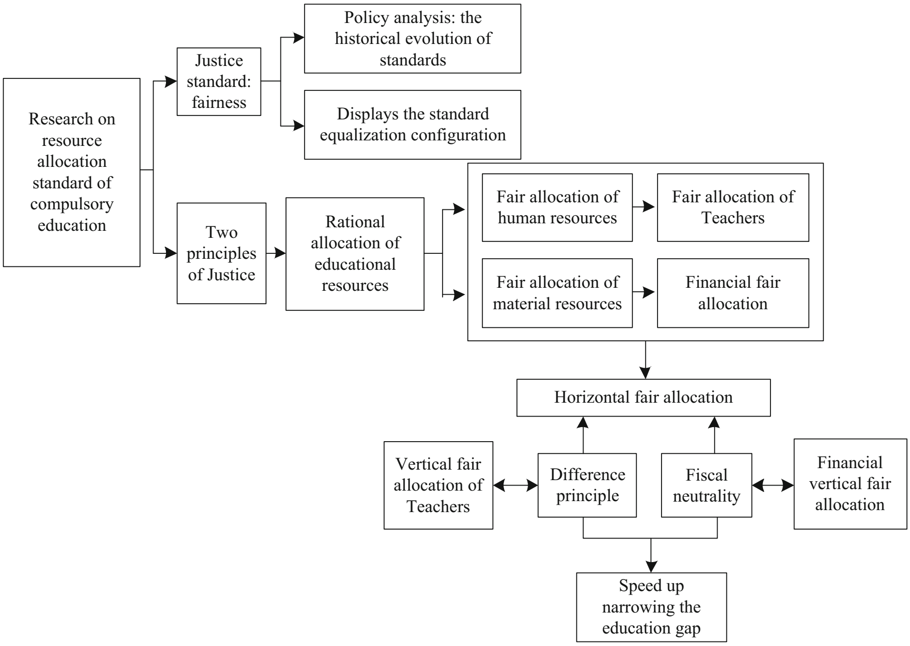

Fig. 1. Collection framework of online education resources for economics and management in colleges and universities

The teaching of information resource management of economics and management specialty is very important and has a profound impact on China's future development. Therefore, it is necessary to reasonably arrange the teaching of economics and management specialty [4].

From the perspective of production, information technology in the field of education is not a simple knowledge transfer tool, but an important organic part of the learning ecosystem and an important platform to support the subject's cognition and learning activities. Information technology can effectively support the social and material extensions of the subject's cognitive activities, promote the interaction of learners with teachers, partners, and other members of the society, and at the same time support learners with rich information resources and powerful cognitive tools Cognitive activity. Therefore, in the modern learning ecosystem, learners and technology will form a new type of partnership. The advantage of information technology is that it can help subjects build a new learning ecosystem. Based on this, an integrated learning model under the background of information technology is constructed. The specific model structure is shown in Fig. 2.

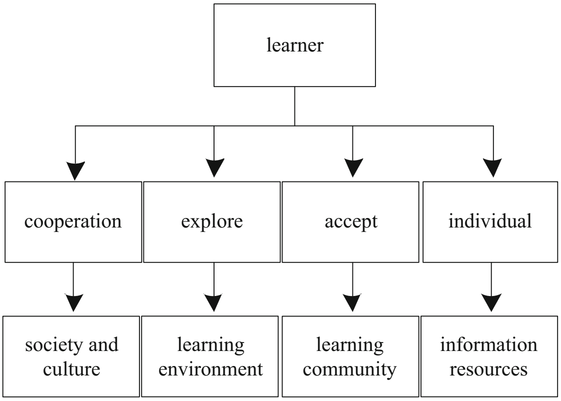

Fig. 2. Integrated learning model under the background of information technology

From the perspective of equity, this paper puts forward the basic framework for analyzing the allocation standards of economic and management online education resources in colleges and universities, which is not used to explain the meaning of "balanced development" or "educational equity", but mainly used to describe the implementation path of balanced development and balanced allocation of resources of economic and management online education in colleges and universities. At the same time, it is also used as the technical route of this paper. In other words, the fundamental measure to promote the balance of online education of economics and management in colleges and universities lies in the rational and balanced allocation of educational resources. According to the equality principle of Rawls' horizontal equity, the allocation of resources and the implementation of vertical equity differential compensation can accelerate the education gap between schools, between urban and rural areas and between regions. The gradual realization of "financial neutrality" and "difference principle" is the key to ensure the equal distribution of resources and realize difference compensation. It is the institutional innovation of Rawls Theory in the standard of resource allocation. Without "financial neutrality" and "difference principle" as the institutional guarantee, the allocation of online education resources of economics and management in colleges and universities will not be balanced, and the efforts to promote the balanced development of online education of economics and management in colleges and universities will not be effective.

2.2 Online Education Resource Management Algorithm for Economic Management

The practice of resource allocation standards based on incremental reforms has seriously delayed the balanced development of online education in economics and management in colleges and universities. Therefore, the teacher resource allocation standards analyzed in this article are based on Rawls' principle of difference, and the implementation of stock reform design. Design a new model of teacher allocation standards to accelerate the balanced development of online education in economics and management in colleges and universities.

In order to realize networked distance education, some communication tools and software are needed. According to the different functions of communication tools, we can classify them appropriately:

The first type of tools is mainly used to support the transmission of information between users;

The second type of tool is mainly used to support the sharing of information space; the third type of tool has the functions of the first two types and can be used to support collaborative work between remote users, usually called "groupware". For each type of tool, it can be divided into two working modes: synchronous and asynchronous. The following table lists commonly used networked distance teaching communication tools, and the specific content is shown in Table 1.

Table 1. Networked distance teaching communication tools

Tool category	Synchronization	Asynchronous
Information transmission tool	Video conference system, voice conference system, real-time written conversation system	E-mail, e-newsgroup, asynchronous computer conference system
Information sharing tools	Remote screen sharing system, real-time group editor	Server file sharing, asynchronous coauthoring system
Collaborative operation tool	Video conference system with whiteboard, group decision support system	Asynchronous computer conference system and group object management system with CO authorship tool

The framework analysis of the research on the allocation standards of financial resources and teacher resources for online education of economics and management in colleges and universities follows the overall framework of Fig. 1, and its focus is still slightly different. The allocation of financial resources for online education of economics and management in colleges and universities follows Rawls's principle of financial neutrality. The focus of the reform is incremental reform, so as to realize the balanced allocation of financial resources [5]. The allocation of teacher resources follows Rawls' difference principle, and the focus of the reform is the stock reform, so as to realize the balanced allocation of teacher resources. The differences in research focus can be expressed in Table 2.

Table 2. Differences in the focus of research on the allocation of teaching resources

Name	Rawls' principle of justice	Focus of future reform	Target
Allocation of financial resources	Principle of fiscal neutrality	Incremental reform	Balanced allocation of financial resources
Teacher resource allocation	Difference principle	Stock reform	Balanced allocation of teacher resources

The classification objects are divided into several classes, similar ones are classified into the same class, and dissimilar ones are classified into different classes. Parallel cluster analysis is divided into two similarity measures of type x_{ik} (classification object is sample) and type x_{jk} (classification object is variable): distance Q and similarity coefficient M. Distance is often used to measure the similarity between samples, and parallel clustering is often used to measure the similarity between variables. The Euclidean distance between the i sample and the j sample is

$$d_{ij} = \left[Q - M \sum_{k=1}^{p} \left| x_{ik} - x_{jk} \right|^2 \right]^{1/2} \tag{1}$$

In here:

$$x_i = \left(x_{i1}, x_{i2}, \cdots, x_{ip}\right)', x_j = \left(x_{j1}, x_{j2}, \cdots, x_{jp}\right)' \tag{2}$$

When the units of variables in parallel clustering are different or the range of measured values is very different, the data of variables in parallel clustering should be standardized first [6]. The most common standardized treatment is to make:

$$C_{ij}^{*} = \frac{1}{d_{ij}\sqrt{\frac{1}{n-k}\sum_{i=1}^{n}\left(a_{ij} - x_i + x_j\right)^2}} \tag{3}$$

Suppose that students can be divided into two types: high-scoring students and low-scoring students. The grades are represented by a_{ij}, and the change rate of grades over time is n and k. Each student has the motivation to improve his academic performance. The better the students are. The stronger the motivation, the higher the self-demand, so the change of score is directly proportional to the current score. However, due to different factors such as pre-education, family background, etc., there will be an upper limit for the improvement of their scores. The upper limit for high-scoring students is higher, which is represented by a; the upper limit for low-scoring students is represented by b. The closer to this upper limit, the slower the growth of performance. From this, we established a log istic form of student performance growth equation

$$\begin{cases} \frac{dX}{dt} = C_{ij}^{*} - M(a - x_i) \\ \frac{dY}{dt} = C_{ij}^{*} - Q(b - x_j) \end{cases} \tag{4}$$

There are two fixed points (a, b) in the system described by the equation. The fixed point is divided into a stable fixed point and an unsteady fixed point. The calculation shows that (a, b) is a stable fixed point of the system [7]. The stable fixed point corresponds to the educational meaning in this model, that is, if there is no influence of other factors, students with high scores will eventually get points steadily, and students with low scores will eventually get points steadily, even if other external factors cause deviations. The amplitude is also very small. However, in reality, due to the existence of the "peer effect" and the role of teachers, there will be mutual influences between students, teachers and students, so we have to expand the model. Real experience tells us that in a school, different The students in the score section will form groups, and influence each other within the group [8]. Due to the small intersection between the groups, the direct mutual influence is relatively small. However, what is special is that students with good grades will be classified as typical because of the school and teachers, so that through the role of role models, they will have an impact on students in other grades.

In order to better analyze this problem, we can study it with the help of graphical model. Generally speaking, the marginal return of education investment is decreasing [9]. Take axis X as the investment limit and axis Y as the marginal income of investment, as shown in Fig. 3.

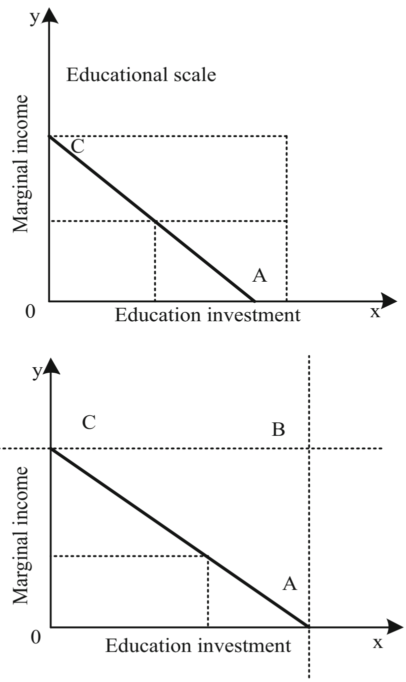

Fig. 3. Marginal return function of educational investment

The marginal return function of education investment can be expressed as CA. The maximum marginal return of education investment is OC and decreases with the increase of investment. Finally, when the investment reaches OA, the marginal return of education investment is close to zero return. For each unit of education, OA's educational investment quota is the best investment quota. The part of education investment larger than OA will be wasted and reduce the efficiency of resource allocation. Most ordinary high school students have a strong desire to enter higher education and are driven by role models. The existence of role models around them can effectively promote their learning progress. According to this logic, students with good grades will have a greater impact on students with poor grades, and they are positive. The impact of students with poor grades on students with high scores is not obvious. In our model, in order to simplify the processing, we ignore the impact of low-scoring students on high-scoring students, and only consider the impact of high-scoring students on low-scoring students. The (X-Y) factor indicates that the effect of this role model on the improvement of the scores of students with poor performance is related to the difference between the two scores, which is consistent with the facts.

2.3 Realization of Balanced Allocation of Educational Resources

The purpose of studying the resource allocation standard of public goods from the perspective of fairness is utility and fairness. From the perspective of fairness, the purpose of analyzing the allocation standards of economic and management online education resources in colleges and universities is also to achieve the greatest degree of fairness. Fairness, as the standard for the allocation of economic and management online education resources in colleges and universities, is gradually recognized by scholars and the government. The conceptual model of educational resource cloud is mainly composed of four layers: identity layer, role layer, service exhibition and IP layer. In the practice field of educational resource cloud, physical field, action field and information field all have their own internal motion rules, and they also interact and influence each other [10]. Physical field is the information infrastructure and system software of educational resource cloud, that is, the above IP layer. The field is composed of various learning and teaching activities that cooperate closely and interact frequently. It is a service system that implements and decomposes learning objectives and teaching tasks. It is a space where information words and physics are intertwined. Information field is almost a digital space, in which the main actors of gods are also active. It includes action information, resource information, state information and so on. Figure 4 shows the field relationship of online education resource cloud of economics and management specialty.

Informationized teaching resources are an important condition for teaching in an informationized environment. Through the analysis of the current situation of online high-quality education resource sharing at home and abroad, it is pointed out that the establishment of information-based teaching resources "co-construction and sharing mechanism includes at least five forces: government, schools, experts, associations and enterprises" clarifies information-based teaching sharing The subjects involved have a greater impact on the practice of resource sharing.

At present, sharing informatization teaching resources based on the resource library has become an important consensus in the study of sharing informatization teaching resources. Since then, the resource public service platform based on the resource library

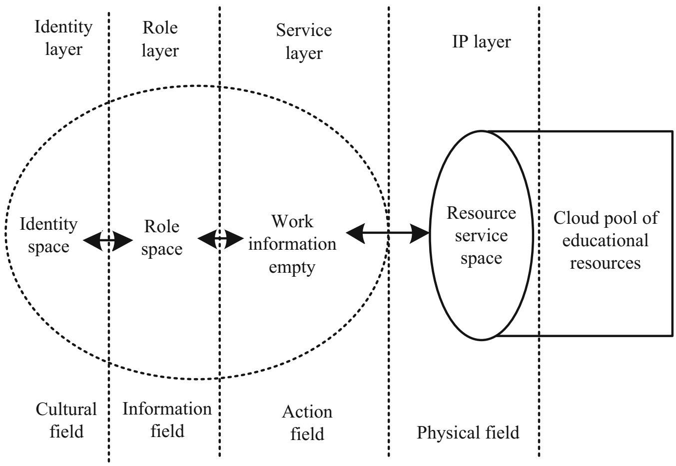

Fig. 4. Field relationship of educational resource cloud

has been the most important carrier, directly affecting the convergence, sharing, construction and application of educational resources. In order to solve the problem of the shortage and sharing of informatization teaching resources in the region, through years of analysis and practical exploration, regional education institutions have gradually formed a resource sharing model centered on the regional informatization teaching resource library. The government, schools, teacher associations and the information-based teaching resource sharing mode in which enterprises participate together is shown in Fig. 5.

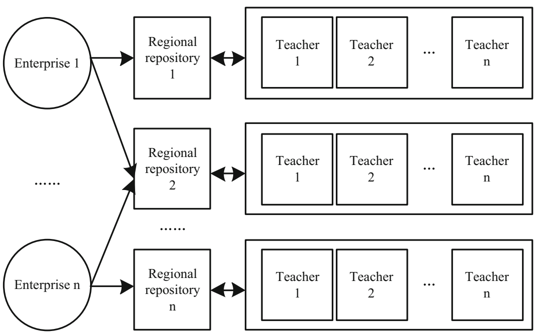

Fig. 5. Resource sharing model with regional resource library as the core

In order to promote the sharing of information-based teaching resources, various regions have successively built regional resource databases. In the initial stage of the construction of these resource banks, education and teaching resources are mainly purchased, and the supply of education and teaching resources is mainly borne by relevant enterprises; With the gradual improvement of various information-based teaching resource databases, a large number of front-line teachers participate in the construction of information-based teaching resources, upload the teaching resources made by teachers to the resource database for use by other front-line teachers, so as to realize the sharing of information-based teaching resources in the region. In order to solve various management problems caused by the centralized management of teaching resource database, some institutions began to build distributed resource database with the help of information technology in management, so as to improve the access speed of educational resources and reduce the management difficulty of educational resource database. The management model of distributed resource database is shown in Fig. 6.

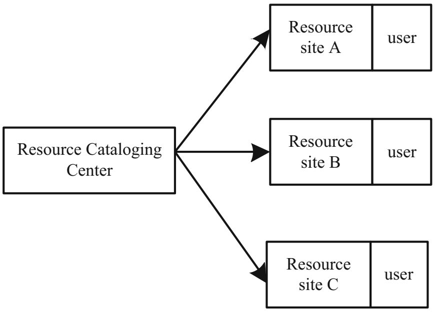

Fig. 6. Distributed resource library management model

The resource sharing mode with the resource pool as the core can concentrate the strength of all schools and teachers in the region to build a certain scale of resource pool in a short time. It is a good way to quickly solve the shortage of resources. At the same time, this resource sharing model is of great significance in maintaining educational equity. The educational resource sharing model with resource bank as the core can enable schools in the region to obtain the same educational resources, so as to reflect educational equity. In view of this, the resource sharing model with resource database as the core has attracted the attention of government agencies. Combined with a variety of teaching modes, improve the teaching quality of economics and management specialty, and make more students interested in learning software development.

1) Campus network combined with bilingual teaching is one of the methods to improve the teaching quality of economics and management specialty. Because it's managed developers often come into contact with some English, and most references are also related to English. Therefore, teachers should use English as one of the teaching tools when making courseware, and interact with students in English in class.
2) Campus network combined with practical teaching is one of the methods to improve the teaching quality of economics and management specialty. Through cooperation with enterprises, the school provides students with a practice base, carries out team cooperation according to students' thinking mode and combined with actual theory, technology and environment, improves students' comprehensive quality in team cooperation and practical ability, and enables students majoring in economics and management to integrate into the enterprise more easily.

3 Analysis of Experimental Results

The online education industry of economics and management of universities in 31 provinces, autonomous regions, and municipalities in my country is selected as a sample, and the online education resource allocation data of colleges and universities is used to conduct research. The research content includes 10 educational resources, which refer to the area of school buildings per student and the area of classrooms per student. Area of gymnasium per student, percentage of online education teachers in economics and management majors, number of books per student, number of computers per student, assets of teaching equipment per student, education expenditure per student, education expenses in budget per student, budget per student Internal public funds. KMO value test, KMO value = 0.719. Bartlett's sphericity is extremely significant ($P < 0.01$), the test shows that the data statistics from the questionnaire are more suitable for factor analysis. The specific results are shown in Table 3.

Table 3. KMO value and Bartlett sphericity test

Kmo value of sample appropriateness measure		−721
Bartlett sphericity verification	Chi square test	207.652
	Freedom	77
	Test value with significant difference	.000

See Table 4 for the indicators of online education resources of economics and management in Colleges and universities and the specific meanings of various indicators.

Table 4. Indicators of online educational resources in economics and management in colleges and universities

Name	Meaning
Average school building area per student	Construction area of school buildings in the province (M2)
Classroom area per student	Area of school teachers in the province (M2)
Per student sports tube area	Area of school gymnasium in the province (M2)
Proportion of teachers with bachelor degree or above	Number of full-time teachers with bachelor degree or above in the province
Number of books per student	Number of school books in the province (volume)
Number of computers per student	Number of school computers in the province (sets)

(*continued*)

Table 4. (*continued*)

Name	Meaning
Education expenditure per student	Provincial Education Expenditure (yuan)
Education expenses within the budget per student	Education expenses within the provincial budget (yuan)
Public funds within the budget per student	Public funds within the provincial budget (yuan)

According to the statistics, the highest proportion of online education teachers of economics and management specialty in China is Beijing, and the lowest proportion is Hainan; From the median and average values, the overall level of the proportion of teachers in online education of economics and management specialty in China has improved. From the perspective of standard deviation, range and range rate, the inter provincial difference in the proportion of teachers in online education of economics and management specialty in China has narrowed. The specific change index timing chart is shown in Fig. 7.

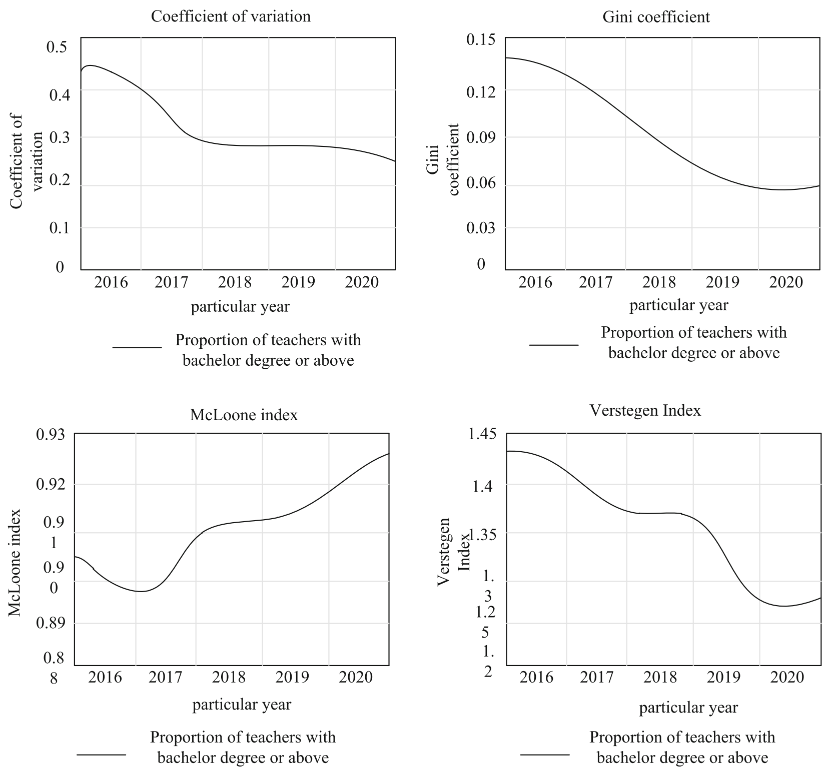

Fig. 7. Timing diagram of the index of difference in the allocation of teaching resources

From the changes in the coefficient of variation and the Gini coefficient, the inter-provincial difference in the proportion of online education education in economics and management in the United States has been shrinking year by year. The overall allocation of faculty resources is relatively fair. From the change in the Vostgen index, the proportion of teaching resources is relatively comparative. The inter-provincial differences between high regions are shrinking year by year, that is, the inter-provincial differences between regions with strong resource management capabilities become smaller. Based on the test results shown in Fig. 7, it can be seen that the parallel clustering-based high-efficiency economic management professional online education resource balanced allocation model proposed in this study has high practicability in the actual application process and fully meets the research requirements.

On this basis, in order to further highlight the application advantages of the model in this paper, the traditional educational resource balanced allocation model based on statistical theory is compared to complete the performance verification with the model in this paper. The index used in the comparative experiment is the balance degree of resource allocation, and the experimental results are shown in Fig. 8.

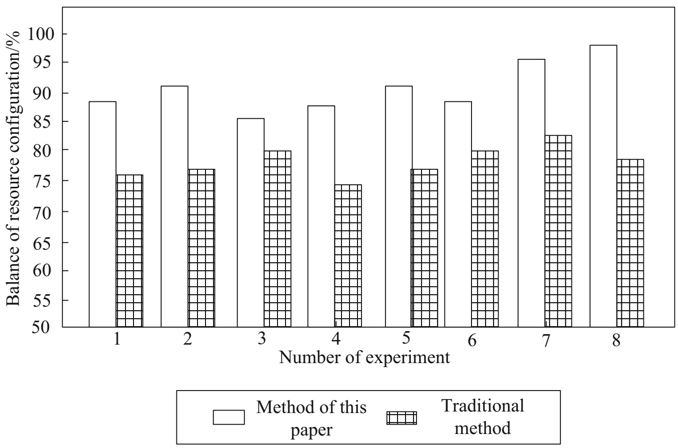

Fig. 8. Comparison results of resource allocation balance degree among different models

The analysis of the results shown in Fig. 8 shows that, with the increase of the number of experiments, the resource allocation equilibrium pairs of different models are constantly changing. However, compared with the traditional model, the balance degree of resource allocation of the model in this paper always remains above 85%, which is significantly higher than the traditional model, indicating that the application advantages of the model in this paper are more obvious.

4 Conclusion

The balanced allocation of basic education resources refers to the allocation of roughly equal educational resources and educational conditions between regions, between schools within regions, and between groups, so that every educated person has a fair opportunity to receive education and guarantees the education of the educated. The right to education promotes the democracy and fairness of education and the development of students themselves. There are many factors that affect the balanced allocation of basic education resources. In order to implement quality education, we must overcome these factors, fundamentally change education awareness, increase economic investment to manage and utilize educational resources rationally, and quickly realize basic education. Shift of focus of work.

Therefore, this study proposes a balanced allocation model of online education resources of economics and management in colleges and universities based on parallel clustering. Firstly, an online education resource database is established by using the principle of parallel clustering, and a large number of economics and management teaching resources are stored in this database. Then, an information management platform is constructed to realize the balanced allocation of resources according to the field relationship of educational resource cloud on the basis of optimizing the evaluation index of balanced allocation of educational resources.

According to the verification results, the model presented in this paper has high practicability in practical application, and the balance degree of resource allocation is always above 85%, which fully meets the research requirements.

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Research on Data Classification of Online English Teaching Platform Based on Deep Neural Network

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Abstract. Due to the diversity of online English teaching platform data, the accuracy of its classification results is low. Therefore, a data classification method of online English teaching platform based on deep neural network is proposed. In order to reduce the difference attribute between the data, the data of online English teaching platform are normalized. On this basis, the attributes are discretized, the corresponding attribute codes are established, and two constraints are constructed. The deep neural network is used to classify the data of online English teaching platform. The test results show that the accuracy of data classification can reach more than 98.0%.

Keywords: Deep neural network · Online English teaching platform · Data classification · Data normalization · Mean method MapReduce · Attribute discretization

1 Introduction

Network education is an advanced modern distance education method based on computer-aided education with the development of computer network technology. With the maturity of network technology and its rapid popularization, The development of network education is also in full swing. Network education overcomes the limitations of traditional education on both sides of teaching in time, space and real-time interaction. Make learners more flexible and free in learning content, learning form, learning time, learning place and so on, Fully mobilize learners' enthusiasm [1]. These characteristics undoubtedly make network education the best way to realize lifelong education. Network education realizes the fairness of education, the openness of objects, time and space, and resources. Network education realizes the autonomy of learning. Network education realizes the efficiency of education, and network education realizes the diversity of education [2]. It is because of so many advantages of network education that network teaching, as the product of educational informatization, has developed unprecedentedly, a variety of online education platforms are emerging one after another. However, careful

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observation of these prosperous educational platforms still has some problems [3]. The first is the lack of personalization, which makes it difficult to teach students according to their aptitude. For technical reasons, the web-based education platform is usually centered on the website, and what each learner sees is the same fixed and pre-designed content [4]. If there are few learning resources on the platform, the problems will not be exposed. With the increase of resources on the platform, the common problem is that learners hope that the learning content does not know where to put it. No matter how many times they log in, they have to repeat the fixed path again and again, unless they collect the link of the content, but if learners do not have a fixed machine, the file cannot be collected [5]. In this case, people increasingly hope that the web-based learning platform can change from the original website centered learning mode to the learner centered mode, automatically or semi automatically adjust the web content to suit each learner's interests, and make each learner feel that the platform is to provide services for him. The second is the lack of monitoring of the learning process and formative evaluation. In the traditional classroom teaching method, teachers can have an insight into learners' learning situation according to learners' classroom performance, while online education is a personalized learning in which teachers and students are separated. Generally, learning resources will not change when they are put on, which will widen the distance between teachers and learners, lack of understanding of learners' learning situation and lack of communication between learners. Moreover, network education is a national learning, and learners vary greatly, which is not convenient for teachers to fully understand learners' learning situation, and it is difficult to control the learning process [6]. Formative evaluation refers to the continuous evaluation to make the teaching activities better in the process of a certain teaching activity. It can timely understand the effect of teaching and the progress and existing problems of learners' learning, so as to feed back in time, adjust and improve teaching in time. Constructivism believes that we should pay attention to the analysis and evaluation of learners' learning process, support and encourage the cultivation of innovative thinking and ability, so as to correctly evaluate learners' final learning effect [7]. Therefore, in network teaching, we should pay attention to tracking and feedback the network teaching system in the process of real-time teaching and learning, find problems in time, feed back to the evaluation object or implement the remedial scheme according to the remedial measures to reduce losses [8]. Finally, there is the problem of lost navigation. The arrangement of knowledge in network teaching is a nonlinear structure, which has advantages in meeting the needs of different learners. However, if there is no good navigation system, it is easy to make learners lose in complex hyperlinks. In addition, due to the certain order of knowledge, for learners with poor learning ability, Without personalized learning guidance, it is easy to feel at a loss about learning [9]. In addition, the waste of resources is also a problem worthy of attention. The site has accumulated a large amount of information conducive to teaching, such as user access log files, registration information, Q& a information, examination information, communication information and learning progress information. These information has not been effectively utilized in many network teaching platforms, resulting in a great waste of resources [10].

Due to the diversity of online English teaching platform data, the accuracy of traditional online English teaching platform data classification methods has decreased.

Therefore, based on the normalization of online English teaching platform data, this paper uses deep neural network to classify the data, so as to ensure the accuracy of online English teaching platform data classification. On this basis, its effectiveness is verified by experiments. Through the research of this paper, it is expected to provide reference for the resource classification of relevant teaching platforms.

2 Data Preprocessing of Online English Teaching Platform

In the process of designing the data classification method of online English teaching platform, in order to effectively reduce the difference attribute between the data, the data of online English teaching platform are normalized. In order to ensure the data processing speed, the data mean method MapReduce method is adopted to improve the data processing speed, in order to provide an important data foundation for the subsequent online English teaching platform data classification, and make outstanding contributions to the further development of the online English teaching platform data classification technology.

2.1 Data Normalization Processing

The raw data value range of the online English teaching platform is too wide. In order to facilitate the realization of BP network training in MATLAB, the data needs to be normalized before use. Data normalization is actually a way to simplify calculations. In theory, it converts the results of a dimensional expression into a dimensionless expression, so as to avoid different physical meanings and differences. Dimensional input variables produce inequality when used. For example, pronunciation generally exists in the form of sound source, while the measured grammar score is in the form of words. It is obviously inappropriate to compare and process these two attributes only in a numerical sense. In fact, the specific role of normalization in statistics is to summarize the statistical distribution of a unified sample. Normalized between [0, 1] is a statistical probability distribution, normalized between [−1, 1] is a statistical coordinate distribution. Since the collected data units are not consistent, this paper needs to normalize the data [−1, 1], and there are many normalization methods. In order to simplify the operation, the text is transformed by a linear function, and the expression is as follows:

$$y = (x - MinValue)/(Max\,Value - MinValue) \tag{1}$$

In the formula, x is the data value before conversion, y is the data value after conversion, and MaxValue and MinValue are respectively taken from the maximum and minimum values of the attribute in the sample. In the design of this paper, when the data is loaded, the click data normalization system will realize the normalization of the original data in the way of linear function transformation.

2.2 Data Mean Method MapReduce

By analyzing the principle of Hadoop, it can be found that the biggest difficulty in implementing BP neural network on the cloud platform is how to abstract the BP algorithm running on a single machine into two functions of Map and Reduce to realize parallel computing. Since only the content of the neural network training part needs to be implemented under the Hadoop platform, the input content is only the training sample set. Hadoop supports the HDFS file system, so the first step before MapReduce the algorithm should be to decompose the training sample set files into multiple small data sets and ensure that they can be processed in parallel [11]. In the data set division stage, first, the training sample set file should be decomposed into a key/value pair such as (file line number, sample item > key/value pair, and the size of the decomposed data block (the default value is 64 MB) needs to be configured. With these operations after that, the framework can divide the file, and send each divided data block to each Datanode node computer for MapReduce calculation. Next is the Map stage, when the framework divides the divided data that can be processed in parallel After the block is sent, the Map class will call the member function map under the class to receive the sent data block. In the map function, you first need to set the topology of the current training BP neural network, and then put the data in the function. The block is decomposed into input components and target output components. According to the calculation principle of the BP algorithm, it can be known that after each comparison error, the network will produce a local gradient change to the connection weights. After each Map task is executed, it is not Eager to write the generated modified key/value pairs into the data block file, but temporarily store them in the local system file, and then use them as input for local reduction operations when the member function is called and combine is called. All intermediate key/value pairs with the same key value are also collected to facilitate the parsed Reduce operation.

For this reason, in the Reduce phase, this paper firstly calls the member function reduce after the Reduce class receives the completion signal sent by the Map function to reduce the key-value pairs sent over. In the function, the gradient change generated in the Map stage is used as input, and the reduction operation is performed through the following process.

$$\begin{cases} sum \leftarrow 0, count \leftarrow 0 \\ sum \leftarrow sum + value \\ count \leftarrow count + 1 \\ sum/count = \sum_{i=1}^{m} \Delta\omega/i \end{cases} \tag{2}$$

Among them, sum represents the summation function, count represents the counting function, $\Delta\omega$ represents the gradient change amount, i represents the gradient order, and m represents the total order. Based on this, after each reduce task is completed, the system will output a - shaped final key-value pair and send them back to the Namenode node. After receiving the information, the system will call the job() function pair Each weight in the existing BP neural network is updated in a batch process, and the system saves multiple weight matrices between the BP networks to the global variable configuration file supporting cloud computing. In this way, the whole process of network training MapReduce is completed. In the next training, each time MapReduce is completed, the global variable configuration file will be updated to ensure that all computing nodes use the data trained BP neural network to keep synchronized.

After executing the above MapReduce process for many times, like the traditional BP network training mode, the variation of the weights between the layers in the network will become smaller and smaller. When the overall error reaches the target requirement, the network training can be ended. From the data point of view, the trained BP neural network includes the threshold matrix of each layer of nodes and the weight matrix connecting them, as well as the configuration information file that saves the topology of the BP neural network, so that it can be easily transplanted to a specific the data is classified in the online teaching platform area.

On this basis, this paper proposes that the overall decomposition idea of BP algorithm still uses the traditional error direction propagation method to train the network. The whole process iteratively updates the network weights until all the weights converge to a fixed value (that is, the classification error meets the expected requirements). Through the analysis of formula (2), it is easy to find that after the algorithm is decomposed, the modification of individual weights is temporarily stored. After the end of one training content, their mean value is loaded into the weights as the local gradient change to correct it. In this paper, this method is called data mean method MapReduce.

3 Data Classification of Online English Teaching Platform

3.1 Basic Steps of Data Classification Based on Deep Neural Network

When using deep neural network for data classification, this paper mainly consists of the following basic steps.

(1) Attribute discretization and attribute coding

Attribute discretization is a data preprocessing method to discretize continuous attributes by dividing the attribute value domain into several intervals. Before classifying the data, almost all continuous attribute values should be discretized to reduce the possibility of attribute values. Attribute coding is a data preprocessing method according to the characteristics of deep neural network activation function. Because the depth neural network adopts S-type activation function, most of the negative real number mappings are infinitely close to the value of 0, while most of the positive real numbers are infinitely close to the value of 1. Therefore, the discretized attributes are represented by attribute coding based on 0–1 sequence. The advantage of 0–1 coding is that it can provide as large an independent variable definition domain as possible for the target output approximation of neural network self-learning. For example, if a discretization and coding representation of the difficulty field in a database can be shown in Table 1.

3.2 Parameter Settings of Deep Neural Network

Selection of Learning Rate

The learning rate in the standard BP algorithm is taken as a positive value n, n = (0, 1). This will lead to the inconsistency between the learning process of BP algorithm and

Table 1. Discretization and encoding representation of difficulty attribute

Attribute discrete interval	Attribute encoding
Simple	000
Medium	001
Difficult	010
Difficulty	100

the expected learning process. Next, n is used to analyze this inconsistency. For the deep neural network with S-type activation function, there are only two cases of target output of neurons in the output layer when BP algorithm is used for data classification, that is, the target output is 0 or the target output is 1. Then the connection in the corresponding neural network, there are only two methods to adjust the weight and the threshold of neuron node.

For the neuron whose target output is 1, formula (3) is used to calculate the adjustment amount of weight, and formula (4) is used to calculate the adjustment amount of threshold.

$$\Delta W_{jk} = \eta err(\overline{x}) \tag{3}$$

$$\Delta G_{jk} = \eta err(\overline{x})V(\overline{x}) \tag{4}$$

Among them, ΔW_{jk} represents the weight, η represents the transfer coefficient, err represents the error, ΔG_{jk} represents the adjustment amount, V represents the transmission speed, and $\overline{x}$ represents the processed data value before conversion.

On this basis, for neurons with target output of 0, formula (5) is used to calculate the adjustment amount of weight, and formula (6) is used to calculate the adjustment amount of neuron threshold.

$$\Delta W_{jk} = \eta err_k(\overline{x}) \tag{5}$$

$$\Delta G_{jk} = \eta err_k(\overline{x})V(\overline{x}) \tag{6}$$

where err_k is the total error and k is the number of neurons.

For S-type functions, most of the real numbers belonging to empty sets are mapped to numbers infinitely close to 1, while most of the real numbers belonging to forward are mapped to numbers infinitely close to 0. Therefore, if a neuron k in the output layer is expected to produce an output as close to 1 as possible, the input net of the neuron should be a large positive number; On the contrary, if it is expected to get an output as close to 0 as possible in an output neuron k, the input net of the neuron should be a small negative number. It has been known from the previous chapters that the positive and negative of net is associated with the positive and negative of the connection weight of connecting neuron k and the positive and negative of the output of neuron sending information to neuron k through the connection weight. However, in the deep neural network, the output value of any neuron is always positive, so the expected input can only be obtained by adjusting the positive and negative connection weight.

If a positive learning rate $n \in (0, 1]$ is adopted, for the first case of threshold and weight adjustment, the conclusion obtained by analyzing formula (3) and (4) is that for neurons whose expected output is 1, BP method of learning is to minimize the size of the connection weight associated with the neuron, which contradicts the theoretical learning process of the above analysis; for the second case of threshold and weight adjustment, analyze formula (7), formula (8), the same Contradictory conclusions are drawn. Therefore, an improved strategy for the value of the learning rate can be drawn. Therefore, the learning rate should be in the interval $[-1, 0)$, denoted as -η.

On this basis, after taking the learning rate as $-\eta$ in this paper, formula (3), formula (4), formula (5), formula (6) are transformed into formula (7), formula (8), formula (9) respectively) and formula (10). Since the value range of the sigmoid function is $[-1, 0)$, the values of formulas (7) and (8) are always positive, while formulas (9) and (10) are negative. Therefore, the learning rate is guaranteed by using $-\eta$. Therefore, the BP learning algorithm should positively adjust the weights and thresholds connected to the neuron nodes whose target output is 1, and negatively adjust the weights and thresholds connected to the neuron nodes whose target output is 0. Basic learning principles toward conditioning.

$$\Delta W_{jk} = -\eta err(\overline{x}) \tag{7}$$

$$\Delta G_{jk} = -\eta err(\overline{x})V(\overline{x}) \tag{8}$$

$$\Delta W_{jk} = -\eta err_k(\overline{x}) \tag{9}$$

$$\Delta G_{jk} = -\eta err_k(\overline{x})V(\overline{x}) \tag{10}$$

In this way, the learning rate of deep neural network is selected.

Setting of Learning Depth

Based on the above, the correctness of the basic principles of BP algorithm learning is guaranteed. However, only optimizing the learning rate can not ensure that the learning of neural network will not enter the local optimal solution. Because the selection of learning rate does not involve the details of the adjustment of weight and threshold in the network by BP learning algorithm, and the emergence of local optimal solution is caused by the improper control of weight and threshold adjustment. Therefore, this paper discusses some strategies and algorithms to detect and control the adjustment process of weight and threshold of BP algorithm. The basic starting point of these strategies and algorithms is the depth setting of sample learning.

The learning depth of depth neural network for a training sample is evaluated by the mean square deviation of the actual output of each output node and the target output of each node calculated by neural network. The intuitive understanding seems to be that the smaller the value of the energy function, the better. Through the learning of the training samples, for the output neuron with target output of 1, its input connection weight should be all positive; For the output neuron whose target output is 0, its input weight should be all negative. However, this conclusion is wrong. Once the above conclusion is established, for any sample with different classification labels, the termination condition for learning by BP algorithm has been established, and the obtained neural network is a local optimal network. Therefore, we can get a constraint that restricts the sample learning of B Ye algorithm into extreme depth.

Constraint 1: When the deep neural network adopts the BP algorithm for sample learning, the learning of any sample should not be based on adjusting the input connection weights of all output neurons whose target output is 1 to be positive and the output neuron with all target output being 0. The input connection weight adjustment is negative at the cost. Even before the learning of the samples by the BP algorithm enters an extreme depth, it is possible to generate a local optimal network that makes the termination condition of the BP learning algorithm true. Therefore, it is necessary to further explore more powerful constraint adjustment on the basis of constraint 1, in order to thoroughly detect and prevent the generation of local optimal solutions. Suppose the desired sample learning depth is controlled by the depth constraint parameter ε. Then formula (11) holds for the output neuron whose target output is 1, and formula (12) holds for the neuron whose target output is 0.

$$\Delta W_{jk} < \varepsilon \tag{11}$$

$$\Delta G_{jk} < \varepsilon \tag{12}$$

Using the formula (11) and formula (12), another constraint condition of the deep neural network on the learning depth of the sample can be obtained, as shown in the formula (13).

$$\ln\left(\frac{\sqrt{\varepsilon}}{1-\sqrt{\varepsilon}}\right) < \Delta W_{jk} V + \Delta G_{jk} < \ln\left(\frac{1-\sqrt{\varepsilon}}{\sqrt{\varepsilon}}\right) \tag{13}$$

On this basis, the first constraint of depth neural network on sample learning depth is constructed.

Constraint 2: Given a learning sample x, once formula (13) holds, the input connection weights of output neuron k should not be adjusted. The key to using Constraint 2 is how to determine the value of ε. Before discussing the value of ε, consider a simple classification problem. Assuming that the class identifier of a deep neural network is identified by a 0–1 string of length 1, and the total number of samples is 10, the most ideal classification result should be as shown in Fig. 2. However, if the neural network has been trained to distinguish samples with a class ID of 1 from samples with a class ID of 0, then the neural network has met the basic requirements for data classification, and it can be considered that the neural network has the division ability of this sample group. In other words, there is no need to demand that the neural network must make the actual output of all neuron nodes with the target output of 1 infinitely close to 1, and the actual output of the neuron nodes with the target output of 0 to be infinitely close to 0, it is considered that the neural network has completed the learning. Moreover, a large number of facts have proved that such neural networks rely too much on training samples, and lose the actual classification ability and anti-noise ability.

According to the above classification idea, when the absolute value of the difference between the actual output and the target output of an output neuron satisfies formula (14), the neural network has completed the correct classification of sample x.

$$0 \leq |\Delta err_k(\overline{x})| \leq 0.5 \tag{14}$$

According to the further derivation of formula (14), it can be determined that the value interval of the learning depth constraint parameter ε is [0, 0.25/K), where K is the number of output neurons. The value of ε follows the following two rules.

Rule 1: If the learning purpose of the neural network pair is general approximation, ε is in the interval [0.25/2K, 0.25/K), and the larger ε is, the better the learning of the neural network.

Rule 2: If the learning purpose of the neural network pair is strict approximation, ε can take a value in the interval [0, 0.25/2K), and the smaller ε is, the better the learning of the neural network.

3.3 Data Classification Method Based on Deep Neural Network

Combined with one strategy and two constraints that have been proposed above, an improved algorithm of BP learning algorithm when using neural network for data classification can be given, which is referred to as LMDBP algorithm. Before learning a sample, the LMDBP algorithm will strictly detect whether the conditions for the emergence of the local optimal network are established, so as to formulate a sample learning strategy. The core idea of LMDBP is to retain strong classification ability for the deep neural network as much as possible during sample learning, and complete the learning task of classifying samples by ensuring the proper approximation of the actual output of each output neuron and the target output. This can not only avoid the problem of falling into the local optimal solution due to improper sample learning depth when the neural network uses the BP algorithm to learn, but also plays a certain role in preventing the learned knowledge from being masked by the new sample learning. The detailed description of the LMDBP algorithm to achieve data classification is as follows.

Algorithm: LMDBP algorithm
Iaput: learning sample set x, deep neural network net.
Outpat: Completely learned deep neural network without local optimal solution netMethod.
Set the learning parameters, and use random numbers between [-1,1] to initialize the weights and neuron node thresholds of the net;
Awhile termination condition does not hold;
for all samples $\overline{x}$;
for any hidden layer node and any output layer node j;
for any output node k;
for each hidden layer in the neural network from back to front {
for the data of each hidden layer with node j;
for each neuron k of the output layer;
if

$$\ln\left(\frac{\sqrt{\varepsilon}}{1-\sqrt{\varepsilon}}\right) < \Delta W_{jk}V + \Delta G_{jk} < \ln\left(\frac{1-\sqrt{\varepsilon}}{\sqrt{\varepsilon}}\right)$$

($\overline{x}$ is target output at neuron k is 1) && (all input weights of neuron k are positive))
($\overline{x}$ is target output at neuron k is 0) && (all input weights of neuron k are negative))){
Do not adjust the threshold and input connection weight of neuron k;
}
else {

$$\Delta W_{jk} = -\eta err(\overline{x})$$

$$\Delta G_{jk} = -\eta err(\overline{x})V(\overline{x})$$

for each neuron j of each hidden layer;

$$\Delta W_{jk} = -\eta err_k(\overline{x})$$

$$\Delta G_{jk} = -\eta err_k(\overline{x})V(\overline{x})$$

In this way, the classification processing of the data is completed.

4 Trial Test

4.1 Construction of Hadoop Experimental Environment

When building the Hadoop platform, according to the hardware conditions of the laboratory, this paper uses 7 computers, one of which is a Namenode node, and the remaining 6 are used as Datanote nodes. The configuration of the node machine is Intel Core Duo 2.1 GHz processor, 2 GB memory, 300 GB hard disk, and the software environment is Red Hat Enterprise Linux 5 operating system, JDK1.6.0_20, Hadoop0.21.0. The deployment process for Hadoop cluster is:

(1) IP address configuration: 7 machines are named: Namenode, Datanode1, Datanode2,…, Datanode6, representing 1 Namenode node and 6 Datanode nodes respectively, because the platform interaction method uses TCP/IP method, then you only need to assign an address in one network segment to 7 nodes. The final allocated address segment is 192.168.1.1–192.168.1.6, and they are all set to fixed P addresses.
(2) Set the user directory: In order to facilitate the update of unified distributed files, the Hadoop platform requires that each node has the same directory, and each machine has the same account name hadoop. There is a directory structure of /hadoop/hadoop-0.21.0, and the open source hadoop-0.21.0 compressed package is extracted to a folder under this directory.
(3) SSH settings: After Hadoop is started, the Namenode node uses SSH (Secure Shell) to start and stop the daemon process on each Datanode node, which requires us to use passwordless public key authentication when configuring SSH. First of all, you need to install the SSH server on each node. In this article, OpenSSH is used, which is an open source implementation of the SSH protocol.
(4) Setting the configuration file: Hadoop configuration information is stored in the masters, slaves and hadoop_env.sh.hadoop-site.xml files in the hadoop-0.21./conf directory. In addition, a hard disk with HDFS file system needs to be formatted in each node.

After completing the above four steps, the entire Hadoop cloud computing platform has been built. At this time, it is only necessary to write the Map function and Reduce function for parallelization of the BP algorithm through the Map interface and the Reduce interface, respectively. After setting the running parameters of MapReduce, the training data set can be loaded from the local HDFS file system, and then the cluster nodes can be started for parallel computing.

Use the web crawler to crawl the online English teaching platform data, including browsing data, evaluation data, query data, learning behavior data and learning performance data. These data are integrated to obtain the experimental data set. The number of experiments used in this experiment is 6.39 GB.

4.2 Classification Results and Error Analysis

Determination of the Number of Hidden Layer Nodes

In this experiment, BP networks with different hidden layer node points are trained to achieve the same target network accuracy of 0.01. It is worth noting that the improved BP algorithm proposed in this paper is used in the next series of BP network training. The network accuracy given during training is only the network error for the training sample set, and each value comes from the classification deviation of a single sample, so it can not represent the performance of the whole network. Finally, this experiment uses the mean square error MSE of the network to the classification results of the test set to measure the classification performance of the network under different structures. Through the classification result error and the training times required to achieve the accuracy of the target network, the best classification structure suitable for the data set is calculated. In the whole process, this experiment counts the MSE of the network when the hidden layer has 10 to 40 contacts. The results are shown in Fig. 1:

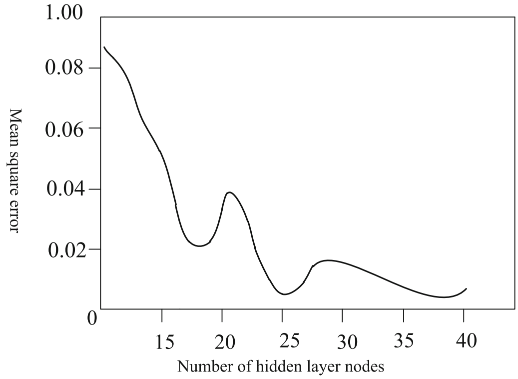

Fig. 1. The relationship between the number of hidden layer nodes and the mean square error

Analysis of Experimental Results

According to the comparison of the classification errors and convergence rates of BP networks composed of different numbers of hidden layer nodes, it can be found that when the number of hidden layer nodes is 24, the network MSE basically reaches the minimum value. At this time, the number of training times required to achieve the target network accuracy is 11710 times can also be accepted by the experiment. And through comparison, it can be found that the continuous increase of the number of hidden layer nodes after more than 24 does not bring significant improvement to the network performance, but causes the convergence speed to be significantly slower. To this end, the BP network topology used in the classification experiment of the data set in the online teaching platform is finally finalized: 10 nodes in the input layer, 24 nodes in the hidden layer, and 6 nodes in the output layer.

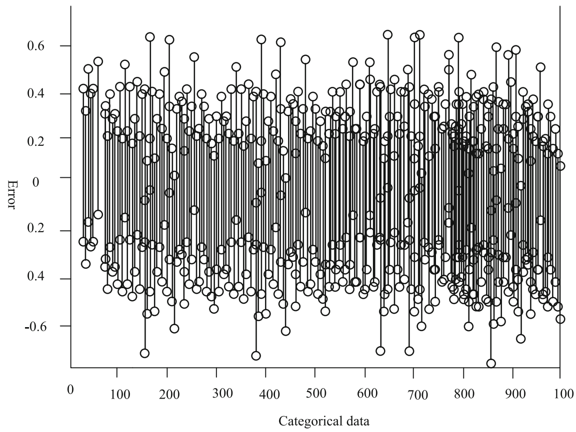

Fig. 2. Classification results

The final classification experiment is performed with the selected network structure, and the results are shown in Fig. 2:

Figure 2 shows the classification result error, which is a direct error, that is, the error obtained by directly subtracting the actual result from the classification result root. It can be seen that under the optimal BP neural network determined by the experiment, our results are still very ideal, and the mean square error MSE is about 0.015 at this time. By using the errsurf function provided by the neural network toolbox in MATLAB, the error surface of a neuron node in the network during the training process can be easily obtained. Obviously, the surface has only one extreme point, so in the process of using the improved BP algorithm to train the network to achieve convergence, the correction of the neuron weights does not fall into a local minimum.

Finally, this paper sets the classification rule that the error is within 0.5 as the correct classification result, and the statistical classification results are shown in Table 2. The results show that the final classification accuracy is more than 98%.

Table 2. Comparison of network learning rate and training times

Experimental dataset	Classification type	Training set	Test set	Number of accurate classifications/%	Classification accuracy/%
BL25151K110	First classification	1000	1000	981	98.1
BL25151K110	Cross-validation	1000	1000	989	98.9

During the whole classification experiment, the time consumed by recording 11710 times of BP network training for a single machine is about 257 s, while the time consumed by classifying 1000 groups of test sets is less than 1s. It can be seen that the bottleneck of BP neural network application is that there is no improvement problem in its training convergence speed, and a higher classification effect is achieved. The accuracy rate is above 98.0%.

In order to verify the effectiveness of the improved BP algorithm proposed in this paper, this paper implements a data classification system in an online teaching platform under the GUI environment of MATLAB, and conducts a large number of classification experiments through this system. The results show that within a certain training interval, the improved BP algorithm can obviously speed up the convergence speed of the network. In addition, this paper also tests the performance of BP neural network with different topological structures under this system. Through the combined analysis of network classification error and convergence speed, a BP neural network topology suitable for this data type is finally determined, and the It is used to conduct data classification experiments on the prediction dataset at the end. The classification results show that when the BP neural network is used to classify the data set in the online teaching platform, the classification success rate is as high as 98%, which can meet the general data classification requirements. By analyzing the error surface of a single neuron, it was found that the network did not get stuck in a local minimum. It can be seen that the improved BP algorithm proposed in this paper improves the performance of the BP neural network to a certain extent. By comparing the time consumed by BP network training and the time consumed by classification, this paper finds that even under the improved algorithm, the convergence speed of the network is still not ideal. Because in the online teaching platform, there are a lot of networks with very special environment. For example, in the coal safety information collection system, the source of the data in this paper, for the sensor network arranged in the mine several hundred meters, it is limited by energy and various environments, and it is difficult to achieve the computing power required for network training. At this time, it is necessary to consider the combination of the mature BP neural network and the core technology cloud computing technology in the online teaching platform to improve the classification performance of the network to adapt to various special environments. Finally, this paper discusses and realizes the cloud computing process of BP network. The experiment adopts the current popular Hadoop cloud computing platform. The main work in the experiment is to propose the MapReduce scheme of the BP algorithm. This scheme realizes the use of data in the online teaching platform by combining the mean method and the classification method by type. MapReduce of the classified BP algorithm. Finally, this paper presents the relationship between the speedup ratio of the BP algorithm and the computing nodes under the Hadoop cluster computing framework. Through the final results, it can be found that the use of cloud computing technology can greatly improve the convergence speed of the BP network.

The proposal and development of online teaching platform system has brought great opportunities and challenges to the existing Internet system. Facing the growing maturity of cluster computing technology, many algorithms are expected to break through their computing bottlenecks. Although this paper puts forward two experimental schemes of data classification under the system of online teaching platform, there are still some problems to be further studied:

(1) The online teaching platform system is too broad, and it is difficult to put forward a data classification scheme or model for all existing situations. Especially when dealing with the massive high-dimensional data in front of the future online teaching platform, whether the existing BP network algorithm is competent remains to be proved.
(2) At present, there is no exact theory to guide the determination of the optimal BP neural network topology. There are differences in different experimental environments. In this paper, the classification error comparison method of different structures is used to determine the final network structure. It is not difficult to find this way, and a large number of comparative experiments need to be done. Therefore, it is necessary to explore a simpler method to determine the network topology.
(3) Although this paper proposes a parallel training scheme of BP network based on Hadoop platform, there are still many immature problems in the actual cloud computing deployment. The MapReduce method used needs to be further improved to reduce redundant computation in the parallel process and achieve better cloud computing performance.
(4) BP neural network can be combined with many algorithms to improve performance, such as ant colony algorithm and genetic algorithm, and these algorithms can also

be MapReduce, so it can be studied to realize these algorithms under the cloud computing platform combination.

5 Conclusion

Online teaching platform is another new revolution in the world information industry after computer, Internet and mobile communication network. It has attracted great attention all over the world, involving all aspects of human life, work, health and social fields, and will have a significant impact on the future development of global economy and society. How to classify the data in the online teaching platform at the front end is very important, because there are unprecedented scale and extremely high dimension data in the online teaching platform system. Due to the diversity of online English teaching platform data, the accuracy of traditional online English teaching platform data classification methods has decreased. Therefore, based on the normalization of online English teaching platform data, this paper uses deep neural network to classify the data, so as to ensure the accuracy of online English teaching platform data classification. Therefore, this study can lay a solid foundation for the optimization of education platform and promote the further development of modern education.

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Data Optimization Query Method of Online Education System Based on Decision Tree

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Abstract. The traditional online education system data query method has the problem of unclear track data type, which leads to a long query time. To solve this problem, this study designs a data optimization query method of online education system based on decision tree. According to the teaching objectives of teachers and the characteristics of courses, extract the course characteristics of online education system, and adjust the data segmentation process, so as to extract the grid memory query index structure. Then select a field as the segmentation basis and mark, and use the decision tree to identify the trajectory data type. Finally, set the data optimization query mode by continuously predefined query interval. The experimental results show that compared with the other two query methods, the query time of this method is less, which shows that the application performance of the data optimization query method of online education system integrated with decision tree is better.

Keywords: Decision tree · Online education system · Data query · Data flow · New media technology

1 Introduction

Although continuous queries on data streams have a lot in common with queries in traditional database management systems DBMS. Parallel databases and SQL on Hadoop, as important development directions for large-scale structured data set processing, have their own advantages and disadvantages in practical applications, and have typical applicable scenarios and query characteristics, and cannot completely replace each other.

The data object of a query in traditional database management is the data set at the query time, and the result is returned to the user immediately. The storage organization mode and management method of the two architectures are quite different, which brings the problem that the data is not connected to each other. However, in the era of big data, the demand for horizontal connection and joint query between data sets is becoming more and more common. Therefore, establishing a collaborative query and analysis mechanism of multiple data sources across the system has always been an important issue concerned by academia and industry. Continuous queries run continuously on continuously arriving data.

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Continuous queries are the most common form of query on data streams. Continuous query reflects the status of data flow from the time of query submission. The simplest solution for collaborative query of multiple data sources is data migration. When the relational table involved in the SQL command is not in the system, use the ETL tool to read it from the outside and load it in. The results of continuous queries are stored, updated, or sent as data streams as new data arrives. For example, an aggregate query needs to update the current results frequently, while a join query only needs to continuously output new matching results. Apache Sqoop can transfer data in both directions between HDFS and relational databases, and is currently a relatively mature cross-system data connector.

At present, relevant scholars have carried out a series of studies on data query methods of education system, such as: Reference [1] proposes a low-latency and high-reliability data query mechanism in a dynamic network, which retrieves and returns the sensory data in the network according to user requirements. According to the monitoring events, the network is divided into several sub-regions, a reasonable backup quantity is calculated, and the source data is stored in the neighbor nodes according to the quantity. Select multiple neighbor nodes with smaller remaining energy and storage space as the next hop receiving node. Finally, it is concluded that the proposed query mechanism has higher query success rate, lower communication energy consumption and communication delay, but the description is not perfect for the problem of unclear trajectory data types. In reference [2], an analytical query optimization method based on window functions is proposed to partition operations. In-memory column store optimization technology and Spark distributed cluster computing are used to improve query performance. At the same time, its effectiveness is verified by a typical analytical SQL query example, but the problem of unclear trajectory data type has not been effectively solved. Therefore, it is necessary to enrich the relevant research data.

In view of the above problems, this study designed a decision tree-based data optimization query method for online education system. The specific design ideas are as follows:

(a) On the basis of analyzing teachers' teaching objectives and course characteristics, extract the course characteristics of online education system;
(b) Adjust the data segmentation process and extract the grid-like memory query index structure;
(c) Select a field as the segmentation basis and marker, use decision tree to identify the trajectory data type, and then achieve data optimization query through continuous predefined query interval.

2 Method Design

2.1 Extracting Course Features of Online Education System

This study takes "New Media Technology" as an example to extract the curriculum characteristics of online education system. This process is mainly designed into two modules, which are website content management module and mobile terminal application module.

The functions of the website content management module mainly include website related content maintenance and website content display of the investor education system. With the rapid development of Internet and mobile Internet based on digital technology, the transformation from traditional media to new media is an inevitable trend [3]. The administrator is responsible for the maintenance of website content. The main use cases include: news release, notice release, home page maintenance, simulation game management, document and video data management, teacher data management, knowledge competition, channel management, etc. New media technology covers most of the contents of digital publishing technology, and the fields involved are even broader.

Mobile terminal application module. The popular application based on mobile terminal is very popular. Simple classroom teaching cannot meet the students' immersive experience of learning effect. Front desk users mainly browse the relevant contents of the website, and the use cases mainly include: home page browsing, news browsing, notice viewing, teacher viewing, document viewing and downloading, on-site search, competition information viewing, game viewing and downloading, etc. Cutting edge new technologies, including 3D printing, virtual reality technology, smart wear, smart home and other knowledge, are more suitable for online teaching mode. The most important thing of similarity retrieval is the measure of similarity, which can also be said to be the measure of the distance of elements in space. The commonly used similarity (distance) measurement in similarity retrieval is expressed as follows:

$$G(\phi) = \frac{(\phi - 1)^2}{H} \tag{1}$$

In formula (1), ϕ represents the document similarity, and H represents the dimension vector.

The users involved in this module mainly include: micro-course administrators and front-end users. The biggest feature of micro-lecture is that it is short, generally controlled at about 10 min, but it is a complete teaching activity. Learning services such as how to interact with teaching content, interact with teachers and students, and get answers from teachers. Micro-course administrators are responsible for creating micro-courses and managing and maintaining all resources involved in micro-courses. The main use cases include course management, homework management, exam management, questionnaire management, statistical information, registration approval, notification release, etc.

Before the design and development of the online learning system, the development process of the platform should be clearly planned. First, the necessity of the development of the online learning platform should be determined. According to the characteristics of students, analyze the needs of students. Institutional users are mainly responsible for the online course registration of all individual users under the institution, while individual users are entities for online learning, and individual users can be affiliated to an institutional user. According to the teacher's teaching objectives and the characteristics of the course, analyze the needs of the course effect. Analyze platform framework requirements based on online education models. Secondly, based on the theoretical basis of the online learning model, combined with the actual needs of this study, the guiding ideology of the platform is clarified, and an overall plan for the platform is further developed. Page adaptability, the system user interface should be able to reflect the requirements of mobile Internet applications, provide a responsive user interface, and automatically provide a display method suitable for the user's device according to the resolution of the user's device (computer, mobile phone, PAD, etc.). Including layout, content, style, etc., to achieve page adaptive. Based on this, the functional design of the platform is carried out according to the plan, including basic use functions, platform management functions, system setting functions, course management functions, and user management functions.

2.2 Adjust the Data Segmentation Process

Application structured data includes basic device information, content push sequence information, user behavior information and related statistics. The characteristics of analyzing data can lay the foundation for subsequent data query. Therefore, this study adjusts the data segmentation process before designing the specific query process.

In unstructured data management system, query processing module is an important part. According to the characteristics of unstructured data, it is very important to design a reasonable query processing framework and query optimization strategy for fast and effective access to unstructured data. The content push sequence is edited by the administrator in advance, and then pushed to each user. Therefore, the content sequence is also mainly used for user query operation.

The traditional structured query processing process is: first, the translator translates the query request to generate the query expression, then the optimizer optimizes the query expression to obtain the optimized query plan, and finally the executor selects the optimal query plan for execution to obtain the query results [4, 5]. User behavior information is the log information generated when the user uses the mobile terminal, which mainly records the times and duration of browsing advertisements using the device. The main operations of query processing include selection, connection, projection, aggregation function, sorting, etc.

The methods of query optimization include optimization based on cost estimation and Optimization Based on heuristic rules. Due to the delay of objects, the number of objects from the data stream that need to be stored on the query Skyline is relatively small. In addition, objects on the data stream are highly dynamic, so it is not beneficial to establish an index structure for data objects. In this section, a memory based grid like and flexible query index structure is proposed. After the roles of query and data object are exchanged, it is concluded that the optimized data segmentation method is as follows:

$$L = l \sum \frac{(\eta - l)}{2} \tag{2}$$

In formula (2), η represents the query vector, and l represents the vector attribute. Statistical information mainly includes information such as the number of times users browse advertisements, user points and so on. This information is mainly written into the table by the time period when the user activity of the timed statistics task is low.

In the process of unstructured query processing, in addition to the operations contained in structured data query processing, there are two important operations, similarity retrieval and similarity connection. Therefore, statistical information is mainly used for user query. The number of application users is expected to be about one million, with a large number of read and write operations. Similarity retrieval refers to finding similar elements in the set composed of such elements given an element. For example, the paper duplicate checking system uses text similarity retrieval, Google's image search function uses image similarity retrieval, and the matching music on the mobile phone according to humming is audio similarity retrieval.

In order to ensure that the database system can handle the user's reading and writing needs and obtain a good user experience, the data should be read and written separately, and the large concurrent read data and the large concurrent write data should be vertically divided and stored in different databases. There are many reasons for the generation of uncertain data, which may be due to the accuracy error of equipment recorded data, the network delay caused by real-time data transmission, the impact of data environment (e.g.: the impact of high-voltage line on equipment), data loss, the need for data privacy protection (e.g.: the disturbance information inserted by timing privacy protection) Data represents the need for granularity (e.g.: cumulative sum, mean value, maximum value, minimum value in cumulative query), etc.

Similarity connection is an extension of database connection operation on unstructured data. It looks for element pairs satisfying similarity constraints between two sets with the same element types. It plays an important role in the fields of data cleaning, data duplication checking, plagiarism detection and so on.

Through further analysis, it is found that due to the large number of users, storing all query intensive information in a database cannot meet the needs of system query performance. Therefore, it is necessary to further segment the data. Unstructured query processing framework should improve the structured query processing framework for the unique query operations of these two unstructured data. The amount of concurrent queries for content sequence information and statistical information exceeds the capacity of a single database, so the two information related tables are placed in different databases to better meet the needs of user queries. The user behavior information table is used to store the user browsing advertising record information.

2.3 Decision Tree Identification Trajectory Data Type

Decision tree is an important score subject in machine learning field. Decision tree is a prediction model which can reflect the mapping relationship between object attributes and object values [6, 7].

In the decision tree, nodes represent objects, and each bifurcation path represents a possible attribute value, while each leaf node corresponds to the value of the object represented by the path from the root node to the leaf node. The decision tree classifies the data. In this process, the probability that the expected value of net present value is not less than zero is obtained, so as to estimate the risk of the project and judge whether the project is feasible. The decision tree has only a single output. If you want to have complex output, you can establish an independent decision tree to deal with different outputs. Decision tree is a tree structure, which contains three kinds of nodes: root node, internal node and leaf node. It is a graphic method of intuitively using probability analysis. The decision tree consists of decision point, state node and leaf node. According to the principle of decision tree, the expression formula of expected information required for sample classification is obtained:

$$Info(T) = -\sum\nolimits_{j=1}^{i} \log_2\left(\frac{1}{T_{ij}}\right) \tag{3}$$

In formula (3), T represents any sample, i represents the proportion of elements, and j represents discrete attributes.

In a decision tree, each leaf node contains a class label, and the root node and internal nodes represent a test on an attribute. It is an inductive process from top to bottom, divide and conquer. Decision trees are a typical representative of learning discrete-valued functions, but they are not suitable for some specific Boolean problems. Decision trees are generally generated according to a top-down recursive method.

After the decision tree is constructed, it needs to be pruned. The pruning algorithm has two different methods: pre-pruning and post-pruning. Redundant attributes will affect the accuracy of decision attributes, so classification with decision trees is to perform feature selection on training data. Trajectory data has two characteristics of time and space. It is the data information generated by recording the movement process of the moving object, including the position, time, speed and so on of the sampling point. Its collection sources are rich and diverse, such as GPS, mobile services, mobile phone base stations, POS machines, vehicle recorders, etc.

Due to the large number of users, a large amount of recorded information will be written to the database every day. A single database can no longer meet the processing needs of such huge data. According to the collected objects, trajectory data can be divided into human activity trajectory, vehicle trajectory, animal activity trajectory and natural law activity trajectory. Therefore, it is necessary to horizontally segment the user behavior information table. To segment the user behavior information table horizontally, you need to select a field as the segmentation basis and mark. Through careful analysis, it can be found that the user's mobile phone number is regional, and the statistical analysis of the project is also analyzed on the basis of region. Before using trajectory data, we should first consider the preprocessing problems, such as data noise reduction, trajectory compression and trajectory segmentation. Trajectory preprocessing is one of the most basic tasks of trajectory data mining. Therefore, the horizontal segmentation of data according to the mobile phone number is more appropriate.

There are many kinds of segmentation algorithms for horizontal segmentation, such as modulo, hash, etc. Secondly, for the real-time system of online analysis, it is necessary to provide a fast and efficient trajectory query service, which requires an optimized trajectory data storage structure and query algorithm. If other algorithms such as modulo or hash are used, the regional characteristics of project data are destroyed, and the complexity of statistical analysis is also increased. In addition, when the number of users continues to increase in the future, the data can be divided according to regions in a more fine-grained manner, and the scalability of the system will be better. For trajectory query, there are mainly two types: nearest neighbor query and range query. There are usually two trajectories that need to be analyzed, historical data and recently generated data. According to these two kinds of data, we can analyze and mine a lot of trajectory data, such as analyzing the motion pattern of moving objects, analyzing the reachable area of the trajectory, anomaly detection and trajectory classification.

2.4 Set Data Optimization Query Mode

Join query is a common and expensive query in database. Because the data flow is infinite, unlimited memory is required if the connection query is processed in the traditional way. Therefore, connection operations on data streams usually have window restrictions.

Due to the fast flow rate of data flow, batch processing can be adopted instead of one data element [8, 9]. The return of query results is also scheduled, rather than updating the results every time the data arrives. In a sense, it can be considered that the result is also approximate. In the attribute level model, the probability database contains several tuples. Each tuple has an uncertain attribute value, which is described by discrete probability (or continuous probability density function). Obviously, these two advantages are more prominent after sequence data sorting. Single column sorting is relatively simple, and most storage structures provide this function.

The approximate method of batch processing can produce deterministic query results [10]. It is also a good query method on the data stream with mutation. Real time query is generally a single query or continuous query. Real time query makes the data flow management system more complex, because the system does not know the query in advance, so it is unable to optimize the query. The main flow of data query is shown in Fig. 1.

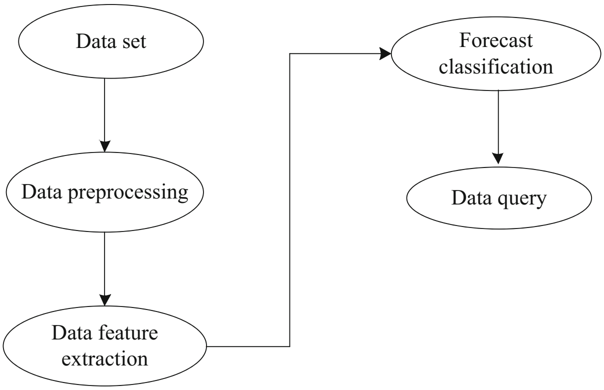

Fig. 1. Schematic diagram of the main flow of data query

As can be seen from Fig. 1, the data is temporarily cached and processed when the data flow speed drops. An algorithm that cannot deal with sudden peak flow rate can usually deal with the data of average flow rate. More complicated, real-time queries usually require accurate results, and some relevant data may have been lost before the real-time query is submitted.

In traditional database query processing, the data is large but limited, and the data scale is known in advance. The query results are returned immediately after the query is submitted. In contrast, in data stream query processing, queries are submitted in a dynamic data stream environment. However, when the data set is large, this task-centered data migration method will undoubtedly seriously affect the query performance.

External tables are also a common mechanism for solving collaborative queries. By creating external tables, splitting commands, and sending tasks to operational data sets, the overhead and performance loss caused by data transmission can be reduced. External tables essentially create virtual tables for data sources outside the system, along with internal entity tables to maintain consolidated database views. Users can make query requests transparently. After the SQL commands are parsed, operations on external tables are directly sent to other systems and the returned results are received. The query problem on data streams has two main challenges: The data on the data stream arrives at a very high rate.

Take network monitoring as an example to describe a data flow application scenario. System administrators can describe suspicious network packets (intrusions, rule violations, abuse, etc.) and submit them as queries to the terminal. Then, the network traffic continuously returns packets similar to the query submitted by the administrator. As a second example, let's look at advertising in the marketplace. Each user describes the attributes (price, color, size and weight, etc.) of the product they are interested in, and the system notifies the user whenever an advertisement matches the user's needs.

3 Experiments and Research

In order to verify the practical application performance of the data optimization query method of online education system based on decision tree, the following experiments are designed.

3.1 Experiment Preparation

The experimental basic environment consists of a Hadoop cluster containing three Linux servers, each of which is a node. The nodes are composed of PC servers, and the hardware is configured with two Intel Xeon CPUs, 32G memory, 2 TB hard drives, and Gigabit Ethernet cards. The Hadoop cluster consists of 1 Master node and 2 Slave nodes. The CPUs are 24 cores, 8 cores, and 8 cores, respectively. The main frequencies of the CPUs are 2 GHz, 2.4 GHz, and 2.5 GHz, respectively. The memory is 16 GB, 8 GB, and 8 GB.

Since the EduSoh test cluster includes 1 NameNode, the number of DataNodes is set to 20, 40, and 100 respectively. When the number of DataNodes is 20 and 40, use 48-port full-gigabit switches for interconnection; when the number of DataNodes is 100, they are divided into 5 groups, each group is connected by 24-port full-gigabit switches, and 10 Gigabit fibers are used on the 5 groups of switches. The switches are interconnected to ensure that the network environment will not affect the objectivity of the test results.

During the experiment, all requests are entered from the app.php file, and public files are stored in the edusoho/web directory, such as avatar files, js files, css files, etc. In order to keep the nodes at the same load, each DataNode is fixed to store SOGB of data, and the relational tables are partitioned and placed using the DPAZ data partitioning mechanism. Other files are in non-public directories such as app and src. So for security, choose Nginx server here.

3.2 Experimental Results and Analysis

In order to verify the effectiveness of the online education system data optimization query method designed in this paper, the traditional online education system data optimization query method based on data mining and the ant colony algorithm-based online education system data optimization query method are selected to compare with the method in this paper.. Test the time-consuming of the three methods to query data sets of different sizes, and the experimental results are shown in Table 1 and 2.

Table 1. Data set 150 GB query time (s)

Number of experiments	Data optimization query method of online education system based on data mining	Data optimization query method of online education system based on ant colony algorithm	The method of this paper
1	216.33	223.15	145.61
2	220.19	226.18	144.39
3	255.16	226.77	152.31
4	249.31	206.31	136.25
5	250.88	226.44	141.59
6	236.49	223.18	137.44
7	242.16	226.18	136.22
8	239.74	225.31	141.12
9	248.56	254.46	143.66
10	233.44	236.19	135.71

As can be seen from Table 1, the average query time of the online education system data optimization query method and the other two query methods are 141.43 s, 239.23 s and 227.42 s respectively.

Table 2. Data set 50 GB query time (s)

Number of experiments	Data optimization query method of online education system based on data mining	Data optimization query method of online education system based on ant colony algorithm	The method of this paper
1	168.31	161.54	86.22
2	158.91	158.36	82.03
3	152.37	146.16	84.19
4	166.25	157.22	83.67

(*continued*)

Table 2. (*continued*)

Number of experiments	Data optimization query method of online education system based on data mining	Data optimization query method of online education system based on ant colony algorithm	The method of this paper
5	155.49	148.49	84.14
6	161.55	153.18	83.22
7	158.12	145.85	83.46
8	162.11	150.36	82.59
9	158.59	146.99	83.19
10	152.22	148.25	82.08

As can be seen from Table 2, the average query time of the online education system data optimization query method and the other two query methods are 83.48 s, 159.39 s and 151.64 s respectively.

4 Conclusion

Aiming at the shortcomings of traditional methods in query time, this study designs a new data optimization query method for online education system based on decision tree algorithm. This method converts SQL commands into grouped subtasks on a data stream basis and generates a minimum-cost execution plan. Then, in the execution process, the operation mode of the execution plan is dynamically optimized to further reduce the startup waiting time and data transfer volume between sub-tasks.

According to the experimental verification, the proposed method achieves good application effect and requires less query time. However, due to the limited research conditions, the method in this paper still has some deficiencies. In the future research, the method will be further optimized in terms of query scope and directional query.

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Research on Online Mathematics Teaching Resource Integration Model Based on Deep Neural Network

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Abstract. Improving the quality of resource integration is one of the effective ways to improve the utilization of teaching resources. Therefore, aiming at the online mathematics course, this research uses the deep neural network as the basic means to carry out a new design of the teaching resource integration model. First, the overall design is carried out, including the model architecture, resource data transmission mode, data management mode, model function design and cloud platform configuration. Then, using the elastic computing technology in the field of deep neural network technology, based on the collection of relevant resources, the cloud storage and management of resources are implemented with the mathematics course courseware as the core and the extensible software as the support. Finally, in the deep neural network, the dynamically expandable and virtualized storage resources are used to provide the storage and access services of teaching resources, and the integration effect is improved by classifying the resource categories when uploading resources. Compared with the traditional model, the results show that the characteristics of this model are more prominent, and the application advantages in accuracy and resource reading speed are obvious.

Keywords: Deep neural network · Mathematics courses · Teaching resources · Resource integration · Cloud storage

1 Introduction

Distance education is a new form of innovative educational means. It combines modern Internet communication and multimedia network technologies to create a new era of information education. Distance education is mainly carried out between students and teachers, which improves the convenience of communication. Through multimedia technology, educational institutions can also better communicate with users.

With the continuous development of learning resources, the disadvantages of online teaching are gradually highlighted [1]. The heterogeneity of the network makes some learning reference materials unable to be effectively shared, and there are serious disadvantages of multiple development.

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Under the above-mentioned background, researchers have conducted in-depth research on the processing of teaching resources by means of information technology, and designed a series of methods including integration, classification and sharing. Among them, the development momentum of resource integration technology is better. Researchers hope to improve the utilization efficiency of teaching resources through resource integration, and put forward teaching resource integration model based on cloud computing and B/S architecture. However, after putting these models into practical projects, it is found that they cannot effectively meet the needs of advanced learners for learning resources [2].

After analyzing the above research background, this research applies deep neural network to the integration of teaching resources and designs a new integration model.

2 Online Mathematics Teaching Resources Integration Model Design

When designing the integration model, the overall structure of deep neural network and its configuration and deployment are firstly analyzed, and then the online mathematics teaching information management system is established, and the input unit, platform management unit, maintenance unit and information storage unit are designed. Finally, the integrated design is realized by elastic calculation.

2.1 Collection and Storage of Online Mathematics Teaching Resource Information

Nowadays, the idleness and waste of teaching resources have become the main problems faced by online education. Relevant universities and educational institutions have also put forward various solutions to this problem [3]. However, due to the inappropriate business architecture and data access methods, there are many problems in the current teaching resource integration model. At present, there is no special platform to integrate curriculum teaching resources in China. If we analyze the existing related research, we can find some learning resource platforms with similar functions. The common forms of these platforms include education administration website, school website, special learning website, distance education website, etc. Their functions and column contents are shown in Table 1.

It can be seen by analyzing the contents of Table 1 that the functions of these platforms are different. Although these platforms can provide teaching resources, their main function is not to provide teaching resources, some are to perform administrative functions, some introduce the school appearance, and some focus on establishing contact with students and getting closer.

Teaching resources are mainly teaching resources in mathematics education, obviously it is higher education resources, to be exact, college teaching resources [4]. For the needs of research, this study grasps the essence and characteristics of teaching resources, combines school conditions and mathematics education practice, and defines mathematics teaching resources as being able to provide support and support for the development of mathematics teaching activities. The sum of various resources of the service can be

Table 1. Platforms that can provide learning resources

Type	Function introduction	Column content
Education administration website	Perform the duties of the administrative department of education and provide educational and teaching resources	Public information; Educational resources; Service teachers; Serving students; Serving parents; Educational hot spots; Interactive communication; Navigation services; E-government; Government affairs publicity
School website	Publicize and introduce the achievements of the school and provide some educational and teaching resources	It has columns such as "school profile", "campus news", "teacher style", "educational trends" and "alumni style"
Distance education platform	It is a supplement to the traditional education model	Provide more learning on demand, live broadcast, teaching video, remote monitoring, current events, etc.
Learning resources website	Provide necessary resources for teaching and learners for students' research and learning	Upload and download resources, search engine; Internal and external information links; Exchange world, etc.

divided into tangible resources and intangible resources as a whole. Among them, physical resources mainly include human, material and financial resources. Human resources include mathematics teachers, mathematics management team, laboratory management staff, etc. Material resources include teaching infrastructure, curriculum resources, practice platforms (bases), information networks, etc.; financial resources include mathematics education funds, financial support from the state and schools, social donations, etc. [5]. Intangible resources include school reputation brand, scientific research level, social influence, etc.

Because this research mainly aims at the integrated design of the mathematics curriculum resources of the school level platform, therefore, in the design process, more attention is paid to tangible teaching resources. Human resources mainly include tutor team, teaching team and management service team. Among them, the material resources are mainly teaching hardware and infrastructure, professional courses, and scientific research project platforms, and the financial resources include the investment and financial support of schools, colleges and other departments in mathematics teaching.

The resource composition involved in this study is shown in Fig. 1.

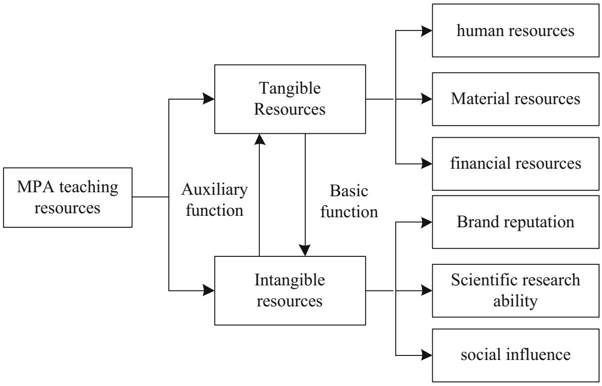

Fig. 1. Resource composition structure chart

2.2 Online Mathematics Teaching Information Management System

For colleges and universities, teaching resources refer to various elements that can form more significant teaching ability, have obvious social value and play a positive role in talent training in education and teaching practice. Therefore, in the design of resource integration, it is first necessary to clarify the design expectations and objectives of the resource pool, so as to promote the balanced and sustainable development of educational resources [6, 7].

The following figure compares deep learning with traditional algorithms. As shown in Fig. 2, in order to make the weight learning in the last step more simple and effective, the deep learning algorithm learns the basic features from massive data, and then combines the basic features into advanced features.

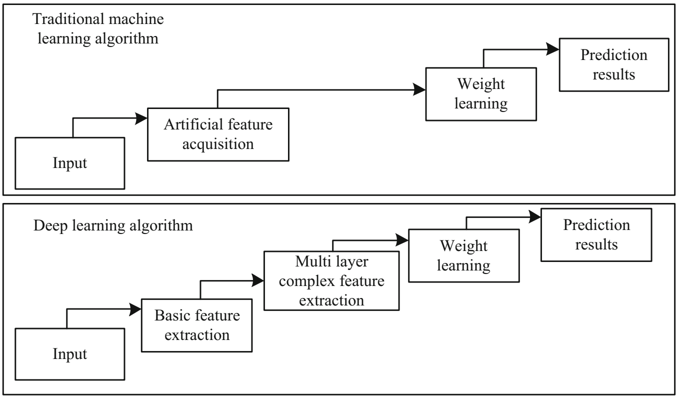

Fig. 2. Comparison of online teaching resource management transmission modes

The curriculum teaching resource integration platform is composed of the following 15 modules, whose names and functions are shown in Table 2.

Table 2. The components of the integrated platform for curriculum teaching resources

Name	Function
Identity information management	Manage user registration and login
E-books	Provision of electronic books
Job submission	Students submit electronic homework
frequently asked questions	Students submit electronic homework
Teaching case	The teacher answers the students' questions regularly
Online Q & A	Use professional communication tools to realize information exchange
Resource upload	After uploading resources, users can share resources
Search engines	Resource search engine

After completing the design of the integration platform, the relevant resource data types are counted, and the integration situation is presented in Table 3.

Table 3. Integration of teaching information resources

	Average value	Standard deviation	Variance
Resource distribution	4.25	0.865	0.852
Resource storage	3.65	1.065	1.052
Paper newspaper	2.65	0.899	0.895
Supporting CD	1.95	1.025	1.236
Get your own CD	1.68	1.065	1.165
Electronic archives	1.61	0.856	0.758

The data in Table 3 shows: the utilization rate of paper newspapers and periodicals is relatively high compared with that of electronic manuscripts; The information resources obtained from the unified distribution of periodicals and the self access of periodicals are higher.

The teaching resource management system includes input unit, platform management unit, maintenance unit and information management unit. The information integration management model designed based on neural network is shown in Fig. 3.

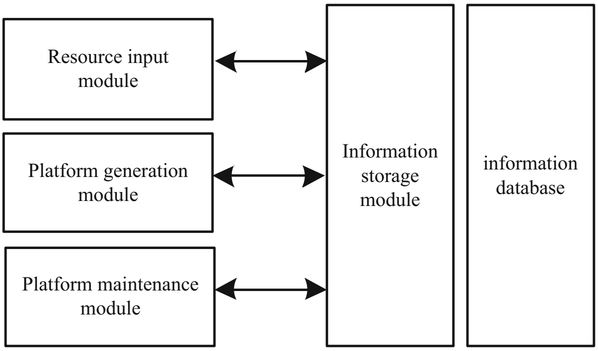

Fig. 3. Teaching information integration management model based on deep neural network

2.3 Realization of Integration of Mathematics Teaching Resources

The integration process of teaching information resources is shown in Fig. 4.

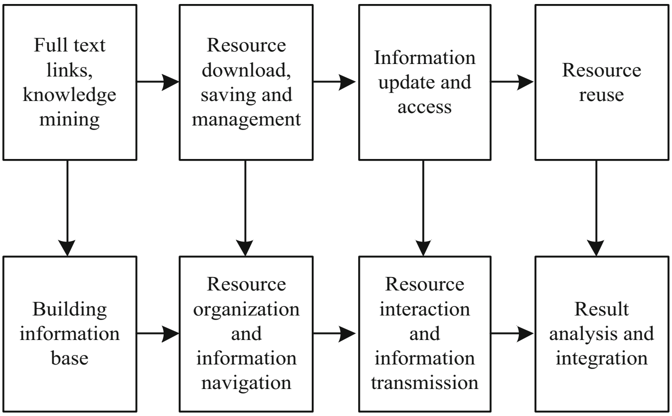

Fig. 4. Integration process of teaching information resources

The overall flow chart of the specific deep neural network-based resource integration method is shown in Fig. 5.

Before storing resources, ensure the stability of the database middle layer, so that the data flow has enough buffer to ensure the stability of the system [8, 9]. Table 4 shows the difference between operational database and common data warehouse.

In the deep neural network, the storage and access services of teaching resources are provided by dynamically expandable and virtualized storage resources. Through cloud computing, huge teaching resources can be automatically divided into a large number of smaller data blocks, which are distributed and stored by a huge computer cluster model composed of multiple nodes [10]. Before using cloud storage to integrate teaching resources, we must first build a deep neural network. What is needed to compress and encrypt resource files is the content of the resource files. The file information required

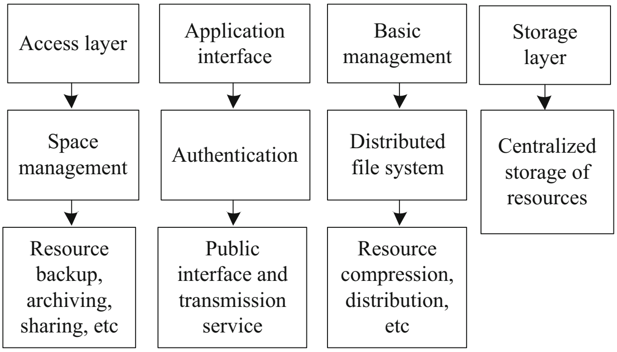

Fig. 5. The overall process of resource integration method based on deep neural network

Table 4. Difference between an operational database system and a data warehouse

Name	Operational database system	Analytical data warehouse
System purpose	Support daily operation	Support to manage requirements and obtain information
User	Clerk, database expert	Economics, administrators, analysts
Data content	Current data	Historical data, derived data
Data characteristics	Detailed	Comprehensive or refined
Data organization	Application oriented	Subject oriented
Access type	Add, change, query, delete	Query and aggregation
Data stability	Dynamic	Relatively stable
Characteristics of operation requirements	The operation requirements are known in advance	Operation requirements are not known in advance
Operating characteristics	Operate one unit at a time	Operate a set at a time
Database design	Based on E-R diagram	Based on star mode and snowflake mode
Primary data operation volume	Less	More
Access frequency	Relatively high	Relatively low
Response time	Less than 2 s	A few seconds - a few minutes

for this process has structural attributes. The specific module interface design process is shown in Fig. 6.

Based on the model in Fig. 6, the huge teaching resources can be automatically divided into a large number of smaller data blocks, which are distributed and stored by a huge computer cluster model composed of multiple nodes. Teaching resources

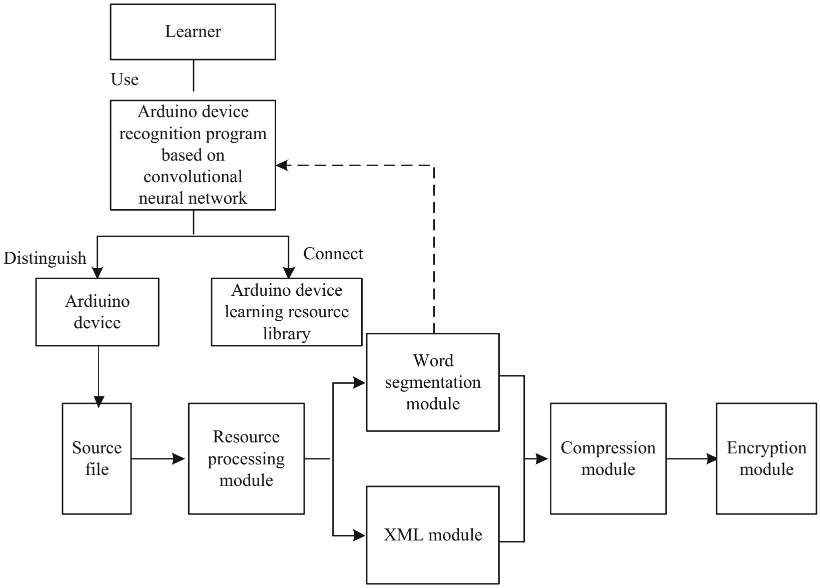

Fig. 6. Neural network resource information extraction model

are often hundreds of gigabytes or even T megabytes. In order to ensure the running speed of the model, this article adds a multi-day standard service scheduling method, which can select the appropriate node according to the priority to optimize the running speed. Mainly consider several parameters, completion time: the total time required by the deep neural network. This article estimates based on data such as the number of requests, previous running time, and estimated running time. Then the completion time T of request S is:

$$T_c = QLd - S + \sum_{k=1}^{QLd} Num \tag{1}$$

$$T_c = \frac{T_{ini} + \sum_{n=1}^{N} T_n + QLd}{\mathrm{Num} + 1} \times \text{S-}Num \tag{2}$$

Among them, QLd represents the length required on node d, and T represents the estimated calculation time of S. The estimated calculation duration of S is T_m, the value of which is the average of the calculation time before the request represents the number of requests, and T_n represents the calculation duration of the n time. The more times S is completed, the closer the value of T is to the real completion time of the service. The smaller the value of T_{ini}, the faster the service can be completed. Finding the node Num with the smallest T, and running on this node can ensure the real-time performance of the service.

In the teaching process of mathematics, one of the most advantageous features of big data is visual teaching. The traditional teaching mode relies on teaching materials and courseware, most of which take words as the carrier. Visual teaching relies on images, animation and video, which can effectively improve students' learning initiative, which is mainly reflected in three aspects: first, students have a more intuitive self-awareness. Students' learning and performance fluctuations can be presented in the form of charts and animation through big data. Students can see at a glance the quality of their recent personal learning. Second, the teaching atmosphere is relaxed. The teaching content of mathematics course is more serious and boring. If visual teaching is often used, the teaching environment can be improved and the relatively serious teaching content can be more interesting. Third, we can follow the trend of the times. The implementation of visual teaching needs the help of new media. At present, intelligent electronic products have been quite common in the campus. The use of new media is the trend of the development of the times, which can be close to the current trend, and there is no obstacle for students to accept it. According to the logical address arrangement results, the information resource storage process is planned and the reading scheme is designed. The design of information resource storage scheme is shown in Fig. 7.

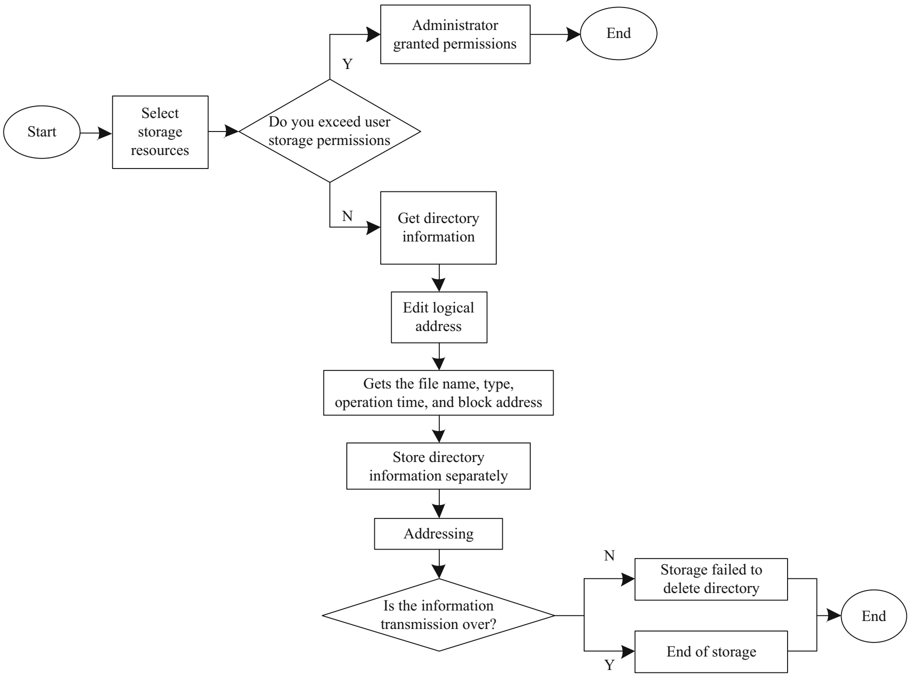

Fig. 7. Information resource scheduling management plan

In the process of selecting electronic information resources to be stored, users need to split them first. The storage process is usually divided into two parts: one is to obtain the resource name, extended naming, starting unit, file attributes, creation date, etc. Information, and obtain the storage address of the information resource at the same time; the other is to store the actual information of the resource in the information resource integration area through the model.

At present, more and more colleges and universities continue to develop and apply teaching resource libraries, material libraries and online courses based on big data, as well as multimedia courseware, electronic literature, etc., by making use of their own subject advantages and teaching characteristics, so as to expand and extend college teaching The scope and depth of use of resources. In order to achieve better application effects, in addition to clarifying the key points of the construction of the university teaching resource library, it is also necessary to create matching supporting conditions to promote the integration of university teaching resources based on big data and maximize the use of resources.

3 Experiment and Result Analysis

To verify the feasibility of the above design, deploy Hadoop-0.183 on 19 computers to build a cloud storage environment. Among them, the operating model is FCl0, and the Java version is jdk1.5. First modify the conf/hadoop-site, xml files in the Hadoop directory of 9 computers, and then configure SSH. Since Hadoop is started, the name node uses SSH (Secure shel) to start and stop the various daemons on each data node, which requires no password when executing instructions between nodes, so you need to configure SSH to use no The method of password public key authentication.

The integration of traditional teaching information resources adopts the information navigation model to optimize the integration of information resources. It is compared with the model in this paper as follows (Table 5).

Table 5. Comparison of two teaching modes

	Traditional model	Paper model
Achievable goals	Mathematics course resource storage and resource search	Mathematics course resource collection, resource classification, resource integration, providing resource access interface, and real-time resource query
Resource retrieval method	Complete resource retrieval in different mathematics course data sets according to user needs	Integrated search
Model characteristics	Ease of use and effectiveness of the system; Search interface friendliness and link rationality	The retrieval performance of resources is superior, the mathematics curriculum system is rich, the resources are transmitted quickly, and the scientific integration of resources can be realized

(*continued*)

Table 5. (*continued*)

	Traditional model	Paper model
Rationality of resource structure	It is difficult to realize convenient access only by connecting different types of resources	It can effectively store resources and reflect the characteristics of resource structure
Integration effect	Integrated different database resources	Display the integration results in the navigation industry classification to help users select appropriate course resources

Multilayer neuron structure is an important feature of deep learning, and it is also the reason why it solves more and more complex problems than shallow neural network. On this basis, the influence of the depth network layers on the accuracy of the model is explored, and the accuracy analysis results are presented in Table 6.

Table 6. Accuracy rate of teaching model of different depth network layers

Number of network layers	2 convolution + 2 full connection	2 convolution + 3 full connection	3 convolution + 3 full connection
Accuracy	21%–55%	71%–91%	Over fitting

The setting of the number of network layers has a lot to do with the number of samples. It can be seen from the data in Table 6 that for mathematics teaching resources, when the number of layers is less than 5, the model extracts the features of the collected resource information, which can express the extracted features to some extent, but the degree of abstraction is still It has to continue to improve, the test accuracy of the model is not high, and it is easy to show shocks. When there are too many layers of the network, because the number of resources is limited, and the parameters of the network with too many layers are more than the amount of resource data, there will be an over-fitting problem. At this time, the loss function is negative, which indicates the network structure design mistaken.

On this basis, we tested the speed of reading teaching resources from the cloud by 1 to 16 clients, and the results are shown in Fig. 8.

Figure 8 shows the total read speed and theoretical upper limit of the client. The theoretical upper limit of the total is reached when the 1 Gbps link between the two switches is saturated, that is, the speed is 125 MBs, or when the client's 100M network card is saturated, that is, the speed is 125 MBs. When there is only one client reading, the observed reading speed is 10 MBs, which is 80% of the theoretical upper limit. From this formally, the model in this paper can better realize the research goal of online teaching resource integration, and better guarantee the line Improve the quality of mathematics teaching.

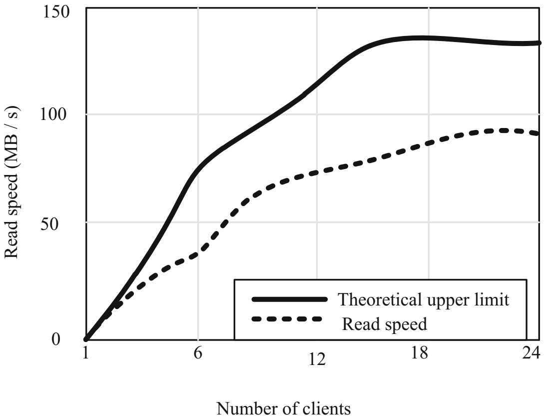

Fig. 8. Comparison test results of teaching resource information reading speed

4 Conclusion

The development of the big data era has promoted the progress of teaching technology. In this field, the integration of teaching resources has also become a research hotspot. In this study, the deep neural network is used as the main technical means to realize the integration of resource storage and management, and improve the utilization of teaching resources.

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Resource Matching Method of Online Education Platform Based on Artificial Intelligence

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Abstract. At present, the educational resources of the online education platform are mixed, and the matching accuracy of the resource matching method of the platform is low. This paper designs and realizes the resource matching method of online education platform based on artificial intelligence technology. The information is rectified by histogram equalization, and the multi-dimension feature is sorted according to the Euclidean distance ratio method, then the multi-dimension registration model is constructed. The edge of multi-dimensional image registration is precisely processed, and finally individualized matching of resources can be realized. The experimental results show that the resource matching method based on AI technology can make students and teachers communicate and communicate with each other in time, and make full use of the teaching resources. This system simple operation and the pointed teaching design, lets the student not be subjected to the time and place control, the choice likes the teaching content, provides the service for the education teaching activity.

Keywords: Artificial intelligence technology · Online education · Education platform · Platform resources · Resource matching · Matching method

1 Introduction

With the realization of multimedia technology and network teaching, network teaching has been popularized in higher vocational colleges. Nowadays, teachers and students can access to a very rich network resources, the need to build a network teaching platform. The platform can support the teaching and learning activities of teachers and students in the Internet environment, and the teachers and students can interact with each other to facilitate students' inquiry learning and autonomous learning.

Now many schools in our country have been equipped with advanced computer hardware resources and functional network environment, so the development of multimedia teaching and network teaching in schools has the necessary hardware support first, so it is necessary to develop an efficient network collaborative teaching system with open features and interactive functions. In terms of software conditions, teachers actively participate in national and provincial courses and research topics, making teaching courseware, recording teaching videos, many excellent resources are being developed or published.

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With the support of software and hardware, how to apply the huge teaching resources to teaching, how to better serve teaching, save resources, save manpower, so that teachers can have more time to invest in the research and development of new projects, and how to build a network teaching platform suitable for the humanities development of our school is particularly important. With the development of information technology, the number of educational resources on the Internet is increasing. The huge educational resources bring more learning opportunities to users, but also make users easily lost in the ocean of resources. In the current education platform system, the number of educational resources is huge and covers a wide range, and they cannot search for resources according to their individual needs, which brings a burden to student users to search for resources. Therefore, the research of this project is to establish an online education platform resource matching method on the basis of the existing campus network. After the research, this method can provide abundant materials for learners to complete the learning and transformation of knowledge and who can swim in the ocean of knowledge when they need it. This platform can not only effectively implement individualized teaching to meet the needs of learners with personalized learning needs, but also provide more space for collaborative learning to provide strong and powerful platform support for interactive learning, so as to optimize teaching effects and improve teaching efficiency. Under the new educational system model, there will be great room for improvement in teaching means, construction of teaching staff and teaching model.

The definition of artificial intelligence technology is very broad. As an important branch of artificial intelligence, machine learning technology has been widely used in data and speech processing [1]. The traditional methods are mainly based on large-scale perspective, Improved SIFT algorithm and improved k-means clustering algorithm to realize the resource matching of online education platform. However, the multi-dimensional matching accuracy of the data is not accurate enough, the response time is long and the power consumption is large. The artificial intelligence technology involved and used in this paper is mainly based on machine learning technology. The histogram equalization method is used to correct the information, the Euclidean distance ratio method is used to sort the multi-dimensional features, the multi-dimensional registration model is established and the image is accurately processed, and finally the personalized matching of resources is realized. To sum up, this paper studies a new resource matching method of online education platform based on artificial intelligence technology.

2 Resource Matching Model of Online Education Platform Based on Artificial Intelligence Technology

Firstly, this paper constructs the resource matching model of online education platform. The main task of the model is to improve the basis of resource registration by theory and accurate analysis. In order to make the model meaningful, this paper completes the construction of online education platform resource matching on the premise of preprocessing and extracting multi-dimensional features of information edge [2, 3].

2.1 Education Platform Data Preprocessing

The principle of resource equalization is to enlarge the blurred image of the data to reduce the noise of the resource data, and then to improve the pixel value of the data by rescaling. The histogram equalization calculation formula is as follows:

$$Ps(\mathrm{S})\mathrm{ls} = \mathrm{Pr(r)dr} \tag{1}$$

Among them, r represents the pixel gray level before data radiation correction; s represents the pixel gray level after data radiation correction; $Ps(\mathrm{S})$ represents the probability density of the distribution of gray level before data radiation correction; and Pr(r) represents the probability density of the distribution of gray level after data radiation correction.

The above formulas are constrained to some extent, and the gray level of pixels must be monotonically increasing function after data radiometric correction, and the extreme value of the function will not change after data correction [4].

The specific volume algorithm is as follows:

$$S = \sum_{j}^{k=0} \mathrm{Pr}\left(r_j\right) = \sum_{j}^{k=0} \frac{n_j}{n} \tag{2}$$

In the formula, k represents the gray level of the data; n represents the total number of pixels; j represents the number of pixels on the gray level of the data; and $\mathrm{Pr}\left(r_j\right)$ represents the corresponding probability of the occurrence of the gray level of the data [5].

2.2 Multi-dimensional Feature Extraction

Through the above information preprocessing, the multi-dimensional feature extraction of information is simplified. In this paper, scaling invariant feature method is used to extract multidimensional scaling features and construct scaling space. The principle of construction is to circle the multi-dimensional features of data in a certain area by means of the format of vectors. The formula for constructing the scale space is as follows:

$$L(x, y, \delta) = G(x, y, \delta) * I(x, y) \tag{3}$$

In the formula, $L(x, y, \delta)$ represents a variable Gaussian function, (x, y) represents a multidimensional spatial coordinate, and I represents a data scale spatial factor.

Taking the preprocessed information into the above formula, we can calculate the region where the information multi-dimensional vector is located, and then extract the multi-dimensional feature points in the effective region. In the edge multidimensional space of remote sensing information of UAV, the result of each comparison is the initial recognized edge feature vector of information multidimensional [6]. Establish an information coordinate system, as shown in Fig. 1 below:

On the established rectangular coordinate system, determine the edge feature vector, and the calculation formula is as follows:

$$\mathrm{k(x)} = \mathrm{q} + \frac{1\mathrm{d^t}}{2\theta \mathrm{x}}\varphi \tag{4}$$

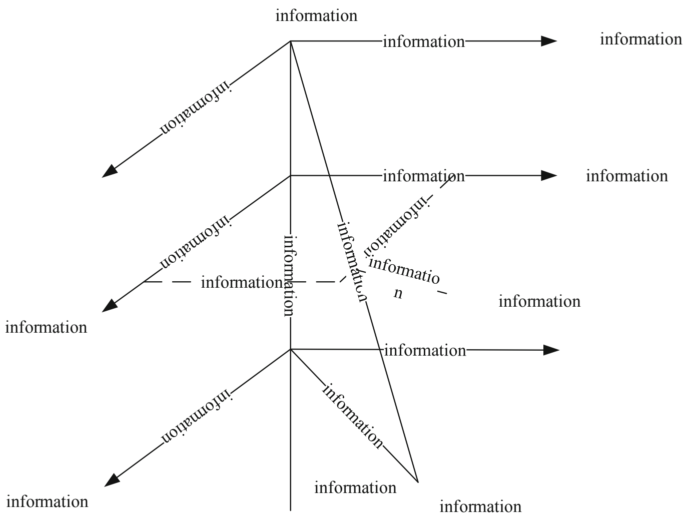

Fig. 1. Coordinate system

In the formula, $\frac{1d^t}{2\theta x}\varphi$ is a spatial scale Taylor function and q is a measurement factor. When the result is more than 0.5, it shows that the feature points need to be eliminated, otherwise, the feature points remain.

3 Quick Splicing of Information

The AKAZE algorithm is used to extract the characteristic points, and the variable conduction function is used to establish the scale space to detect the nonlinear diffusion filter. The information data quantity is set as L, and the formula for calculating the divergence of the flow function is as follows:

$$\frac{\partial L}{\partial t} = div(c(x, y, t) \cdot \nabla L) \tag{5}$$

In the formula, t represents the scale parameter; $c(x, y, t)$ is the conduction function, if the conduction function is a normal value, the diffusion adaptive local structure obtained is also a normal value [7]. As can be seen from formula (5), the complexity of expression decreases as the value of t increases.

Construct nonlinear scale space, analyze the change of scale level, judge whether the resolution of each layer is the same as the original resolution. The formula for calculating the scale parameters is as follows:

$$\begin{aligned} \sigma^i(m, s) = \quad & \sigma_0 2^{o+\frac{s}{s}}, m \in [0, 1, \cdots, M-1], \\ & p \in [0, 1, \cdots, P-1], i \in [0, 1, \cdots, N] \end{aligned} \tag{6}$$

where, σ_0 represents the initial value obtained in the data splicing process; N represents the total number of images in the scale space of stitched data; $\sigma^i(m, s)$ represents the matching relationship of scale parameters.

$$t_i = 0.5\sigma_i^2 \qquad i \in [0, 1, \cdots, N] \tag{7}$$

where, t_i represents the time of evolution.

In the process of processing resource information, Gaussian filter function is introduced to obtain the data features, and the gradient histogram is displayed on the large screen to determine the contrast parameters. The nonlinear scale space is constructed by AOS algorithm, and the maximum point of online education platform resources is obtained by normalization, and the acquisition matrix is set:

$$L_{Hessian} = \sigma^2(L_{xx}L_{yy} - L_{xy}^2) \tag{8}$$

where, σ is the average value obtained from the scale parameter σi. by obtaining the extreme points, we can get more accurate feature points, get the position of feature points, realize accurate positioning and get the accurate position of feature points.

After the location of the feature points is determined, the range of the feature points is determined to obtain the field, which is divided into 36 direction histograms in an equally divided way, and the main direction of the maximum feature points is determined in the histogram. Looking for calculations histogram peak, will receive the histogram and histogram peak biggest comparison, if you get the results more than 80% from its peak, the direction for the auxiliary direction, the direction of peak can find 1/5 feature points in the direction of auxiliary data, in the uav remote sensing data splicing, feature point plays a very important role, The feature points in the auxiliary direction can affect the stability of data matching and stitching.

In the process of stitching, the feature points in the main direction need to be corrected. The corrected feature points can generate descriptors, so that they can evolve into a feature vector. The dimension of the feature vector is 128 dimensions. After determining the feature vector, normalize it to reduce the reduction of matching rate caused by illumination.

4 Resource Matching of Online Education Platform Based on Artificial Intelligence Technology

The principle of Euclidean distance ratio method is to select two feature points with the shortest distance in the effective multi-dimensional feature vector region, and then calculate the threshold value between these two feature points. If the threshold value is within the specified range, it means that the two data edge multidimensional feature points are correct registration features. If no, perform the preceding operations until all valid feature points of the required registration data are matched successfully.

The thresholds are shown in Fig. 2 below:

The calculation formula is as follows:

$$\mathrm{E} = \mathrm{g} * \lim_{\mathrm{i} - \mathrm{z}_1} \mathrm{k(x)} \tag{9}$$

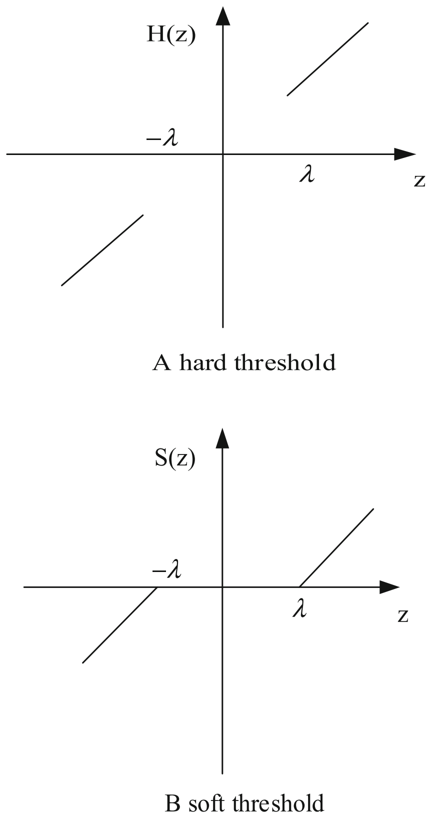

Fig. 2. Data threshold

where, g represents the shortest distance between two feature points. Here, the threshold value is set to 0.8. When the above formula is satisfied, it is considered to be the correct matching point pair.

Then, the above successfully paired features are hierarchically graded to obtain the final information registration model, as shown below:

$$f(x) = \frac{L(x, y, \delta)}{p_8(s)} * \sqrt[3]{E} \tag{10}$$

RPCA technology is also called banglu principal component analysis method. The traditional RPCA technology decomposes the data frame based on the augmented Lagrange function, so as to complete the multi-dimensional data registration operation. However, because the traditional banglu principal component analysis method has low requirements for the reduction of data and low definition of processed data, this paper breaks through the traditional method and improves the RPCA technology. The flow chart of improved RPCA algorithm is shown in Fig. 3 below:

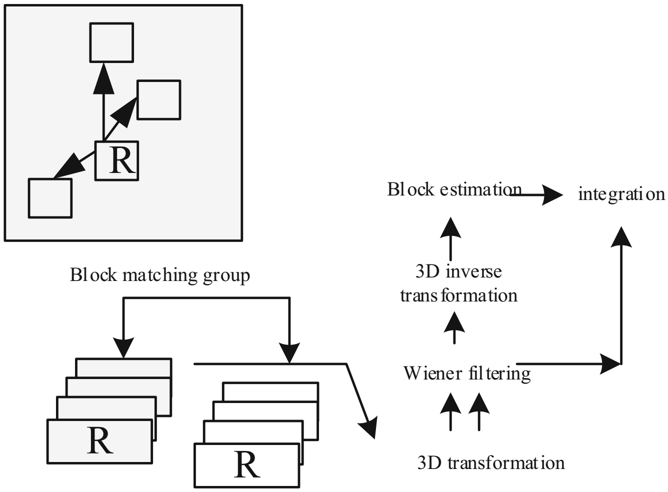

Fig. 3. Improved RPCA algorithm flow

The definition of augmented Lagrange function is as follows:

$$\tau(\mathrm{L}, \mathrm{S}, \mathrm{Y}) = \mathrm{L}_1 + \gamma * \mathrm{S}_1 + \frac{\frac{1}{2}(\mathrm{D} - \mathrm{S} - \mathrm{L} + \mathrm{Y})}{\mu_{\mathrm{F}}^2} \tag{11}$$

where, Y represents Lagrange operator; μ represents a constant greater than zero; S represents nonnegative singular value; L represents the weighted data norm; D represents the signal-to-noise ratio of the data; F represents the weight of the data frame; γ represents the equilibrium factor.

The data frame is decomposed according to the function, and then the function is weighted. First, the data frame in the data is formed into an objective function. The function formula is as follows:

$$\mathrm{L} = \sum \mathrm{v}^{\mathrm{t}} \tag{12}$$

Then calculate the weighted kernel norm of the objective function to calculate the edge data frame whose data needs multi-dimensional registration. The calculation is as follows:

$$S = S_{\frac{I}{\mu}}\left[D - L + \frac{Y}{\mu}\right] \tag{13}$$

The improved method can provide accurate registration data for information registration. LSH algorithm is used to obtain the initial point pair features of data. Splicing is an important part of data splicing, and the selection of reference plane is the key. To solve the problem of multi-data matching, a global optimal matching method is proposed to find the best location of the data to be matched as a reference, and the continuous cumulative error is reduced. The registration relation of data is determined by point-to-point matching and point-to-point matching. The best matching point pair is the priority of registration, and the registration order is determined by searching multiple data sets. After the data matching is completed, the multi-band fusion algorithm is transformed into seamless smooth matching, and the data is fused through the inverse pyramid process to achieve the overall fusion.

In view of the large amount of calculation of SFM algorithm and the large amount of overlap between data and adjacent data, part of skeleton data is selected from the gap. In point cloud data calculation, the skeleton data of SFM algorithm is used to estimate the optimal reference surface and improve the calculation efficiency.

The obtained timestamp information and GPS information should be retained in the resource data, and the main data should be determined according to the spatio-temporal clues. In this method, the data are sorted by timestamp first, and then the data with the furthest distance and the smallest overlap area is selected as skeleton data according to the spatial displacement information between adjacent data. For the determination of the minimum overlap region, the method of rough data splicing is used to determine the feature pair and coverage region.

Through the above research on resource matching methods using various technologies, this paper summarizes the resource matching method of online education platform based on artificial intelligence technology, and the specific process is shown in Fig. 4:

According to Fig. 4, the data is preprocessed first to provide a basis for subsequent data analysis and registration; Then, the scale invariant feature transformation method is used to extract the edge features of the data, and the extracted features are brought into the constructed multi-dimensional registration model for verification, so as to further improve the accuracy of the multi-dimensional registration method; Finally, the weighted improved RPCA technology is used to correct the data sequence of the extracted multi-dimensional edge feature data frame. The data edge feature sequence is decomposed according to the calculation process of the augmented Lagrange function and the objective function. After decomposition, it is brought into the weighted RPCA algorithm to obtain the signal sequence of the data corresponding to each feature. Finally, the data with the same sequence are multi-dimensional registered to complete the operation.

5 Experimental Analysis

The research on the resource matching method of online education platform based on artificial intelligence technology is completed. In order to test whether this method is practical, this paper carries out comparative experimental analysis and carries out scientific demonstration.

From the perspective of large-scale resource matching method, this paper selects online education platform, online education platform based on Improved SIFT algorithm and online education platform based on improved k-means clustering algorithm for comparative test. To ensure the authenticity and scientificity of test data is the purpose of the test. In this paper, three randomly matched data were selected as the test analysis objects half an hour before the test, and three methods were triggered at the same time to carry out multidimensional data registration operation respectively. After the end of the test, the definition, focal length and SNR parameters of the data submitted by the operation were measured by professional data inspection software, and finally the test conclusion was drawn according to the comparative test data.

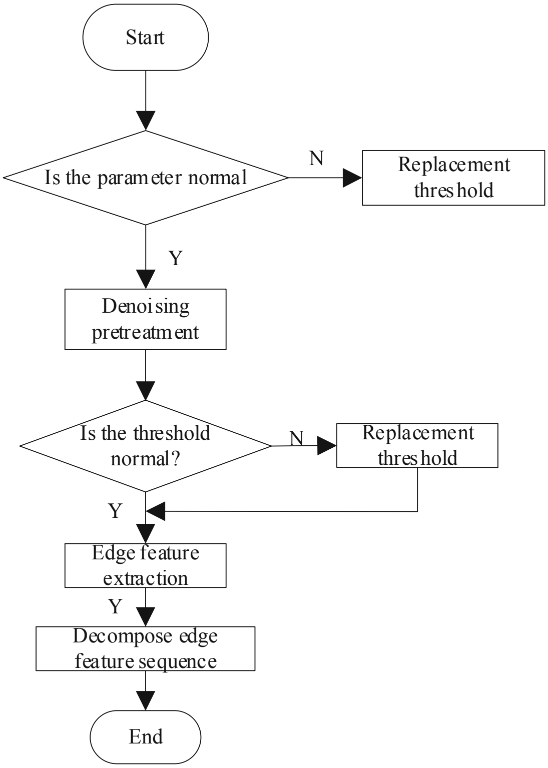

Fig. 4. Resource matching process of online education platform based on artificial intelligence technology

Through the above rigorous comparative test operation, the test error is avoided to a certain extent and the authenticity of the test data is guaranteed. The experimental results of data matching accuracy are shown in Table 1:

Table 1. Experimental results of data matching accuracy

Number of experiments/times	Matching accuracy/%			
	Large scale perspective	Improved SIFT algorithm	Improved k-means clustering algorithm	Paper method
1	85.21	75.39	80.23	98.95
2	86.22	76.85	81.42	99.43
3	84.93	77.44	82.35	98.69

(*continued*)

Table 1. (*continued*)

Number of experiments/times	Matching accuracy/%			
	Large scale perspective	Improved SIFT algorithm	Improved k-means clustering algorithm	Paper method
4	85.07	75.27	80.75	99.07
5	85.32	76.34	81.69	99.56
6	86.07	76.22	82.32	99.66
7	85.46	75.94	81.58	98.41
8	84.99	76.58	80.96	98.87
9	85.61	76.31	81.24	99.02
10	85.73	75.48	80.25	99.51

Because the test object of this paper is multi class data, finally, combining the multi-dimensional registration accuracy of each different data, it is concluded that the data effect of the matching method in this paper is higher than that of the two traditional methods.

The experimental results of data response time are shown in Table 2 below:

Table 2. Response time experimental results

Number of experiments/times	Response time/s			
	Large scale perspective	Improved SIFT algorithm	Improved k-means clustering algorithm	Paper method
1	2.88	3.42	3.21	0.21
2	2.91	3.35	3.23	0.23
3	3.04	3.32	3.19	0.19
4	2.79	3.40	3.20	0.20
5	2.99	3.38	3.18	0.18
6	2.85	3.39	3.17	0.17
7	3.02	3.44	3.21	0.21
8	2.80	3.34	3.22	0.22
9	2.94	3.52	3.18	0.18
10	2.95	3.61	3.17	0.17

According to Table 2, the response time of the method designed in this paper is far less than that of the traditional system. The response time based on the large-scale perspective method is about 3 s, the response time based on the Improved SIFT algorithm is more than 3 s, and the response time based on the improved k-means clustering algorithm is more than 3S. The response time of the method designed in this paper is less than 0.25 s. The reason for this phenomenon is that in the process of integration, the method designed in this paper shields the differences between heterogeneous data, integrates resources centrally, and establishes the relationship between data. The integrated data has the sharing characteristics of WebGIS program. The integration of resources is very important for the unified and authoritative release of data information, which is conducive to the efficient operation of the program and give play to higher efficiency. Compared with the traditional matching method based on Improved SIFT algorithm and the matching method based on improved k-means clustering algorithm. The experimental results are shown in Table 3:

Table 3. Experimental results of power consumption test

Number of experiments/times	Power waste/mA			
	Paper method	Large scale perspective	Improved SIFT algorithm	Improved k-means clustering
1	0.56	2.22	3.21	3.12
2	0.58	2.25	3.33	3.15
3	0.59	2.36	3.24	3.24
4	0.67	2.45	3.45	3.35
5	0.62	2.47	3.69	3.42
6	0.64	2.58	3.44	3.45
7	0.63	2.69	3.47	3.47
8	0.61	2.66	3.52	3.52
9	0.59	2.75	3.53	3.54
10	0.54	2.89	3.57	3.57

According to Table 3, the power consumption of the proposed method is much lower than that of the traditional method. In 10 experiments, the power consumption of the proposed method is lower than 0.7 mA, the power consumption of the system is between 0.5 and 0.7 mA, and the overall power consumption is low. The traditional large scale angle of view consumes power between 2–3 mA, which is 4 times of the designed system, and consumes too much power. The power consumption of the Improved SIFT algorithm and the K-means clustering algorithm reached more than 3 mA in 10 experiments, and the energy consumption was huge, which was difficult to be applied to practical work.

The reason for this phenomenon is that during the process of data acquisition, the transmission port of the data acquisition node is directly associated with LoRa wireless communication node, and the wireless communication address is set according to the main control node network configuration of LoRa wireless communication. The signal receiving port of LoRa wireless communication should also collect the monitoring instructions of industrial robot control port in time, and wake up MCU to parse the data program of displacement sensor. When the sensor rotates linearly in the industrial robot, the pulse is sent out, which corresponds with the signal of LoRa wireless communication, so the power consumption is low.

To sum up, the resource matching method of online education platform based on artificial intelligence technology in this paper embodies excellent matching ability in the process of matching, and can realize matching in the state of strong external interference, and the system has lower power consumption and stronger working ability in the process of running, so it is suitable for practical operation.

6 Conclusion

Internet technology is widely used in our daily life. Based on the analysis of Internet technology, this paper studies the matching method of online education platform resources according to the software and hardware environment resources of colleges and universities. Using software development method, using ASP. NET, SQL Server database technology and recommendation algorithm as the key technologies, we develop a long-term use value of network teaching matching method that can recommend teaching courses according to students' learning preferences. It is feasible to use collaborative filtering technology to recommend personalized learning content for the users who use the network teaching system. The purpose of developing the network teaching platform is to serve for education and teaching, and to enhance the enthusiasm of students in our school. This topic involves each discipline teaching content and the function, in the matching method also has many insufficiencies to wait for the consummation.

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Remote Sharing of National Music Teaching Resources Based on Big Data Analysis

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Abstract. The traditional long-distance sharing method of teaching resources is insufficient in the analysis of resources, and it is difficult to achieve a clear classification, which leads to the low integrity of resource collection and transmission. According to the functional characteristics of the curriculum resources, adjust the screening process of music teaching resources, collect and sort out folk music materials, use big data analysis technology to build open teaching mode, and design a remote sharing method. The results show that the transmission integrity of the remote sharing method is 66.990%, 57.450% and 58.190% respectively, which shows that the remote sharing method has better performance.

Keywords: Big data analysis · National music · Teaching resources · Remote sharing · Remote education · Performance characteristics

1 Introduction

With the wide application of computer technology and the rapid development of network technology, distance education as a new mode of modern social education has attracted more and more attention. Modern distance education is a new type of education with the development of modern information technology. It overcomes the drawbacks of traditional education and is the main means of building a lifelong learning system in the era of knowledge economy. Distance education has become an effective form for people to obtain knowledge and academic promotion in today's society. The implementation of the modern distance education project to form an open educational network and build a lifelong learning system is a major project to make full use of and optimize the educational resources of our country, popularize and improve the quality of the whole people, reduce educational costs and enable the whole people to enjoy the full right to education. Our country's distance education starts late, the development history is also quite short, many aspects wait for further standard and the promotion. Modern information technology is the means of distance education project. In the early stage of distance education, the Ministry of Education formally approved four key universities directly under the Ministry of Education as the pilot colleges and universities of distance education. With the education software suitable for distance transmission and interactive learning as the teaching material, and with the start and support of the government, a new management

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mode of modern education industry that combines public welfare with industrial nature and finally achieves independent rolling development shall be established step by step. After more than ten years of development, distance education has been widely concerned by the people and welcomed by the majority of educatees. Distance education, also known as distance education, refers to non-face-to-face education by teachers and students through the media [1]. The position of distance education is more and more important in the field of modern education. Distance education is a new field of education. In this field, students and teachers are in a state of relative separation during the whole learning period, and students and learning group are in a state of relative separation during the whole learning period. Nowadays, modern distance education has developed rapidly. As a new educational model, it has been brought into the national education system and supported by the Ministry of Education and other competent departments.

The domestic researcher data about the teaching resources remote sharing method has also accumulated some. Document [2] On the basis of cloud computing, a remote teaching resource sharing platform is built, which is divided into several modules, including education application service module, resource layer, examination of teaching resource module, and finally verification of the effectiveness of the remote teaching resource sharing platform, but the imperfect problem of the open teaching model is ignored. Document [3] Using virtual reality technology, this paper puts forward the framework of distance learning space, analyzes three main application scenarios and the components of software and hardware, and analyzes the application effect of distance learning space based on virtual reality, but does not fully consider the imperfect problem of open teaching mode. As the main force of lifelong education, distance education is widely recognized in the field of international education. Our country's distance education has become an integral part of international education [4]. Technical media have replaced the traditional, dictation, group learning -based education for interpersonal communication. From the experience of running distance education in our country for many years, the students of distance education mainly come from the in-service personnel of different ages. Therefore, the remote sharing of national music teaching resources based on big data analysis needs to be further explored. In this paper, through deep data mining of ethnic music teaching resources, all kinds of labels are obtained and corresponding to the teaching resources, which can completely classify the resources and enhance the integrity of transmission when sharing them remotely.

2 Remote Sharing of National Music Teaching Resources Based on Big Data Analysis

2.1 Identification of National Music Performance Characteristics

Music, broadly speaking, refers to the music of different nationalities, is in ethnic regions or certain cultural and social groups in common and continue to be handed down with local ethnic characteristics of the overall music. Music has been accompanied with poetry and songs since its birth. It is a necessary skill for literati and poets from ancient times to the present. Therefore, music education should pay attention to the cultivation of personality, emotion and heart. Narrowly speaking, national music is a kind of traditional music which is rooted in the production, labor and social life of all ethnic groups and has the characteristics of their music [5]. Folk music refers to the music works created by the children of the Chinese nation, reflecting the history, culture and customs of the Chinese nation and in line with the characteristics of the traditional music of the Chinese nation. We should embody the requirements of environment edification, life value release and self-development, combine music art to cultivate imagination, intuition and creativity, and actively carry out music practice. Teaching strategy is the product of the combination of teaching theory and teaching practice. It refers to the teaching implementation plan based on certain theory and around several teaching goals. Provides the sustainable development ability to the student's subsequent artistic accomplishment promotion and the self-enhancement. Its contents include selecting reasonable teaching methods, determining suitable materials for students, and designing reasonable teaching activities or behavioral procedures and means. The cultural connotation of music has been spreading since ancient times, only because of its universality and infectivity. Teaching strategy of national music is a kind of teaching strategy which is carried out by teachers according to the characteristics of music subject and teaching practice, including selecting teaching resources, selecting teaching contents, establishing implementation evaluation and widening implementation path. Music is an important form of expression and communication of human emotion and thought. It is also the richest and most colorful part of human spiritual life. Through participating in systematic music teaching activities, students can get the process and content of music culture knowledge and skills. Music is an important form and carrier of human culture, which has irreplaceable artistic charm. It will keep pace with the development of human history and meet the multi-level spiritual and cultural needs of mankind. In the process of developing the school-based curriculum of national music, the content of the curriculum should be balanced with the level of physical and mental development and cognitive level of the students. One of the missions of modern education is to make students accept and understand the similarities and differences of the cultures on which people in different countries and regions live, and to understand the diversity of human society. The educational value of curriculum resources should be brought into full play within the range of knowledge students can expect to master. In a number of countries and peoples of different cultures have been mutual respect and understanding, human society has a basis and premise for communication. Different nationalities have different styles of national music, so the course content is rich and varied in the development process, which can provide adequate nutrients for the contents of the school-based curriculum. Based on this, the steps of identifying the characteristics of national music performance are completed.

2.2 Adjust the Screening Process of Music Teaching Resources

Teaching resources are the source of various factors in the subject and the necessary and direct precondition for teaching. From Guofeng to Yuefu of Han and Wei Dynasties, from Song Ci and Yuan Opera to Ming and Qing Dynasties, in this colorful history, the multi-ethnic family has created colorful folk music in the wisdom of the working people. According to the functional characteristics of curriculum resources, the concept of curriculum resources is divided into a broad sense and a narrow sense: the broad sense of curriculum resources refers to various factors conducive to the realization of curriculum and teaching objectives, including knowledge, experience, human resources, concepts, material resources, financial resources, environment and other factors. Simple folk songs, rich local color of rap, quyi, opera, colorful national musical instruments, are the precious wealth left to us by our ancestors. The narrow sense of curriculum resources refers to the factors that can directly serve the teaching activities, including teaching materials, teaching aids, equipment and other tangible material resources. Assuming that the data sets corresponding to the music teaching resources belong to the same subcategory, the expression formula of the indicators is as follows:

$$S(\alpha, \beta) = 1 - \frac{\beta}{\alpha/2} \tag{1}$$

In formula (1), α represents any data object, and β represents any subclass of data objects. The new curriculum standard points out that music is an important carrier of human cultural heritage. Taking China's ancient music classics, traditional music with a long history and profound Chinese folk music as the focus of music learning helps students understand and love the culture of their motherland. It also includes intangible resources such as students' existing knowledge and experience, parents' supportive attitudes and abilities. According to the space, it can be divided into in-school teaching resources and out-of-school teaching resources. The in-school teaching resources are the in-school teaching resources and the out-of-school teaching resources are the out-of-school teaching resources. The study of Chinese national music focuses on the study of music culture. Only by combining the knowledge of national music with the knowledge of humanities can students understand the excellent traditional culture of China. Also may according to the reality, carries on the division from the different angle. Because the criteria for classification can be varied, the definitions need to be adjusted accordingly. National music culture has a strong vitality, flowing like the long river of history, accompanied by the replacement of each dynasty and change, but also on behalf of the cultural content at that time. In-school teaching resources may include teaching resources that provide materials and qualified teaching resources, and out-of-school teaching resources may also include teaching resources that provide textbooks and qualified teaching resources. Folk music depends on unconscious dissemination and conscious dissemination. According to the needs of this study, the teaching resources are divided into obligatory and non-obligatory basic teaching materials. Folk performers perform and sing, such as Qin Opera and Huaer, as well as folk recreational activities, such as Errenzhuan and Shehuo. This is unconscious communication. Conscious communication is mainly through formal music education in schools, which teaches the knowledge of national music and culture to all students, and promotes national music and culture. In the course of choosing curriculum resources, students' physical and mental development characteristics, cognitive level, hobbies, development needs and so on should be taken into consideration. School music education is the most important and basic behavior mode of contemporary national music culture inheritance, which objectively reflects the music culture development level of a country and a nation. The development of curriculum resources in this course is based on the content of the textbook, and the core resources suitable for this course are selected and refined from each textbook. Therefore, the basic idea of music curriculum in China should emphasize the promotion of national music: "The excellent national music of all ethnic groups and excellent music works reflecting modern and contemporary Chinese social life should be regarded as important teaching contents in the music curriculum of ordinary high schools." Our country has a broad and profound national culture, many kinds of national music are listed as the world intangible cultural heritage, national music as an important teaching content, integrated into the curriculum objectives. The development of curriculum resources of folk music outside the textbook is helpful to the diversification of curriculum resources. In the process of development, we should combine the characteristics of student resources and characteristic curriculum resources of the school. Densities are represented by an internal deviation matrix, which is defined as:

$$L = \frac{h\left(\frac{\phi}{2}\right)}{\left(h^2\right)} \tag{2}$$

In formula (2), h represents the number of clusters, ϕ represents the trace of the deviation matrix between classes. Many of our country's excellent music works experience and dissemination, to facilitate students to enhance the love of the motherland music art. Our country is a multi-ethnic country, has a very rich national music resources, the curriculum research is established on the basis of teaching materials, and fully integrated with the local teaching practice. At the same time, it points out in the content of music appreciation: "Learn Chinese folk music and world folk music, experience and experience the national cultural characteristics of music." At the same time, the local music resources that students are familiar with will be transformed into the primary school music school-based curriculum for research and development, the local characteristics of alley nursery rhymes, Jinshan local characteristics music culture play Lianxiang, etc., highlighting the strong home feelings. Based on the above description, complete the steps of adjusting the screening process of music teaching resources.

2.3 Big Data Analysis Technology Constructs Open Teaching Mode

Big data analysis, to capture more similarities in ethnic music teaching [6, 7]. Singing is an effective way to cultivate musical ability and aesthetic ability, and it is also a very practical learning content. The essence of music culture belongs to a kind of "national culture phenomenon", which is the cultural foundation for the people of all ethnic groups to survive, and the culture of all ethnic groups is full of characteristics. It is these colorful national cultures that create a complete music culture mechanism. New singing module courses learn to sing excellent folk songs, and appreciate listening to a wealth of instrumental works, feel the expression of folk music and beauty. Due to the differences in the living environment, language features and thinking modes, the cultures of different nationalities show great splendor and diversity in communication and integration. On the basis of certain conditions, excellent folk music is collected and performed. Define the number of samples in the test set classification space based on how big data works:

$$\gamma = \sum \frac{(1-g)^2}{H} \tag{3}$$

In formula (3), g represents the initial sample space, and H represents the data objects in the classification space. In areas with strong regional characteristics and rich folk music, it is recommended to organize students to learn and learn styles, learn and play simple folk music. In the long course of historical development, multiculturalism stands on the top of history with its unique posture. Nowadays, with the rapid development of economy, different cultures rub against each other and produce amazing sparks. With the change of the concept of the times, we gradually have a new understanding of the cultural pattern. Music creation can cultivate creativity, explore creative thinking potential of the effective means, is to stimulate the imagination of the process. Throughout the course of historical development, in ancient and modern society, the existence of multicultural pattern has become an indisputable fact. Encourage and organize students to carry out collection activities in local areas with artistic characteristics, collect and sort out folk music materials, and analyze and understand excellent national art and culture. China's national music includes a variety of music forms, including "folk songs, opera music, folk instrumental music, song and dance music, rap music and so on." Moreover, can have the expression ground to sing our country the opera aria and the Chinese and foreign opera selection. Understand the origin, development, genre style, main representatives and artistic achievements of traditional Chinese and foreign operas, and be able to evaluate the representative works. But we should establish the national music culture view at the same time also should establish the corresponding national music education view. It is of great practical significance to carry forward and inherit national music culture, understand multi-music culture and enrich school curriculum, and can make the selection of national music resources outside the textbook more standardized and reasonable. Various forms of national music will show their own characteristics of the music incisively and vividly, reflecting the strong vitality of our national music. Based on this, complete the construction of open teaching mode steps.

2.4 Designing Remote Sharing Methods

Distance education will have different social demands for diploma education and non-diploma education in the face of more and more extensive social groups. "Sharing of educational resources" refers to the sharing of quality educational resources, the aim of which is to optimize the allocation of resources to the maximum extent and reduce repeated investment [7]. This requires us to provide academic education and non-academic education parallel teaching model, but also a rich and colorful curriculum for different needs of people to meet the needs of different groups. The process of remote sharing of national music teaching resources is shown in Fig. 1:

Figure 1 shows that the integration of resources is the basis of resource sharing, the development and improvement of network teaching resources is an effective way of resource integration. In the distance teaching method, all kinds of resources need to present synchronously in the student receiving end, in order to present the teaching effect completely, realizes the teaching goal. Sharing is a popular word in recent years. In the era of knowledge economy, the integration and diversification of knowledge and information technology reflect the overall efficiency of people's pursuit of optimization system and maximization tendency. Introducing the mature streaming media technology into the application of real-time distance education can solve the basic problem of audio

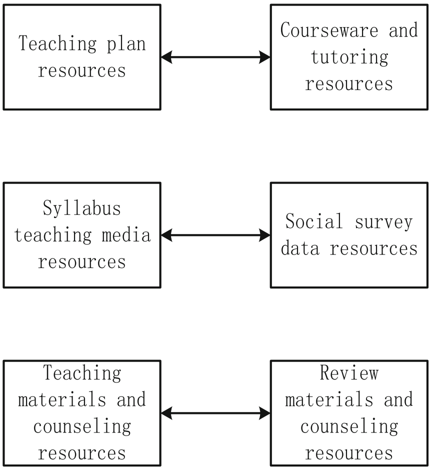

Fig. 1. Process diagram of remote sharing of national music teaching resources

and video image transmission. Sharing emphasizes the sharing of quality resources. However, due to the different economic development in different regions, the level of education development also has a large gap, but in some areas and schools still have the output of resources. However, due to the specialization of streaming media technology, teaching resources can not rely on audio and video channels for network transmission, but must be used in parallel with streaming media channels, but independent transmission path. On the whole, there are sufficient teachers and advanced experimental conditions in the developed areas. There is a lack of excellent teachers and advanced experimental conditions, as well as development funds. At the same time, hardware facilities are also an important guarantee for the development of the course, including teaching materials, music classroom equipment, ethnic music teaching equipment and the funding support for the development of the course. Due to the separation of audio and video data transmission and teaching resources transmission, teaching resources in the student receiving end of the time can not be guaranteed. In the quantity, the education resources construction and the renewal content, and the conformity and the sharing are to the existing education resources optimization reorganization. This is the key problem to be solved in distance education system. At the same time, after the end of the real-time teaching process, all the synchronous control information needs to be recorded and reused courseware needs to be generated together with the teaching resources. To make full use of quality resources and give full play. Based on the above description, complete the steps of designing the remote sharing method.

3 Experimental Study

3.1 Construction of Experimental Environment

Based on lab testing needs, Qt Creato is actually an integrated development environment (IDE), so in Eclipse CDT, Netbeans for C+, Qt Creator is a lightweight alternative to the IDE.The teaching resource service terminal is mainly a server group, including live Web server, on-demand Web server and streaming media server. All we need to do is create an automated build project in Qt Creator's wizard that uses CMake instead of Qt, so that we don't have to make our own Makefile, because we can just run CMake in Qt Creator. Live Web server for students to visit the live page, synchronous display of teachers used by the teaching resources, and provide real-time interaction between teachers and students. Motherboard CPU frequency of 1200 MHz, memory frequency of 400 MHz, HT dial code switch with default configuration, the processing unit configuration parameters are the same. The communication between teacher workstation and web server adopts FTP protocol, so it is equivalent to FTP server. When using the HT bus, you can implement the CC-NUMA structure and its cluster structure. Live Web Server is used to store various resources used in Live Teaching. VOD Web servers store standardized courseware packages in categories for on-demand or download.

3.2 Analysis of Experimental Results

The experiment selects the remote sharing method of national music teaching resources based on data mining, the remote sharing method of national music teaching resources based on improved genetic algorithm, and the remote sharing method of national music teaching resources in this paper for comparison, and tests the transmission integrity of the three remote sharing methods of national music teaching resources under different data noise conditions. Transmission integrity means that the same teaching resource data set is acquired by different methods and transmitted to other users, and the ratio of the data transmitted to other users to the original data is detected. The specific results are shown in Fig. 2–6:

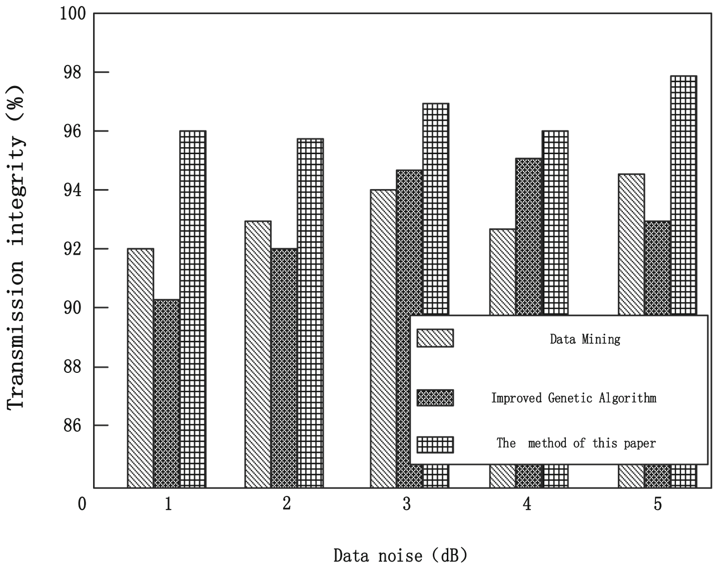

Fig. 2. Transmission integrity with 5 dB data noise

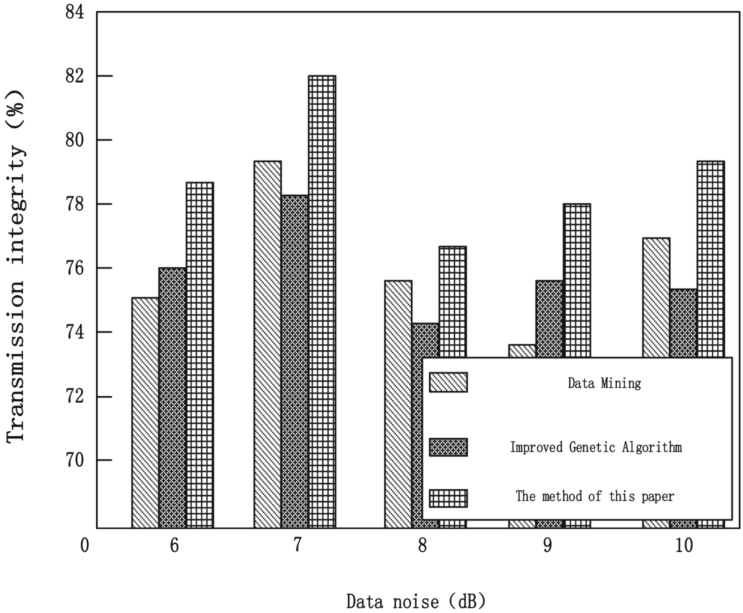

Fig. 3. Transmission integrity when data noise is 10 dB

According to Fig. 2–Fig. 5, it can be concluded that under different data noise conditions, the average transmission integrity of three remote sharing methods of ethnic music teaching resources is shown in Table 1:

From the Table 1, we can see that the transmission integrity of the remote sharing method and the other two remote sharing methods is 66.990%, 57.450% and 58.190% respectively, which shows that the remote sharing method is more perfect.

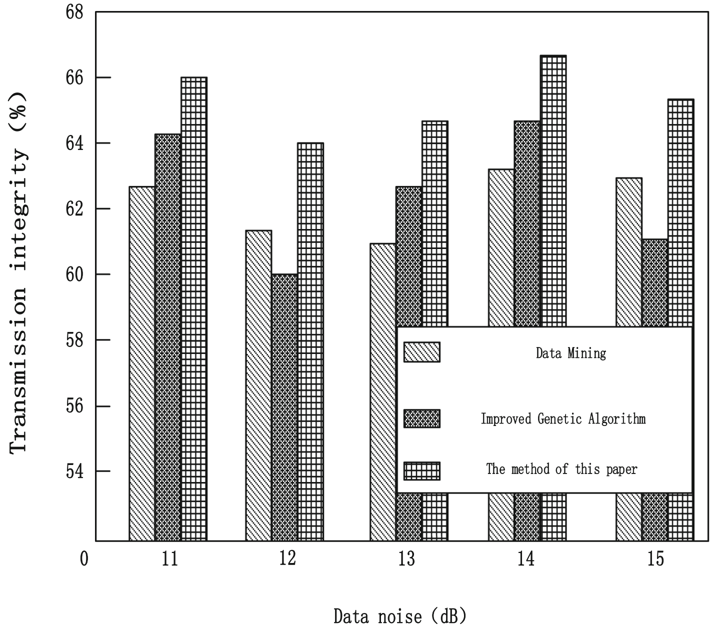

Fig. 4. Transmission integrity when data noise is 15 dB

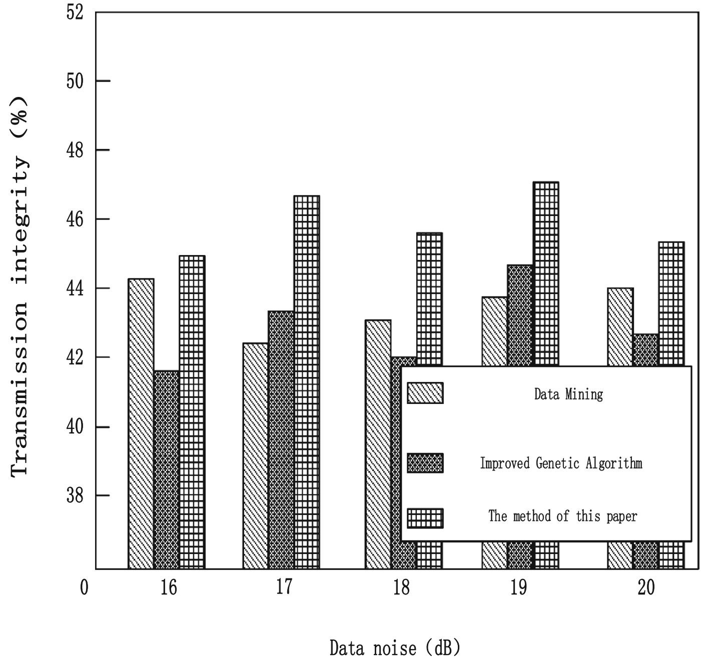

Fig. 5. Transmission integrity with 20 dB data noise

Table 1. Average value of transmission integrity (%)

Data noise (dB)	Data mining	Improved genetic algorithm	The method of this paper
5	92.316	91.502	95.889
8	72.216	71.149	82.306
12	51.874	53.785	69.548
15	52.618	57.225	65.948
17	35.508	33.165	42.551
20	40.165	42.316	45.699

4 Concluding Remarks

This paper proposes to use big data analysis technology to deeply mine teaching resources, classify and label them, and realize the sharing and transmission of teaching resources by this way. With the advantage of transcending time and space and concentrating high quality education resources, the sharing method in this paper makes up for the shortage of higher education resources in our country, alleviates the contradiction between limited university and large number of educated personnel in our country, and provides the educated with flexible and diverse learning methods. Because the research condition is limited, the article also needs to carry on the consummation to the sharing way multiplication.

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Mining Algorithm of Massive Online Financial Education Resources Based on Apriori TIDS

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Abstract. Online financial education resources are massive. Traditional algorithms are affected by the load of resource processing nodes, resulting in low accuracy and long mining time. Therefore, a massive online financial education resource mining algorithm based on Apriori TIDs is proposed. The Apriori TIDS algorithm is used to establish the characteristic equation of massive online financial education resources. By extracting the number of principal factors of the characteristic vector, the proportion of financial education resources in each dimension of each resource processing node in its total resources is calculated, so as to obtain the residual value of financial education resources of the resource processing node, and calculate the dynamic weight of financial education resources based on this, The residual load capacity of resource processing nodes is obtained. Combined with the design of massive online financial education resource mining algorithm, the mining of massive online financial education resources is realized. Experimental results show that the proposed algorithm can not only improve the accuracy of mining, but also shorten the mining time and have better mining performance.

Keywords: Apriori TIDS algorithm · Educational resources · Mining algorithm · Eigenvector · Balanced allocation · Processing node

1 Introduction

The development of computer science and technology provides necessary technical support for the rise of information industry. The rapid development of computer software industry makes it possible for people to deal with massive data. At present, most database systems are still used in transaction processing, and the inherent value of a large amount of data has not been well mined. When making decisions, decision makers mainly rely on the analysis results, intuition, experience and relevant professional knowledge of historical data, but can not use the knowledge and laws hidden behind massive data. The fundamental reason is that decision makers lack tools to extract valuable knowledge from massive data [1]. Therefore, how to mine and refine the "minerals" contained in massive data to make them useful knowledge, so as to give full play to their social and economic value is a work of great significance. Data mining is a process of extracting hidden but potentially useful information and knowledge from a large number of incomplete, noisy,

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fuzzy and random practical application data. According to its functions, data mining can be divided into characterization and differentiation, association analysis, classification and prediction, cluster analysis, outlier analysis and evolution analysis.

In the existing data mining applications, it is less found to mine the information of educational resources and the association rules of massive online financial education resources. In fact, data mining technology can also be applied to the field of education, but the main purpose of application is not only for commercial interests [2].

Financial education mainly refers to financial accounting education and financial management education. Through professional education in management, economy, law and accounting, we will cultivate professional talents engaged in financial management education, financial management, business administration, scientific research and financial management. In the process of education, through the in-depth interpretation of professional education ideas, educational concepts and professional quality, combined with the professional talent training mode, we have cultivated a number of professionals who can meet the needs of social development and socialist market economy construction, have a solid foundation, high comprehensive quality, innovative cooperation consciousness and relevant knowledge of financial management.

In domestic research, GUI Zhongyan et al. [3] used data mining technology to analyze E-learning behavior data, mine its implicit behavior characteristics, and provide personalized learning resource services for learners. Aiming at the problem that the applicability of the model is not high when the existing data mining algorithms analyze the network learning behavior data, a Learning Resource Recommendation Algorithm Based on behavior sequence analysis is proposed. Firstly, the definition of behavior sequence and its related concepts are proposed, and the similarity calculation method of behavior sequence is proposed; Then, a collaborative filtering recommendation algorithm based on behavior sequence similarity is proposed to calculate the learner similarity and generate a learning resource recommendation list for the learners to be recommended; Then, the recommendation method based on learning style is given, and the characteristics of learners' learning style are integrated into the recommendation process; Finally, the model of Learning Resource Recommendation Algorithm Based on behavior sequence analysis is given. The proposed algorithm does not limit the pattern of behavior sequence, and has high applicability. It can be used as a reference for in-depth study of network learning behavior sequence data and providing personalized learning services for learners. Li Hao Jun et al. [4] in order to meet learners' personalized needs for online learning resources, A personalized learning resource recommendation method based on three-dimensional feature cooperative domination is proposed (tplrm). Firstly, by improving the matching relationship between learners and online learning resources, a personalized learning resources recommendation model dominated by three-dimensional features is established and described parametrically; secondly, a binary particle swarm optimization algorithm based on Gaussian membership function fuzzy control is designed (fcbpso) to solve the objective function of the recommendation model; finally, under multiple evaluation indexes, five groups of comparative experiments verify that the tplrm recommendation method has good recommendation performance.

In the field of education, with the popularization of informatization, information management system has played an important role in school teaching management and affairs management, and has become an important part of school management system. As an information management system, the database usually stores a large amount of data, of which a considerable part is directly related to teaching, and the other part contains the basic data of students [5]. With the advancement of educational informatization, all kinds of new educational concepts and teaching models are constantly introduced, which greatly enriches the content of the school database supporting this model. The school has realized from paperless management to self-learning using the network, online testing, etc. almost all the information can be found through the computer. However, these data are still mainly used for teaching management and teaching support, and the historical data hiding a large amount of education and teaching information has not been well used, and the inherent value of these data has not been fully understood. Of course, there is no question of how to mine the education laws, students' training modes, differences and correlation laws hidden in these data.

The emergence of data mining technology provides a necessary technical basis for giving full play to the potential value of massive online financial education resources. The rules mined from the massive online financial education resources can be used as an important basis for education and teaching management decisions, and have practical guiding significance for education, teaching reform and targeted training of students. The decision-making body of the school can integrate the learning courses according to the relevance of various subjects of students' learning revealed in these guidelines, make the relevant courses promote each other, improve the relevance of courses, the relevance of knowledge and the mobility of students' learning interests, arrange activities of multiple disciplines in the activity class, and increase the relevance and relevance of students in learning, Guide students to start from advantageous disciplines, improve relatively weak disciplines, fully tap students' learning potential and improve learning efficiency, so as to realize students' learning balance.

2 Algorithm Design of Massive Online Financial Education Resources Mining

2.1 Extract Feature Vectors of Massive Online Financial Education Resources

In the process of designing the massive online financial education resource mining algorithm, the Apriori TIDS algorithm is integrated into the feature vector extraction of massive online financial education resources, the feature variance contribution rate of online financial education resources is calculated, and the observable random vector of the characteristics of online financial education resources is given, By extracting the number of principal factors of the feature vector of massive online financial education resources, the feature vector of massive online financial education resources is decomposed. The specific process is as follows:

$M = m_1, m_2, \cdots, m_n$ is defined as the random vector of the characteristics of online education resources, and the observable random vector of the characteristics of online financial education resources is calculated by formula (1), namely:

$$\varphi(M) = \frac{M \otimes G_i}{\left(b_{ij}\right)_{n \mp m}} \otimes d_i \otimes \phi_i \times M_i \tag{1}$$

Among them, b_{ij} represents the factor load of the feature vector of online education resources, G_i represents the unobservable vector of massive online financial education resources, d_i represents the factor load of massive online financial education resources, and ϕ_i represents the unique factors affecting factor load d_i.

Suppose y represents the number of characteristic variables of massive online financial education resources, and M represents y in the sample of massive online financial education resources; Four characteristic variables need to meet $M = m_1, m_2, \cdots, m_n$ conditions, and the massive online financial education resources are processed by orthogonal transformation to synthesize ψ A characteristic variable of massive online financial education resources, $(z_1, z_2, z_3)\chi^0$ represents the correlation coefficient matrix of massive online financial education resources samples. The characteristic equation of massive online financial education resources is established by using Apriori TIDS algorithm [2], which is expressed as:

$$\lambda^y(i) = \frac{\{\chi^0 \otimes M\}^y}{\{(z_1, z_2, z_3)\}} \otimes \frac{\left(m_1, m_2, \cdots, m_y\right)}{\psi} \tag{2}$$

Order β indicates the first a The variance of the characteristics of massive online financial education resources is calculated as follows:

$$\partial(p) = \frac{a \otimes \beta}{\mu(\chi^0)} \times \vartheta(o)(\xi \otimes k_0) \tag{3}$$

Among them, $\mu(\chi^0)$ represents the weight of the characteristic samples of massive online financial education resources, $\vartheta(o)$ represents the information entropy of the characteristics of different massive online financial education resources, ξ represents the best threshold of the characteristic variables of massive online financial education resources, and k_0 represents the observation variables of student characteristics.

Assuming that ϖ_i represents the number of non negative eigenvalues of the correlation coefficient matrix of massive online financial education resources samples, and ϖ_i is sorted [6] under the condition of $\varpi_1 \geq \varpi_2 \geq \varpi_n \geq 0$ the characteristics of the first f massive online financial education resources can be extracted, namely:

$$\ell(r) = \frac{f \otimes (\varpi_i)}{\xi(o)} \otimes \eta(u) \tag{4}$$

Among them, $\xi(o)$ represents the noise interference of the characteristics of massive online financial education resources, and $\eta(u)$ represents the uncertainty of the feature vector of massive online financial education resources.

According to the characteristics of the first massive online financia f education resources, the uncertainty of massive online financial education resources information source B^* is measured, and the calculation formula is:

$$K\left(B^*\right) = \frac{\lg h_i}{H(h_1, h_2, \cdots, h_n)} W(\sigma_i) \tag{5}$$

Among them, $W(\sigma_i)$ represents the space of massive online financial education resource information source B^*, h_i represents the probability of massive online financial education resource mining strategy, and $H(h_1, h_2, \cdots, h_n)$ represents the probability of discrete random variables.

Let $J(\phi_i)$ represent the information function of massive online financial education resource mining, and the probability of massive online financial education resource mining behavior class can be defined as:

$$f(\omega) = \frac{J(\phi_i) \otimes K(B^*)}{\Re(k)} \otimes \gamma(\tau) \tag{6}$$

Among them, $\Re(k)$ represents the amount of information of massive online financial education resources, and $\gamma(\tau)$ represents the cumulative information contribution rate of massive online financial education resources mining.

The Apriori TIDS algorithm is integrated into the feature vector extraction of massive online financial education resources to calculate the observable random vector of the characteristics of online financial education resources. The Apriori TIDS algorithm is used to establish the feature equation of massive online financial education resources. By extracting the number of principal factors of the feature vector of massive online financial education resources, The feature vector of online financial education resources is extracted, which lays a foundation for the mining of massive online financial education resources.

2.2 Balanced Distribution of Massive Online Financial Education Resources

Suppose that c represents the number of financial education resource processing nodes and $V(v_1, v_2, v_x \ldots)$ represents financial education resource processing nodes x To maintain system resources, calculate the proportion of each financial education resource processing node in its own total resources:

$$\gamma(g) = \frac{V(v_1, v_2, v_x \ldots) \otimes c}{x \otimes \zeta(r)} \times \frac{S(g)}{E(f)} \tag{7}$$

where, $\zeta(r)$ represents the task selected from the task set to form r Three disjoint subsets, $S(g)$ representing the g th of the financial education resource processing node; Dimension resources, $E(f)$ represents the financial education resources required for each task.

It is assumed that the f th financial education resource processing node represented by $\vartheta_{(f,j)}$ has been allocated to the j th Dimension resource quantity, obtain the residual value of each resource in the financial education resource processing node, and calculate the dynamic weight of each financial education resource:

$$w = \frac{\vartheta_{(f,j)} \otimes O}{F} \otimes \frac{\eta(h) \otimes W(\sigma)}{\psi(s)} \tag{8}$$

where, O represents the dynamic weight of residual resources, F represents the residual value of financial education resources, η represents the constant, h represents the load weight of nodes, $W(\sigma)$ represents the impact of financial education resources on the residual load capacity of nodes, $\psi(s)$; Represents the financial education resource balance of the node after joining task s.

Assuming that v_{ij} represents the allocated financial education resources of the resource processing node, the ratio of the allocated financial education resources of each resource processing node to all the allocated financial education resources of its nodes is calculated:

$$\Delta(d) = \frac{v_{ij}}{\Phi(t)} \otimes \frac{\chi(g) \otimes \Upsilon(g)}{\kappa(y)} \tag{9}$$

where, $\Phi(t)$ represents the financial education resources allocated by the resource processing node, $\chi(g)$ represents the balance degree of financial education resources, $\Upsilon(g)$ represents the load degree of financial education resources, and $\kappa(y)$ represents the second i A processing node has been assigned to the second processing node y Maintain financial education resources.

Assuming that I represents the heat of financial education resources and z represents the number of all situations in which nodes interact with financial education resources, based on the feature vector of financial education resources extracted from the sea volume online in Sect. 1.1 [7], the current processing consumption of financial education resources is given as follows:

$$H = \frac{I \otimes G(\Phi)}{N_j \times z} \otimes a_j N_j \tag{10}$$

where, N_j stands for financial education resources in the second j The amount of time consumed in three interactive situations, a_j represents the occurrence of financial education resources j Probability of two interaction situations.

According to the processing consumption of financial education resources, δ represents the total number of requested tasks, and the remaining load capacity of the resource processing node is obtained:

$$\phi(u) = \frac{\delta \otimes W(\omega)}{\Delta(E)} \oplus \varepsilon(d) \times U \times \psi(n) \tag{11}$$

where, $W(\omega)$ represents the number of task sets requested by the outside world, $\Delta(E)$ represents the number of financial education resources per dimension required for each task, $\varepsilon(d)$ represents the capacity of financial education resources per dimension of the specified system, U represents the number of tasks per set in the task set, and $\psi(n)$ represents the total financial education resources of the system.

Assuming that $\xi(e)$ represents any non negative positive integer, the balanced allocation of financial education resources can be completed:

$$\chi(S) = \frac{\xi(e) \otimes \phi(u)}{\gamma(g)} \tag{12}$$

In the process of balanced allocation of massive online financial education resources, first calculate the proportion of financial education resources in each dimension of each resource processing node in its total resources, and then obtain the ratio of the allocated financial education resources in each dimension of each resource processing node to all the allocated financial education resources in its nodes, Obtain the residual value of financial education resources of the resource processing node, calculate the dynamic weight of financial education resources according to the residual value of financial education resources of the resource processing node, obtain the residual load capacity of the resource processing node, and complete the balanced allocation of financial education resources.

2.3 Design a Massive Online Financial Education Resource Mining Algorithm Based on Apriori TIDS

According to the balanced distribution results of financial education resources, a complete financial education resource data set is established. Through the Apriori TIDS algorithm, all the characteristics of financial education resources in the financial education resource data set are reconstructed, and the reconstructed financial education resource data set is decomposed. According to the decomposition results, the wavelet variance of financial education resources is calculated, which is used as the weight to fuse the wavelet coefficients, and the mining results of financial education resources are obtained.

Assuming that q_{st} represents the initial method factors of financial education resources, h_t represents the sudden factors of financial education resources mining, and B_{in} represents the correlation coefficient between influencing factors and financial education resources, the obstacle level of financial education resources mining is obtained by using formula (13):

$$S = \frac{\int_t q_{st} h_t dt}{T_s \times \frac{m_p}{n_r}} \times B_{in} \tag{13}$$

where, n_r represents students' cognitive factors, T_s represents students' self-concept, m_p represents students' cognitive evaluation function, and u represents the decision function describing financial education resource mining.

Hypothesis n Multiple resource managers manage multiple financial education resources C at the same time. The reserve value of financial education resources in each resource manager can be expressed as:

$$D_i = C + F_i, i = 1, 2, \cdots, m \tag{14}$$

where, F_i represents the financial education resource parameter in the resource manager.

Suppose ξ_i^2 represents the weight in each resource manager and ζ_i^2 represents the variance of financial education resource parameters. Finally, the mining value of financial education resources is $D = \sum_{i=1}^{q} \xi_i D_i$ and there is $\sum_{i=1}^{q} \xi_i = 1$. The total mean square error of financial education resource mining is:

$$\psi^2 = G\Big[(C - D)^2\Big] = \sum_{i=1}^{q} \frac{1}{\zeta_i^2} \tag{15}$$

According to Apriori TIDS algorithm, it can be calculated that the minimum value of formula (15) is $1/\sum_{i=1}^{q}\frac{1}{\zeta_i^2}$, and the weighting factor corresponding to the minimum value is:

$$\delta_i = \frac{1/\sigma_i^2}{\sum_{i=1}^{q} 1/\sigma_i^2} \tag{16}$$

Using the weighting factor obtained from formula (16), the characteristics of financial education resources are reconstructed. The formula is:

$$Z_J = \sum_k \frac{h_n(J,k)}{g_n(J,k)}\varphi_{J,k} + \psi_{J,k} \tag{17}$$

where, Z_J represents the reconstructed financial education resources, and $\varphi_{J,k}$ represents that the financial education resources are in the second stage; The scale function of level J, $h_n(J,k)$ represents the second level of financial education resources k approximation coefficients, $\psi_{J,k}$ represents the wavelet resource function of financial education resources at layer J, and table $g_n(J,k)$ shows the second approximation coefficient of financial education resources k detail resource functions.

It is assumed that λ_{dr} 1 represents the cognition of college students in different stages of financial education resource mining, and ς_u 2 represents the methods of college students in different stages of financial education resource mining. Combined with Apriori TIDS algorithm, the influence degree formula of financial education resource mining is given:

$$Y_\varphi = \gamma_v \sum_{d=1}^{p} \frac{f_{st} \times \lambda_{dr}}{\varsigma_u \cdot E} + \beta_i \tag{18}$$

where, β_i represents college students' cognitive level of financial education resource mining in different stages, γ_v represents the financial education resource mining coefficient, p represents the attribute variable of financial education resource mining under phased cognitive level, and $d = 1$ represents college students' energy value.

Suppose $W_{h,i}$ represents the weighting factor of the approximation parameter of financial education resources, $W_{g,i}$ Represents the weighting factor of the detailed parameters of financial education resources, then:

$$\sigma^2 = E\left[W_{g,i} - \sum_{i=1}^{q} W_{h,i}^2\right] \tag{19}$$

According to formula (19), the mean square deviation of the weighted results of financial education resource mining is less than or equal to the mean square deviation of the optimal weighting of financial education resources in time domain, mining financial education resources through Apriori TIDS algorithm makes the mean square deviation of financial education resources smaller and smaller with the decomposition of scale. The final conclusion provides a theoretical basis for financial education resource mining.

Assuming that K represents the parameter sequence of managed financial education resources, the energy on the financial education resource manager can be decomposed into:

$$\|K\|^2 = \sum_{i=1}^{J} \frac{\|G_J\|^2}{\|H_J\|^2} \tag{20}$$

Then the variance of financial education resources obtained from the actual test is:

$$\sigma_X^2 = \frac{1}{N}\left(\left\|G_{j,n}\right\|^2 + \left\|H_{j,n}\right\|^2\right) \tag{21}$$

The wavelet entropy of financial education resources is obtained by using the distribution of energy series of financial education resources. The specific process is as follows:

$$H_{\text{we}} = H(p_1(E), p_2(E), \cdots, p_J(E)) \tag{22}$$

where, $p_J(E)$ represents the normalization processing result of financial education resources.

To sum up, the wavelet entropy of financial education resources is used as the fusion weight of financial education resources, and the mining coefficients are obtained. Through the Apriori TIDS algorithm, the mining results of financial education resources are obtained to realize the mining of financial education resources.

3 Experimental Analysis

3.1 Experimental Preparation

The experiment uses the financial education resources in the online financial teaching system of a higher education university as the experimental data, segments the financial education resource data, including a total of 4000 financial education resource data, and takes them as the experimental data set, as shown in Table 1.

Table 1. Experimental data set

Dataset name	Total	Average length of financial education resource data	Average length of frequent items
1	2000	9	5
2	2000	11	8
3	2000	8	4
4	2000	10	7
5	2000	12	6

Based on the experimental data set in Table 1, a PC with a CPU hard disk capacity of 3 GHz and a memory of 1G is selected, the operating system is windows10, and visual studio 2003 is selected as the development tool. Five PCs with the same configuration are used as the experimental machines, the data of the data generator is saved on the PC, and the data flow required for the experiment is simulated by the reading mode of serial port I / O.

Based on the above experimental preparation, the mining algorithm based on behavior sequence analysis and the mining algorithm based on three-dimensional feature cooperative domination are used to compare, highlight the performance of the massive online financial education resource mining algorithm based on Apriori TIDS in practical application, and compare the performance of the three mining algorithms according to the obtained experimental results.

3.2 Result Analysis

Based on the above experimental preparation, the data flow is divided into 15 segments, and every two segments are recorded as a mining statistical point, a total of eight statistical points. Comprehensively count the mining accuracy of three data mining algorithms on financial education resources, as shown in Fig. 1.

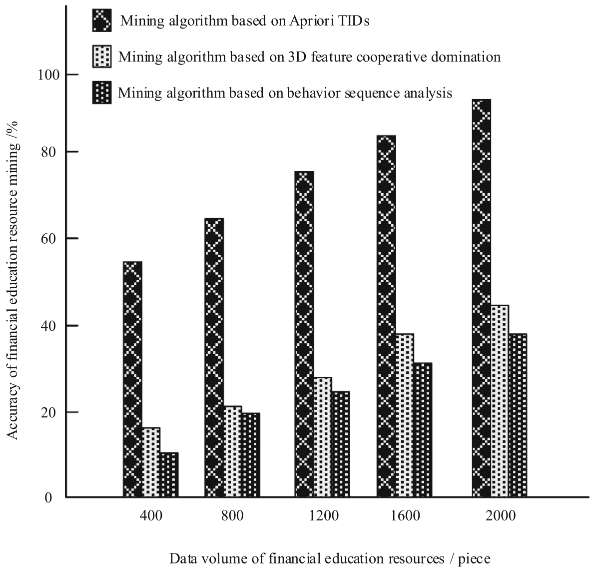

Fig. 1. Accuracy results of financial education resource mining

The results in Fig. 1 show that the accuracy test results of massive online financial education resource mining obtained by the massive online financial education resource mining algorithm based on behavior sequence analysis and the massive online financial education resource mining algorithm based on three-dimensional feature collaborative control are relatively close, and the accuracy of financial education resource mining is less than 50%, The highest accuracy rate of financial education resource mining is only 44% and 38%. When using the massive online financial education resource mining algorithm based on Apriori TIDS, the lowest accuracy rate of financial education resource mining has reached 55%. With the increase of financial education resources, the accuracy rate of financial education resource mining has become larger and larger, up to 93%, Therefore, it shows that the massive online financial education resource mining algorithm based on Apriori TIDS can improve the mining accuracy of financial education resources and improve the mining performance of financial education resources.

Based on the mining accuracy results of financial education resources in Fig. 1, the financial education resources are mined, and the execution time of three algorithms in mining massive online financial education resources is counted. The results are shown in Table 2.

Table 2. Comparison results of mining time of massive online financial education resources

Mining statistical points	Excavation time/s		
	Mining algorithm of massive online financial education resources based on behavior sequence analysis	Mining algorithm of massive online financial education resources based on three-dimensional feature cooperative domination	Mining algorithm of massive online financial education resources based on Apriori TIDS
1	48.7	31.7	20.6
3	50.4	31.7	20.6
5	51.6	28.6	20.6
7	48.7	33.2	20.7
9	43.4	32.6	21.2
11	52.6	37.3	21.3
13	49.3	31.4	22.4
15	50.4	32.1	16.5

By analyzing the execution time of the mining algorithm shown in Table 2, it can be seen that in the initial stage of mining, with the continuous increase of mining statistical points, the execution time initially increases, but finally the execution time of the three algorithms tends to change stably. The execution time of the massive online financial education resource mining algorithm based on behavior sequence analysis is the longest, The reason is that most of the time of the algorithm is wasted in the transmission process from the remote site to the main site. The average execution time of the final algorithm is about 48S, which takes the longest time. Compared with the massive online financial education resource mining algorithm based on behavior sequence analysis, the mining time, update time and transmission time of the massive online financial education resource mining algorithm based on three-dimensional feature collaborative control are reduced, the final execution time is about 33 s, and the execution time is relatively reduced. The algorithm for mining massive online financial education resources based on Apriori TIDS designed in this paper has the shortest execution time, with an average of about 20 s and the shortest execution time, which is suitable for mining massive online financial education resources.

4 Conclusion

This paper presents a research on the mining algorithm of massive online financial education resources based on Apriori TIDs. By extracting the number of main factors of the feature vector of massive online financial education resources, the residual value of financial education resources at the resource processing node can be obtained. Based on this, the dynamic weight of financial education resources is calculated, and the residual load capacity of resource processing nodes is obtained. Combined with the design of massive online financial education resources mining algorithm, the mining of massive online financial education resources is realized. Experiments show that the mining algorithm can not only improve the accuracy of financial education resource mining, but also shorten the execution time of mining, and has better performance. However, there are still many deficiencies in this method. In the future research, we hope to use the improved decision tree algorithm to optimize the massive online financial education resource mining algorithm, so as to meet the needs of students for financial education resources.

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Design of Educational Resource Sharing System for Financial Management Specialty Based on Data Mining

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Abstract. Due to the long response time of the traditional financial management education resource sharing system, a financial management education resource sharing system based on data mining is designed. Firstly, the hardware configuration structure and function of the financial management education resource sharing system are optimized to improve the hardware performance of the system. Then, the massive financial management education resources are effectively stored and classified, and the targeted real-time extraction and sharing of teaching information are carried out. Finally, the experiment proves that the response time of the educational resource sharing system of financial management specialty based on data mining is short, and it has high practicability in the process of practical application.

Keywords: Data mining · Financial management · Resource sharing

1 Introduction

Learning in the process of socialization is necessary for the development of digital educational resource sharing network system. Based on the analysis of data mining and its technical advantages, this paper studies and designs the educational resource sharing system of financial management specialty based on data mining, and discusses in detail the main implementation methods of computing service layer and the design of mobile Agent in the system [1]. The system can fully centralize the high-quality educational resources around the country and automatically manage them by the data mining end to maximize resource sharing, which will help to solve the problems of uneven distribution of educational resources and low degree of resource sharing in China, so as to improve the level of educational informatization in China [2]. In addition, at present, intelligent word segmentation technology and mobile agent technology are introduced to design the educational resource sharing system of financial management specialty, which makes the system more intelligent, provides personalized services for users, dynamically adjusts and presents the retrieval content of educational resources, and improves the usability and interactivity of the system. Based on the basic functions, the resource sharing and

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retrieval system is designed. According to the survey, the existing teaching resource sharing platform has many styles, However, no one can say that the platform designed by themselves can meet the actual needs, because the construction of teaching resource sharing platform is an accumulation process, and the lack of resources is a major obstacle [3]. It hinders the modern establishment of teaching resources on the online learning platform, resulting in a long response time of the educational resource sharing system for the financial management specialty. With the development of multimedia technology and the advantages of modern teaching, this paper designs a new educational resource sharing system for financial management specialty based on data mining, which solves the problems existing in the traditional system.

2 Financial Management Professional Education Resource Sharing System

This paper designs the hierarchical structure of regional education resource grid management system through RGES grid, RGES regional network and RGES campus network, stores and classifies the massive financial management education resources, extracts teaching information and shares teaching in real time.

2.1 Hardware Structure of Financial Management Education Resource Sharing System

The development of the system follows the principles of completeness, versatility, practicability, advancement and openness, and uses more advanced structured system analysis methods to conduct detailed analysis of data processes and data structures, and formulate a logic suitable for university education resource management Model. Propose a set of overall design schemes for the education resource sharing system of colleges and universities based on the interconnection network and using large-scale database development [4]. When designing a grid-based regional education resource grid system, follow the principle of "opening to the inside and shielding from the outside", that is, all middle schools and other educational institutions that access the regional education resource grid system can use this system according to the authorization of the system External users cannot enter the system without authorization. This principle not only ensures that the grid system can fully play its role in resource sharing, but also ensures the stability and safety of the system's operation. The regional education resource grid system should adopt a hierarchical organization model [5]. In the design of this system, a three-tier structure is adopted, from top to bottom are RGES grid, RGES regional network, and RGES campus network. The three-tier structure is easy to manage and can ensure the efficient operation of the system. According to the above-mentioned three-tier structure, three-level functional organizations are established: RGES engineering group, RGES research group, and BGES project group to implement the planning, construction and management of the system. The hierarchical structure of the regional education resource grid management system is shown in the (Fig. 1):

The structural design of the system requires modular operation. Modularization can form several modules from top to bottom. During the development process, a certain

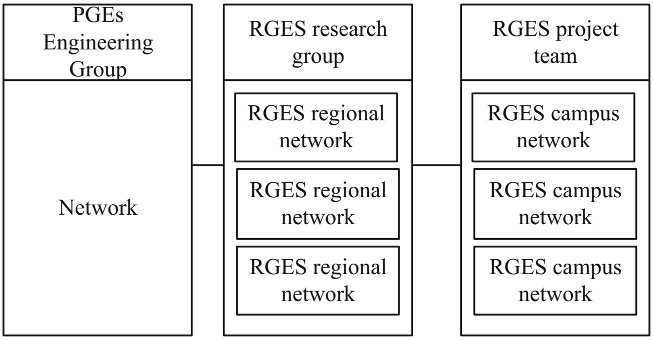

Fig. 1. Hierarchical structure of regional education resource grid management system

module can be developed or each module can be modified. They will not affect each other. After the development of each module, they form a whole system [6]. The client uses Javascript, Jquery, Hml, Css and other programming technologies. The logic processing layer is based on the αI framework, using PHP language, SQL statements and other technologies. In the data layer, the attribute data is stored in MYSQL database. The logic diagram of the platform based on data mining is shown in the (Fig. 2).

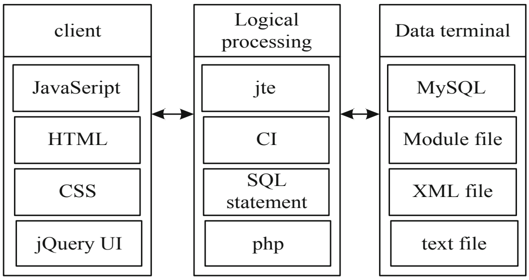

Fig. 2. Logical architecture diagram of the system platform

Modular development of the system has its unique advantages, which can easily reduce the complexity of the system, improve the operability of the system, facilitate the maintenance of the system, and replace any module without affecting other modules [7]. Each module only needs an interface for docking, and each module has strong independence, which can lay a good foundation for large-scale advanced development. The campus resource sharing system takes advantage of the operating system management, security management, monitoring management and other convenient conditions of the resource layer, as well as the database service and other convenient conditions of the platform layer. It has two identities and many permissions of users and administrators in the application layer. The system hardware framework is shown in the figure below (Fig. 3):

The system design adopts the Internet/Intranet brand-new technology, which can achieve the integration and sharing of educational resources in various universities,

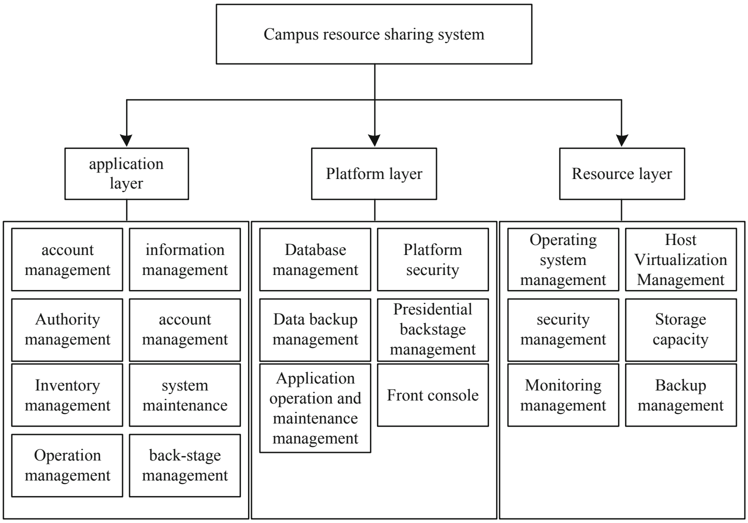

Fig. 3. Fine soil hardware structure frame

research and formulate the topology structure and application platform of the educational resource sharing system in universities [8]. In order to ensure the normal and stable operation of various educational information systems, software and hardware such as computers, servers, networks and resource databases must be maintained, upgraded and updated frequently. Since the data mining mode only requires the user terminal to be able to access the Internet, the daily maintenance of the system's software and hardware is solved by the data mining provider. Therefore, the difficulty of maintaining the educational resource sharing system in schools is greatly reduced.

2.2 System Software Function Optimization

The function of financial management teaching resource sharing trading system mainly has two roles, one is administrator and the other is user. The administrator manages the whole system, including user review, commodity information review, order viewing, deletion and review of commodity evaluation. For some unhealthy information, the administrator also needs to maintain the system regularly and manage the normal operation of the system [9]. Protect the security of data, make timely backup to prevent data loss, and update the website information in a timely manner. The functional structure module diagram of the system is shown in the figure below (Fig. 4):

In the traditional single-user nature, the database only retains the business data of one user, but on the customer's own server. In this case, data sharing is not possible. And data mining technology has the characteristics of multiple users, users can not only obtain public data, but also their own unique data resources, so a factor to be considered is to seek a balance between data sharing and themselves [10]. Assuming that the number of nodes forwarding the query request is N, that is, the coverage rate $C = 1$, there are e edges, the average degree of the nodes is d and d = 2EN, which can be calculated by a

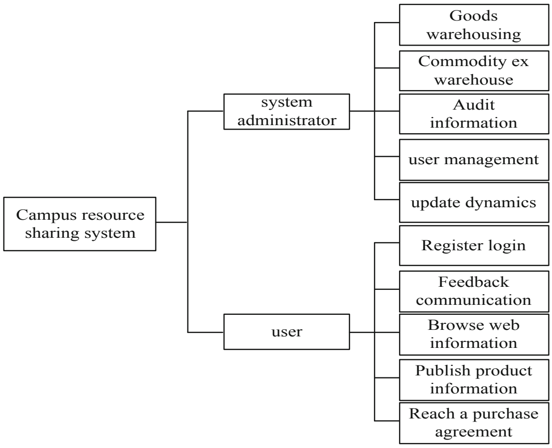

Fig. 4. System function structure

function of the number of nodes M and the index A:

$$E = \frac{1}{2M(e+1)}\left(1 - \frac{1}{AN^{e+1}}\right) - CN \tag{1}$$

In the retrieval strategy based on route labeling, each time a node $\overline{d}$ newly added to the target d_i set is deleted in the next round of forwarding, the number of query requests forwarded during the retrieval process is

$$LMsg_{otal} = E\sum_{i=1}^{N}(d_i - e)N\overline{d} - \sum_{i=1}^{N}(C - A)N \tag{2}$$

The information scheduling is designed according to the multi protocol identification exchange header format and SDN three-tier architecture. The results are shown in Table 1 (Table 2, Table 3, Table 4 and Table 5).

Table 1. Information scheduling task table

Network sharing structure	Task scheduling database		
	Identification management	Table item adjustment	Information scheduling calculation
Control platform	Topology information	information acquisition	Table item distribution rules
Underlying infrastructure	Network equipment supports information exchange protocol		
	Backbone entrance A	Backbone entrance B	Backbone entrance C

Table 2. Evaluation indicators of the use efficiency of the educational resource library based on usability

Evaluation object	Primary index	Secondary index
Educational resources	Effectiveness	Resource reserve; Resource content coverage; Form richness of resource media
	Efficiency	Learning effect; Study time
	User satisfaction	Satisfaction with resource richness, resource practicability and resource renewal speed
Resource platform	Effectiveness	Functional design, platform reliability and security, interface design, interaction design
	Efficiency	Stable operation, fast operation, intelligent storage mechanism and independence
	User satisfaction	Satisfaction with platform personalization, interactivity and performance

Table 3. The final version of the evaluation index framework for digital education resource sharing

Primary index	Secondary index	Tertiary indicators	Index connotation
Resources	Administration	Access mechanism	Resources can be released only after they are approved as qualified
		Copyright	Attach importance to resource copyright. Maintaining the copyright of users and platforms
		Storage	Save the resource upload time, resource contributor name and historical version of the resource
	Activity	to update	Update efficiency of resources
	Administration	Resources	Amount of resources owned by the platform
	Dynamics	Total activity	Total activity of users using resources
		Per capita activity	Average activity of users using resources

(*continued*)

Table 3. (*continued*)

Primary index	Secondary index	Tertiary indicators	Index connotation
User	User experience	Retrieval convenience	Support fast search and positioning based on discipline, grade, media category and source
		User mutual evaluation	Users can evaluate the resources uploaded by each other
		Information description	Push relevant resource information to users according to existing user personal information
		Resource preview	Online full-text preview supporting multiple document formats

Table 4. Judgment matrix corresponding to the first-level indicators

Matrix	A	B	C	D
A	1	1/4	1/4	1
B	4	2	2	3
C	4	2	2	3
D	1	1/3	1/3	1

Table 5. Test results

Merge factor	Minimum number of merged documents	Maximum number of merged documents	Number of documents	Time (seconds)
20	20	Integer.MazValue	6500	798
150	150	Integer.MazValue	6500	499
150	150	Integer.MazValue	6500	431
150	150	150	6500	465
1000	1000	Integer.MazValue	6500	332

The design of platform database adopts centralized database design. All data of the platform is stored in a centralized manner, that is, there are only databases, and each tenant shares this database. Reasonable database physical design and logical design help to reduce the difficulty of system development and maintenance, and improve the security of the platform. The physical model describes the real database. The platform uses MySQL database to store and query data. The physical architecture of cloud database is shown in Fig. 5.

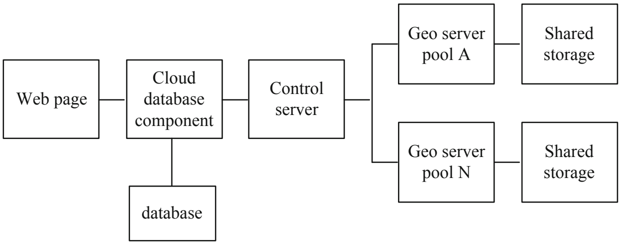

Fig. 5. Physical architecture of teaching resource database

The evaluation indicators for the use of the educational resource library based on usability include three primary indicators of effectiveness, efficiency, and user satisfaction. The primary indicators remain unchanged according to different evaluation objects, but corresponding to different secondary indicators. The evaluation objects are educational resources. There are 8 secondary indicators when the assessment object is a resource platform, and there are 10 secondary indicators. As table.

According to the analysis of sharing and characteristics of sharing, the author believes that the elements that affect sharing evaluation should be carried out from four aspects: resources, users, platforms, inputs and benefits. From the perspective of the shared structure, the shared content is the resource, the shared carrier is the platform, the main body of the sharing is the user, and the guarantee of sharing is the investment and benefit. Benefits here are regarded as social benefits generated by sharing. In terms of service quality theory, the service performance proposed by Sasser has three levels of material, equipment, and personnel. The author corresponds to the three levels of service performance to the sharing of educational resources: "material" refers to the shared resource itself, "equipment" "Refers to the related software and hardware facilities, technology and platforms of computer networks. "Personnel" mainly refers to suppliers in the service. The introduction of services into the field of educational resource sharing can divide personnel into suppliers from the perspective of the overall service process., Consumers and related service providers, etc. Total quality management (TQM) includes people, environment, materials, methods, and machines that also correspond to resource sharing elements. People correspond to providers, consumers and related service providers, materials correspond to resources, and environment, methods, and machines correspond to sharing platforms. Material or non-material things. In addition, service itself is an investment, and investment must conform to corresponding economic laws and achieve corresponding results. Service quality and benefits are closely linked.

2.3 Realization of the Sharing of Teaching Resources for the Major of Financial Management

Case analysis of digital education resource sharing platform. The number of registered users, browsing and searching times presented by the national basic education resource network and Shanghai Education Resource Database on the government supported education resource website reflect the use of resources and user stickiness. The activity exchange center of Shanghai Education Resource Database pays attention to user experience, and the consulting service center provides systematic cognitive function. In the educational resource websites founded by Internet enterprises, students emphasized the standardization of resource audit, the consultation and application of resource copyright users, the incentive mechanism of the platform and user interaction. In community websites, nutshell, Zhihu and Baidu know that they have important reference for the index framework in terms of user autonomy, user clustering, user privacy protection, user stickiness, platform culture, user needs and incentive mechanism. The evaluation index framework is shown in the table below.

The four first-level indicators of the digital education resource sharing evaluation indicator framework are resources, users, platform investment and benefits. This study uses the above four first-level indicators to represent A1, A2, A3, and A4, and A12 represents resources and platforms. Compared with the importance of resources, A21 represents the importance of resources compared to platforms. By analogy, A represents the importance of i compared to i, and Aj represents the i row and j column in the judgment matrix. Perform operations on 18 pieces of data to get the arithmetic mean and standard deviation, remove the data that does not meet the standard, and then find the arithmetic mean of the remaining data and round it, and finally bring the calculated value into the judgment matrix, as shown in the table.

Learning resource sharing system is an application service based on data mining infrastructure, which provides a platform for students, teachers and administrators to interact with learning resources. The system includes database, learning platform, management platform and access layer. The specific architecture is shown in the figure below (Fig. 6).

The lowest layer of the learning resource sharing system is the database system and learning resource library. These infrastructures will rent the resource pool in the logical layer for data storage. The database system mainly stores student information and administrator information. The learning resource database is mainly used to store learning resources. It adopts the mode of distributed storage and centralized management, that is, the specific information is stored dispersedly and redundant backup is provided. At the same time, the metadata server is provided at the upper layer to uniformly manage these decentralized information and resources.

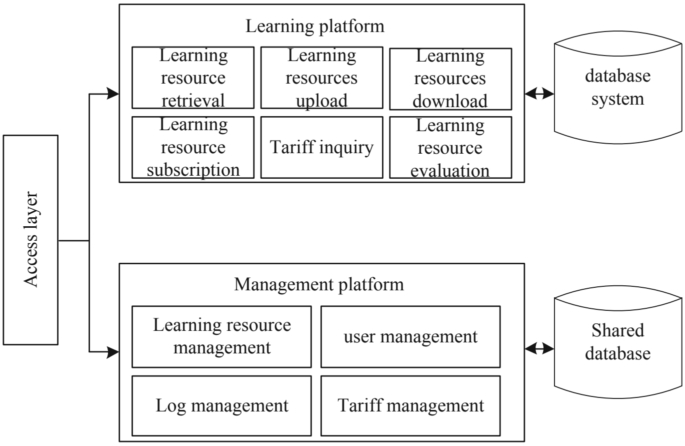

Fig. 6. Overall structure of the learning resource sharing system

3 Analysis of Experimental Results

Build a Floodlight + Mininet SDN experimental platform, which uses a 2.4.0 model virtual switch inside, which can realize the underlying switching equipment, and supports path identification and table entry functions. Floodlight runs on a separate virtual switch and provides a control platform for the SDN architecture. It is mainly responsible for monitoring the network link load and dynamically adjusting table entries; while Mininet is used to design the network topology, supporting the network structure and the control platform on Floodlight For information exchange. In this paper, 3000 data samples are obtained from the teaching resource database of financial management major in a university, including 2000 test samples and 1000 training samples.

The data mining platform built is composed of three roles: the client, the controller, and the computing node. Deployed on one physical host, or separately deployed on different physical hosts, in order to improve the performance of data mining and reduce the pressure on the controller when a large number of users visit, this paper adopts the scheme of deploying on different physical hosts. Computing nodes are composed of separate physical machines supporting VT technology, which are mainly used to run virtualized instances and provide computing services. The performance test first needs to test whether the response time is normal, such as whether the response speed is normal, if the customer visits are very slow, the user experience is very bad, this work is also very important. This article uses automatic load testing tools to test the load capacity and response time of the system. Load test is to gradually increase the pressure on the system under test to test the response time of the system. When it does not exceed the predetermined index, it is deemed to be up to the standard (Fig. 7).

Based on the above detection results, it is not difficult to find that, compared with the sharing system based on intelligent word segmentation technology and the sharing system based on mobile agent technology, the error rate of this system in the actual process is significantly lower and the system performance is better. After testing, in general, when the number of users is about 100, the system can complete loading in

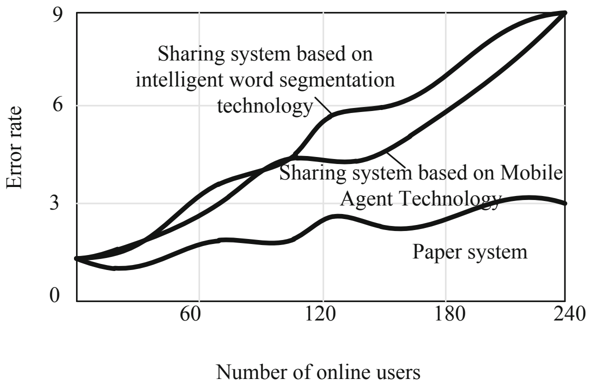

Fig. 7. System performance test results

3 s. When there are a large number of users, the response can be completed in 5 s, which basically meets the requirements. The performance of index is very important for a full-text retrieval system. Because the resources in the educational resource sharing system need to be updated regularly and temporarily, the resources need to be indexed. In the process of creating the index, we can make full use of the hardware resources of the machine to improve the efficiency of the index. When you need to index a large number of files, you will notice that the bottleneck of the indexing process is the process of writing index files to disk. In order to solve this problem, the system sets a buffer in memory, and controls the size of the buffer and the frequency of index files written to disk by setting parameters in the program. The following is a practical test of the performance of the system index:

As shown in the table, it can be seen from the first three columns that this article sets different values for the three parameters of the merge factor, the minimum number of merged documents, and the maximum number of merged documents to comprehensively test the efficiency of indexing. In a real environment, user requests generally obey Poisson distribution. However, Jmeter currently does not support Poisson distribution. In order to simplify the period, this section uses uniform distribution to simulate user requests. All user requests are issued in a uniform distribution within 1 s.,Visit the system homepage. In order to test the consistency of the environment, both the original system and the newly developed system are deployed on the same hardware facilities. The test results are as follows (Fig. 8).

Because data mining technology adopts virtualization and distributed processing methods, and learning resources adopt the strategy of multiple copies in storage, the scheduling algorithm provided by data mining can make the computer resources flow in a more optimized way. As can be seen from the figure, by adopting the method of data mining and combined with the distributed learning resource sharing system in the upper application, the response time is significantly shortened when the concurrency is large, which effectively improves the response speed (Fig. 9).

The educational resource sharing system of financial management specialty based on data mining shares curriculum resources by building server clusters. Compared with

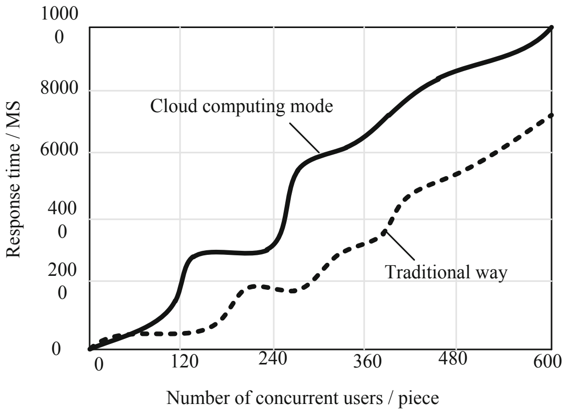

Fig. 8. Hardware device phase response time

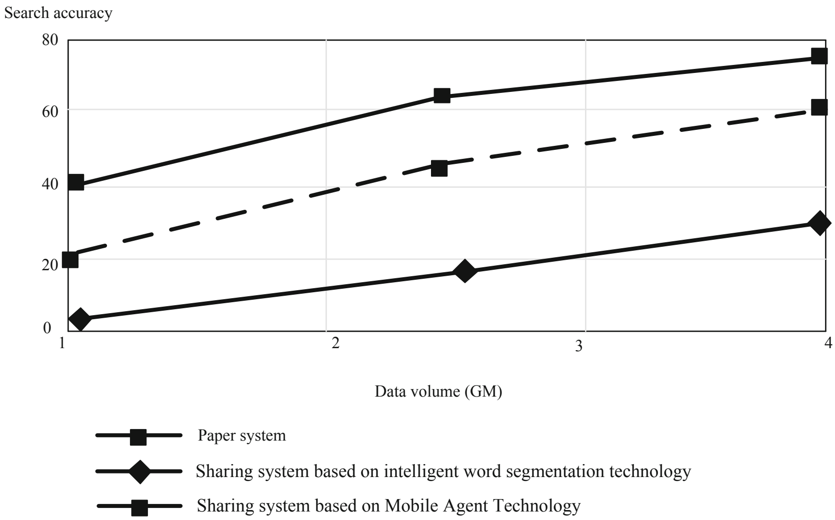

Fig. 9. Comparison and inspection of the operating quality of system resource sharing functions

the sharing system based on intelligent word segmentation technology and the sharing system based on mobile agent technology, which shares curriculum resources based on a single server, it has considerable advantages in the function of curriculum resource search and curriculum resource recommendation, Its data search and server response time are 5 times higher than the traditional network sharing mode of a single server.

4 Conclusion

In the daily learning process, a large amount of important learning materials are needed to deliver shared information in a timely manner. Based on the concept of information sharing, how to quickly and accurately obtain information has also become a key issue for learners, whether it is office or leisure culture and entertainment, it is even more demanding. Such an efficient information system: First, it is for the convenience of friends or trusted colleagues in the same local area network to enjoy the file; second, it can save a lot of hardware resources and enrich network resources; third, it is required to provide an effective retrieval mechanism to facilitate users Looking for the required directories and files is to solve the needs of users. The development of a local area network-based educational resource file sharing and retrieval system is of far-reaching significance.

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Personalized Recommendation System of College Students' Employment Education Resources Based on Cloud Platform

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Abstract. In view of the current use of the linkage university student employment service platform, the recommendation method under the "double innovation" education perspective is generally based on the stand-alone mode, with limited processing capabilities and scalability, resulting in low system recommendation accuracy and recall rates. In order to solve this problem, a personalized recommendation system for college students' employment education resources based on a cloud platform is designed. Use the Elastic Search open source search engine to build indexes so that users can quickly locate the resources they need from the search results. Build a talent training decision-making system platform to enable students to choose high-quality module resources that they are interested in. Design a hypertext service platform to obtain recommended paths. Establish a keyword index platform to index educational resources based on keywords. Construct a vector space model, describe the keyword vector, and determine the similarity between the relevance of the courseware and the category. Analyze queries and documents, remove stop words, extract stems, and vectorize documents. The document content is represented by the feature weight set, and a personalized recommendation process is designed. It can be seen from the experimental results that the highest recommendation accuracy rate of the system is 99%, and the highest recall rate is 98%, which has an efficient recommendation effect.

Keywords: Cloud platform · College students · Obtain employment · Educational resources · Personalized recommendation

1 Introduction

With the launch of many education cloud platforms, the massive courseware data stored in the cloud platform has reached the upper limit. In addition to the data storage requirements, the problem of "information overload" has long appeared for the users of the system. The traditional information search methods of classified search and keyword search have been difficult to meet the needs of users under the cloud platform. In order to meet the needs of user information filtering under the cloud platform, various personalized cloud recommendation systems based on the cloud platform came into being.

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However, many so-called cloud recommendations are only a traditional service on the cloud platform. The collection method of user behavior data is still the traditional user scoring evaluation mode. The amount of data collected is not only small, but many invalid or malicious ratings will even seriously affect the performance of the whole recommendation system. Its calculation method is still the traditional single machine operation mode, although the collaborative filtering computing model based on matrix decomposition has appeared, it still cannot fundamentally meet the computing requirements of the recommendation system on the cloud platform. Such huge computing requirements put forward harsh requirements for the performance of the single machine system. Under this background, this paper starts to study the recommendation of employment education resources for college students. Reference [1] puts forward the practical exploration of building a college enterprise bank linkage employment service platform for college students, and constructs a college enterprise bank linkage employment service system based on the curriculum system; Taking improving students' employability as the core, build a college enterprise bank linkage college students' employment service platform; Taking enterprises and industries as the starting point, integrate resources and open up employment service channels for college students linked by schools, enterprises and banks; Taking improving the ability of employment guidance teachers as the key, strengthen the construction of employment guidance team and ensure the sustainable development of school enterprise bank linkage employment service platform. Reference [2] puts forward the analysis method of College Students' employment satisfaction from the perspective of "mass entrepreneurship and innovation" education, build the campus culture of innovation and entrepreneurship, improve the classroom teaching effect of innovation and entrepreneurship education, stimulate students' learning motivation of innovation and entrepreneurship, strengthen the participation in innovation and Entrepreneurship practice, and improve the assistance system of innovation and entrepreneurship education. Although these two methods have built an effective recommendation system, the current recommendation methods are generally based on single machine mode, and the processing capacity and scalability are very limited. Therefore, a personalized recommendation system of College Students' employment education resources based on cloud platform is proposed.

2 System Hardware Structure Design

Each university improves or updates information collection equipment, collects big data on college students' behavior, grasps how students learn at a personalized level, builds a personalized learning analysis system, learns more, better, and more accurate information from students, and analyzes them systematically Educational data of each student [3].

The function to be realized by this system is to establish a user preference model by analyzing the personal job search information and feedback information of college students, and then find out the employment information suitable for their job search intentions and personal interests from the millions of employment information in the recommendation interface Presented on [4]. Therefore, this system mainly includes three parts: basic data part, personalized recommendation strategy part and system display interface part, combined with the introduction of cloud platform and key technologies, using cloud platform and related open source components, the overall framework of this system is shown in Fig. 1. Shown.

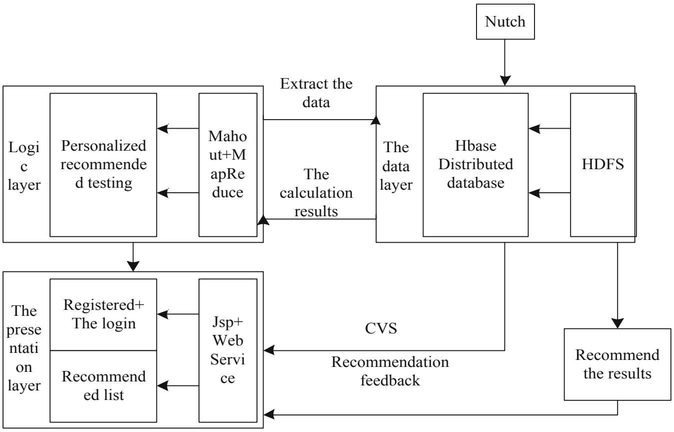

Fig. 1. System hardware structure

It can be seen from Fig. 1 that the hardware structure is composed of three parts, namely the logic layer, the presentation layer and the data layer.

(1) Data layer

Data is the basis of the entire personalized employment recommendation system. Without data as support, all the functions of the entire system are empty words. As the saying goes, "you can get melons by planting melons, and you can get beans by sowing beans." The final recommendation result of the recommendation system depends on the quantity and quality of the data to a certain extent. The recommendation strategy is inherently data-intensive, and having a huge amount of high-quality data is important for recommendation. The system is naturally a good thing [5]. The data stored in the data layer can be divided into four categories: all employment information crawled from the Internet, user information (mainly personal job search information), recommendation results, and user feedback information. The distributed database HBase is used to store the data.

All employment information is obtained by crawling the employment information on the third-party employment service website through the distributed crawler Nutch, analyzing the webpage and storing it in HBase; the user's job application resume includes the user ID, name, gender, contact information, professional name, graduation school, Job search intention, professional skills and expertise, personal introduction, internship or practical experience, etc.; for each different user, the recommendation results calculated by the personalized recommendation strategy are stored in the HBase database, which is convenient for users to quickly display personalized recommendations after logging in Results: The user's feedback information is the user's reflection on the recommendation system or recommendation results, such as the user's interest in each piece of recommended information, and the user has opinions or suggestions on the recommended information [6]. These feedback information can be used to objectively evaluate the quality of personalized recommendation results, so as to better improve the existing recommendation system.

(2) Logical layer
The logic layer is the personalized recommendation engine, which is the core of the entire personalized recommendation system. Just have a large amount of data and do not use the data to generate value, then these data cannot be used properly and can only become "waste"; through the logic layer, the large amount of data in the data layer is analyzed, calculated or reasoned to find the hidden "treasure". According to the characteristics of each user, the personalized recommendation results are all due to the credit of the logic layer [7]. To obtain these credits, relying on Mahout and MapReduce for distributed computing can achieve even more powerful results.

(3) Presentation layer
The presentation layer is the user interface of the personalized recommendation system. It is not only the nearest part to the user, but also an important part of a complete personalized recommendation system. The functions of the presentation layer include user registration and login, user personal information interface, recommendation information list, part of expressing information feedback, and scored information list. The content of each part includes user information interface, which is used for users to fill in, view, modify and submit personal resume. It is the interface for the recommendation system to collect user job information; The recommendation information list is used to present the recommendation results of the personalized recommendation system to users, and is the most important part of the client of the personalized recommendation system; Users can score the interest degree of each recommendation information presented and write down their own opinions or suggestions. These information is the most objective evaluation of the personalized recommendation system and the driving force for system improvement [8]. User information and feedback information is one of the basic data sources of personalized recommendation system, and it is also a very important part. For the recommendation information that has expressed the interest score, you can still browse it many times or modify the interest score.

2.1 Open Source Search Engine

Elastic Search is an excellent open source search engine, which provides a large number of configurable options and is very flexible to use. It is precisely because of this that it needs to be configured and improved in a specific application scenario.

The structure of the Elastic Search open source search engine is shown in Fig. 2.

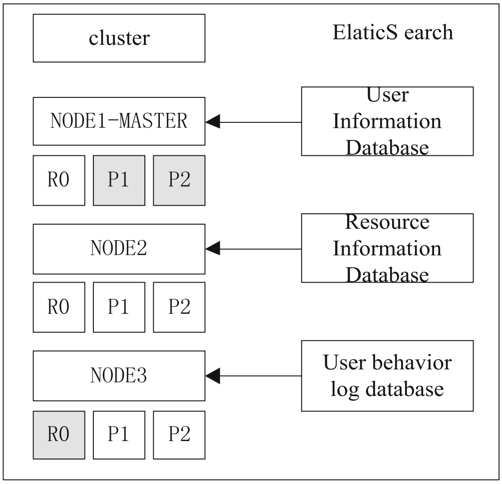

Fig. 2. Elastic Search open source search engine

For the resource search function, it is necessary to import teaching resource data from the resource database into Elastic Search to establish an index; when the user searches through keywords, the keywords must first be accurately segmented to obtain accurate search results. At the same time, considering that the user may use Synonyms are used for searching, so the query of synonyms also needs to be supported; for Elastic Search, the weights of search keywords appearing in each position are equal by default, but in actual educational resources, the importance of keywords appearing in the title and content is different. Therefore, the sorting needs to be optimized; finally, in order to facilitate users to quickly locate the required resources from the search results, the search results need to be highlighted [9].

(1) Data import module

Elastic Search can import data in various formats to build indexes, including data in files, various relational databases (such as SQL Server, MySQL, etc.) and non-relational databases (such as MongoDB). SQL Server is used in this system teaching resource data in the database. There are two ways to import data in the database in Elastic Search. One is to query the data in the database through query statements through the program, and then import the data into Elastic Search through the indexing API of Elastic Search; the other is imported via River. The second method is usually used, because there are often new and updated resource data changes in the database. The second method can easily update these changes to the index by defining a timestamp, and is compared to the first the way is simpler [10].

(2) Chinese word segmentation and synonyms query

For Elastic Search, the default tokenizer used is the standard tokenizer, and its Chinese word segmentation effect is very poor. It simply splits Chinese characters one by one, which cannot meet actual needs. The Chinese sentence "Senior Chinese mid-term examination paper communication analysis" is segmented. The default segmentation device standard segmentation device separates the Chinese characters one by one.

Elastic Search's tokenizer is extensible, you can customize the tokenizer. Just inherit its Analyzer class and implement the word segmentation logic in a custom word segmenter. After the custom tokenizer is implemented, both the indexed tokenizer and the query tokenizer are designated as the custom tokenizer, and then the custom tokenizer can be used. In order to achieve a satisfactory word segmentation effect, we decided to use an open source third-party Chinese word segmentation device in this system. After investigation and comparison of various Chinese word segmentation devices, it was finally decided to use IK word segmentation device.

(3) Highlight query results

Generally, the amount of data of search engines is very large, and the number of results searched by keywords is also very large. In the face of a large number of search results, how to quickly find the key and useful information you need is very important to improve users' search efficiency and search experience. In the search results of search engines such as Baidu and Google, the method of highlighting matching keywords is usually used to display the search results, which is very helpful for users to quickly obtain key information.

Elastic Search's default search results do not highlight matching keywords. In this way, when the number of search results is large, users will spend a lot of time looking for the resources they need from these results, which will affect the user experience of the system. Therefore, referring to the practices of well-known search engines such as Baidu and Google, the matching keywords in the search results can be highlighted, so that users can easily find the resources they are most interested in in a large number of search results. Reduce the time it takes for users to find resources.

2.2 Talent Training Decision-Making System Platform

Form a student-oriented and data centered personalized talent training decision-making system platform, break the fixed talent training scheme and traditional teaching mode of each major, and students can complete their courses as long as they have enough credits during school, so as to realize personalized talent training. Students use the system platform to select the high-quality module resources recommended by the system they are interested in. The school arranges experienced teachers to teach on the basis of students' course selection data. Guided by interest, it changes the current situation that students have to go to class passively even if they are not interested in the course in order to get enough credits, so that students can come to class with interest, In the process of learning, we can constantly explore ourselves and form the habit of self-study, so as to realize personalized talent training and promote the reform of personalized talent training in Colleges and universities.

2.3 Hypertext Service Platform

Hypertext service platform is a web text server, which stores different versions of information in the same space through hyperlinks. Hypertext is stored in the form of electronic documents. Users can determine the specific location of hypertext links according to the initial reading location.

The hypertext service platform structure is shown in Fig. 3.

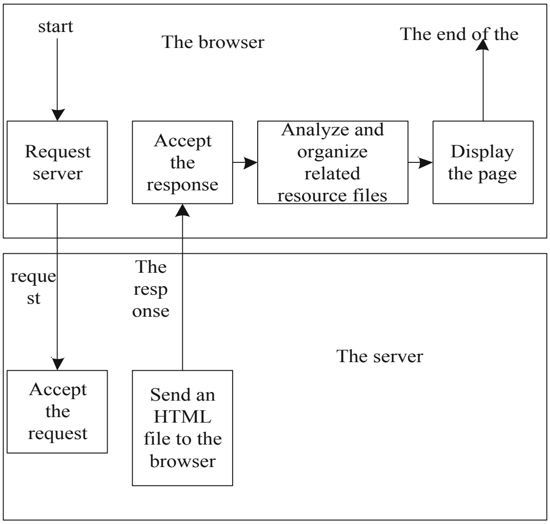

Fig. 3. Hypertext service platform structure

As can be seen from Fig. 3, hypertext transfer protocol is the most widely used network protocol on the Internet, with relative path and absolute path. Relative path refers to the path where the file really exists on the hard disk, and absolute path refers to its own relative to the target location.

2.4 Keyword Index Platform

The Network spider searches for links in a webpage. It starts from a page of the website, reads the content of the page, looks for other links, and then uses these links to find the next page, repeating it until all the pages of the site have been visited. The selection of index keywords is a core issue in search engines. Although the memory required for retrieval is very small, when the search engine selects common words as index terms, each index term will appear more. Use statistical methods to automatically generate words using co-occurrence information between words. A word is a stable combination of words in form. Therefore, in the same context, the more adjacent words appear at the same time, the more likely they are to form a word. The frequency and possibility of word and word combination can better reflect the reliability of word formation. This method combines the index of group K with data from the same index item to generate an inverted file index with the index item as the primary key—Inverted index.

After analyzing the page, you will get a forward index table with the page number as the primary key. Use the inversion method to generate the K group inversion index.

This method combines the indexes of the K groups with the data of the same index item, and finally obtains an inverted file index, which uses the index item as the primary key an inverted index.

3 System Software Part Design

3.1 Recommended Object Modeling

The main issues to be considered when describing the recommended object are: (1) which features of the recommended object are extracted and how to extract it. (2) The connection between the object model description and the user interest model description. (3) Automatic update of the feature description of the object. (4) The influence of the extracted object features on the recommendation result. The same method is usually used to describe the user's interest preferences and recommended objects, establish the association between the user and the recommended object, and obtain the recommendation degree for the recommended object through calculation. Recommended object modeling mainly includes content-based object representation methods, clustering and classification-based methods, and so on. The content-based object representation method extracts information from the object itself to represent the object, mainly through the vector space model. For object a, its content is expressed as a keyword vector as follows:

$$a_i = \{(\lambda_1, w_1), (\lambda_2, w_2), \cdots\} \tag{1}$$

In formula (1), λ_i is the keyword, and w_i is the weight of the keyword. If the object is text, the weight of the word can be calculated using the formula of the information retrieval domain. The object representation method based on clustering and classification is to divide the object set into several categories, calculate the relevance of each object to these categories, so that you can make relevant recommendations for users, and measure the courseware based on the relevance of the courseware and the category. The similarity.

3.2 Query and Processing of Educational Resources Based on Cloud Platform

Before creating an index, the document statistics component needs to summarize and record the statistical data corresponding to the text features, and then use these data to calculate the document score. According to the sorting algorithm and retrieval model, determine the data users want to obtain.

(1) Database index construction
The process of establishing the data index database in the query system includes the following main parts: the user gives the conditions of the query requirements, the index system retrieves the subset of documents related to the query requirements according to the query requirements, the obtained documents are sorted based on whether they are related to the query conditions and relevance, and the sorted documents are finally returned to the user.

(2) Analyze queries and documents
Firstly, the analysis and processing of the query correspond to the processing steps of

the document, that is, the words in the query are converted into the same form as the words generated when processing the document text. Otherwise, an error will occur when sorting. Text analysis mainly includes lexical analysis, that is, to identify the morpheme information, vocabulary information and phrase information contained in the text content. The result of file analysis is the representation of the corresponding structure and related content of the file.

(3) Remove stop words

Stop words are high-frequency words or text information, such as prepositions used in document files. These two function words are helpful to sentence structure, but also help to describe the topic in the article. Removing these two words cannot only reduce the size of the index, but also reduce the occupation of corresponding memory space, but also improve the speed and effect of the index.

(4) Extract stem

In the process of retrieval, stem extraction can match information retrieval with related semantics. If a word is deformed or derived from multiple forms, it can be simplified to the same stem.

(5) Document vectorization

Document vectorization is to calculate the weight value by using several features (token representation, calculating the weight value of each feature for the document) of each courseware content. Divide each courseware content document into several features using word segmentation tools, and calculate a certain feature i (the number of times the token appears in the document T) in each courseware document through statistics, and the number of documents that the word appears in the entire document set. The frequency F is the reverse document word frequency I of a certain characteristic word i. The calculation method is shown in formula (2):

$$\mathrm{I}_i = \log \frac{T_i}{F_i} \tag{2}$$

The weight of a certain characteristic word i in a certain courseware document is the product of the word frequency T of the characteristic word and the reverse document frequency I of the characteristic word. The calculation method is shown in formula (3):

$$\mathrm{T} \cdot \mathrm{I}_i = T_i * \mathrm{I}_i \tag{3}$$

The feature weight calculation method tends to retain the special words in the document, filter the common words, and can well represent the content of the document through the feature weight set.

3.3 Personalized Recommendation Process Design

Based on the query and processing results of educational resources on the cloud platform, a personalized recommendation process is designed as follows:

Step 1: users can use the full-text search system to conduct full-text search according to keywords or filter conditions when they are logged in or not logged in. Before searching, it is necessary to ensure that the value of the recommended results of the two is within the comparable range, otherwise the weighted mixing cannot be started. The assignment range of content-based recommendation results is [0.1, 1], the assignment range of collaborative filtering recommendation results is [–1, 1], and the value is within the comparable range. Formula (4) calculates the weighted mixed recommendation value of each result calculated by multiple recommendation strategies. In this way, the prediction ability of multiple recommendation strategies can be combined in a weighted way.

$$r_w(a) = \sum_{n}^{k=1} \varphi_k \times r_k(a) \tag{4}$$

In formula (4), φ_k represents the predicted value of the recommendation result; r_k represents the corresponding weight. After weighting the recommendation results of the two recommendation strategies, each recommendation result is assigned a new recommendation value. After sorting, the recommendation value greater than 0.1 is stored in the HBase database.

Step 2: when the user browses the details of resources under login and non login, the recommendation system uses the following recommendation strategy: under login, directly recommend personalized resources through the recommendation system;

Step 3: when the user logs in to the personal desktop, the Resource Recommendation column will judge whether it is a new user based on whether there is a historical behavior record of the user in the system. If not, it is a new user. For new users, the recommendation system will use the following recommendation strategy: when logged in, purchase resources through the recommendation system for personalized recommendation, If you are an old user, use the following recommended strategy: check whether the user is a new user when you are logged in. If it is a new user, it will directly carry out personalized recommendation;

Step 4: when a user logs in to collect resources, the recommendation system uses the following recommendation strategy: when he has logged in, recommend his personal desktop and check whether he is a new user. If not, recommend similar resources for him;

Step 5: when the logged in user purchases resources, the recommendation system will use the following recommendation strategy: when logged in, personalized recommendation will be made to the user through collection resources.

4 Experiments

4.1 Test Environment Deployment

The entire system is based on the B/S architecture. The server program runs on the Linux system and requires the support of the Tomcat web server and Hadoop cloud platform. Users can directly access the services provided by the system through a browser. The actual test environment configuration is as follows:

The CPU of the machine in the server cluster is Pentium Dual-Core E5300, the memory is 4G, and it runs on the Ubuntu 12.04 operating system; install Hadoop, the version is hadoop-1.1.2; install the Mysql database, the version is mysql-5.5.25; install Tomcat 7, Run the server program Hwadee.jar of the education cloud service platform; use the browser Chrome 25, FireFox 19, Internet Explorer 9 for testing. The user interface of this system is shown in Fig. 4.

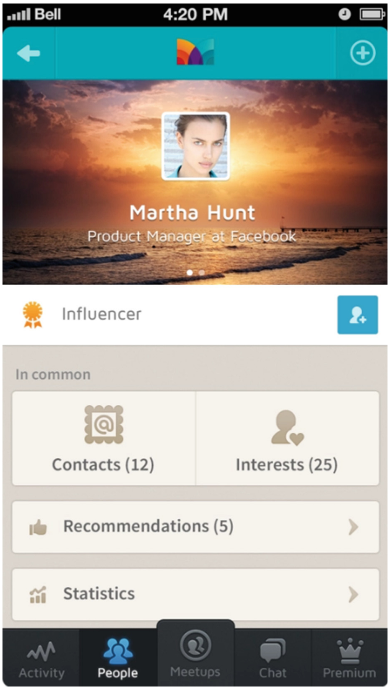

Fig. 4. User interface of the system

4.2 Test System Deployment

The deployment of this search recommendation system is shown in Fig. 5 below.

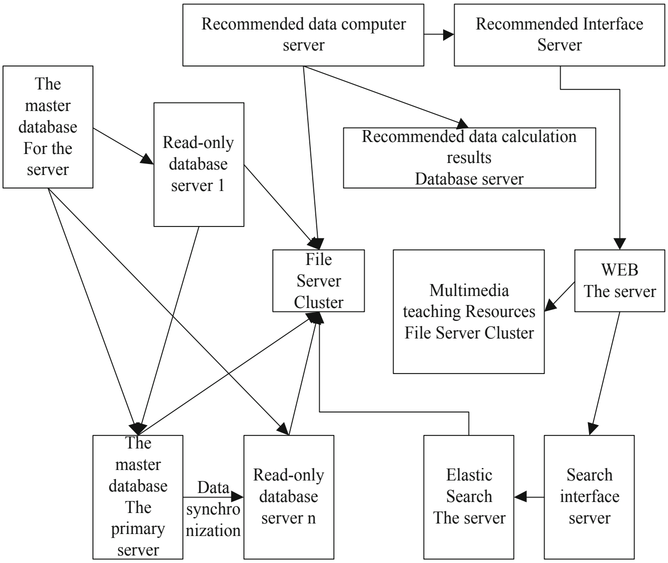

Fig. 5. The deployment diagram of this search recommendation system

It can be seen from Fig. 5 that the system requires a total of 2 main database servers, one main and one standby constitute a dual-system hot standby system. Under normal circumstances, the main database main server is active and mainly provides data writing services for the system. The main database standby server and the main server of the main database is connected through a heartbeat line, and heartbeat detection is performed regularly. When the main server of the primary database is working normally, the standby server of the primary database is in the standby state; when the standby server of the primary database detects an abnormal situation in the primary server, the standby server is switched to the active state. At this time, the system provides data writing services to ensure the system's high Availability. In addition, because the reading of data is far more than the modification and writing of data, two or more read-only database servers are also required. Read-only servers provide read-only services for the system. Elastic Search builds indexes and recommends data for data calculation. All come from a read-only server. These read-only database servers form a load-balanced cluster through load balancing equipment, which can prevent some servers from being overloaded and downtime to stop services. Finally, a recommended data calculation result database server is needed to store the offline calculation results of the recommended data calculation server and provide data support for the recommended interface server.

4.3 Experimental Results and Analysis

Under the above environment background, this paper takes the accuracy rate and recall rate as indicators, and uses the traditional system and this system for comparative analysis.

(1) Accuracy

The recommendation accuracy determines the recommendation effect. The practical exploration of building a university enterprise bank linkage college student employment service platform, the analysis of college student employment satisfaction from the perspective of "mass entrepreneurship and innovation" education and the personalized recommendation system of college student employment education resources based on cloud platform are used to compare and analyze the recommendation accuracy. The comparison results are shown in Fig. 6.

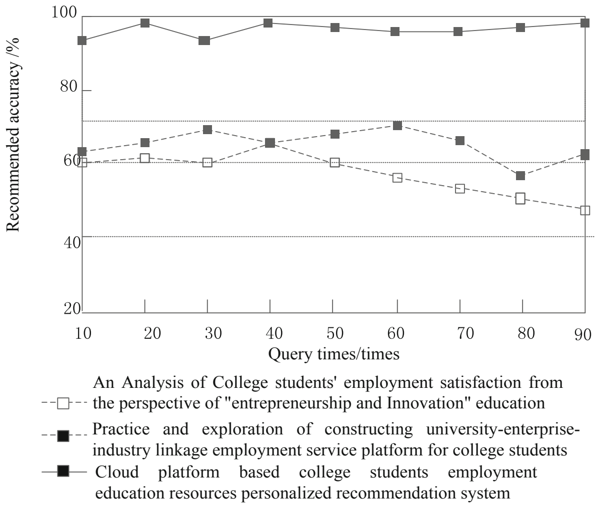

Fig. 6. Comparison and analysis of the recommended accuracy rates of the three methods

It can be seen from Fig. 6 that using the recommendation method from the perspective of "mass entrepreneurship and innovation" education, the highest recommendation accuracy is 68% and the lowest recommendation accuracy is 49%; Using the recommendation method of linkage college students' employment service platform, the highest recommendation accuracy is 71%, and the lowest recommendation accuracy is 58%; Using the personalized recommendation system based on cloud platform, the maximum recommendation accuracy is 99% and the minimum recommendation accuracy is 90%, which has the effect of accurate recommendation.

(2) Recall rate

Three systems are used to compare and analyze the system recall rate, and the comparison results are shown in Fig. 7.

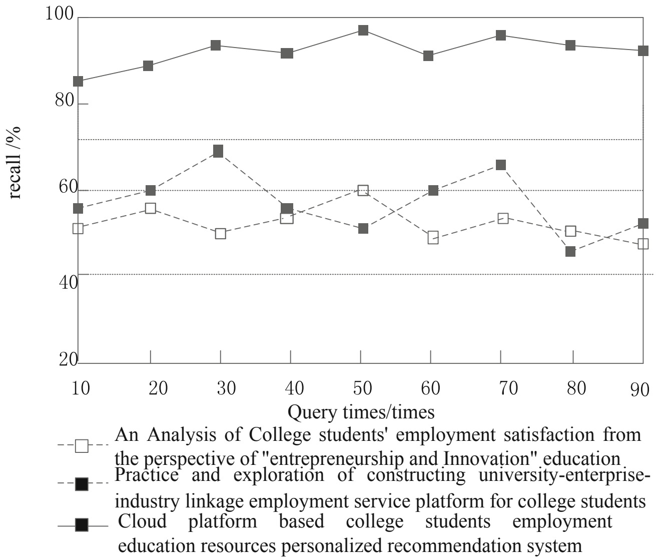

Fig. 7. Comparative analysis of the system recall rate of the three methods

It can be seen from Fig. 7 that using the recommendation method under the "double innovation" education perspective and the recommendation method of the linkage college student employment service platform, the highest recall rates are 60% and 71%, and the lowest recall rates are 48% and 45%, respectively. Using a personalized recommendation system based on a cloud platform, the highest recall rate is 98%, and the lowest recall rate is 85%, which has an efficient recall effect.

(3) Recommended time

By adopting the personalized recommendation system of College Students' employment education resources based on collaborative filtering method, the personalized recommendation system of College Students' employment education resources based on tag and the personalized recommendation system of College Students' employment education resources based on cloud platform, the time taken for the personalized recommendation of College Students' employment education resources is compared and analyzed. The comparison results are shown in Fig. 8.

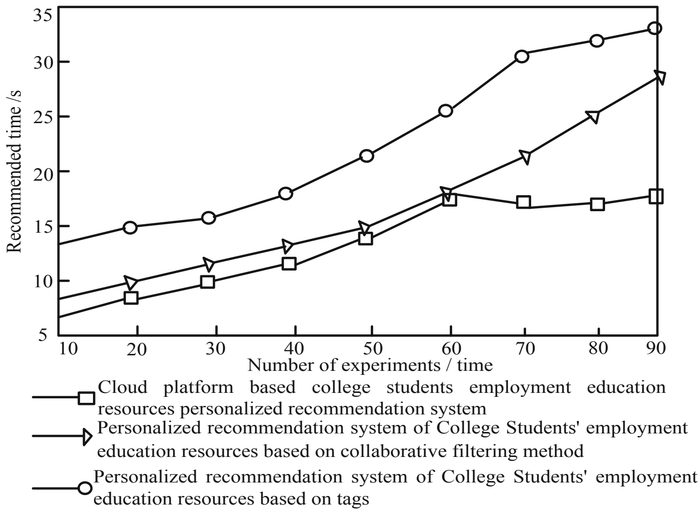

Fig. 8. Comparison results of personalized recommendation time of College Students' employment education resources

It can be seen from Fig. 8 that the system in this paper takes less time to personalize the employment education resources of college students in 16 S, which is shorter and more efficient than the personalized recommendation system of employment education resources of college students based on collaborative filtering method and the personalized recommendation system of employment education resources of college students based on tags.

5 Conclusion

Through text information processing and recommending interested information for users, a personalized recommendation system of College Students' employment education resources based on cloud platform is designed to realize the automatic recommendation of educational resources and facilitate the retrieval of educational resources. The retrieval of educational resources database is introduced into the process of educational resources query, which improves the query efficiency and can effectively feedback and retrieve the query results. After experimental verification, the recommendation has high accuracy.

For a real system used in production environment, there is always room for optimization and improvement in performance and user experience. For the implementation of this paper, the performance can be optimized from the following aspects:

(1) Avoid the use of database query technology in the MapReduce calculation process, and all use multiple data source connections to complete data reorganization calculations, and improve the calculation performance of the entire system.
(2) Add the function of automatic classification to the system. When a new courseware is added to the system, it will be automatically classified into the existing theme,

so as to avoid repeating the courseware with a clear theme when the theme of the whole system stabilizes. Classify.

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Optimization and Recommendation Method of Distance Education Resources Based on Particle Swarm Optimization Algorithm

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Abstract. Aiming at the problem that the low matching degree between educational resource path planning and learners' needs affects the success rate of recommendation, a distance education resource optimization recommendation method based on particle swarm optimization algorithm is proposed. Starting with the attributes of users and distance education resources, a portrait model is established to accurately describe the characteristics of users and resources. The characteristics of users and distance education resources in personalized learning resources are parameterized, the path of education resources is planned based on particle swarm optimization algorithm, and the learning path suitable for learners is formed by the reorganization and sorting of resources. A learner neighbor is established, and a recommendation model is established according to the difference matching degree between learners and learning resources. The experimental results show that when the number of educational resources is 1000, the average success rate of Distance Education Resource Recommendation Method Based on particle swarm optimization algorithm is 87.1%, which is 8.3% and 6.9% higher than that based on multivariate hybrid criteria fuzzy algorithm and multi-layer perceptron model. Therefore, the recommendation success rate of this method is relatively the highest, and can provide a set of learning resources that better match the characteristics of learners.

Keywords: Particle swarm optimization · Distance education · Educational resources · Optimization recommendation · Resource Recommendation · Intelligent learning

1 Introduction

With the development of the Internet and the widespread application of technologies such as big data, machine learning, and cloud computing, changes in the learning field are also deepening. High-bandwidth computer technology and network technology are driving the rapid development of education informatization, as well as the arrival of education artificial intelligence and education big data. The learning resources in various online learning platforms have experienced explosive growth, which has brought

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people to the way of learning. More selectivity. The application of distance online learning can help learners easily obtain online learning resources and solve the problem of traditional learning methods limited by time and space. Education is a process in which students' cognitive level and emotional state cooperate and influence each other. The distance education platform lacks the integration of emotional state, it only provides services for learners through electronic learning resources, and learners' learning completely relies on subjective initiative. In order to make the learning resources provided by the system consistent with the needs of learners and reduce the probability of learners' "learning trek" and "cognitive overload" phenomena, the distance education platform should provide personalized learning paths for different learners' characteristics. In the remote online learning environment, in order to discover, import, combine, and distribute suitable resource sequences and resource content to learners from numerous learning resources, it is necessary to design intelligent, dynamic and personalized resource processing tools for learners. Recommendation of distance education resources in the field of online learning. Because learning is a process of constructing overall knowledge based on prior knowledge, learning resources must be an organic sequence to meet the needs of learners to construct overall knowledge based on prior knowledge. When learners use the online learning platform to learn, they can choose the learner's choice or be recommended by the platform, and the platform mainly uses the learning resources obtained by the recommendation algorithm. At present, the research on the recommendation of distance education resources has achieved certain research results. Li Linxia extracts the most recommended educational information according to user preferences through a multivariate hybrid criteria fuzzy decision model, and feeds back the list of recommended resources to users, It solves the problem of accurately extracting the educational information required by users from a large number of educational resources [1]. However, in the practical application of this method, the matching degree of users' needs is low, which affects the recommendation effect. Zhang Yanhong and Chen Ying use tags to build an autonomous educational resource recommendation algorithm, and conduct research from three aspects: learning environment construction, learning resource improvement, and information retrieval speed improvement, to achieve the key process control of educational resource recommendation [2], information retrieval is relatively timely. However, in the process of recommendation, it is easy to be affected by environmental factors, which reduces the success rate of recommendation. Li Wenxin and others used the matrix factorization model, the multilayer perceptron model and the NeuMF predictive analysis model to analyze and process the user characteristic value matrix and the educational resource characteristic value matrix, correlate the user characteristic information and the educational resource information, and obtain the user-educational resource predicted value to improve Improve the search efficiency and resource utilization of educational resources [3]. Although the resource utilization is improved, the accuracy of feature extraction for user needs is low, which affects the success rate of final resource recommendation. The above studies can meet the individual needs of different learners for educational resources, but there is also the problem of low matching degree between educational resource path planning and learner needs. To solve this problem, this paper proposes a distance education resource optimization recommendation method based on particle swarm optimization algorithm, which pushes matching personalized learning resources for students according to their characteristics. This is helpful to improve learners' learning efficiency and interest, and has research and promotion value.

2 Recommendation Method for Distance Education Resource Optimization Based on Particle Swarm Algorithm

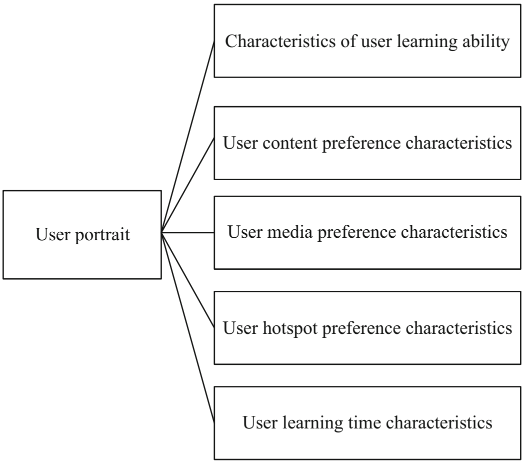
2.1 Establish a User Profile for Distance Education

The essence of recommendation problem is the process of accurately matching users and recommended resources to form a list of recommended resources. For Personalized Learning Resource Recommendation problem, it is essentially the process of matching learner characteristics and learning resource characteristics, finding the minimum difference solution, and then outputting the sequence of learning resources. In terms of the content and form of learning resources, traditional online learning mainly focuses on large resources and systematic curriculum resources, while distance learning generally focuses on small resources and fragmented resources of learning units or knowledge points. In terms of learning time characteristics, in the case of online learning, learners generally have a long learning time to complete the learning of a resource. In the practical application environment, the resources to be recommended have their own resource attributes and characteristics. These attribute features can usually be divided into explicit attributes and ambiguous attribute information. Explicit attribute means that the meaning of this attribute is relatively clear. Its attribute usually refers to the explicit information that can be obtained directly, and its attribute can be expressed quantitatively; Ambiguous attributes are often unable to be obtained directly or have no clear quantitative representation, so they cannot be used directly. The fragmentation of learning content, the mobility of learning location, the volatility of learning network and the fragmentation of learning time. When building the resource model, the location of learners Learning network status information and learning time information (including learners' expected time and learning resource required time) to improve the matching degree between resources and Learners [4]. This paper introduces the portrait technology into the research of distance education resource optimization and recommendation, and establishes the portrait of users and distance education resources. Multiple portrait features of users and educational resources are defined, and the established portrait model is shown in Fig. 1.

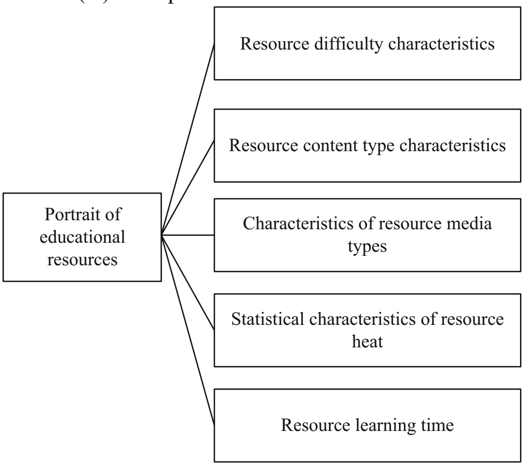
In the recall stage of the recommendation system, the accuracy of the recall of learning resources is improved by accurately describing and matching the characteristics of learners and learning resources. Therefore, the key characteristics of learners and learning resources play a decisive role in the accuracy and order of recommended resources.

2.2 Parameterized Representation of Distance Education Resources

The recommendation model in the field of Learning Resource Recommendation has the following two characteristics: first, the recommended learning resources must be



(A) User portrait of distance education



(B) Portrait of distance education resources

Fig. 1. User and educational resource portrait model

basically orderly to meet the objective law of knowledge learning in the educational field of objective and orderly learning according to a priori knowledge. There are a large number of online learners with diverse characteristics, and the needs of learners will continue to change in the learning process. The online learning system should be able to provide learners with dynamic and personalized resource sequence and content, and should not push the guided learning resources prepared for beginners to learners with a certain learning foundation, Similarly, programming learning resources provided for learners with programming experience should not be pushed to learners without programming experience. Second: through similar learners' estimation algorithm and model parameters, since the resources to be recommended in the learning field are for different knowledge points and there is no similarity between knowledge points, the parameters such as learners' mastery of new knowledge points in the model cannot be obtained through the learning data statistics of learners learning other knowledge points [5]. The degree of understanding of new knowledge points can only be estimated in advance by similar learners. The premise of solving the problem of online learning resource scheduling is to describe the characteristics of learning resources, which is divided into user parameters and learning resource parameters. The representation of learner characteristic parameters and learning resource characteristic parameters is the premise of personalized learning path optimization. The basic target attributes of each user include gender, age, number, grade and level. The number is the learner's sequential integer code. Grade level is the educational level of learners. The user's subjective attribute consists of six tuples, which can be expressed as:

$$\lambda_U = \{G_U, T_U, Q_U, A_U, M_U, C_U\} \tag{1}$$

In formula (1), U represents the user; λ_U represents the subjective attributes of the user; $G_U, T_U, Q_U, A_U, M_U, C_U$ corresponds to the learning goal, planning time, learning ability, learning attitude, media type preference and content preference respectively. In the online learning environment, compared with the input learning style, the output of the learning style is also very important, so it is necessary to design a reasonable and effective resource model. Each characteristic parameter of the two is expressed in mathematical notation, and the function expression between the two is constructed, that is, the personalized learning path optimization function, and the function construction of the personalized learning path optimization problem is completed. Each learning object is defined by basic attributes and additional attributes, and these attributes are consistent with the learner model. Basic attributes refer to knowledge points, media types and content attributes. Other attributes include time, difficulty, and importance. Other attributes are obtained from the evaluation feedback of experts and previous learners. The learning resources of distance education also consist of six tuples, which can be expressed as:

$$\vartheta_D = \{L_D, T_D, F_D, H_D, M_D, C_D\} \tag{2}$$

In formula (2), D represents the learning resources of distance education; ϑ_D represents the attributes of learning resources; $L_D, T_D, F_D, H_D, M_D, C_D$ respectively corresponds to the knowledge point, the difficulty level of the knowledge point, the learning time, the importance level, the media type and the content attribute. According to the six attributes of learners and distance education resources, six objective functions are constructed respectively. Taking learning ability as an example, the objective function constructed is explained in detail. Learning ability represents the difference between the cognitive level of the learner and the difficulty level of the learning resource. The smaller the difference, the more difficult the learning resource in the recommended learning path is in line with the learner's learning ability. The objective function can be expressed as:

$$f_1 = \sqrt{\sum_{i=1}^{s} \left| \frac{\sum_{i=1}^{s} \alpha_i(\beta_i - \delta)}{\sum_{i=1}^{s} \alpha_i \beta_i} \right|^2} \tag{3}$$

In formula (3), f_1 represents the objective function of learning ability; s represents the total number of learners; i represents the number of learners; α represents the resources being learned; β resources correspond to knowledge points; δ represents the level of learning ability. The characteristics of users and distance education resources in the personalized learning resource list are parameterized to prepare parameters for the construction of distance education resource optimization recommendation model later.

2.3 Planning Educational Resource Path Based on Particle Swarm Algorithm

After user preference modeling and resource feature modeling, a list of resources to be recommended is formed by matching user preference information and distance education resource feature information. Learning resource arrangement is to provide learners with the best sequence of personalized learning resources so that they can complete learning tasks efficiently. The compilation of learning resources involves learners' relevant characteristics and learning contents, including learners' background, previously mastered learning contents, learning motivation, achievement, learning ability and style. In the sorting stage of recall learning resources, through the sorting of resources, the learning resources meet the requirements of objective and orderly a priori knowledge. Personalized recommendation technology is applied to the process of online learning resource recommendation or online learning resource path generation. It usually provides personalized learning resource serialization services for learners based on the personalized learning characteristics of learners or users. Even for a certain learner, with the increase of the learner's learning content and the improvement of the learner's ability, the learner's actual learning needs will change, and the corresponding learning resources will be added or removed. These are the problems that need to be solved in the compilation of learning resources. In order to solve the problem of low matching between educational resource path planning and learners' needs, this paper generates educational resource path based on particle swarm optimization algorithm. Firstly, according to the population iteration, the inertia weight is adaptively adjusted in a nonlinear and gradually increasing way, so that the algorithm has a large inertia weight in the later stage of the iteration, improves the ability of global optimization and enhances the ability to escape from local optimization [6]. In each iteration, the inertia weight is calculated as follows:

$$\vartheta = \vartheta_{\min} + \frac{2}{\pi}\arctan\left[\frac{\pi\kappa(\vartheta_{\max} - \vartheta_{\min})}{\kappa_{\max}}\right] \tag{4}$$

In formula (4), ϑ represents the weight of inertia; $\vartheta_{\min}$ and $\vartheta_{\min}$ represent the minimum and maximum values; κ and $\kappa_{\max}$ represent the number of iterations and the maximum number of iterations, respectively. The problem of online learning path planning can be described as: on the basis of the completion of the recommendation of learning resources, according to the difficulty of the learning resources and the ability of the learner, the learning cost between the learning resources, and the correlation between the knowledge points and the learning resources, the learning resources are sequentially The fitness function values are sorted, and learners start learning from the designated learning resources until they complete the learning of all resources. At the same time, increase the mutation operator for the unknown space exploration, improve the velocity formula, increase the particle's exploration of the unknown space, expand the particle search space, and then increase the probability of the particle swarm algorithm jumping out of the local optimum [7]. The particle position update process can be expressed as:

$$\eta_{\kappa+1} = \vartheta \eta_\kappa + \varsigma(l_\kappa - r_\kappa) + 2(mo - \eta_\kappa) \tag{5}$$

In formula (5), η_κ and $\eta_{\kappa+1}$ represent the particle position before and after the update; ς represents the learning factor; l_κ represents the optimal solution of the individual particle; r_κ represents the dimension of the particle; mo represents the random position of the solution space. Learning path planning is to enable the intelligent online learning system to reorganize and sort the recommended learning resources according to the learner's knowledge level and learning goals, form a learning path suitable for learners, and enable them to quickly and effectively complete the learning goals. The solution to the online learning path planning problem is a set of ordered sequences composed of online learning resources. This set of ordered sequences is the result of comprehensive matching and optimization of the attributes of learners and learning resources.

2.4 Establish a Recommendation Model for Distance Education Resources Optimization

The distance learning system provides a new way for learning and teaching through the carrier of the Internet, which makes full use of modern information technology. These modern information technologies create a new communication mechanism for the distance learning system, and can provide a learning environment rich in learning resources for the online learning system, which creates convenience for learners [8]. Learners can learn through the distance learning system at any time and at any place. These convenient conditions have laid the foundation for the distance learning system to provide personalized services, so that more learners are attracted to the distance learning system for learning, improve the learning efficiency in the process of learning knowledge, and can learn more knowledge in a limited time [9]. Because learning resource sequence recommendation is a constraint based recommendation problem, which is essentially a multi-objective combinatorial constraint optimization problem, according to the definition of Personalized Learning Resource Recommendation Model and the characteristics of Personalized Learning Resource Recommendation field, this paper constructs a distance education resource optimization recommendation model. The variability of learners' characteristics is difficult to quantify, and online learning resources are massive and complex, resulting in high requirements for online learning resource recommendation, which leads to the problems of slow speed and low matching degree of online learning resource recommendation methods [10]. Particle swarm optimization algorithm can accurately and orderly recommend learning resource sequences and construct resource paths. On this basis, the modeling analysis is carried out according to the difference matching degree between learner characteristics and learning resource characteristics. The evaluation matrix of learners and learning content is constructed, and the Pearson distance formula is used to calculate the correlation between learners. Construct learner neighbors according to relevance. The nearest neighbor set is used to estimate the score of learners on the content to be learned. The calculation formula is as follows:

$$\theta = \overline{\mu}_1 + \frac{\sum_{M} \left[\rho(\mu_1 - \overline{\mu}_2)\right]}{\sum_{M} \rho} \tag{6}$$

In formula (6), θ represents the learner's estimated value of the content to be learned; $\overline{\mu}_1$ and $\overline{\mu}_2$ represent the scores of two learners respectively; ρ represents the learning similarity value of the two learners; M represents the total amount of resource content; μ_1 represents the score obtained by similar learners' learning resources. Through the analysis of related information, the score value of similar learners for the same learning resource content is obtained, and the score value of the person with the highest learning similarity to the current learner will be selected. Since the two have similar mastery of the same knowledge point, then based on the mastery of the learned knowledge points of similar learners, the new learner's mastery of the learned knowledge points is estimated. Users can use the learner interface to view the knowledge points that can be learned in the platform. Learners can select the knowledge points in the tree structure directory, and select the degree of mastery, time limit and other related information according to their own cognitive level [11]. This article uses the following parameters as the parameters of individual needs: the learner's mastery of knowledge points, the knowledge points that learners expect to learn, the difficulty of learning resources and the learning time. After the learner determines each parameter, the corresponding interface is modeled and submitted to the personalized recommendation interface. The personalized learning path is generated by the corresponding interface, and the learning path is finally returned to the user. So far, the design of the optimization recommendation method for distance education resources based on particle swarm optimization is completed. The optimization and recommendation process of distance education resources based on particle swarm optimization algorithm is shown in Fig. 2.

3 Experimental Research

3.1 Experimental Environment

In order to verify the effectiveness of the distance education resource optimization recommendation method based on particle swarm algorithm proposed in this paper, a simulation experiment environment for the application field of learning resource recommendation is constructed, and simulation data is input according to actual learning resources for validity verification. The basic environment of this experiment is divided into hardware environment and software environment. The hardware environment is as follows, CPU: Intel(R) Core (TM)i5-7200U, clock speed: dual-core clocked at 2.50 GHz, 2.70 GHz, memory: 8 GB, hard drive: 256 G high-speed solid-state drive. The software environment is as follows, operating system: Windows 10 64-bit Chinese Professional Edition, programming language: Python is used as the programming language, python basic environment: Python 3.5 64-bit, Python programming environment IDE: PyCharm Community Edition, Java basic environment: JRE 1.7 64, JDK 1.7 64-bit. Considering the content of learning and the difficulty of learning will affect the recommendation of

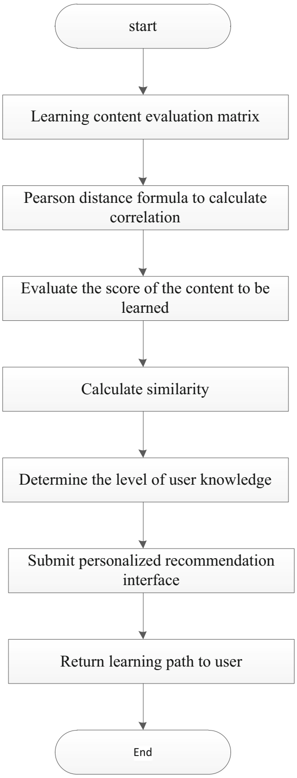


Fig. 2. Flow chart of distance education resource optimization and recommendation based on particle swarm optimization algorithm

learning resources, and the number of resources corresponding to the knowledge points will also affect the recommendation of resources. In the experimental parameter settings of this chapter, the number of educational resources is set to 100, 500 and 1000 respectively., To recommend application scenarios more in line with actual online learning resources.

3.2 Results and Analysis

The running results of the distance education resource optimization recommendation method based on particle swarm optimization are compared with the fuzzy algorithm based on multiple hybrid criteria and the educational resource recommendation method based on the multilayer perceptron model. The experimental evaluation criterion is the success rate, that is, the percentage of the ratio of the number of times the resource recommendation problem obtains the optimal solution to the total number of recommendations. Under the conditions of different amounts of educational resources, the comparison results of the success rates of each method are shown in Tables 1, 2 and 3.

According to the comparison results in Table 1, when the number of educational resources is 100, the success rate of the distance education resource recommendation

Table 1. Experimental results of the number of educational resources 100

Number of experiments	Average success rate of resource recommendation method(%)		
	Recommendation method based on particle swarm algorithm	Recommendation method based on fuzzy algorithm with multiple mixed criteria	Recommendation method based on multi-layer perceptron model
10	96.5	92.4	91.4
20	95.6	90.8	91.8
30	97.2	91.9	90.6
40	96.8	92.5	90.5
50	95.6	92.2	92.2
60	94.2	91.3	92.1
70	95.3	90.4	93.4
80	96.5	90.1	92.8
90	96.2	91.5	91.5
100	97.1	92.6	91.3

method based on the particle swarm algorithm in this paper is 96.1%, which is compared with the recommendation method based on the fuzzy algorithm based on the multi-hybrid criterion and the multi-layer perceptron model. Compared with that, they have increased by 4.5% and 4.3% respectively.

According to the comparison results in Table 2, when the number of educational resources is 500, the success rate of the distance education resource recommendation method based on particle swarm optimization algorithm in this paper is 92.9%, which increases by 7.2% and 6.9% respectively compared with the recommendation method based on multivariate mixed criteria fuzzy algorithm and multi-layer perceptron model.

According to the comparison results in Table 3, when the number of educational resources is 1000, the success rate of the distance education resource recommendation method based on the particle swarm algorithm in this paper is 87.1%, which is compared with the recommendation method based on the fuzzy algorithm based on the multi-hybrid criterion and the multi-layer perceptron model. Compared with that, they have increased by 8.3% and 6.9% respectively. Comprehensive analysis of the above experimental results, as the number of educational resources increases, the implementation success rate of each recommended method has shown a downward trend. On the whole, the educational resource recommendation method based on particle swarm optimization has the smallest reduction in success rate. When the number of educational resources is large, the method in this paper can still maintain a high recommendation success rate. Therefore, the recommendation success rate of the distance education resource recommendation method based on the particle swarm algorithm is relatively the highest, and it can provide a learning resource set that more matches the characteristics of the learner.

Table 2. Experimental results of 50 educational resources

Number of experiments	Average success rate of resource recommendation method(%)		
	Recommendation method based on particle swarm algorithm	Recommendation method based on fuzzy algorithm with multiple mixed criteria	Recommendation method based on multi-layer perceptron model
10	93.4	85.4	87.2
20	92.8	84.6	86.6
30	91.6	85.2	85.5
40	92.2	86.5	86.8
50	93.5	87.8	84.9
60	94.3	86.9	85.6
70	93.2	85.6	86.5
80	92.9	84.3	84.4
90	93.2	85.2	86.1
100	92.1	85.5	86.2

Table 3. Experimental results of 100 educational resources

Number of experiments	Average success rate of resource recommendation method(%)		
	Recommendation method based on particle swarm algorithm	Recommendation method based on fuzzy algorithm with multiple mixed criteria	Recommendation method based on multi-layer perceptron model
10	88.4	79.4	78.6
20	85.8	75.8	81.5
30	86.6	78.6	80.2
40	87.2	79.2	79.8
50	88.5	78.1	78.8
60	85.3	77.4	79.2
70	86.9	80.7	80.5
80	88.2	79.8	81.3
90	86.4	78.5	82.2
100	87.7	80.3	79.4

4 Conclusion

With the development of distance learning platform, it is possible to meet the "personalized" needs of education and learning. The realization of Personalized Distance Education requires the learning platform to generate the sequence of learning resources according to the characteristics of learners. Therefore, the distance education resource optimization recommendation method based on particle swarm optimization algorithm proposed in this paper can maintain a high recommendation success rate when there are a large number of educational resources, and can provide a set of learning resources that can better match the characteristics of learners. It is helpful to improve students' learning efficiency and interest, and has good research and promotion value. The key to the accuracy of Personalized Learning Resource Recommendation is the accurate analysis and prediction of the characteristics of learners and learning resources. In the next research, we will focus on the content analysis and understanding of documents, pictures and videos, and then automatically classify and label the characteristics of learning resources, so as to automatically classify learning resources, reduce the cost of manual data annotation and classification, and accurately analyze the characteristics of learning resources, Form a more accurate portrait of learners and learning resources.

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Prediction of Online Learning Resource Demand Based on BP Neural Network

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Abstract. In order to solve the problems of low prediction accuracy and long prediction time of traditional resource demand prediction methods, an online learning resource demand prediction method based on BP neural network is proposed. Online learning resources are collected, online learning resource management evaluation indicators are constructed, and online learning resource demand prediction algorithms are optimized. Finally, experiments show that the resource demand prediction accuracy of this method is higher than that of traditional methods, it can fully meet the requirements of online learning resource demand forecasting, and can help improve the efficiency and quality of online learning.

Keywords: BP neural network · Online learning · Learning resource management · Resource demand forecast

1 Introduction

The traditional online learning resource demand forecasting method is affected by the interference of similarity features in the abnormal network environment. The forecasting model does not have the feature classification and exclusion feature, resulting in the problems of low forecasting accuracy and poor effect [1, 2]. Efficient and accurate allocation of resources to users is an important guarantee for maximizing benefits. Resources can be dynamically adjusted according to the running status of online learning resource management. However, it takes some time to prepare and initialize instances, which makes resources unable to be dynamically scheduled according to user needs, making it impossible to effectively provide flexible resource management for users, and reducing the effect of online learning resource demand forecasting.

Reference [3] proposes a resource demand prediction method based on feature selection. Candidate feature sets highly related to prediction targets are screened based on data features, and then the greedy forward search strategy is used to further screen the candidate feature sets to obtain the best feature sets, and finally different types of prediction models are trained. However, the prediction accuracy of this method is insufficient. Reference [4] proposes a prediction method to optimize SVR based on the improved artificial fish swarm algorithm. This method first improves the artificial fish swarm algorithm, and uses the improved artificial fish swarm algorithm to optimize the support

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vector machine, and completes the prediction according to the classification results of the support vector machine. However, the prediction time of this method is long.

In order to solve the problems of low prediction accuracy and long prediction time of the above traditional methods, this paper proposes the online learning resource demand prediction based on BP neural network, collects the sample data of BP neural network resource demand for a period of time, and establishes the prediction model of training samples: the pattern search method is used to continuously search the optimal parameter combination, and the sequence of fitting error is used as the training data to establish the prediction model of validation samples, and carry out generation selection processing, continuously eliminate the error of the model, and finally obtain an accurate prediction model.

2 Forecast of Demand for Online Learning Resources

2.1 Feature Collection Model of Online Learning Resources

The structure of BP neural network resource feature acquisition model is shown in the figure. Before resource demand forecasting, first analyze the user requests in the historical database, including data structure, content and quantity, and obtain user preference selection, demand description, etc. [5]. In order to achieve accurate and effective prediction, different resource requirements are analyzed. The specific steps are as follows (Fig. 1):

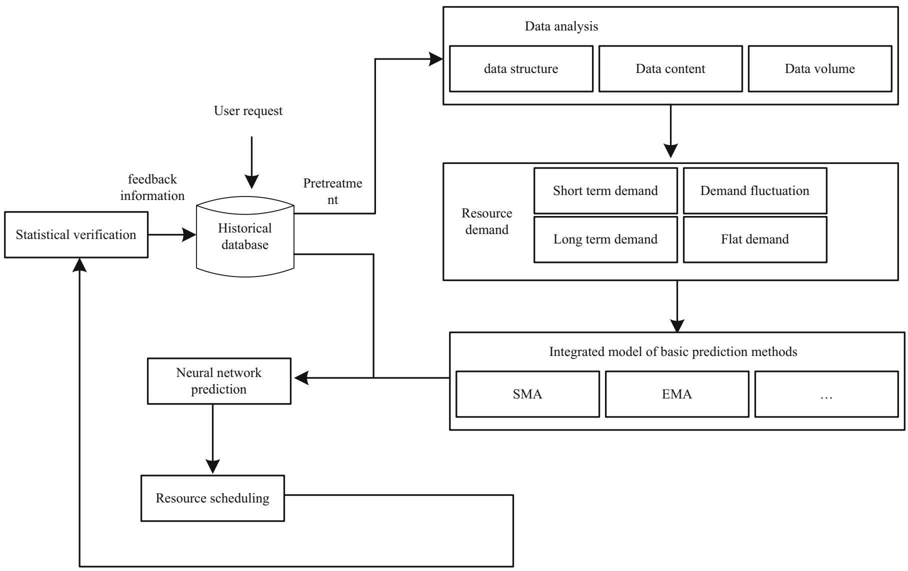

Fig. 1. BP neural network resource feature collection model

According to the user's demand for the description of functional attributes of online learning resources, suitable information resource identification and extraction can be found by calculating the semantic matching degree between customer requests and teaching resources keywords, usage data, experience, and computing expectations and preferences [6]. On this basis, the following figure gives a detailed classification structure model of the dynamic classification structure of teaching resource features (Fig. 2):

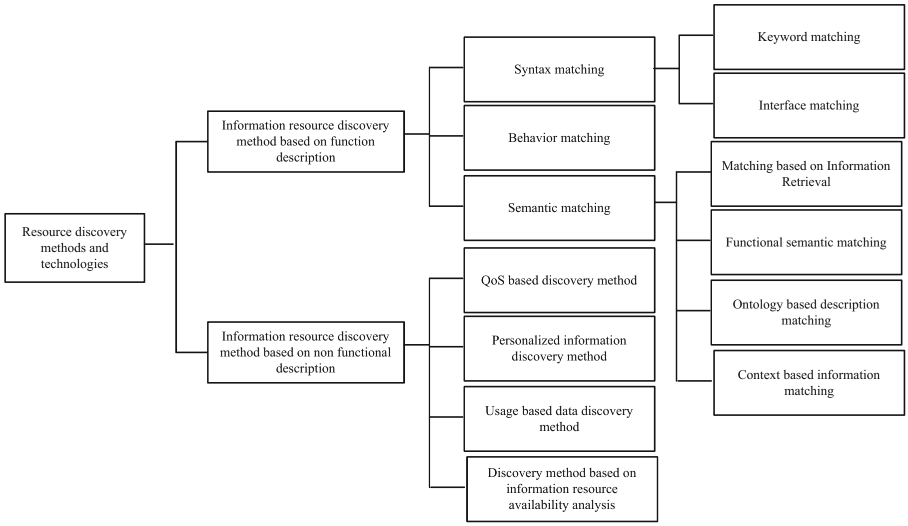

Fig. 2. Dynamic classification structure of teaching resource features

The main purpose of the dynamic analysis of teaching resources is to provide model selection basis for how to more accurately predict the resource scheduling in the future in the resource scheduling prediction of BP neural network. From the above analysis results on the task priority, task execution time, resource request submission frequency and resource utilization of BP neural network resources, we can also roughly see the dynamic characteristics of BP neural network resource scheduling [7–9]. The information resource integration concept based on optimizing the platform structure is mainly based on the doctrine theory and resource dependence theory, and follows the four elements of information resource creation, information resource use, integration and effect evaluation, which can improve the information resource ability and independent integration ability. The interaction and role of these four elements can build a teaching resource integration management platform, The specific structure and function are shown in the figure (Fig. 3).

Information resource integration based on optimizing platform structure is the learning product of the common application of building socialist theory and human capital theory. Constructivism theory mainly emphasizes the initiative and situational nature of information integration. Information resource integration is not passively receiving the stimulation of information, but actively processing external information according to learning background, so as to build the core theme of learning [10]. The teaching resource dependence theory mainly emphasizes that the survival of the whole learning organization needs to absorb resources from the surrounding environment, and interact with

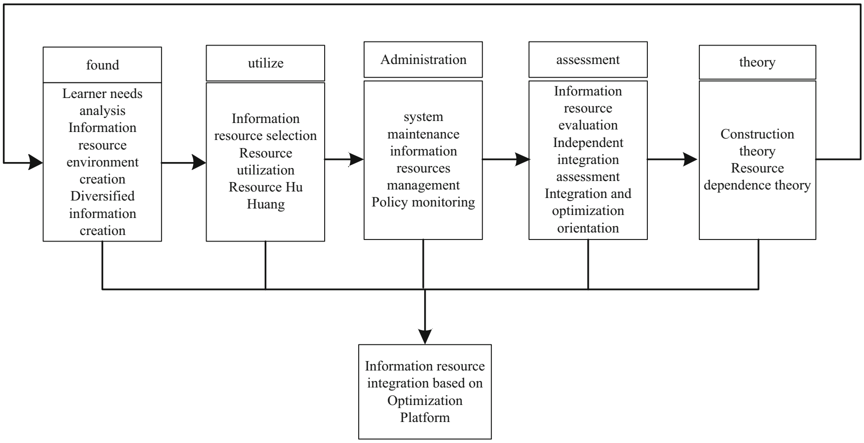

Fig. 3. Teaching resource integration management platform

the control resources in other environments. The resource integration and optimization model based on the platform emphasizes that students need to actively choose information resources, which fully reflects the learning value of "student-centered" and realizes the resource sharing concept advocated by the resource dependence theory (Fig. 4).

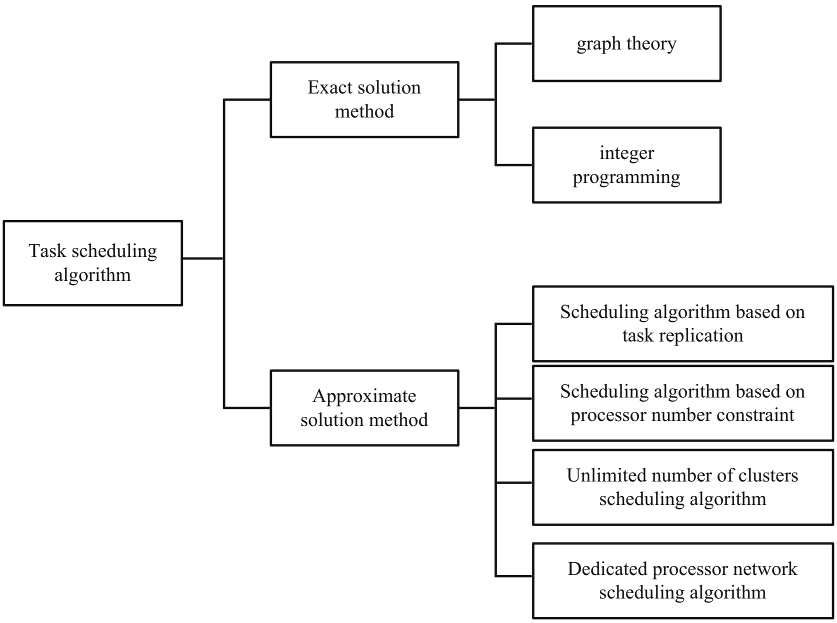

Fig. 4. Classification of BP neural network task scheduling algorithms

BP neural network is the core of resource demand prediction, and the key for various resource service models to provide users with appropriate and satisfactory resources. Based on the previous research in this field, it can be concluded that the resource scheduling algorithms of distributed heterogeneous computing models such as BP neural network can be divided into two categories: one is the accurate solution method to realize the optimal allocation of resources by looking for a given goal, such as the scheduling method based on graph theory and integer programming theory 9, therefore, another kind of method using heuristic algorithm to find approximate solution has been widely used. Online teaching resource prediction under BP neural network mainly refers to the implementation of network security analysis, load balancing, event prediction, scheduling detection and recovery. The purpose is to maintain the normal operation of the whole model and provide users with efficient and high-quality information resource services. At present, in the research of resource prediction, the research on resource monitoring in grid environment is relatively mature. While constantly exploring the monitoring framework, many application models and tools have been developed.

2.2 Evaluation Algorithm of Online Learning Resource Management

Since the BP neural network adjusts the weights and thresholds of the network through continuous training, the process starts at the output layer and then moves backwards through the hidden layer. Better weights and thresholds can be found by applying BP neural network, but the problem of local minima is easy to occur, and the phenomenon of unstable convergence occurs in the training process. Therefore, the genetic algorithm is used to train and optimize the initial weights. Genetic algorithm is a random search method. It performs a global search in the search process and can carry out an effective search in a larger space. Therefore, GA can help the BP neural network to find better network connection weights and parameters, and improve the BP. Predictive performance of neural networks. Genetic algorithm optimization BP neural network algorithm flow The Ga-BP neural network model is shown in the figure (Fig. 5):

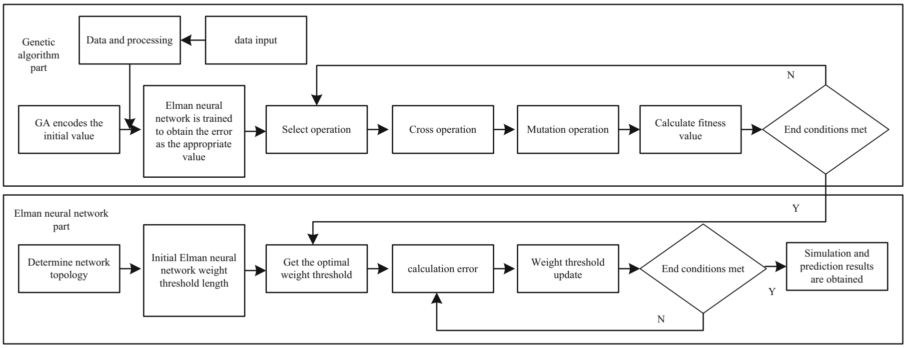

Fig. 5. Genetic algorithm optimization E-an neural network algorithm flow

The input layer of the neural network has a series of input neurons, and the input data sequence is denoted as $x = [x_1, x_2, ..., x_n]$. The output layer has only one node w, and the output value is represented by b. The nodes of the hidden layer are abstracted as the number of nodes $h = [h_1, h_2, ..., h_n]$, where a is the adjustment constant, and the connection between neurons i and j in different layers of $a \in [1, 10]$ is called synapse, corresponding to Weights:

$$s = ah - f(wx + b) \tag{1}$$

In the formula: $w = [w_1, w_2, ..., w_n]$ is the weight vector; $w_k^{(l)}$ is the bias, set to 1. Let the number of nodes in the l layer of the network be $y^{(l-1)}$, and the output value of node p is k, which can be expressed as:

$$\begin{cases} x_k^{(l)} = sl - w_k^{(l)} y^{(l-1)} \\ y_k^{(l)} = f - l\left(\overline{y}_k^{(l)} - p\right) + k \end{cases} \tag{2}$$

In the process of BP neural network teaching resource demand forecasting, it is first necessary to eliminate redundant data in the forecasting process, and select features with larger contribution values as variables, and then establish a BP neural network resource demand forecasting model. Continuous learning and prediction, and finally obtain accurate BP neural network resource demand prediction results. Using the covariance matrix s_j, the data can be mapped from a high-dimensional space to a low-dimensional space, which reduces the amount of computation and simplifies the prediction process. The vector variance of the data after dimensionality reduction is the largest in the low-dimensional space. Then there are:

$$y_{ij} = \frac{s_j - 1}{\left| x_k^{(l)} - y_k^{(l)} \right|} - 1 \tag{3}$$

Further, the covariance matrix in the dimensionality reduction process can be described by using the following formula:

$$M = \frac{1 + y_{ij}}{f(wx + b) - 1} - f \tag{4}$$

The essence of BP neural network resource demand forecasting in abnormal network environment is an optimization problem:

$$\min_{w,b \cdot \xi_i} = \frac{1}{2} wx + M \tag{5}$$

In the process of resource demand prediction of BP neural network under abnormal network environment, the sample data X needs to be normalized first, and its formula is as follows:

$$X_1(i) = \frac{\min_{w,b \cdot \xi_i}}{\max(X) - \min(X)} - 1 \tag{6}$$

According to the above formula, the training samples can be selected to train the BP neural network resource demand prediction model, and the BP neural network resource demand prediction model can be established.

2.3 Realization of Online Learning Resource Demand Prediction

The dynamic management of teaching resources based on BP neural network is a complex problem. In BP neural network, the geographical distribution of teaching resources is very wide, the teaching types are rich and the number is huge, and it requires a certain degree of collaborative work: resources are dynamic, including the change of resource attributes, as well as the replication and migration in BP neural network; Resources work on heterogeneous platforms and are controlled by different management strategies. In the process of teaching resource demand coordination across BP neural network platform, resources are owned by different organizations, which have different use rules, billing models, scheduling capabilities and use models. In such an environment, it is necessary to study a method with strong real-time Expand the resource dynamic management mechanism with excellent performance and adapt to the dynamic changes of resources. Therefore, the future research methods in this field should be committed to coordinating the relationship between users and resource providers, effectively organizing and allocating resources, studying the Resource Recommendation Model and algorithm based on user needs and user behavior in the BP neural network environment, and studying the acquisition of resource service protocol, establish a dynamic optimal allocation mechanism of resources. When the classified online learning resources are automatically classified and saved to the above established database by the model, the model will generate corresponding fields according to the saved information, so as to build a classification information index table. Using this form, teachers and students can easily find the information they want to share. Due to the numerous forms and huge number of online learning resources, there are relatively many categories, so there are many database tables established. The following table is a classified category database table (Table 1).

Table 1. Classified database of teaching resources

Field Name	Field Type	Length	Explain
ID	Varchar	8	code
NAME	Varchar	9	name
SIZE	Bit	6	scale
Description	Varchar	9	Content description
Imgurl	Varchar	7	Content attachment
Abstract Start Date	Text	6	Storage date
Abstract Title	Varchar	8	theme

Based on the above table to provide users with high-quality resource services, based on the above research results of various parts of teaching resource management under the BP neural network environment, and according to the internal connection between the databases, the resource management model framework under the BP neural network is established, as shown in the figure, The framework includes five parts: resource representation and description, dynamic organization, discovery and matching, dynamic optimization and allocation, and dynamic real-time monitoring. The main functions of each part and the relationship between them are given in detail (Fig. 6):

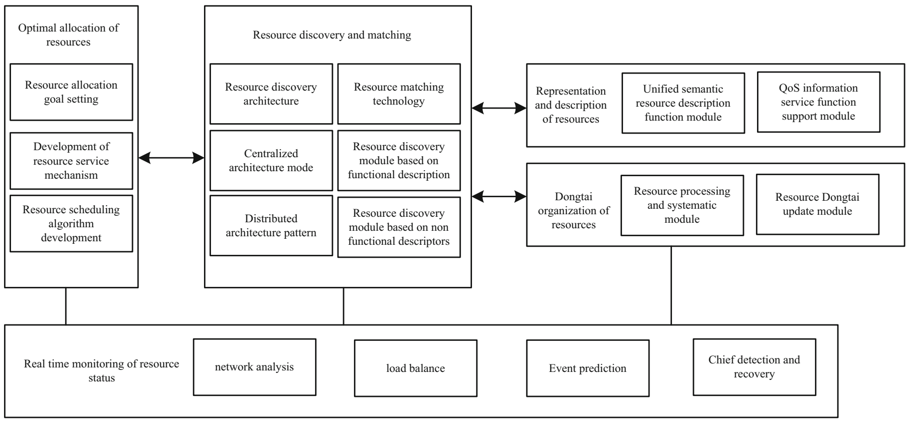

Fig. 6. Functional structure of resource management framework

In terms of the matching method of teaching resources of BP neural network, since the resources contained in BP neural network platform come from different geographically distributed organizations and belong to different management domains, and the predicted objects also run through the whole manufacturing industry and involve many other industries, it is appropriate to adopt the discovery mechanism with adaptive characteristics based on distributed architecture in this environment, a matching model based on semantic description and iterative feedback adjustment mechanism is established, and the user demand characteristics are fully considered in the acquisition process of manufacturing resources to provide high-quality resources. Similarly, in the process of resource organization, its organization form should be able to better adapt to the dynamic environment, flexibly add new resources and eliminate invalid resources, which can bring better scalability and fault tolerance to the BP neural network platform. This paper integrates the teaching management contents of the above parts, constructs a multi-step prediction framework of unsupervised teaching resource scheduling based on BP neural network, and gives the corresponding algorithm. The multi-step prediction framework of teaching resource scheduling based on BP neural network is given, as follows (Fig. 7):

The teaching resource demand forecasting management mainly includes two modules: resource demand queue module and resource demand scheduling module. The resource demand queue module is mainly responsible for putting the resource requirements submitted by each user into the corresponding resource queue for use by the resource demand scheduling module; The resource demand scheduling module is mainly responsible for investigating the priority information of each demand stored in the

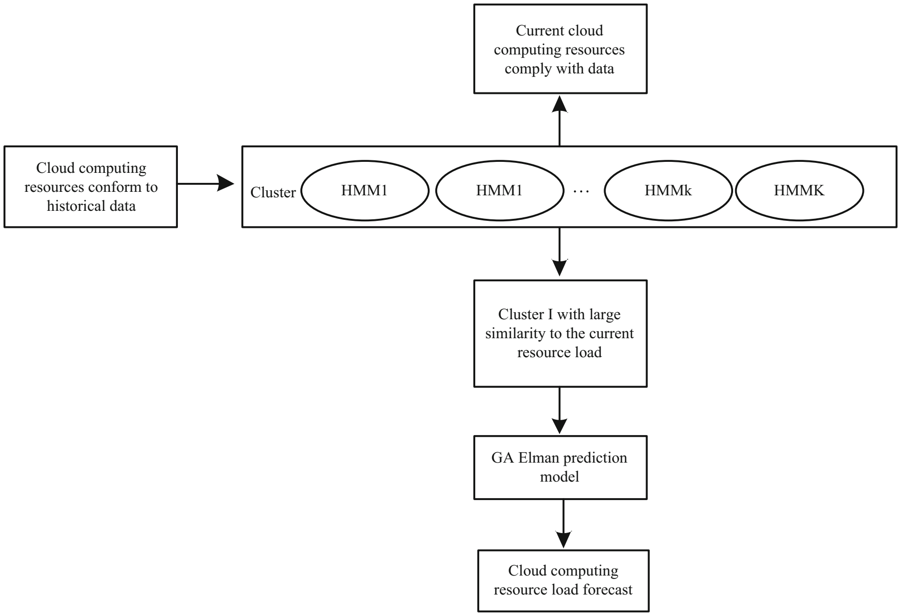

Fig. 7. Multi-step prediction framework for teaching resource scheduling

resource demand queue module, and sending each demand to the virtual resource configuration module according to the priority information, so as to achieve the objectives of teaching resource prediction and scheduling management.

3 Analysis of Experimental Results

In order to verify the effectiveness of online teaching resource demand prediction based on BP neural network, an experiment is needed. The experiment of the encryption and compression storage model design of massive educational resources is verified on the basis of the file archiving and file retrieval performance of the prototype model, which involves each specific functional module. The model is developed using the java language, and the operating model is windows 10. According to the actual application, the storage model is tested on a local area network in a university laboratory, and 4 hosts are selected to set the network environment. The specific settings are shown in the table (Table 2).

The experimental data mainly uses text and video files, and there are about 80,000 different types of files collected. Using different file compression methods for different file types is one of the most effective ways to improve compression efficiency. It can be seen that the decompression time is significantly shorter than the file compression time. It is precisely because the file compression in the model involves multiple sliding windows. Internal resources need to be matched with dictionaries, among which string matching is the most time-consuming, and when decompressing files, string matching

Table 2. Experimental environment settings

Test tools	Memory size/g	Hard disk size/g	Control system	Set quantity
The server	5	550	Linux	1
Host A	3	300	Win10	1
Host B	5	350	Linux	1
Host C	5	350	Win8	1

is not required. The simulation software mat-lab is used to construct the experimental environment for resource demand prediction of BP neural network. Comparative experiments under the same conditions were carried out using traditional algorithms. During the experiment, the data of BP neural network resource demand was collected for 5 days, the BP neural network resource demand during this period was recorded every 10 min, and a total of 720 time-point samples of BP neural network resource demand were collected data. Use the sample data of the first 3 days as the training sample to build the model, and use the sample data of the last 2 days as the test data to test the performance of the model. The computer hardware configuration of the experiment is: CPU is Intel core2Q83002.5 GHz, 4GDDR21333, Window7 Ultimate. The experimental dataset includes 20160 resource request data. The traditional learning resource management uses the information navigation model to optimize the information resource integration. In order to verify the optimization performance of the information resource integration based on the optimized platform structure, the two methods are compared, as shown in the table (Table 3).

Table 3. Comparison of operating effects of different forecasting modes

	Traditional mode	Paper mode
Function	Use links to provide retrieval entry and quickly locate resources	Provide references, information abstracts and automatic retrieval
Retrieval	Establish a one-stop resource navigation database	One stop information query and obtain results
Basic	The system is easy to use, effective, friendly and reasonable	Powerful, complete and convenient
Features	Integrate the information resources through the organization system and deeply reveal the resources	Connect distributed information resources in a conventional manner
Resources	Use navigation to process the search results and select reasonable results to pass to users	Cross database integration, merging multilingual search results

As shown in the table, the traditional information resource integration mode, as a virtual link set, can save and download information, especially for the established information resource database, which is convenient for long-term storage and data uploading. However, the model adopted by the traditional model relies too much on a single integration function, and is seriously lack of cutting-edge and variability, resulting in inaccurate information collection, which makes the integration of information resources in a passive state and reduces the practical value. Select 34 of them as the training set and the remaining 1/4 as the test set. In order to make up for the shortage of data, the cross validation method is used to test the accuracy and performance stability of the resource demand prediction model. In order to fully verify the effectiveness of the prediction model, this paper repeated experiments in the same experimental environment for 20 times, and selected the mean value of 20 experiments as the experimental result data. This method can effectively eliminate the experimental interference caused by accidental factors (Fig. 8).

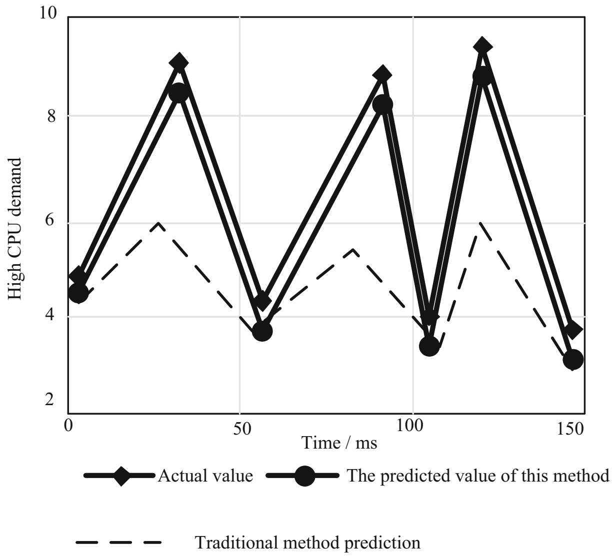

Fig. 8. Comparison of predicted value of resource demand with actual value

Based on the comparison of the above test results, it is not difficult to find that compared with the traditional method, the method in this paper is relatively consistent with the actual value in the process of practical application. The comparison results of resource teaching performance under the traditional method and the method in this paper are further compared and analyzed, as follows (Fig. 9):

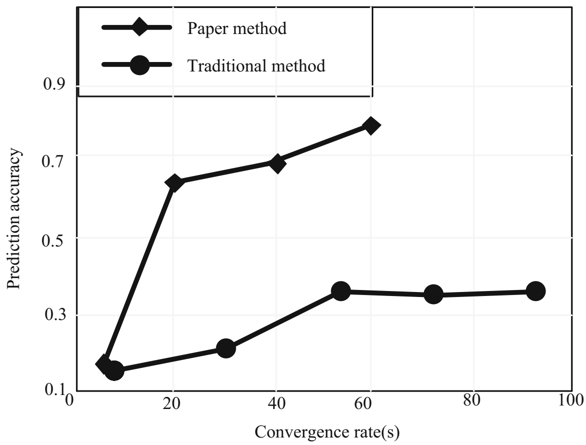

Fig. 9. Comparison of resource prediction effects in interference environments

It is not difficult to find out that, compared with the traditional method, the prediction effect of the method in this paper is obviously better in the actual application process. Based on the short-term prediction of the prediction model in this paper, the MAPE of different prediction models is compared and analyzed and RMSE values are recorded as follows (Table 4):

Table 4. MAPE and RMSE of different prediction models%

Algorithm	Mape	Rmse
Autoregressive model	19.65	4.98
Exponential smoothing algorithm	12.85	3.68
Prediction model in this paper	9.68	2.85

In order to test the performance of each prediction model, the prediction time of different models was counted during the experiment. Experiments are carried out according to 10%–90% of the data set, and the time required for each prediction algorithm to predict in different data sets is measured. The results are shown in the figure (Fig. 10).

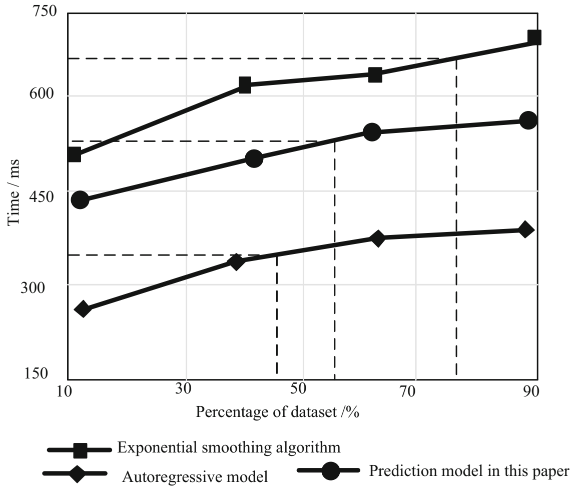

Fig. 10. Comparison of prediction time of different algorithms

From the analysis of experimental results, it can be seen that the prediction time of BP neural network is the shortest, and the error of detection results is significantly lower. Considering comprehensively, the prediction model proposed in this paper has achieved high accuracy. Through the comparison and analysis of experimental results, it can be seen that the comprehensive prediction model based on the combination of short-term prediction and periodic prediction proposed in this paper performs better in prediction accuracy and performance.

4 Conclusion

Aiming at the problems of low early warning accuracy and long prediction time in traditional prediction methods, an online learning resource demand prediction method based on BP neural network is proposed. The prediction model of training samples is established. The BP neural network method is used to continuously search for the optimal parameter combination. The sequence of fitting error is used as the training data to establish the prediction model of verification samples. The generation processing is carried out to continuously eliminate the error of the model. Finally, the accurate prediction model is obtained. The simulation results show that the prediction error can be reduced by using BP neural network algorithm to predict the resource demand under abnormal networks, the generalization ability has been improved and satisfactory results have been achieved.

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Educational Information Evaluation

Research on the Evaluation Method of Ideological and Political Effect of Online Courses in Internet of Things

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Abstract. In order to solve the problem that the evaluation results of the ideological and political effect of the Internet of things network course are not accurate, this paper puts forward the research on the evaluation method of Ideological and political effect of online courses of Internet of things. The influencing factors of Ideological and political effect of online courses are deeply analyzed, and the evaluation indexes of Ideological and political effect of online courses are determined by KMO statistics and factor analysis; The analytic hierarchy process is applied to calculate the weight of evaluation indexes and construct the evaluation model of Ideological and political effect of online courses; Formulate the evaluation standard of Ideological and political effect of online courses, so as to realize the evaluation of Ideological and political effect of online courses. The experimental results show that compared with the existing methods, the minimum delay determined by the evaluation index obtained by the proposed method is 0.8s, the minimum delay calculated by the index weight is 2.3 s, the gap between the evaluation result and the actual evaluation value is less than 1 point, and the accuracy of the evaluation result is high. The above data fully confirm the feasibility and effectiveness of the proposed method.

Keywords: Professional course of the Internet of Things · Online course · Ideological and political course · Effect evaluation

1 Introduction

The Internet of things (IOT) is a strategic emerging industry that is currently the focus of national development. On the basis of embedded systems, wireless sensor networks, communication networks and other technologies, it connects objects with the Internet and summarizes, analyzes and processes the real-time dynamic information collected by the wireless network. The Internet of things industry covers a wide range, has a long industrial chain, a wide range of applications and a strong demand for talents.

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The Internet of things major in Application-oriented Universities focuses on cultivating high-quality Internet of things application-oriented talents and strengthening students' system design and software and hardware programming ability [1]. Internet of things majors include Internet of things sensing technology, Internet of things access technology, Internet of things network technology, Internet of things security technology and Internet of things application technology. Professional basic courses include: C language programming, data structure, operating system, database principle and application, computer network, computer composition principle, analog and digital electronic technology, signal and system Digital signal processing, object-oriented programming, single chip microcomputer and interface technology, etc. Professional core courses include: embedded system principle and application, RFID principle and application, sensor technology, advanced embedded technology (AB + Linux Application Development), ZigBee technology application and wireless network, Internet of things information security, Linux system development, cloud computing, embedded Linux system application development, Internet of things application system design and development, etc. The core courses of Internet of things include embedded technology, communication technology, computer technology and other software and hardware courses. These courses cover a wide range and are highly practical. Therefore, the teaching goal of cultivating applied talents is that students have solid theoretical knowledge and skilled practical operation ability. Traditional teaching methods pay more attention to theory than practice, which is not conducive to cultivating students' innovative thinking and practical ability, and inhibits students' development. Online teaching mode meets the requirements of cultivating technical talents for applied undergraduate majors and is an effective means to cultivate applied technical talents.

In order to ensure the smooth implementation of online teaching of Internet of things professional courses, ideological and political courses are indispensable[2]. In essence, curriculum ideological is to achieve morality and cultivate people. It has always been a fine tradition of China's education to "educate people" before "educate morality", pay attention to the organic unity of preaching and teaching, dispelling doubts, and educating people and talents. "Ideological and political education is the work of being a man. It solves the problems of" what kind of people to cultivate "and" how to cultivate people. "It is the fine tradition of our party and country and the lifeline of all kinds of work. It always adheres to building a body, learning and teaching with morality, pays attention to strengthening the education of students' world outlook, outlook on life and values, and inherits and innovates the excellent traditional Chinese culture, actively guide contemporary students to establish correct national, national, historical and cultural views, so as to cultivate more talents with all-round development of morality, intelligence, physique, art and labor for the society, and cultivate qualified builders and reliable successors for the cause of socialism with Chinese characteristics" [3]. Based on the influencing factors of the ideological and political effect of online courses, the evaluation indexes of the ideological and political effect of online courses are creatively set through kmoo statistics and factor analysis methods; Using the analytic hierarchy process to determine the weight of the evaluation index, build the evaluation model, and realize the ideological and political effect evaluation of the network course.

2 Research on the Evaluation Method of Ideological and Political Effect of Online Courses in Internet of Things Professional Courses

2.1 Analysis of the Influencing Factors of the Ideological and Political Effect of Online Courses

This paper summarizes 24 representative influencing factors, which are: curriculum ideological and political description, goal setting, environment creation, interest stimulation, installation and unloading, network transmission, operation help, goal, interaction, demonstration, unity, connection Download method, knowledge copyright, service life, assignment design, performance evaluation, classroom discipline and standards. By compiling the questionnaire on the influencing factors effect of online courses, the appropriate influencing factors of online course quality are selected [4]. The concept of these 24 influencing factors is defined as follows:

Course Ideological and political explanation: it explains the teaching objectives, teaching contents, and teaching plans of the course.

Goal setting: set the expected learning results to be achieved.

Environment creation: create conditions that meet the requirements of online learning software and hardware.

Interest stimulation: the motivation to promote learners' learning activities and produce the psychological tendency of knowledge exploration.

Installation and uninstallation: learners can install and uninstall programs independently according to the prompts.

Network transmission: during the online course, the network transmission route can communicate stably and smoothly.

Operation help: provide clear and understandable instructions for the operation and use of the course.

Goal synergy: curriculum tools and technologies, curriculum materials and curriculum activities promote the realization of learning objectives.

Teacher student interaction: teachers carry out teaching activities through the network learning platform, communicate and interact with students at the same time, immediately understand students' learning needs and make guidance feedback immediately.

Student interaction: learners communicate freely and share resources around the course content.

Interface design: according to the learning function module, design a clear and understandable text and graphic state displayed on the computer screen.

Media presentation: various technical forms such as moving text, tables, images and videos intuitively express the course content.

Unified style: the overall web page format of the course is consistent with the language style.

Content connection: there is logic and integrity between learning units, which is in line with the cognitive law of learners.

Download method: provide various resource download methods such as computer terminal and intelligent mobile terminal.

Intellectual property rights: the course content and course materials are licensed.

Service life: clearly mark the starting time of the course and the deadline for the use of online resources.

Homework design: personalized homework is generated according to learners' learning progress, with diversified sending and receiving methods.

Performance evaluation: the analysis of learners' academic performance, including the description of evaluation criteria and the interpretation of evaluation results.

Data analysis: analyze learners' learning behavior, put forward personalized learning suggestions and plans, and track the learning progress.

Course duration: set a reasonable course duration according to teaching needs.

Intelligent learning: provide online automatic troubleshooting and intelligent push automatic learner support services.

Classroom discipline: to ensure the realization of classroom objectives and formulate classroom codes of conduct that students are required to abide by.

Language standard: the use of written text and standard pronunciation in course teaching.

Through the above process, the analysis and definition of the ideological and political are completed, which lays a solid foundation for the determination of the evaluation indicators of the ideological and political effect of subsequent online courses.

2.2 Determine the Ideological and Political Effect Evaluation Indicators of Online Courses

According to the analysis results of the influencing factors of the ideological and political online course teaching evaluation effect described in the previous section, the ideological and political effect evaluation index system of the online course is finally determined in accordance with the principles of combining formativity with totality, scientificity with value, external and internal, quantitative and qualitative, and kmo decision-making rules and factor analysis.

KMO statistics is correlation between variables, there are among variables. Therefore, before the application of factor analysis, KMO statistics need to be used to judge whether the variables are suitable for factor analysis [5, 6]. KMO decision rules are shown in Table 1.

Table 1. KMO Decision rules

KMO	Factor analysis of suitability	Determined description
>0.90	Excellent	It is very suitable for factor analysis
>0.80	Good	It is suitable for the factor analysis
>0.70	Mezzo	Factor analysis can also be carried out
>0.60	Ordinary	Factor analysis is barely available
>0.50	Poor	Factor analysis is not appropriate
<0.50	Unacceptable	It is not suitable for factor analysis

According to the KMO rules shown in the table above, the questionnaire data of the online course Ideological and political effect evaluation indicators obtained in this study are deeply analyzed, and the KMO value is 0.88, indicating that the relationship between variables is good, and this result is more suitable for factor analysis [7].

Relevant studies have shown that if the number of variables is 10 to 50, it is suitable to extract factors with eigenvalues greater than 1. There are 24 variables in this study, which are in the above interval, so the method with eigenvalue greater than 1 is used to extract factors. At the same time, the actual number of factors should be determined in combination with the change in the number of factors. As shown in Fig. 1, there are 4 factors with eigenvalues greater than 1.

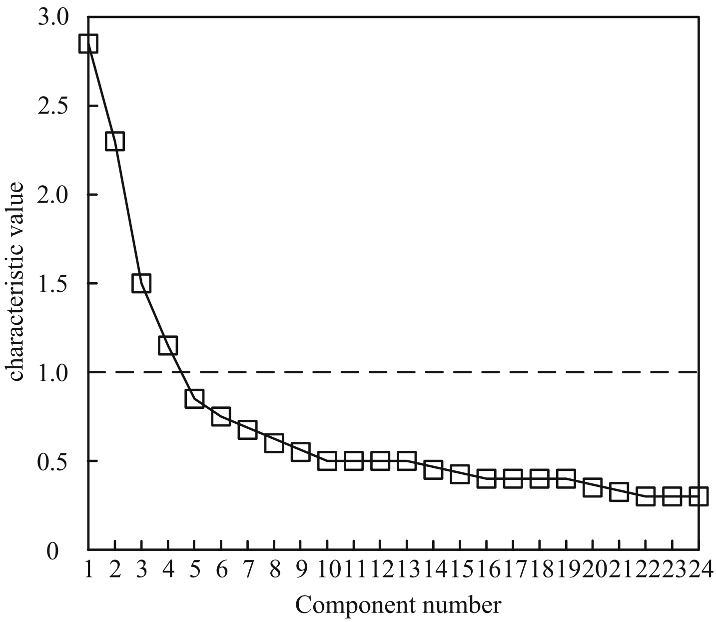


Fig. 1. Gravel Fig

The factors were extracted by the principal component analysis method, and the factors were rotated based on the maximum variance method. When the cumulative variance ratio of the common factors exceeds 50%, the accuracy of the factor analysis results of the four factors can be determined [8].

The above method is applied in the course effect evaluation, the indexes for evaluating the effect of the ideological and political online course are extracted, and the evaluation index system is determined, as shown in Table 2.

Table 2. Ideological and political effect evaluation indicators of online courses

Target	Level 1 index	Level 2 index
Online Ideological and political course teaching effect evaluation	1 Course offered	5 Course ideological, 6 political explanation, 7 environmental creation, 8 goal setting, 9 interest stimulation
	2 Course interaction	10 Student interaction, 11 media presentation, 12 goal collaboration, 13 interface design, 14 teacher-student interaction
	3 Course support	15 Network transmission, 16 operation help, 17 content contact, 18 download mode
	4 Course analysis	19 Data analysis, 20 performance evaluation, 21 intelligent learning, 22 course duration, 23 language standards, 24concept understanding

Through the above process, the ideological and political evaluation indicators of the effect of online courses were determined, with a total of 24 evaluation indicators, which can comprehensively measure the ideological and political effect of online courses.

2.3 Evaluation of the Index Weight Assignment

Based on the above-mentioned evaluation indicators of Ideological and political effect of online courses, the hierarchical analysis method (AHP) is used to design the Internet of Things professional courses to implement the ideological and political effect evaluation model of online courses. The specific process is as follows:

Analytic hierarchy process (AHP) divides the overall structure of the evaluation index system into control layer and network layer to form a network structure including internal circulation and interaction, and then obtains the comprehensive weight of the underlying index by constructing a super matrix and calculating the limit operation. The structure of the model is shown in Fig. 2.

As shown in Fig. 2, the control layer in the setting hierarchical analysis method is the ideological and political effect of the online courses, and the network layer is the curriculum setting, course interaction, course support and course analysis. Comparing the association situation count table, the indicators with counts greater than 1 were selected as influencing factors and constructed the pairwise comparison matrix. Due to space limitation, only one first-level index comparison matrix is selected with a second-level index comparison matrix for display, and the specific matrix is shown in Fig. 3.

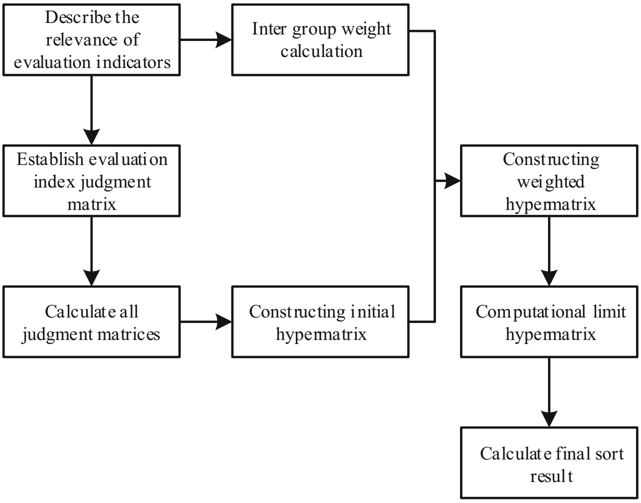


Fig. 2. Structure diagram of ideological and political effect evaluation model of Internet of Things professional courses

A	A	B	C	D
A				
B				
C				
D				

(1) Comparison matrix of 1-level index

a1	a1	a2	a3	a4
a1				
a2				
a3				
a4				

(2) Comparison matrix of 2-level index

Fig. 3. Schematic diagram of the comparison matrix

Based on the comparison matrix shown in Fig. 3, the 1–9 scale method was introduced, and expert groups were invited to score the comparison matrix one by one.1–9 Scaling regulations are shown in Table 3.

Table 3. 1–9 scaling rules

Evaluation	Importance	Evaluation	Importance
1	Both elements are equally important	1/3	Compared with the two elements, the former is slightly less important than the latter
3	Comparing with the two elements, the former is slightly more important than the latter	1/5	Compared with the two elements, the former is significantly unimportant than the latter
5	Compared with the two elements, the former is significantly more important than the latter	1/7	Comparing the two elements, the former is strongly unimportant than the latter
7	Compared with the two elements, the former is strongly more important than the latter	1/9	Compared with the two elements, the former is extremely unimportant than the latter
9	Compared with the two elements, the former is extremely important than the latter	-	-

The comparison matrix of the ideological and political effect evaluation indicators of the online courses is scored with the rules shown in Table 3, and the final weight of the evaluation indicators is shown in Table 4.

Table 4. Weight table of ideological and political effect evaluation indicators of online courses

Level 1 index	Level 2 index	Weight
Course offered	Ideological and political course instructions	0.06
	Environment creation	0.01
	Target setting	0.03
	Interest stimulation	0.12
Course interaction	Student interaction	0.05
	Media demo	0.15
	Goal collaboration	0.08
	Interfacial design	0.03
	Teacher-student interaction	0.03

(*continued*)

Table 4. (*continued*)

Level 1 index	Level 2 index	Weight
Course support	Network transmission	0.03
	Operation help	0.04
	Content contact	0.01
	Download method	0.01
Course analysis	Data analysis	0.01
	Performance evaluation	0.05
	Intelligent learning	0.01
	Course duration	0.01
	Language standard	0.27

This assignment complements the weighting of evaluation indicators and supports the implementation of the final online course on the evaluation of ideological and political effect.

2.4 Realization of Ideological and Political Effect Evaluation of Online Courses

Based on the above ideological and political impact assessment indicators for online courses, build an ideological and political impact assessment model for online courses and formulate criteria for assessing the ideological and political impact of online courses, an online course that assesses ideological and political influence.

Each evaluation index has different dimensions, so it needs to be normalized first. The formula is:

$$x_i' = \frac{x_i - meanx_i}{\max x_i - \min x_i} \tag{1}$$

In formula (1), x_i and x_i' represents the original evaluation index value and the normalized evaluation index value respectively; $meanx_i$ represent the average value of evaluation index value; $\max x_i$ and $\min x_i$ represents the maximum and minimum value of the evaluation index value.

Based on the normalized evaluation index value, the online course Ideological and political effect evaluation model is constructed, and the formula is:

$$R = \sum_{i=1}^{n} \omega_i x_i' \tag{2}$$

In formula (2), R represents online ideological and political course effect evaluation value; ω_i represents the weight assignment corresponding to the i evaluation index; n represents the number of evaluated indicators, and this study takes a value of 18.

Based on the calculation results of formula (2), formulate the online curriculum ideological and political effectiveness evaluation standards, as shown in Table 5.

Table 5. Standard table for ideological and political effect evaluation of online courses

Level	Evaluation value	Course effect
The first Level	8.1–10.0	Excellence
The second level	6.1–8.0	Good
The third level	3.1–6.0	Pass
The fourth level	1.1–3.0	Fail
The fifth level	0–1	Odious

Through the above process, the evaluation of the ideological and political effect of online courses of Internet of Things professional courses can be completed, so as to provide reliable data support for the implementation of ideological and political teaching of online Internet of Things professional courses.

3 Experiment and Results Analysis

The above process has completed the design of the ideological and political effect evaluation method of the online Internet of Things professional courses. To test the efficiency of the proposed method, simulation experiments are conducted. The specific experimental process is as follows.

3.1 Experiment

Taking 100 students of the Internet of things major in a university as the experimental object, the online ideological and political teaching effect data of 100 students of the Internet of things major courses are counted in the student data system of the University, and the proposed methods and existing methods are evaluated accordingly. The accuracy of the evaluation results is taken as the final evaluation index to verify the application effect of this method.

Based on the class, the subjects were divided into 7 groups to obtain the actual evaluation values of the subjects and take them as the experimental standard, as shown in Table 6.

Table 6. Table of actual evaluation values

The experimental group	Actual evaluation value
01	5.6
02	4.5
03	6.8
04	7.2
05	8.0
06	9.4
07	8.1

Through the above process, the preparation of the experiment is completed, which provides help for the smooth progress of the ideological and political effect evaluation experiment of the follow-up Internet of things professional courses.

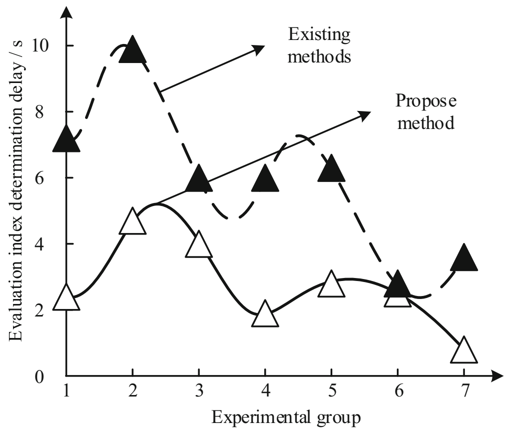
3.2 Analysis of Experimental Results

Based on the above experimental preparation contents, the ideological and political effect evaluation experiment of the implementation of online courses in Internet of things professional courses is carried out. In order to visually display the application performance of the proposed method, the evaluation index determination delay, index weight calculation delay and evaluation result accuracy are selected as the application performance measurement parameters. The specific experimental result analysis process is as follows:

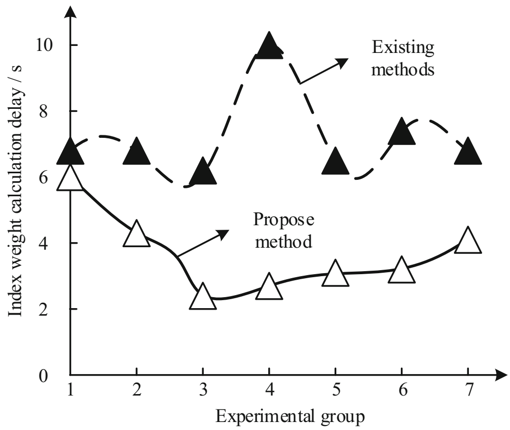
The delay in determining the evaluation index and calculating the index weight reflect the efficiency of online course effect evaluation of Internet of things professional courses. In general, the shorter the time delay, the higher the efficiency of online course effect evaluation of Internet of things professional courses; On the contrary, the longer the delay, the lower the efficiency of online course effect evaluation of Internet of things professional courses.

The evaluation index determination delay and index weight calculation delay are obtained through experiments, as shown in Fig. 4.

As shown in Fig. 4 (1), compared with the existing methods, the evaluation index obtained by the proposed method determines that the delay is shorter, and the minimum value can reach 0.8 s; As shown in Fig. 4 (2), compared with the existing methods, the calculation delay of index weight obtained by the proposed method is shorter, and the minimum value can reach 2.3s .



(1) Deferred delay data diagram of evaluation indicators



(2) Time delay data diagram of index weight calculation

Fig. 4. Time delay data diagram of evaluation index determination and index weight calculation

The accuracy data of evaluation results obtained through experiments are shown in Fig. 5.

As shown in Fig. 5, compared to the existing methods, the estimation results by applying the proposed method are closer to the actual values, indicating that the estimation results of the proposed method are more accurate.

The above results show that compared with the existing methods, the evaluation index determination delay and index weight calculation delay obtained by the proposed method are shorter, and the accuracy of the evaluation results is higher, which fully proves that the application performance of the proposed method is better. This is because this paper deeply analyzes the evaluation effect of network curriculum; using KMO statistics and factor analysis method to determine the evaluation index of the ideological and political effect of the evaluation of network curriculum.

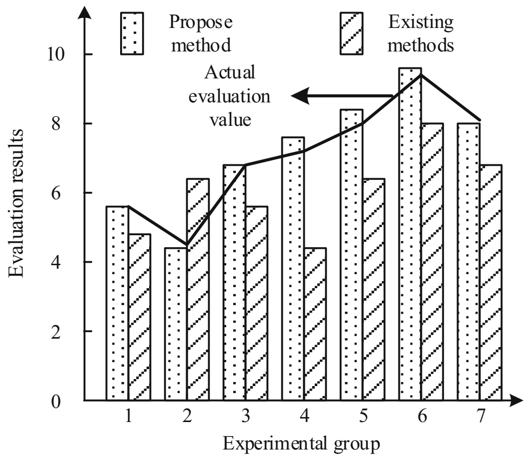


Fig. 5. Accuracy data of evaluation results

4 Conclusion

Based on the current teaching needs of Internet of things professional courses, this study puts forward the evaluation method of Ideological and political effect of online courses in Internet of things professional courses. Through the experimental data, it can be seen that the proposed method greatly shortens the time delay of evaluation index determination and index weight calculation, improves the accuracy of evaluation results, provides more effective means support for the implementation of Online Course Ideological and political effect evaluation of Internet of things professional courses, and also provides a certain driving force for the development of online course teaching of Internet of things professional courses. However, due to the limited conditions, there are still some deficiencies, and the efficiency of the evaluation is not significantly improved. Future studies can improve evaluation efficiency based by ensuring evaluation accuracy.

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Research on Evaluation Method of College Students' Innovation and Entrepreneurship Training Mode Based on Deep Neural Network

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Abstract. China adheres to the core of "cultivating college students' innovation and entrepreneurship ability" and attaches great importance to innovation and entrepreneurship education. On the basis of establishing the evaluation index system of classroom teaching quality, this paper establishes the evaluation model of classroom teaching quality based on BP neural network. The results were validated using the Matlab Neural Network Toolkit, and the collected data was used for network training, optimization, and testing. It shows that the model can be used to evaluate the quality of classroom teaching, and can make scientific and reasonable decisions according to the evaluation indicators.

Keywords: Deep neural network · College Students' innovation · Entrepreneurship courses · Training mode · Evaluation method

1 Introduction

Judging from the current social development situation, the innovation and entrepreneurship of college students is urgently needed by the current society, and education has become more and more important. So as to stimulate people's enthusiasm for innovation, stimulate people's creativity, and achieve national prosperity and people's prosperity [1].

In today's era of knowledge economy, Follow the progress of the times, innovative talents are urgently needed by the society, and the desire for Talent of this type in all walks of life is increasing. Therefore, with the goal of disseminating knowledge and cultivating talents and the responsibility of transporting talents for the country and society, Schools that take the responsibility of transporting talents to the country and society. Also Take on the important task of cultivating talents. Facing the challenges of this era, how effectively cultivate innovative talents required by the society has also become a challenge for colleges and universities [2]. Build an education system for entrepreneurial talents, so Train the talents needed by the country; Build a relevant quality evaluation system, Is our ultimate goal [3].

However, with the advent of the wave of entrepreneurship, it has gradually exposed the problem of the shortage of related aspects talents in China at this stage. Many recent

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graduates are unable to meet the needs of employers, can only complete the specified work, and it is difficult to express their own opinions and suggestions. The emergence of this problem also shows that there is a certain lack of education in our country in this regard [4]. It is not difficult to see that Chinese schools are aware of the urgency of education in this area, and gradually begin to notice to the cultivation of innovative talents. However, it has not formed a formed education system, let alone an evaluation system for the results of such education. Although education and teaching in this field have been carried out in various aspects, it is still in the primary stage, most of them are scattered. In the setting of the relevant courses, most schools have not included it in the formal teaching plan, but exist in the form of elective courses, or simply carry out some lectures related to entrepreneurship. Moreover, The teachers did not teach according to the needs of the students. Most of them were empty and lacked practical theoretical education. It was difficult to stimulate students' enthusiasm for innovation and meet the expectations of education. In the face of such a situation, few colleges and universities can effectively introspect, find their own problems and correct them, precisely because of the lack of an effective education quality evaluation system [5]. Therefore, establishing a mature and effective quality system as soon as possible is an important topic in this research direction. On this basis, some scholars have proposed to use the entropy weight method to effectively evaluate the relevant curriculum training mode of college students. First, an evaluation system is established, and evaluation indicators are obtained, and then the relevant weights of the college students' curriculum training mode for the indicators are calculated. Finally, the entropy weight method is used to construct the evaluation model. Another part of researchers use analytic hierarchy process to calculate the weight of students' evaluation indicators. Evaluation and evaluation of the training mode of related courses for college students. However, these two methods take too long to cultivate students in colleges and universities, resulting in poor teaching results.

In view of the above two deficiencies, this paper takes the training of innovative and entrepreneurial talents as the background, takes the local school as the research object of this paper, On the basis of the corresponding theory, the evaluation method of this paper is designed. The college student training evaluation index trains college students, and then inputs the trained sample data into the deep neural network model. The above process is used to verify the effectiveness of this method.

2 Training Mode Evaluation Metrics

2.1 Evaluation Index Training Mode for College Students

Determining a scientific, reasonable, objective and fair teaching evaluation index system is the first step in evaluating. According to the teaching supervision contents of the teaching supervision group, Combining various factors in the questionnaire, Build a relevant index system. There are three second-level indicators under each first-level index. The details are shown in Table 1:

In the process of evaluating the quality of teaching, the teaching instructors generally set 15 indicators according to the relevant concepts, design, content, methods and means of teaching, and evaluate from x1 to x15. The quality of classroom teaching of 12 teachers was tested by random sampling, and 10 samples were made into a sample set, and the

Table 1. Classroom teaching quality evaluation index system

First-level evaluation index	Secondary evaluation index
Teaching philosophy	Guide students to Actively participate in relevant content, promote students' active development, attach importance to ability training, and considering the development needs of students at all levels (x1) Pay attention to students' autonomous learning, so as to reflect the role of information technology (x2)
Instructional Design	Accurately grasp the role of the curriculum in the talent training curriculum system (x3) Organizational overall planning focusing on optimizing Learning Objectives, Related Content, Related Methods (x4) Focus on students as the main body to realize the relevant design of the transition between teaching and learning (x5)
Teaching content	To meet the "curriculum standards" (x6) In line with the characteristics of teaching objects and cognitive laws, with prominent emphasis and strong pertinence (x7) The teaching content of cultural courses reflects the trend of professional development, grasps the frontiers of discipline development, and the teaching content of military courses is close to life, and the internal answers are updated in a timely manner (x8)
Teaching method	Teaching methods suitable for course characteristics and teaching objects (x9) Use a variety of teaching methods such as heuristic, case-based, and seminar-based (x10) Provide guidance for students to study independently and conduct relevant thinking and research (x11)
Teaching means	Carry out relevant teaching according to relevant teaching objectives and characteristics of each course (x12) Reasonable choice of teaching methods (x13) Apply new educational technologies (x14) value information resources related to course teaching (x15)

11th and 12th samples were used as experimental examples. Through the analysis of the evaluation results, it is found that there is a nonlinear relationship between the quality of classroom teaching and various evaluation indicators [6].

2.2 Indicator Training

According to the establishment of the relevant system, there are 15 secondary evaluation indexes in total, and these 15 indexes can be input as a model, so the number of neurons in the input layer is $l = 15$.

The network output index is the relevant evaluation result, so the number of the above neurons is $n = 1$.

At present, many scholars are looking for methods of hidden layer neural network, where the hidden layer neural network is low, it is difficult to detect samples, and even for network training, there are many hidden layers. The neural network will extend the training time of the network, thereby reducing the generalization performance of the network. By designing the structure of the BP neural network and its own experiments, a method of calculating the hidden layer neural network number is obtained:

$$m = \sqrt{l + n} + q/2 \tag{1}$$

Among them, for neurons, l represents the number of input layers, n represents the number of output layers, and q represents the number of samples.

According to the above analysis, the evaluation model is drawn, the specific model structure is shown in Fig. 1:

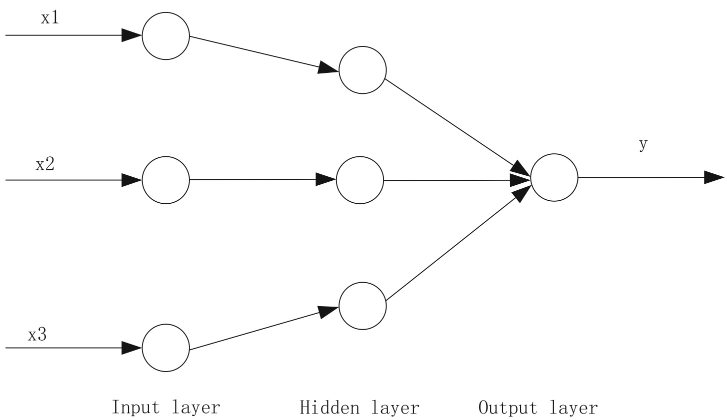

Fig. 1. Classroom teaching quality evaluation model

BP network learning has two stages: information transmission and backward error. Each input layer neuron receives input from the outside, and then sends it to each intermediate layer neuron. The intermediate layer of data conversion is the internal data processing layer based on the data. Conversion requirements, the intermediate level may be divided into single layer or multi-layer; on this basis, the final information is sent to each neuron in the output layer, after further processing, it completes forward propagation once, and the result of the output information processing. The result is not consistent with the expected result, it will enter the error back propagation stage [7]. The cyclical forward and backward communication process, so each layer is repeated and continuous, through the BP divine network learning and training process, directly within the receiving band, or reaching the fixed learning degree, After completing the above-mentioned online learning and training process, you will get the best combination [8].

BP God's network is the root of Matlab's newff function structure. Before training, the network correlation function that was set in advance, the retransmission function called logsig function, the purelin function used when exporting, the Traingdx function coming through the training, and reaching the goal. After multiple exams, the general course length is set to 100, the learning efficiency is set to 0.9, the maximum number of courses is 50000, and the target difference is $1 \times e{-5}$. Modeling and learning through adoption of Matlab files, specific information as shown in Fig. 2:

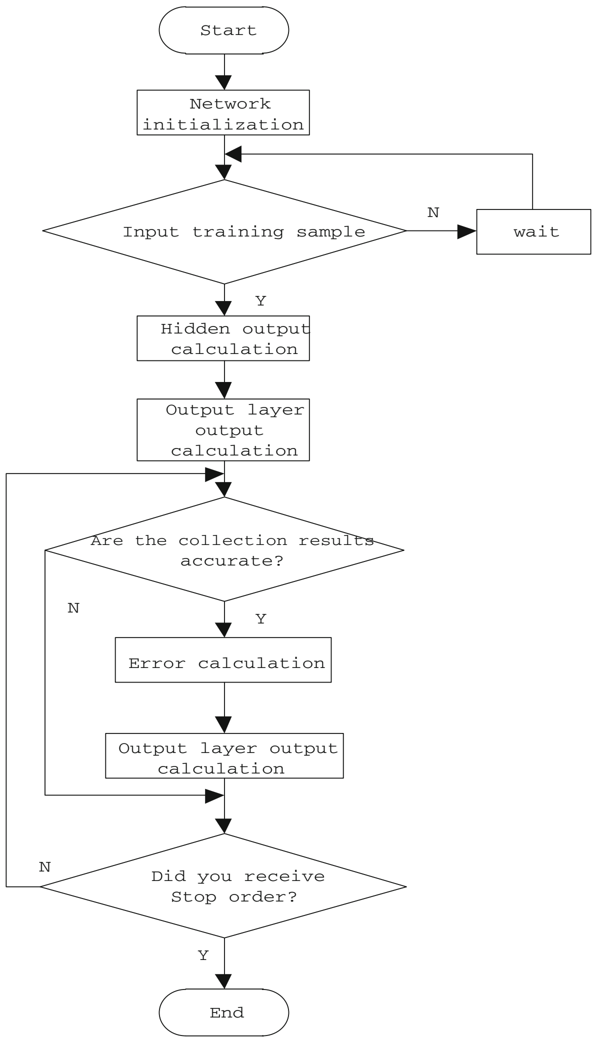

Fig. 2. The learning process of the teaching quality evaluation model of BP neural network

Based on the above Fig. 3, it is possible to understand the network learning heavy repetition number reached 3741 times. It has a high-performance function and a very high-quality effect.

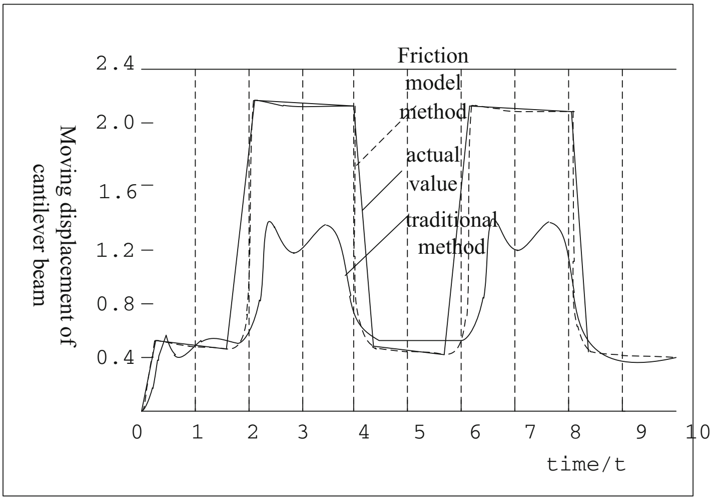

Fig. 3. Neural network learning process

3 Training Model Review

In terms of the SNE adoption shooting conversion, the number of points and the distribution of the shooting rate, the details are divided into the following two steps:

(1) Approximate distribution between structural high-density objects, more likely to be selected for similar objects, and approximate distribution for non-similar objects. [9].
(2) Overall, the low-level spatial distribution of the low-level structure, and the approach of the two-way distribution of the approximate distribution.

The basic neuron structure is shown in Fig. 4 below:

In Fig. 4, x_1, x_2, x_3 is the input of the neuron, w_1, w_2, w_3 is the weight of the corresponding input, x_0 is fixed to 1, and $w_0 = b$ is the bias coefficient, the neuron output value is $a = w_1x_1 + w_2x_2 + w_3x_3 + b$ and the output is $y = f(a)$, where the function $f()$ is the activation function.

(1) When the excitation function is nonlinear, the two-level neural network can approximate all the functions. However, a special case is the constant activation function. In a multi-level neural network, if the constant activation function is used, the network is equivalent to a single level network.
(2) Variable continuity. This case is a prerequisite for adopting the gradient based optimal solution.
(3) Limiting its output. Only in the case of limited activation function, the learning algorithm using gradient will become more stable.

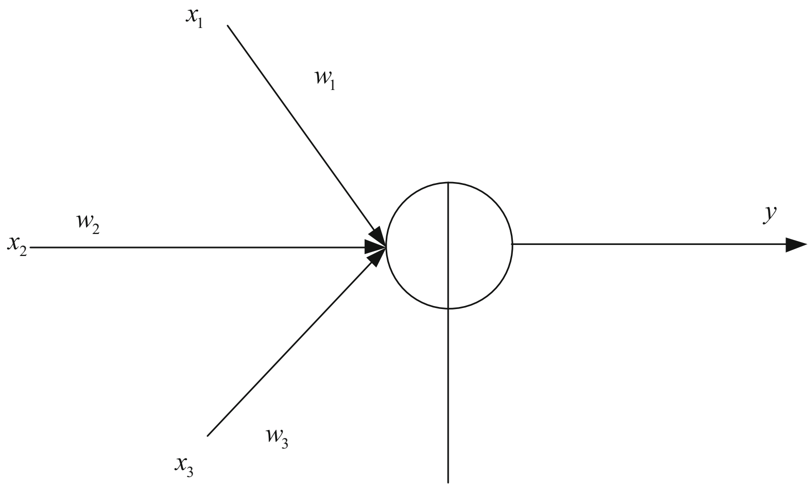

Fig. 4. Basic neuron structure

(4) A single scale. If the activation function is a single single network mode, the loss is convex.
(5) Close to the original function of a constant. When the excitation function near the origin is approximate, if the weighting is initialized, the learning speed of the neural network will be accelerated [10].

The image of the Sigmoid function is a curve shaped like an "S", as shown in Fig. 5. It has previously been the most commonly used activation function in neural networks, with the formula:

$$f(\mathrm{x}) = \frac{1}{1 + e^{-x}} \tag{2}$$

where, e^{-x} is the feedback coefficient.

The derivative function of the Sigmoid function is $f(\mathrm{x}) = \frac{1}{(1+e^{-x})^2}$, which is exactly equal to $f(x)(1 - f(x))$, so it is easy to calculate. When the output value is close to 1, the input value is large, and when the output value is close to 0, the input value is small, so that the data will not be too large during the transmission process. Divergence easily.

When processing high-dimensional information such as images, it is impractical to have connections between neurons. In contrast, in the latter layer of the brain, each neuron is only connected to a specific part of the upper layer. The size of the connecting region is a super parameter as the sensing field.

For example, assuming that the size of an input image is $28 \times 28 \times 3$ and the filter is 5×5, each cell in the convolution layer will be associated with the input area of $5 \times 5 \times 3$, with a total of $5 \times 5 \times 3 = 75$ weight parameters (plus a variable).

In general, a pooling layer is periodically added to any convolutional neural network. The pooling layer can effectively reduce the size of the input of each layer (do not change the depth, only change the width and height) and the number of parameters, shorten the

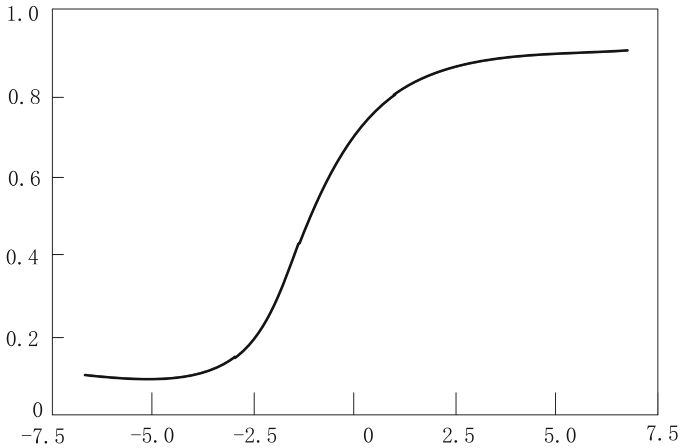

Fig. 5. Sigmoid function

operation time, and reduce the occurrence of overfitting. The commonly used pooling layer size is 2 × 2, and the step size is 2. According to the input sample, the maximum value of the adjacent 4 values is taken each time, which reduces the data by 75%, and the data depth size constant. In addition to this, there is also a pooling operation that takes the average of 4 adjacent values. For example, suppose the input of a pooling layer is 10 × 10 × 32, then after the max pooling operation, the size of the data becomes 5 × 5 × 32.

Full connection layer is the most common structure in artificial neural networks, not only in convolutional neural networks. Connect the output of the upper layer to the neurons connecting the layer. Its output can be realized directly by matrix multiplication and bias.

Softmax layer is also a common neural network structure. The role of this layer is mainly used for classification. In fact, this level is a function of "compressing" a vector containing any real number in the K dimension into other k-dimensional vectors. So that each element of it is in the range (0, 1), and all The sum of the elements is 1. The formula is:

$$\sigma(\mathbf{z})_j = \frac{e^{z_j}}{\sum\limits_{k=1}^{K} e^{z_k}} \tag{3}$$

where, e^{z_k} and e^{z_j} represent neurons in k-dimensional vector and neurons in j-dimensional vector respectively.

The output of the softmax layer can be regarded as the probability that the input is corresponding to each category.

4 Experimental Studies

In this paper, the traditional method is selected as the comparative method for experimental comparison. In order to test the effectiveness of this method.

Specific results are shown in Table 2:

Table 2. Experimental parameter table

Project	Parameter
Operating Voltage	200 V
Working current	150 A
Operating system	Windows 10
Operation time	10 min
Programming language	C++
Number of operations	7 Times

The experimental operation environment is shown in Fig. 6 below:

Fig. 6. Experimental operating environment

According to the above experimental parameters, The traditional method is compared with that of this paper, and the areas with deep defects and shallow defects in the internal equipment of power transmission and transformation are detected respectively.

The evaluation duration obtained is as follows Fig. 7:

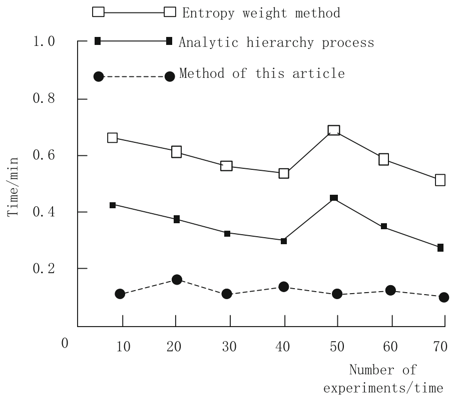

Fig. 7. Evaluation time experimental results

According to the figure above, the evaluation time of this method is within 0.2min, prove this method is relatively short, time-consuming and has high evaluation efficiency.

In this paper, five universities in Liaoning Province were selected as experimental subjects, and they were randomly ranked. According to the actual situation of each university, 10 experts are invited to assign values to the evaluation indicators. The assignment standard is within the range of 0–1, with two decimal places reserved. The initial scores of the indicators of the five universities are sorted out by the arithmetic average method, and the matrix X is obtained according to the formula.

Calculate the distances of the five evaluated objects from the positive and negative ideal solutions. The following Table 3:

Table 3. Five distances near / away from the positive and negative ideal solutions

	d_i^+	d_i^-
A1	0.0152	0.1457
A2	0.1089	0.0520
A3	0.1441	0.0140
A4	0.1505	0.0248
A5	0.0109	0.1526

Calculate the closeness of the five to the ideal solutions:

d1 = 0.9055,d2 = 0.3231,d3 = 0.0885,d4 = 0.1413,d5 = 0.9336.

The order is: d5 > d1 > d2 > d4 > d3.

Through the comprehensive evaluation of the five schools, we can know that school E has the highest quality and school C is lower. It is consistent with the real situation, so it is believed that the evaluation method is true and effective.

5 Conclusion

The method proposed in this paper not only solves the nonlinear problem of evaluation, but also does not need to establish a complex mathematical model. According to the relevant courses, the training mode of the course is evaluated by establishing the BP neural network model; This model can not only solve the problems of traditional evaluation methods, reduce the influence of human factors in index weight evaluation, and realize high-precision prediction. It is scientific, accurate, reliable and fast; In addition, the more training samples the network has, the higher the output accuracy will be.

In short, the proposed method has a high application and promotion value. It can evaluate the teaching quality level scientifically and accurately; the model application is convenient. In the future application, as long as the secondary index is scored and the scoring results are input into the training network, the objective and reasonable evaluation results can get, laying a certain foundation for the improvement of teaching quality.

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Evaluation Method of Oral English Digital Teaching Quality Based on Decision Tree Algorithm

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Abstract. In order to solve the shortcomings of low accuracy and long time-consuming in the evaluation process of traditional teaching effect evaluation methods, this paper applies the decision tree algorithm to this, and designs an evaluation method for the teaching effect of oral English teaching. Different from other methods, the method designed in this paper is to evaluate students and teachers. After the evaluation system is constructed, the decision tree algorithm is used to process the collected original data samples, and the data attribute classification rules are set, the evaluation score is formulated, and the final evaluation is obtained by synthesizing the evaluation results. The experiment proves that the designed evaluation method has high accuracy and short time-consuming, which proves that the designed evaluation method has good evaluation effect.

Keywords: Decision tree algorithm · English · Oral language · Teaching quality evaluation method

1 Introduction

In the teaching of colleges and universities, the teaching effect is the content that can best reflect the teaching ability of the school. The teaching ability of teachers is the general means to improve the competitiveness of the school [1]. The evaluation results of the high quality of teachers' teaching can be used to measure teachers' teaching ability. Through the results, teachers can reflect on their own teaching methods and methods, and on this basis, put forward measures and methods to improve their own level, so that teachers can further reflect the advanced effect of teachers' ability to their own education level in self-evaluation, and increase the level of teachers' teaching ability, So as to improve the teaching ability of teachers' professional courses. Generally speaking, at the present stage, colleges and universities will evaluate the teaching ability of the teachers in the school. The commonly used evaluation methods are generally fuzzy algorithm and neural network algorithm. Although it can effectively evaluate the actual teaching level and teaching effect of the teachers in the vacuum chamber, it is easy to be

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affected by many factors in the process of practical application, such as random external influence factors, Or including the subjective influence factors when the experts give the evaluation results, which are some factors that can cause great changes to the evaluation results [2–4]. This situation will lead to inaccurate evaluation results of teaching ability and teaching effect of college teachers and affect the final evaluation results. The most important course in college is English, which is a required course for every student to study at school. Students' mastery of English plays an important role in their future work development and life planning. Therefore, it is necessary to pay attention to the improvement of students' oral English ability. It is particularly important to improve the oral English level to improve the overall English expression ability [5]. Therefore, against the background of the current popular English style, it is necessary for colleges and universities to establish a very effective and objective method for evaluating the level and effect of oral English Teaching [6]. This is not only a problem that needs attention, but also a problem that must be solved at this stage. Due to the particularity of English course, oral English teaching is more difficult. Therefore, for oral English courses, the evaluation results of teachers' teaching effect and teaching ability need to be more accurate and stable [7]. From the previous results, it can be seen that there may be some errors in the results, which will make the evaluation results of teachers very different, and will also have an impact on the follow-up teacher performance.

Due to these problems and shortcomings in the evaluation of colleges and universities, in order to solve this problem and obtain the evaluation results that are more in line with the actual situation, this paper will introduce the decision tree algorithm to effectively evaluate the quality and effect of digital teaching of oral English for college teachers. It is hoped that the method designed in this paper can bring favorable support for the teaching effect of colleges and universities, and provide certain technical reference for the teaching effect and teaching process of colleges and universities.

2 Design of Evaluation Method Based on Decision Tree

2.1 Constructing the Quality Evaluation Index System of Spoken English Digital Teaching

Aiming at the design of oral English teaching effect evaluation in Colleges and universities, this paper introduces the analytic hierarchy process (AHP) to construct an overall teaching structure model in the teaching related content of colleges and universities. This model consists of three layers, namely, the target layer, the criteria layer and the influencing factor evaluation factor layer. The importance of the constructed teaching evaluation indicators of colleges and universities, that is, the weight, is ranked. Based on the ranking results, a more real judgment matrix is established by using the method of pairwise comparison. Since the evaluation of teaching effect belongs to the classification and comparison of multiple factors, it is necessary to establish a data classifier in the teaching structure model. Therefore, a widely used support vector machine classifier is applied here to realize the classification of multiple factors and indicators [8]. Let (x_i, y_i), $x_i \in R^n$, $y_i \in \{-1, 1\}$, $i = 1, 2, ..., n$, and x_i represent the index of English teaching quality evaluation; y_i represents the grade of English teaching quality. Based on the theory of risk minimization, the following hyperplane is established:

$$y = \varpi \phi(x) + b \tag{1}$$

Among them, ϖ represents the normal vector; B represents the offset vector.

Every time a new sample is introduced, the support vector machine needs to learn again. When the sample size is large, the learning time is long, resulting in a high complexity of computing time [9]. In order to speed up the learning speed, the Lagrange multiplier is introduced to obtain the dual problem, so that the hyperplane classification function is:

$$f(x) = \mathrm{sgn}(\alpha_i y_i (\phi(x) \cdot \phi(x_i)) + b) \tag{2}$$

Among them, α_i represents the Lagrange multiplier. After the above calculation, the calculation results of the classification function of this study are obtained. In order to make the results of the designed teaching effect evaluation method more accurate, this paper establishes a more comprehensive evaluation effect index system. At present, there are many evaluation methods for teaching, so there are many evaluation index systems in the existing research. The system adopted by some colleges and universities will focus on the course content of teaching, while some colleges and universities will focus on the experience effect of students in the classroom. It is easy to happen that the evaluation results do not conform to the actual situation [10]. For example, in the classroom, the teacher completely explains all the knowledge content. In the evaluation system that focuses on the course content of teaching, the teacher's score will be very high, but the students may not understand the teaching content; Another example is that students can learn very full knowledge in every English class. For the evaluation system that focuses on the effect of students' experience in the classroom, the teacher's score will also be high. However, in the long run, the progress of the course is slow, and the teachers' teaching time is long, so it is difficult to complete the teaching objectives within one semester, which will have a large error with the evaluation results.

After a long-term analysis of previous studies, this paper sets the main core of evaluation into two parts, with teachers and students as the two main contents, so as to build an evaluation index system that is closest to and consistent with the actual teaching effect. See Fig. 1 for details.

As shown in Fig. 1, teachers' own teaching indicators are usually dominated by the number of above classes, including the number of classes transferred, suspended, postponed and substituted; The setting of evaluation indicators for students in the classroom is relatively broad, including the degree of course acceptance, the effect of classroom learning, the importance of learning content, and so on [11]. The specific flow is shown in Fig. 2.

According to the evaluation process in Fig. 2, the process of the evaluation model constructed in this paper can be analyzed. It is necessary to collect the previous teaching data of the teachers to be evaluated in Colleges and universities as the basic data of evaluation; After the evaluation system is constructed, the collected teachers' teaching data are processed and analyzed, and the data are benchmarked according to the standards of the evaluation system and the scoring situation to obtain the basic model learning samples of the evaluation results of the teachers' teaching effect.

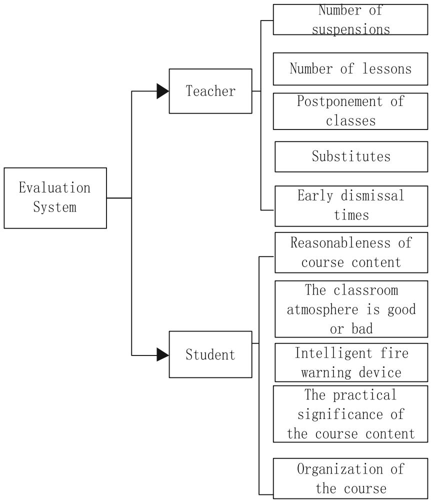

Fig. 1. Evaluation index system of English Teaching

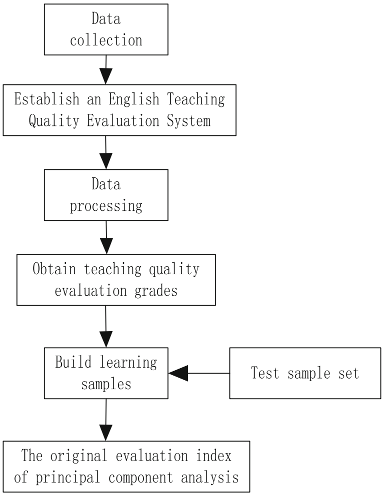

Fig. 2. Overall process of evaluation

In order to achieve a more real evaluation of the teaching effect of teachers, it is necessary to reduce the dimension of the evaluation indicators in the system, which requires the principal component analysis method to deal with the indicators. As a result, the new index after dimension reduction is taken as a new evaluation system. The purpose is to reduce the relationship between indicators, minimize the number of vectors input at the beginning of the system, reduce the pressure of model analysis data, and achieve a higher level of evaluation. The results obtained from the above contents can be used to process the learning samples of teachers' teaching conditions and reduce the dimension and scale of the data. Some of the learning samples are selected as the samples for the next training, and they are studied. They are classified and calculated by the classification function calculated before. After calculation, the samples are evaluated according to the system, and the actual teaching quality is classified according to the evaluation results of the classification function on the learning samples.

2.2 Data Preprocessing Based on Decision Tree Algorithm

There are great differences between the educational methods and modes of higher education institutions and intermediate education institutions, both in the ability of professional knowledge and the absorption of classroom content. The teaching objectives of higher education institutions always focus on the students' real ability level, and always pay attention to the degree of students' absorption of teaching contents. Through the teaching methods of teachers' personal charm and personal color, the curiosity and enthusiasm of college students for professional knowledge are increased, which helps students actively participate in classroom teaching, increase the interest of the classroom, and acquire professional skills and knowledge.

Collect the data of students' evaluation and teachers' lecture evaluation, and summarize and calculate the average value. Deal with the vacancy in the data, discretize the data attributes and reduce the number of characteristic attributes. The decision tree has angle ode branches and branches and leaves. Its branch development process is similar to that of the decision process. The nodes belong to the internal decision attribute. Each branch of the tree is a decision process layer, and the nodes of each leaf are decision categories. The number of trees can judge the accuracy of the classification results, and determine the richness of the decision result process through the size of the tree.The ID3 algorithm is used to test the characteristics of the teacher's teaching data, and the corresponding decision tree node needs to be selected for feature decision. By judging the number of nodes in the decision tree, the accuracy of the decision is measured. The characteristic branches with different values are identified by recursive cutting of the branches; And the branches with the same feature quantity are classified into the same category by recursive method, so as to realize supervised cutting classification [12]. The calculation process is shown in Table 1.

Suppose there are N training samples (X_i, Y_i), and the input and target vectors are $X_i = [x_{i1}, x_{i2}, ..., x_{in}]$ and $T_i = [t_{i1}, t_{i2}, ..., t_{in}]$, respectively. X and T represent $n \times Q$ dimensional and $m \times Q$ dimensional matrices, respectively. Construct the quality judgment matrix B of oral English digital teaching, and set the evaluation index set of oral English teaching quality as $A = \{a_1, a_2, ..., a_i, ...a_n\}$, where n represents the number of evaluation indicators; a_i represents the i need. The construction matrix is as follows:

$$B = \begin{bmatrix} r_{11}, r_{12}, ..., r_{1n} \\ r_{21}, r_{22}, ..., r_{2n} \\ ..., ..., ..., ... \\ r_{n1}, r_{n2}, ..., r_{nn} \end{bmatrix} \tag{3}$$

Among them, the weights corresponding to each evaluation index $a_1, a_2, ..., a_i, ...a_n$ are $w_1, w_2, ..., w_i, ...w_n$ respectively, and the weights are normalized.

Table 1. Specific process of decision calculation

Algorithm	Generate a decision tree from a given dataset
Enter	Training samples, each attribute takes discrete values, and the candidate attribute set for induction is attribute-list
Output	Decision tree
Step	(1) Create a node; (2) Divide node categories; (3) Mark the node category; (4) Select the node with the largest amount of information for attribute division; (5) Dividing the sample set; (6) Test branch; (7) Decision classification

2.3 Extracting Decision Tree Classification Rules

The corresponding weight confidence is obtained according to the above contents. According to the knowledge content expressed by the matrix, a classification rule that conforms to the tree growth path is created. According to the actual situation of classification, the rules are further divided in detail, and the joint positions of the branches and leaves are merged to complete the classification rules.

Traverse from top to bottom along the decision tree, test each node, form different branches of the test output results on each node, and finally transmit them to a leaf node by a certain way. In this process, several variables can be used to determine the category. Expert explanation as "an intelligent computer program that uses knowledge and reasoning to solve complex problems that require professionals to apply their domain knowledge (Harman & King 1985)." The expert system can use the knowledge and experience of professionals for reasoning, judgment and decision-making, can explain the reasons for the decision-making, and can operate in the case of missing or uncertain data.

Mining and analyzing important data is one of the important tasks of classification [13]. The classifier proposed in the above article can calculate and classify the classification function, mine important data, and record different types of data information. The information gain is applied to the decision-making process to judge the classification ability in this way, and the nodes of the tree are divided into attributes. The attribute can be divided by the category of unconditional entropy and conditional entropy of information. And the attribute value can be judged by the maximum gain information in the process of calculating the branch attribute to find the optimal solution.

Both SLIQ and SPRINT use the Gini index as a measure of attribute selection, both can perform inductive learning of decision trees on a very large training sample set, both can handle continuous attributes and discrete attributes, and both use pre-sorting technology. Disk-resident datasets that cannot be sorted into memory at once. Both algorithms define and use new data structures to facilitate tree construction. Data integration is the merging of data from multiple data sources [13]. In this paper, the multiple database files obtained by data collection are used to generate teacher evaluation database by database technology. Data is integrated (averaged and rounded) to fill in missing data values, smooth noisy data, identify or remove outliers, and resolve inconsistencies. In the teacher evaluation analysis database, due to various data quality problems, there may be incorrect values in the data, and some attributes have missing attribute values. For these problems, data cleaning techniques can be used to fill in.

Set the Category attribute of the sample set as "excellent", and there are two values: "yes" and "no". Therefore, the sample set can be divided into two sub sample sets. C1 corresponds to the "yes" category and C2 corresponds to the "no" category to calculate the expected information (i.e. entropy) of each decision attribute.

For the attribute "Title", there are 4 attribute values of {Professor, Associate Professor, Intermediate, Junior}. Calculate the desired information needed to divide a given sample by "job title". Since the attribute "professional title" has the greatest information gain, this attribute is selected as the root node of the decision tree. Next, the branch "professional title = professor" is further split according to this method.

On the one hand, there are many unavoidable data noises in the original data, which will increase the abnormal behavior of the branches in the training process, thereby reducing the effect of the branch training. On the other hand, it is also easy to have some isolated points in the data text, which are often unrelated to other nodes. It is easy to ignore the existence of these isolated points, resulting in the loss of data resources and incomplete final results. Therefore, the widely used measurement method will be adopted. Firstly, the branches will be pruned to remove the meaningless and unreliable branches. Thus, the speed of tree branch classification can be increased, and the nodes of unified category can be marked continuously according to the trend of tree branches in time, so as to increase the accuracy of tree branch classification in data testing. By cutting off redundant branches and special branches, the shape of the tree is improved, the branch structure is recorded, and the branch points that have been cut off and no longer continue to grow are taken as nodes. This node can be marked as leaves because it no longer grows branches. This kind of leaves is the most comprehensive category in the tree and has the largest number of samples under the unified category. The most widely used is to control the height of the tree, make the tree grow according to the specified level, and control the number of categories. This requires that each node in the tree branch be marked as an available data type, and each node will contain at least "1" of data. When the data amount is less than "1", this node will stop growing and self pruning will stop dividing. However, there is a problem in the application of this method, that is, how to ensure the correct pruning time. Therefore, it is necessary to set a threshold that conforms to the actual application environment, and the setting of this threshold is related to the accuracy of the results of the tree. If the threshold value is too large, the tree will grow too many branches, not dense enough, and the data will be too sparse; However, if the threshold value is too small, the classification result of the tree will be limited. Some redundant branches are not within the pruning range, and cannot be pruned in time, resulting in more redundant branches. This requires measuring the effect of pruned trees. The tree after pruning is shown in Fig. 3.

As shown in Fig. 3, it is the decision tree structure after pruning designed in this paper. After constructing a decision tree, we should also form a teaching evaluation

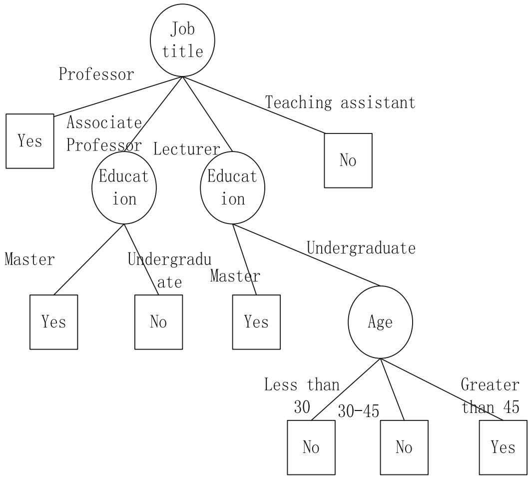

Fig. 3. Decision tree after pruning

analysis and evaluation model, that is, to obtain the classification rules from the decision tree. The order of the rules does not affect their execution results.

Use the generated decision tree to predict a teacher, that is, to find out whether he has the basic qualities required by an excellent teacher, so that targeted measures can be taken to improve the teaching level. When analysis and evaluation are required, some attributes related to the teaching analysis and evaluation model can be extracted according to the information in the teaching evaluation database as judgment conditions, and the corresponding attributes can be matched according to the rules formed by the decision tree. If the attributes meet the conditions of the IF part, the corresponding THEN part of the conclusion can be obtained.

2.4 Design of Fuzzy Evaluation Method

It is a very complicated problem to evaluate the teaching effect of colleges and universities, because there are many factors that are easy to be affected, and the coverage of each factor is relatively wide, so it often affects the actual results. The factors that affect the results can be divided into three levels. Among them, the weight of the first level focuses on the direction of four main factors, namely, teaching attitude, specific course content, teaching method and teaching effect. The primary factors are: $U_i = \{u_1, u_2, u_3, u_4\}$; the second-level factor set includes four directions: student evaluation, peer evaluation, supervisory evaluation, and self-evaluation, and the second-level factor is described as: $U_{ij} = \{u_{i1}, u_{i2}, u_{i3}, u_{i4}\}$; the third-level factor set is based on the first-level factor set. And the sub-factor set defined on the basis of the second-level factor, which can be specifically described as the k third-level factor under the j second-level factor of the corresponding i first-level factor is U_{ijk}, then the third-level factor set can be described as $U_{ijk} = \left\{u_{ij1}, u_{ij2}, u_{ij3}, u_{ij4}\right\}$. According to the most conventional method, the evaluation grade can be divided into five types: excellent, good, medium, pass and fail. Then the evaluation set is $V_i = \{v_1, v_2, v_3, v_4, v_5\}$. The evaluation factors have different effects on the evaluation results, reflecting the importance of the factors, and the weight values of all factors constitute a weight set. The teaching quality factor set in this paper has a three-layer structure, and the corresponding weights can be divided into three layers. In this paper, the weight value of the indicators is obtained by the method of hierarchical division and the average method of expert opinions, and obtained after the consistency test. The weight set is expressed as follows:

The first-level weight set $A_i = \{a_1, a_2, a_3, a_4\} = \{0.1, 0.4, 0.3, 0.2\}$; the second-level weight set $A_{ij} = \{a_{11}, a_{12}, a_{13}, a_{14}\} = \{0.3, 0.1, 0.4, 0.2\}$; the third-level weight set $A_{ijk} = \{0.55, 0.45, 0.60, 0.40, 0.30, 0.70, 0.30, 0.35, 0.35, 0.30\}$. Determine the fuzzy relation matrix. The fuzzy matrix $R = r_{ij}$ represents the evaluation of the i factor and obtains the possibility measure of the j evaluation level, that is, obtain the evaluation level information of teachers by obtaining the percentage of the evaluation set V_i corresponding to the U_{ijk} evaluation factor (i represents the primary evaluation factor, j represents the secondary evaluation factor, k represents the tertiary evaluation factor). Fuzzy comprehensive evaluation will carry out three-level evaluation according to the evaluation index of teaching quality.

The evaluation process is calculated by the lowest level (three-level) evaluation index. In the process of teaching evaluation, the evaluation results are continuous, while the evaluation grade is fuzzy value, and the two kinds of data attributes are inconsistent. This paper divides the grades by defining the scope of evaluation results, that is, each grade in the evaluation set often corresponds to a specific value. The evaluation results of (100,90) are set as “excellent”, “89,80” as “good”, “79,70” as “medium”, “69,60” as “qualified” and (59,50) as “unqualified”.

At this time, the evaluation results need to be based on the principle of maximum subordination [14], which can draw the conclusion that the maximum ratio of excellent students will represent the highest evaluation level of the teacher. Then the weighted average method is applied to the result calculation to calculate the final result obtained by the teachers participating in the evaluation. So far, the design of teacher evaluation method can be realized.

3 Experimental Test

3.1 Experimental Process

Taking the English major class of a key university in this city as the test object, the actual teaching effect of the teachers participating in the class will be evaluated based on the above contents of this paper. After data collection, 200 data set samples were obtained, some of which are shown in Table 2.

Explain the data in Table 2: x_1–x_{13} represents the contents of various evaluation indicators in the evaluation system, including the number of missed classes, the number of transferred classes, the teaching time, the self-study time, and the degree of correcting homework. y represents the score level of the final evaluation result. Calculate the data in Table 2 according to the above analysis method to obtain the cumulative contribution rate of the evaluation indicators, as shown in Table 3.

According to the conclusions in Table 3, the cumulative contribution rate of the main evaluation indicators numbered 1 to 5 is more than 80%, which is enough to show that

Table 2. Experimental data

Sample number	x_1	x_2	x_3	x_4	x_{13}	y
1	8	10	8	7	5	2
2	7	8	9	9	6	1
3	9	8	9	9	8	3
4	6	9	7	8	10	4
5	8	8	6	6	7	5
6	8	7	10	7	9	3
7	4	5	5	6	7	4
8	6	9	7	8	10	4
9	8	7	10	7	9	3
10	4	5	5	6	7	4
…						
200	6	9	7	8	10	4

Table 3. Principal component evaluation index processing results

Numbering	Eigenvalues	Contribution rate	Cumulative contribution rate
1	5.16	56.34	86.41
2	1.85	16.85	81.34
3	0.73	10.34	80.26
4	0.49	6.52	87.59
5	0.12	1.37	88.08

these evaluation indicators occupy an important part in the evaluation system and cover more information in the original data. Taking these five indicators as the main indicators of the evaluation system can completely obtain the evaluation results that are consistent with the actual teaching situation. Therefore, the five evaluation principal components are selected to constitute the main data scalar in the evaluation system, and based on this, 100 data samples are selected as the training data samples for the actual test, and the remaining 100 data samples are used as the test samples for the experiment.Through the above algorithm using support vector machine and calculating its core classification function, the authenticity of the final evaluation result is improved. After training, the data samples are used as the basis for actual testing, and the evaluation results of 100 test data samples are obtained. The overall teaching process is fitted and calculated to increase the accuracy of the actual teaching effect evaluation.

At the same time, select 10 teachers to be evaluated in the university to participate in the evaluation, and number the teachers as teacher a ~ teacher J. the specific evaluation scores are shown in Table 4.

Table 4. Evaluation scores of 10 English teachers

Teacher's number	Evaluation score	Evaluation results
A	98	Excellent
B	96	Excellent
C	85	Good
D	83	Good
E	78	Medium
F	84	Good
G	95	Excellent
H	77	Medium
I	90	Excellent
J	88	Good

3.2 Experimental Results and Discussion

In order to increase the reliability of experimental test results, the evaluation method based on decision tree algorithm proposed in this paper is compared with PCA - RBF evaluation method and SVM evaluation method. In order to increase the effectiveness of the comparison test, two test indicators are selected for the test. The accuracy and time consumption of the evaluation results are taken as the test indicators, and three methods are used for the test. The higher the accuracy of the evaluation results, the less the time-consuming, indicating the better the evaluation effect of the evaluation method. The specific results are shown in Table 5.

Table 5. Comparison results of three evaluation methods

Evaluation method	Evaluation accuracy	Average evaluation time
PCA-RBF	81.08%	5.24 s
SVM	83.59%	9.08 s
The method of this paper	95.67%	3.05 s

According to the comparison results in Table 4, it can be concluded that the evaluation accuracy of PCA-RBF evaluation method is 81.08%, which is at a low level among the three evaluation methods. However, it takes a short time, 5.24 s, and the overall evaluation accuracy is poor; The evaluation accuracy of SVM evaluation method is 83.59%, which is higher than that of PCA-RBF evaluation method. However, it takes 9.08 s and takes a long time, indicating that the work efficiency of this method is low; The evaluation method designed in this paper has an evaluation accuracy of 95.67% and an evaluation time of 3.05 s. It is the method with the highest evaluation accuracy and the least time-consuming among the three methods.

It can be proved that the evaluation method proposed in this paper can stand out among the comparison methods, with higher evaluation accuracy, less time-consuming, enhanced evaluation effect, improved evaluation efficiency and better practical performance.

4 Conclusion

In order to solve the problems of low accuracy and long time-consuming in the evaluation of oral English teaching effect in Colleges and universities, this paper applies decision tree to design an effective evaluation method. Through the experimental test, it is verified that the designed evaluation method has the advantages of high accuracy and short time-consuming in the application of evaluation, and can provide a certain economic role for the curriculum arrangement of colleges and universities and the self-improvement of teachers. Therefore, the evaluation method designed in this paper can be applied to other colleges and universities to constantly improve the design evaluation method in practice and improve the evaluation method to the most effective. However, the method of this paper also needs to add the evaluation of students' preference for teachers in the evaluation index, because the teaching method also represents the personal characteristics of teachers. If teachers are liked by more students, it is also a project that can add points to their teaching effect, so as to realize the comprehensive evaluation of the evaluation method.

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Research on Quality Evaluation of Accounting Online Education Based on Artificial Intelligence Technology

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Abstract. In view of the low accuracy of the traditional methods in the evaluation of the quality of accounting online education, artificial intelligence technology is used to study the evaluation methods of the quality of accounting online education. The dgk means algorithm is used to mine the education quality evaluation index data. According to the mining results, the tndicator unit is constructed under the basic principles of the evaluation system, the evaluation index is obtained, the correlation coefficient of the evaluation index is calculated, and the online education quality evaluation is carried out through the established BP evaluation neural network. Simulation experiments show that the proposed method has high accuracy and good evaluation effect.

Keywords: Artificial intelligence technology · Accounting online education · Education quality evaluation · BP neural network · Data mining · Fuzzification

1 Introduction

With the rapid development of higher education in China, the quality problems of higher education also appear. In the past, the evaluation of undergraduate teaching quality focused on teaching design, teaching simulation and the construction of teaching content, and in practice, the interaction between teachers and students is not considered. This is a teaching method that focuses on static evaluation. At the same time, due to the tendency of managerialism in the teaching quality evaluation of universities in our country, we only pay attention to the role of controlling it, which makes it more and more superficial and formal, and it is difficult to really realize the effect of "promoting teaching by evaluation" and "promoting learning by evaluation". The existing assessment methods are still the traditional teacher assessment methods, i.e. teacher listening and student after-school assessment [1]. The evaluation and judgment criteria of this evaluation method will be affected by personal cognition, situation, preference, and the relationship between evaluation object and evaluator. Moreover, the traditional evaluation ignores the teaching methods and contents of courses with different characteristics. The results of the evaluation deviate from the objective, fair and just evaluation of the educational

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process, and achieve the goal of improving the quality of education. However, due to the limitation of evaluation indicators, it is difficult to accurately reflect the ability of evaluation objectives by traditional methods, and the subjective initiative of evaluation subjects is poor. In practice, there is a large error in the evaluation value, and a good evaluation effect cannot be obtained [2, 3]. In computer-aided education, computer-aided teachers are more and more widely used in the classroom. This method based on special system has greatly improved the objectivity, but these methods and systems have some defects in information comprehensiveness, system function and performance.

Accounting is a profession with high technical content and high technical content. The development and future development of this industry require a large number of highly skilled personnel. Therefore, we must regard improving the quality of professional education as a major objective. In order to strengthen the financial and accounting management of colleges and universities in China, meet the needs of students, parents, society and other social sectors for running schools, and thus enhance the comprehensive competitiveness of colleges and universities. The online accounting education will be evaluated [4, 5]. Therefore, this paper uses artificial intelligence technology to evaluate the education quality of schools.

2 Quality Evaluation Method of Accounting Online Education

2.1 Data Mining of Online Accounting Education Quality

This paper uses clustering algorithm to mine online education quality data, so as to provide more accurate raw data for the evaluation method.

In this paper, the genetic algorithm is used to improve the clustering algorithm, using the modified DGK-means algorithm to mine the educational data. Details are as follows [6]:

(1) Firstly, all the teaching data on the accounting online education platform are encoded. This article uses 8 bytes for encoding;
(2) Set genetic parameters.
(3) Randomly generate q initial populations.
(4) Calculate the fitness of each individual of the group. Fitness is a parameter for evaluating the pros and cons of an individual after encoding, that is, a parameter for evaluating the pros and cons of the number of clusters, used to judge whether the number of clusters obtained meets the distribution characteristics of the data, and this clustering is used here in previous studies The number is used as input for K-means clustering.

Calculate the clustering template matrix according to the following formula [7]:

$$P_i^{b+1} = \frac{\sum_{k=1}^{n} \mu_{ik}^{b+1} \cdot x_k}{\left(\sum_{k=1}^{n} \mu_{ik}^{b+1}\right)^m} \tag{1}$$

In the above formula, m is a weighted exponent, and the value is usually 2. Take 1 as the step length to accumulate and iterate, and repeat the above two-step algorithm until the minimum value of the objective function is approached to meet the requirements of the following formula.

$$\left\| P^b - P^{b+1} \right\| < \varepsilon \tag{2}$$

In the above formula, ε is the minimum value of the iterative approximation of the objective function. After determining the clustering template, perform clustering data mining.

Compare the similarity of the data in the data set with the N cluster centers in turn. Sort the data into clusters where the cluster centers with greater similarity are located. Similarity is the distance between two data. The specific calculation formula is as follows:

$$sim(x, y) = \left(\sum_{i=1}^{n} |x_i - y_i|^p \right)^{\frac{1}{p}} \tag{3}$$

In the formula, p is the similarity coefficient, x_i is the cluster center data during clustering, and y_i is the data to be clustered. The smaller the value of $sim(x, y)$, the more similar the two data. After selecting the factors that affect the quality of accounting online education, according to the typical characteristics of the factors, follow the above process to mine the educational data that meets the requirements.

2.2 Accounting Online Education Quality

The establishment of scientific and reasonable evaluation system should generally follow the following basic principles.

(1) Scientific principle. Scientificity is one of the most basic conditions for establishing the tndicator unit.
(2) Systematic principle. The tndicator unit can not only reflect the teaching quality, but also reflect the relationship between the indexes.
(3) The principle of comprehensiveness. We should select typical indicators to cover the scope of assessment as much as possible, so that they can fully reflect the quality of education and describe the quality of education from multiple levels and levels.
(4) Guiding principle. The purpose of the evaluation system is to evaluate the results of the evaluation, so as to promote the improvement of teaching methods and means, and thus improve students' academic performance.

According to the above standards, the tndicator unit of accounting online education quality described in Table 1 below is established [8].

According to the tndicator unit constructed above, 19 evaluation indicators were obtained.

Among them, the direct receiver of the teaching quality of accounting teachers is students. Students are regarded as the evaluation subject, and a simplified questionnaire

Table 1. Evaluation index system

Overall layer	Criterion layer	Index layer
Quality Evaluation Index of Accounting Online Education	Teaching management responsibilities	Quality policy and objectives
		Teaching organization
	Teaching resource management	Teachers
		Teaching Management Staff
		Abundance of teaching resources
		Online teaching environment
		Educational investment
	Education service process	Training plan development
		Professional Construction
		Theory teaching
		Practical teaching
	Student innovation ability	Innovative mind
		Creative Thinking
		Creative Thinking
	Teaching effect evaluation	Evaluation of teachers
		Evaluation of students
		Reverse scoring
	Monitor, analyze and improve teaching quality	Monitoring analysis
		Feedback and improvement

of teachers' teaching quality is issued to them. Students only need to spend a very short time to complete the questionnaire, which can achieve the purpose of observing teachers' teaching effect at any time, and make teachers correct teaching methods according to students' learning status, teaching style and so on. Because graduates have job hunting and employment experience and can feel the social demand for accounting students, the comprehensive evaluation of accounting graduates needs an important source of information.

The index judgment matrix is constructed and the two indexes are compared. After normalizing the judgment matrix by the normalization method, the consistency test is performed [9].

$$CR = \frac{\lambda_{\max} - n}{n - 1} \tag{4}$$

In the formula, CR is the judgment consistency index; λ_{max} is characteristic value; n is number of indicators. If $CR < 0.1$, there is consistency. According to the judgment matrix, calculate the correlation of evaluation factors under each secondary index.

Calculating the correlation between the evaluation factors can make the evaluation method suitable for the evaluation of accounting online education quality. Assuming that the evaluation factors in the tndicator unit can make the following formula approximately true, it can be determined that there is a multicollinearity phenomenon between the evaluation factors.

$$c_1X_1 + c_2X_2 + \cdots + c_pX_p = c_0 \tag{5}$$

In formula (5), c_0 is a constant; $c_k, 0 < k \le p$ is a collinear test parameter; $X_k, 0 < k \le p$ is an evaluation factor. The correlation coefficient matrix was used to diagnose multicollinearity. Assuming that $(X_1, X_2, \cdots, X_n)$ is an n-dimensional evaluation factor vector sequence, the correlation coefficient between any two evaluation factor vectors exists. The calculation formula of the correlation coefficient is as follows:

$$\begin{cases} \rho_{ij} = \dfrac{\mathrm{cov}\left(X_i, X_j\right)}{\sqrt{DX_i}\sqrt{DX_j}} \\ \mathrm{cov}\left(X_i, X_j\right) = E[X_i - E(X_i)]\left[X_j - E\left(X_j\right)\right] \end{cases} \tag{6}$$

Among them, $\mathrm{cov}\left(X_i, X_j\right)$ is the covariance between the two vectors.

2.3 Establish BP Evaluation Neural Network

When the BP neural network solves evaluation problems, it only needs to adjust the connection weight, threshold and network size, and then store the important information summarized by the training data in each neuron in the network, and the knowledge network is constructed. Finally, Use existing network knowledge to complete the evaluation and prediction functions [10].

First, the learning rate is adjusted:

$$\eta(k+1) = \begin{cases} 1.05\eta(k), e(k+1) < e(k) \\ 0.7\eta(k), e(k+1) > 1.04e(k) \\ \eta(k), else \end{cases} \tag{7}$$

where, $e(k)$ is the error coefficient. When correcting the learning rate, first check whether the correction of weights can reduce errors. The details are as follows:

(1) Structural information of the neural network is read-in;
(2) Sample data were entered and normalized;
(3) Select a sample; the calculation formulas of the actual output y of the forward calculation network, the output h_p of the hidden layer and the output y_i of the output layer are as follows:

$$\begin{aligned} h_p &= f\left(\sum V_p x_{ij} - \psi_p\right), p = 1, \cdots, m \\ y_i &= f\left(\sum V_p h_p - \phi\right) \end{aligned} \tag{8}$$

Calculates the number of hidden layers:

$$m = l \cdot \log_2 p + l \tag{9}$$

In the above formula, p is the sample number, and l is the number of nodes.

BP has forward and reverse transmission in neural networks for learning. Under normal circumstances, it is mainly to calculate the forward network. When the output of the output layer does not meet the expected output, the data transmission direction will change, turn to reverse transmission, and reverse layer by layer transmission error.

2.4 Achieve Online Education Quality Evaluation

Because there are dimensional differences in the eigenvalues of each quality evaluation index of the selected college accounting report samples, in order to eliminate the dimensional influence between the eigenvalues of the index, it must be standardized. The calculation formula is as follows:

$$X' = \frac{X - X_{\min}}{X_{\max} - X_{\min}} \tag{10}$$

In the above formula, X is the raw data corresponding to the quality evaluation index; X' is the normalized data; $X_{\min}$ is the minimum value in the index data; $X_{\max}$ is the maximum value in the index data. After processing, calculate the membership value of each data according to the following formula:

$$\mu_{ik}^{b} = \left\{ \sum_{j=1}^{c} \left[\frac{d_{ik}^{b}}{d_{jk}^{b}} \right]^{\frac{2}{m-1}} \right\}^{-1} \tag{11}$$

where, b is number of iterations; d_{ik}^{b} is the measure the distance between the data. If $i \neq j$, then there is $\mu_{ij}^{b} = 1$. The calculated values form the relative membership matrix U of the data set. Then calculate the fuzzy partition $F(U : c)$:

$$F(U : c) = \frac{1}{n} \sum_{i=1}^{c} \sum_{j=1}^{n} u_{ij}^{2} \tag{12}$$

In the above formula, u_{ij} is the matrix coefficient. When each data belongs to a single teaching behavior category, the division coefficient $F(U : c)$ takes its maximum value of 1; When the membership degrees of teaching quality caused by all teaching behaviors are equal and the same value 1/c, the division coefficient $F(U : c)$ takes the minimum value. After the fuzzy division, the evaluation index is blurred, and the processing results are input into the BP neural network for training.

The initial weight of BP neural network represents the first conjecture of suitable weight for online education quality evaluation. The evaluation result of BP network does not depend on this first conjecture, instead, the output squared error is calculated. Build the objective function:

$$E(W) = \frac{1}{2}\sum_{k=1}^{M}\left\|T^k - Z^k\right\|^2 \tag{13}$$

where $E(W)$ is the error sum of squares; T is the standard output value; Z is the actual output value. But:

$$Z^k = f\left(Y^k\right) \tag{14}$$

In the above formula, Y is the state coefficient; f is the Sigmoid function. The neural network was trained iteratively and training was stopped when the output error remained constant, and determine the network parameters for the quality evaluation of accounting online education. In the actual evaluation work, the online education data mined is input into the BP neural network determined by the parameters, and the education quality is evaluated according to the interval of the network output data.

3 Experimental Research

In order to ensure the availability of this method, an experimental research is carried out. Compartest with traditional methods through MATLAB simulation software.

3.1 Experiment Content

The evaluation accuracy of education quality was selected as the experimental index, and the method and that based on AHP were compared.

3.2 Experimental Results

Figure 1 shows the comparison of the accuracy of teaching quality evaluation of the 12 groups participating in online accounting education using two evaluation methods.

According to Fig. 1, the evaluation accuracy of this method can be more than 85. The highest accuracy of the traditional method is only above 70. The method of this paper has high accuracy and good evaluation results.

The method of this paper and the AHP-based method were used to test the time of education quality evaluation, and the test results are shown in Fig. 2.

According to Fig. 2, The evaluation time of the present method is no less than 5s, the education quality evaluation method based on AHP takes less than 18S to evaluate the accounting online education quality, and the accounting online education quality evaluation method based on artificial intelligence technology takes the shortest time to evaluate the accounting online education quality.

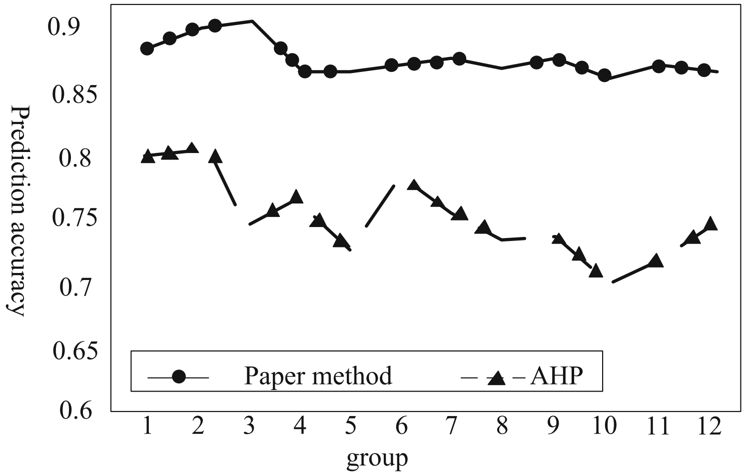

Fig. 1. Comparison of evaluation accuracy

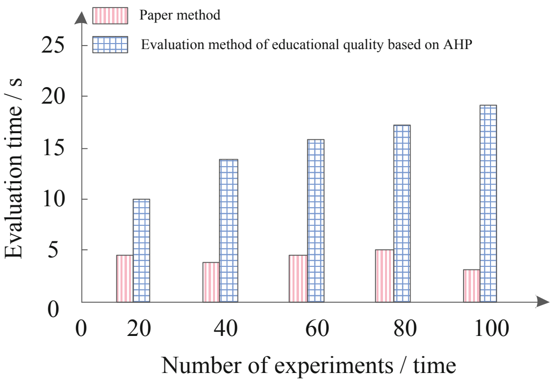

Fig. 2. Time comparison results of accounting online education quality evaluation

4 Conclusion

In order to improve the quality of accounting online education, this paper studies the evaluation method based on artificial intelligence technology. The clustering algorithm improved by genetic algorithm is used to mine the online education quality data. According to the mining results, the indicator unit is constructed, the evaluation index is obtained, and the BP evaluation neural network is constructed. The evaluation index is input into the BP evaluation neural network as a sample, and the evaluation result is output. The experimental results show that the proposed method has good robustness.

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An Analysis on the Training Mode of Master Students in Artificial Intelligence Field for Electronic Information Professional Degree—Take Hunan Normal University as an Example

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Abstract. The ability of independent innovation in the field of artificial intelligence is a key element to occupy the commanding heights of future technology and talent competition in China. The cultivation of artificial intelligence talents, especially the cultivation high-end talent, it is essential to promote the development of artificial intelligence industry. At present, the market for artificial intelligence talents is in great demand. There is a shortage of high-end artificial intelligence talents, the weak strength of artificial intelligence teachers in universities, and the incomplete education system for talent training and many other issues. This paper combines some measures taken by Hunan Normal University for graduate students in the field of artificial intelligence in the degree of electronic information, the necessity and feasibility of artificial intelligence training senior talents are discussed for social needs in the field of artificial intelligence, The training goals and methods of postgraduate students in the field of artificial intelligence under the professional category of electronic information major are clarified, and the construction of artificial intelligence field is planned.

Keywords: Electronic information · Professional degree · Artificial intelligence · Postgraduate training · Construction planning

1 Introduction

In recent years, with the vigorous development of artificial intelligence technology, the era of artificial intelligence has come, which is the second germination of the second global technical social transformation after the birth of the Internet, and is known as the fifth major form of the evolution of the information technology society [1].The new generation of artificial intelligence technology has promoted the revolution of Industry

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4.0, and its application field has been continuously expanded in the social category. At present, artificial intelligence technology has been widely applied in education, security, health care, finance and robotics, driverless driving, intelligent finance, smart home, wearable devices, intelligent marketing, intelligent agriculture, intelligent education, intelligent medical care, e-commerce logistics and other fields. Artificial intelligence is increasingly permeating into the daily lives of human beings, as a participant and a driving force to promote and improve the quality of human life [2].

Artificial intelligence is a cross-disciplinary discipline aiming at the automation of intelligent behavior. It has the characteristics of generality of research objects, symbolization of problem representations, and generality of research methods [3].Wang Xue et al. [4] systematically combed and analyzed from the dimensions of personnel training motivation, personnel training subject, personnel training level, personnel training scenario and personnel training logic, and constructed a nine-dimensional analytical framework for artificial intelligence personnel training research.

Feng Yong proposed a hierarchical ability measurement and dynamic expansion of knowledge system based on the integration of data and intelligence, an open training team organization and teaching process based on the integration of science and engineering, the integration of production and education and innovation traction, a multi-party cultivation mechanism system based on research and production with positive interaction and collaborative innovation, and a featured course project and scene case pool with contributions and collaboration from multiple channels and masses of wisdom [5]. Wang Guoyin et al. took the discipline construction of Chongqing University of Posts and Chongqing city as an example, and proposed the cross-fusion mode of "artificial intelligence +" discipline construction, to consolidate the foundation of discipline in the field of artificial intelligence, and realize the symbiosis, mutual assistance and collaborative development of discipline construction of artificial intelligence and discipline construction in other fields [6].

Zhao Guihai et al. explored the integration of artificial intelligent courses into the automation professional talent training mode of under the background of new engineering [7]. Lin Jian from the four aspects of the construction of teachers team, the construction of curriculum system, the development of academic disciplines and engineering ethics education analyzes the realistic path of the artificial intelligence professional construction in the USA, and from the five aspects of the level of colleges and universities, the integration of science and education, teachers team, curriculum system and engineering ethics to discuss the enlightenment on emerging engineering professional construction in our country [8].

Internationally, the top three universities (Carnegie Mellon University, Massachusetts Institute of Technology and Stanford University) in the field of artificial intelligent in 2019 actively promoted the upgrading of the organizational structure of artificial intelligent schools, institutes or research centers, and improved the supporting incentive mechanism of artificial intelligent graduate scholarships, competitions and academic conference funding [9].

Huang Houkuan et al. analyzed and drew on the experience of foreign postgraduate training, combined with the specific situation of postgraduate training, and put forward the working measures in the course construction process of artificial intelligence graduate students [10].Tan Zhi et al. studied the cultivation method of robotics graduate students in Carnegie Mellon University, in order to promote the reform and implementation of graduate education in cultivating top-notch robotics talents in Chinese universities [11]. Aiming at the current trend of accelerating the construction of "artificial intelligence + X" majors and disciplines in many universities, Hai-bin xie, etc. analyzed the characteristics of the artificial intelligence course, from the ten aspects of the course orientation, knowledge system and teaching mode, evaluation method, the teaching staff to explain the misunderstanding and deviation of artificial intelligence graduate course construction and teaching implementation and put forward the corresponding countermeasure [12].

In the following article, the author analyzes the development situation of electronic information professional degrees in China, especially in the field of artificial intelligence, and explains the necessity of the development of the field of artificial intelligence professional degrees. Taking Hunan Normal University as an example, the cultivation mode of graduate students in the field of artificial intelligence artificial intelligence in the electronic information professional category is analyzed.

2 Basic Overview of Electronic Information Degree Categories and Fields

2.1 The Status and Development of Electronic Information Professional Degree Categories and Fields in China

Electronic information is one of the most popular subjects in the world at present and in the future. It plays an important role in modern scientific research, national economic construction, national defense construction and social development. Electronic information majors as a key development areas of graduate education in China at present, and they will take more important responsibility in the future graduate education.

As the foothold of the third generation of industrial revolution, IT industry has attracted educational resources around the world. At present, relatively well-known universities in the world have established graduate degree programs in computer or software. China is no exception. With the adjustment of the professional master's catalogue in 2019, more than 300 universities nationwide have opened electronic information master's degree programs. However, with the rise of the fourth generation of industrial revolution represented by artificial intelligence and big data technology, the Ministry of Education has responded to the development trend and further divided electronic information professional degrees into different fields, the purpose is to further subdivide the professional degree fields to realize the accurate training of talents.

At present, more than 50 artificial intelligent colleges have been established in China to train high-end artificial intelligent talents. More than 300 artificial intelligent majors have been established to train artificial intelligent undergraduates. However, according to the statistics of the artificial Intelligence Industry Talent Development Report 2019–2020 edition of the Ministry of Industry and Information Technology, it is estimated that the effective talent gap in China's artificial intelligence industry will reach 300,000 by 2020, and the balance between supply and demand in specific technical directions and positions will be more prominent. At the present stage, in the supply and demand of artificial intelligence talents for various functional positions, the supply and demand ratios of algorithm research post, application development post, practical skill post and high-end technology post are 0.13, 0.17, 0.98 and 0.45 respectively, indicating that the talent gap for technical positions is very large, while the supply of practical skilled personnel is relatively sufficient.

Therefore, the new artificial intelligence field under the electronic information professional degree category is the need of the new generation of artificial intelligence development wave, as well as the need of national and local artificial intelligent empowerment construction. Therefore, the establishment of the new field of artificial intelligence under the electronic information professional degree is a positive response to the national and local artificial intelligence development strategy needs, and also a new force and growth point of our school's academic level.

2.2 Professional Degree Categories, Fields and Related Degree Authorization Points of the Existing Electronic Information in Hunan Normal University

The authorization of electronic information master's degree at Hunan Normal University can be gone back to 2010. In 2019, due to the policies of the Ministry of Education, authorized computer applications and software engineering professional degree point are combined into the electronic information professional master with two sub-directions: computer technology and software engineering. There are more than 70 master supervisors, 22 professors and more than 30 associate professors, and more than 80% of them have doctoral degrees. The research direction of this subject field is deep, distinctive and attractive. In the past three years, more than 20 high-level papers have been published in the SCI block one of the Chinese Academy of Sciences, more than 10 invention patents have been approved, and more than 30 national and provincial scientific research projects have been approved.

Other relevant degree authorization include: in 2003 the computer application technology, computer software and theory two level master degree are authorized, in 2005 the computer science and technology first-level master degree is authorized, in 2019 the education technology doctoral degree is authorized.

The development of this discipline not only focuses on the theoretical frontier and technical practicability, but also carries out in-depth cross-research with the double-first-class disciplines "Language and Culture", "pedagogy" and other majors, forming a distinct disciplinary characteristic. The discipline master program has formulated complete degree awarding standards and training programs, and the setting of curriculum takes into account the basic theory and frontier of the discipline. The Curriculum teaching pays attention to the combination of basic theory and practical ability; With sufficient source of master students and high training quality, it has been widely praised by the society. The employment rate for the first time is above 95%, and the score for 2021 enrollment is about 390.

2.3 The Main Research Content in the Field of Artificial Intelligence Professional Degree

Generally, the research content in the field of artificial intelligence can be divided into three layers, namely, the basic layer, the technology layer and the application layer. The basic layer is the cornerstone of promoting the development of artificial intelligence, it mainly includes three aspects: data, chip and algorithm; The technology layer is mainly the application technology provider, common machine learning, natural language processing, speech recognition and so on. They all belong to the technology layer research; The application layer is mostly technology users. The three forms a complete industrial chain and promote each other.

At the basic layer level, my country's strength is still relatively weak, especially in the chip field. In the field of basic technology framework, there are Google, Microsoft, Facebook, Amazon, etc. on abroad, and Baidu, Tencent, Alibaba, etc. in China. In this field, we have deep cooperation with JingJiaWei Company, which is a well-known chip company in Hunan province, so as to make social contributions to the "stuck neck" chip and algorithm fields facing our country; In the data field, leading Internet companies have accumulated massive amounts of data. These companies have a demand for effective data after processing to the labeling of valid data. Therefore, this professional field cooperates with the Hunan Provincial artificial Intelligence Association and the Hunan Provincial Department of Human Resources and Social Security to lead the formulation of artificial intelligence data labeling industry specifications, and jointly develop data processing capabilities with several companies such as Keda Xunfei to meet market needs.

The technical layer is mainly divided into the fields of machine learning, natural language processing, and computer vision. Hunan Normal University in artificial intelligence technology level is mainly used for new artificial intelligence algorithms, speech recognition and language information processing and multi-modal research in the field of data processing, and has published a number of papers, won a number of national and provincial projects, and won a number of awards; In terms of natural language processing, it has carried out multi-lingual cross-language cultural research based on the national "111" innovation and intelligence introduction platform and Ruihong Laboratory, and also conducted research on intelligent educational text recognition in the doctoral authorization of educational technology. In the field of multi-modal data processing, including smart media, smart education and other fields of research.

In the field of artificial intelligent application, the main research content is the application of the methods of technology-level in different interdisciplinary in technology layer. At present, our school mainly focuses on the fields of education, media, language and other fields in terms of field research, and has cooperated with many enterprises to complete the purpose of cross-field artificial intelligence talent training for graduate students.

3 The Necessity and Feasibility of Setting Up the Field of Artificial Intelligence Under the Electronic Information Major

3.1 Social Demand for Talents in Artificial Intelligence

At present, the competition among countries in the world in the field of artificial intelligence is increasing. In order to promote the high-quality development of our country's artificial intelligence industry, accelerate the transformation and upgrading of traditional industries to intelligent industries, and strengthen the right to speak in the global industry, The State Council have issued the "New Generation artificial Intelligence Development Plan", which made artificial intelligence as one of the key national strategic development directions. By 2020, the sales scale of my country's artificial intelligence market has seen an average annual growth of 34.2% in the past five years. Becoming one of the largest and fastest growing market of artificial intelligent in the world. The annual demand for artificial intelligent application technology talents is over 200,000, while China's annual training of artificial intelligent professional technology talents is less than 20,000. It is far from meeting the demand for artificial intelligence professional talents for national economic development, and cannot meet the professional talents engaged in the design, development, production and application of artificial intelligence systems. In the next 10 to 20 years, there will be a huge demand gap for talents in this direction.

As far as Hunan Province is concerned, in order to promote the implementation of the spirit of the fifth Plenary Session of the 19th CPC Central Committee in Hunan province, Hunan Province has put forward the main direction and strategic focus of the development in the new era and new stage, that is, the implementation of the strategy of "three high and four new" makes Hunan province as a national important advanced intelligent manufacturing highland. Under the vigorous promotion of Hunan Province, according to statistics from the Provincial Economy and Information Technology Commission, the scale of artificial intelligence industry represented by robots in Hunan province has grown rapidly since 2016, and the annual growth rate of main business income in the past five years has been above 35%. In 2020, the main business revenue of artificial intelligent related manufacturing industries in Hunan province has exceeded 20 billion Yuan. The use of artificial intelligence technology and robots to replace traditional jobs, industrial upgrading and technological innovation has become a consensus of the industry in Hunan, the market prospect is broad. In order to promote the artificial intelligent industry in Hunan province to the middle and high-end, it is urgent to focus on the development of a variety of artificial intelligent products for commercial applications. At present, there are not many artificial intelligence talents cultivated by colleges and universities in Hunan province, which is far from meeting the demand for industrial upgrading in Hunan Province in the new era and new stage.

3.2 Talent Training Goals in the Field of Artificial Intelligence

According to the "New Generation artificial Intelligence Development Plan" issued by the State Council, the Ministry of Education, the National Development and Reform Commission, and the Ministry of Finance formulated "Some Opinions on Building a "Double First-Class" University to Promote Disciplinary Integration and Accelerate the

Training of Graduate Students in the Field of artificial Intelligence" in April 2020.To strengthen the degree of emphasis on the cultivation of graduate students in the field of artificial intelligence. According to a document released by the Ministry of Education in 2021, the master's degree in electronic information will be established several branches, including the field of artificial intelligence.. This field mainly explores and develops theories, methods, technologies and applications for simulation, extension and extension of intelligence. It is a new field direction generated by the rapid development of the new generation of artificial intelligence. Its main feature is to empower all disciplines and majors, and it will become the core driving force to promote the cultivation of professional innovation ability of other disciplines and majors. At the same time, cultivating excellent talents with cross-border innovation and engineering practice ability. At present, artificial intelligence is rapidly entering into various fields, such as education, language, literature and so on. Both the industrial and academic circles have an urgent need for artificial intelligence talents.

But the construction of the field of artificial intelligence cannot "rush" and "big help coax", It should have local and university characteristics. As for Hunan Normal University, its artificial intelligent field construction adopts the model of "language and culture" centering on the national double-class discipline group, combining language, culture, and education with artificial intelligence, highlighting the school's characteristics. Its main construction direction is intelligent language information processing and intelligent education technology. To be specific, the development of the field of artificial intelligence in Hunan Normal University should focus on the "National New Generation Artificial Intelligence Development Strategy", the construction goals of Hunan Normal University's "Double First-Class Discipline", and the "Educational Discipline Advantages" of Hunan Normal University, taking language information processing, intelligence education technology and multi-modal information processing as the main research direction, Gradually realize the construction goal of distinctive research direction and coordinated development of multiple disciplines. At this time, setting the direction of artificial intelligence field alone can further steadily improve the enabling ability of artificial intelligence discipline, and then improve the overall scientific research level, school quality and social service ability of the school.

Considering that strengthening and improving the ideological and political work of graduate students is an important factor for high-level innovative talents, and considering the front-line working ability and professional ethical quality that professional degree talents should have, as well as the ability to learn and develop in the future, the training objectives of talents in the field of artificial intelligence should mainly include three aspects:

Firstly, cultivating talents should have the spirit of patriotism and sense of social responsibility, good scientific research ethics and dialectical materialist world outlook. Secondly, they should master solid basic theories and in-depth specialized knowledge of artificial intelligence, be able to skillfully use methods, technologies and tools of artificial intelligence, and engage in basic research of artificial intelligence, interdisciplinary application research of artificial intelligence, analysis, design, development and management of intelligent technology and system. Finally, it is important to have an innovative and international perspective, and we must play a role in the intersection of artificial intelligence. Therefore, it should include:

(1) Support the leadership of the Communist Party of China, love the motherland, abide by the law, have a high sense of social responsibility to serve the country and the people, have a good professional ethics and professionalism, have a scientific and rigorous academic attitude and work style, and abide by academic ethics, Comply with laws and regulations related to intellectual property rights, and be physically and mentally healthy;
(2) Systematically master the basic knowledge and frontier theories of artificial intelligence; Be familiar with the research direction of the scientific development trend, independent in the field of artificial intelligence scientific research and related product development and design ability. Be competent for innovative artificial intelligence work in an interdisciplinary field; Be able to engage in scientific research, engineering application and management decision making of intelligent theory, intelligent system, intelligent information processing, intelligent manufacturing and other aspects;
(3) Have good language and written communication skills and team awareness and spirit; be able to read the scientific and technological literature proficiently, have the ability to write academic papers independently or collaboratively; have the ability to independently acquire new knowledge and search for information and analytical capabilities.

3.3 The Development Prospects in the Field of Artificial Intelligence Under the Professional Electronic Information Major

At present, artificial intelligence has been comprehensively involved in social development and people's life. As the driving force for economic transformation and upgrading in the new generation of industrial revolution and the commanding heights of a new round of science and technology competition, artificial intelligence has been elevated to the national strategic height in recent years. The country has put forward a three-step development strategy for artificial intelligence; for several years, the government work report has mentioned to accelerate the development of artificial intelligence industry; in 2020, artificial intelligence will be added to the new infrastructure. At present, artificial intelligence will provide underlying support for the development of smart economy and the digital transformation of industries in China.

An important reason for the addition of artificial intelligence is the promotion of industrial development. With the support of industrial policies, the social demand for artificial intelligence professionals is very large. With the gradual improvement of market legislation, the scale of China's artificial intelligence market will grow rapidly in the future and exceed 400 billion yuan by 2025. According to the global artificial intelligent talent distribution released by linked in, China currently has a shortage of more than 5 million artificial intelligent talents, which is extremely short of supply. From research institutes to commercial enterprises, all walks of life are developing and introducing artificial intelligent, and as a new high-end technology industry, the salary is also very attractive. In the next decade or even longer, artificial intelligence industry talents are in short supply.

At present, the main research direction in the field of artificial intelligence is focused on the intersection of artificial intelligence and artificial intelligence algorithm itself, in which the industrial demand of the intersection of artificial intelligence is extremely high. Artificial intelligence is an important infrastructure for the digital economy in the new situation, and the new era of artificial intelligence will be an era of pan-intelligence, which has the ability to combine with all walks of life and covers far more than the Internet and science and technology industry in the traditional understanding. More and more industries and fields are carrying out intelligent upgrading at different levels. Therefore, artificial intelligence, as the core driving force of a new round of industrial revolution, that is releasing enormous energy of previous scientific and technological revolution and industrial transformation. In addition, due to the artificial intelligence is a typical interdisciplinary project, involving mathematics, philosophy, cybernetics, economics, neurology, and linguistics and many other disciplines it is not only rich in content, but also relatively difficult, although some schools currently offer the artificial intelligence majors at the undergraduate level, However, as the current talent demand in the field of artificial intelligence is still dominated by R&D talents, it is a trend for undergraduates who choose the direction of artificial intelligence to continue to study for postgraduates, which will have stronger job competitiveness. Therefore, the addition of specialized master's degree in artificial intelligence has become an inevitable trend in the development of the discipline.

3.4 Setting the Foundation for the Field in Artificial Intelligence Professional Degree

The new artificial intelligence field established under the electronic information major degree should have a certain foundation for development. First of all, it should have the research direction of pan-artificial intelligence; second, it should have certain industrial integration advantages or industrial practice base; in addition, it should have good teaching level and scientific research results in the direction of artificial intelligence. Finally, it should have a distinct practical application direction and job market.

Take Hunan Normal University as an example. In 2018, Hunan Normal University and Xiangjiang New Area jointly established Xiangjiang Artificial Intelligence Institute. In 2020, the undergraduate program of artificial intelligence was opened, and in 2021, the specialized degree field of artificial intelligence was added, forming a good training system from undergraduate to master, from theory to practice, from classroom to enterprise. Relying on the regional and school characteristics, Hunan Normal University has formed a discipline team with strong innovation ability, distinct research direction and great development potential. It has formed three research directions with outstanding advantages, distinctive characteristics and continuous stability, which is cognitive intelligence, intelligent language information processing and intelligent educational technology. Our school has more than 20 master tutors and 10 industry tutors in the field of artificial intelligence. The field is closely combined with the Key Laboratory of "Intelligent Computing and Language Information Processing" of Hunan Province. In recent years, our school has achieved fruitful scientific research results.

In terms of talent training, Hunan Normal University has established a good platform for academic exchange and cooperation, and actively carried out academic exchange and cooperation with other countries. Including relying on Hunan Xiangjiang Institute of Artificial Intelligence to carry out postgraduate training. Cooperating with head enterprises (such as Baidu, Ali, Huawei, etc.) settled in Changsha to arrange interdisciplinary professional internship and practical training, and relying on the needs of cooperative companies to create additional courses. Organizing Sany modern Industry Institute with Sany group. Through the joint training of various industries, the need for graduate students to serve the development strategy of the artificial intelligent industry in Hunan Province and Changsha city will be continuously improved.

4 Construction Planning in the Field of Artificial Intelligence Under the Background of Electronic Information

4.1 Construction of Teaching Staff

There are mainly four measures to train teachers in the field of artificial intelligence:

First, teacher training

Adopt various forms to organize tutors to improve and update their knowledge. Such as: carry out academic leave, arrange teachers off - job training; Organize tutors to take part in short-term training in their spare time, and actively participate in various training work organized by ministries and relevant institutes.

Second, tap the internal potential

We will give preferential policies to supervisors with great academic potential, engineering level and talent cultivation ability, and encourage them to publish high-level scientific research results, build high-level technical teams and train more graduate students. At the same time, it is inclined to it in terms of job title review and project declaration.

Third, talent recruitment

Adopt various forms to recruit high quality, high ability, high level of domestic and foreign talents; the combination of flexible introduction and rigid introduction is adopted to attract high-level talents in the field to join the tutor team. Attract outstanding doctoral graduates and postdoctoral researchers from well-known universities at home and abroad to strengthen the faculty.

Fourth, integrate forces

Establish 1 to 3 research teams with doctoral supervisors as the leaders, young teachers and graduate students as the backbone, and focus on the development of artificial intelligent enabled industry, and actively undertake the Ministry of Education, the Ministry of Science and Technology, local governments and major enterprises related to the intersection of artificial intelligence, intelligent information and other major topics. It plays an important role in promoting subject development, educational reform and teaching optimization.

4.2 The Combination of the Characteristics of Talent Training with Social Needs

(1) Strengthen the field of curriculum, teaching materials and laboratory construction

Encourage each supervisor to create a first-class graduate course with innovative characteristics for students in all research fields to choose; Strive to publish 1–2 textbooks and 1 monograph in the field of artificial intelligence within 3 years; Actively strive for the input of schools, competent departments and social institutions to establish a training base for graduate students in artificial intelligence; Give full play to the existing key Laboratory of Intelligent Computing and Language Information Processing of Hunan Province, Hunan Normal University Xiangjiang School of Artificial Intelligence base role, strengthen cooperative research, empirical research and technology development. Through teaching, training, academic exchange and promotion and application, it will play a leading role in the field of artificial intelligence.

(2) Aim at the frontier of the subject, strengthen the training of core quality, train qualified graduate students with both moral integrity and ability

Based on the "Intelligence +" era, aiming at the industry based on artificial intelligent, education, medical, algorithm and other frontier fields, based on the participation of project projects, project problem solving and empirical discussion as the focus, comprehensive training of graduate students' scientific literacy, technical literacy, humanistic literacy. Among them, it emphasizes the comprehensive training of discipline integration, technology development and field application, the cultivation of scientific research methods and academic norms, the cultivation of innovation and communication ability, and the achievement of first-class research results in the discipline direction.

(3) Carry out multi-level exchanges and cooperation to promote the internationalization and practicality in the field

It attaches great importance to the exchange and cooperation with foreign counterparts, actively introduces foreign teachers and top talents, co-hosts and participates in international academic conferences, establishes cooperative research platform and joint training mechanism, and cultivates graduate students with international vision. Based in Hunan, facing the whole country, highlighting the application, attaching importance to the cooperation with all kinds of researchers, competent authorities, industrial enterprises. Every year, high-level experts are invited to give lectures in the university through various channels, and artificial intelligent personnel are encouraged to visit and study in high-level universities. Strengthen scientific research training for doctoral students and encourage doctoral to innovate and start business.

5 Summarize

Artificial intelligence professional construction should reflect the needs of technology development and conform to the national development strategy, colleges and universities is the first productive force, talent is the first resource, the innovation of science and technology is the first power point, It is necessary to continuously promote the deep integration of the artificial intelligence and education, so as to lead the field of artificial intelligence in our country science and technology innovation, personnel training and technology application demonstration, and promote the improvement of the overall strength of China's artificial intelligence. Firstly, this paper summarizes the specific situation of electronic information major in China, and discusses the necessity and feasibility of cultivating talents in the field of artificial intelligence in combination with the specific situation of cultivating graduate students in the field of artificial intelligence in Hunan Normal University. Then, according to the social demand for talents in the field of artificial intelligence, the training objectives and training methods of graduate students in the field of artificial intelligence under the category of electronic information major are defined. Finally, the construction of artificial intelligence field is planned from the aspects of teaching staff construction and how to combine talent training with social needs.

The "Computational thinking" formed by computer science has become a consensus, and has begun to be valued and developed in primary and secondary education. Although artificial intelligence originated from computers, as a typical interdisciplinary subject, artificial intelligence related models and algorithms will also go beyond computers and gradually form a "intelligent thinking" mode. Computational thinking is the way of thinking that decomposes real problems into computable problems, while "intelligent thinking" is the way of thinking that introduces real problems into the framework of intelligent computing and turns them into problems based on statistics and game theory. This way of thinking can be introduced into other disciplines and provide intelligent and automated support for their development. However, how to better sort out the relationship between the basic content and core support of artificial intelligent and other disciplines required further thinking and further exploration in the follow-up process of talent training.

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The Problems and Analysis of Artificial Intelligence Specialty Construction in Universities Under the Present Situation of Artificial Intelligence Development

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Abstract. China's independent innovation ability in the field of artificial intelligence is a key link to occupy the commanding heights of future science and technology and talent competition. The cultivation of artificial intelligent talents is crucial to promote the development of the artificial intelligent industry. There is a large demand for artificial intelligence talents in the market, but the development of artificial intelligence in colleges and universities is still faced with many problems, such as the construction of related disciplines and majors has just started, the strength of artificial intelligence teachers in colleges and universities is weak, the talent training is mainly based on postgraduate education and the education system is not perfect. This paper analyzes the current cultivation situation of artificial intelligence major in undergraduate colleges and vocational colleges, points out the shortcomings in the construction of artificial intelligence major, and gives some suggestions.

Keywords: Artificial intelligence · Professional construction · Undergraduate institutions · Vocational colleges · The new situation

1 Introduction

In the past 40 years, the evolution of information technology society has gone through five form [1]. In the 1980s, with the rapid popularization of personal computers, informatization becomes the theme of the times, and human society has entered the information age. In the 1990s, with the rapid development of communication technology and Internet technology, Internet information sharing has become the theme of the times, this period is called the Internet Era. In the first decade of the 21st century, smart phones personalized information, "Internet +" came into being, and the society entered the era of mobile Internet. In 2012, "New York Times" column published a article, pointed out that the

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era of big data has arrived, decisions will increasingly be based on data and analysis to make; In recent years, with the vigorous development of artificial intelligence technology, the era of artificial intelligence has come, which is the second germination of the global technological social form change after the birth of the Internet. The new generation of artificial intelligence technology has promoted the revolution of Industry 4.0, and its application field has been continuously expanded in the social category. At present, artificial intelligent technology has been widely empowered in the fields of education, security, medical care, finance and robotics, and has achieved good applications in in driverless driving, intelligent finance, smart home, wearable devices, intelligent marketing, intelligent agriculture, intelligent education, intelligent medical care, e-commerce logistics and other fields. Artificial intelligence is increasingly penetrating into human's daily life, and as a participant and driving force to promote the continuous improvement of the quality of human life [2].

Artificial intelligence is a cross-disciplinary discipline aiming at the automation of intelligent behavior. It is characterized by generality of research objects, symbolization of problem representation and generality of research methods [3]. Wang et al. [4], constructed a nine-dimensional analysis framework for artificial intelligence talent training research, Systematically organize and comparative analysis personnel training motivation, training the body, training level, training personnel training scenarios and logical and other dimensions, Determine the talent training logic as the core dimension of the framework, and there is a non-linear causal relationship between all dimensions in the framework. Fang et al. [5] analyzed the driving factors for the formation of artificial intelligent schools from the aspects of social development requirements, national strategic drive and self-reform of colleges and universities, and examined the multiple values of artificial intelligent school construction from the dimensions of talent training, scientific research and social service, and carried out philosophical thinking on the construction of artificial intelligence school from the three aspects of "inevitability and accident", "commonness and individuality" and "affirmation and negation", and further clarified the direction of the construction of artificial intelligence school in Chinese universities. Jiang et al. [6] explored the efficient approach of government-school-enterprise integration, the innovation and entrepreneurship education mode for college students, and the entrepreneurship project incubation mode, so as to cultivate the entrepreneurship spirit, consciousness and ability of college students, and improve the high incubation rate of entrepreneurship "project-entity" and the employment rate and the quality of college students. Zhao et al. [7] studied the employment flow of college graduates in China, and found that the local employment tendency of college graduates was obvious, and the overall cohesion of the inter-provincial graduate mobility network has gradually enhanced. They also put forward corresponding suggestions for the layout adjustment and regional talent policy. Cai has studied the innovation and entrepreneurship education of college students in non-central cities. Innovation and entrepreneurship education should try to explore natural resources, human resources and social resources in local economy to avoid the technological, conceptual and innovative thinking gaps in local economy [8]. In terms of employment, from the perspective of the joint development of regional education, Zhang selected the practical experience of government-school-enterprise cooperation in the context of Guangdong-Hong Kong-Macao Greater Bay Area as the research object to deconstruct the bottlenecks restricting cross-regional education construction, school-enterprise cooperation and collaborative education [9]. Mo analyzed the main defects of employment and entrepreneurship education in vocational colleges in remote areas, and proposed that localization of employment and entrepreneurship education for vocational students in remote areas is a path for the development of vocational education [10]. Li suggested that the government, universities and enterprises should implement localized strategies to improve the local employment and entrepreneurship rate of college students, so as to achieve a win-win effect of "government-school-enterprise-students" [11].

In the following, the author will start with the development of artificial intelligence in China and discuss the construction of artificial intelligence.

2 The Development Status of Artificial Intelligence in China

2.1 Artificial Intelligent Professional Construction and Approval Status in China

In order to build the first-mover advantage of China's artificial intelligent development and accelerate the construction of an innovative country and a world technological power, The State Council issued the Development Plan for the New Generation of artificial intelligent in 2017 [12]. The document states: "Artificial intelligence is a strategic technology leading the future. In order to solve the problem such as artificial intelligence theoretical foundation in our country original is weak, and to establish a new generation of artificial intelligence basic theories and key technical systems, improve discipline layout in the field of artificial intelligence, set up professional artificial intelligence, level of subject construction, promote the construction of a first-level discipline in the field of artificial intelligence, as soon as possible to establish artificial intelligence colleges in pilot schools, and expand the team of high-end artificial intelligence talents and form China's capacity for sustained artificial intelligent innovation. Colleges and universities are encouraged to broaden the content of artificial intelligence professional education on the original basis, form a new model of "ARTIFICIAL intelligence +X" composite professional training, and pay attention to the intersection and integration of artificial intelligence and mathematics, computer science, physics, biology, psychology, sociology, law and other disciplines. We will strengthen industry-university-research cooperation, and encourage universities, research institutes and enterprises to cooperate in the construction of artificial intelligence laboratories." The plan requires that by 2030, our country's artificial intelligence theory, technology and application will generally reach the world's leading level and become the world's major artificial intelligence innovation center. Since the release of the "Development Plan for the New Generation of artificial Intelligence" document, the construction of high-end artificial intelligent talents has become a top priority in the development of ARTIFICIAL intelligence.

As the main position of talent cultivation in China, the news of the establishment of artificial intelligence colleges and universities is constantly heard. In April, 2018, issued by the Ministry of Education of the institutions of higher learning in artificial intelligence innovation action plan [13] clearly put forward "the support the university in computer science and technology subject setting artificial intelligence research fields, improve the discipline system of artificial intelligence, promote the construction of the level 1 discipline of artificial intelligence", "increase the intensity of artificial intelligence personnel training, To provide talent reserve and strategic support for the sustainable development of the next generation of artificial intelligent in China," he said. In 2019, 35 universities were approved to set up artificial intelligent colleges. In February 2020, the Ministry of Education released the results of the registration and approval of undergraduate majors in general institutions of higher learning in 2019. A total of 180 universities added artificial intelligence majors, including the artificial intelligent major at Hunan Normal University. At present, more than 200 undergraduate colleges and universities in China have established ai majors. In terms of higher vocational education institutions (junior colleges), the Ministry of Education has added the major of artificial intelligence technology service (major code: 610217) to the Catalogue of Higher Vocational Education (Junior colleges) in General Institutions of Higher Learning (Supplementary Majors in 2019) released in October 2019. In 2020, a total of 171 higher vocational colleges in China successfully applied for the major of artificial intelligence technology service. Internationally, Carnegie Mellon University opened the first undergraduate program in artificial intelligence in the United States in 2018. Unlike the late start of computer technology education in China, artificial intelligence research and professional education in China have caught up with the development of The Times.

2.2 The Development of M Artificial Intelligence Industry and the Status of Demand for Employees in China

The scale of artificial intelligent industry is growing significantly in China. The Map of global artificial intelligent Industry in 2020 released by China Academy of Information and Communications Technology [14] shows that the scale of global artificial intelligent industry in 2020 reached $156.5 billion, with a year-on-year growth of 12.3%, and the growth rate decreased compared with 2019. China's industrial scale reached $43.4 billion, with a year-on-year growth of 13.75%. In the field of artificial intelligence, China and the United States have a competitive advantage. In 2020, American artificial intelligent companies accounted for 38.3% of the global total, followed by China with 24.66%. According to The 2021 Artificial Intelligence Development White Paper [15] compiled by Shenzhen Artificial Intelligence Industry Association, in 2020, the scale of China's artificial intelligence core industry reached 325.1 billion yuan, with a year-on-year growth of 16.7%. Artificial intelligence is accelerating the integration with all walks of life in the real economy, helping industrial transformation and upgrading, improving quality and efficiency.

The number of artificial intelligence companies in China ranks second in the world. According to incomplete statistics, as of the end of 2019, there were more than 2,600 artificial intelligence companies in China, and local governments had issued more than 270 artificial intelligence-related policies. As of the end of 2020, the number of artificial intelligence-related enterprises in my country has reached 6,425. In terms of regional distribution, the three major regions of Beijing-Tianjin-Hebei, Jiangsu, Zhejiang and Shanghai, and Guangdong, Hong Kong and Macao account for more than 80% of the number of artificial intelligence companies in the country. Currently, Beijing, Shanghai, and Shenzhen each have more than 1,000 artificial intelligence companies, ranking among the top three cities with the development strength of the artificial intelligence industry.

There is a large gap in artificial intelligence talents in China. At present, there are more than 600,000 employees in my country's artificial intelligence industry, mainly in the IT Internet and electronic communications industries. However, there is still a shortage of talents in the field of artificial intelligence, especially high-level talents. At the same time, with the continuous implementation of various types of applications in the field of artificial intelligence, the demand for artificial intelligent talents in the industrial sector has surged, with a blowout growth, and the dilemma of talent shortage has become increasingly prominent. It also requires universities and higher vocational colleges to put more energy into in the field of artificial intelligence (technical service).

3 Artificial Intelligence Professional Characteristics and Industry Needs

3.1 Artificial Intelligence Expertise Structure

The study of artificial intelligence covers many small areas of computer science. Such as machine learning systems, computer languages, image processing, speech recognition, robotics, human-computer interaction and so on. Based on the development orientation and professional characteristics of artificial intelligence, its professional knowledge structure should be considered from five levels: infrastructure layer, core technology layer, support technology layer, system platform layer and application layer, as shown in Table 1.

Table 1. The expertise structure of artificial intelligence

Level of knowledge	
Application layer	Field-oriented application systems, such as: smart medical care, smart agriculture, etc.
System platform layer	Artificial intelligence platform, intelligent system, etc.
Support technology layer	Natural language processing, pattern recognition, computer vision, speech processing, etc.
Core technology layer	Machine learning (deep learning), knowledge representation, knowledge reasoning, etc.
Infrastructure layer	Artificial intelligence foundation supports the software and hardware environment

In addition, artificial intelligence is not only as widely absorbing ideas from other disciplines, but also widely used in other disciplines to empower. At present, the "artificial intelligence +" commonly discussed refers to this category: When the framework structure of artificial intelligence is studied, the models of psychology, biology, linguistics, mathematics and other disciplines can be used to construct artificial intelligence models, so as to complete the refinement of artificial intelligence models; On the contrary, when artificial intelligent algorithms are applied to other disciplines, such as engineering, medicine, transportation, education, etc., the powerful computing power and content understanding ability of artificial intelligent can be used to empower research in other disciplines. So there is a professional strong demand in the intersection of artificial intelligence.

3.2 The Development and Demand of the Artificial Intelligence Industry

Artificial intelligence industry enterprises correspond to the five levels of artificial intelligence, enterprise content can be classified as industrial chain base layer artificial intelligence enterprise, technology layer artificial intelligence enterprise and application layer artificial intelligence enterprise. By the end of 2020, the number of artificial intelligent-related enterprises in China had reached 6,425, The proportion of each type is 22.3% for the industrial chain base layer, 18.6% for the technology layer and 59.1% for the application layer.

At present, Artificial intelligence companies related enterprises are facing many different fields in China. The direction with the largest number of industry layout is computer vision, followed by service robots, and speech and natural language processing rank third.. It can be seen that the layout direction of industry enterprises is proportional to the difficulty of landing artificial intelligence professional technology, that is, the easier the landing, the easier the commercialization, the greater number of layout enterprises. Computer vision has attracted the largest number of enterprises because it has the widest application scenarios. Service robots closely behind, especially after the impact of the epidemic, the number of service robot enterprises increased sharply due to the impact of market demand; Language and natural language processing are widely used in media, translation and other interactive scenarios.

At present, apple, Google, Microsoft, Amazon, Facebook and other companies, without exception, are investing more and more resources to seize the artificial intelligent market, and even to establish themselves into an enterprise driven by artificial intelligence. BAT, a leading Chinese Internet company, has also regard artificial intelligent as a key strategy and actively layout the field of artificial intelligence by virtue of its own advantages.

Of course, in addition to the above areas, various cross-cutting areas such as intelligent medicine, machine learning, intelligent driving and other areas are also the key target of artificial intelligent development. Generally speaking, the current mainstream artificial intelligence technology in China has reached the world's leading level.

4 Understanding and Thinking of Artificial Intelligence Professional Talent Training

First of all, it needs to be admitted that there are certain differences in the construction of artificial intelligence between undergraduate and vocational colleges, which are determined by different talent training goals. Therefore, the author starts from the structure of artificial intelligence specialty in undergraduate and higher vocational colleges, analyzes the situation of their talent training, and then puts forward some deficiencies in the construction of artificial intelligence specialty at present.

4.1 The Cultivation of Artificial Intelligence Talents in Undergraduate Colleges

The artificial intelligent disciplines in undergraduate universities pay more attention to the basic construction of artificial intelligent disciplines, and some of them have experience in cultivating graduate students and doctoral students in artificial intelligent direction. From the perspective of course setting, the course content is quite comprehensive, which not only contains the basic necessary knowledge system, but also constructs a good practical teaching system through the school-enterprise cooperation platform. A solid basic knowledge system and a good practical education platform are effective means to cultivate high-quality professional talents, which can effectively improve students' innovation and practical ability. At the same time, colleges and universities pay more attention to the construction of artificial intelligence teaching system, the formulation of subject teaching materials, the training and formation of teachers. In terms of practical projects, undergraduate universities mainly focus on artificial intelligence technology research, such as computer vision laboratory, image recognition laboratory, target tracking laboratory, speech recognition laboratory, automatic driving laboratory and so on. Some undergraduate colleges and enterprises conduct joint training to jointly study the case of the combination of artificial intelligence and the characteristic major of their own universities to form the compound characteristic major of "Artificial intelligence + X".

Although the training of high-end talents is excellent, the construction of artificial intelligence major in undergraduate universities is still in exploration. The professional curriculum is mainly based on the experience of teachers with artificial intelligence related research direction and similar mature majors such as computer science and automation technology, so there are two contradictory problems in the setting of subject teaching system, which are too scattered and too bloated. The construction of artificial intelligence major should further clarify the training objectives of students, rearrange the curriculum system, and differentiate it into a more efficient, accurate and concise curriculum system. In particular, mathematics and statistics, programming, machine learning, deep learning and other courses should be taken as the core knowledge, and image recognition, speech recognition, natural language processing, reinforcement learning and other algorithm content should be regarded as the compulsory content of the course.

Artificial Intelligence Professional Training Objectives
A typical talent development goal is as follows:

This professional through comprehensive training of students' knowledge, ability and quality, so that the students have a solid mathematics, natural science, engineering, humanities and social science of theoretical foundation, and systematic and in-depth artificial intelligence professional knowledge and practical ability, and have ability to track and develop new theories in the field of artificial intelligence and related fields, new knowledge and new technology ability and certain international field of vision.

According to the decomposition of cultivation objectives, the main abilities that students should possess are shown in Table 2.

Table 2. The main abilities of artificial intelligence professionals

Ability classification	Specific content
Construction	Solve complex engineering problems by using mathematics, natural science, the scientific basis of the information and artificial intelligence professional knowledge, artificial intelligence
Problem analysis	Obtain effective conclusions through literature research, analyze, identify, and express complex computer engineering problems
Design/develop Solutions	Design technical solutions to solve complex artificial intelligence problems, design and implement intelligent systems or modules that meet specific needs
Scientific research	Study complex artificial intelligence engineering problems by using scientific methods, including experimental design, analysis and interpretation of data; obtaining reasonable and effective conclusions through information analysis and interpretation
Use of artificial intelligence tools	The development, selection and use of appropriate technology, resources and modern engineering tools, hardware and software development tools, to complex artificial intelligence to predict and simulate engineering problems, to understand the application scenarios and limitations of different development techniques and tools

This kind of talent training goal focuses on the personnel training idea of "all", but because of artificial intelligence discipline of wide caliber and its overlapping, apart from a few high level university has a strong academic faculty, they can cover the whole system of artificial intelligence personnel training, most undergraduate course colleges and universities do not have the capacity to have the ability to offer all artificial intelligence courses. In this case, the cultivation of "tall and complete" artificial intelligence talents will only train undergraduates into "four-unlike" talents who understand everything but are not proficient in everything, which is neither in line with the original intention of talent cultivation nor in line with the needs of the industry.

Artificial Intelligent Professional Teacher Requirements

In order to meet the diversified talent training objectives, the major of artificial intelligence needs teachers with interdisciplinary backgrounds. However, the current strategy of blindly pursuing the accumulation of talents in various fields is not applicable, which not only brings pressure to the recruitment of talents in universities, but also weakens the academic characteristics of universities in the direction of artificial intelligence and obscures the main research direction. Therefore, the author believes that the construction of artificial intelligence teachers should combine the discipline characteristics of artificial intelligence itself, regional development characteristics, school characteristics and teacher structure characteristics, and consider from multiple levels, and finally specify the construction strategy of teachers.

Furthermore, in the construction of artificial intelligence professional teachers, except for a very few universities aiming at the fundamental and structural research of artificial intelligent, most universities should first combine the enabling and intersecting nature of artificial intelligent, and fully integrate the educational teachers with multi-disciplinary integration background based on the connotation of multi-disciplines. Secondly, combining the regional advantages and the distribution characteristics of industry and field, we should introduce high-quality interdisciplinary teachers who can promote the development of regional economy and regional industry in a reasonable and effective manner according to local conditions. Thirdly, it is necessary to rationally formulate artificial intelligence professional personnel training objectives and discipline construction development plans based on the school's basic positioning of superior disciplines, so as to cultivate artificial intelligence professional teachers in multi-faceted and orderly manner. Finally, combining the new ecology of artificial intelligence professional education, the existing teaching, research and innovation teachers that should be actively guided to transform and upgrade based on ARTIFICIAL intelligence and integrate into the development of artificial intelligence majors. These ideas can effectively alleviate the problem of artificial intelligence teachers.

The Development Needs of Artificial Intelligence Students

The employment rate and promotion rate of undergraduates have always been an important indicator to measure the success of professional construction. The purpose of talent training is also to cultivate useful talents for the industry, which can be directly reflected in the employment rate and promotion rate. From the perspective of employment, undergraduate students majoring in artificial intelligence need to conduct a lot of industry practices in the senior stage to enhance the matching degree with industry talents. Therefore, it is necessary to cooperate with industry enterprises to set up several school-enterprise cooperation courses with long span and specialized direction in for senior students in the training program. The course format needs to be flexible. We can adopt a hybrid course system that integrates technical personnel from enterprises to teach and arrange students to practice in enterprises, so that students can better combine theoretical knowledge with practical application, and enterprises can also understand the school and students, so as to improve the employment environment for students.

On the other hand, since artificial intelligence itself is not a first-level discipline, students need to choose among the major subjects of computer when entering a higher education. Some schools' examination subjects do not match the training direction of their majors, which will also cause some problems in talent cultivation. However, as the country attaches great importance to the field of artificial intelligence, the caliber of students majoring in artificial intelligence is gradually increasing. Traditional intelligent science and technology secondary disciplines (academic sites) can match the needs of artificial intelligent research talents; The newly established artificial intelligence field direction under the electronic information major degree is also well matched with the cultivation of artificial intelligence advanced application talents. Therefore, as long as you adhere to the basics and highlight the characteristics in talent cultivation, you must learn basic knowledge such as machine learning, deep learning, pattern matching, and mathematical foundations, and then natural language processing, computer vision, neural network, recommendation system in the field of artificial intelligence. A higher level of application expansion in one direction in the field direction will naturally be favored by tutors under the same conditions, thereby increasing the overall rate of professional admission.

4.2 The Cultivation of Artificial Intelligence Talents in Higher Vocational Colleges

The Current Situation of Artificial Intelligence Training in Higher Vocational Colleges

As an important talent training position in China, especially under the background of promoting vocational education in China, the social status and value of higher vocational colleges cannot be ignored. The core of the education work in higher vocational colleges is to train professional applied talents. Therefore, the current artificial intelligence talent training in higher vocational colleges mainly focuses on artificial intelligence service, and strives to better combine with the industry.

Therefore, many higher vocational colleges are looking for a complete set of intelligent industry combination scheme, which is directly used to cultivate students' practical application ability. For example, railway junior college combined with railway + industry applications, construction vocational school combined with intelligent building solutions, transportation vocational school oriented smart transportation solutions, and so on. This layout is quite advanced. It directly adopts the mode of "artificial intelligence +X" compound major, which basically avoids the phenomenon of curriculum homogeneity, and can meet the national requirements for personnel training in higher vocational colleges. The organic combination of specific majors and artificial intelligence technology is conducive to the healthy development of China's artificial intelligence industry.

The Problems and Solutions for the Construction of Artificial Intelligence Specialty in Higher Vocational Colleges

The compound professional model of "AI +X" is too oriented toward a single application.

The composite artificial intelligence (service) profession cannot only be applied, not the foundation. In fact, the more industry-specific programs are, the more they need to be combined with basic theoretical systems.

As far as the personal development of students is concerned, a complete set of artificial intelligent industry-integrated schemes alone cannot substantially improve the quality of talent training and solve the problem of talent training. Artificial intelligence, as an independent discipline, is important in its technology itself, rather than a simple industry-combined scheme. If universities only pay attention to buying mature industries and laboratory resources such as laboratory equipment and experimental kits for students to learn, what they really cultivate is not specialized technical service talents of artificial intelligence, but only engineers oriented to specific system integration, which is not very robust. In fact, when the software and hardware changes due to the system update, the talents cultivated by the industry combination program often show poor learning ability and need a longer time to adapt to the new system.

Therefore, the artificial intelligence major of higher vocational colleges should not be eager to achieve success. The basic knowledge of the subject should be as close as possible to undergraduate students, so that students can fully understand and learn and apply artificial intelligence technology from the knowledge system and curriculum system. Applied talents also need to understand the steps and processes of an artificial intelligence project from the overall system of artificial intelligence At the same time, the artificial intelligence technology service major should strengthen the training of students' professional quality and innovative consciousness, promote the comprehensive development of students, and the innovative, entrepreneurial, application-oriented talent training throughout the whole process of artificial intelligence service technology professional training in higher vocational colleges.

The problem of "software and hardware" environment construction for artificial intelligence majors in higher vocational colleges is outstanding.

Software refers to the human factor, namely the shortage of teachers in higher vocational colleges. Subjectively, some existing teachers are unable to get close to the direction of artificial intelligence independently; objectively, some teachers' knowledge structure is not firm, which leads to inability to learn the professional knowledge of artificial intelligence.

In the author's opinion, we can solve this problem from three aspects: finding the direction, asking for foreign help and tapping the potential.

First, the introduction of high-level talents related to artificial intelligence as professional leaders, clarify the direction of professional development, and build the direction of professional construction that adapts to the disciplinary foundation;

The second is to introduce high-level enterprise R&D personnel with project experience as part-time teachers, and introduce the R&D processes, methods and tools of enterprises into higher vocational talent training, so that students can adapt to the employment environment of the industry as soon as possible;

Third, teachers are sent to enterprises for learning and training by means of teacher training and training, so that teachers can participate in enterprise project research and development. In this way, the knowledge system of existing teachers can be expanded and their knowledge can be integrated into the innovative talent training system.

Through the above three-mentioned method, we can expand the teaching staff, optimize the teaching structure, build a team of high-level teachers with theoretical basis and practical project ability, and improve the "soft" environment of artificial intelligence major in higher vocational colleges.

Hardware means that the construction and application of artificial intelligence experiment (training) rooms in schools are too narrow to provide compound training for students. Due to the demand for large computing power and controlled specialized equipment, the artificial intelligence laboratory requires a relatively high space and funds for its construction. Generally, after the construction of artificial intelligence laboratory in a certain field, there is not enough site and capital for the construction of artificial intelligence laboratory in other fields.

The author thinks that the construction of artificial intelligence laboratory should be divided into two parts: on the one hand, for the self-built laboratory in the school, it should be inclined to the practical training system which can train the students' ability systematically, and the construction of the laboratory should focus on cultivating the students' practical application ability; On the other hand, for professional laboratories, artificial intelligent research and practice bases should be jointly built with enterprises for students' professional artificial intelligent practice.

At present, the university-enterprise cooperation platform has become a good industry-university-research integration construction plan. The state and the Ministry of Education have issued several documents to support and encourage the talent training method of industry-university integration. The establishment of a school-enterprise joint platform can form a comprehensive experimental practice base that integrates "teaching, scientific research, and service integration", so as to meet the needs of artificial intelligence service technology professional talent training, professional teaching, teacher training and social services.

5 Summary

The construction of artificial intelligence majors must reflect the needs of technological development and conform to the national development strategy, undergraduate and vocational colleges is the first productive force, talent is the first resource, the innovation of science and technology the first power point, The deep integration of artificial intelligence and education should be continuously promoted, leading the field of artificial intelligence in our country science and technology innovation, personnel training and technology application demonstration, To promote the overall strength of Artificial intelligence in China. Based on the current situation of the construction of artificial intelligence major in undergraduate colleges and higher vocational colleges, this paper analyzes some common problems in the construction of artificial intelligence major, and puts forward the author's own views on these issues.

In the future, how to achieve the integration of the development of artificial disciplines and other disciplines, How to clarify the relationship between the research on the methods, models, and key technologies of the artificial intelligence discipline involved in talent training and the application of intelligent methods, models, and technologies in other disciplines is very important under the development framework of "artificial intelligence +X" co-prosperity and co-construction. Similar to the "computational thinking" formed by computer science and technology as a basic support for other disciplines, the related models and algorithms in the field of artificial intelligence will gradually form "intelligent thinking" and further provide intelligent support for the development of other disciplines. How to better sort out the relationship between the basic content of artificial intelligence and other disciplines and core support needs further thinking and exploration in professional talent training. In-depth thinking and further exploration are needed in the training of professional talents.

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Firmware Security Verification Method of Distance Learning Terminal Based on MD5 Algorithm

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Abstract. In order to solve the problem of high leak and error rate in the process of firmware security verification of distance learning terminal, a method of firmware security verification of distance learning terminal based on MD5 algorithm is proposed in order to solve the adaptability problem of existing security verification methods. According to the structure of distance learning terminal, the corresponding structure model is constructed, and the firmware types of distance learning terminal are divided under this model. Collect different types of firmware programs, use MD5 algorithm to verify user identity, detect firmware code security defects and malicious attacks, and identify firmware service daemon. Combined with the verification results of user identity, the final firmware security verification results are obtained through the comparison of attacks and firmware guard strength. Through the test experiment, it is concluded that the average missed acceptance rate and false acceptance rate of the design firmware safety verification method are less than 1%, and are suitable for multiple firmware samples, which proves the safety verification effect and adaptability of the design method.

Keywords: MD5 algorithm · Distance learning terminal · Terminal firmware · Safety verification

1 Introduction

Distance learning terminal is a device that connects the sensor network layer and transmission network layer in the Internet of things to collect data and send data to the network layer [1, 2]. It is responsible for data acquisition, preliminary processing, encryption, transmission and other functions. All kinds of distance learning terminal devices can be divided into scenario awareness layer, network access layer, network control layer and application/business layer. Each layer has a corresponding relationship with the control

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equipment on the network. Distance learning terminals are often in a variety of heterogeneous network environments. In order to provide users with the best use experience, the terminal should have the ability to perceive scene changes, and on this basis, select the best service channel for users by optimizing decisions. The terminal equipment senses the changes of the environment through the RF module or sensor module at the front end, and determines the countermeasures to be taken after calculation. Firmware is the first code executed after the computer is powered on. It is mainly responsible for the initialization of the system hardware platform, loading the operating system, and finally passing control to it. In the process of design and development, most distance learning equipment manufacturers give priority to realizing functions to seize the market and ignore security factors, such as lack of security treatment of existing vulnerabilities in the development stage, lack of security testing in the pre delivery stage, etc. In terms of hardware, the resources of distance learning devices are limited, so it is more difficult to implement security configuration and deployment after accessing the network, and the distance learning devices exposed to the public network are particularly vulnerable to hacker attacks and utilization. In terms of operating system, a large number of distance learning devices directly reference or simply develop the existing embedded system, which intensifies the risk of bringing the existing vulnerabilities into the distance learning system.

Because the security of firmware is of great significance in information system, the research on firmware security has attracted more and more attention. On the one hand, firmware manufacturers are committed to the analysis of firmware defects to improve the quality and security of their products. On the other hand, some security researchers analyze the firmware code to detect whether there are malicious codes in the firmware and ensure the security of the firmware. There are also some security researchers hackers, By analyzing the defects of firmware, we can explore the exploitable vulnerabilities, and even implant malicious code into firmware to enrich its attack means. Reference [3] provides an analysis tool iotdit to solve the problem of runtime detection in current IOT based services. Dynamic firmware information can be obtained through this tool, which is helpful for firmware performance analysis and security detection. Reference [4] uses open standards to update the security firmware of constrained IOT devices, which can ensure that restricted IOT devices create a secure and standard compliant firmware. Although the current firmware security research technology has made good achievements in some aspects, there are still some limitations, including the lack of generality of firmware code security analysis methods and the low coverage of firmware code program analysis code. Therefore, based on the traditional method, MD5 algorithm is used to optimize the firmware security verification method of distance learning terminal.

MD5 algorithm is one of the hash algorithms widely used in computers to ensure the integrity and consistency of information transmission. MD5 algorithm has the characteristics of good compression, easy calculation, anti modification and strong anti-collision. Through the application of MD5 algorithm, we hope to improve the adaptability of security verification methods while improving the security verification effect of distance learning terminal firmware.

2 Design of Firmware Security Verification Method for Distance Learning Terminal

The operation of the firmware security verification method of the distance learning terminal is based on the cooperative work process of the software and hardware of the distance learning terminal. On this basis, it is verified from the aspects of firmware attack, user identity, daemon and so on, and the final comprehensive security verification results are obtained.

2.1 Construct the Structure Model of Distance Learning Terminal

The distance learning terminal can be divided into three parts: perception/control module, hardware module and firmware module. Sensing/control is a unique module of distance learning terminal, and its basic structure is shown in Fig. 1.

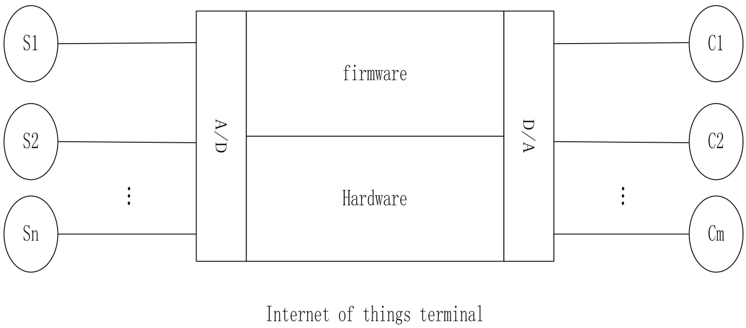

Fig. 1. Structure diagram of distance learning terminal

The sensing/control module senses the information of the physical world through various sensors, converts the obtained information into digital state information that can be processed by the terminal firmware, and sends it to the terminal for processing. The terminal also converts the processing results into information that can be recognized by the physical world, and reacts on the physical world through the controller. The hardware module is the basis of the distance learning terminal, including various hardware equipment necessary for the terminal to access the network and complete the terminal carrying business, such as network access board card, processor, memory, various communication interfaces, etc. The firmware is the "brain" of the terminal and the core to complete the terminal business. The firmware of the distance learning terminal refers to the combination of program code and data running on the distance learning terminal and stored in the non-volatile memory of the terminal. Multiple structures of the distance learning terminal work together according to the flow in Fig. 2.

As can be seen from Fig. 2, several key steps of software and hardware cooperation in the process from the computer power on to the complete startup of the operating system. When the computer is just powered on, the first work performed by the firmware code is usually to initialize the CPU and check whether the contents in the current microcode file

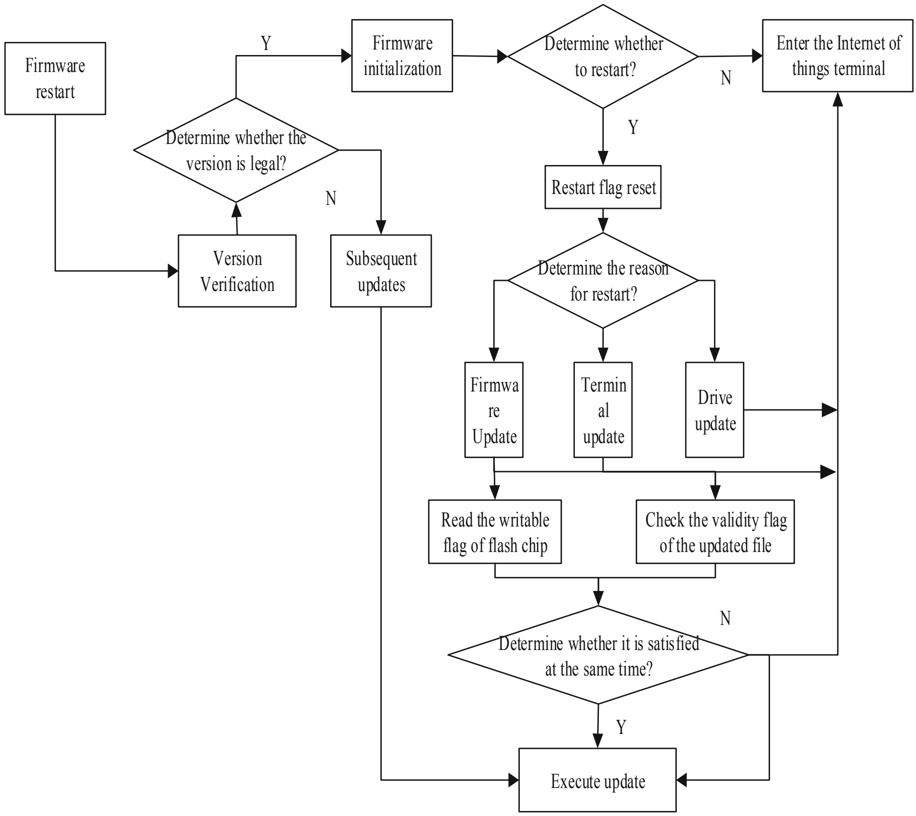

Fig. 2. Flow chart of software and hardware collaborative work of Internet of things terminal

register support the specific model of the current processor. Mismatched processors often produce many problems in the actual working process, such as excessive heat generation, frequent system failures, etc. the expansion of microcode files usually needs to be realized through firmware update. The next step is the initialization of the chipset, which prepares relevant registers and other hardware resources for the subsequent execution process. After that, the firmware will analyze the information saved in CMOS, check the reason for restart, and judge whether the system was shut down normally or abnormally due to other reasons. If it is normal startup, follow the normal startup process to directly execute the subsequent steps. On the contrary, there is a corresponding branch processing process. This stage is called soft restart judgment. After the judgment of soft restart, if it is determined that the soft restart is performed, the corresponding causes of soft restart shall be investigated. There are many reasons for the soft restart of the system. System updates, firmware updates, discovery and driver installation of new hardware, and updates of some underlying software may lead to the soft restart of the operating system. Because the research object is computer firmware, the operating system update and subsequent operation are abstracted as a state, and the hardware change and driver update are also abstracted as a state. If it is determined that the cause of the soft restart is firmware update, the system will further perform judgment to check whether the conditions for executing the update operation are met. The most important thing is to check the writable flag of the firmware storage chip flash and the legitimacy of the firmware update file.

2.2 Classification of Firmware Types of Distance Learning Terminals

According to the difficulty of analysis, the firmware of distance learning terminal can be divided into shallow embedded firmware and deep embedded firmware. Shallow embedded firmware has clearly divided software architecture and complete file system, including known General operating systems, such as Android, embedded Linux, etc. The operating system and its related public function libraries provide rich semantic information for this kind of firmware analysis, which is convenient to analyze the functional structure and file attributes of firmware programs in combination with the analysis method based on API functions [5, 6]. Deep embedded firmware. Most of the distance learning terminals with this kind of firmware belong to traditional embedded devices. This kind of terminal firmware compiles the trimmed operating system, application program and configuration data into a whole. Deep embedded firmware has no explicit file system and lacks auxiliary symbol information and library function information, so it is difficult to analyze this kind of firmware.

2.3 Firmware Collection and Pretreatment

Firmware acquisition is the basis for analyzing firmware function and security. Filter the full version of firmware, and write a crawler to download in combination with firmware analysis tools. Firmware collection mainly refers to the characteristics of the information to be collected by the user. The topic is usually determined by the user specifying several relevant web pages as the training set, which is extracted by firmware after word segmentation. Firmware extraction is to analyze a given sample network, automatically extract the firmware features in these distance learning terminals, calculate their weights according to the number of times the firmware features appear in distance learning, and finally synthesize the firmware features of each sample network to determine a set of features that can represent the subject [7, 8]. The selected firmware features should meet the following requirements: completeness, that is, it can reflect the content contained in the sample web page; Discrimination, that is, whether the search network is related to the sample network can be determined by characteristic words. The weight of feature is calculated by TF-IDF formula, that is, the more times a feature vector appears in the same firmware program, the stronger its ability to distinguish the content attributes of firmware program, and the greater its weight should be; The feature vectors that appear in several firmware programs show that the lower its ability to distinguish firmware content attributes, the smaller its weight should be. Therefore, the weight of the eigenvector in the firmware program is calculated as follows:

$$w_{ik} = \frac{t_{ik} \lg\left(\frac{N}{n_k} + 0.1\right)}{\sqrt{\sum_{k=1}^{n} (t_{ik})^2 * \lg^2\left(\frac{N}{n_k} + 0.1\right)}} \tag{1}$$

where, variable t_{ik} represents the number of occurrences of feature vector T_k in firmware program D_i, n is the total number of all firmware programs in firmware program, and n_k is the number of feature vectors containing feature vector T_k in distance learning terminal [9]. The topic thus determined is essentially a benchmark feature vector that can represent the firmware program related to the topic: the dimension of the vector is the number of feature words, and the size of each one-dimensional component is the weight of each feature vector. Package the collected firmware program into an image that allows the device in recovery mode to load and restore to flash memory. In order to meet different needs, manufacturers will adopt or design various firmware packaging methods, such as adding parity check codes between the images of flash memory partitions, storing files in a differential way to reduce the volume and obtain the preprocessing results of firmware.

2.4 Using MD5 Algorithm to Verify User Identity

The user authentication mechanism using MD5 algorithm is shown in Fig. 3.

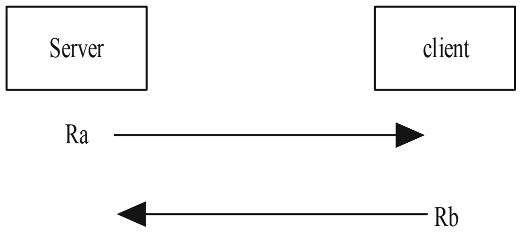

Fig. 3. User authentication mechanism using MD5 algorithm

Ra in Fig. 3 represents a random number, and symbol 2 in formula | is the juxtaposition of bit streams [10]. According to the process in Figure |, the server can confirm that the other party has the same password plaintext by recalculating and comparing the 3 information excerpts sent by the client, so as to identify the other party's identity. This is equivalent to passing the password once using the one-time encryption method, in which the password is encrypted by the information extraction algorithm, so it does not need to be decrypted. The authentication process used for authentication can be expressed as:

$$\begin{cases} \mathrm{Kab} = \mathrm{Ka(b)} \\ \mathrm{Rb} = \mathrm{MD5(Ra|Kab)} \end{cases} \tag{2}$$

Based on the above verification mechanism, MD5 algorithm is introduced. The operation of the algorithm is divided into filling decomposed data, setting variables, cyclic linear coding and so on. Figure 4 shows the basic operation principle of MD5 algorithm.

Because the input data is different, a specification is needed to format the input information. In MD5 algorithm, the input information needs to be filled and decomposed

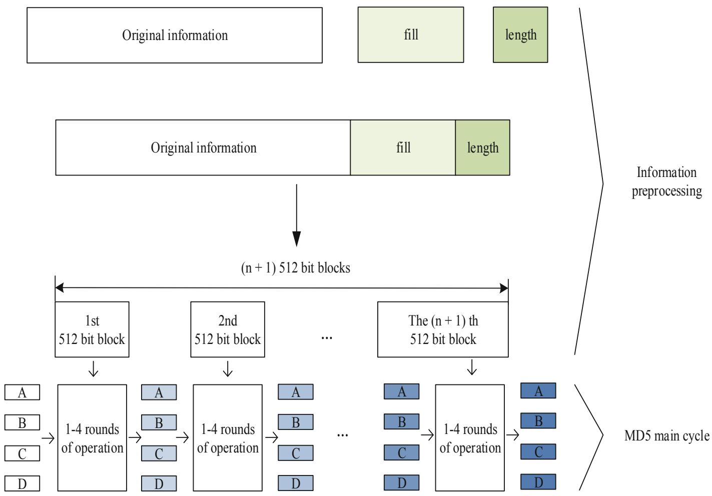

Fig. 4. MD5 basic principle diagram of algorithm

for coding. First, fill one 1 and several zeros after the input information so that the bit length is:

$$l_0 = N * 512 + 448 \tag{3}$$

where n is a nonnegative integer. If the bit length of the input information itself meets the requirements of formula 3, fill in a 1 and several zeros successively so that its length is:

$$l_1 = (N + 1) * 512 + 448 \tag{4}$$

Then, the length before the input information is filled is calculated, represented by a 64 bit binary, and then the 64 bit binary number is filled behind the previously filled input information. If the initial length is greater than 264, only the lower 64 bits of the length are used, so that the input information length is exactly an integer multiple of 512 bits. After the data is filled, the data is grouped in 512 bits. If the data length is k * 512 bits, it is divided into k data segments, and each data segment has 512 bits. Then, each data segment is divided into 16 32-bit sub data segments, which are numbered M0 ~ M15 from low to high. After filling, each 512 bit message packet is divided into 16 32-bit message words. First, set the initial values of link variables a, B, C and D as follows:

$$\begin{cases} a = 0x67452301 \\ b = 0xefcdab89 \\ c = 0x98badcfe \\ d = 0x10325476 \end{cases} \tag{5}$$

MD5 algorithm processes each 512 bit message packet separately. Each message packet is divided into 16 32-bit byte blocks, which are cyclically processed with 32-bit connection variables and other variables. The function for processing includes 4 rounds, and 16 byte blocks are processed in each round. Therefore, there are 64 steps in total. The general formula of the function can be expressed as:

$$\begin{aligned} &\mathrm{M}(\mathrm{ab}, \mathrm{Gdm}[i], \mathrm{k}[i], \mathrm{s}[i]) : \\ &\mathrm{a} = \mathrm{b} + ((\mathrm{a} + \mathrm{f}(\mathrm{b}, \mathrm{cd}) + \mathrm{m}[i] + \mathrm{s}[i]) <<< \mathrm{k}[i]) \end{aligned} \tag{6}$$

where sign + is modulo 32 addition, k[i] and s[i] are given constants, and m[i] is the separated 32-bit message word. Variable s[i] is calculated as follows:

$$\mathrm{s}[i] = 232 \times \mathrm{abs}(\sin(i)) \tag{7}$$

where the variable I is the unit radian, and $x <<< k$ indicates that the X cycle shifts k bits to the left. The rounding of the calculation result of formula 7 is the specific value result of formula s[i]. Similarly, the value results of other variables in formula 6 can be obtained. The other $f(b, c, d)$ is a Boolean function, which is different in each round of loop. After the completion of cyclic coding, the final output is the 128 bit digital fingerprint obtained by connecting a, B, C and D. The sequence of cascade output is: from the low byte of a to the high byte of D, match the output 128 bit digital fingerprint with the digital fingerprint initially input by the user. The matching process can be expressed as:

$$sim = \sqrt{\sum_{i=1}^{k} (x_i - y_i)^2} \tag{8}$$

where x_i and y_i respectively represent the position of each pixel in the user's initial input digital fingerprint and the MD5 algorithm output fingerprint image. If the value of *sim* calculated by formula 8 is higher than 0.9, it means that the user is matched in the distance learning terminal environment, and the corresponding user is the authentication result of the user's identity.

2.5 Detect Firmware Code Security Defects and Malicious Attacks

Generally, the firmware program of distance learning terminal is composed of main function, interrupt processing function and interrupt vector table. The main function is also an interrupt processing function in essence, which is generally a reset interrupt. The interrupt vector table describes the entry address of the interrupt processing function in the firmware program, that is, the interrupt vector. Each interrupt processing function contains one or more functional modules, which complete the function of interacting with a specific hardware, and the same functional module can be included in different interrupt processing processes at the same time. On this basis, firmware attack verification includes three types of terminals: attack verification target, attack experimental terminal and attack verification server. The firmware attack verification target can be customized x86 and domestic computer hosts according to the needs of attack scenarios. The firmware information acquisition agent and customized firmware have been installed in the target. Such terminals can be equipped with corresponding boards according to different experimental requirements. The firmware attack verification server has two functions: one is to track and record the effect of firmware attack, and the other is to detect the firmware of the target. Figure 5 shows the working principle of firmware attack verification.

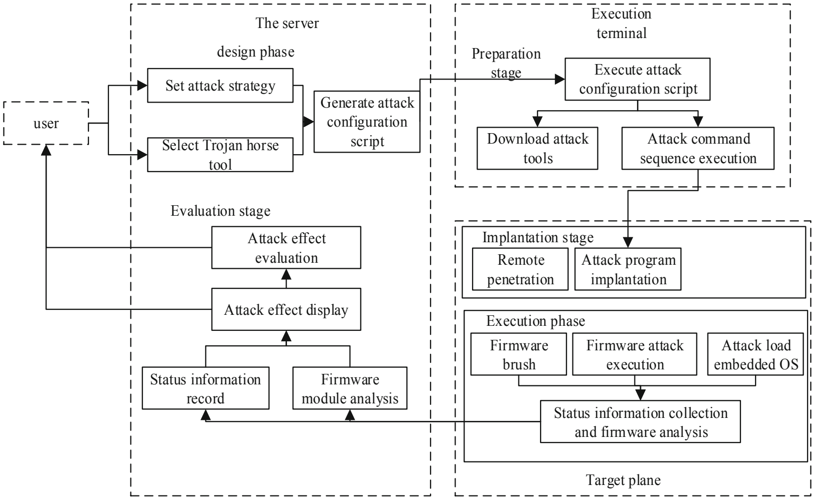

Fig. 5. Firmware attack verification flow chart of distance learning terminal

In addition, the firmware attack verification terminal mainly deploys firmware development tools and debugging environment supporting X86 platform and domestic processor platform. Compiling tools, debugging tools and extension devices are integrated in the development and debugging environment. Determine an attack model, that is, the model has the right to directly modify the firmware content, but at this time, the error path given by TLC tool can not be actually used after analysis, because the modification of flash chip also involves some judgment mechanisms. A judgment condition is added to the attack model. It is found that TLC will not provide the wrong path, because the attack model does not have sufficient permission to modify the flash chip under this condition, which is not that there are no vulnerabilities in the specification. Through dynamic adjustment, the final attacker model formula is as follows:

$$\begin{aligned} &Attack \triangleq \$Varset' = \\ &[VarsetEXCEPT!.Write\_flash\_sign = 1, \\ &!.Update\_verification_s\_sign = 1, \\ &!.Firmware\_security\_data = AtkFirm] \end{aligned} \tag{9}$$

According to Eq. (9), the attack intention of the firmware attacker of the remote learning terminal can be determined. That is, the attacker can change the writable flag bit of the flash chip, making it possible for the attacker to modify the contents of the firmware storage chip flash. At the same time, the model can meet the requirements of updating file legitimacy verification. In addition, the attacker is required to modify the firmware content in the computer. In order to distinguish the original firmware version oldfirm in the computer from the version newfirm in the legal update file, mark the modified new firmware as atkfarm. By reading and matching the versions of the two types of firmware, it is determined whether the current distance learning terminal firmware has attack behavior.

2.6 Identify the Firmware Service Daemon

Combined with the detection results of firmware code security defects and malicious attacks, the service daemon of firmware is identified. The identification of service daemon is divided into two steps: startup parameter identification and security identification. The purpose of startup parameter identification is to determine whether the service daemon of firmware has startup behavior in the presence of attack, and the security identification of daemon is to judge whether the current daemon can resist malicious attack. The first step in identifying startup parameters is to find the script or application responsible for starting the daemon. Generally speaking, an executable file used to start the daemon should contain complete startup instructions or fragments of startup instructions. The most basic part of the startup instruction is the file name or path of the started program. By using the grep command, you can find the executable file that may be used to start the service daemon and the string contained in it in the file system. By using regular expressions to filter strings, you can get complete startup instructions or startup instruction fragments. The second step is to check the obtained string. If the string contains formatting characters such as "% d" and "$conf" or variable names similar to shell script, it is speculated that some parameters in the string need to be calculated or obtained from the environment. For these cases, the framework will report that the generation of this parameter requires manual participation. If the string contains file paths or file names, it is speculated that the operation of this daemon may require the assistance of these files. In this case, the framework checks whether the file exists. If the file does not exist, the framework will try to find the executable file containing the file name or file path in the file system and report it to the user for processing.

After starting the service daemon, you need to check whether the program can work normally. If the firmware program does not work properly, the framework needs to recognize its abnormal state and stop the simulation. When the program starts running for a period of time or a function call is used, the framework will try to send a network request to the program. If the program cannot respond to the request of the framework within the timeout, the framework will start to detect whether the program has exited or fallen into an abnormal state. So as to realize the identification of the running state of the firmware service daemon.

2.7 Realize Firmware Security Verification of Distance Learning Terminal

Considering the running state detection and verification results of user identity, malicious attack and service guard degree, the final firmware security verification of distance learning terminal is obtained. If the user authentication is dangerous, observe the running state of the service daemon at this time. If the program is started at this time, the current remote learning terminal firmware security verification result is safe, otherwise it is dangerous. In addition, after user authentication, judge whether the firmware is attacked, and quantify and compare the malicious attack intensity and service guard intensity. If the attack intensity is greater than the guard intensity, the final security verification shows danger, otherwise it shows security. Integrate multiple aspects, complete the firmware security verification program of the distance learning terminal, and output the security verification results including the firmware security factor.

3 Test and Experimental Analysis

In order to test the optimization effect of the firmware security verification method of distance learning terminal based on MD5 algorithm, a test experiment is designed. The experiment is mainly divided into two parts: the safety verification effect test and the adaptability of the safety verification method. The safety verification part is to determine the current safety state of the distance learning terminal through human control, and compare it with the conclusion of the safety verification method, so as to determine whether the design safety verification method is accurate. The adaptability test is mainly to apply the designed security verification method to a variety of different types of distance learning terminal firmware programs, observe whether the security verification program can run normally, and compare the changes of the verification speed of the design method in different firmware program samples.

Before the experiment, several different distance learning terminal firmware are selected as the research samples of this experiment. By forging the firmware version number of different types of devices on the cloud and reporting it to the cloud server, you can obtain the firmware download link sent by the cloud to the fake device. These firmware download links allow you to download the latest firmware version of the corresponding model device within the effective time. Through this method, 199 firmware of distance learning devices were collected. Among the 199 distance learning device firmware, 27 belong to encrypted firmware. Because the architecture and operating system of this kind of firmware can not be recognized, it is not within the scope of this paper. Among the remaining firmware, 37 are rishos based distance learning device firmware and 135 are lightweight distance learning device firmware. Among the firmware of lightweight distance learning devices, 100 are ARM processor architecture firmware and 35 are xtensa processor architecture firmware. Because the xtensa architecture is less used and the existing analysis tools cannot analyze the assembly instructions of this kind of architecture, the arm architecture is determined as the main running environment, and the lightweight distance learning device firmware in this environment is observed. Classify 100 lightweight distance learning device firmware according to the equipment manufacturer, finally determine that the number of iRobot type firmware is 6, and store the prepared firmware samples in the form of data set according to the type.

In the configured experimental environment, write the malicious attack program of the firmware of the distance learning terminal and take it as the experimental variable. Write the startup control interface of malicious attack program, as shown in Fig. 6.

Through the control of malicious attack program, the experimental environment is divided into malicious attack and non malicious attack. Import the prepared firmware

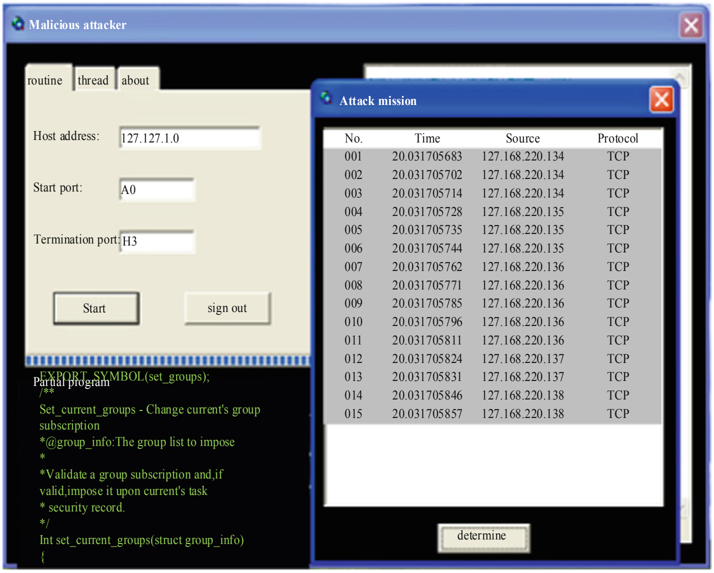

Fig. 6. Firmware malicious attack program interface

sample of distance learning terminal into the experimental environment, and determine the current security state through the control of running program and state. After the operation of the design safety verification method, the verification results are obtained, as shown in Fig. 7.

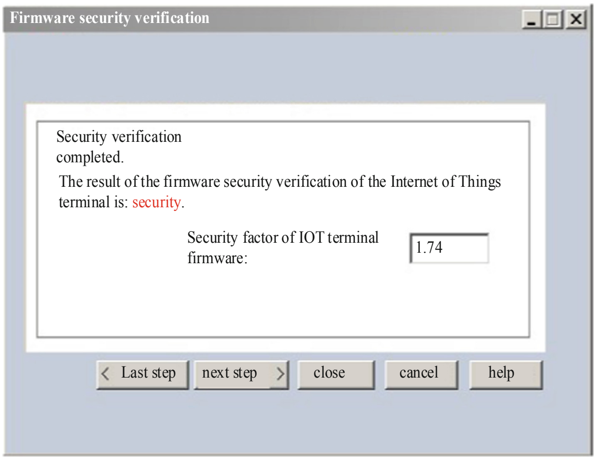

Fig. 7. Firmware security verification output results

In the experiment, the missed acceptance rate and false acceptance rate are respectively set as the quantitative test indicators of firmware safety verification effect. The numerical results are as follows:

$$\begin{cases} FNR = \left(1 - \frac{FN}{N}\right) \times 100\% \\ FPR = \left(1 - \frac{FP}{FN}\right) \times 100\% \end{cases} \tag{10}$$

where, N is the number of all firmware programs to be verified, FN is the number of actually verified firmware programs, and FP is the number of correctly verified firmware programs. In addition, the adaptability test is to observe the verification speed of firmware samples. Generally speaking, the safety verification speed is within the interval [0 s, 10 s], indicating that the safety verification program operates normally. Otherwise, it is considered that the design verification program is not suitable in the corresponding firmware sample data set. Through the statistics of relevant data, the effect test results of the design firmware security verification method are obtained, as shown in Table 1 and Table 3 (Table 2).

Table 1. Test results of firmware security verification effect of this method

Firmware sample dataset name	FN/piece	FP/piece	N/piece	Verification time/s
Dataset 1	30	30	30	0.67
Dataset 2	38	37	38	0.84
Dataset 3	41	41	42	1.35
Dataset 4	6	6	6	0.49

Table 2. Test results of firmware security verification effect of reference [4] method

Firmware sample dataset name	FN/piece	FP/piece	N/piece	Verification time/s
Dataset 1	28	28	25	1.58
Dataset 2	35	32	35	1.28
Dataset 3	39	39	40	1.95
Dataset 4	5	3	4	0.99

By substituting the data in Table 1 and Table 3 into formula 10 and integrating multiple sample sets, it can be concluded that the average missed acceptance rate and false acceptance rate of the design safety verification method are 0.6% and 0.7% respectively, both lower than 1%, meeting the application requirements of firmware safety verification. In addition, in terms of adaptability, the running time of the design method in different firmware data sets is within the interval [0s, 10s], indicating that the design firmware security verification method is applicable to multiple firmware data sets in the experiment, that is, the degree of adaptability is high。

Table 3. Test results of firmware security verification effect of reference [5] method

Firmware sample dataset name	FN/piece	FP/piece	N/piece	Verification time/s
Dataset 1	25	27	28	0.97
Dataset 2	30	35	36	1.24
Dataset 3	35	38	40	1.58
Dataset 4	2	5	5	0.89

4 Conclusion

According to the structure model of distance learning terminal, this paper divides the types of firmware. Verify the user identity of different types of firmware programs according to MD5 algorithm, detect the security defects and malicious attacks of firmware code, and combine the verification results of user identity to achieve the final firmware security verification. Experiments show that the security of important information is effectively enhanced by introducing MD5 algorithm in the firmware security verification of distance learning terminal. However, due to the small number of firmware samples set in this experiment, the final experimental results have certain limitations and contingency, which need to be further supplemented and improved in the future work.

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Early Warning System of Computerized Accounting Teaching Data Quality Based on Artificial Intelligence

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Abstract. In order to solve the problems of low warning accuracy and long warning time in the existing teaching quality early warning system, this paper presents a computerized accounting teaching data quality early warning system based on artificial intelligence. In the hardware part of the system, the data acquisition module, storage module, processor module and LCD display module are mainly designed. In the software part of the system, the data are collected and cleaned in advance, then the data association relationship is mined, and the early warning method is put forward, so as to realize the early warning of computerized accounting teaching data quality based on artificial intelligence. The experimental results show that the proposed early warning system effectively improves the accuracy and efficiency of early warning.

Keywords: Artificial intelligence · Computerized accounting · Data quality · Early warning system

1 Introduction

Teaching data quality early warning is to scientifically analyze and infer the factors that affect the teaching quality by using the past and present relevant data and materials of the school, logical reasoning and calculation, so as to send out targeted warning signals, provide scientific basis for improving the teaching quality, facilitate the timely prevention of the expansion of problems, select effective measures to solve problems, and cultivate more excellent talents for the society. With the continuous development of technology, big data technology can establish a more scientific learning environment. In the big data scenario, cloud computing technology can change students' learning methods and play an auxiliary role in teaching. Teachers can apply big data scenarios in the classroom,

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which can enhance students' interest in learning and improve teaching efficiency. In the campus, we can build a cloud computing environment platform by ourselves, and design corresponding links for teachers and students to participate together to reduce resource investment. At the same time, the process of establishing a big data cloud computing platform is taken as a practical link and sorted into relevant internship training cases, which is a typical project for students of relevant majors to improve their practical ability. Improving the speed of data processing, analyzing and processing data, and finally achieving accurate push are the advantages of big data scenarios. Through the relevant data collected in various teaching links, designing personalized information push or interaction in students' course selection, class, roll call and other links can enhance students' learning fun and feel the charm of big data in a pleasant scene. In the big data scenario, students will also express their feelings, put forward more new suggestions for the school, and promote the continuous improvement of teaching quality.

Based on the advantages of modern technology, more and more scholars have studied the teaching data quality early warning system. Reference [1] proposes a teaching data quality monitoring and early warning system based on the evaluation system. Under the guidance of the idea of monitoring and early warning and evaluation system, the system designs the framework of teaching data quality monitoring and early warning. The evaluation index system of monitoring and early warning is designed to get the monitoring results of teaching data quality. If the quality of teaching data is not ideal, an early warning will be issued. However, the early warning accuracy of the system still needs to be further improved. Reference [2] proposes a teaching data quality early warning system based on learning analysis technology, which analyzes the factors affecting the quality of teaching data and constructs a teaching data quality prediction model. Combined with naive Bayes, decision tree, feedforward back propagation neural network and support vector machine, the classification algorithms in data mining are used to predict and analyze the quality of teaching data, so as to complete the early warning of teaching data quality. However, the calculation process of this method is complex, resulting in the overall prediction time-consuming.

In view of the shortcomings of the teaching data quality early warning system, it is necessary to design an effective teaching quality early warning system. In computer science, artificial intelligence (AI) is sometimes called machine intelligence. It is the intelligence displayed by machines, in contrast to the natural intelligence displayed by humans and animals. Generally speaking, the term "artificial intelligence" is used to describe machines that imitate the "cognitive" functions associated with human thinking, such as "learning" and "problem solving". Based on the advantages of artificial intelligence, a computerized accounting teaching data quality early warning system based on artificial intelligence is designed.

2 The Hardware Design of the Computerized Accounting Teaching Data Quality Early Warning System

Before the hardware design of the system, first plan the overall framework of the system to help readers better understand the content of the article. The overall structural framework of the system is shown in Fig. 1.

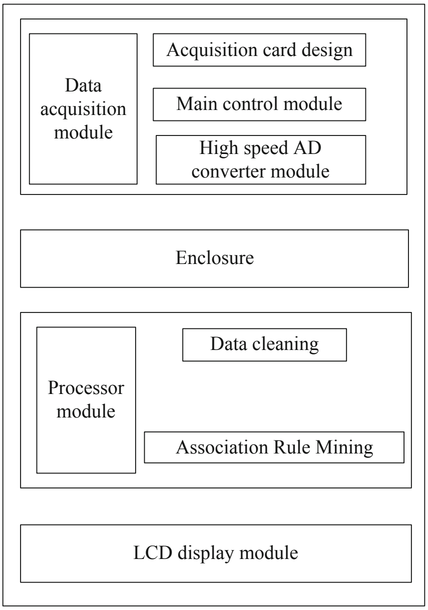

Fig. 1. Overall structure framework of the system

2.1 Data Acquisition Module

Design Scheme of Capture Card

At present, high-performance data acquisition cards based on PCI, CPCI, VME and other buses are not easy to reach 400 MB/s in actual maximum transmission rate. Therefore, in order to improve the efficiency of data acquisition as much as possible, designers use time-sharing work of acquisition and storage. Mode, the use of collection and transmission pipeline work, this method improves the collection efficiency to a certain extent, but when the signal density is very high, alternate sampling can not meet the requirements. Therefore, this paper proposes a design method for high-speed data acquisition based on PCIe bus technology, which achieves 8bit sampling accuracy, 6GSPS sampling rate, and also has real-time acquisition and transmission functions. The acquisition card can be used in conjunction with a high-speed signal processor to form Channelized digital storage oscilloscope. The design idea of this system mainly combines the design technical index requirements of the subject itself, and designs a high-speed data acquisition card. Two ADC083000 chips with a sampling rate of 3GSPS are alternately sampled in parallel time. The sampling clock is converted into a differential clock signal by the clock synthesis chip LMX2531 outputting a 1.5 GHz single-ended clock signal through the clock buffer/distributor LMK01010. The differential clock signal has two channels and there is a 90° phase difference. FPGA acts as the main control chip to receive the data sampled by the two ADCs and the synchronous clock signal. The data is processed by the internal memory of the FPGA and sent to the DDR2 SDRAM for temporary storage. Then PowerPC reads the stored data from the DDR2 SDRAM through the PCIe bus interface. After the data is processed by the PowerPC terminal, it can be displayed in a graphical form.

High-speed data is transmitted to the host computer through the bus. The design of the bus technology is the focus and difficulty of this subject. The reason for considering the use of the PCI Express bus is that the data transmission rate in this system has reached the GHz level. The earlier computer buses such as ISA, PCI simply cannot achieve such a high data transmission rate. The actual sampling rate of 6GSPS is temporarily stored in DDR2 SDRAM by means of speed reduction, and then read out and then passed through the FIFO buffer. The maximum data bandwidth can reach 1 GBytes, 4-channel PCIe The bus can also achieve 1GByte unidirectional effective data transmission, so it just meets the design requirements.

Main Control Module

In this design scheme, large-capacity high-speed data needs to be stored, transmitted and processed. The traditional single-chip microcomputer is far from reaching the design requirements, so we selected FPGA as the main control chip of the data acquisition card. FPGA has the advantages of supporting a variety of communication protocols and interface standards, and a short development cycle. With the development of semiconductor technology, its process level has reached 28 nm, which significantly reduces its static power consumption, thereby achieving a higher level of integration and better system performance.

Currently, the suppliers of FPGA chips on the market mainly include companies such as Altera, Actel, and Xilinx. Choosing a cost-effective FPGA chip in the design requires comprehensive consideration from the chip's performance, internal resources, and price. The necessary resources for this design scheme: PCIe interface, RoceketIO GTP transceiver, high-speed differential I/O interface, etc. Altera's Stratix II GX series and Arria GX series chips provide PCIe endpoint controller IP cores. However, although the Stratix II GX and Arria GX series have excellent performance, they are too expensive. Through comparison, they decided to use the high cost-effective Xilinx Virtex-5 series. XC5VLX110TFFG1136 chip, it can fully meet the design requirements [3], it has the following advantages:

1. The most advanced, best utilization, high-performance FPGA structure realizes true 6-input LUT technology, and has dual 5-LUT, 64-bit distributed RAM and SRL32/dual SRL16 options.
2. Powerful clock management module (CMT), each CMT contains 2 DCM modules and 1 PLL module, up to 6 CMT modules can be used, and a total of 18 clock generator components can be generated.
3. Provide a flexible 36 Kb Block RAM/FIFO, which can store up to 5328 Kb after cascading. This RAM contains programmable FIFO, and each Block RAM can be configured as two independent 18 Kb true dual-port RAM modules.
4. High-performance parallel SelectIO technology, single-ended HSTL and SSTL level standard rate can reach 800 Mb/s, differential LVDS level standard rate can reach 1.25 Gb/s, support high-speed memory interface, use TMChipSync technology active synchronization interface connection.

5. Flexible configuration options, providing SPI and parallel Flash interfaces, and automatic bus bandwidth detection.
6. Provide 16 pairs of RocketIO GTP transceivers with rates ranging from 100 Mb/s to 3.75 Gb/s [4].
7. Provide a PCI Express integrated endpoint module, which can be configured into x1, x4 and x8 channel bandwidth modes, in line with PCIe basic specification 1.1. When used with RocketIO transceivers, a complete PCIe endpoint can be realized with minimal FPGA logic resources.
8. Using 65 nm copper CMOS process technology, 1.0 V core voltage.

High-Speed AD Converter Module Realization

Another key module of the high-speed data acquisition card is the AD converter module. The design requires a digital storage oscilloscope with 6GSPS sampling rate and 1 GHZ bandwidth. It is currently difficult to buy a single-chip high-performance ADC chip that can achieve 6GSPS sampling rate. Therefore, the sampling rate of the system must be increased in an effective way to meet the design requirements.

The design method of time parallel alternate sampling can effectively improve the system sampling rate, has the advantages of easy implementation and low cost, and has been applied in actual design. The sampling rate of the final output that uses multiple ADCs to sample alternately in parallel is equal to the sum of the sampling rates of all ADCs. The following Figure uses M-chip ADCs to sample alternately in parallel.

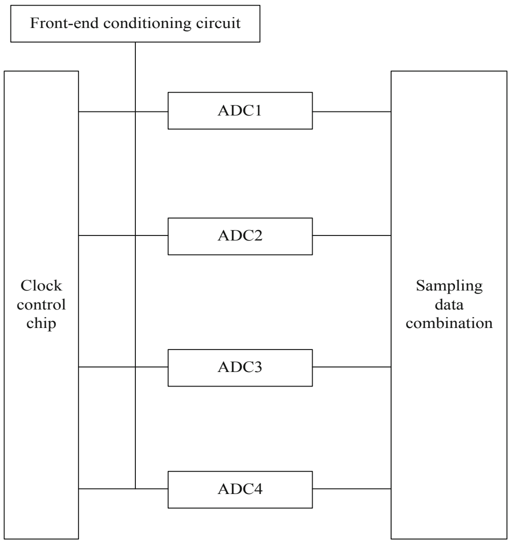

Fig. 2. Multi-chip ADC parallel sampling method

Among them, ADC1 ~ ADCM represent M AD converter units. The clock control chip generates M ADC input sampling clocks with the same phase offset. When the system starts sampling, all channels work at the same time, and each ADC operates on its own sampling clock. The input signal is sampled on the edge to achieve the purpose of increasing the sampling rate.

High-speed AD module design method, the choice of ADC chip directly affects the sampling rate and sampling accuracy of the system [5], ADC083000 is a low-power, high-performance, sampling accuracy of 8 bits, the highest sampling rate can reach 3.4GSPS Digital converter chip. In a 1.9 V power supply environment, the typical power consumption of a sampling rate of 3GSPS is only 1.9 W. It adopts a dual-channel structure. If a 1.5 GHz clock signal is input, it can sample on the rising edge and the lower edge of the clock at the same time to achieve a sampling rate of 3GSPS. The ADC contains a 1:4 multiplexer. By setting the DDR transmission mode, the output sampling rate is 1/4 of the sampling clock rate, which reduces the requirements for the processor interface speed. A piece of ADC083000 chip contains two AD converter units. The sampling rate of each converter unit is the same as the sampling clock frequency (ie 1.5 GHz). To achieve a 6GSPS sampling rate, four AD converter units are needed. That is, two ADC083000 chips. According to the method of calculating the phase offset of the input clock in Fig. 2, it is obtained that the sampling clock frequency phase difference of two adjacent AD converter units is 90 4/360, and the two AD converter units integrated inside the ADC083000 chip sample When the inherent phase difference is 180, the sampling clock phase difference of ADCA and ADCB needs to meet 90. The phase difference adjustment of the input sampling clock of the two ADC083000 chips can be realized by two schemes: one is through the programmable sampling clock phase adjustment function in the internal register of the ADC083000 chip, and the main control module controls its corresponding register through SPI communication; One is the implementation of external hardware. The external clock module is designed to generate a sampling clock sequence with a certain phase difference [6].

The first scheme must make the ADC chip work in the external control mode (Extended Mode), the register addresses Dh and Eh correspond to the fine and thick lines of the phase adjustment of the sampling clock signal, and the phase of the sampling clock in the coarse and fine adjustment modes is shifted. Coding. The clock phase shifts by 90, which is equivalent to a 166.7 ps shift of the clock edge. The LSB of the thick bar is close to 70 ps, so the code of the thick bar is "0010", and the thin bar is a non-linear adjustment. You need to keep trying to get a satisfactory clock phase difference. The debugging code range is 128–256. The only disadvantage of this method is that the manual debugging workload is relatively large [7].

2.2 Storage Module Design

High-speed data acquisition system must consider the design of data storage. The limited memory resources inside FPGA cannot meet the real-time requirements for high-speed and large-capacity data processing. How to design external memory effectively and reasonably has become another key issue in the design of this program. Compared with DDR SDRAM, DDR2 SDRAM can provide twice the memory bandwidth of the latter. DDR2 can be accessed in parallel [8], and can process 4bit data in each clock cycle. That is to say, the read/write speed of DDR2 is 4 times that of the external bus clock. DDR2 uses on-chip ODT technology, so the terminal does not need to be connected.

Matching resistance. MICRON's memory module model MT16HTF25664HY-667E1 has a storage capacity of 2 GB and a module bandwidth of 5.3 GB/s. The internal memory module is actually cascaded and expanded by 8 chips with a capacity of 1 Gb and model MT47H128M8 DDR2 SDRAM [9], with a 200-pin SODIMM package, the module has 14 address lines, 64 data lines and other control lines. The main pin usage instructions are shown in the following Table 1:

Table 1. Instructions for the main pins of MT16HTF25664HY

Serial number	Name	Describe
1	A0–A13	Address input, which provides the row or column address to be accessed and is responsible for transmitting the control word to the mode register during initialization
2	BA0–BA2	Bank address input to determine the Bank address to be accessed
3	CK0/CK0# CK1/CK1#	Differential clock input, all control signals and addresses are latched on the rising edge of clock CK
4	CKE	The clock enable signal is active at high level, enabling the internal clock, input buffer and output buffer of the chip
5	DM0–DM7	Write data mask, high level active
6	ODT	On-chip terminator, when ODT is valid, matching signals will be added to the chip, including DQ, DQS, DQS#, DM and CB
7	RAS#, CAS#, WE#	They are: row address selection signal, column address selection signal and write enable signal
8	DQ0–DQ63	Bidirectional data input/output bus
9	DQS0/DQS0#–DQS63/DQS63#	Read/write data strobe signal, when writing data, the controller sends out the DQS signal and aligns with the write data center; when reading data, the memory sends out the DQS signal and aligns with the edge of the read data

Using a single DDR2 memory module MT16HTF25664HY-667E1 alone cannot meet the storage requirements of the highest 6GSPS sampling rate, so the simpler way is to use two identical DDR2 memory modules. The highest sampling rate of each AD chip is 3GSPS, which is reduced to 187.5 MHz 64 bits data stream by the internal IDDR module of FPGA, so the clock input of DDR2 SDRAM memory module must be greater than 187.5 MHz, DDR2 SDRAM can receive AD sampled data and apply it Perform complete and loss-free storage.

2.3 Processor Module Design

The MS320F281x series of digital signal processors is a digital signal processor recently launched by TI. This series of processors is a fixed-point digital signal processor based on the TMS320C2xx core. The device integrates a variety of advanced peripherals, and the codes and instructions are fully compatible with the F24x series of digital signal processors. The F28x series of digital signal processors have improved the calculation accuracy (32 bits) and the processing capacity of the system [10] (up to 150 MIPS) The main features of F2812 are listed below:

(1) Using high-performance static CMOS technology, the main frequency reaches 150 MHz (clock cycle 6.67 ns), 1.9 V core low-voltage design;
(2) High-performance 32-bit CPU, Harvard bus structure, 4 MB program/data addressing space, efficient code (using C/C++ or assembly language);
(3) Storage space: 18 kX 16-bit 0-waiting period on-chip SRAM and 128 k × 16-bit on-chip FLASH (access time 36 ns), 3 independent chip selection signals, expandable 1 MB storage space;
(4) Rich on-chip peripherals:

Two event managers EVA and EVB, each event manager includes timer, comparator, capture unit, PWM logic circuit, quadrature encoding pulse circuit and interrupt logic circuit, etc.;

A 12-bit, pipelined analog-to-digital converter ADC (Analog-to. Digital Converter) with two 8-to-1 multiplexers and dual sample/hold devices;

The conversion time of a single channel is 80 ns, so the maximum sampling rate of DSP can reach 12.5 MHz;

Three 32-bit CPU timers;

2 asynchronous serial communication interfaces SCI;

A high-speed synchronous serial interface SPI; an enhanced CAN interface with a high communication rate up to IMbps;

6 independent programmable, multi-purpose general-purpose input/output (GPIO) pins;

Three external interrupts, the expandable peripheral interrupt module supports 45 peripheral interrupt sources;

Working environment temperature: 40–85 °C.

2.4 LCD Display Module

The liquid crystal display module in the design of this node adopts the 12864 series built-in font display module produced by Jinpeng Electronics Co., Ltd. The pins and specific function diagrams of this series of modules are shown in Table 4–1. The module provides three control interfaces: 8-bit microprocessor interface, 4-bit microprocessor and serial interface. All functions including display RAM and font generator are contained in a chip, and only a micro-processing system is required to operate the module. The multi-function operation instructions include: screen clear, display switch, cursor return, cursor shift, cursor display or hide, display shift, vertical screen rotation, standby mode and reverse display instructions. The built-in Chinese font ROM (CGROM) in the module can provide 8192 Chinese fonts, the built-in font generation RAM (CGRAM), the half-width font ROM (HCGROM) provides 126 symbol font display, and the drawing display screen provides a 64 The drawing area (GDRAM) of × 256 dots can be mixed and displayed with the text screen.

LCD module pins are shown in the following Table 2:

Table 2. LCD module pins

Pin	Name	Instruction
1	VSS	Power ground (0 V)
2	VDD	Working voltage (+5 V)
3	VO	Floating (LCD drive voltage input)
4	RS(CS)	Parallel mode: H: data L: instruction Serial mode: chip select control, high effective
5	R/W(STD)	Parallel mode: H: read status L: write status Serial mode: data signal input
6	E(SCLK)	Parallel mode: enable control, high efficiency Serial mode: clock signal input
7	DB0	Data 0
8	DB1	Data 1
9	DB2	Data 2
10	DB3	Data 3
11	DB4	Data 4
12	DB5	Data 5
13	DB6	Data 6
14	DB7	Data 7
15	PSB	Serial and parallel mode selection: H: parallel port L: serial port
16	NC	Empty foot
17	/RST	Reset control signal input, low effective
18	LEDA	Backlight positive (+5 V)
19	LEDK	Backlight negative (0 V)

In the design of the display module, first define the input and output ports of the module and the required register variables, and then define the LCD state machine constants. Divide the input 50 MHz clock to meet the LCD data setup time. The liquid crystal display drive control process includes setting the function to an 8-bit data parallel input interface, turning on the display, clearing the display content, setting the cursor state, setting the display position, displaying communication data, and setting the data bus to a high-impedance state to end the display. Release its control.

3 Software Design of Computerized Accounting Teaching Data Quality Early Warning System

3.1 Data Cleaning

The main work of data cleaning is to deal with the dirty data in the original data that cannot be analyzed directly. It mainly includes: vacancy value, abnormal value and duplicate value. If these data are directly substituted, there will be many problems in the mining process. This paper uses the following methods to deal with these dirty data. The first is the processing of data vacancy value. The vacancy value is mainly reflected in the loss of the original data record and the loss of a field information in the record, both of which will have an impact on the final result analysis. Generally speaking, the processing of missing values can be divided into deleting missing value records and interpolating possible values. The method of deleting missing values is simple and efficient, but it affects the integrity of data and causes the loss of many valuable information. In this paper, Lagrange interpolation method is used to fill the consumption amount field of student all-in-one card with more vacancy values. The lack of score field is mostly caused by the student's abandonment of the exam. For this part of data, this paper uses the average scores of all other courses to fill in to minimize the impact on the final result: for other fields, because there are few missing and relatively unimportant, this paper directly deletes these fields. After cleaning the student data by the above methods, a relatively more reasonable and clean student data is obtained as the data source for the subsequent feature extraction steps.

3.2 Associated Data Mining

Association rule mining is one of the important research methods in the field of data mining. It is widely used in the fields of e-commerce, medicine, finance, education and so on. Association rule mining is mainly to mine the hidden association relationship between different commodities by analyzing transaction data, so as to guide merchants' decision-making. Then, according to the different data characteristics faced by different fields, many researchers at home and abroad divide association rules into Boolean association rules, data flow based association rules, graph based association rules, sequence based association rules and so on. This paper mainly uses Boolean association rules. The following focuses on its related definitions and related optimization algorithms.

In unweighted data mining, the frequency of itemsets in the transaction database is taken as the support, that is:

$$\sup(I_1, I_2) = P(I_1, I_2) = n_1/n \tag{1}$$

In the above formula, n represents the total number of transaction records.

On this basis, calculate the vertical weighted support:

$$\sup_{v} = \frac{\sum_{n}^{i=1} V_i Count(X_i)}{N_v} \tag{2}$$

In the above formula, $Count(X_i)$ represents the number of itemsets.

On this basis, the early warning is carried out. On the early warning, the threshold is mainly set, and the moving weighted average algorithm is applied to the adaptive threshold setting. Considering the historical data, the statistics at the current time are expressed as:

$$R_t = \lambda B_t + (1 - \lambda)R_{t-1} \tag{3}$$

In the formula (3), λ represents the comprehensive influence parameter, R_t represents the influence parameter of each indicator on the early warning index up to the period t, and B represents the weighted average parameter.

On this basis, the expected value and variance of statistics are expressed, and the calculation formula is:

$$\begin{cases} \mu_{R_t} = \mu_{B_t} \\ \sigma_{R_t}^2 = \frac{\sigma_{B_t}^2}{n_s}\left\{\frac{\lambda\left[1-(1-\lambda)^{2t}\right]}{2-\lambda}\right\} \end{cases} \tag{4}$$

In formula (5), μ_{B_t} represents the average value of the current data, $\sigma_{B_t}^2$ represents the standard deviation of the statistical data, and n_s represents the length parameter of the data sampling.

At this time, the detection threshold calculation formula varying with equipment failure is expressed as:

$$q_i = Q + n_v A \tag{5}$$

In formula (5), Q is the monitored normal data value, A is the data judgment parameter, and n_v is the threshold judgment parameter of the v data.

In the specific event analysis process, if there is an abnormal situation, it will exceed this threshold and give an early warning, so as to realize the early warning of computerized accounting teaching data quality based on artificial intelligence.

4 Experimental Comparison

In order to fully verify the effectiveness of the proposed computerized accounting teaching data quality early warning system based on artificial intelligence, the comparative experiment of this system with reference [1] and reference [2] system is carried out under the same experimental environment. In order to ensure the preciseness of the experiment, the teaching quality data of each subject in the school for a whole academic year were collected as the sample data of the experiment.

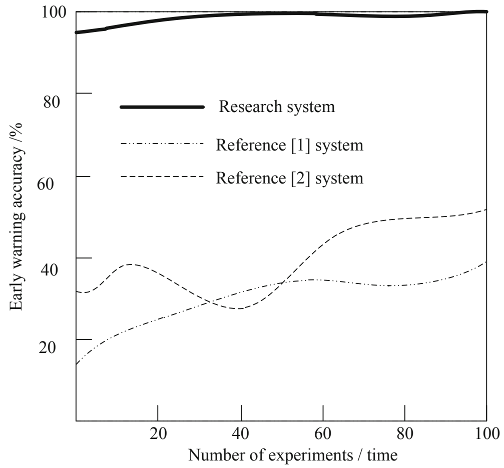

Fig. 3. Comparison of data quality warning accuracy

4.1 Comparison of Data Quality Warning Accuracy

The following Fig. 3 shows the comparison results of the early warning accuracy of the proposed system with reference [1] and reference [2] systems:

Based on the above figure, the accuracy of the proposed teaching data quality early warning system is higher than that of the two literature comparison systems.

4.2 Comparison of Data Quality Warning Time

The following Fig. 4 shows the comparison results of the alert time of the three systems.

It can be seen from the above figure that after applying the teaching data quality early warning system studied, the early warning time is significantly reduced, and the quality problems of teaching data can be found in time. Compared with reference [1] and reference [2], the early warning time of this system is significantly reduced, which effectively solves the existing problems of the system.

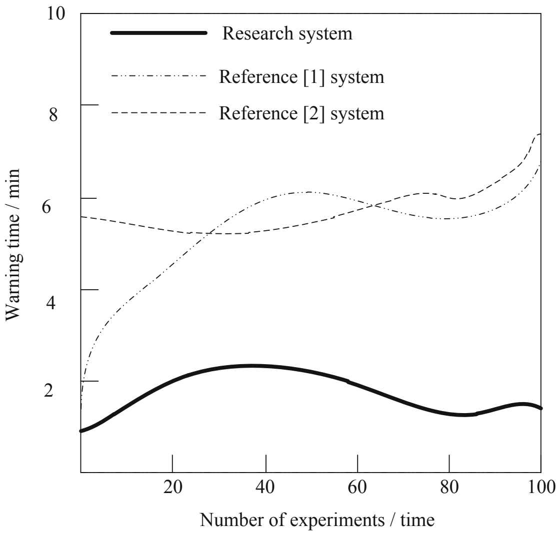

Fig. 4. Comparison of data quality warning time

5 Conclusion

In order to improve the teaching quality, this paper puts forward and designs an early warning system of computerized accounting teaching data quality based on artificial intelligence, and verifies the performance of the system from both theoretical and experimental aspects. The system has higher early warning accuracy and shorter early warning time when carrying out the early warning of computerized accounting teaching data. Specifically, compared with the system based on evaluation system, the early warning accuracy of this system is significantly improved; Compared with the system based on learning analysis technology, the early warning time of this system is significantly shorter. Therefore, this system can provide great help for improving the quality of computerized accounting teaching data. However, due to the limited research time, the proposed method still has shortcomings, and further research is needed in the follow-up study.

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Performance Evaluation Model of Substation Battery Pack Based on New Series Parallel Topology

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Abstract. Because the traditional substation battery performance evaluation model has some problems, such as the fuzzy structural characteristics of the substation battery, resulting in excessive corrosion rate, this paper designs a new substation battery performance evaluation model based on the new series parallel topology. Obtain the performance parameters of the battery pack, predict the operation performance and failure of the battery, calculate the relationship function between open circuit voltage and electrolyte density, identify the structural characteristics of the battery pack in the substation, optimize the voltage regulation strategy of the high-frequency scheme, charge according to the specified constant current, calculate the amount of electricity released by the battery in the discharge process, and build a performance evaluation model with a new series parallel topology. The experimental results show that, compared with the other two traditional evaluation models, the corrosion rate of the substation battery performance evaluation model proposed in this paper is the lowest, with an average value of 3.269, which shows that the substation battery performance evaluation model described in this paper has better performance and certain effectiveness.

Keywords: Series parallel connection · New topology · Substation · Battery pack · Power grid · Performance evaluation

1 Introduction

As a backup power supply, the battery mainly provides emergency power for the equipment in the power system. Its own working stability and operation and whether the equipment is good or not are directly related to the safe operation of the power system. At present, battery pack is widely used in various industries. The research on battery performance evaluation technology has become an important research direction of researchers and related research institutions at home and abroad, and has developed a variety of related products. However, since the battery was installed and put into use, it was lack of relevant operation and maintenance and effective management, and it was often not repaired in time during use. In the battery pack, the single battery is often not charged in time and the capacity decreases, resulting in the capacity and service life of

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the whole battery pack [1, 2]. In the performance evaluation of battery, the accurate measurement of battery capacity is the key to judge its health status. However, the capacity of battery is related to a variety of complex factors, and the calculation of capacity has always been a difficulty in the industry. Therefore, the calculation of battery capacity is generally inferred comprehensively by using the characteristic parameters of battery. More seriously, it leads to the failure of the whole backup power supply system and the collapse of the whole power supply system. Therefore, the premise of performance evaluation of battery is to obtain its accurate working characteristic parameters. In the substation, after the main transformer bus of the battery pack is powered off, the battery will be used as an emergency power supply to ensure the safe operation of the equipment. At present, most of the performance evaluation of the battery still adopts the traditional manual method, which requires maintenance personnel to go to the battery site for discharge test or conductivity measurement. Discharge test is the most direct method to calculate the battery capacity, but the operation process is very cumbersome. During the test and calculation, the battery must be separated from the power supply system for offline discharge, Long operation time and high risk. Since the battery pack plays a great role, the stable operation of the battery is very important for the power supply system. Conductance test method uses specific measuring instruments to take the measured conductance value as the index of performance evaluation, but the accuracy is not high. The battery pack itself has a certain maintenance free feature, which is often misunderstood by many users as that the battery does not need maintenance during use. In fact, no device can be maintenance free, especially the battery. In recent years, many research experts and scholars in related fields at home and abroad have systematically studied the evaluation technology of battery pack and made great scientific research progress. In China, relevant scientific research institutions and companies of battery have developed a variety of internal resistance detection equipment to judge the health status of battery by measuring its internal resistance.

Luo Ping and other scholars have carried out a series of studies on the interaction of nickel-hydrogen battery, constructed the capacity decline model and voltage decline model of the battery, and obtained the performance change trend of the battery pack, but ignored the problem of the structural characteristics of the battery pack in the substation [3]. Fan Xinxin and other scholars proposed an online detection method based on fuzzy logic to predict SOH. The principle is to judge the state of the battery pack based on the linear relationship between the amount of charge and the open circuit voltage, but the problem of the structural characteristics of the battery pack in the substation is not addressed. Detailed study [4]. Therefore, it needs to be discussed in depth.

2 Performance Evaluation Model of Substation Battery Pack Based on the New Series-Parallel Topology

2.1 Obtaining Battery Pack Performance Parameters

The plastic tank of the substation battery is the plastic shell used to hold the discharge solution and fix the pole group. Generally, ABS synthetic resin composed of three monomers of acrylonitrile (A), butadiene (B) and styrene (S) is used. Or made of flame-retardant plastic, it is also used to protect the internal structure of the battery from external forces. Due to the different materials and packaging processes used in the production and processing of batteries, as well as the complexity of a series of chemical reactions generated inside the batteries, there are great differences between the characteristics of substation batteries. The battery uses a special lead-free calcium alloy to replace the lead-antimony alloy in the traditional substation battery. Self-discharge. So far, no one has invented a method to accurately determine battery performance, which can predict battery performance and failure in advance. The separator generally uses ultra-fine glass fiber material, which can inhibit the precipitation of hydrogen to a certain extent and has a higher efficiency. The oxygen released from the positive plate during the charging of the substation battery can circulate to the negative electrode more quickly [5]. The terminal voltage of the substation battery when the positive and negative poles are not connected (open circuit state) is called the open circuit voltage, but it is not a balance difference. Due to the high degree of reversibility of the battery, the open circuit voltage is approximately equal to the electromotive force of the battery. The open circuit voltage of the battery is usually expressed by H, the unit is volts, and the specific expression is:

$$H = \frac{\sum (1 - \delta)^2}{P} \tag{1}$$

In formula (1), P represents the positive electrode potential of the battery, and δ represents the negative electrode potential of the battery. At present, the widely used open-type acid-proof explosion-proof lead-acid batteries have been used in large quantities, and have been widely used in many industries, such as in finance, transportation, power and communication industries. At the same time, the separator has a good adsorption function for sulfuric acid electrolyte, so even if the battery is dumped, there will be no electrolyte leakage. This open type anti-acid explosion-proof lead-acid battery can measure the terminal voltage, quickly check the battery's liquid level, temperature and other parameters to understand the status of the battery. There is a safety valve on the top of the storage battery of the substation, so that the air pressure inside the storage battery of the substation is always maintained within the safe pressure range [6, 7]. However, because the battery pack has its own airtightness, it is impossible to know whether the battery is operating normally without seeing changes in the liquid level and electrolyte density inside the battery. The entire battery is a sealed structure, which will not leak acid or emit acid mist, so as to achieve the purpose of safety and environmental protection. At present, the measurement method of whether the battery operates stably is mainly determined by measuring the terminal voltage, capacity and internal resistance when the battery is discharged. The process of storing and releasing electric energy in the battery is completed by the electrochemical reaction inside the battery. Sulfuric acid solution). In normal use, especially in the floating charge state, the method of measuring the terminal voltage cannot truly reflect the battery performance state. Sometimes the qualified voltage value will be measured in the floating charge state, but if the power is cut off, the battery In the case of discharge, emergency use cannot be guaranteed. In the process of battery charging and discharging, the reaction mechanism on its plates is often discussed in bipolar sulfate theory.

2.2 Adjust the Substation Operation Management Process

The substation usually adopts advanced sensing, information, communication, control and other technologies, based on intelligent equipment, standardized information platform and highly integrated system, to realize the functions of substation real-time panoramic monitoring, automatic control and protection, collaborative interaction with off-site systems, so as to improve the operation reliability of the substation, optimize the utilization of assets and reduce manual intervention, Substation supporting safe operation of power grid and flexible access and exit of renewable energy. The substation operation management mainly includes four items, as shown in Fig. 1:

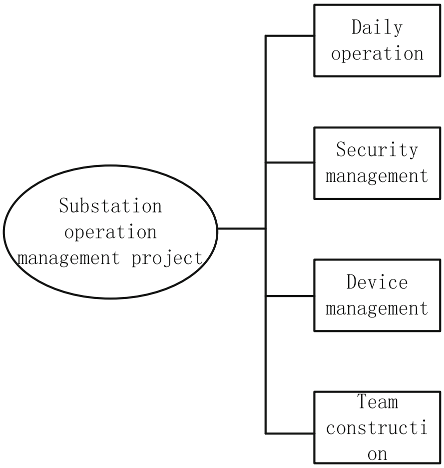

Fig. 1. Main items of substation operation management

According to Fig. 1, the substation operation management mainly includes four parts: daily operation management, safety management, equipment management and team construction. Among them, daily operation management mainly refers to the duty management of employees in the station, shift management, the implementation of rules and regulations, accident handling, equipment inspection, technical data and drawing management. The substation has three main characteristics: one is the intelligence of primary equipment, the other is the digitization of information and signal of digital substation, and the third is the advanced application function. Intelligent substation is based on fully intelligent equipment and fully intelligent measurement and control. It has the functions of intelligent monitoring of substation equipment, online early warning of power supply safety, automatic identification of weak links and so on. Safety management mainly refers to the formulation of safety objectives, accident emergency repair, switching operation, safety records, configuration and storage of safety appliances, dangerous goods management, formulation and implementation of anti accident measures, etc. The main workplaces for equipment management are shown in Fig. 2:

It can be seen from Fig. 2 that the specific work of substation equipment management includes relay protection equipment, equipment fire prevention and defect management,

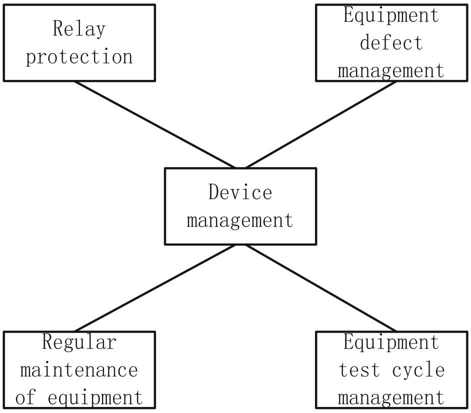

Fig. 2. Schematic diagram of substation equipment management

equipment regular maintenance management, equipment test cycle management, etc. At present, the main technical features of the intelligent substation are the digitization of the whole station information, the intellectualization of primary equipment, the standardization and networking of communication platform, the communication network of industrial ec61850 standard based on Ethernet and the automatic operation management system. Team construction mainly includes civilized production, station appearance management, environmental greening, equipment, appliances, site cleanliness, etc. In addition, the switching operation in daily operation is the most complex and cumbersome work in the substation. Its workload is large, the work steps are orderly and rigorous, and it is one of the contents that the personnel on duty are most likely to make mistakes in their work. The implementation form is mainly based on "digital substation". Based on the digitization of information signals in digital substation, the integration of real-time on-line monitoring, condition based maintenance and intelligent operation is realized, including the application of intelligent equipment, on-line monitoring and secondary equipment. In the active scheme, the high-voltage partial voltage generally adopts three types: resistance partial voltage, capacitance partial voltage and inductance partial voltage. The former two are mainly used in low voltage, and the latter is widely used in traditional high voltage transformer. According to the principle of capacitive voltage division, A_1, A_2 Indicates high and low voltage capacitors of voltage divider, The measured high voltage is applied to both ends of the high voltage capacitor A_1, Then the smaller voltage on the low voltage capacitor is:

$$K = \frac{\sum A_1}{A_1 + A_2} \times \varphi \tag{2}$$

In formula (2), φ represents the relative accuracy of the capacitor. Switching operation needs to change the operation mode and operation state of electrical equipment. In case of misoperation accident, it will directly lead to equipment damage, endanger personal safety and cause large-scale power failure. Highly integrated equipment: facing the needs of smart grid, pay attention to strong, safe, reliable, integrated and advanced interactive functions. The construction of substation is not only the basis and important part of establishing smart grid, but also the core of realizing intelligent operation of power grid. When the incident light passes through the electro-optic crystal, the light wave will be birefringent under the action of electric field. After transmission through the crystal, the phase difference between the two linearly polarized light waves is directly proportional to the measured voltage q. Namely:

$$I(q) = \begin{cases} \sum \frac{\pi q}{q_e} \\ \frac{\frac{\pi q}{1}}{2gd} \end{cases} \tag{3}$$

In formula (3), g represents the refractive index of the crystal, d represents the electro-optic coefficient of the crystal, and e represents the wavelength of the input light. According to formula (3), the phase difference between polarized light waves is directly proportional to the measured voltage. Electro optic crystal opt detects the light intensity of two polarized lights modulated by electric field through polarizing beam splitting prism. The transfer function of electric field sensitive system can be expressed as:

$$M = \begin{cases} \frac{D_0 W}{2} \\ 1 + \kappa \cos\left(\frac{1}{W} + \kappa_0\right) \end{cases} \tag{4}$$

In formula (4), D_0 represents the incident light intensity of the two detectors, W represents the input electric field intensity, κ represents the coefficient related to the optical path system, and κ_0 represents the applied electric field intensity when the phase of polarized light changes. The importance of switching operation is self-evident. Substation is the most grass-roots and active team of power supply company, and the team construction is the foothold and specific practitioner of each work. The characteristics of small organizational structure, less staffing, complex daily work and strong personnel cooperation make the team construction the basic point of other production work in the substation. However, the intelligent development of primary equipment lags far behind the intelligent technology of automation and secondary equipment. The intelligent development of primary equipment often relies on additional equipment to access the secondary system and then form an intelligent regulation function. The working attitude and sense of responsibility of team members not only rely on rules and regulations and employment mechanism to motivate and restrict, but also must be stimulated with the help of good team construction work. At present, the application of all optical fiber electronic transformer is still in the trial and initial stage, especially the optical fiber PT is only in the network operation stage. In the exploration and test correction stage of operation and maintenance management of intelligent substation, it is necessary to constantly innovate the operation management mode and explore the maintenance test method. The quality of team construction directly affects the enthusiasm of personnel at various posts in the substation and the cohesion and centripetal force in the substation. Good team construction is the basis for realizing the efficient completion of various operation management work and the primary premise for doing a good job of substation operation management. Accumulate operation and maintenance experience of intelligent equipment through practice. It lays a solid practical foundation for comprehensively spreading the operation of substation. On the other hand, the operation of the secondary system is relatively stable, which is improved and deepened on the basis of the application of the traditional substation secondary system. At present, there is a unified standard of IEC61850. Substation equipment inspection is an important part of the operation management process. It is an essential basic work to check the operation status of equipment, master the operation law of equipment and ensure the safe operation of equipment. Equipment patrol inspection includes normal patrol inspection, comprehensive patrol inspection, special patrol inspection and light off patrol inspection. The whole substation management system has gradually matured. It is generally divided into station control layer, process layer and interval layer. On the premise of checking the inspection cycle and comprehensively analyzing the dangerous points and safety measures, reasonably divide the work and be familiar with the inspection circuit diagram, comprehensively include all operating and standby equipment and their accessories into the inspection scope, and inspect the equipment to ensure the arrival rate of equipment inspection. In the future, with the continuous development of intelligent primary equipment, the original R & D and manufacturing pattern of intelligent primary and secondary equipment will develop in the direction of organic combination of primary and secondary equipment science. The boundary between primary and secondary equipment will become increasingly blurred. The substation and centralized control center on duty shall conduct normal patrol four times a day. Each unit shall adjust the patrol time appropriately according to the actual situation of the region, conduct comprehensive patrol once a week, and turn off the light once a week. The comprehensive patrol inspection of unattended substation shall be conducted once a week, and the patrol inspection with lights off shall be conducted once a week. There are secondary equipment in the primary equipment. The functions of the secondary equipment are integrated with those of the primary equipment to form a unified equipment unit, which depends on each other, integrates and restricts each other. Based on the above description, complete the adjustment of substation operation management process.

2.3 Identify the Structural Characteristics of the Battery Pack in the Substation

When the substation battery is charged with DC, the electric energy will be converted into chemical energy and stored in the battery, which is opposite to the discharge process. The state of charge of the battery can be seen through the change of electrolyte. The main realization process is that when the battery is charged, after the external power supply is connected, many ions and other substances on the positive and negative electrodes that disappear during the discharge process will slowly recover with the increase of charging time. At this time, the lead sulfate particles finely distributed on the positive electrode will be decomposed and oxidized into lead dioxide. At the same time, the lead sulfate on the negative electrode will be reduced into sponge metal lead. At this time, the concentration of electrolyte in the substation battery gradually increases, which indicates that the active material in the battery has been reduced to a state that can supply power again. During this charging process, the sulfuric acid components in the electrolyte of the substation battery will increase accordingly, so the increase of these components will lead to the rapid reduction of the water molecules of the battery, and the electrolyte concentration will increase accordingly. Through these changes, we can quickly judge the charging condition of substation battery. There is a certain relationship between the open circuit voltage of the battery and the electrolyte density, and its relationship function can be approximately expressed as:

$$l = 1.85 + 0.917 \sum \frac{1}{(\alpha + \beta)} \tag{5}$$

In formula (5), α represents the density of the electrolyte at the temperature of the battery, and β represents the density of water at the temperature of the battery. If the degree of sealing is high, the electrolyte is absorbed in the high-porosity separator like a gel and will not flow easily, so the battery can be placed horizontally. The internal resistance of a substation battery is usually composed of ohmic resistance and polarization resistance. The grid of the substation battery adopts antimony-free lead alloy, and the self-discharge coefficient of the battery is very small. The internal resistance of the battery is not a constant, it is related to a variety of complex factors, the value of the internal resistance will change with the changes of the internal electrolyte concentration, internal active material, working environment temperature and other factors during the charging and discharging process of the battery.. The positive and negative plates of the substation battery are completely surrounded by the isolation plate, the effective material is not easy to fall off, and the service life is long. The volume of the substation battery is smaller than that of the old battery, but the capacity is higher than that of the old open type battery. The ohmic resistance of the battery follows the general Ohm's law, which is mainly related to the internal electrolyte concentration, the number of electrodes, the resistance of all components such as the positive and negative poles of the battery, the separator, and the connecting strip. It is less affected by the external environment, so it is always fixed. Value. The battery does not need to be supplemented with any liquid during long-term operation, and at the same time, it usually does not produce acid mist or gas during use, and the maintenance workload is very small. The internal resistance of the battery is small, and the characteristics of large current discharge are good. The internal polarization resistance of substation battery includes electrochemical polarization resistance and concentration polarization resistance, which are generated by battery polarization. In appearance, corrosion or protrusion of the battery poles, deformation of the casing, and acid mist overflow around the safety valve can all reflect the performance degradation of the battery. During the charging and discharging process of the battery, the internal electrochemical reaction continuously changes the ion concentration in the electrolyte, so there is a certain relationship between the polarization resistance and the current density, which increases linearly with the increase of the logarithm of the current density. The working temperature of the battery rises, and the measurement of the working temperature can only measure the temperature of the battery shell at the current maintenance level. The degradation of battery performance is mainly reflected in the abnormality of internal parameters: the battery voltage is too high or too low, the internal resistance value is too large, and the capacity is reduced. The parameter value provides a data basis for battery performance judgment. The performance of the battery is ultimately reflected in the life of the battery, but this is the most difficult place to test.

2.4 Optimize the Voltage Regulation Strategy of the High-Frequency Solution

In the primary stage of the development of high-voltage DC, whether linear high-voltage power supply scheme or switching high-voltage power supply scheme is selected, its control circuit is built by analog controller. Under this control scheme, the high-voltage DC power supply can only output a single power. At present, most of the valve regulated lead-acid batteries used in substations are generally composed of 2 V single batteries in series. If you want to supply power to different types of laser tubes, you need to change its output power, and it can only be realized by changing its hardware parameters. The general operating voltage levels of the substation battery pack are 48 V (Communication battery pack), 110 V and 220 V (secondary equipment battery pack in the station), and the capacity of the battery is determined according to the different load currents of 110 kV, 220 kV and 500 kV substation equipment. This limitation limits the development of the universality of laser power supply, that is, a laser power supply can only be used to drive the corresponding type of laser. During the operation of the storage battery in the substation, the floating charge mode is adopted. Under the floating charge mode, the number of circulating charge and discharge of substation battery is less, especially after the self discharge or shallow discharge of substation battery, it can quickly supplement power, reduce the conversion times of positive and negative active substances, and have a long service life. With the increasing maturity of microelectronics technology, digital control chips are gradually widely used in the control field. Digital control chips are also used in the control circuit of high voltage DC power supply. When the whole battery is charged in series, if there is one or several abnormal failed batteries in the battery pack, when the charger charges the battery pack, the failed batteries will soon reach saturation state and normal voltage because of their weak charging capacity. This paper introduces the digital analog hybrid control, that is, the control loop still adopts the analog loop, but its benchmark is given by the digital control chip. It is the same as all digital control, that is, both loop and reference are controlled by digital chip [8–10]. The application of digital control technology in the field of high-voltage DC power supply makes the high-voltage DC power supply realize different output power in a certain range without changing hardware parameters within the allowable range of load power. The newly installed battery pack shall be charged according to the specified constant current. After the battery is fully charged, it shall be discharged according to the specified constant current until one of them is discharged to the termination voltage. Calculate the capacity according to the following formula:

$$S = \frac{I_{\varepsilon} - r}{T} \tag{6}$$

In formula (6), I represents the capacity of the battery pack, ε represents the constant discharge current, r represents the discharge time, and T represents the rated capacity. The remaining batteries in good condition cannot get enough power. At this time, if the capacity test is not carried out in time to find and remove the failed batteries, the service life of the battery pack will be shortened, and the capacity for accidental discharge will also be weakened, which indirectly affects the safe and stable operation of the power supply system. When the battery pack undergoes a charge discharge cycle, the capacity of the faulty battery will be used as a reference. In this way, after several vicious cycles of charge and discharge, the capacity will continue to decrease and the battery backup time will become shorter and shorter. The voltage regulation control strategy of the high-frequency scheme is shown in Fig. 3:

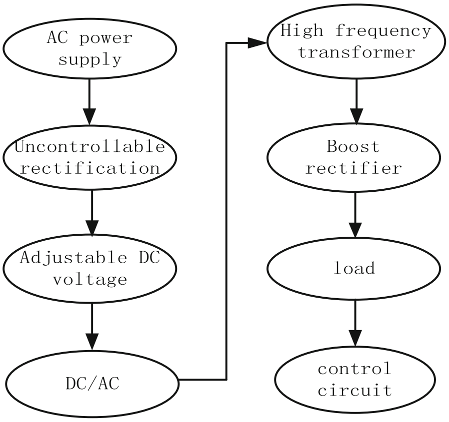

Fig. 3. Schematic diagram of the voltage regulation control strategy of the high-frequency scheme

As can be seen from Fig. 3, the choice of digital control strategy makes it have a certain range of versatility. After selecting the digital control technology, the control circuit can be greatly simplified. What is more valuable is that it provides the possibility for the application of more complex control algorithms, that is, it increases the controllability of the system and achieves a more precise output of the system. At this time, the charging opportunity automatically judges that the charging work of the entire battery pack has been completed and automatically switches to floating charging operation, which becomes the constant voltage and trickle current charging of the battery pack. In particular, the application of microprocessor ARM, DSP and FPGA has greatly improved the integration of high-voltage DC power supplies, and at the same time further improved the controllability of the system, making the output voltage and output current of the high-voltage DC power supply higher The stability.

2.5 Series-Parallel New Topology Construction Performance Evaluation Model

Under the new series parallel topology, the internal resistance of the battery also indicates the degree of battery aging. The battery aging process is related to the damage rate of the materials and components constituting the battery under the battery design conditions. With the increase of the service time of the battery, the corrosion of active substances on the plate, the falling off of active substances, the corrosion of connecting strips, the sulfation of the plate, the deformation of the plate, the water loss of the battery and other factors will reduce the capacity and increase the internal resistance of the battery, R is the internal resistance, and its calculation formula is:

$$R = \frac{\rho \cdot L'}{S'} \tag{7}$$

In formula (7), ρ represents the resistivity of the resulting material, L' represents the length of the conductor, and S' represents the area of the cross section of the conductor. Corrosion: the bus bar and positive and negative grid of the battery are corroded by sulfuric acid, resulting in an increase in the internal resistance of the battery. Grid creep: the grid creep caused by incomplete oxygen recombination reaction during charging, corrosion and battery aging will cause the active substance (paste) to loosen from the grid structure, resulting in high resistance on the connection. The natural process of the battery entering the end of life is a very slow process of grid and connection corrosion, loosening of the combination between paste and electrode plate and drying of electrolyte [11]. In practical application, in order to calculate the capacity of the battery, users often calculate the capacity of the battery by integrating the current with the discharge time. The amount of electricity released by the battery during discharge can be expressed as:

$$F(\eta) = \int_0^{\eta} \left(U - \frac{1}{\eta} \right) \tag{8}$$

In formula (8), U represents the discharge current, and η represents the time it takes for the discharge to reach the corresponding termination voltage. The sign of the battery aging process is the increase of battery internal resistance and the decrease of battery capacity. Because the negative electrode has been in an incompletely charged state for a long time, or the electrolyte density and terminal voltage are abnormal in the initial stage, the equalization charge is not carried out to sulfide into lead sulfate crystals. Deep discharge at low current or frequent over-discharge, the active material on the negative plate cannot participate in the reaction and the hindrance is strengthened, which increases the resistance of the negative plate. In the new series-parallel topology, when the actual capacity of the battery drops below 80% of the rated capacity, its aging rate will increase rapidly, and the battery can no longer be used, that is, the battery life ends. The formula for calculating the service time of the battery is:

$$I' = P_{(l)}/U^e \tag{9}$$

In formula (9), $P_{(l)}$ represents the power consumption of storage battery, and U^e represents the power supply of electric equipment. Dry up: The battery will dry up due to battery loss, and finally cause the electron conduction path of the adjacent grid to be completely disconnected. Under normal circumstances, the discharge voltage refers to the voltage of the battery when it is discharged. The discharge voltage is generally called the voltage value of the battery during normal operation. The word line W is used to represent the voltage value. The following is the voltage calculation formula:

$$W = V - \sigma \left(\frac{\sigma - 1}{h} \right)^2 \tag{10}$$

In formula (10), A represents battery discharge current, B represents battery ohmic resistance, and D represents battery polarization resistance. The electrolyte of the battery has been completely absorbed by the diaphragm, and the diaphragm has been tightly assembled inside the battery, so the internal resistance of the lean-liquid valve-regulated lead-acid battery is smaller than that of the traditional flooded lead-acid battery. An increase of about 25%, but some may also increase by 50%. When the temperature of the battery rises, the activity of the electrolyte is strengthened, so the internal resistance of the battery is reduced. The internal resistance of the diaphragm is affected by the following aspects: 1. Saturation: When the saturation of the diaphragm is 80% to 100%, the internal resistance of the battery is the smallest and changes smoothly. The internal resistance value at the end of the battery life is generally greater than the initial value. When the battery temperature decreases, the electrolyte activity weakens, so the internal resistance of the battery increases. When the saturation is 60% to 80%, the internal resistance increases significantly, and when the saturation is below 60%, the internal resistance of the diaphragm further increases. A large amount of test data shows that when the temperature is low (below 25 °C), the internal resistance of the battery changes significantly with the temperature, and when the temperature is high (above 25 °C), the internal resistance of the battery changes slowly with the temperature. The saturation of the diaphragm is related to factors such as the depth of battery discharge, the degree of electrolyte leakage, and the number of valve openings. Large depth of discharge, serious leakage, and many opening times of battery valves can accelerate the battery's water loss, thereby reducing the saturation of the diaphragm and increasing the internal resistance of the battery. Therefore, if the internal resistance of the battery at standard temperature is required, the measured internal resistance of the battery should be temperature corrected. For valve-regulated lead-acid batteries working in floating charging mode, when the temperature rises, due to the decrease of internal resistance, the floating charge current increases, the corrosion of conductive elements increases, and the service life is reduced. 2. The thickness of the diaphragm: When the battery is assembled, the assembly pressure becomes larger, the diaphragm becomes thinner, the surface area of the diaphragm becomes correspondingly larger, and the internal resistance of the battery becomes smaller. On the other hand, when the temperature is very low, the battery cannot release energy to the load due to the increase of internal resistance. Therefore, it is very necessary to monitor the temperature and ambient temperature of VRLA batteries. In a battery that has undergone multiple charge and discharge cycles, cracks in the active material on the positive grid or expansion of the active material on the negative grid will cause uneven pressure on the diaphragm, which will cause changes in the internal resistance of the diaphragm. The charging voltage must also be temperature compensated to avoid overcharging at high temperatures and undercharging at low temperatures.

So far, the construction of the performance evaluation model of substation battery pack based on the new series parallel topology has been completed, and its overall process is shown in Fig. 4.

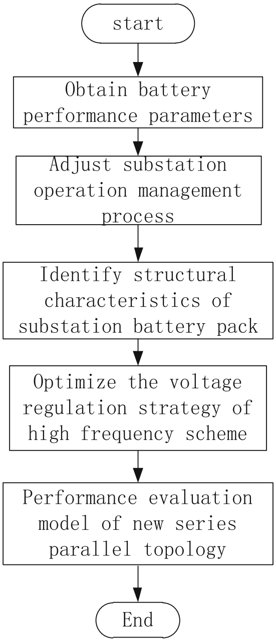

Fig. 4. Overall flow chart based on new series parallel topology model

3 Experimental Research

3.1 Experiment Preparation

The experiment uses STM32's PA9 and PA10 pins to connect to the PC. The single-chip microcomputer receives instructions from the PC through the serial port 1. In the PC serial port command operation, the rated capacity and discharge current of the battery can also be set to adapt to different specifications of batteries Health assessment. The experimental parameters are shown in Table 1.

Table 1. Experimental parameters

Parameter	Numerical value
Voltage detection range	1.5 V–3.0 V
Internal resistance detection range	0.1 mΩ–100 mΩ
Voltage detection accuracy	±0.2%
Discharge capacity	≥70%
Charging temperature	−20–45 °C
Charging rate	10 h

Based on the above parameters, the system main program will execute the battery health evaluation program after the value of the evaluation activation flag analysis flag is set to 1 in the PC serial port interrupt program. At the same time, the operating parameters and health assessment results of the battery are transmitted to the PC through the serial port 1, which is convenient for local users to view. During program development, it is necessary to call the relevant APIs in the SDK toolkit to reduce development difficulty and improve development efficiency. Using the ADT plug-in in the Eclipse software, the program can be run through the ADT simulator without online debugging. On the basis of A/S type, C/D type can be expanded: C type (Control Unit) adds CU module on the basis of A/S type, which has data storage, analysis, statistics, and processing capabilities, which can solve multiple BMM connection problems. Perform experimental tests on the basis of the above-mentioned experimental preparations.

3.2 Experimental Results

In order to verify the effectiveness of the model in this paper, the on orbit performance evaluation model of high track Ni MH battery set in document [3] and the on-line health status evaluation model of substation battery based on fuzzy logic in document [4] are selected to compare with the performance evaluation model of substation battery set in this paper. The corrosion rates of the three models under different charging voltages are tested respectively. The calculation formula is:

$$V_{(f)} = \frac{k(W_1 - W_2)}{Ft\gamma} \tag{11}$$

In formula (11), k represents the unit constant, W_1 represents the original weight, W_2 represents the weight after corrosion and removal of surface products, F represents the surface area, t represents the corrosion time, and γ represents the density. Therefore, the lower the corrosion rate, the lower the value, the better the performance, the experimental results are shown in Table 2 and 3:

Table 2. Corrosion rate of charging voltage 2.15 V

Number of experiments	Literature [3] model	Literature [4] model	Paper model
1	1.866	2.014	1.465
2	1.694	2.062	1.382
3	1.735	1.997	1.264
4	1.925	1.874	1.307
5	1.867	2.031	1.258
6	1.914	1.779	1.369
7	1.732	1.856	1.215

(*continued*)

Table 2. (*continued*)

Number of experiments	Literature [3] model	Literature [4] model	Paper model
8	1.806	1.911	1.361
9	1.891	2.032	1.220
10	1.997	1.948	1.315
11	1.865	1.857	1.277
12	1.908	1.922	1.188

Table 3. Corrosion rate of charging voltage 4.15 V

Number of experiments	Literature [3] model	Literature [4] model	Paper model
1	6.558	6.995	5.614
2	5.974	7.123	5.583
3	6.335	6.849	5.591
4	5.879	7.036	5.648
5	6.125	6.879	5.154
6	5.977	7.592	5.203
7	6.331	6.978	5.167
8	5.864	7.213	4.988
9	6.203	7.152	5.203
10	7.102	6.987	4.667
11	6.885	7.232	4.815
12	6.358	6.885	5.203

According to Table 2, when the charging voltage is 2.15 v, the average corrosion rate of the substation battery pack performance evaluation model described in this paper is 1.302, and the average corrosion rates of the other two evaluation models are 1.850 and 1.940 respectively; According to Table 3, when the charging voltage is 4.15 V, the average corrosion rate of the substation battery pack performance evaluation model described in this paper is 5.234, and the average corrosion rate of the other two evaluation models are 6.299 and 7.077 respectively. The results show that the corrosion rate of the substation battery performance evaluation model designed in this paper is the slowest and the service life is longer, which has a certain value.

On this basis, in order to further verify the effectiveness of this model, the accuracy of this model is compared with two traditional models in literature [3] and literature [4]. The experimental results are shown in Fig. 5:

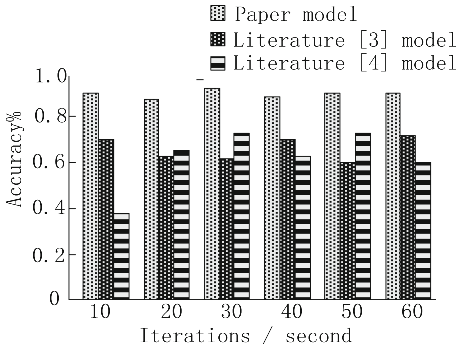

Fig. 5. Comparative analysis of accuracy of different models

According to Fig. 5, with the increasing number of iterations, the accuracy of the models in this paper is more than 80%, while the accuracy of the models in literature [3] and literature [4] is about 70%. It can be seen that this model can accurately evaluate the performance of substation battery pack, and has certain effectiveness.

4 Conclusion

Aiming at the problem that the corrosion rate of the traditional substation battery performance evaluation model is too fast, this paper designs a substation battery performance evaluation model based on the new series parallel topology. The corrosion rate of this model is the slowest and the performance is better, so it has certain application value. However, due to my limited ability, it is necessary to further study the corresponding relationship between output voltage and duty cycle under different hardware parameter combinations in the future.

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An Online Vocal Music Teaching Timbre Evaluation Method Based on Feature Comparison

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Abstract. The traditional vocal music teaching model has been unable to meet the needs of today's vocal music teaching, and the promotion and improvement of the online vocal music teaching model is imperative. Due to the influence of various factors (online equipment, environmental noise, etc.), there are certain defects in the timbre of online vocal music teaching, which cannot guarantee the effect of vocal music teaching. Preprocess the timbre signal of online vocal music teaching (remove mute segment, pre-emphasis and windowing), and based on this, extract timbre signal features (time domain feature, frequency domain feature and cepstral domain feature). In this paper, a feature comparison model of timbre signal is constructed to reduce the dimension of timbre signal feature vector. It adopts SAGA algorithm to determine the timbre evaluation formula of online vocal music teaching, and realizes the evaluation of timbre of online vocal music teaching. The experimental data show that compared with the reference standard, the complete rate of timbre signal feature extraction and the correct rate of timbre evaluation obtained by the proposed method are higher. The experimental results fully confirm the effectiveness and feasibility of the proposed method.

Keywords: Feature comparison · Online · Timbre · Vocal music teaching · Evaluation · Timbre parameter extraction

1 Introduction

Vocal music is a long and ancient art discipline, and its final form is to form beautiful singing. It is produced with the emergence of human civilization. Today, there are three typical performance styles of vocal performance art in my country at this stage: national singing, bel canto, and popular singing. If you want to learn vocal music well and even teach vocal music well, you must have a basic understanding of these three methods [1]. Vocal singing and teaching is a comprehensive performing art that integrates music theory knowledge, solfeggio, and vocal singing. Vocal music is not something that can be done in a short time, it will be a long and difficult road.

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In the past, the vocal music teaching mode in colleges and universities adopted a one-to-one oral teaching mode, which is commonly known as “master leads apprentices”. Especially in some colleges and universities specializing in music and vocal music, the teaching of vocal music pays more attention to a “teacher’s door” or a “genre”. Vocal music teaching in colleges and universities is limited to the “one-to-one” teaching mode. And from the perspective of the development history of Western professional vocal music, vocal music teaching is mainly passed down to the present through demonstration and imitation. In the process of vocal music teaching and learning, the teacher’s explanation and demonstration occupy an extremely important position and leading role. Therefore, on the road of vocal music learning, as long as conditions permit, most learners will still visit famous teachers, just to get better guidance and teaching.

In my country, the holy land of vocal music learning is divided into the north and the south. They are represented by Shanghai Conservatory of Music and Central Conservatory of Music respectively. Because these two professional colleges have strong teachers, such as Guo Shuzhen, Jin Tielin, Zhou Xiaoyan and so on. And most of the students of these famous teachers are now active on the vocal stage in China and even the world. This also makes it a great honor for vocal music learners to accept the guidance of famous teachers on the road of vocal music learning. However, the traditional vocal music teaching method has been passed down to the present, and an inherent teaching mode has been formed. And this model limits the number of students that vocal music teachers bring. Although in recent years, many schools have adopted the mode of group teaching in the teaching of vocal music. But if you want to learn vocal music in a targeted manner, you still need to adopt a small class system or even a one-to-one teaching mode. This has also caused many vocal music learners and vocal music lovers to have a headache in finding a teacher. Because there are very few professional vocal music teachers, a targeted teaching model must be adopted. This makes great limitations in time and space, and raises the threshold of vocal music learning. As a result, although most people have a passion for vocal music learning, they can only be discouraged in the face of real conditions.

The development of Internet technology has brought new means to support vocal music teaching, and online vocal music teaching came into being. The advent of the Internet has not only revolutionized the teaching of other traditional subjects. It also plays a very good supplement and expansion role in vocal music teaching. To a certain extent, under the influence of the Internet, the methods and teaching methods of vocal music teaching have undergone major changes. The Internet will play a positive and beneficial supplement to traditional vocal music teaching [2]. Aiming at the limitations of traditional vocal music teaching mentioned above, effective and beneficial new attempts can be made under the Internet-based teaching mode. Internet teaching has strong practical significance for making up for the time and space of traditional vocal music teaching. In the past, because there were no opportunities and conditions, students who studied face-to-face could conduct online vocal music teaching in the vocal music teaching forum on the Internet. This kind of vocal music teaching requires certain technical equipment, and through the instant transmission of video and audio, the limitations of space can be broken. Today’s Internet technology can fully support the implementation of this educational method. In the process of online vocal music teaching, due to the influence of various factors, there will be a lot of noise and other interference signals in the timbre, which cannot achieve the desired teaching effect. Therefore, this paper proposes a research on the timbre evaluation method of online vocal music teaching based on feature comparison. The method in this paper firstly carries out signal preprocessing, removes the silent segment, pre-emphasizes processing and divides the frame to add the window, guarantees the integrity of the signal characteristic. Based on this, the timbre signal features are extracted, the timbre signal feature comparison model is constructed, and the dimension of the timbre signal feature vector is reduced. The SAGA algorithm is used to determine the timbre evaluation formula for online vocal music teaching. Realize the evaluation of timbre in online vocal music teaching.

2 Research on Timbre Evaluation Method in Online Vocal Music Teaching

2.1 Tone Signal Preprocessing

In the process of online vocal music teaching, sound waves with integer multiple frequencies are usually generated. This frequency is called harmony or overtone. The lowest frequency is the fundamental f_0, which is closely related to timbre. The second highest and higher frequency spectrum are called overtones. In addition to the fundamental frequency, it is mainly these harmonics that determine the timbre, also known as the tonal timbre. The difference in the auditory sense of vocal music among different teachers is mainly due to the difference in these timbres. Due to the influence of various factors in online vocal music teaching, the timbre will also have a certain attenuation and change, and the attenuation time is relatively long and gentle [3]. The human ear is able to perceive these attenuations and may also recognize the sounds produced by these teachers.

According to the digital signal analysis of timbre, vocal music can be divided into two categories: monophonic and polyphonic. A monophonic is an unaccompanied, single melodic line. Polyphony is made up of two or more separate musical lines at the same time. In the online vocal teaching process, polyphony is much more common than monophonic. This paper mainly evaluates the timbre of polyphony. ANSI Definition of Timbre: Timbre is an attribute of sound quality. It is not the loudness and intensity of the sound that can distinguish the auditory differences of the same note from different teachers. Therefore, it is the most important aspect of information related to vocal music teaching information. In daily life, people can distinguish timbre from speech and vocal music. However, this definition is too subjective, which is not conducive to the online vocal music teaching. Therefore, the main work of this paper is to parameterize the timbre characteristics in detail to realize the timbre evaluation of online vocal music teaching.

Obtain timbre signals for online vocal music teaching. The original sound signal contains a lot of noise and interference signals, which cannot be accurately evaluated, so it is preprocessed. The basic process of preprocessing of timbre signal is divided into: removing mute segment, pre-emphasis processing and framing windowing [4].

Among them, we use the short-term energy double-threshold endpoint detection method to remove the silent segment of the timbre signal. Specific steps are as follows:

Step 1: The first is to frame the timbre signal to obtain the short-term average energy. Then compare and judge frame by frame according to the threshold,

Step 2: A rough judgment is made according to a higher threshold α_1 selected on the short-term energy envelope of vocal music, that is, it is definitely vocal music above the threshold. The vocal start and end points should be located outside the time point corresponding to the intersection of the threshold and the energy envelope.

Step 3: Determine a lower threshold α_2 on the average energy. Search from the previous intersection points to the left and right to find two points where the short-term energy intersects the threshold α_2. It is the position of the starting and ending points of the vocal segment determined by the double-threshold method.

Step 4: Take into account that there may be a minimum length between notes of a vocal signal to represent pauses. The end of the vocal segment is judged only when the length is smaller than the threshold α_2 and satisfying such a minimum length. In fact, it is equivalent to extending the tail length.

Due to the principle of sound pronunciation, the amplitude of the high-frequency formant is lower than that of the low-frequency formant, and the higher the frequency, the smaller the spectral value. In order to improve the high-frequency resolution of the timbre signal, an overall spectrum analysis is carried out on the entire frequency band, and a processing method is proposed. Before feature parameter extraction, pre-emphasis is usually achieved by a first-order digital filter. The transfer function of this filter is expressed as:

$$H(\gamma) = 1 - \frac{\beta}{\gamma} \tag{1}$$

In formula (1), $H(\gamma)$ represents the transfer function of the first-order digital filter. γ represents the transfer factor. β represents the pre-emphasis factor, which is generally a decimal close to 1. The specific value needs to be selected according to the actual situation.

After pre-emphasis, the timbre signal expression is:

$$x(n+1) = x(n) + \beta x(n) \tag{2}$$

In formula (2), $x(n+1)$ represents the timbre signal after pre-emphasis. $x(n)$ represents the original tone signal.

Timbre signals can be considered stationary in a relatively short period of time. The feature extraction of the timbre signal here is based on the steady state signal [5]. Therefore, before extracting the features of the timbre signal, it is usually necessary to perform frame segmentation processing. That is, the signal is divided into small pieces of signal with stable statistical characteristics, and each small piece of signal needs a frame. Due to its relatively slow time transition, the timbre signal can be slightly longer in each frame. In order to ensure that information is not lost, the frame needs to overlap 1/3 to 1/2 frame between the two frames. This is called frame shifting. The theoretical calculation formula of the frame number of the timbre signal segment is:

$$N = \left[\frac{N_1 - N_0}{N_2 - N_0}\right] \tag{3}$$

In formula (3), N represents the number of frames of the tone signal segment. N_1 represents the total length of the tone signal. N_0 stands for frame shift. N_2 represents the frame length.

After all vocal pieces have been framed. In order to increase the continuity between frames, reduce edge effects, and reduce spectral leakage, it is also necessary to perform window operation on the segmented frames [6]. Window functions commonly used in audio signal processing include rectangular window, Hanning window and Hamming window. Its related parameters are shown in Table 1.

Table 1. Window function parameter table

Window function	Spectral roll-off	Main lobe width	First side lobe attenuation
Hamming window	20 dB	8π/M	−43 dB
Hanning window	60 dB	8π/M	−32 dB
rectangular window	20 dB	4π/M	−13.3 dB

The tone signal has many prominent peaks and harmonics and is a composite signal. This makes peak identification more difficult. Because of the distortion caused by improper selection of the window. Therefore, in general, when selecting the time window, the amplitude of the side lobes should be kept as low as possible. It not only alleviates the problem of spectral energy leakage, but also makes the peak value of the main lobe itself more obvious and prominent.

In the process of digital signal processing, each FFT can only transform the finite length of time domain data, so it is necessary to truncate the time domain signal. Even for periodic signals, if the truncated length is not an integral multiple of the period (the period truncated), then the intercepted signal will leak. To minimize this leakage error (note the reduction, not elimination, I said), we need to use a weighting function, also called a window function. According to the parameters shown in Table 1, combined with the online vocal music teaching timbre evaluation requirements. It selects the Hamming window as the window function, and the expression is:

$$w(n) = \begin{cases} 0.54 - 0.46\cos\left(\frac{2\pi n}{M-1}\right) & 0 \le n < M \\ 0 & \text{others} \end{cases} \tag{4}$$

In formula (4), $w(n)$ represents the Hamming window function. M represents the window length of the window function.

Through the above process, the preprocessing of the timbre signal (removal of mute segments, pre-emphasis processing and framed windowing) is completed. It lays a solid foundation for subsequent feature extraction.

2.2 Tone Signal Feature Extraction

Timbre, as a key factor to describe sound, especially vocal music, is also of great significance in the stage of vocal music feature extraction. Before extracting the timbre features of vocal music, we first introduce what the timbre of vocal music is and what are the reasons for different timbres. When people hear someone speaking, the brain will judge in a short time who made the sound, and whether it recognizes the sound or not. In a vocal piece, the same melody may be played by the piano or by the guitar. Then people can distinguish these different instruments, the most fundamental reason is because of their different timbres.

To explain the formation of vocal music from a physical point of view, it is composed of the frequency spectrum of the sound signal and human synaesthesia. Most of the musical sounds produced by human beings are compound sounds, and compound sounds are produced when objects vibrate in compound. For example, the sound of musical instruments will produce compound sounds. The common explanation of compound sound is that when the instrument vibrates and sounds, not only the whole section of the sounding body is vibrating, but its parts are also vibrating separately. The sound produced by the whole vibration of the sounding body is called the fundamental sound, and the sound produced by the segmental vibration is called the overtone. Therefore, the compound tone of a unique timbre is formed by the superposition of the fundamental tone and several overtones generated by its entire vibration. The combination and superposition of the different frequency components of these sound signals constitute the spectrum of the composite sound, that is, the spectrum of this type of timbre. So for vocal music data, the timbre in vocal music can be determined by spectrum [7]. By observing and comparing the frequency spectrum of the musical sound data of different vocal music. It can be found that the difference in the fundamental part is small, and the main difference between different timbres lies in the number of overtones at the octave of the fundamental and the difference in the amplitude of the overtones. Therefore, the difference in timbre is caused by the difference in its physical vibration components, and the timbre can be quantitatively described by means of spectral analysis.

According to the above description, the characteristics of the timbre signal can be roughly divided into three categories: time domain characteristics, frequency domain characteristics, and inverse frequency domain characteristics. The specific extraction process is as follows.

Time domain features are the most intuitive, which describe the time waveform information of vocal music. As a member of timbre characteristics, its important role cannot be ignored. The time-domain characteristic parameters are zero-crossing rate, autocorrelation coefficient and logarithmic attack time. Among them, the zero-crossing rate calculates the number of times the signal crosses the time axis per frame. To a certain extent, it reflects the nature of the spectrum and can be regarded as a rough estimate of the frequency. The overall performance is that the period component is small when the period component is long, and the noise component is large when the noise component is long. The autocorrelation coefficient is the time domain representation of the spectrum distribution, which is the inverse Fourier transform of the signal power spectrum; the logarithmic attack time refers to the duration of the attack segment, and the calculation formula is:

$$\begin{cases} N_{zero} = \sum_{n=0}^{N-2} |\mathrm{sgn}[x(n)] - \mathrm{sgn}[x(n+1)]| \\ A_{AC}(k) = \frac{1}{A_{AC}(0)} \sum_{n=0}^{N-k-1} x(n) \cdot x(n+k) \\ T_{LAT} = \log_{10}(T_{end} - T_{start}) \end{cases} \tag{5}$$

In formula (5), N_{zero} represents the zero-crossing rate. sgn[·] stands for a symbolic function. $A_{AC}(k)$ represents the autocorrelation coefficient. T_{LAT} represents the logarithmic attack time. T_{end} represents the end of the vocal music. T_{start} represents the beginning moment of the vocal music.

The frequency domain features mostly describe the characteristics of the magnitude spectrum from the perspective of probability distribution. The calculation of frequency domain features is based on an assumption: the normalized amplitude spectrum can be regarded as a certain probability distribution of sound energy as a function of frequency. The frequency domain features include spectral centroid, spectral standard deviation, spectral skewness, spectral kurtosis, spectral slope, spectral drop, spectral roll-off, etc. Due to space limitations, it will not be described in detail [8].

Vocal music is represented by an excitation-filter model to represent the teacher's pronunciation process. Since the filter plays a key role in timbre formation, extracting the unit impulse produced by the resonator is a very critical step. Given that the vocal is the convolution of the excitation source and the filter's unit impulse response. Therefore, deconvolution becomes an unavoidable problem. Deconvolution algorithms can be divided into two categories: (1) "parametric deconvolution", that is, linear predictive analysis. (2) "Non-parametric unwrapping", that is, homomorphic analysis, also known as inverse (frequency) spectral analysis. Cepstral domain features mainly include Mel-frequency cepstral coefficients, Gammatone cepstral coefficients, and linear prediction cepstral coefficients.

The calculation process of the Mel frequency cepstral coefficient is as follows:

Step 1: It adds a window to the signal frame, performs DFT transformation on each frame signal, and takes the amplitude spectrum.

Step 2: The magnitude spectrum is squared to obtain the power spectrum.

Step 3: This paper designs a triangular filter bank based on Mel scale.

Step 4: It filters the power spectrum using a triangular filter bank and takes the logarithm.

Step 5: It performs DCT transformation on the result obtained in step four.

Through the above process, the Mel frequency cepstral coefficient MFCC can be obtained. The calculation process of Gammatone cepstral coefficient and linear prediction cepstral coefficient is relatively simple. Due to space limitations, it will not be comprehensively displayed.

The extraction of timbre signal features is completed through the above process. It provides a basis for the comparison of subsequent timbre signal characteristics.

2.3 Comparison of Timbre Signal Characteristics

Based on the above extracted timbre signal features, a timbre signal feature comparison model is constructed. We select the feature parameters with higher similarity and reduce the dimension of the feature vector of the timbre signal. Provides convenience for subsequent timbre evaluation.

The timbre signal feature comparison model is shown in Fig. 1.

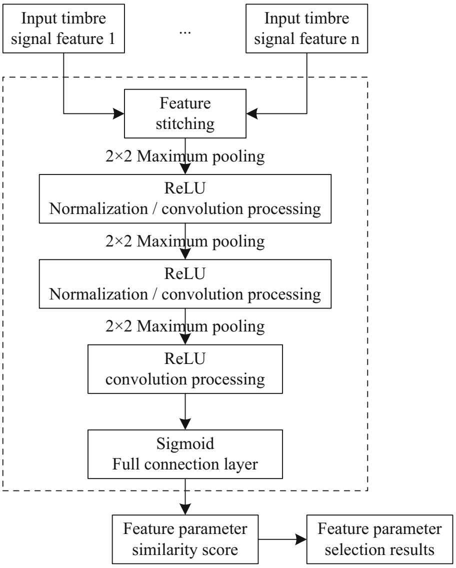

Fig. 1. Tone signal feature comparison model

As shown in Fig. 1, based on the feature parameter selection result output by the timbre signal feature comparison model, the timbre signal feature vector is dimensionally reduced to obtain a simplified timbre signal feature vector [9]. To prepare for the implementation of the subsequent online vocal music teaching timbre evaluation.

2.4 Online Vocal Music Teaching Timbre Evaluation

Based on the feature vector of the timbre signal after feature comparison above. The SAGA algorithm is used to determine the timbre evaluation formula of online vocal music teaching, so as to realize the evaluation of timbre of online vocal music teaching.

SAGA algorithm is a global optimization algorithm combining simulated annealing algorithm and genetic algorithm. This method not only has the advantages of strong overall grasping ability of genetic algorithm, but also has the characteristics of strong local search ability of simulated annealing algorithm. The SAGA algorithm starts its search with a randomly generated initial solution (initial population). First, a group of new individuals is generated through genetic operations such as selection, crossover, and mutation. The simulated annealing operation is then independently performed on each of the resulting individuals. Use the result as an individual in the next generation of the group. This process is repeated iteratively until a certain termination condition is met [10].

It is worth noting that the simulated annealing algorithm contains 2 loops inside and outside. The outer layer cycle is used to control the temperature drop (annealing operation). The inner loop performs a random search of states at the same temperature. The Metropolis criterion is used in the search process to receive the new solution $f(j)$. The Metropolis criterion expression is:

$$\xi = \begin{cases} 1 & f(j) \leq f(i) \\ \exp\left(-\frac{f(j)-f(i)}{t_k}\right) & f(j) > f(i) \end{cases} \tag{6}$$

In formula (6), ξ represents the Metropolis criterion function. $f(i)$ represents the objective function. t_k represents the temperature value in the simulated annealing algorithm.

In general, when the value of t_k is large, more differential solutions can be accepted. When the value of t_k is small, the probability of accepting the difference solution is small. When the value of t_k approaches 0, hardly any poor solutions are accepted anymore.

Based on the output results of the above SAGA algorithm, the timbre evaluation formula for online vocal music teaching is determined, and the expression is:

$$Q = \frac{100}{1 + a\left[f(j)\right]^b} \tag{7}$$

In formula (7), Q represents the timbre evaluation score of online vocal music teaching; a and b represent the calculation parameters, and the value range is [0, 20].

Through the above process, the evaluation of timbre of online vocal music teaching is completed, which provides more effective support for the development and promotion of online vocal music teaching. It also provides some reference for the study of timbre evaluation.

3 Experiment and Result Analysis

3.1 Experimental Preparation Stage

In order to verify the application performance of the proposed method, an online vocal music teaching timbre evaluation experiment was designed. The first task is to prepare experimental data and objects.

The experimental data includes 7 groups of online vocal teaching vocal signals with a sampling frequency of 16 kHz. Each group of vocal music signals for online vocal music teaching is divided into reference signals and training/testing signals. The reference signal comes from the vocal music database of the Human-Computer Media Interaction Laboratory of the Department of Computer Science, Tsinghua University. The experimental data consists of 70 samples (training/testing signals) from online vocal teachers with different levels of Mandarin.

The experiment randomly divided 70 training/testing vocal signals into 7 groups with 10 samples in each group. The ratio of the test vocal signal and the training vocal signal is 1:6. Each time, 1 group was selected as the test vocal signal, and the other 6 groups were used as the training vocal signal. Each group had one chance to serve as a test vocal signal. A total of 42 training samples in 6 groups were compared with the reference vocal signal to obtain 42 model scores. An optimization algorithm is used to determine a pair of optimal parameters Q and W to minimize the sum of squares of errors between the 42 model scores and the corresponding expert scores.

The relationship between the SAGA algorithm parameters a, b and the evaluation accuracy is shown in Fig. 2.

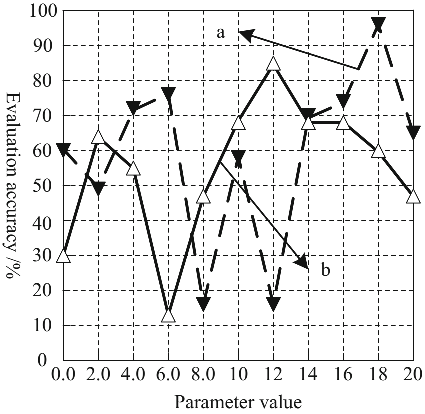

Fig. 2. Relationship between parameters a, b and evaluation accuracy

As shown in Fig. 2, when the value of parameter a is 18 and the value of b is 12, the obtained timbre evaluation is more accurate, so the optimal parameters are determined to be $a = 18$ and $b = 12$.

The above process completes the determination of the optimal parameters of the experiment, that is, the preparation task for the experiment is completed. Provide sufficient support for the smooth progress of subsequent experiments.

3.2 Analysis of Results

Based on the experimental preparation content, the complete rate of timbre signal feature extraction and the correct rate of timbre evaluation are selected as the performance evaluation indicators of the proposed method. The specific analysis process of the experimental results is as follows.

The calculation formula for extracting the complete rate of timbre signal features is as follows:

$$Z = \frac{U}{U + O} \times 100\% \tag{8}$$

In formula (8), Z is the complete rate of signal feature extraction. U represents the correctly extracted tone signal frequency. O represents the frequency of the timbre signal that was forgotten to be extracted.

The complete rate data of timbre signal feature extraction obtained through experiments are shown in Table 2.

Table 2. Tone Signal Feature Extraction Integrity Rate

Number of experiments	The method of this paper	Guideline
1	87.45%	80.00%
2	90.12%	75.64%
3	84.15%	72.15%
4	82.01%	74.10%
5	79.35%	80.20%
6	84.35%	80.00%
7	86.64%	80.14%

From the data in Table 2, it can be seen that compared with the given reference standard, the extraction integrity rate of timbre signal features obtained by the proposed method is larger, and the integrity rate is higher than 81%. The result of the completeness rate of signal feature extraction in this paper is higher than the reference standard, which indicates that the proposed method can extract the characteristic parameters of timbre signal more comprehensively. Because in this paper, in order to increase the continuity between frames, reduce edge effects, and reduce spectral leakage, a window function is performed. This can improve the extraction integrity of signal features.

The correct rate of timbre evaluation obtained through experiments is shown in Fig. 3.

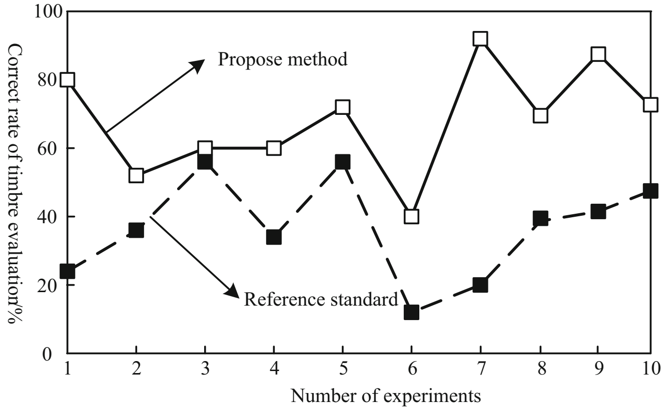

Fig. 3. Accuracy of timbre evaluation

As shown in Fig. 3, compared with the given reference standard, the correct rate of timbre evaluation obtained by the proposed method is higher. The highest accuracy rate of the method in this paper can reach 95%, which is higher than the reference standard, indicating that the proposed method can more accurately evaluate timbre. The above experimental results show that compared with the reference standard, the complete rate of timbre signal feature extraction and the correct rate of timbre evaluation obtained by the proposed method are higher. The experimental results fully confirm the effectiveness and feasibility of the proposed method.

4 Conclusion

This study proposes a new online vocal music teaching timbre evaluation method based on feature comparison technology. We performed muted segment removal, pre-emphasis processing and framing windowing of the timbre signal. Based on this, time domain features, frequency domain features and cepstral domain features of timbre signals are extracted. A comparison model of timbre signal characteristics is constructed, and the SAGA algorithm is used to determine the timbre evaluation formula of online vocal music teaching, so as to realize the timbre evaluation of online vocal music teaching. It greatly improves the completeness of timbre signal feature extraction and the correct rate of timbre evaluation, provides effective method support for online vocal music teaching, and adds a certain theoretical reference for timbre evaluation research. Considering the difficulty of pitch detection required by different speakers in different environments, we will focus on this in the future to further improve the timbre evaluation method.

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Construction of Teaching Quality Evaluation Model of Hotel Management Specialty Based on Association Rules

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Abstract. In order to solve the problem of low evaluation accuracy and efficiency in the existing teaching quality evaluation methods, this paper proposes and constructs a new teaching quality evaluation model of hotel management specialty based on association rules. Set SERVQUAL Association evaluation objective, design two-way evaluation structure, and establish G1 internal association weight evaluation system. On this basis, the entropy method is used to complete the construction of the related teaching quality evaluation model. The final model test results show that: compared with the initial teaching evaluation model, the evaluation accuracy of the teaching quality evaluation model under the association rules designed in this paper is higher, indicating that it has practical application value and social significance.

Keywords: Association rules · Hotel management · Professional teaching · Teaching quality · Evaluation model · Model construction

1 Introduction

Teaching quality evaluation mainly refers to a performance evaluation mode established by the school. In the face of the current fierce social competition, higher vocational colleges, in order to seek their own development and improve the quality of education and teaching, adopt multi project, multi-level and multi-objective methods to carry out targeted training for talents, and pay attention to the practicality and effectiveness of talents [1, 2]. In essence, teaching quality evaluation is a "win-win" mode that attaches importance to training quality, optimizes school and enterprise resources, and realizes information sharing. The promotion of teaching quality evaluation is also a specific manifestation of adapting to social development. Through enterprise feedback and market orientation, students' practical ability can be cultivated to better cultivate talents needed by the society [3]. In addition, it can save the cost of education and enterprises, and realize the two-way consistent development of the school [4]. In general, the teaching quality evaluation model can further build the practice quality evaluation system, comprehensively cover the knowledge literacy and application skills required by higher

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vocational students majoring in hotel management in the future, and provide students with the necessary experience and transition before employment. Therefore, the positive significance of building the practice quality evaluation system is very obvious [5]. On the one hand, it is beneficial to improve the practice effect.

In addition, with the continuous development of our society in recent years, the requirements for foreign language and vocational skills of future hotel employees are also becoming higher and higher [6]. The rapid growth of the hotel requires more and more human support. However, contrary to the hotel's demand for high-quality and highly skilled employees, most of the existing hotel staff do not have relevant degrees with hotel management background. Under this background, it is necessary to improve the coverage of teaching quality evaluation model and comprehensive evaluation ability [7].

Reference [8] proposes a teaching quality evaluation model based on fuzzy comprehensive evaluation method. The model constructs an evaluation index system, obtains evaluation data through questionnaires, substitutes the evaluation data into the fuzzy comprehensive evaluation model, and obtains the final teaching evaluation results through calculation. However, the model has the problem of low evaluation accuracy. Reference [9] proposes a teaching quality evaluation model based on GA optimized RBF neural network. First, the principal component analysis is used to select the teaching quality evaluation indicators, then the RBF neural network teaching evaluation model is designed, and GA is used to optimize the initial weights of RBF neural network to obtain the final teaching quality evaluation results. However, due to a large number of calculations, the evaluation time is increased.

In order to solve the problems of low evaluation accuracy and long evaluation time, this paper proposes a teaching quality evaluation model of hotel management specialty based on association rules. Using the management ideas and methods of enterprises, combined with association rules, to build a more stable evaluation structure and improve the quality of practical teaching. Then, the relevance evaluation model is introduced to further improve the practical application effect of the overall hotel professional teaching quality evaluation model.

2 Construction of a Teaching Quality Evaluation Model for Hotel Management Majors

2.1 SERVQUAL Related Evaluation Target Setting

Before constructing the teaching quality evaluation model of hotel management specialty, it is necessary to set SERVQUAL related evaluation objectives. Usually, the goal of SERVQUAL relevance evaluation is mainly the actual learning situation of students minus the expected score of teachers' teaching. Evaluate the service quality from 22 measurement questions in four dimensions of tangibility, reliability, sensitivity and assurance. The evaluated person scores by the expectation and actual feeling of the same problem. Among them, the relevant connection degree is the comprehensive aspect of evaluation services, including related factors and related structure [10]; At the same time, the reliability of related evaluation objectives is also an important factor affecting the accuracy of evaluation; Sensitivity refers to voluntary, rapid and timely multi-level processing and evaluation; Assurance is to evaluate professional knowledge and ability; The principle structure of setting specific evaluation objectives is shown in Fig. 1 below:

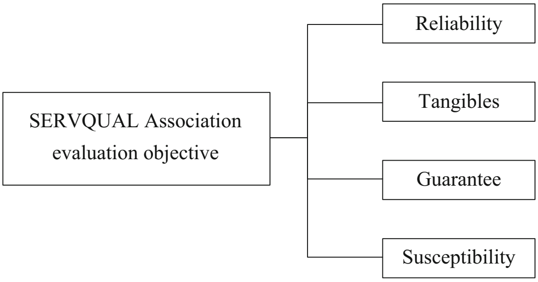

Fig. 1. Structure diagram of evaluation goal setting principle

According to Fig. 1, the design of the principle structure for the evaluation target setting can be completed. In addition, according to the hotel management professional talent training plan and talent training goals of higher vocational colleges, as well as the interview feedback of teachers' students' internships for many years, combined with their years of experience in internship guidance and practical teaching, the following higher vocational colleges hotel management is constructed. The evaluation index system of professional teaching practice bases outside the school [11]. The evaluation index system is divided into target layer, criterion layer and scheme layer. The ideal off-campus internship base is set as the target layer; the teaching evaluation of the interns, the basic situation of the internship enterprise, the school-enterprise cooperation, and the internship conditions and environment are set as the criterion layer, which are listed as the criteria layer. B1, B2, B3, B4; and each criterion layer teaching index has its own secondary index, which constitutes the program layer, that is, the reverse factor layer. At the same time, the corresponding teaching program layer also has a total of 15 evaluations. The indicators are all further decomposition of the four evaluation categories in the criterion layer, thus constructing a structure hierarchy diagram, as shown in Fig. 2 below:

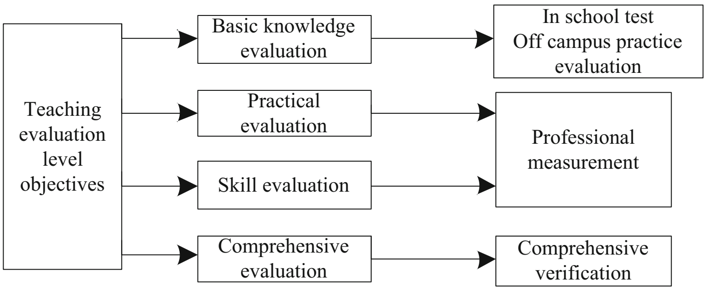

Fig. 2. Teaching evaluation hierarchy

According to Fig. 2, the setting of the teaching evaluation level of the SERVQUAL related evaluation target can be completed. In the follow-up, it is also necessary to optimize and improve the systematicness of the target according to the principles of evaluation. One is the scientific principle. The teaching quality evaluation of students majoring in hotel management is mainly to master the rules of hotel operation, management and service work, and to improve their professional awareness and ability [12]. Therefore, when designing the evaluation system, scientific principles should be adhered to, so that the indicators should be consistent with each other. It has a logical relationship, which is both independent and related, and improves the validity of the evaluation system. The second is the principle of combining quantitative and qualitative. Quantity and quality are dual natures of things, and the two are complementary and complementary to each other. Qualitative evaluation is the premise of quantitative evaluation. The former is mainly aimed at the analysis of the nature of the results of the teaching process, while the latter is evaluated from the quantitative aspect. Adhering to the principle of combining the two can improve the comprehensiveness of the evaluation. The third is the principle of effectiveness. The implementation of teaching quality evaluation must adhere to the principle of effectiveness, improve the feasibility of indicators, and improve the effectiveness of evaluation from the perspectives of indicators, data and the whole [13].

In recent years, with the continuous development and improvement of China's society, most higher vocational colleges have launched the major of hotel management, and even many junior colleges. On the other hand, with the rapid development of the hotel industry, enterprises need more and more relevant employees [14]. On the surface, the professional development will increase the number of graduates, which will meet the needs of teaching quality evaluation of hotel management specialty. In fact, before the cooperation between schools and enterprises, the coverage of SERVQUAL related evaluation objectives was small. Schools and enterprises were like a production line, and students were the products on the line. In the process of school teaching quality evaluation, schools and enterprises acted independently. The disadvantage of this model is that in the process of training and teaching evaluation, students may consider the current actual industry situation, but they still consider their own actual situation more, such as teacher resources, investment in the construction of training room, etc. Therefore, the trained students lack practical work experience and the evaluation results of teaching quality are not ideal; Although hotel enterprises have a large demand for employment, they can not recruit employees suitable for their own needs. Therefore, "school enterprise cooperation and joint education of talents" has emerged accordingly, which also has a positive impact on the construction of teaching quality evaluation system [15].

After the school-enterprise cooperation, the relationship between enterprises and schools is relatively close. Schools and enterprises are still in the same procedures as before, except that they are no longer their own lines, but are linked through students. This is also very beneficial to the upgrading of the teaching quality evaluation structure, and the setting of SERVQUAL-related evaluation goals is also better. For precision. Students' "study in school" is the stage in which schools and enterprises jointly carry out theoretical training. It is carried out in schools. The main content is that while schools carry out basic management theory education, enterprises carry out corporate culture education; "professional practice" means that schools and enterprises jointly carry out skills training. At the stage, it is generally carried out in the enterprise, while the enterprise carries out skill training, the school carries out the improvement of theory; "graduation work" is the result of school-enterprise cooperation. Comparing the two models, the school-enterprise cooperation model obviously cultivates more targeted skilled talents suitable for the needs of enterprises than the traditional education method. At the same time, the effect of teaching quality evaluation has also been greatly improved, and the SERVQUAL association Evaluation goal setting.

2.2 Two-Way Evaluation Structure Design

After setting the target of SERVQUAL Association evaluation, we need to design the two-way evaluation structure. The establishment of evaluation structure is closely related to the feasibility and reliability of the model. From the construction of the subject model of the evaluation system and combined with the interest related theory, the subject of teaching quality evaluation of hotel management specialty should be composed of students, enterprises and schools. As the main part of teaching quality evaluation, students are the object of school education and the main body of practice; Enterprises, as an important part, lack of enterprises, and cooperation is impossible. It is a necessary condition for school enterprise cooperation; The school is the carrier connecting enterprises and students. Therefore, the main body of teaching quality evaluation should be composed of three parts. The structure of the evaluation subject model constructed in this paper is shown in Fig. 3 below:

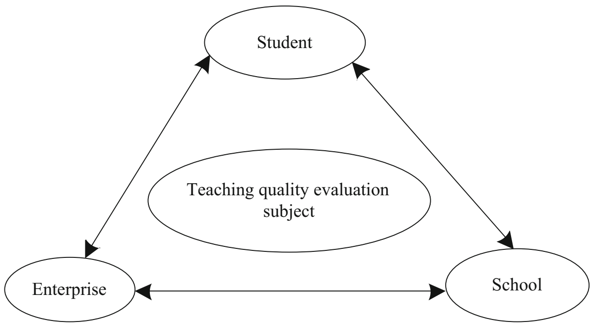

Fig. 3. Diagram of the structure of the evaluation subject model

According to Fig. 3, the structure of the evaluation subject model can be designed. Then, we can conduct case analysis and select school a as the target object of the test. Three, six and nine people are selected from the three aspects of high-level, middle-level and grass-roots respectively. For schools, it is mainly professional leaders. Set a specific test cycle, carry out the actual test under the form of school enterprise cooperation, verify and analyze the specific teaching evaluation results. Then, under the above background environment, the weight of teaching quality evaluation index is determined. The evaluation weight of teaching quality refers to the quantitative sign to measure the relative importance of each index system in the teaching process. Determining the evaluation index weight is the difficulty of constructing the system. At present, combined with relevant hotel management theories and relevant literature, the index weights at all levels are determined to improve the objectivity and feasibility of the index system. The specific index weights are distributed as follows:

Table 1. Teaching quality weight evaluation allocation table

Project	Enterprise	Student	School
Weight ratio	0.3	0.5	0.2
Indicator execution rate	45.21	80.25	53.15
Secondary indicators	Professional practice	Comprehensive ability	Theoretical knowledge
Weight difference	0.25	0.11	0.21

According to Table 1, complete the distribution of weight evaluation of teaching quality. Then, for the implementation of school enterprise cooperation evaluation, the relevant indicators are mainly five three-level two-way indicators. The satisfaction is divided into five levels: dissatisfaction and satisfaction, and the arithmetic average method is used to obtain the teaching evaluation results. For example, the weight of students' satisfaction with school enterprise cooperation is 15%. Enterprises and schools also evaluate the quality of the practice mode according to the above methods. Next, under the above background conditions, determine the evaluation grade and standard, take the evaluation standard as the top priority of the evaluation system, and formulate scientific and reasonable standards, which directly determines the success or failure of the system. In order to improve the operability of this index system, quantitative evaluation criteria should be adopted.

Improve the utilization rate of two-way evaluation results, build the fundamental goal of teaching quality evaluation index system, find all kinds of problems in teaching in time, provide basis for improving and optimizing the index system, and finally improve the quality of school enterprise cooperative practice, so as to cultivate more professionals for the development of the hotel field. Therefore, in the process of constructing the teaching quality evaluation system of hotel management specialty, higher vocational colleges should establish a modern evaluation concept, comprehensively consider the subject of teaching two-way evaluation, improve the comprehensiveness of teaching two-way evaluation system and strengthen students' professional ability. Relevant departments should take effective measures and methods according to the practice quality results, Improve the quality and professional development ability of hotel management professionals in higher vocational colleges, and complete the design of two-way evaluation structure.

2.3 Establishment of G1 Internal Association Weight Evaluation System

After completing the design of the two-way evaluation structure, the next step is to establish the G1 internal association weight evaluation system. This part needs to establish a corresponding evaluation structure first. In the initial evaluation structure, the G1 correlation weight ratio can be calculated, as shown in the following formula 1:

$$K = \frac{\Im + 1}{2} - (0.25 - 7\chi) \tag{1}$$

In formula 1: K represents the G1 correlation weight ratio, $\Im$ represents the dynamic change evaluation standard, and χ represents the comprehensive correlation value. Through the above calculation, the actual G1 association weight ratio can be finally obtained, and a specific evaluation weight hierarchy can be set. The first is the practical level. Strengthen the training of practical teachers, continuously improve and cultivate a "double-qualified" practical course teaching team, and form a more stable evaluation model. Regular associated teaching evaluation training is the guarantee for improving the professional knowledge and quality of teachers in practical courses and improving the teaching quality of practical courses. On the one hand, more than 80% of the teachers of the hotel management professional practice course are from the hotel industry, with industry experience and professional skills, but there is often no systematic construction of professional knowledge, so the school needs regular training for these teachers, within the scope of G1, Realize the relevant weighted teaching evaluation, deepen their understanding of educational theories, teaching methods and means, and encourage them to improve their academic qualifications; on the other hand, for practical course teachers who do not have relevant industry experience but have a higher degree The relevant industries carry out practical work, strengthen the training of professional skills, deepen the understanding of the trend of the hotel industry, and bring them back to the practice site through systematic summaries, and teach them to students, and finally form a learning atmosphere of continuous improvement. Then, a hierarchical system of two-way evaluation was established, with students as the center and two-way evaluation of personalized teaching. As each student's ability to accept knowledge and mastery of skills is not the same, in the organization of course content and two-way teaching evaluation, teachers should respect the characteristics of students' personal development and consider their acceptance. First of all, the level of practical courses, each practical course compiles the syllabus according to the knowledge, ability and quality mentality. This part takes into account the particularity of the two-way teaching evaluation of the hotel management major, and puts the ability goal in the first place, and the quality mentality goal in the first place. It is realized by subtle influence; secondly, elective courses are arranged in the practical curriculum, and clubs are developed to expand the actual scope of teaching evaluation, and to cultivate students' comprehensive practical ability, so that they can benefit from internship and employment; finally, establish personalized management of G1 association rules. Teaching evaluation system, formulate a student-centered training plan, formulate career planning according to the characteristics of students, and form a multi-level teaching evaluation system.

Finally, establish a sensitive teaching evaluation hierarchy system. Pay attention to student feedback. In the evaluation of practical teaching, teachers should improve the course content, increase the interaction of practical courses and improve the teaching evaluation link of G1 association rules according to the students' response to teaching and the mastery of skills, so as to reduce the gap cost of teaching communication and avoid the estrangement between teachers and students; Schools should encourage students to put forward suggestions on the development of their professional courses and give timely feedback on the contents reflected by students, so as to avoid attacking the enthusiasm of students' suggestions, which also has a positive impact on the optimization and innovation of teaching evaluation model; Pay attention to the G1 satisfaction evaluation of graduates, update the talent training scheme according to the evaluation, and constantly adjust the preset teaching evaluation scheme to ensure that the G1 internal correlation weight evaluation system is more complete and comprehensive.

2.4 Entropy Value Method Completes the Construction of Related Teaching Quality Evaluation Model

After completing the establishment of the G1 internal association weight evaluation system, the entropy method is used to complete the establishment of the association teaching quality evaluation model. According to the five teaching evaluation factors, set the evaluation target at the grass-roots level. The five factors obtained from the analysis of various factors, the first is the predictor variable: setting the hotel management and training indicators, the teacher associates the internship guidance with the school internship arrangement plan, and uses the five factors to obtain the average value of the corresponding item, and obtains the 511 sets of mean data for five predictors. On this basis, a regression analysis was performed. Suppose the constructed model is: After the internship satisfaction measurement is completed, output the product-difference correlation matrix among the five predictors and the p-value of the correlation coefficient significance test. It can be known that there is a significant positive correlation among the five predictors. That is, $p < 0.001$, the correlation coefficient is between 0.373 and 0.733, which is a medium-low correlation, while the correlation between the five variables and internship satisfaction is between 0.505 and 0.728, which is a moderate correlation. It is known that the obtained teaching quality model data of hotel management major conforms to the conditions of the best relationship between variables. The correlation between the variables "hotel management and training" and "hours worked" indicates that there may be a collinearity problem between these variables. After comparing the four values of tolerance TOL, variance expansion coefficient VIF, condition index CI and eigenvalue of the five predictors, the results of collinearity diagnosis need to be delineated and analyzed accordingly. Only the eigenvalue of "working hours" of the entropy method is $0.07 < 0.12$, indicating that there is a slight collinearity problem, and the multicollinearity problem among the remaining four predictors does not exist. On the whole, the linear coincidence among the five variables is not serious, and further regression model construction can be carried out. The F value of the regression model analysis of variance was 126.146, and the significance test was $p = 0.000 < 0.05$. The overall explained variance of the regression model reached a significant level. It means that at least one of the regression coefficients a1–a5 is not equal to 0, that is, at least one predictor variable will reach a significant level.

Then, according to the above setting and analysis, based on the PZB Service quality gap model, this paper constructs the differential application of the teaching evaluation model of practical courses of hotel management major in higher vocational colleges. The revised teaching quality evaluation model of practical courses of hotel management specialty in Higher Vocational Colleges Based on PZB model consists of five gaps: gap 1: between schools, teaching affairs managers, practical teachers and students. There is a certain gap between teachers' expectations of students' teaching quality and students' actual expectations. This is the wrong judgment of the school and practice teachers on the students' misunderstanding and expectations. Gap 2: occurs within the school. It is the gap between the perception of the school, teaching affairs managers and practical course teachers on the quality expectation of practical teaching from students and the training standards of hotel management professionals formulated by the school. In other words, the school's talent training program can not provide the learning course content that students want. Gap 3: the gap in teaching implementation within the school. The gap between the quality of practical teaching and the established standards. Gap 4: due to the asymmetry of information, there is a gap between the training standards of hotel management professionals and the educational ideas and teaching plans mentioned by the school in enrollment and education. Gap 5: the gap between students' expectation of practical teaching quality and the reality in the teaching process due to their understanding of hotel management through publicity before teaching.

In order to ensure the scientific and reasonable index system, combined with the entropy value method, the teaching quality evaluation model of the practice course of higher vocational hotel management major has higher reliability. Three principles: First, change pertinence. For students, they are "consumers" of teaching and service providers in the hospitality industry. For hotel management students in higher vocational colleges, they should focus on the cultivation of their professional skills and service awareness, and targeted teaching. Second, the entropy method ensures a reasonable and comprehensive evaluation of the teaching model. Comprehensively consider all aspects related to the hotel industry and higher vocational colleges, and ensure comprehensive quality control in the teaching content and teaching process; at the same time, according to the positioning of students, around the practical teaching of this major, reflecting the representativeness of the indicators. Third, scientific. This indicator system is based on management and education to ensure the accuracy of the results. Subsequently, according to the relevant nature of the delineation, the relevant normative documents for the evaluation of teaching quality are implemented. The documents of teaching quality management are sorted out, and the high-frequency words related to teaching quality requirements are extracted as the basis for secondary indicators. Based on the existing theories on teaching quality evaluation, the indicators are obtained, and the existing research results on the teaching quality of undergraduate majors and hotel management teaching quality are used for reference, and the evaluation indicators are formed in combination with the training objectives of higher vocational colleges. A method based on expert consultation, through consultation with relevant industry experts, to improve the relevant indicators. A SERVQUAL teaching quality evaluation model suitable for the professional practice course of hotel management in higher vocational colleges is formed. This part requires a study of the constituent elements. First, tangibility. Refers to the physical objects in teaching, the people and things that students feel, experience, and see in the course of class. Mainly include: good practical teaching facilities and advanced equipment conditions, which meet the needs of hotel management practice courses; the practice site is clean and the equipment is regularly maintained; the grooming of teaching staff; the course content is closely integrated with the requirements of the hotel industry. These factors have more or less influence on the evaluation of teaching quality. Then there's reliability. Refers to the ability to deliver the promised teaching activities reliably and accurately. Including: teachers teach according to the teaching plan; Complete teaching tasks on time; clear teaching plan and teaching content; have equal learning opportunities. Sensitivity mainly refers to the agreement evaluation model formed by teachers who are ready and willing to assist students at any time. Including: teachers take the initiative to help students with difficulties encountered in practice; evaluation is fair, objective and systematic; patiently provides help and guidance; summarizes according to teaching feedback; has a clear assessment quality evaluation system for the results of practical teaching. Refers to the knowledge and character of teachers to make students feel at ease and respect for students. Including: the personal character of the practical course teachers is trustworthy; the teachers have rich professional knowledge; the practical course teachers have teaching experience and authority; feel safe in the practical operation environment; adopt heuristic teaching methods; rich teaching resources, courses have Interesting; attach importance to teaching interaction. Fifth, empathy. Refers to the teacher's provision of services that meet the needs of the students in accordance with the individual situation of the students. Including: teachers can teach students according to their aptitude; understand students' receptive ability to adjust teaching progress; give students time for feedback and communication and care about students' emotions.

After the initial setting of the teaching quality evaluation model is completed, the more specific model design and construction are carried out in combination with the entropy method. According to the regression coefficient and the significance test of the regression coefficient, the multiple regression analysis of five predictive variables on intern satisfaction is sorted out. The data shows that the correlation coefficient R1 between the five predictive variables and satisfaction is 0.75, and the determination coefficient R2 is 0.555, The adjusted R2 = 0.591. Because the variable method of forced entry evaluation is adopted, and there is only one regression teaching quality evaluation model, the five prediction variables can explain 75.5% of the variation of intern satisfaction calibration variable. The standardized regression coefficients of the five predictive variables are positive, indicating that the impact of the five predictive variables on intern satisfaction is positive. Get the non standardized regression coefficient, that is, the dynamic change coefficient, and standardize the above equations. It can be observed that the sample observation values are basically normally distributed, and the regression standardized residual values are mostly within the range of four standard deviations, and there are no extreme values, indicating that the regression model constructed after standardization is accurate and effective. So far, the entropy method is used to complete the construction of the evaluation model of related teaching quality.

3 Model Testing

3.1 Test Preparation

Before the test, it is necessary to build the corresponding test environment. First, the normalized eigenvector W and the maximum eigenvalue max of the judgment matrix are obtained by the sum-product method, and the consistent teaching quality evaluation test is carried out, and the weight vector of each factor is finally determined. Specifically as shown in formula 2 below:

$$M = \frac{(3\varpi - 1)}{2} + \sqrt{e} \tag{2}$$

In formula 2: M represents the weight vector, ϖ represents the evaluation change ratio, and e represents the strain order. Through the above calculation, the actual weight vector can be finally obtained. Check the consistency value of the judgment matrix, and at the same time, judge the order of the matrix, and then set the average random consistency teaching evaluation index according to the proportion of consistency. In this way, it is judged that the matrix conforms to the satisfactory consistency index.

According to the above process, the judgment matrix of the criterion layer is calculated, and the standardized eigenvector w of matrix A-B is obtained. The maximum eigenvalue obtained is max = 4.22. Meet the satisfactory consistent teaching quality evaluation standard. Similarly, the management evaluation node for interns is constructed. At the same time, the corresponding criteria are set in combination with the basic situation of the enterprise, the cooperation between schools and enterprises, as well as the internship conditions and environment. After completion, the judgment matrix at the scheme level is combined and solved. This part is mainly measured and calculated from the weight value obtained from the criterion level. The first one is the evaluation model of school enterprise cooperation and teaching quality, and its weight value is 47%, which shows that the most key factor in selecting the off campus practice base of Higher Vocational Hotel management specialty is the evaluation of teaching quality. According to the importance, it is shown in the cooperation mode between enterprises and schools, which is generally in-depth cooperation. According to the actual standards and management requirements for the evaluation of hotel management specialty, the weight is set to 38%, which can well explain that the off campus practical teaching management of higher vocational education is becoming more and more important in the whole learning stage of higher vocational students. It is not only the key of the whole practical teaching, but also the extension of on campus learning, which has a certain positive impact on the final test results. The last two are the practice conditions, environment and the basic situation of the enterprise, indicating that these two indicators are important auxiliary conditions for off campus practical teaching.

Next, based on the obtained data information, from the perspective of the weight value of the program layer, there is a large space for curriculum cooperation development and career planning under school-enterprise cooperation, indicating that the teaching quality evaluation of the hotel management major can be further extended and expanded. The two are closely related and cannot be separated. The calculated weight algebra value, combined with the combination coefficient, builds a specific teaching quality evaluation model. After the above determinations are completed, more specific tests and model validations are subsequently required. After completing the test environment built above, make sure that there are no external factors that affect the final test results, and start specific testing and verification.

3.2 Test Process and Result Analysis

In the above test environment, specific test objectives are set in combination with the evaluation characteristics and treatment standards of the hotel management specialty. Select A higher vocational college hotel management classes as the main object of this test. First of all, for students, the teaching evaluation goal of learning hotel management major is to start its specific application effect and learning form in the hotel. The level of learning quality determines the accuracy and reliability of its future evaluation results. The effect assessment of hotel management practice in A higher vocational college is the most important quality evaluation standard.

(1) Accuracy of teaching quality evaluation

Compare the teaching quality evaluation accuracy of the constructed evaluation model with that of the teaching quality evaluation model proposed by reference [8] based on the fuzzy comprehensive evaluation method. The comparison results are shown in Table 2.

Table 2. Comparison results of teaching quality evaluation accuracy

Test class	Model built in this paper/%	Evaluation model based on fuzzy comprehensive evaluation method/%
Class 1	92.09	73.22
Class 2	92.17	73.45
Class 3	92.78	74.01
Class 4	93.21	74.89

According to the results in Table 2, compared with the evaluation model based on fuzzy comprehensive evaluation method, the evaluation accuracy of the model constructed in this paper has always remained above 92%, increased by about 18%, indicating that the evaluation results of the teaching quality evaluation model under the association rules designed in this paper are more accurate, indicating that it has practical application value and social significance.

(2) Teaching quality evaluation time

In order to ensure the reliability of the experimental results, under the same experimental environment and experimental conditions, comparing the constructed evaluation model with the reference [8], the teaching quality evaluation model based on the fuzzy comprehensive evaluation method is time-consuming. The specific results are shown in Table 3.

Table 3. Teaching quality evaluation time

Test class	Model built in this paper/%	Evaluation model based on fuzzy comprehensive evaluation method/%
Class 1	3.11	12.47
Class 2	3.13	13.84
Class 3	3.22	14.35
Class 4	3.14	12.71

By observing the time-consuming results of teaching quality evaluation shown in Table 3, it can be seen that the evaluation time of this model is far lower than the evaluation model based on fuzzy comprehensive evaluation method proposed in reference [8]. Therefore, it shows that this model can obtain accurate teaching quality evaluation results in a short time and has high practical application value.

4 Conclusion

To sum up, it is the construction of the teaching quality evaluation model of hotel management specialty based on association rules. Under the association rules, the set teaching evaluation indicators have variability and flexibility, and the corresponding coverage evaluation scope can be further extended in the process of practical application. At the same time, the comprehensive quality of the school's hotel management major and the students' practice quality can interact to promote or inhibit together. It can further improve the practice quality of students majoring in hotel management, and at the same time, ensure the final teaching quality evaluation effect.

5 Fund Project

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Performance Appraisal System of Teachers in Higher Vocational Colleges Based on Fuzzy Comprehensive Evaluation Model

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Abstract. Aiming at the problem of poor evaluation effect of traditional teacher performance evaluation system, this study designs a new teacher performance evaluation system of higher vocational colleges based on fuzzy comprehensive evaluation model. In the hardware part, B/S manager and ASP.NET processor are designed to help the system better adapt to the wan environment, and implement the operation of application program based on Web type dynamic server. In the software part, on the basis of analyzing the demand of performance evaluation of teachers in higher vocational colleges, the fuzzy comprehensive evaluation model of performance evaluation is constructed, and the functional module and database module are designed. The test results show that the application performance of the system is good.

Keywords: Fuzzy comprehensive evaluation model · Higher vocational colleges · Teacher · Performance appraisal · System design

1 Introduction

With the development of computer technology and network technology, people have entered a new era of information technology. At present, the development of software technology has promoted the enrichment and improvement of related work in the office field [1]. As an important place for cultivating cutting-edge talents, colleges and universities not only accelerate the development of society, but also promote China's industrialization and modernization to a certain extent. At present, the development of science and technology makes people pay more attention to the introduction of high-tech talents, and strengthen the improvement of daily teaching quality and teaching efficiency through the innovation and effectiveness reform of educational institutions, which makes relevant education staff need to constantly focus on the existing teaching mode and teaching content under the background of current education and teaching [2, 3]. In order to quantify the work, while strengthening the embodiment of education quality and teaching content. In order to significantly improve teachers' teaching quality, we need to carry out performance management on them. Through effective performance management

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information, we can timely obtain teachers' comprehensive information to feed back to schools and teachers themselves, so as to mobilize teachers' enthusiasm and encourage teachers to improve the good results of education and teaching level [4].

In recent years, with the continuous development of China's education, major universities have begun to study how to effectively improve their own education quality and teaching efficiency. Higher vocational colleges are an important base for transporting talents to the society and the cradle for cultivating "Four Haves" senior talents [5]. With the increasingly fierce competition in higher education, the development of higher education has changed from the traditional extensive development to the current intensive development. The core of connotative development is the effective utilization of existing teaching resources, people and property. Its fundamental and focus is to implement the construction of teacher team, that is, the construction of talent team, The quality of teaching team construction determines the overall teaching quality of colleges and universities.

In order to create a good scientific research and teaching atmosphere for teachers, we need to set up a good performance appraisal mechanism for teachers, which can not only restrict teachers' behavior, but also encourage teachers to improve their work enthusiasm and do a good job in teaching and educating people, scientific research and social services.

In the aspect of teacher performance appraisal, some developed countries have stipulated teacher performance from various angles and in all directions. In contrast, the performance appraisal mechanism of college teachers in China is relatively imperfect, and most appraisal modes refer to the performance appraisal methods of enterprises. Although this performance appraisal mechanism can assess teachers' behaviors to a certain extent, it improves teachers' working enthusiasm. However, due to the development of colleges and universities and the particularity of the work nature of college teachers, this performance evaluation model has been difficult to meet the needs of the current performance evaluation of college teachers. Relevant scholars put forward a teacher performance appraisal system based on grey clustering analysis, but found in the practical application, because there are many performance indicators involved in the appraisal process, it has high requirements on the comprehensive analysis ability of the system. As a result, the traditional system has low assessment accuracy.

Aiming at the shortcomings of traditional methods, this paper designs an efficient performance appraisal system for higher vocational colleges based on fuzzy comprehensive evaluation model. This study mainly designs the system from two perspectives of hardware and software. The main work is as follows:

(a) In the hardware part, B/S manager and ASP.NET processor are designed respectively to help the system better adapt to the wan environment and realize the implementation of the application.
(b) In the software part, on the basis of analyzing the demand of performance evaluation of teachers in higher vocational colleges, the fuzzy comprehensive evaluation model of performance evaluation is constructed, and the functional module and database module are designed. Improve performance assessment accuracy according to assessment coefficient and actual impact factor.

2 System Hardware Design

2.1 B/S Manager

The Browser/Server structure originated in the development process of computer network. People learned its advantages and disadvantages from the use of traditional C/S mode in the development and application process. With the rise and development of the network, more and more drawbacks are gradually revealed, leading more researchers to work on a new software development structure to meet the new needs of network development. Later, there was the B/S manager, which is an improved model structure based on the C/S model. Its core is the Web server [6]. With the help of the Browser/Server model structure, all applications are implemented through the Web browser. The execution operation of the B/S manager is shown in Fig. 1.

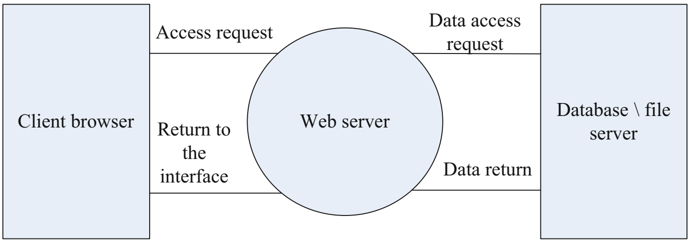

Fig. 1. B/S manager structure diagram

In Fig. 1, the most common structure of the B/S manager is a three-tier architecture, which divides the entire system application into three layers: the application layer, the business logic layer and the data access layer, which is similar to the three-layer C/S mode. The difference is that It is a network-based Web application that can be used in a wide area network and can better meet the needs of network development.

Because the client in C/S mode will carry a large number of processing tasks, it is bound to affect the response processing time of the whole system, especially when the data to be processed is relatively large. The B/S manager solves this problem properly. It applies the browser and can share the work of the client without downloading a large number of corresponding applications. Usually, it only needs to download and install the browser to meet the corresponding requirements, which greatly reduces the complexity of the client program. B/S is a three-tier structure model including application layer, business logic layer and data access layer. Among them, the application layer is responsible for interactive operation with users [7]. The business logic layer can judge and process the business logic in the request; The data access layer completes the data call processing. The processed data results are usually returned to the browser in HTML format for user operation. In this mode, the browser and server undertake the tasks of operation, management and maintenance respectively, so it is relatively simple in the later management of the system.

In addition, this mode supports the implementation of the system operation by the browser, and the browser can be used directly, which reduces the trouble of downloading related applications, and is more convenient for the user [8].

With the continuous development of network technology and the popularization of home applications, applications based on B/S managers are more popular among people. The three-layer structure in this mode can greatly improve the running speed and work efficiency of the system. At the same time, the three-layer division that is independent of each other is adopted. Even if there is a problem in one of the layers, it will not affect the normal operation of the other layers, which is not only consistent with the concept of "low coupling and high cohesion" of engineering software, but also to a certain extent. This increases the chances that the system can be successfully ported [9].

B/S manager has the characteristics of distributed application. Distributed means that by dividing the application tasks that need to be realized in the form of corresponding multiple processes and handing them over to the corresponding devices, the processes of each part are separated, and multiple devices are used to process the data, and then with the help of distributed computing, to achieve the purpose of the entire application task. B/S managers can meet these requirements well, especially in the case of network-based applications are cheaper.

As a B/S manager based on WEB application, its data execution work is realized by the server, as long as the application browser is downloaded on the client side to meet the operation needs, all data execution work is concentrated on the server, and the client only needs to It can be achieved by installing a browser, so the need for cross-platform applications for users can be avoided by shielding the physical location of the database.

Usually, if an application wants to continuously meet the development needs of technological changes, it must go through a continuous update and upgrade process. B/S manager is more convenient to implement this aspect. Compared with the traditional C/S, which needs to update and maintain each node, it only needs to perform maintenance operations on the server side. It reduces the workload of maintenance and update and improves work efficiency [10]. This is even more evident in companies with more and more dispersed users. It has strong portability and expansibility, and adopts a three-layer structure that is independent of each other, which can ensure that when a situation occurs in any layer, it will not affect the work operation of other layers. The realization probability of each layer function to expand operation makes the system have strong portability.

2.2 ASP.NET Processor

ASP.NET processor is widely used in the research and development process of Web application system, which can be used to realize the development of server-side applications. In fact, it is a type of programming scripting technique. The application script realized by using it can be executed in the Internet server, which is a part of the .NET framework, and the functions supported by the .NET class library can be applied to this according to the needs. The technology is powerful and stable, and it is suitable for the development of Web-based dynamic server pages.

In the late 1990s, ASP processors were widely used in the development of server-side applications, and by the beginning of this century, a large number of ASP websites and software applications emerged on the market. ASP processor has attracted the general attention of software enthusiasts with its unique performance characteristics, promoted its development in the software industry, and made it occupy a long position in the server application development technology. However, the application of the script has gradually exposed more problems such as inconvenient maintenance and poor plasticity in the development process. Therefore, a new development technology is urgently needed to meet the new needs of network development. At this time, ASP.NET The processor will follow the trend. After that, the technology has become more mature and comprehensive after a period of application development, and the expanded ASP.NET processor has become one of the most mainstream Web-based application R&D technologies. Its performance is briefly introduced below, and the processing flow of the processor is shown in Fig. 2.

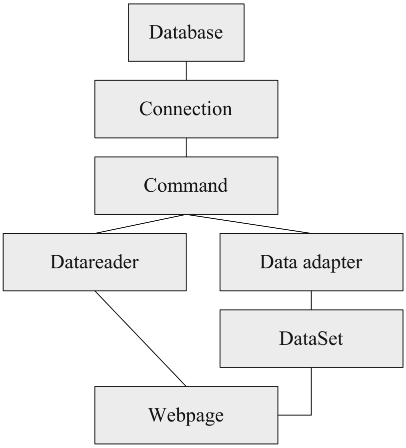

Fig. 2. Processing flow

The ASP.NET processor uses two different files to separate and save the code and the page, which can greatly improve the speed and work efficiency of the system response operation. Usually, the system will automatically archive the pages compiled and used by users, so that users can directly call and use them from the cache when they need the same operation request again, which not only reduces the trouble of compiling pages again, but also effectively improves the overall system operation efficient.

Using the ASP.NET processor to develop software can easily achieve some seemingly difficult problems, and because it can call all the functions of the .NET class library, it is easier to develop the system and the application of the developed system is more flexible.

ASP.NET is a component of NET Framework, so it can call all NET class library functions, and developers can use these functions reasonably according to their needs, so as to shorten the development time of the application as much as possible and improve the R&D efficiency.

3 System Software Design

3.1 Analysis of the Needs of Teachers' Performance Appraisal in Higher Vocational Colleges

From the current situation of performance appraisal standards for teachers in higher education schools in China, teacher performance still remains in the paper version. The purpose of designing performance appraisal system is to realize performance automation and convenient processing in essence.

Around the performance management system of college teachers, the perspective of information management and application between different roles and different users will also be different. Taking this as the starting point can effectively simplify the work content of relevant personnel, strengthen the effective improvement of work efficiency, and strengthen the embodiment of the authenticity and intelligence of office content.

When setting performance, it is necessary to fully consider the issue of having user permissions. The main body of performance appraisal users is normal teachers. This kind of users need to meet the requirements of teachers' performance rapid evaluation, teachers' performance score query and other practical functions. In addition, such users can also be leaders, because leaders have the right to directly manage teachers. Teachers are the most representative among them. Generally, the performance evaluation among teachers is the evaluation of peer workers. After all, they are engaged in similar teaching tasks. Therefore, they still know more about teachers' teaching performance and can score teachers' performance more intuitively; Scientific research management personnel mainly assess the publication of teachers' scientific research papers. If the publication is good, the performance score of the teacher can be appropriately improved; In the assessment scope, students are the group most in contact with teachers. Therefore, it is more practical for students to score teachers. The specific scoring table is shown in Fig. 3.

In Fig. 3, the administrator of the system, as the name implies, is the person who manages the information of the system. The system administrator has the highest authority and can change the relevant data of various users, such as user name, login password and other information. The system use case is shown in Fig. 4.

In Fig. 4, the role of the personnel management department in the enterprise is to evaluate the performance of employees and give corresponding suggestions. In the team of college teachers, the personnel management department can also play a similar function to scientifically manage the performance, salary adjustment and professional title promotion of teachers according to the performance evaluation of Teachers.

Performance evaluation is not a simple scoring work, it is a complex process. In general, it needs the cooperation of multiple departments to complete this work. Teacher performance evaluation is a serious matter, and it must be open, fair and impartial, which is related to the future development direction of teachers. There are also many evaluation groups, including teachers' teams, scientific research managers, students taught by teachers and department leaders.

In the performance evaluation of teachers, at least the performance indicators of teachers need to be confirmed, and each teacher sets different performance requirements according to their professional title, so as to ensure that the performance arrangement is

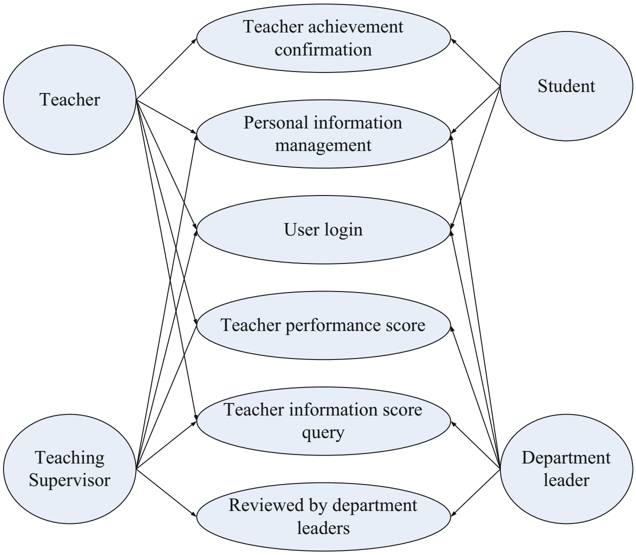

Fig. 3. Performance scoring table

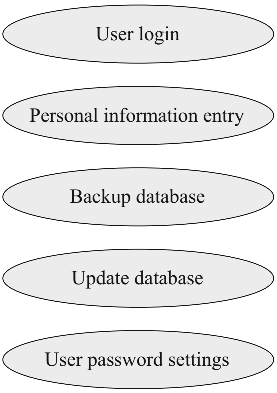

Fig. 4. System use case

more reasonable and in line with the actual work situation of teachers. After the relevant leaders confirm the performance evaluation standards, the performance objectives are communicated to the corresponding teachers through the school personnel management department, and the teachers are responsible for performing the corresponding contents of performance.

The performance evaluation of teachers is the core part of the management of teacher performance evaluation. This part mainly includes the performance evaluation between teachers, the performance evaluation of teachers by scientific research managers, the performance evaluation of teachers by students and the performance evaluation of teachers by department leaders. Among them, the teacher assessment is mainly the assessment among peers to investigate whether the teachers' teaching situation is good. For the performance assessment of teachers, the scientific research managers mainly investigate how the teachers' scientific research achievements are and whether the relevant papers have been published within the specified time, while the student assessment of teachers is due to the more contact between students and teachers. Therefore, teachers have a better understanding and the evaluation results are also referential. Department leaders mainly conduct overall control and evaluation on Teachers' daily work, life and learning.

The teacher's performance appraisal results include the teacher's performance score and the comprehensive score of the personnel department. If the teacher finds that the total score has no objection, he/she should sign in the corresponding performance appraisal file. If the teacher finds that the evaluated performance can not feed back his/her own performance, he/she needs to re-examine the current performance score. If there are any problems, The need for reconsideration; Then go through the performance scoring and evaluation system again, and then evaluate the performance; After confirming that the performance is correct, the teacher needs to sign for confirmation, and the performance appraisal results are saved to the personnel management department. This performance appraisal can be declared over.

3.2 Build a Fuzzy Comprehensive Evaluation Model for Performance Appraisal

The assessment business of classroom teachers is mainly to conduct a comprehensive assessment of the subject teachers they can contact. The teachers and teachers are colleagues, and colleagues spend the most time with colleagues, so they can give teachers an objective and positive evaluation.. Different teachers have different scores for teacher assessment standards. At this time, it is necessary to encapsulate the class Teacher Assessment Business Action-Teacher Assessment Business Manager-Teacher Assessment Business Manager-New Assessment Logic Class New Assessment Manager-Confirm the assessment plan Define The Name of Exam() method to complete the naming work of this performance appraisal. The responsibility of the assessment administrator is to score the performance of the teachers who teach in the subject. The teacher evaluation team is divided into several subject groups, and teachers are scored according to the principle of group scoring. The fuzzy comprehensive evaluation model is established based on the fuzzy comprehensive evaluation method, which is a comprehensive evaluation model based on fuzzy mathematics. The comprehensive evaluation model transforms qualitative evaluation into quantitative evaluation according to the membership degree theory of fuzzy mathematics, that is, using fuzzy mathematics to make a general evaluation of things or objects restricted by many factors. It has the characteristics of clear results and strong systematicness, can better solve fuzzy and difficult to quantify problems, and is suitable for solving various uncertain problems. Based on this, a fuzzy comprehensive evaluation model of performance appraisal is constructed, as shown in Eqs. (1) and (2).

$$\mathrm{P} = \frac{g}{TF} \tag{1}$$

$$E = P\sqrt{D^2} \tag{2}$$

Among them, g represents the evaluation coefficient, T and F represent the actual impact factor, and D represents the evaluation index. Using this model can effectively conduct performance evaluation. When using this assessment model, the code program becomes the class template of Assessment Business Action, Assessment Business Manager assessment business boundary class, group assessment logic class Assessment Business Manager, and team scoring method team Scoring()" to work.

3.3 Design Function Modules

The performance plan module focuses on the setting of teacher performance by the performance administrator. Generally, for a teacher, performance appraisal is the core part of the work. Only with good performance score can we obtain affirmation and better professional development. This module mainly realizes six functions.

As for the change of performance evaluation methods, teachers change frequently in Colleges and universities. Therefore, in view of this situation, it is necessary to give different performance evaluation methods to teachers at different levels, so as to avoid giving associate professors or professors lower performance evaluation standards or giving low-level teachers higher performance evaluation standards, Thus, the scientificity and impartiality of performance evaluation are improved.

For the formulation of teachers' performance, it should meet the evaluation and scoring functions of different types of groups on Teachers' performance, including scoring among teachers' colleagues, scoring among department leaders, scoring of scientific research managers and students' evaluation of teachers. These parts should be fully combined, so that teachers can better understand themselves, Find out the deficiencies in the work and improve it in the future to improve the work ability. Support the retrieval of teachers' past assessment. Through this function, teachers can see their own progress or shortcomings. Using this method, teachers can be urged to adapt to the current performance assessment methods and promote teachers to improve teaching and scientific research methods.

Plan adjustment: although some adequate solutions have been made to eliminate the possible abnormal factors affecting teachers before teachers' performance evaluation, there will still be some special conditions that will affect teachers' performance evaluation. Therefore, teachers' performance should be based on the actual situation, not invariable. For teachers' data, To improve the four functions of addition, deletion, modification and inspection, the administrator should scientifically and reasonably formulate performance management methods according to the changes of teachers' actual situation. The specific standards that can be implemented are that after the formulation of teacher performance, a standby performance scheme is reserved. If the main performance changes, the standby performance scheme can be enabled immediately. According to the comparison scheme before and after the teacher performance evaluation method, formulate a set of reasonable teacher performance evaluation methods.

Plan decomposition: the plan decomposition function is actually the performance decomposition function, which divides teacher performance into multiple modules for processing. At present, most colleges and universities improve teacher performance from the perspectives of teaching and scientific research. Using this method can reduce the difficulty of managers in Teachers' performance evaluation. On the other hand, it can better supervise teachers' daily behavior norms. Key points and temporary plans: there will be some changes in the team of college teachers, such as the resignation of teachers or transfer to management positions. Therefore, in addition to ensuring the teachers' own performance, some new teachers should be trained to replace the changed teachers. This function can be added to the management. Once the teachers change, And if there is no staff to replace as soon as possible, it will increase the workload of other teachers and directly affect their teaching energy and effect. After a teacher logs in to the performance management system, the system will automatically judge which permission the teacher has. Then, according to different permissions, teachers are given different operation schemes. Teachers can only add, delete, modify and check their own performance, but cannot modify the performance of other teachers.

The core problem of the performance management module score is that the scoring standards for teachers' performance part are formulated for different teachers, and the proposed scheme models are also different. However, there is a common characteristic that teachers' performance scores are closely related to their personal planning. This module mainly realizes six functions: the design of the performance system, this part includes the basic content of teacher performance, the score of teacher performance and the modification rules of teacher performance. The specific score design standard should be determined according to the actual performance of teachers. Usually, the better the teacher's performance in teaching, the more obvious the score will be. It is necessary to set up archiving work for the drafted teacher performance norms, keep the manuscript, and only the relevant leaders can change the manuscript. Moreover, relevant leaders can also analyze whether teachers complete performance tasks according to the requirements according to the manuscript. For the control of teachers' performance scores, information can be recorded using tables and text software.

The performance contract is a key task for teachers' work standards. It is mainly reflected in the fact that teachers only fulfill the contract requirements when they complete the performance tasks. Afterwards, the post-sequence operation can be carried out. If the review fails, it will be returned and the teacher will revise and improve it. In order to effectively and intuitively reflect the performance status of teachers, the performance contract cannot be modified by the teachers themselves, and only the leaders of the colleges in charge have the authority to modify them. In terms of teacher performance, a performance table needs to be developed to facilitate teachers to compare their scores. After the performance evaluation is completed, teachers should confirm their own performance evaluation results. If teachers disagree with the evaluation results or need to revise the content of the evaluation, the teacher can report the relevant problems to the evaluation leader and propose improvement plans, and finally the performance evaluation results will be evaluated. After the department leader has passed the review of the performance assessment results, it needs to be submitted to the school personnel management department for storage; the personnel management department will finally review and output the performance assessment results according to the submitted results and make backups for storage.

At the end of the semester, the teacher will automatically generate a performance report after completing the work. After the report is approved, it will be communicated to the teacher through the software system. The system automatically generates performance reports, which can also reduce the workload of staff and improve work efficiency. After teachers conduct performance evaluation, they will analyze the results, so as to make a staged summary and evaluation of teachers' performance. After the performance evaluation is implemented, the evaluation results should be communicated to teachers, and teachers' opinions and suggestions should be listened to, so as to ensure the objectivity and accuracy of the performance evaluation results. Teachers' performance changes every semester. Therefore, a correct analysis of teachers' performance is conducive to the adjustment of school teachers' performance wages and the normal progress of professional title promotion, so that the school can better manage personnel.

3.4 Design Database

Database plays a very important role in the management of teachers' performance. The storage function of database can store the information of teachers' performance. Moreover, the security of the database is very high, which can encapsulate each teacher's performance independently, so as to avoid the performance being tampered with by others. The data server is the core part of the evaluation of the whole teacher performance information system. The quality of the server directly determines whether the evaluation of teacher performance can be in place. Therefore, for the construction of servers, high configuration computer systems must be equipped. In terms of establishing data, we should consider both safety and speed.

In response to this situation, this time we chose the SQL Server 2015 database as the application database. The characteristics of this kind of database introduced above are that it solves information processing requests based on the communication between the server and the client. According to the principle of Internet communication, the client sends instructions to the server, and then the server returns instructions to the client. Terminal for users to view. The database itself is just a data system, and it does not have the function of querying application data. In order to enable teachers to check performance, it is necessary to combine teacher performance software with the database to achieve the purpose of querying data. Generally, it is based on the application of a certain point. to confirm that the database follows the principles. When carrying out the task of the database, we need to adhere to the following principles: first, the database system needs to be concise and efficient, and a good database system can ensure the smooth operation of the software system; secondly, we must ensure the security of the data system and have a secure database, in order to make the user's data more secure.

The data used for performance evaluation is Microsoft SQL Server 2015. The biggest advantage of this database is that its security is very strong. In addition, in the process of development, developers have a more convenient operation mode and can quickly locate each data that needs to be processed. Moreover, the database is usually based on the Internet as a carrier. Realize the cloud disk storage function. When the user has edited the data content, the computer server will upload it to the cloud network disk in time, and automatically back up to prevent information loss.

With the continuous improvement of the level of science and technology, there are also many new processing solutions in cloud storage. For example, Weiyun, Baidu Netdisk, etc., all have powerful database information storage functions. After the database is set up, most of the language compatibility problems encountered in database development can be solved by using SQL tools. SQL structured query language, simply a database management language, is a standard language for defining and manipulating databases in relational databases. This function is mainly used in data storage functions, and at the same time, it can better optimize data content.; In addition, it also includes a set of functions that combine various contents with each other to maximize the advantages of the database.

4 System Test

In order to test the evaluation effect of the performance evaluation system of Higher Vocational Colleges Based on the fuzzy comprehensive evaluation model, this paper establishes the relevant test platform for the following tests.

4.1 Test Preparation

Firstly, the system describes the function and is easy to operate: the operation link of the system is fully realized by using Internet technology. System administrators, evaluated teachers and participants in the evaluation can log in to the system for operation anytime and anywhere. High security: different users can set different passwords to operate. For example, the personnel participating in the evaluation have only their own permissions. They can only enter their own evaluation interface to change the evaluation value, and cannot enter the teacher system. After entering the performance information statistics link, the relevant procedures can complete the overall evaluation form after receiving the teacher performance information for easy reference. Powerful background management: the system can manage background data well, which can be reflected in the control of running programs in the background. If there are a large number of running programs in the background, it will automatically hide some open programs to prevent illegal theft.

The security setting of the system is also very high. For example, teachers want to understand the students' evaluation of teachers. At present, teachers can only see the specific evaluation score level through the system, but can not locate the evaluation from whom. For evaluators, they can give real evaluation to the current teachers without worrying about too many questions. Before logging in to the system, the system administrator shall set the permission content in advance. If a person with abnormal permission tries to enter the system, the system will automatically refuse to join. At the beginning of the evaluation, each person who logs in to the system must be authenticated. Only the authenticated user can enter the function of the corresponding system. After scoring the teachers according to the system prompt, the scoring software will automatically upload to the database. The vulnerabilities selected in the test are shown in Table 1 below.

In Table 1, the recovery test mainly checks the fault tolerance of the system. When a system error occurs, whether the error can be corrected and the system restarted within a specified time interval. First, force the system to fail, and then use the Kusuo family disk detection and repair tool master to perform a recovery test. After verification, the system can recover as soon as possible. Security testing mainly checks the security performance

Table 1. Testing vulnerabilities

Serial number	Test for vulnerabilities	Method
1	Check for permission identity vulnerabilities	Enter the address directly in the browser address bar
2	Check SQL	Construct an injected SQL statement
3	Injection vulnerability	Enter address
4	Object Vulnerability	Change parameters

of the system. For this teacher performance evaluation system, the safety test starts from the following.

Three aspects: check for permission identity vulnerabilities, check for SQL injection vulnerabilities, and directly reference object vulnerabilities.

4.2 Test Results and Discussion

Under the above conditions, the response time changes of the system after logging in with different numbers of users are tested, and the test results are shown in Table 2.

Table 2. System test results

Number of logged in users	Login response time	Test results
100	0.35	The login is normal, the test is passed
200	0.43	The login is normal, the test is passed
300	0.32	The login is normal, the test is passed
400	0.53	The login is normal, the test is passed
500	0.42	The login is normal, the test is passed
600	0.53	The login is normal, the test is passed
700	0.55	The login is normal, the test is passed

It can be seen from Table 2 that the performance appraisal system of higher vocational colleges designed in this study has good performance and short response time, which meets the needs of practical applications.

In order to further highlight the application advantages of the system in this paper, the traditional teacher performance appraisal system based on grey clustering analysis is taken as a comparison, and the performance appraisal accuracy is taken as an indicator to complete the performance verification jointly with the system in this paper. The obtained results are shown in Table 3.

By analyzing the results shown in Table 3, it can be seen that with the increase of experimental time, the performance assessment accuracy of different systems also

Table 3. Comparison results of performance assessment accuracy of different systems/%

Number of experiments	System of this paper	Traditional system
100	93.35	87.41
200	92.43	85.23
300	95.32	80.49
400	95.53	83.17
500	96.55	82.88

changes. In the whole experiment cycle, the maximum performance assessment accuracy of this system can reach 96.55%, while the maximum performance assessment accuracy of the traditional system is only 87.41%. In contrast, using the system in this paper can get more effective results of teacher performance appraisal.

5 Conclusion

This paper designs an effective performance appraisal system for teachers in higher vocational colleges according to the current form of education management. In the research, the fuzzy comprehensive evaluation model of performance appraisal is constructed, and the accuracy of performance appraisal is improved according to the evaluation coefficient and actual impact factor.

From the point of view of practical design to practical application, due to the interference of various practical factors, the system itself has some defects and deficiencies, which need to be improved in time. In the process of system design, it is not only necessary to focus on the exploration from the perspective of actual demand, but also need to take the overall comprehensive consideration from the two perspectives of physics and logic, which are very important for improving the content of performance appraisal database.

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Real-Time Collection Method of Learning Status Data in Distance Teaching Based on Internet of Things

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Abstract. With the increase of distance learning data, the traditional methods have some problems, such as low efficiency and poor accuracy. Therefore, this paper studies the real-time collection method of learning state data of distance education based on Internet of things. Based on the analysis of the interrelated factors of distance learning status data, the different quadrants are divided according to the real-time of learning status data acquisition. On the basis of different collection schemes, the priority level of real-time collection of learning state data in distance education is identified. This paper combines the design of real-time collection algorithm of distance learning state data, and realizes real-time collection of distance learning state data. Experimental results show that the proposed method can improve the efficiency and accuracy of data acquisition in distance education.

Keywords: Internet of Things technology · Distance learning · Learning status · Data collection · Relevance factors · Priority

1 Introduction

At present, traditional education can no longer meet the learning needs of learners, and distance education lacks the sharing and comprehensiveness of learning resources. There are also some disadvantages in teaching application. With the development of science and technology, big data processing technology and open source architecture platform have promoted a new development model of educational informatization. Namely the emergence of distance online learning platforms. This large-scale online open course has a variety of learning resources and a variety of learning support service tools, which can meet the learning needs of various learners [1]. However, in practical applications, researchers have found that the actual learning situation of learning users is not optimistic, and many online courses have a large number of registered learning users in the initial stage. But as the course progresses, many learners choose to give up or have low learning outcomes. These phenomena cannot be ignored for course organizers and

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platform managers. How to improve the effective utilization rate and user traffic of the online learning platform requires researchers to analyze the online learning status of learning users in a timely manner.

In domestic research, Sa Zhibin et al. [2] proposed a method of extracting learning resources from digital library based on personalized push service, aiming at the problems of user satisfaction and low response efficiency in current research results. Collect data such as user resource download information, access URL content, and system access time. Select a small log file parsing tool to directly parse the collected data. Save the parsed data to a MySQL or Oracle database. According to the collection and processing results of readers' personalized behavior data, fuzzy clustering is carried out on the visiting users of digital library by using the clustering method under the equivalence matrix. Provide users with personalized push services based on the user's browsing and borrowing and resource utilization in the optimal clustering. Use fuzzy recognition method to identify the individual status of target users. According to the recognition result, it is fed back to the user as a user retrieval resource, so as to realize the extraction of learning resources. The experimental test results show that the performance of the digital library learning resource extraction method is relatively perfect. The user satisfaction is high, the response speed is faster, and the extraction accuracy is high, showing good application performance. Because of the large number of remote users, the accuracy of the collected data has a certain deviation, which needs further optimization.

Yan et al. [3] explored the influencing factors of online video on user interactive continuous learning behavior. The exploration of its influencing factors and mechanism will help increase user stickiness and promote the construction of a good online learning ecosystem. Using the qualitative research method of grounded theory, the three-level coding of the bullet screen data is used to extract the concepts and categories, and then the theoretical model of influencing factors is constructed. The study found that individual factors, curriculum factors and teacher factors can affect user satisfaction through influencing user interaction behavior factors. And further affect the user's interactive continuous learning behavior. In addition, the individual characteristics of users will moderate the influence of user interaction behavior factors on user satisfaction. And teachers' teaching style will directly affect users' interactive continuous learning behavior. However, with the increase of the number of distance learning, the amount of related data is explosive growth, so the speed of data collection needs to be further improved. In foreign research, Wu et al. [4] considered that the new rules of deep mining of learning habits can be decomposed into constructing a scientific and effective learning habit measurement model. To describe the dynamic changes of learning habits and explore the dynamic mechanism of the evolution of learning habits to discover the law of the formation of learning habits and other two key issues. To solve these two key issues, this paper integrates learning analysis and big data analysis methods into the study of learning habits. Starting from the analysis of learners' learning behavior, a reusable multi-granularity data sharing model is constructed by collecting massive learning behavior trajectory data. On this basis, the statistical law of data is deeply analyzed, and the measurement model of learning habits is constructed. Based on this model, a precise learning habit intervention model is designed to explore the learning habit dynamics mechanism based on educational big data. This method traces the development law of students' study habits under the background of "Internet + education".

With the development of information technology, online learning platforms are popular with learners. Its personalized learning mode and shared resources have certain advantages for learners' thinking and knowledge construction. The current MOOC user registration is huge. However, the actual course completion rate is very low, and users give up a lot during the course learning process. This serious loss of users is not conducive to the operation and development of the platform. Therefore, in order to find out the main factors that affect learners' successful completion of the course, it is necessary to track and analyze the user's learning status trajectory in the platform. Through the observation of various behaviors of learners through data, it is possible to find out which learning states of users have a greater correlation with the successful completion of the course. At the same time, based on the learning status, it recommends personalized course resources for users to improve their online learning satisfaction. Based on the analysis results, feedback and guidance can be given to learners' online learning activities to achieve the purpose of promoting effective learning.

From the perspective of theoretical research, in the educational information environment, classroom teaching based on mobile terminals has gradually become an integral part of school teaching. In this type of classroom, teachers' teaching behavior and learners' learning status gradually reflect complex and diverse characteristics. Starting from the actual classroom teaching, combined with data warehouse technology, data analysis and research are carried out on the learning state, and the corresponding behavior data distribution model and behavior specification are obtained. The establishment of a data warehouse system is of great significance to perfecting the learning state analysis theory under the background of the new curriculum reform.

Based on the above research background, this paper uses the Internet of Things technology to design a real-time collection method of distance teaching learning status data. Thereby improving the learning quality and efficiency of learners.

2 Design of Real-Time Collection Method for Distance Teaching Learning Status Data

2.1 Analysis of Correlates of Distance Learning Status Data

As a multi-dimensional complex system, the learning state needs to be analyzed in detail for its influencing factors. We need to clarify the learning characteristics, learning motivation and style of learners, and help teachers and distance learning platform managers to design reasonable teaching structures and teaching strategies. And provide guidance and help for the clustering of learning status, the recommendation of learning resources, and the relationship between exploration and learning effect. In analyzing the influencing factors of distance learning learning status data. It is necessary to consider not only the internal factors of the learners themselves, but also external factors including the learning environment, support system, teaching mode and so on.

Internal Factors

The internal factors that affect the learning status data of distance teaching mainly include learners' information literacy, learning motivation, original subject knowledge, learning style and self-efficacy [5]. As shown in Fig. 1.

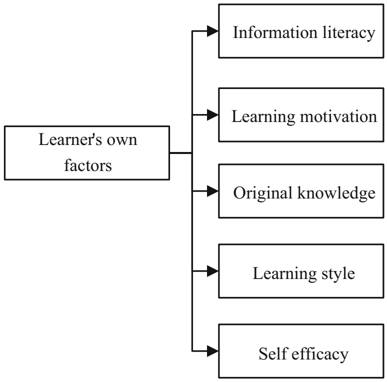

Fig. 1. Internal influencing factors of learning status

Learner Information Literacy. Online learning requires students to have the ability to proficiently use technical means and tools, and to use computer technology to efficiently store, analyze and filter teaching resources. Not only can you get excellent grades, but also stimulate intrinsic interest and motivation, which is positively related to the effective progress of online learning.

Learning motivation. As the main driving force, it is divided into internal and external. Among them, the inner motivation is generated by the learner's own psychology and guides them to carry out autonomous learning. External motivation is that learners are supervised and motivated by external forces, such as teachers' supervision, homework, tests, grades and other factors. Motivation should be clarified before analysis, and learners with weak motivation can rely on the means of increasing external motivation for monitoring and management.

The subject knowledge possessed by learners refers to the relevant curriculum knowledge possessed in the learning process. Online teaching resources show the characteristics of diversification and specialization. Learners lack relevant knowledge and experience and may be confined to limited information space. The original subject knowledge can help to retrieve and process relevant course content, speed up and improve the quality of learning and the stability and enthusiasm of platform users.

Learning style. There are mainly independent type and dependent type, in which independent people tend to learn independently, while dependent people need the outside world to supervise and guide their learning. In the analysis, the internal learning style of the learners should be fully considered, and more evaluation and guidance should be given to the dependents, and a sufficient inquiry environment should be given to the independents.

Learner self-efficacy. Self-efficacy in online learning is reflected in learners' confidence in whether they can successfully complete the course. Learners must fully understand the service functions provided by the platform, and use various learning support tools for efficient online learning, thereby enhancing self-efficacy. Therefore, before the course starts, you should strengthen the practice of platform service functions and tool use, improve your technical operation skills, and enhance your confidence in learning.

External Factors

The external factors mainly include four aspects: online teaching mode, learning resources, learning support system, teachers' level of learning assistance skills, etc. [6]. The specific external factors are shown in Fig. 2.

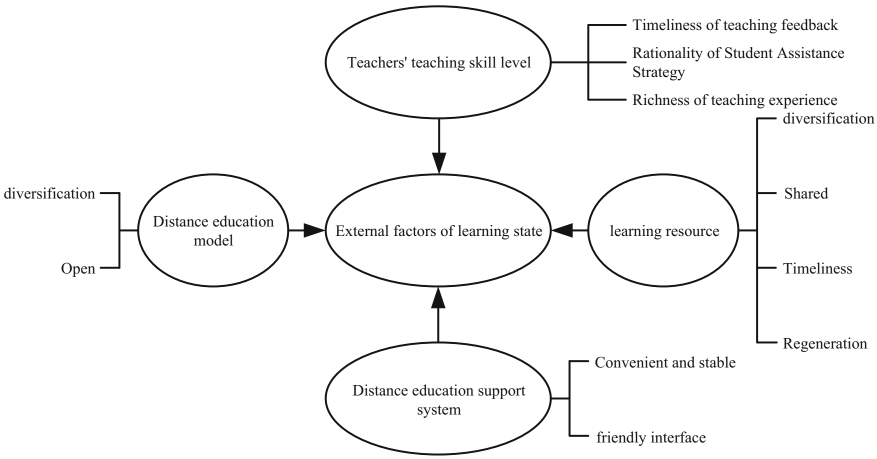

Fig. 2. External influencing factors of learning status

Online teaching mode. Different from traditional teaching, the diversified and open teaching mode of online learning platform has an important influence on the occurrence of effective learning state. Students have changed from passive educated to the main body of learning. In essence, the teaching process is the process of information organization, acquisition, processing, evaluation and storage. Course organizers and educational researchers should explore a more complete online teaching model to better meet the learning needs of various users. It can not only further accelerate the popularization of education informatization, but also improve the quality of online teaching.

Online learning resources. It is the object of the learner's online learning state. Different from traditional teaching resources, it has various forms and can be shared without connection. When learners study a courseware for a long time, mental fatigue may occur. With the help of fragmented course video resources provided in the online learning platform, this deficiency can be compensated. At the same time, the regeneration of online learning resources can help learners to relearn the main points of a certain course, thereby improving the learning effect. In addition, due to the various forms of online learning resources, the focus is different, which is convenient for learners to choose learning according to their learning needs.

Online Learning Support System. The basic function of the online learning support service system is to provide convenient channels and tools for learning interaction in the entire online learning process. In this way, the user's learning effect can be improved while maintaining their learning interest and motivation. Therefore, when developing and designing an online learning platform, platform managers should ensure that the system has complete functions, stable operation, and prevent user congestion, so as to improve the operating efficiency of the platform.

The teacher's aid skill level. In the educational information environment, although the role of teachers has changed a lot, they mainly play the roles of tutors, organizers and academic assistants. However, teachers' guidance and management of platform users continue to exist and play a greater role than traditional teaching. If teachers themselves have high information literacy, they can guide students well, and can play an exemplary role for students to develop a good learning state. Whether the student aid is in place, whether the feedback is timely, whether the learning resources provided are rich, whether the student aid strategy is reasonable, whether the teaching experience is rich and other factors will affect the learner's learning participation.

2.2 Determining the Priority Level of Real-Time Collection of Learning Status Data in Distance Learning

In order to improve the reliability and accuracy of data collection of distance teaching learning status. All cycle-related data should be taken as far as possible, a unified data environment should be constructed, and a comprehensive judgment should be made on the status of the data. The method of four-quadrant diagram is adopted to judge the data collection priority of distance teaching learning status. In the process of judging the priority of data collection by using the Internet of Things technology. Different quadrants are divided according to the real-time nature of the data collection of distance teaching learning status according to the priority [7]. On the basis of different collection schemes, make corresponding reasonable judgments for different types of collected data.

Build a set of judgment factors:

$$M = \{m_1, m_2\} \tag{1}$$

In formula (1), m_1 represents the importance of discriminating the learning status data of distance teaching. m_2 represents the real-time requirement for data collection of distance teaching learning status.

According to the judgment factor set constructed by formula (1), let the weight corresponding to each factor be $A = (a_1, a_2) = (0.5, 0.5)$. Thus, the judgment set is determined, namely:

$$V = \{v_1, v_2, v_3, v_4\} \tag{2}$$

In formula (2), v_1, v_2, v_3 and v_4 represent the first, second, third and fourth quadrants, respectively.

After research by many professionals, a factor discriminant matrix is obtained, which is expressed as:

$$R = \begin{pmatrix} r_{11}, r_{12}, r_{13}, r_{14} \\ r_{21}, r_{22}, r_{23}, r_{24} \end{pmatrix} \tag{3}$$

Then the fuzzy comprehensive judgment obtained is:

$$B = A^{\circ}R \tag{4}$$

In formula (4), $^{\circ}$ is represented as a fuzzy operator. The M ($\bullet$, $\oplus$) operator is selected here. Then the fuzzy comprehensive discriminant can be rewritten as:

$$B = \sum_{j=1}^{m} f_j e_{jk} (m = 2, k = 4) \tag{5}$$

In formula (5), f is the amount of collected distance teaching learning status data. e is a vector in the acquisition interval. k is the threshold.

Through the above calculation process, the discrimination result of the data collection priority can be obtained. Based on this result, the running data is collected in real time according to the higher frequency. And a flexible acquisition method is proposed. According to the difference of the actual learning state in the process of data collection and the final goal of the collection work. The time interval of data collection and the total number of data to be collected are automatically changed and adjusted, and data collection must be focused. Effectively evaluate the degree of fluctuation of data, and collect data on the premise of adjacent data changes [8]. As the learning state data changes, the acquisition interval also changes accordingly. The short-term changes will cause disordered changes in the acquisition interval, which will deplete the system and cause large errors. Therefore, a double judgment method is used when calculating data fluctuations. The specific judgment method is as follows:

The first judgment: take the standard deviation as the quantification standard, and use k collected data in each interval to form the data variation. f_0^2 represents the standard deviation of the collected data in each interval to judge the fluctuation of the data. The following calculation formula is used:

$$f_0^2 = \sum_{i=1}^{k} \left(\frac{f_i - \overline{f}}{k} \right)^2 \tag{6}$$

$$f_0 = \sqrt{\frac{\sum_{i=1}^{k} \left(f_i - \overline{f} \right)}{k^2}} \tag{7}$$

In the formula, f_i is the ith data collection point in the interval. $\overline{f}$ is the mean value of the collected data in this interval.

The second judgment: due to the instability of the data changes of distance teaching learning status, two situations will occur. The first is that the Internet of Things is disturbed by the outside world, so that the Internet of Things will temporarily differ greatly from the central data value. After that, it is close to the data center value, and the collection interval can remain unchanged. In order to make the collection interval not affect the collection process. Use the moving average method to judge the degree of data volatility, and take the first number of each interval as the standard. Each subsequent data change cannot affect the data of the entire interval. The specific formula is as follows:

$$f_1 = \sqrt{\frac{\sum_{i=2}^{k} (f_i - f_1)^2}{k - 1}} \tag{8}$$

The second situation is that the state of the Internet of Things changes irreversibly. At this time, the distance learning state data will fluctuate briefly. After this, a new center value is generated. Data in IoT will again aggregate around this new central value. And maintain a stable state, and the collection interval of distance learning state data remains unchanged. Using the former value of the adjacent two sides as the standard, to judge whether the distance learning state data in this interval is stable, or fluctuates around the central value, the formula is:

$$f_2 = \sqrt{\frac{\sum_{i=2}^{k} (f_i - f_{i-1})^2}{k - 1}} \tag{9}$$

The two methods mentioned above are to judge the changes of the collected data by analyzing the changes of the system data in a certain period [9]. This method has higher work efficiency, because the degree of change of adjacent data does not need to be considered in the judgment process. On the basis of improving the collection efficiency, it also reduces the interference of the outside world to the collection work, and prevents the load change from having a greater impact on the collection system. It can effectively improve the accuracy of data collection.

2.3 Design a Real-Time Acquisition Algorithm for Distance Teaching Learning Status Data

About distance teaching and learning state data acquisition algorithm is to use Internet of Things technology to convert high-frequency and fast long-distance transmission repetitive signals into low-frequency and slow signals. Effective time-frequency decomposition of remote signals is achieved by wavelet analysis. The digital processing of the global operating frequency band signal is realized by band-pass sampling. Finally, the detection signal amplitude information collected from the distance teaching learning status data is collected. According to the optical fiber transmission to the remote computer monitoring system. The specific process is shown in Fig. 3:

Step1: Wavelet analysis process

Wavelet analysis can realize effective time-frequency decomposition for distance teaching learning state data, and realize orthogonal decomposition for distance teaching learning state data within the full frequency bandwidth [10]. The resolution corresponding to different frequency segments of distance teaching learning status data is adaptively

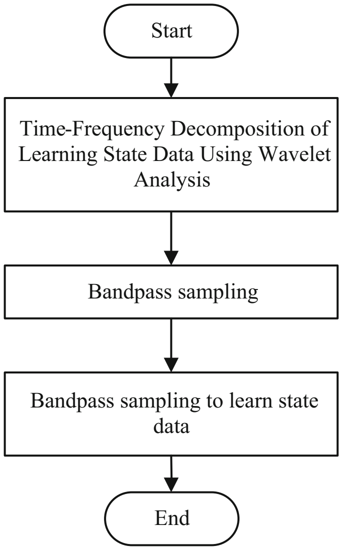

Fig. 3. Real-time acquisition process of learning status data

specified. In order to bring in the wavelet packet, the scaling equation corresponding to the scaling function $\delta(x)$ is expressed as:

$$u_0(x) = \sqrt{2}\sum_{k\in z} h_k u_0(2x-k) \tag{10}$$

The scaling equation corresponding to the wavelet function $\varphi(x)$ is expressed as:

$$u_1(x) = \sqrt{2}\sum_{k\in z} g_k u_0(2x-k) \tag{11}$$

In formula (11), $u_0(x) = \varphi(x)$, $u_1(x) = \phi(x)$ and $g_k = (-1)^k \overline{h}_{1-k}$ [11, 12]. It can be seen that there is also an orthogonal relationship between the two coefficients, and the function set defined by recursion is represented as $\{u_n(x)\}$, which is a wavelet packet determined according to $u_0 = \varphi$. The wavelet packet decomposition process of the signal is expressed as:

$$\begin{cases} d_1^{j,2n} = \sum\limits_{k\in z} h_{k-21} d_k^{j+1,n} \\ d_1^{j,2n+1} = \sum\limits_{k\in z} g_{k-21} d_k^{j+1,n} \end{cases} \tag{12}$$

It can be seen from Eq. (12) that the actual decomposition process of the wavelet packet not only decomposes the low-frequency part, but also decomposes the high-frequency part [13]. Thereby, the resolution of the high frequency part is improved.

Step2: Bandpass sampling process

The global operating frequency band is digitized by bandpass sampling. The $x\left(e^{jw}\right)$ signal is filtered by the digital filter ($B = \pi/D$).

The detected high-frequency distance learning state data is sampled in the time domain where the sampling pulse occurs. In order to make the obtained samples show the trend of instantaneous amplitude variation of the detected signal. When a sampling is performed in the time domain when the sampling pulse occurs, it is delayed by a period of time Δt from the detection signal, so that the sampling pulse sweeps the waveform of the detected signal. The sampled signal is still a narrow pulse. But its corresponding amplitude reflects the amplitude information of the detected signal in the sampling time domain. The factor by which the sampling speed is slowed down is calculated by:

$$q = \frac{T}{\Delta t} \tag{13}$$

In formula (13), the multiple of the sampling speed slowdown is expressed as q. The period of the detected signal is denoted as T. The width of the sampling pulse is denoted Δt. Under the influence of the sampling control pulse, corresponding step waves and ramp waves will be generated. In any sampling control pulse period, the ramp wave will be compared with the step wave as the reference voltage once. Every time a comparison is implemented, there is a fixed delay time $T + \Delta t$ between the next comparison between the ramp wave and the staircase wave compared to the previous comparison. Among them, the pulse period of sampling control is expressed as T. The corresponding time delay of any sampling point in a unit period is expressed as Δt, and the charging slope of the linear ramp is calculated by formula (16) as:

$$K = \frac{U_F}{T_F} \tag{14}$$

The delay time of the step-by-step pulse is expressed as:

$$\Delta t = \frac{\Delta U}{K} = T_F \times \frac{\Delta U}{U_F} \tag{15}$$

In formula (15), the amplitude of the ramp voltage is expressed as U_F. The time that the ramp voltage can last is expressed as T_F. The voltage increment at each stage of the staircase wave is denoted as ΔU. By changing the slope $\frac{U_F}{T_F}$ of the ramp voltage or the voltage increment ΔU of each stage of the step wave, the purpose of regulating the delay time Δt of the step pulse can be achieved. Realize the collection of remote teaching learning status data.

3 Experiment Analysis

3.1 Build an Experimental Dataset

The experimental data of distance teaching learning status data collection comes from the distance teaching learning status database of a university. The database contains 200 users and 500 sets of distance learning learning status data. The dataset includes data type, dimension, and demand. We divide the experimental data into training set and test set, and use the ratio of 7:3 to divide training data and test data. And first set the high-dimensional data recommended by users to 10. Utilize IoT technology to test distance learning learning status data. Finally, the collected experimental results are displayed.

3.2 Set Experimental Parameters

In order to test the superiority of the method of real-time acquisition of learning status data in distance teaching based on the Internet of Things in the implementation process. Use the Matlab 2019 simulation toolbox to set the simulation parameters, as shown in Table 1.

Table 1. Experimental parameters

Parameter name	Parameter settings
Collection frequency	20 Hz
Number of iterations	5 times
Sensor model	LMS200
Learning state packet size	52 byte
Source rate	10 packet/s
The amount of learning state data	1000 pieces

3.3 Result Analysis

In order to highlight the advantages of the real-time collection method (method 1) of the learning status data of distance teaching based on the Internet of Things. The data collection method (method 2/Reference [3]) based on Web embedding is compared with the data collection method based on personalized push service (method 3/Reference [2]). The two methods used in this paper are the latest methods in recent three years, which can support the innovation of the proposed method. The performance of the three data acquisition methods is tested and the results are as follows.

The test results of the real-time collection efficiency of distance teaching learning status data of the three data collection methods are shown in Fig. 4.

It can be seen from the results in Fig. 3 that the real-time collection efficiency test results of learning state data obtained based on method 3 and method 2 are relatively close. Its learning state data collection efficiency is lower than 50%, and the highest collection efficiency is only 44% and 38%. When using method 1, the lowest collection efficiency reached 55%. With the increase in the amount of learning state data, the real-time collection efficiency of learning state data is increasing, reaching a maximum of 93%. Therefore, the method in this paper improves the collection performance of learning state data by improving the collection efficiency. Figure 5 shows the test results of the real-time collection accuracy of the distance teaching learning status data of the three data collection methods.

It can be seen from the results in Fig. 4 that when method 3 is adopted, the accuracy of data collection is between 20% and 40%. When method 2 is adopted, the accuracy rate of data collection is between 50% and 70%, which can basically meet the teaching needs of teachers. When using method 1, the data collection accuracy rate is higher than

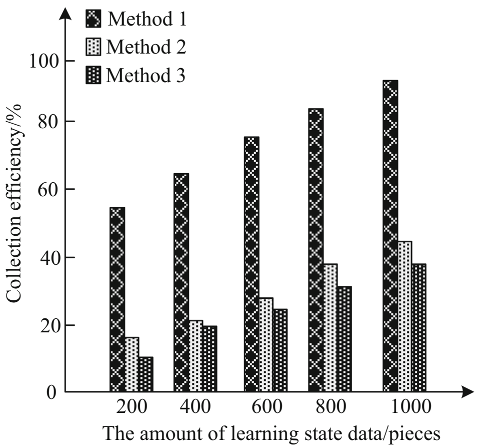

Fig. 4. Real-time collection efficiency test results of distance teaching learning status data

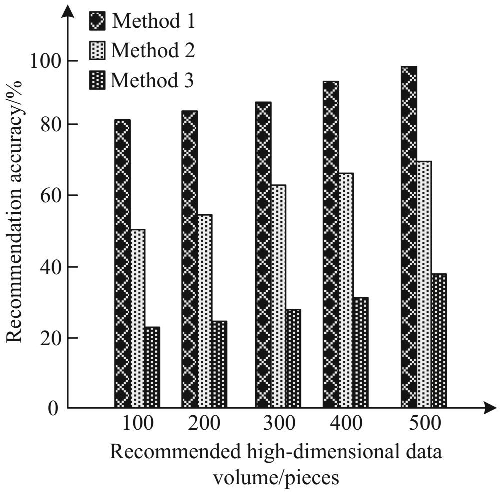

Fig. 5. Learning state data collection accuracy test results

80%, and even the highest accuracy rate reaches 99%. It shows that the performance of the method in this paper can fully meet the teaching needs of teachers when collecting the learning status data of distance teaching.

4 Conclusion

This paper proposes a research on the real-time collection method of distance teaching learning status data based on the Internet of Things, which is found by testing. This method has better performance when collecting distance teaching learning status data. However, there are still many deficiencies in this study. In future research, it is hoped that mobile terminals can be introduced to monitor the learning status data and improve the real-time nature of data collection.

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Research on English Translator Speech Recognition System Based on Deep Learning

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Abstract. The application of English translators is affected by speech recognition technology. Current speech recognition systems use Hidden Markov Models for recognition, which are susceptible to interference from noise and the magnitude of the recognition object, resulting in low accuracy and efficiency of the recognition system. Aiming at the above problems, research and design an English translator speech recognition system based on deep learning. Design the system hardware support software function with the combination of FPGA and STM32F4 microprocessor as the core. After preprocessing the speech sequence collected by the English translator and extracting the features, the DNN neural network trained by the restricted Boltzmann machine is used to recognize the speech sequence features to realize the speech recognition function. In the experiment, the DNN neural network has better recognition performance than the HMM model. The designed recognition system takes an average of 23.5 ms to recognize and has a higher recognition efficiency.

Keywords: Deep learning · English translator · Speech recognition · System design · FPGA · DNN neural network

1 Introduction

English is the most widely used language in international communication. In recent years, with the continuous development of machine translation related technologies, the application scope and demand of English translators have gradually expanded. There will be recognition errors in the use of English translators, resulting in differences in translation and affecting the use effect of translators. Therefore, for English translators, the recognition accuracy of input speech is very important. As the most important and convenient way of information exchange between people, voice is also an ideal bridge between people and intelligent hardware. Speech recognition is to let the machine understand the language spoken by human beings and convert it into accurate text information [1]. As an important interface of human-computer interaction, speech recognition has changed people's life in many aspects. Speech recognition brings a lot of convenience to production, life, work and study. The traditional speech recognition based on statistical model method uses hidden Markov model as an acoustic model component, and uses

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Gaussian mixture model to describe the probability of speech acoustic features. However, hidden Markov model belongs to a typical shallow learning structure. It only contains a network structure that can convert the original input signal into a specific problem space. It has a series of disadvantages, such as complex data annotation, high requirements for application scenarios and poor anti noise ability. The multi-core learning and projection algorithm in reference [2] can effectively classify multi-band noise according to different bandwidth, strengthen the speech feature level, and complete multi-band anti noise speech recognition together with CHMM model. Literature [3] produces phoneme features with different durations, and multi-core convolution fusion network is used to standardize phoneme features with different lengths and reduce the error rate of recognition words. However, the above two systems have a long time for English translator speech recognition, and the recognition accuracy is low.

With the development of deep learning, speech recognition system has achieved better and better results. The speech recognition system based on deep learning can better learn the abstract features of data, so the design difficulty of front-end feature extractor is greatly reduced, and there is no need to manually design complex feature extractor to obtain speech features [4]. The acoustic model based on deep learning needs a deep network structure. However, each voice contains hundreds of frames. With the increase of network level, more and more parameters need to be trained, and the requirements for hardware are higher. English translators have higher requirements for speech data, resulting in long delay and low recognition accuracy of the current speech recognition system. Therefore, aiming at the defects of the current speech recognition system, this paper optimizes the hardware and software, and studies and designs the English translator speech recognition system based on deep learning.

2 Research on the Hardware Part of the Speech Recognition System of English Translator Based on Deep Learning

The hardware of the English translator speech recognition system based on deep learning designed in this paper is mainly composed of speech recognition module, control module, communication module and peripheral circuit. Among them, the control module takes the STM32F4 microprocessor as the core, and consists of a power supply circuit, a crystal oscillator circuit, a reset circuit, a JTAG circuit, and a bootstrap mode selection circuit. The speech recognition module takes FPGA processing chip XC3S500E as the core, and realizes relevant data including data preprocessing, speech feature extraction and template management on the audio information collected by the microphone of the English translator. The communication module uses the integrated USB and UART communication serial ports of the control chip to upload and download data. RS-232 standard interface (also known as EIA RS-232) is one of the commonly used serial communication interface standards. Flash is an excellent web animation design software launched by Macromedia in June, 1999. It is an interactive animation design tool, which can integrate music, sound effects, animation and innovative interfaces to produce high-quality web page dynamic effects. Figure 1 below is a schematic diagram of the hardware part of the English translator speech recognition system designed in this article [5].

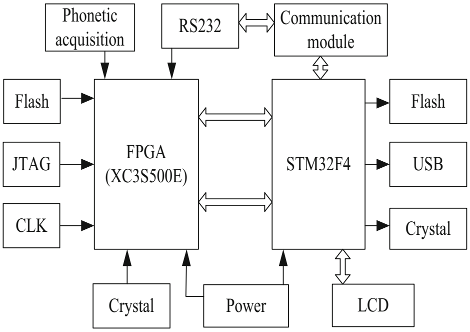

Fig. 1. Schematic diagram of the hardware framework of the speech recognition system of the English translator

2.1 Speech Recognition Module Design

In the speech recognition module, the A/D sampling of speech signal is realized through the serial port software of UDA1341TS speech chip. The frequency is 8 kHz, and the speech recognition results are displayed on LCD. The clock signal of the speech recognition module is generated by an external 32768 Hz crystal oscillator.

Considering that the software part of the speech recognition system uses deep learning algorithms for recognition processing, the data quantization of the FPGA chip uses double-precision floating-point representation. The manifestation is shown in Fig. 2 below [6].

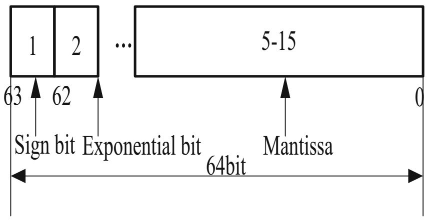

Fig. 2. Schematic diagram of double-precision floating-point representation

The 16-bit double-precision floating-point representation method is adopted. The highest bit of the voice signal is 15th for the sign bit, 14th to 12th are integer bits, and 11th to 0th bits are decimal places. In the FPGA implementation process, the specific data corresponding to the decimal operation needs to be enlarged by 212 times, and the result after the operation is correspondingly reduced by 212 times, that is, the data quantization process in the FPGA is completed. The FPGA chip is debugged through the ACT8990 interface chip. JTAG is mainly used for chip internal testing and system simulation debugging. In this design, for the convenience of online debugging, 20-pin JTAG is selected as the debugging interface. The pin function comparison is shown in Table 1.

Table 1. JTAG pins and corresponding function setting parameters

ACT8990 pin number	Name	Pin setting function
PC10	TMS	Select JTAG test mode
K11	TCKI	Test clock
L9	TDI1	Test data input
H10	TD0	Test data output
F10	RESET	Test reset

After the user releases JTAG after debugging, the GPIO controller will gain control again. After the GPIO control register is reset, the software can use these I/O ports as ordinary I/O.

The system mainly uses Flash memory to store the written related voice program code, some user data that needs to be saved after the system is powered off, constant tables and the results of voice training. This article chooses the 64M Nand Flash-K9F1208U0M chip, which can be automatically erased during programming. The voice recognition module communicates data through the RS232 serial port. When sending data, the parallel bus sends the internal data of the system to the sending unit, then enters the FIFO queue, and then passes through the sending phase shifter and then sends it through the TXDn pin.

2.2 Control Module Design

The STM32F4 microprocessor mainly has three modes of power-on, low voltage and watchdog reset. Among them, the low-voltage reset method means that when the power supply voltage is lower than a certain value, the logic judgment of the entire operating system will be disordered. In order to avoid this phenomenon, a reset signal is generated within 4 clock cycles to make each chip the value of the register returns to the initial state. The watchdog reset is to clear the watchdog at regular intervals. If it is not cleared for more than the specified time, a reset signal will be generated. The operating voltage of the STM32F4IGT6 chip is 2–3.6 V, and 3.3 V is selected as the chip's power supply. The design chooses the linear regulator AMS117 to realize the voltage conversion from 5 V to 3.3 V. The output terminal of the voltage regulator chip is connected to 0.1 μF and 10 μF capacitors, and the input terminal is connected to the same 0.1 μF and 10 μF capacitors [7]. Prevent chip damage caused by voltage inversion at the moment of power failure, and rectify the input voltage.

For the FLASH storage of the control module, the Flash memory chip selected by this system is SPR4096, which has 512 K Flash, 256 sectors of 2 K bytes, and the maximum operating frequency is 5 MHz. The STM32F4 microprocessor selects the memory mode through the combination of pin level signals. The specific memory mode selection pin level combination is defined in Table 2 below.

The microcontroller realizes the communication of the host through its asynchronous serial port UART, and displays the speech recognition results of English translation

Table 2. FLASH storage mode selection pin definition

BOOT0	BOOT1	Storage mode	Storage
0	0	SPR4096	Choose to access the main FLASH chip storage space
1	0	Chip RAM	Select the RAM storage space embedded in the microcontroller
1	1	De-expandable memory outside the system	Select system external expansion memory space

in the display information. Under the hardware framework of the speech recognition system designed above, using deep learning related algorithms, this paper analyzes the requirements of current English translators for speech recognition, designs the software part of the system, and realizes the recognition function of translated speech.

3 Research on the Software Part of the Speech Recognition System of English Translator Based on Deep Learning

3.1 English Translator Speech Signal Preprocessing

When the voice signal passes through the human glottis, it will be affected by the glottal air flow, and will be attenuated at an attenuation rate of 12 dB per octave; when it passes through the oral cavity, it will be affected by the lip radiation and will increase at an increase rate of 6 dB per octave.. The entire voice signal is attenuated by 6 dB per octave, which causes the attenuation rate to become faster and faster as the frequency continues to rise, which causes the high-frequency signal to be attenuated by a large margin. In order to reduce the energy loss caused by the attenuation of high-frequency signals, it is necessary to pre-emphasize the speech signal. Pre-emphasis can filter out low-frequency interference and improve the resolution of high-frequency components in the voice signal. The pre-emphasis operation generally passes the speech signal through a first-order high-pass filter with a characteristic of $(1 - \alpha Z^{-1})$, which is called a pre-emphasis filter in most cases.

The transfer function of the pre-emphasis filter is [8]:

$$H(Z) = 1 - \alpha Z^{-1} \tag{1}$$

Among them, α represents the pre-emphasis coefficient of the speech signal, and its value range is 0.9–1.0. This article selects the pre-emphasis coefficient to be 0.98.

Speech signal is transformed with time, but the spectral characteristics of speech signal will not change in a short time. Therefore, in the process of speech signal processing, a whole segment of speech signal needs to be divided into several segments, that is, framing processing. Before speech signal feature extraction, it needs to be overlapped and segmented, that is, framing operation. When dividing frames, select 25 ms for each frame and l0 ms for frame shift, then the overlapping part is 15 ms.

In this paper, Hamming window function is used to process speech signal by windowing and framing. Hamming window function is as follows:

$$Win(k) = \begin{cases} 0.54 - 0.46\cos\left[2\pi n(K-1)^{-1}\right], 0 \le k \le K-1 \\ 0, \ \ else \end{cases} \tag{2}$$

In the above formula, K is the length of the English translator's speech signal frame number. After the signal is divided into frames, the features of the speech signal are extracted to facilitate speech recognition. When extracting the characteristic parameters of the spectrogram, the discrete Fourier transform is performed on each frame of the speech signal to calculate the frequency spectrum $X(t)$, then the square is taken to calculate the energy spectrum $|X(t)|^2$, the logarithmic energy spectrum $\lg|X(t)|^2$ is calculated, and finally the energy spectrum corresponding to each frame of speech signal Rotate and splice into a matrix of eigenvectors. The discrete Fourier transform formula is shown below [9].

$$X(t) = \sum_{k=0}^{K-1} x(k)\,\omega(k) \tag{3}$$

$$\omega(k) = e^{-j2\pi K^{-1}} \tag{4}$$

In the above formula, $x(k)$ is the limited-length discrete speech signal of the English translator. After the characteristic matrix of the energy spectrum of the speech signal is obtained, the Mel frequency cepstrum coefficient of the signal is extracted. If the frequency of the speech signal of the translator is f and the mel conversion frequency is M_f, the formula for obtaining the mel frequency by using the frequency conversion of the speech signal is as follows:

$$T_M(f) = 2595\ \lg\left(\frac{f+700}{700}\right) \tag{5}$$

After converting the frequency of the speech signal into Mel frequency according to the above formula, the MFCC feature of the signal is extracted. After preprocessing the speech of the English translator, the deep learning algorithm is used to recognize the speech signal.

3.2 Deep Learning to Recognize Speech Signals

This design uses deep learning neural network to realize the speech recognition function of English translator. The multi-layer structure of the DNN neural network model can express complex functions with a small number of parameters, which is convenient for training and recognition. The DNN neural network model has a total of L + 1 layers, where the 0th layer is the input layer, the 1st to L-1 layers are hidden layers, and the Lth layer is the output layer. The adjacent layers are connected by a feedforward weight matrix. If the input vector of the DNN neural network is $I^{(l)}$ and the output vector is $O^{(l)}$, when the characteristic sequence of the speech signal collected by the microphone of the English translator is t, the relationship between the output and input of the network is as follows:

$$I^{(l)} = \beta^{(l)} O^{(l)} + b^{(l)}, O^{(0)} = I^{(0)} = t \tag{6}$$

The activation function of the neural network uses the softmax function. The speech feature sequence t is first sent to the input layer of the 0th layer, and then propagated to each node in the hidden layer according to the arrow connection of each node, and finally to the output of the l layer Layer, and finally get the network output. For the DNN neural network, a restricted Boltzmann machine is used to train the network parameters. The restricted Boltzmann machine is composed of a hidden layer and an observation layer. Among them, the observation layer is represented by g, and the hidden layer is represented by y. The internal nodes of the hidden layer and the observation layer are independent of each other and obey the 0–1 distribution, and there is no correlation, but they are connected to each other through the weight matrix to maintain the inter-layer relationship.

For a restricted Boltzmann machine RBM, assuming the model parameter is $E = (\omega, \mu, \tau)$, its energy function is defined as [10]:

$$E(\mu, \tau) = -\sum_{i=1}^{G} \sum_{j=1}^{Y} \omega_{ij} g_i y_j - \sum_{i=1}^{G} p_i g_i - \sum_{j=1}^{Y} p'_j y_j \tag{7}$$

In the above formula, G is the number of nodes in the observation layer; Y is the number of nodes in the hidden layer; ω is the weight matrix connecting the two layers [11]; p and p' are the bias vectors of the observation layer and the hidden layer, respectively. Since the RBM structure is symmetrical, when the state of the hidden layer unit is determined, the activation states between the visible layer units are also conditionally independent [12].

Therefore, the joint probability distribution of variables μ and τ is:

$$F(\mu, \tau) = \frac{\exp(-E(\mu, \tau))}{\sum_{\mu} \sum_{\tau} \exp(-E(\mu, \tau))} \tag{8}$$

Suppose μ is the speech feature sequence of the English translator, and the edge probability density distribution of the speech feature μ is:

$$F(\mu) = \frac{\exp(-E(\mu, \tau))}{\sum_{\tau} \exp(-E(\mu, \tau))} \tag{9}$$

Since the speech feature sequence is continuous, all nodes obey Gaussian distribution by default. The task of learning RBM is to obtain the optimal solution of parameter $E = (\omega, \mu, \tau)$, so as to fit the training data [13]. In the process of fitting, it is necessary to use Gibbs sampling method to simulate and solve all voice features. In the k-step Gibbs sampling, the larger the k value, the more accurate the fitting voice feature, and the sampling process will take longer to complete. In order to obtain the optimal solution of parameter $E = (\omega, \mu, \tau)$, the maximum value can be solved by the contrast divergence algorithm. That is, with each training data as the initial state, only k steps of Gibbs sampling are required to obtain a sufficiently good approximation. During the training process of the model speech feature sequence, due to the large number of layers of the DNN neural network model, the number of nodes in each layer is also large, and the model processes a large number of feature sequences, it is inevitable that over-fitting problems will occur. Therefore, the Dropout strategy is introduced to suppress the over-fitting problem in the model, so as to ensure the accuracy of the final recognition result of the model [14]. In the parameter tuning process, by setting all nodes in each hidden layer of the model to 0 with a certain probability during the training process, the optimized model is averaged to avoid output over-fitting. Perform parameter training on the DNN neural network according to the above process to determine the translator's speech recognition parameters. Use the trained DNN neural network to recognize the input speech signal sequence. The above is the design process of using the deep learning algorithm to realize the speech recognition software function part of the English translator. The software part is transplanted to the hardware, and the design and research of the speech recognition system of the English translator based on deep learning is completed.

To sum up, the overall process of the English translator speech recognition system based on deep learning designed in this paper is shown in Fig. 3.

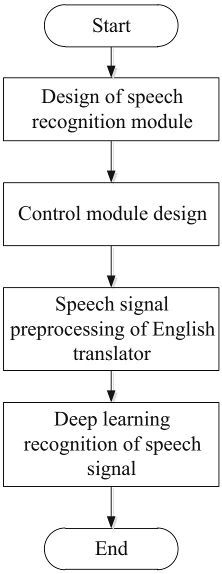

Fig. 3. Overall process of the English translator speech recognition system based on deep learning designed in this paper

4 Experimental Research

Before applying the above designed English translator speech recognition system based on deep learning to practice, it is necessary to test the system in all aspects to ensure the normal functions of the system, and study the performance of the system.

4.1 Experiment Content

The experiment is divided into two parts. One part tests the comprehensive operation performance of the system, and the other part tests the performance of the speech recognition model. The speech recognition system based on Hidden Markov model is compared with the recognition system designed in this paper.

In the performance experiment of the speech recognition model, the Switchboard and RT03S speech library are selected as the training test set. Among them, the Switchboard voice library contains 4870 conversations from 520 speakers, and about 309 h of voice data. Among them, about 30 min of voice data is selected as the test set; and the RT03S voice library contains Switchboard and Fisher. Set, respectively select the speech data of about 30 min in these two sub-data sets as the test set. Use hidden Markov model and DNN neural network model for parameter training, and recognize with the speech sequence in the test set. The performance of the model can be intuitively compared by comparing the loss of the model and the accuracy of the recognition in the recognition process.

In the system performance experiment, two speech recognition systems are applied to the English translator. In order to avoid interference, recording equipment is used as the input of English translator. By comparing the recognition time and accuracy of the system, combined with the experimental analysis of speech recognition model, the final conclusion is drawn.

4.2 Experimental Results

Table 3 below shows the comparison of system recognition time-consuming and accuracy of the two speech recognition systems when recognizing the speech signal input into the English translator in the system comparison experiment.

It can be seen from the data in Table 3 that the recognition time of the system in this paper is lower than that of the comparison system, and the recognition accuracy of the system is higher than that of the comparison system. Further processing the data in the table, the average recognition time of the system in this paper is 23.5 ms, and the average recognition time of the comparison system is 69.84 ms. The recognition accuracy of this system is up to 97.8%, while that of the comparison system is up to 94.7%. The recognition efficiency of this system is higher and the recognition effect is the best.

Figure 4 and Fig. 5 show the comparison of recognition loss and accuracy when the model identifies the test set.

Analyzing Figs. 4 and 5, it can be seen that when the HMM model recognizes the speech sequence in the training set, the recognition loss is higher than that of the DNN neural network model. At the same time, the overall recognition accuracy of DNN

Table 3. Comparison of system identification time and accuracy

Number of recognition speech sequences	Text system		Comparison system	
	Recognition time/ms	Recognition accuracy rate/%	Recognition time/ms	Recognition accuracy rate/%
25	22.2	96.8	38.3	94.7
50	22.5	96.9	39.7	94.5
100	22.8	96.1	45.3	94.5
150	23.2	96.5	56.1	94.3
200	23.5	97.8	67.5	91.6
250	23.6	97.2	74.6	91.7
300	23.9	97.8	80.2	89.0
350	24.3	96.7	88.7	89.2
400	24.4	96.5	96.4	89.4
500	24.6	96.2	111.6	89.1

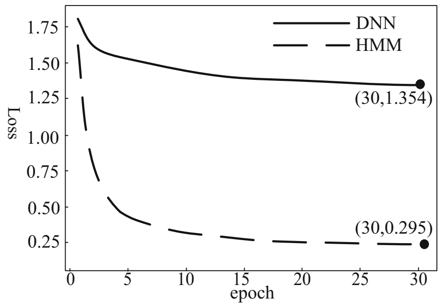

Fig. 4. Comparison of speech recognition model loss

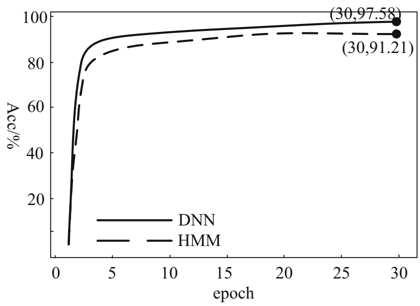

Fig. 5. Comparison of accuracy of speech recognition models

neural network model is higher than that of HMM model. It can be seen from the model experiment that the performance of the DNN model used in this paper is better in speech recognition.

5 Conclusion

Voice is the most commonly used and convenient information carrier for human communication and information sharing. It is also the most natural and indispensable information medium in human-computer interaction. English translator is an important achievement of machine learning, which effectively improves the convenience of English communication. However, the translation accuracy of English translator is also limited by speech recognition technology. In recent years, speech recognition technology triggered by deep learning has promoted the development of speech recognition related fields. Aiming at the defects of traditional speech recognition system, this paper studies and designs an English translator speech recognition system based on deep learning. The DNN neural network trained by restricted Boltzmann machine is used to recognize the features of speech sequence and realize the function of speech recognition. Through the test of the system, it is determined that the designed system can meet the requirements of the current English translator for the speech recognition system, and the recognition accuracy, speed and other performance of the system are improved to a certain extent compared with the traditional speech recognition system. However, the algorithm of this system in the process of English translator speech recognition is complex, which leads to the time of English translator speech recognition not reaching the expectation. Therefore, in the next research, the algorithm is improved to improve the efficiency of English translator speech recognition.

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Evaluation Method of English Online and Offline Mixed Teaching Quality Based on Three-Dimensional Teaching

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Abstract. The lack of process evaluation indicators in teaching quality evaluation will affect the evaluation effect. In view of the problems of low accuracy and efficiency of evaluation results in traditional methods, an online and offline mixed teaching quality evaluation method of English based on three-dimensional teaching is proposed. Establish a three-dimensional English teaching model, which is divided into three stages: teaching preparation, teaching implementation and teaching extension, and analyze the characteristics of English online and offline mixed teaching. According to the characteristics of three-dimensional teaching, the process evaluation index is introduced, and the index system is designed. Calculate the internal weight of indicators, rank them in order according to the degree of importance, and establish a teaching quality evaluation model to test the teaching quality. The experimental results show that compared with the evaluation method based on grey correlation analysis, neural network and decision tree classification algorithm, this method can still maintain high accuracy when the amount of data is large, so it is effective and scientific.

Keyword: Three dimensional teaching · English · Online and offline · Mixed teaching · Teaching quality · Teaching evaluation

1 Introduction

Teaching quality is an important standard to measure teaching and guide teaching reform. It can objectively reflect the level of education and the degree of educational effect. The purpose of teaching quality evaluation is to objectively evaluate the current situation of teaching and learning, while affirming the achievements, find out the problems and find out the causes of the problems, formulate effective and feasible improvement measures, help students better find their own advantages and weaknesses, and make personality development and teaching according to their materials a reality [1]. With more and more schools carrying out English online and offline mixed teaching, the research on its teaching quality has attracted extensive attention at home and abroad. How to improve students' enthusiasm to participate in mixed teaching and how to mix and match online

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and offline teaching contents without increasing students' burden have become important research topics that can not be ignored.

Gu Lin designed a multimedia teaching quality evaluation method based on grey correlation analysis and neural network. This method uses grey correlation analysis to determine the weight of quality evaluation index, and uses neural network to establish a quality grade classifier, which improves the efficiency of evaluation modeling [2]. Gan Tian puts forward a method for evaluating the quality of distance teaching in Colleges and Universities Based on decision tree classification algorithm. The efficiency of this method can adapt to the development trend of distance teaching in modern colleges and universities, and the evaluation accuracy of distance teaching quality in Colleges and universities is high [3]. ZHAO Min designed a teaching quality evaluation system based on deep learning algorithm is designed. The system automatically generates a teacher's teaching quality evaluation report, analyzes the problems existing in the teaching process, and gives optimization suggestions. The teaching quality evaluation system includes five units: user management, online evaluation, data management, evaluation result query, and teaching quality analysis. After users enter the system, they will score the teaching quality. Based on the content of the teaching quality evaluation index system, the convolutional neural network learns the teaching quality evaluation samples of experts, and constructs the convolutional neural network teaching quality evaluation model. The teaching quality evaluation test sample is input into the model, and the model output result is the teaching quality evaluation analysis result [4].

Although the above evaluation methods have achieved certain results, due to the lack of process evaluation indicators, the accuracy and efficiency of evaluation results are low. The three-dimensional teaching transforms the single knowledge information transmission in the traditional face-to-face teaching into the multilateral communication among various dynamic factors of teaching, expands the information source of teaching and learning between teachers and students, students and teachers, and makes the students' learning style characterized by autonomy, cooperation and exploration. Therefore, based on three-dimensional teaching, this paper proposes an online and offline mixed teaching quality evaluation method to improve the teaching quality and ensure the follow-up teaching progress of the course. The application of the system in the daily management and service of regional schools will certainly enhance the comprehensive competitiveness of schools and even the whole region in the current educational reform, and provide powerful help for schools to walk in the forefront of educational innovation.

2 Based on the Three-Dimensional Teaching Method of English Online and Offline Mixed Teaching Quality Evaluation

2.1 Establish a Three-Dimensional English Teaching Model

When carrying out specific teaching practice activities, teachers should play the role of guiding students to construct a knowledge system, and in this process strengthen or correct students' learning behaviors, while students are the main body of information construction, emphasizing the initiative of students. Therefore, teachers should actively construct good autonomous learning conditions for students, cultivate and enhance students' autonomous learning ability, change students' inherent dependent thinking, and let them play the role of active builders of knowledge, rather than passive receivers of information. This article divides the three-dimensional English teaching model into three stages: teaching preparation, teaching implementation and teaching extension, as shown in Fig. 1.

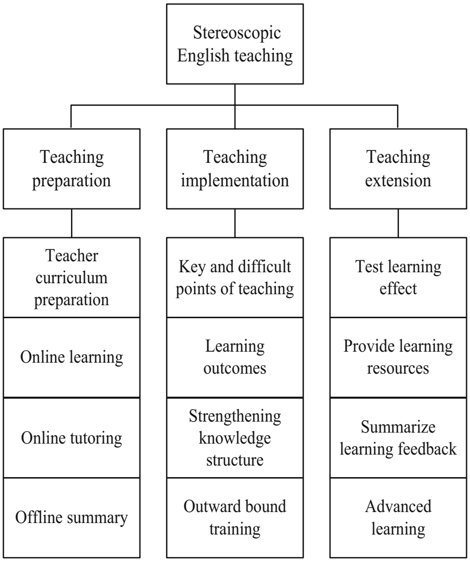

Fig. 1. Three-dimensional English teaching mode

In the teaching preparation stage, the main tasks to be completed are teachers' teaching preparation, students' Online Autonomous Learning, teachers' online supervision and guidance, and summary and analysis of learning. The implementation of hybrid teaching needs the network teaching platform as the carrier to provide a perfect user virtual learning environment, so that students and teachers can realize the transmission, communication, evaluation and feedback of teaching content on the interactive platform. English online teaching platform can provide students with rich and diversified learning resources, such as teaching videos, interesting evaluation games, communication conference rooms, etc. Hybrid teaching process can promote students to form a unique learning experience, and exercise the uniqueness of thinking and the ability to solve problems independently. Curriculum resources determine the thickness and depth of teaching. As an important prerequisite for the smooth development of blended learning, blended learning curriculum resources need a set of scientific and operable evaluation index system as an effective reference for building good curriculum resources to help teachers and students better achieve teaching and learning objectives through blended learning. In the teaching preparation stage, students learn through the learning materials and task list provided by teachers, which lays a foundation for their learning in classroom teaching. The teaching stage is mainly completed through face-to-face classroom teaching. In this stage, teachers and students mainly display online learning results, summarize students' learning feedback, break through teaching key and difficult points, summarize and strengthen knowledge structure, and carry out transfer and transformation training. The specific manifestations are online synchronous classroom test, sorting out the knowledge points of teaching materials, and leaderless unstructured group discussion after class. Combined with the actual situation of students' participation rate in classroom activities and knowledge learning progress, it can effectively improve the efficiency of information technology classroom teaching in senior high school. The teaching extension stage of hybrid teaching mode is mainly for hierarchical consolidation and improvement. Teachers can design hierarchical promotion according to students' learning ability, learning potential and existing knowledge level. The general steps are to detect students' learning effect, provide learning resources for students at different levels, re detect learning effect and create learning advanced mechanism. Teachers master the overall learning situation and individual differences of class students, and evolve the traditional knowledge teaching classroom into an inquiry classroom. The online teaching platform can automatically start the discussion area, teacher live broadcast and remote homework guidance after class.

2.2 Analysis of the Characteristics of Online and Offline English Teaching

In online teaching, students can use mobile terminal devices to learn online teaching materials and exercises issued by teachers, and consciously complete the teaching content assigned by teachers. Learning activities become more convenient and help stimulate their learning. Enthusiasm, improve the ability of independent learning. In the process of online English learning, if students want to achieve meaning construction through classroom and off-class learning, this requires abundant teaching resources as the basic premise. Based on the knowledge points of in-class teaching materials, expand and integrate extra-curricular teaching resources. Integrate the characteristics of blended learning and set up different curriculum resources for different courses. At the same time, because the presentation forms of blended learning curriculum resources are inherently diverse, including textbooks, reference materials, review materials, electronic courseware, electronic teaching plans, study notes, micro-classes, online courseware, online test library and other resource forms, Need to consider the technicality and artistry of various curriculum resources in the design and use process [5]. Calculate the Kendall harmony coefficient of various curriculum resources, and use this as a standard to obtain the ranking of resources. Calculated as follows:

$$\delta = \frac{N}{\alpha^2 \left(M^3 - M\right)} \tag{1}$$

In the formula (1), δ represents the Kendall harmony coefficient; α represents the number of decisions; M represents the number of objects to be sorted; N represents the sum of squared deviations of the ordered sum of each course resource object and the average. The calculation formula of F is as follows:

$$N = \sum_c \gamma^2 - \frac{\left(\sum_c \gamma\right)^2}{c} \tag{2}$$

In formula (2), c represents the total number of sorts; γ represents the sum of sorted orders. When the decision-making opinions are consistent, the course resource is selected as the English teaching resource. At the same time, online education resources can improve the richness and comprehensiveness of teaching content, attract students' interest in learning, and online teaching feedback enables teachers to have a more intuitive understanding of students' learning conditions, and provide different students with corresponding levels of feedback based on the feedback. Learning resources and tasks, and teaching students in accordance with their aptitude. On the other hand, with the help of network technology to realize the diversification of teaching methods, including videos, games, practical homework, etc., to meet the individual learning needs of students as much as possible. In offline classroom teaching, teachers combine students' learning feedback to explain the teaching content in a more in-depth and comprehensive manner, achieve breakthroughs in teaching important and difficult points, summarize and strengthen the student's knowledge structure system, and carry out further exercises to complete the question in the box Knowledge teaching [6]. When designing curriculum resources under any teaching format, the effective presentation of teaching content and learner-centeredness should be the first to bear the brunt, especially for college learners, with high-quality learning support and services, and exquisite classroom design and arrangement. Can effectively promote learners to master learning, and then deep learning occurs, the same is true for blended learning. Blended teaching needs to subdivide the course teaching content into several teaching units, which are then subdivided into three parts: pre-class video teaching, in-class knowledge construction, and after-class training consolidation. This combination of "online and offline" enables students to learn independently without being separated from the guidance and inspiration of teachers. Through online and offline communication between teachers and students, the relationship between teachers and students will also be improved. Become closer.

2.3 Evaluation Index System Based on Three-Dimensional Teaching Design

Online network teaching is not used to replace offline classroom. Although online and offline are two different teaching methods, they pursue the same basic teaching objectives. Through the organic combination of the two, we can strengthen teaching, improve and enhance traditional teaching, and improve teaching quality and level. English teaching quality evaluation runs through the whole process of online Hybrid Teaching [7].

The English Classroom Based on the three-dimensional teaching theory should be: students are carrying out meaningful language practice in a well-designed language environment; Teachers' teaching is centered on students' ability to improve their language use through language practice; Class time is fully utilized. Based on this theory, an evaluation index system of English online and offline hybrid teaching is constructed. According to the three-dimensional teaching theory, the "process evaluation" factor of the mixed teaching evaluation index system is set as three secondary indicators of "before class, in class and after class", in order to highlight the importance of students' active participation in learning, active participation in pre class preview and active after-class cooperation and communication. The evaluation index system based on three-dimensional teaching designed in this paper is shown in Table 1, in which the criterion level is English online and offline mixed teaching quality.

Table 1. Evaluation index system based on three-dimensional teaching

Sub-criteria layer	Index layer
Pre-class evaluation	Monthly preview video views A1
	Daily preview video viewing time A2
	Daily preview of online answer scores A3
	Completion of pre-class homework A4
In-class evaluation	Number of discussions per day A5
	The number of students' questions per day A6
	Frequency of Student Class Participation A7
	Lecture practice results A8
	Group discussion results A9
After class evaluation	Test score A10
	Group work grades A11
	Feedback after class A12
	Student reflection after class A13

The important role of mixed teaching evaluation index system is to use evaluation standards to measure the effect of mixed teaching, and the implementation process also involves the problem of specific index score weight, so the mixed teaching evaluation index system must be measurable. Specifically, the design of evaluation indicators should comprehensively consider all possible factors and strive to express them accurately, specifically and intuitively. Factors that are difficult to describe should be transformed into quantifiable indicators as far as possible to ensure the reliability and measurability of the evaluation index system. Pre class evaluation mainly refers to students' online learning through online learning platform, acquiring new knowledge through online channels, and cultivating the ability of knowledge acquisition, knowledge integration, knowledge summary and practical innovation. The hybrid teaching mode is different from the traditional teaching mode. It is a collaborative process of online and offline links, which is both different and related. Learning links mainly emphasize the distribution and connection of each link in mixed teaching and the role of teachers in each learning link. Taking the teaching process and characteristics of blended learning as the clue and the function, content, technology and artistry of curriculum resources as the main logical idea, comprehensively evaluate the blended learning curriculum resources. At the same time, comprehensively consider the "Online + offline" resources in combination with the characteristics of "Online + offline" learning of Blended Learning [8]. Classroom teaching evaluation mainly refers to students' performance and behavior in information technology classroom. Students have relatively low interest in classroom lectures, textbook reading, PPT viewing, etc., but by participating in teaching exchange and discussion, computer practical operation, problem guidance and communication, students can effectively improve their thirst for knowledge of information technology course learning. Classroom teaching content is not limited to textbook knowledge [9]. At the same time, it also pays attention to the stimulating effect on students' learning potential, and investigates whether the online and offline teaching content has hierarchy, etc. After class evaluation is mainly used to analyze the knowledge consolidation and practical ability evaluation of students in their spare time after classroom learning. After receiving feedback and real-time evaluation from teachers and learning collaborators, re learning and secondary learning are realized to optimize their own knowledge network [10].

2.4 Establish a Teaching Quality Evaluation Model

Teaching quality is the general level reached in teaching, which is reflected in the ability and characteristics of the talents cultivated by education in terms of social needs [11], which reflects the quality of work in all aspects of teaching. The structure of teaching quality evaluation based on three-dimensional teaching in this paper is shown in Fig. 2.

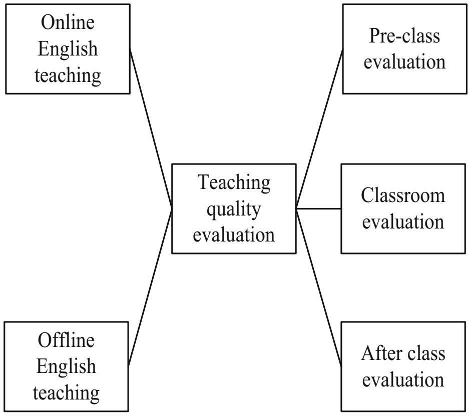

Fig. 2. The composition of teaching quality evaluation

According to the foregoing evaluation index system based on three-dimensional teaching design, the internal weights of the indicators are calculated, and the order of importance is sorted to establish a teaching quality evaluation model to test the quality of teaching and make improvements [12]. Use specific software and formulas to calculate the weight values of different indicators within the hierarchy, and after the consistency check and pass, design the scientific order of the weights of the hierarchical indicators. Constructing a judgment matrix can effectively judge and analyze the correlation between the various elements of the decision-making layer, the criterion layer, and the index layer. The teaching quality evaluation model constructed through the above steps can effectively improve the accuracy of the evaluation results, and before the evaluation model is constructed, establishing an evaluation index system can avoid time-consuming post-evaluation and improve evaluation efficiency. The defined standardization matrix can be expressed as:

$$W_{xy} = \frac{w_{xy}}{\sqrt{\sum_{x=1}^{s} w_{xy}^2}} \tag{3}$$

In formula (3), W_{xy} represents the standardized matrix; y represents the index; x represents the plan; s is the total number of indicators; w represents the initial matrix of the indicator data. Any element in the standardized matrix represents the decision value of the scheme x under the index y. Taking the judgment matrix of the scheme of the index y for pairwise comparison as an example, the feature vector of each scheme is calculated. Then the feature vector of scheme z under the corresponding y index can be expressed as:

$$\eta_{zy} = \frac{\sum_{z=1}^{s} w_{zy}}{s} \tag{4}$$

In formula (4), η represents the feature vector. Calculate the largest characteristic root corresponding to the y index, and conduct a consistency test. By looking at the evaluation random consistency index value table of the judgment matrix, find out the corresponding ratio value, and obtain the consistency index. Generally, if the judgment matrix is considered reasonable and the calculated weight coefficients are also appropriate, the test conditions must be met. For the indicators that pass the consistency test, the information entropy value is calculated to measure the consistency of the contribution of each program, that is, the information utility value. From this, the weight of each indicator is obtained, and the calculation formula of the weight is as follows:

$$\vartheta_y = \frac{1 - \varphi_y}{\sum_{y=1}^{s} \left(1 - \varphi_y\right)} \tag{5}$$

In formula (5), ϑ represents the index weight; φ represents the information entropy value. The calculation results of the teaching quality evaluation model without entropy weight, the weight of each indicator is relatively average, and according to the actual situation, there may be mutual influence between the indicators, which are not absolutely independent individuals, which inevitably makes the indicator system There are a number of interdependent relationships between indicators, which is manifested in the fact that the weights of indicators are quite different. Therefore, the weights obtained by combining the entropy weight with the evaluation method are more in line with objective reality. According to the above calculation method, all the combined weight coefficients of all the evaluation indicators at each level from the top to the bottom can be calculated. According to the distribution of the weight coefficients of the bottom layer, the priority order of the evaluation indexes in the evaluation index system is obtained. According to the weight coefficient, the influence degree of each evaluation index on the English teaching instruction is represented, and the overall evaluation result is finally output. So far, the design of the online and offline hybrid teaching quality evaluation method based on three-dimensional teaching has been completed.

According to the teaching quality evaluation method in this paper, the index weight is calculated, and the results are shown in Table 2.

Table 2. Index weights

Sub-criteria layer	Weights	Index layer	Weights
Pre-class evaluation	0.1827	A1	0.0845
		A2	0.0625
		A3	0.0814
		A4	0.0956
In-class evaluation	0.3448	A5	0.0743
		A6	0.0857
		A7	0.0632
		A8	0.0548
		A9	0.0614
After class evaluation	0.4725	A10	0.0682
		A11	0.0832
		A12	0.0987
		A13	0.0865

The weight calculation results are substituted into the evaluation of English teaching quality.

3 Experimental Research

3.1 Experimental Scheme Design

(1) Experimental data: This paper proposes an online and offline mixed teaching quality evaluation method based on three-dimensional teaching, and takes the English teaching class of a school as the research object. Collect and analyze the online and offline mixed English teaching data.
(2) Experimental indicators: the accuracy and efficiency of teaching quality evaluation are taken as experimental indicators to analyze the effectiveness of this method.
(3) Comparison method: Evaluation method based on three-dimensional teaching, evaluation method based on grey relational analysis and neural network and evaluation method based on decision tree classification algorithm.

3.2 Results and Analysis

In order to verify the effectiveness of the method in this paper, the evaluation accuracy index is selected to measure the pros and cons of the teaching quality evaluation method. Two experimental comparison methods are selected, which are the evaluation method based on grey relational analysis and neural network in literature [2] and the evaluation method based on decision tree classification algorithm in literature [3]. The experimental conditions set up this time are different amounts of mixed teaching data, namely 10 GB, 50 GB and 100 GB. Under different data volume conditions, the accuracy comparison results of the online and offline hybrid teaching quality evaluation methods for English are shown in Tables 3, 4 and 5.

Table 3. Comparison under the condition of 10 GB data volume

Number of experiments/time	Accuracy rate (%)		
	Evaluation method based on three-dimensional teaching	Evaluation method based on grey relational analysis and neural network	Evaluation method based on decision tree classification algorithm
1	94.14	90.74	89.44
2	94.56	91.88	90.86
3	95.22	90.05	88.92
4	94.31	91.66	89.68
5	93.62	92.32	90.29
6	94.25	91.91	91.06
7	96.19	91.24	91.12
8	95.42	92.52	92.21
9	96.87	90.18	89.54
10	95.58	90.46	90.33

According to the results in Table 3, under the test condition that the amount of English online and offline mixed teaching data is 10 GB, the accuracy of the teaching quality evaluation method based on three-dimensional teaching is 95.02%, which is 3.72% and 4.67% higher than that based on grey correlation analysis, neural network and decision tree classification algorithm respectively.

According to the results in Table 4, under the test condition of 50 GB of English online and offline teaching data volume, the accuracy rate of the teaching quality evaluation method based on three-dimensional teaching is 93.14%, which is higher than that based on grey relational analysis and neural network, and based on decision-making. The evaluation method of the tree classification algorithm has been improved by 6.47% and 7.65% respectively.

According to the results in Table 5, under the test condition that the amount of English online and offline mixed teaching data is 100 GB, the accuracy of the teaching quality

Table 4. Comparison under the condition of 50 GB data volume

Number of experiments/time	Accuracy rate (%)		
	Evaluation method based on three-dimensional teaching	Evaluation method based on grey relational analysis and neural network	Evaluation method based on decision tree classification algorithm
1	92.47	87.47	86.74
2	93.88	88.88	84.85
3	94.65	86.69	85.57
4	92.24	85.26	84.66
5	91.50	87.53	86.23
6	92.31	86.34	85.32
7	93.22	85.21	85.05
8	94.95	86.98	84.18
9	92.53	87.30	85.46
10	93.64	85.06	86.84

Table 5. Comparison under the condition of 100 GB data volume

Number of experiments/time	Accuracy rate (%)		
	Evaluation method based on three-dimensional teaching	Evaluation method based on grey relational analysis and neural network	Evaluation method based on decision tree classification algorithm
1	88.14	81.03	82.49
2	89.58	82.46	81.68
3	87.66	80.89	80.27
4	88.32	81.65	82.04
5	89.85	82.27	80.16
6	90.93	82.58	79.53
7	88.62	83.34	80.82
8	89.29	82.06	78.61
9	87.42	81.12	80.35
10	88.24	80.51	79.22

evaluation method based on three-dimensional teaching is 88.81%, which is 7.02% and 8.29% higher than that based on grey correlation analysis, neural network and decision tree classification algorithm respectively. Comparing the test results under the three data conditions, the accuracy of the three evaluation methods decreases with the increase of the data. However, the teaching quality evaluation method proposed in this paper can still maintain high accuracy when the amount of data is large, so it is suitable for online and offline hybrid teaching evaluation.

According to the above experimental results, regardless of the amount of data, the accuracy of the evaluation results of this method is higher than that of the traditional method. This is because this method establishes the teaching quality evaluation model, uses specific software and formulas to calculate the weight values of different indicators within the level, and through the consistency test and judgment matrix construction, it can effectively judge the correlation among the elements of the decision-making level, the criterion level and the index level, thus improving the accuracy of the teaching quality evaluation results.

In order to further verify the effectiveness of this method, the evaluation efficiency is taken as the evaluation index, and different methods are compared and analyzed. The results are shown in Table 6.

Table 6. Comparison of evaluation efficiency

Number of experiments/time	Evaluation efficiency/s		
	Evaluation method based on three-dimensional teaching	Evaluation method based on grey relational analysis and neural network	Evaluation method based on decision tree classification algorithm
1	9.23	15.23	12.57
2	9.47	16.39	12.69
3	9.63	16.57	13.08
4	9.89	16.88	13.27
5	10.25	17.46	13.69
6	10.94	17.69	14.59
7	11.70	18.52	15.66
8	11.97	19.06	16.39
9	12.03	20.37	16.57
10	12.16	21.54	16.98

According to the experimental results in Table 6, the evaluation time of this method is shorter, and the shortest time is only 9.23 s, while the evaluation time of the two traditional methods is higher. This is because this method first establishes an evaluation system before teaching evaluation, which is conducive to improving the efficiency of teaching evaluation.

4 Conclusion

By reflecting on the network-based learning and complementing the respective advantages of traditional face-to-face teaching and network-based learning, a new model - hybrid teaching has emerged. It not only retains the transmission and good interaction of knowledge and information in the traditional face-to-face teaching, but also integrates the rich personalized guidance in network learning. Teachers not only play the leading role of guidance and inspiration, but also reflect the subject position actively created in the learning process. Based on three-dimensional teaching, this paper proposes an online and offline mixed teaching quality evaluation method of English. Compared with the evaluation method based on grey correlation analysis, neural network and decision tree classification algorithm, this method can still maintain high accuracy when the amount of data is large. Although the research on the evaluation of English mixed teaching quality in this paper has reached the expectation, it still needs to carry out further research in the follow-up work to make the evaluation index system more scientific, reasonable and applicable.

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Sports Online Intelligent Education Effect Evaluation System Based on Deep Learning Algorithm

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Abstract. Because there are too many data about the effect evaluation of sports online intelligent education, and they are not combined with the specific situation of the school, the traditional online intelligent education effect evaluation system has some problems, such as the imperfect effect evaluation model, the slow uploading speed of the system and so on. In order to solve this problem, this paper designs a sports online intelligent education effect evaluation system based on deep learning algorithm. Hardware part: use the streaming transmission protocol of HTTP, design the server architecture, and connect the circuit components; software part: combine the dual-teacher teaching mode, obtain the sports online intelligent education objectives, build the effect evaluation model using deep learning, diagnose the special technical progress of students, combine various learning resources with the professional teaching classification of our school, and design the automatic evaluation function of system software. Experimental results: The upload speed of the sports online intelligent education effect evaluation system can reach 268.49 KB/s, which proves that the sports online intelligent education effect evaluation system combined with the deep learning algorithm is uploaded faster.

Keywords: Deep learning · Sports online education · Effect evaluation · Discipline core literacy

1 Introduction

In recent years, with the continuous development of network technology and the continuous improvement of the network environment, online courses have gradually entered the first-line education, and the development of online courses has also shown a trend of a hundred flowers blossoming. For a long time, people have always been confused about the understanding of physical education teaching evaluation: first, whether there is the objectivity of physical education teaching evaluation that does not depend on people's consciousness. In nature, online courses belong to a third-party education platform, which is another kind of education path beyond classroom education and teacher-student

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interaction. In terms of function, online physical education courses have the irreplaceable value of ordinary education model [1]. Both the formulation of physical education evaluation standards and the implementation of physical education evaluation process are accompanied by human subjective factors. Cultivating the core quality of the discipline requires the intervention of online courses. Any subject knowledge can be divided into the surface structure and the deep structure. The surface meaning is the subject content directly expressed by the language and text symbols, while the deep meaning is the spirit, value, methodology and life meaning contained in or behind the content and significance of the subject knowledge, that is, the core accomplishment of the discipline. The main reasons for the subjective factors in the evaluation results are the differences in the assessors in the evaluation and the personal differences in the standards of distinguishing the pros and cons. Whether the subjective interference factors are excluded in the teaching evaluation is a practical problem that needs to be dealt with correctly in the process of teaching evaluation activities. It not only breaks the limitation of region and space, but also the modular teaching unit and multimedia learning carrier optimize the learning process, stimulate the interest in learning, and provides massive resource information for learners. Second, whether there is not a recognized and consistent evaluation standard in the physical education teaching evaluation. In the process of setting and screening the evaluation indicators of sports teaching, each subject may be different, and the needs of the subject may be different. Given the great advantages of online courses, this topic presents a feasible attempt to integrate online courses with college physical courses. In fact, the essence of the evaluation standard of physical education teaching is the needs of people and society, and different people have different needs of teaching between society and people and society at different periods. Physical education teaching requires the intervention of online courses. Sports is a highly practical discipline. Other disciplines first emphasize the integration of theory, and then the application of practice, while sports more emphasizes the acquisition of sports ability through practice. In this process, theory plays a guiding role of "making the finishing touch". Therefore, it is to cultivate the need of cultivating the core quality of the discipline to study the feasibility of online courses in physical education courses and to become the core path of the university.

Yanshicheng and others discussed the school sports outbreak in the form of cloud interview. They discussed the feasibility of sports network intelligent education and the effect evaluation method from the aspects of curriculum theory, teaching, cognitive psychology, law and so on. However, the evaluation model is not perfect, no perfect solution is proposed, and there are defects in the data upload speed [2]. Through the psychological changes of students in different learning stages, chenxiana and others adopted the way of formulating learning objectives and defining learning task stages. On the basis of the above contents, they orderly arranged the teaching contents of online physical education classes from the aspects of interest satisfaction, skill sharing and self-improvement. However, in the process of effect evaluation, they ignored the problem of imperfect evaluation mode, resulting in slow upload speed of the system, The progress of relevant work is affected [3]. In order to solve this problem and effectively improve the upload speed of evaluation results, this paper introduces the deep learning algorithm into this field, and designs a physical education online intelligent teaching effect evaluation system based on the deep learning algorithm. Hardware part: using HTTP streaming protocol, the server architecture is designed, and the circuit components are connected; Software part: combined with the dual teacher system teaching mode, the online intelligent education goal of physical education has been realized, the effect evaluation model based on in-depth learning has been constructed, the special technological progress of students has been diagnosed, various learning resources have been combined with the teaching classification of our school, and the automatic evaluation function of the system software has been designed. In this way, we hope to provide some help to really improve the data upload speed.

2 Hardware Design of Sports Online Intelligent Education Effect Evaluation System

Online education systems involve terminals, servers, and databases. Servers need to process large amounts of data, especially as users increase demand for processing capacity increases exponentially. The HTML5 < video > tag provides the browser with the ability to play video, and requires no plug-in support. Database needs to store and read and write large amounts of data, and the database is the core link of the online education system, all the teaching resources and user behavior are stored in the database, so the design requirements of the database are very high. Currently, the browser supports limited video formats, and the video elements generally support only the video files in Ogg, MPEG4, and WebM formats. The overall system architecture is shown in Fig. 1:

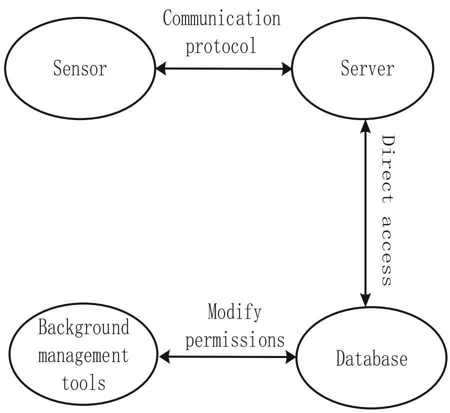

Fig. 1. Overall system design scheme

As can be seen from Fig. 1, the communication between terminal and server is mainly realized through WI-FI and the network provided by operators, and the existing technology is quite mature and can be applied directly. For online education system, video resources are generally transmitted to realize the side broadcast, users do not have to wait for the whole video file to download. Common streaming protocols are RTMP and

HLS. Online education systems focus on databases and algorithms to serve a wide variety of users through software and networks installed on the terminal. Here, the RTMP protocol was developed by Adobe Systs, and the client must use the Flash player. HLS protocol is implemented HTTP based streaming protocol with good support on mobile, but PC browser has only Safari support, other browsers still need to be implemented with Flash player. This design requires the online education system to effectively provide the required data for different users, and record the learning of users' behavior, so that users can enter the registered user name and password in the software to get the service. So, HTML5 doesn't support both streaming protocols perfectly. The MPEG-DASH streaming protocol, like HLS, is an adaptive streaming technology, proposing a hierarchical file structure organization. Similar to the HLS protocol, MPEG-DASH is also a video file divided into segments, each containing a short length of video content, not repeated between consecutive video segments. In addition, a database resource manager needs a convenient tool to add and delete the data. Similarly, each video file can have a different code rate to adapt to different network environments. Media content is transmitted through the HTTP protocol. Through the system work of terminal software, server and database, to complete the various functions of the online education system, at the same time, the functions of the platform should be functional enhanced according to the increase of user needs, to serve users as the purpose, to provide practical and excellent services. Media content is stored on the service and consists of two parts: 1. Media Content Description Media Presentation Description (MPD), which includes the file block index file, variable information of the content, URL, and other features.2. File fragments, which represents all the program data blocks of the program. The MPD file content may include one or more Period components, each representing a certain time period, within the same Period, the available media content and its respective available code rates will not change. MyBatis is an excellent persistent layer framework, which can support ordinary SQL queries, stored procedures, and advanced mappings, without JDBC code, parameters, and retrieval MyBatis for the result set. A Period consists of one or more adaptation sets (Adaptationset) consisting of a set of code streams (Representation) with different code rates for switching. Each Representation consists of one or more segment, each corresponding to a unique URL, and the client can obtain the fragmentation data corresponding to the URL via the HTTP protocol. MyBatis is able to map POJOs in the interface and Java by performing configuration with the original mapping using annotation or simple XML into records in the database. The MPEG DASH describes the composition of the entire code stream through a media description file (Media Presentation Description, MPD).The MPD is a file in XML format that contains descriptions of all the information required to play the video file, including the MIME type, width and height, segment duration, and segment offset list of the video, etc. Based on the above description, to complete the hardware design steps of the sports online intelligent education effect evaluation system.

3 Software Design of Sports Online Intelligent Education Effect Evaluation System

3.1 Obtain Sports Online Intelligent Education Goals

When extracting all kinds of online physical education teaching resources, the training objectives and value orientation should be fully compared. The training goal and value orientation of sports learning resources are also to a large extent a reflection of the importance of sports culture in a university or region. The implementation path of online physical education courses should first be reflected in the team of teachers, and we must establish a team of physical education teachers with strong teaching ability and professional ability. Physical education is not only the expression form of sports culture but also an important part of it. In the current information age, online education forms such as online open courses and mocourses are imperceptibly changing the audience's view of physical education and academic views. In terms of teachers, we should not only select teachers with strong comprehensive ability, but also select teachers who are good at projects. In the teacher display, we should comprehensively introduce the characteristics of each teacher, and attract students of teachers to choose suitable courses through the initial understanding of teachers. Therefore, the university resource construction team should fully consider whether the integrated resources have great differences or even conflict with the training objectives and value orientation of the university, recognize the nature and practical utility of the resources, learn from and accept its ideas and forms in line with the actual teaching situation of the university, so as to take its essence and discard its dross.Drawing lessons from cultural class online education double classroom mode, combined with the traditional physical education coach, deputy coach of double teaching classroom, form a set of complete online sports teaching mode, the teacher is responsible for action knowledge demonstration, the tutor is responsible for following up students to the digestion of the knowledge. The dual-teacher teaching mode of online physical education courses is divided into four parts, as shown in Fig. 2:

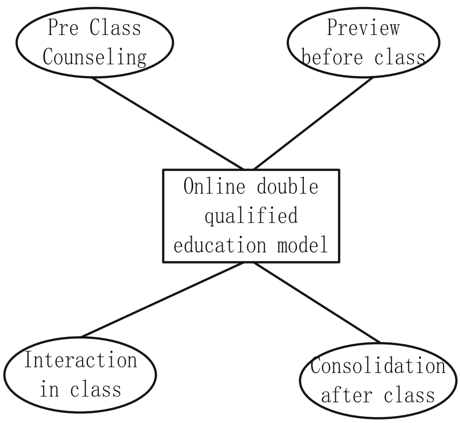

Fig. 2. Online double-teacher teaching mode

As can be seen from Fig. 2, the dual-teacher teaching mode of online sports courses mainly includes four parts: pre-class tutoring, pre-class preview, pre-class interaction, and after-class consolidation. In building and optimizing online sports education resources, colleges and universities should establish a resource classification system suitable for the school, and pay attention to the update and iteration of educational resources. Different sports training objectives and professional levels among different colleges and universities need to consider the use of resources according to local conditions when integrating resources, so as to give great play to their value. In the teaching process of online physical education courses, real-time and efficient interaction of learning process from two aspects: teaching space and learning space. In this regard, colleges and universities can establish a new physical education teaching resources classification system according to the actual development of the physical education discipline system, according to the expansion of online teaching resources according to the teaching plan and the current professional courses. Teaching space: is based on online sports course class, integration of multiple teaching links, by combining homework, test, examination, course notification, data download and other aspects, ensure the combination of teaching and learning, in the process of class, teachers and students can be a real-time interaction, the teacher is responsible for the demonstration, the tutor is responsible for interactive area, truly reflect the value of online sports courses, realize sports distance tutoring. Based on the above description, complete the steps to obtain the goal of sports online intelligent education.

3.2 Deep Learning Builds an Effect Evaluation Model

Deep learning algorithms are one of the most popular research areas in AI, and one of the most likely ways to achieve AI [4, 5]. For example, although machine learning has been developed for decades and has made a lot of progress, there are still many problems that have not been well solved, including image and speech recognition, natural language understanding, LBS-based recommendation, preference classification and other problems. At some stage in the future, if deep learning algorithms can completely simulate the neuronal data of the human brain, then the same questions to human and computer models will be answered exactly the same, while there is no "free will" different from machines [6, 7]. By that point, humans have actually realized artificial intelligence. However, in practical teaching, front-line teachers often need to invest more energy to implement theoretical teaching, which occupies the students' practical training time and affects the teaching quality as a whole. Therefore, it is an important way to improve the quality of online physical education teaching to study the challenges of online course teaching and increase the teaching to practical courses through online courses. Therefore, there is no general, eternal and absolute evaluation standard for physical education teaching evaluation, but it only has a relative, recognized and consistent evaluation standard within a certain time and space limit. Teaching quality is usually manifested as whether the teaching process of teachers choose the teaching content, the teaching attitude is correct, the level of teaching management and ability level, the appropriate use of teaching methods and means, as well as the classroom teaching effect. According on the expression formula of the radial basis function of the deep learning algorithm:

$$l(\alpha) = \sum \frac{(\alpha - \phi)}{\exp\left(-\frac{1}{\phi^2}\right)} \tag{1}$$

In formula (1), α represents any point in space, and ϕ represents the distance between a center and point α. According to formula (1), the function obtained by adding RBF interpolation value is defined as:

$$G(e) = \begin{cases} q(L - L_e) \\ \sum \|e - 1\|^2 \end{cases} \tag{2}$$

In formula (2), e represents sample points, q represents spatial dimension, and L represents the total number of two-dimensional sample points. Teaching effect evaluation refers to the theory, method and technology of educational evaluation for the comprehensive, objective and fair evaluation and judgment of the quality, working process and work performance of teachers. It can be seen that the teaching effect is an integral element of the teaching quality. Secondly, the core content of teaching quality evaluation is the teaching process, focusing on the evaluation of teachers. The teaching effect evaluation can make the functional departments of colleges and universities more accurately grasp the teacher teaching situation and the current situation of students 'learning, improve the teachers' attitude of teaching, teaching methods, cultivate high-quality talents, and carry out the teacher team construction and teaching work reform in a planned way, which is more suitable for the teaching policy of sports and online intelligent education. The teaching effect refers to the degree of understanding, inspiration and memory of what is taught in the classroom. The core content of teaching effect evaluation is the effect or effect of a class or a course on students, and the evaluation object focuses on students. It is especially important to evaluate the fair, fair and unified standard of teacher teaching effect. It can be seen that the core content and focus of teaching quality and teaching effect evaluation are clearly distinguished. Teaching effect is a dynamic concept closely related to the needs of teaching subjects. Combined with the convergence characteristics of the deep learning algorithm, under the condition of given sample point $(a_1, b_1), (a_2, b_2), \cdots (a_e, b_e)$, let $a = 1$, and obtain the expression formula of the spatial interpolation matrix as follows:

$$\begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1e} \\ q_{21} & q_{22} & \cdots & q_{2e} \\ \cdots & \cdots & \cdots & \cdots \\ q_{e1} & q_{e2} & \cdots & q_{ee} \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_e \end{bmatrix} \tag{3}$$

Teacher work is a complex mental work, teaching activities are a complex process of teaching and learning, and it is also difficult for teachers to show the behavior consistent with the educational goals in the teaching process. The special teaching evaluation method of physical education adopts the form of combining final evaluation and process evaluation to determine the change degree of the main final evaluation assessment and evaluation indicators. How to improve the teaching quality of teachers has also become the key problem of running in colleges and universities. Students' teaching evaluation of teachers plays an important role in promoting teachers to improve their teaching methods. The process evaluation is mainly in the teaching process, according to the diagnosis of the situation or progress, so as to better carry out the teaching. The result of student evaluation is also an important basis for the college to evaluate teachers and give necessary rewards and punishments to teachers. There is a perception or hypothesis that the students with better grades in the course tend to give a better evaluation to the teaching of the course teachers. The evaluation of sports skills is the top priority of special teaching, and the grade standard of using special evaluation has been the consensus reached by many teachers and experts. Based on the above description, complete the steps of building the effect evaluation model.

3.3 Design the Automatic Evaluation Function of the System Software

The whole online education system is divided into three levels, which is responsible for the data storage, the erection of the WEB server and the guarantee of the performance load balance of the online education system. Meanwhile, the automatic evaluation function of the system software is designed. All kinds of learning resources are combined with the professional teaching classification of the school to facilitate learners to retrieve quickly and avoid the camouflage phenomenon of learners in the process of platform learning. The bottom level is the data storage layer. The access data and storage data of the online education system are still a large number of data levels. The online education system adopts file sharing and picture server separation and combined with database distributed management to achieve performance optimization. The digital production of sports resources in universities cannot be achieved overnight, and it is not once and for all after its launch. Learning space: Online physical education courses have various functions of real-time teaching and playback generation, and local preservation. At the same time, more online physical education course resources, public lecture courses, physical education learning materials will be integrated in the whole online physical education course platform to realize the easy access of course video materials and reference materials. In order to highlight the weight of the knowledge point constraints, the knowledge point error is specially defined: the weighted sum of the answer time and difficulty coefficient in the test paper as the score factor of the question, and the ratio of the score factor of a test paper and the total score factor of all the test questions in the test paper as its score ratio. Add up the score ratio of the same knowledge point test questions to obtain the weight of the knowledge point in the total knowledge point of the test paper. The difference between the weight and the group volume requirements is the error of the knowledge point. Wherein, if the scoring factor is defined as $\eta_v + h_v \times 20$, η_v is the answer time of the question, and h_v is the difficulty coefficient of the question, the scoring ratio of question y is calculated as follows:

$$H_y = \frac{\eta_v + h_v \times 20}{\sum \left(\eta_y + h_y \times 20\right)^2} \tag{4}$$

The NFS technology used by the online education system is the traditional network file system technology. On this basis, the online education system combines the advantages of HDFS based on GFS to improve the performance of the file access management of the online education system. The recognized and less controversial content in the basic sports technology curriculum resources can be changed less, but still supplementary materials or precautions need to be added according to the learning progress of the learners. Most of this teaching content will appear in the traditional classroom summary of face-to-face physical education in colleges and universities. The middle layer is the erection of the WEB server. The traditional Apache + Tomcat server erection mode provides the guarantee of the application server load balance for the online education system, and the distributed erection of the Tomcat server can improve the access response efficiency of the online education clients to the server [8]. In addition, according to the latest sports scientific research achievements and development trend of the university, we can also update the learning and training methods and sports precautions in real time, and constantly enrich the online sports resource pool. The learning form is displayed in a modular form, divided into three modules: communication and interactive module, tracking and monitoring module, and evaluation and feedback module. The classical MVC architecture itself is a relatively common program structure separation technology in B/S architecture systems like online education, which can improve the separation management of business logic and improve the efficiency of online education system. Communication and interaction module mainly refers to break through the limitations of recording and broadcasting courses, realize the real-time interaction in the course teaching, conduct the interaction of asking questions and answering questions in the interactive section, and reasonably control the classroom teaching progress through real-time communication. Tracking and monitoring module: Through intelligent technology means, the top grasping technology, interactive pop-up answers and other technical means are adopted to monitor the students 'learning status of students in real time and ensure the students' concentration in learning. The underlying data layer of the online education system uses the data persistence layer (ibatis) technology and other caching technology to improve the efficiency of the client to request access. Evaluation and feedback module: homework is assigned after class, homework is directly submitted to the platform, and targeted guidance is given according to the completion of homework submission. Based on this, complete the steps of the automatic evaluation function of the design system software.

4 Simulation Experiment

The functional test of the online education system is mainly based on the steps implemented on each page. Because of the different pages involved in the online system, to achieve more functions, so when the system is functional tested, it must be carefully, tested and repeatedly. This online education system uses Java development language, using MyEclipse development tools and its related plin-in functions to develop and implement system functions. The steps to build the specific development environment are as follows: Java language software development tool installation. follow. After the installation is complete, configure the installation directory of the Java SDK to the system environment variable, and finally verify that the Java SDK installation has succeeded by typing in the command prompt with the "java-version" command. Download the ZIP package for Tomcat windows32 bits from the Apache Tomcat website and extract it to a local directory. Download and install the MyEclipse. After the installation is complete, add the installed Java SDK s as the default Java running environment through the menu bar by selecting Window-Preferences-Java-Installed JREs. When we operate on the page, whether the page reflects the results we wanted, whether we met our expectations, and whether it is different from what we expected at the early stage of our design. Window-Preferences-MyEclipse-Servers-Tomcat configure tomcat to the system. Install the MyEclipse Google plugin, Google plugin for MyEclipse. This plugin can easily generate, test, and deploy all the application. Enter the installation website of the Google plug-in via Help-Install from site for installation. In the experiment, the online intelligent education effect evaluation system of physical education based on neural network (Ref. [9] system), the online intelligent education effect evaluation system of physical education based on clustering algorithm (Ref. [10] system) and the online intelligent education effect evaluation system of physical education were selected. The tests were conducted under different concurrent conditions of users. The faster the upload speed of the three systems, the better the system performance. In order to ensure the persuasiveness of the experimental results, Take the same data set for comparison, and the results are shown in Table 1.

Table 1. Uploading speed experimental results (KB/s)

Number of concurrent users (person)	The evaluation system of physical education online intelligent education effect in this paper			Evaluation system of physical education online intelligent education effect based on Neural Network			Evaluation system of physical education online intelligent education effect based on clustering algorithm		
	First test result	Second test result	Third test result	First test result	Second test result	Third test result	First test result	Second test result	Third test result
100	58.61	58.78	58.91	55.36	55.27	55.18	48.39	48.25	48.36
300	69.34	69.54	69.42	66.28	66.24	66.20	51.03	51.38	51.32
500	72.33	72.11	72.58	74.51	75.13	74.29	49.31	49.21	49.43
800	76.59	75.86	76.84	75.27	75.64	75.53	56.37	56.43	56.65
1200	85.64	86.01	85.95	82.25	82.09	82.73	63.66	63.43	64.03
1500	89.36	89.40	89.51	87.51	87.63	87.87	66.22	66.21	66.38
1800	88.74	88.56	88.63	88.31	88.61	88.65	71.34	71.26	71.37
2200	120.54	120.48	120.79	118.37	118.05	118.38	102.06	102.21	102.32
2500	128.48	128.73	128.43	127.19	127.14	127.32	116.37	116.24	116.35
2800	177.54	177.20	177.41	181.69	181.45	181.89	156.44	156.36	156.27
3200	189.31	189.51	189.04	194.02	194.21	194.38	162.55	162.43	162.29
3500	233.37	233.56	233.32	224.17	224.01	224.98	186.39	186.43	185.07
4000	268.49	268.01	268.33	256.84	255.78	255.98	201.24	201.01	201.14

It can be concluded from Table 1 that the highest upload speed values of the sports online intelligent education effect evaluation system and the other two systems are 268.49 KB/s, 256.84 KB/s and 201.24 KB/s respectively, indicating that the sports online intelligent education effect evaluation system in the article is more effective.

5 End of the Language

This paper designs an online intelligent evaluation system of physical education teaching effect based on deep learning algorithm. Hardware part: the server architecture and connecting circuit components are designed by using HTTP streaming media transmission protocol; Software part: combined with the dual teacher teaching mode, realize the online intelligent teaching goal of physical education, use deep learning to build an effect evaluation model, diagnose according to the students' professional and technical progress, combine various learning resources with the professional teaching classification o our school, and design the automatic evaluation function of the system software. This network system can provide better data support for teachers' teaching evaluation. On this network platform, teachers can reinterpret some knowledge points that are difficult for students to understand in class through students' feedback on knowledge points, which can lay a foundation for improving teaching quality and have certain guiding significance in this field. At the same time, the accuracy of the system needs further discussion.

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Evaluation Method of Teaching Effect of Intelligent Education Model for Electromechanical Equipment Technology Specialty

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Abstract. In view of the poor evaluation effect of the current intelligent education model teaching effect of electromechanical equipment technology specialty, this paper puts forward the evaluation method of the intelligent education model teaching effect of electromechanical equipment technology specialty, constructs the teaching management system of electromechanical equipment technology specialty, optimizes the related technical relationship of electromechanical integration specialty, and constructs the related technical relationship evaluation index of electromechanical integration specialty. Finally, the experiment proves that the teaching effect evaluation method of intelligent education model for electromechanical equipment technology specialty has high effectiveness and practicability in the process of practical application, and fully meets the research requirements.

Keywords: Electromechanical equipment · Intelligent education · Teaching evaluation

1 Introduction

The traditional educational objectives and teaching paradigm are no longer suitable for the needs of today's information and big data era. The concept and model of intelligent education came into being. How to design and construct the teaching effect evaluation method of intelligent education model, analyze students' learning situation and teachers' teaching level through scientific and reasonable collection of dynamic process behavior data, objectively evaluate the teaching quality, assist teachers to clarify their own advantages and disadvantages with the help of big data analysis and data mining, and adjust classroom strategies and methods in time, It is still a difficult point in the field of education and teaching evaluation. With the development of electromechanical equipment technology, electromechanical equipment technology integrates the principle of EEG biofeedback into teaching interaction. Students bring wearable brain wave devices

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in the classroom. Teachers digitize students' attention level and intuitively reflect students' learning effect by monitoring students' learning focus in real time, Objectively reflect the popularity of teachers' teaching content among students and the harmonious relationship between teachers and students. Reverse evaluate teachers' teaching quality based on students' classroom concentration, and help teachers adjust teaching strategies in time. By monitoring, tracking and collecting students' EEG data and analyzing students' learning status in various disciplines and stages, teachers can help pay attention to students' individual development, implement accurate teaching, improve classroom quality, improve teaching methods and promote teachers' professional growth.

Related Work Introduction

Reference [1] puts forward the teaching evaluation method of the "rain classroom" intelligent teaching mode, which aims to comprehensively improve the classroom teaching experience, make more interaction between teachers and students, and make teaching more convenient. Build a "three-dimensional, hierarchical and progressive" rain classroom mixed teaching mode combining "teachers' organizational guidance and students' Autonomous Learning", and conduct in-depth research on the implementation process, assessment methods, teaching effects and teaching mode evaluation of the mode. A comparative experiment was conducted to study the impact of the teaching model on students' learning effect, and a questionnaire survey was conducted to study students' evaluation of the "rain classroom" mixed teaching model. Reference [2] developed an intelligent platform for aesthetic education teaching evaluation in primary and secondary schools based on Internet technology The platform has the following characteristics: first, the evaluation subjects are diverse, and various methods such as expert evaluation, teacher mutual evaluation, and student self-evaluation and mutual evaluation are used to evaluate the development of teachers' and students' aesthetic quality; Second, the evaluation content is comprehensive, which not only evaluates the aesthetic feeling, but also evaluates the logical cognition; Third, there are various evaluation methods, including group summative comparative evaluation and individual formative development evaluation. At the same time, users are allowed to adopt a variety of analysis and evaluation methods according to specific aesthetic education teaching practice.

However, the indicators selected by the current evaluation method of teaching effect are not comprehensive enough, which leads to poor evaluation effect. Based on the above background, this paper puts forward the evaluation method of intelligent education model teaching effect of electromechanical equipment technology specialty. The teaching management system of the electromechanical equipment technology major is constructed, the electromechanical integration professional relationship is optimized, and the relevant technical relationship evaluation index also establishes the intelligent teaching evaluation of the electromechanical equipment. The experimental results prove that the contribution of this paper is to improve the accuracy of the evaluation of the teaching effect of the intelligent teaching mode of electromechanical equipment technology specialty.

2 Evaluation of Teaching Effect of Intelligent Education Model for Electromechanical Equipment Technology Specialty

2.1 Teaching Management System of Electromechanical Equipment Technology

Electromechanical equipment technology can be described as: electromechanical integration technology is a technology intensive model engineering with comprehensive intersection of multi-disciplinary technical fields such as model technology, computer and information processing technology, automatic control technology, detection and sensing technology, servo transmission technology and mechanical technology. Now draw the relationship between each specialty of mechatronics and related technologies and their connotation, as shown in Fig. 1.

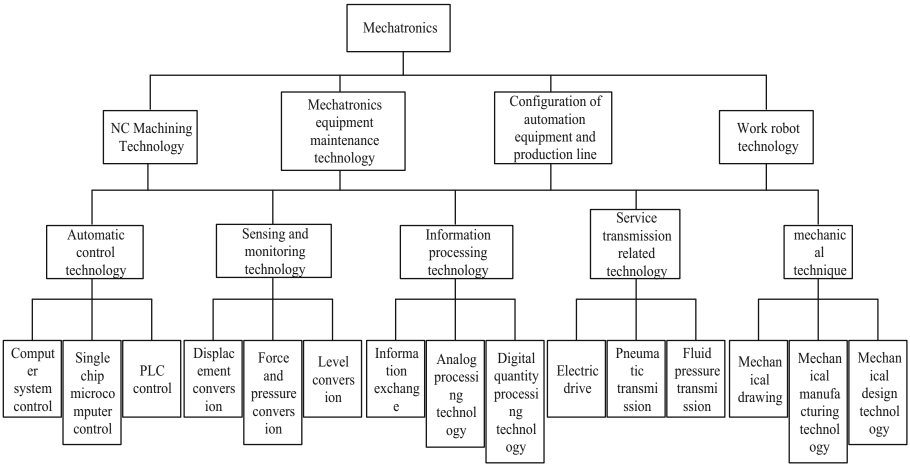

Fig. 1. Related surgical relation diagram of mechatronics major

The content of traditional electromechanical education curriculum effect evaluation belongs to the "Three-stage" curriculum model. The "phased" educational curriculum model generally arranges the curriculum in the order from foundation to application, from abstract to concrete, and from broad to narrow. The "Three-stage" curriculum model usually divides the curriculum into three categories, namely cultural basic courses, professional basic courses and professional courses [3]. The characteristics of the sequence of courses are that the initial bottom is large and gradually becomes smaller upward, forming a pyramid like curriculum model. For the traditional practical teaching system, it also refers to the practical teaching system of early undergraduate education. It is composed of basic ability training, application ability training and comprehensive ability training. These ability training are divorced from production practice and have poor practicability, as shown in Fig. 2.

The curriculum of mechanical and electrical specialty should be based on the needs of the development of mechanical and electrical industry, focus on improving the professional quality of mechanical and electrical specialty students and the adaptability to

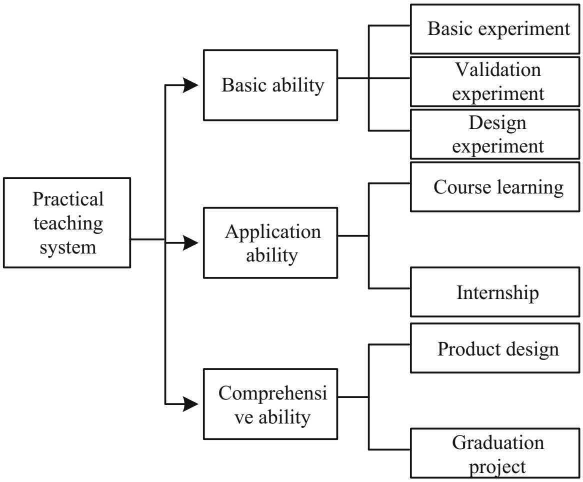

Fig. 2. Three-stage practical teaching system

social needs, take the cultivation of professional ability as the basic requirement, and take the needs of post groups as the basis, Adopt the curriculum system of the integration of core technology curriculum and "four layers and two sections" and the theoretical and practical teaching system of "parallel and integrated intersection", implement the phased practical teaching and module training curriculum mode, and develop from foundation to specialty and finally to practical application [4]. The training of professional skills runs through the whole learning process, as shown in Fig. 3.

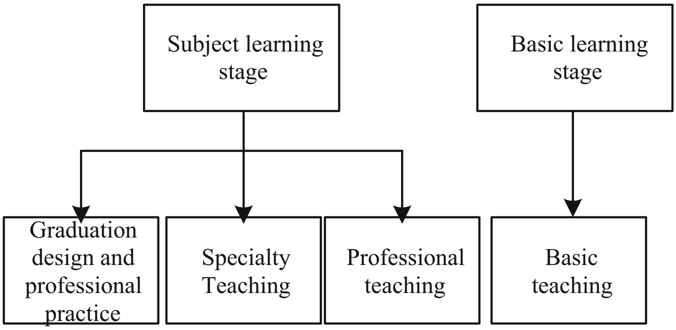

Fig. 3. Two layers and two sections one through

Although in recent years, colleges and universities continue to reform the curriculum system and the curriculum model has changed greatly, the curriculum system of many colleges and universities still retains the shadow of the traditional model more or less [5]. Because the traditional "four stage" course mode adopted in the practical teaching of Electromechanical Specialty in Colleges and universities has great defects; It can not meet the needs of modern society for the training objectives of electromechanical talents.

Because this curriculum model puts the theoretical teaching in the main position of the curriculum content and the practical teaching in the secondary position.

2.2 Professional Education and Evaluation System of Electromechanical Equipment

Most of the evaluation in the field of electromechanical equipment vocational education evaluation system are lack of corresponding cognitive theoretical support. Therefore, the questionnaire setting uses more weak theoretical model. The specific process is as follows: the evaluation experts find out the problems with good performance as the motif, analyze the problems in detail, and form a multi-level problem model, that is, decompose the problem into background, content, problems, auxiliary information and options [6]. Combined with their own school running conditions, adopt the curriculum mode of segmented teaching and module training, and gradually develop from foundation to specialty. It is divided into four levels: basic teaching, professional teaching, specialty teaching, graduation design and professional practice. There are two stages of basic learning and subject learning. The professional and technical skills training module should be continuously updated in the whole three-year teaching process, This is called the curriculum structure system of “four layers and two paragraphs always wear” (see the figure below). The curriculum model of practical teaching and module training is implemented in stages, from foundation to specialty and specialty, and finally to practical application. The training of professional skills runs through the whole learning process. The curriculum structure system of “four layers and two sections” is shown in Fig. 4.

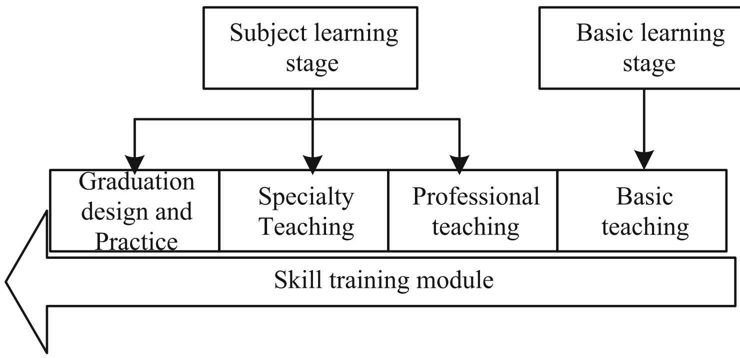

Fig. 4. Curriculum structure system of “four layers and two stages of consistent wear”

In the learning system of mechanical and electrical equipment, it provides students with the basis of adaptive learning behavior [2]. In the evaluation system of electromechanical equipment vocational education, the model needs to evaluate students’ learning ability and process evaluation. Intelligent evaluation aims to complete the evaluation and diagnosis of students with incomparable efficiency of traditional evaluation, so as to complete the scientific evaluation of learners’ learning achievements. In view of the complexity of classroom teaching evaluation, based on the investigation and analysis of typical models, we refer to the architecture design of intelligent guidance model and collaborative learning management model, and finally form a general architecture of formal modeling and intelligent computing for classroom teaching evaluation, as shown in Fig. 5.

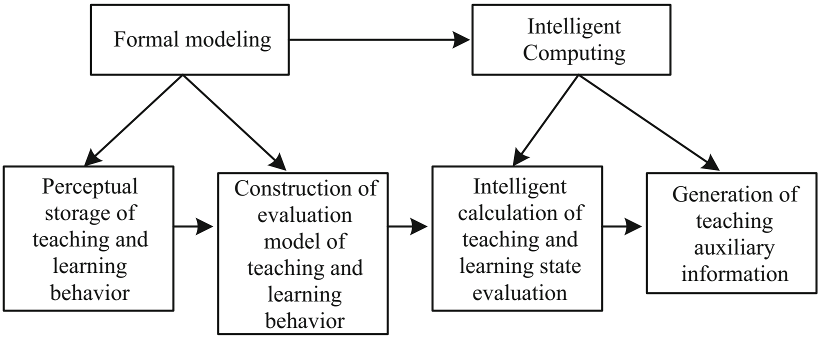

Fig. 5. Construction of the classroom teaching evaluation system

The architecture consists of four parts from bottom to top: the perception and storage of teaching and learning behavior, the construction of teaching and learning behavior evaluation model, the intelligent calculation of teaching and learning state evaluation and the generation of teaching auxiliary information [7]. The whole model is based on the perception and storage of teaching and learning behavior. By constructing the evaluation model, the output of the model, that is, the state, is determined. By introducing intelligent algorithms to calculate the model, the evaluation of teaching and learning state is achieved; Finally, according to the corresponding teaching principles, automatically generate the information to assist teachers in classroom teaching evaluation. The self decision-making based on the intelligent evaluation model collects the multimodal behavior data of online and offline students for intelligent analysis, and automatically carries out learning intervention according to the evaluation results, including recommending learning resources, learning partners, learning methods, and emotional counseling. The self decision-making process based on intelligent evaluation is constructed, and its work flow is shown in Fig. 6.

The research and application of electromechanical equipment in education evaluation system are constantly advancing. However, many researchers believe that these applications do not change the basic content and form of evaluation, but only reduce the cost and improve the efficiency to a certain extent. For example, the online evaluation platform can support the learners to accumulate more data in the evaluation process. The objective functions of the multimodal neural network generated by the restricted Boltzmann machine, the discriminant restricted Boltzmann machine and the hybrid discriminant restricted Boltzmann machine are as follows:

$$L_g(D_{\text{train}}) = -\sum_{i=1}^{|D_{\text{train}}|} \log p(x_i, y_i) \tag{1}$$

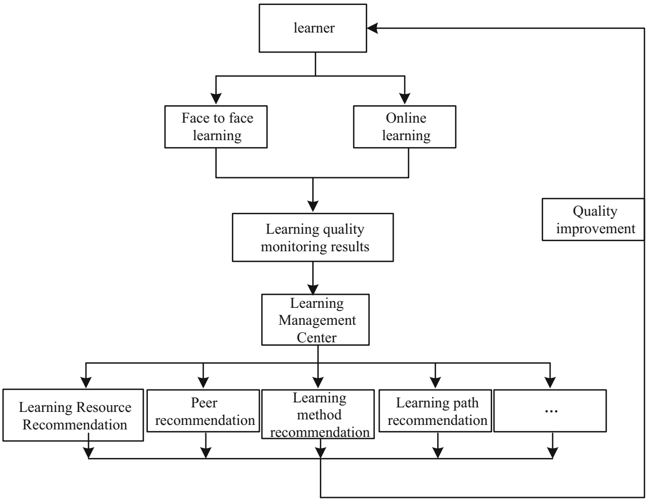

Fig. 6. Teaching information management process of electromechanical equipment

$$L_d(D_{\text{train}}) = -G \sum_{i=1}^{|D_{\text{train}}|} \log S - p(x_i, y_i) \tag{2}$$

$$L_h(D_{\text{train}}) = Me - kL_d(D_{\text{train}}) + \alpha f L_g(D_{\text{train}}) \tag{3}$$

In the formula, D_{train} represents training set; $p(x_i, y_i)$ represents joint distribution of one sample S and one label G; Adjustable parameter α represents the influence of the generated model on the whole model. If α is large, emphasis is placed on generating Bozmann machines, namely a small number of data sets, instead discriminjudging Bozmann machines. Vector e represents the variable sets; f represents represent mixed data features, physiological, psychological, behavioral data features, and learning context elements; k sets of observable dataset M were selected for training to find the dependencies between variable V and learning evaluation. After a Bayesian model training using a constraint-based method, Bayesian networks with high-dimensional variables can be constructed. The Bayesian structure scoring function is presented in the following form:

$$\log P(D|G) = \sum_{i=1}^{n} u_i \sum_{j=1}^{q_i} L_h(D_{\text{train}}) \log\left(\frac{\Gamma(\alpha_{ij})}{\Gamma(X_{ij} + N_{ij})}\right) \tag{4}$$

In the formula, Γ represents the number of states of the node α_{ij}; N_{ij} represents the gamma function; X_{ij} represents that the given data u_i is a Bayesian network topology.

Evaluating students through big data analysis rather than traditional questionnaire, electromechanical equipment has incomparable advantages in realizing personalized learning efficiently, and will be more widely used in the field of education in the future. However, while warmly welcoming the era of electromechanical equipment, researchers and practitioners still need to be cautious [8]. The puzzle of human cognition is far from complete, so we should rationally treat the conclusions drawn according to the existing big data and prevent excessive generalization of inference. In addition, how to protect the privacy and secrets of students, teachers and schools and make rational use of data is also an urgent problem to be considered and solved. The vocational education evaluation system will not only replace the repetitive work of educational evaluators, but also abandon the traditional extensive education evaluation and provide personalized education that can truly teach students according to their aptitude.

2.3 Realization of Intelligent Teaching Evaluation of Electromechanical Equipment

The hierarchical structure of teaching evaluation was determined according to the characteristics of running the school, and 10 excellent expert teachers were selected to discuss and determine the relative proportion of each link in the teaching. Through the investigation data of teaching quality, the hierarchical analysis method in mathematical modeling was used to carry out the evaluation and analysis of teachers' teaching. The structure diagram of the teaching effect evaluation method illustrates the comprehensive analysis method of the teaching effect evaluation of college teachers, as shown in Fig. 7.

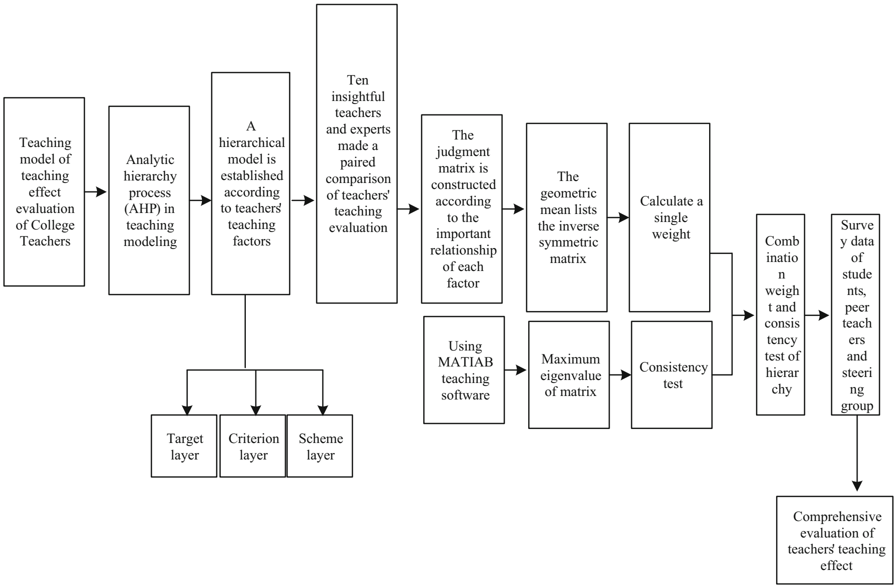

Fig. 7. Optimization of the teaching effect evaluation process

The setting of courses and the choice of teaching methods in Teachers' teaching level are directly related to how to improve students' interest in the course. If students like the teacher's teaching methods, they will have an interest in the course, study the course carefully, and spend more time on the course, so their grades will be improved accordingly. Although we can't judge teachers' teaching level only by their grades.

However, through the evaluation of teaching effect, teachers' teaching level and students' academic performance can be improved. Teaching evaluation takes teaching quality as the link to form a whole. Intelligent teaching behavior analysis model is a teaching behavior analysis model based on St analysis method. Therefore, S-T analysis method is used for reference in the core links of teaching analysis, such as behavior coding, index calculation and teaching mode judgment. However, due to the different sampling methods between the model and St analysis method (the root speech signal characteristics of intelligent teaching behavior analysis model are sampled continuously in the time dimension, and the S-T analysis method is sampled at a fixed time interval), some links are improved. The behavior coding of intelligent teaching behavior analysis model is based on the behavior coding model of S-T analysis method, which divides the behavior into t behavior (teacher behavior) and s behavior (student behavior). Since the model takes the speaker identity of speech signal as the basis for behavior judgment, the speech signal description of each kind of behavior is added to the behavior coding framework of the original st analysis method, as shown in Table 1.

Table 1. Behavioral encoding of the intelligent teaching behavioral analysis model

Category	Speech signal characteristics	Behavior example
T behavior	Teacher talk	Lecture, explanation, question and feedback
S behavior	Student discourse	Answer, discuss and ask questions
	No discourse fragment	Thinking, practice, experiment, observation

There are mainly students 'learning situation, students' ability cultivation, students 'learning harvest, students' love of the course. Teachers 'teaching effect is good, students naturally like the course, will study seriously, then the students' learning situation is good, the results can be improved, the ability will be strengthened. The following hierarchy is obtained by using the hierarchy analysis above. The hierarchical structure model is shown in Fig. 8.

The evaluation scale designed by the model pays more attention to the feasibility and operability of the evaluation index. There are no indicators that are difficult to evaluate and ambiguous. The applicability of the evaluation form is also well grasped, and the indicators are aimed at the normal and general situation and face the evaluation of most teachers. The evaluation form also reflects a kind of teaching thought, which not only attaches importance to teaching but also to learning, pays attention to the subjective initiative of students, and pays attention to the communication between students and teachers in teaching. It is not only rigorous in learning, but also improves students' interest in learning and increases the cultivation of students' various skills. It also allows teachers to have considerable space for independent teaching (there are no indicators that require too detailed requirements for teachers in the index system). The guiding function of teaching evaluation, on the one hand, plays a role in ensuring and improving the quality of classroom teaching On the other hand, it also has negative effects. As teaching evaluation is a means of evaluating teachers' teaching effect, it will inevitably attract teachers' enough attention, and will virtually use the index terms of evaluation

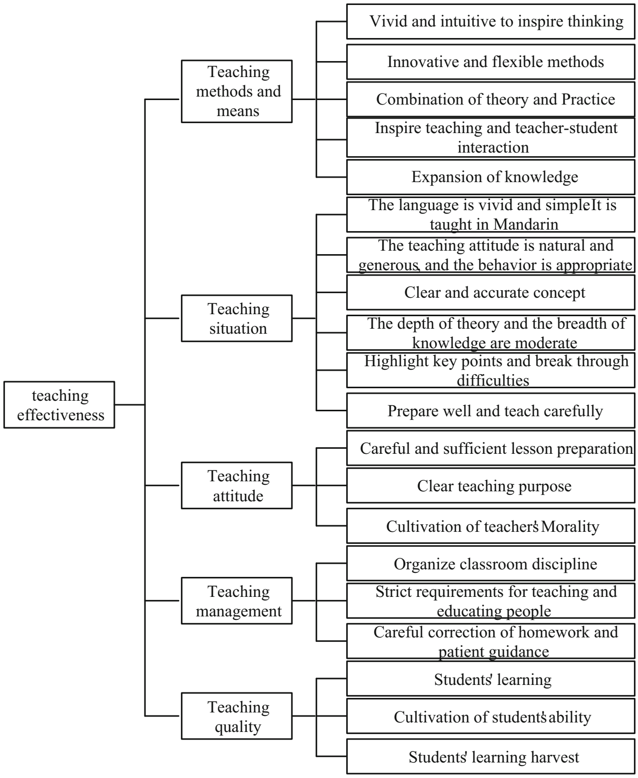

Fig. 8. Hierarchy structure of the teaching effect evaluation model

to restrict their teaching behavior. This model adopts the index of teaching methods and means, that is, to recognize the differences of teachers' individual intelligence and allow and encourage the use of different teaching methods and means, It is also to achieve the talent goal of exposing students to different teaching styles and cultivating multi angle cognitive ability. Therefore, when formulating the teaching evaluation index system, we should look at the problem from a higher and further perspective, and focus on formulating the evaluation index from the aspects of teaching effect and students' ability training.

3 Analysis of the Experimental Results

To test the evaluation effect of this paper, the database is a teaching database of 5.2 G. The hardware configuration is Intel i3 dual-core CPU; the network environment is 100 megabytes switch; the hard disk is 6 TB; the operating system is Centors 7.0; and the processor is Intel Xeon 64 2.33 GHz. The weight of primary index is determined by the branch value factor judgment table method, and the weight of secondary index is preliminarily determined by the factor analysis variance contribution method, and then finally confirmed by mechanical and electrical experts. Therefore, the weight of the practical teaching evaluation index system of mechanical and electrical majors is obtained in two steps, as shown in Table 2.

Table 2. Weight of practical teaching evaluation index of mechanical and electrical major

Primary index	Primary weight	Secondary index	Secondary calculation weight	Adjusted secondary weight	Weight of the whole index system
Teaching objectives	0.17	Target setting	0.58	0.6	0.09
		Ideological understanding	0.45	0.6	0.09
Teaching conditions	0.4	Teaching equipment	0.65	0.7	0.19
		Faculty	0.38	0.5	0.13
Teaching process	0.4	Teaching construction	0.75	0.6	0.22
		Teaching management	0.28	0.4	0.09
Teaching effectiveness	0.25	Student quality	0.62	0.7	0.15
		evaluate	0.31	0.5	0.10
Total weight	1	-	-	1	1

The selection of evaluation indicators for practical teaching of Electromechanical Specialty is related to the professional knowledge involved in specific problems and the available means. If there are too many indicators, they may be repetitive indicators, there will be interference, but too few, they may lack sufficient representativeness and produce one-sided evaluation results. Whether the evaluation result of practical teaching of Electromechanical Specialty is objective and accurate depends on the selected evaluation index first. Therefore, establishing a complete evaluation index system of practical teaching of Electromechanical Specialty is the key to evaluation. According to the variance contribution degree of statistical factor analysis, the weight of the two level index is determined. The data can be calculated from the previous factor analysis, and then fed back to the eight experts in electrical and mechanical expertise. After their confirmation, the data can be adjusted to the final weight. The weight coefficient of each main factor is calculated according to the contribution rate of the characteristic root corresponding to each main factor in the variance in the factor analysis. The weights of 8 factors in four dimensions are given in Tables 3, 4 and 5.

According to the data of the combined weight coefficient in the combined weight table, the teaching effect is the dependent variable Y, the combination weight is the coefficient of the independent variable X, each index of the scheme layer is the independent variable X, X2… X into the data of the questionnaire formula 3–1 of the mathematical model evaluation of peer teachers, as shown in Table 6.

Table 3. Evaluation weights of teaching objectives and concept dimensions

Secondary index	Factor one	Factor two	Total
	Target setting	Target setting	
Variance contribution (%)	42.989	33.652	76.641
Weight (%)	57.652	42.348	100
Adjusted weight	0.59	0.41	1

Table 4. Evaluation weight of teaching condition dimension

Secondary index	Factor one	Factor two	Total
	Equipment input	Equipment input	
Variance contribution (%)	36.875	21.833	58.708
Weight (%)	62.7856	37.2144	100
Adjusted weight	0.65	0.35	1

Table 5. Evaluation weights of the teaching process dimension

Secondary index	Factor one	Factor two	Total
	Construction and links	Construction and links	
Variance contribution (%)	36.988	13.986	50.974
Weight (%)	72.65	27.35	100
Adjusted weight	0.72	0.28	1

In the survey of the evaluation index rationality module, the satisfaction survey of the three-level evaluation index was completed from the aspects of the secondary indicators such as teaching materials, teaching content, teacher behavior, teaching behavior, teaching activities and emotional education in the system quantitative table. Most of the students think that the evaluation scale can start from the learning strategy and learning methods, learn how to correctly evaluate themselves and others, and complete the class activities. A few students think that the system table is not comprehensive, and some standards cannot complete the evaluation well. The resulting data are shown in Fig. 9.

This process evaluation experiment mainly adopts three ways: student self-evaluation, student mutual evaluation and teacher comment. For example, the teacher assigned two cases of SPSs statistical tools (non-parametric test of two independent sample positions in non-parametric statistical mathematics, multimedia teaching effect analysis of educational technology introduction based on SPSs), so that students could explain the knowledge structure, statistical methods and derivative knowledge points

Table 6. Comprehensive evaluation results of the teaching effect

Teacher	Student evaluation	Weight	Peer evaluation	Weight	Supervision and evaluation	Weight	Comprehensive evaluation
A	69.57	0.5	78.23	0.4	80.91	0.4	75.68
B	85.65	0.5	84.12	0.4	82.18	0.4	85.32
C	79.98	0.5	81.25	0.4	78.05	0.4	79.85
D	75.41	0.5	81.28	0.4	80.89	0.4	78.58
E	76.52	0.5	81.46	0.4	81.21	0.4	79.65
F	75.98	0.5	81.98	0.4	80.84	0.4	78.51
G	75.06	0.5	78.65	0.4	77.58	0.4	76.52
H	75.26	0.5	79.85	0.4	82.65	0.4	78.05
I	78.85	0.5	77.25	0.4	79.89	0.4	78.25
J	81.65	0.5	83.65	0.4	85.62	0.4	82.35

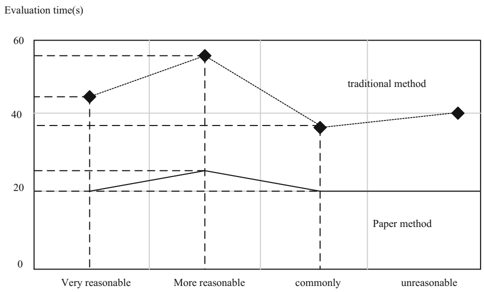

Fig. 9. Time-of Teaching Evaluation Comparison of test results

used in the cases. Based on this comparison, the accuracy comparison test results of classroom teaching evaluation were further analyzed, as shown in Fig. 10.

Based on the above comparative test results, we can know that compared with the traditional methods, the mechanical and electrical equipment technology major proposed in this paper can only significantly improve the teaching effect, and the evaluation effect has been greatly improved and fully meets the research requirements.

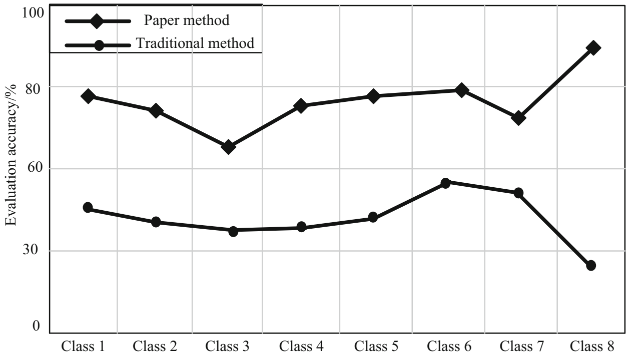

Fig. 10. Comparison and test results of classroom teaching evaluation accuracy

4 Conclusion

The theory, means and technology of classroom teaching evaluation in the new era should focus on tracking the development of students' knowledge and ability and evaluating the whole learning process. Using new technical means to promote the implementation of classroom teaching evaluation, we should pay attention to the cooperation between teachers and machine intelligence, and solve the research topic of how to scientifically integrate technology into the classroom, empower education, stimulate teachers' teaching creativity, and promote students' learning and the development of their high-level ability and emotion. Formal modeling can deconstruct and mathematically represent the complex and changeable classroom teaching process, and build the basis for communication between educational researchers and computer science researchers. On this basis, intelligent computing technology can realize the automation of some classroom teaching evaluation. However, due to the limited conditions, the integration effect of artificial intelligence and machine intelligence evaluation indicators in classroom teaching still needs to be improved. Future research can be student-centered to cultivate the core goals of high-level capabilities such as cooperation, communication and innovation.

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Research on Effect Evaluation Method of Ideological and Political Classroom Teaching Reform in Colleges and Universities Based on Particle Swarm Optimization Algorithm

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Abstract. In order to improve the teaching effect and improve the accuracy of the evaluation method of the reform effect, this paper introduces particle swarm optimization algorithm to realize the effect analysis of the ideological and political teaching reform. First, define the evaluation data file, build a reasonable reform evaluation system, obtain the relevant characteristics of user interests, mine user preferences, design the reform evaluation extraction function, determine the evaluation content according to the system, and complete the reform effect evaluation using particle swarm optimization algorithm. The experimental results verify the accuracy and reliability of this method in the reform evaluation process, which is of great significance.

Keywords: Particle swarm optimization · User preferences · User interest · Reform in education

1 Introduction

Ideological and political teaching occupies an important position in students' life, especially for freshmen, it is a compulsory course. This course does not focus on national policies and conference contents as in senior high school, but also makes a deeper explanation on the improvement of students' self-adaptive quality and level. Promoting and attaching importance to the course in various places can effectively improve students' personal qualities and abilities, making them more important talents.

In order to improve the teaching effect, the paper introduces particle swarm optimization algorithm to complete the evaluation of Ideological and political teaching reform.

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2 Evaluation Method of the Effect of Ideological and Political Classroom Teaching Reform in Colleges and Universities

2.1 Evaluation System of Ideological and Political Teaching Reform in Colleges and Universities

First of all, the main body of teaching reform evaluation is shown in Fig. 1.

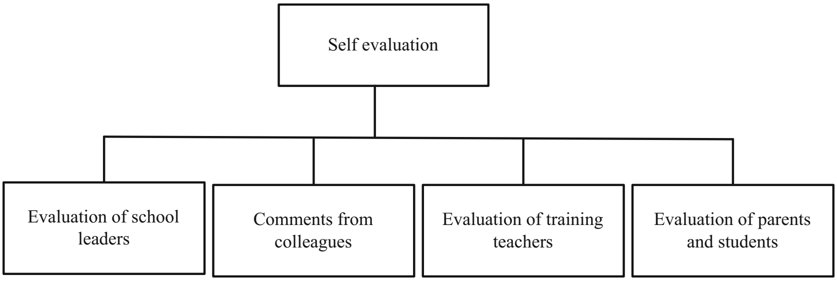

Fig. 1. Distribution map of evaluation subjects of ideological and political teaching reform

Recommendation based on evaluation content is one of the important contents in the social network interest zone recommendation model. The basic formula of Particle Optimization in the optimization algorithm based on chaotic particle swarm optimization is:

$$Y_i^{m+1} = pY_i^m + z_i r_i \times \left(q_i^m - X_i^m\right) + \left(U^m - X_i^m\right) \tag{1}$$

$$X_i^{m+1} = X_i^m + Y_i^{m+1} \tag{2}$$

In the formula: p is the inertia factor; z_i and r_i are the optimized factors; m is the number of calculations; X_i^m is the space area of the particle i when the calculation is m times; Y_i^m is the movement velocity of the particle i when the calculation is m times; q_i^m represents the individual extreme value derived from the number of calculations when the particle i moves from the original position to the current position; U^m represents the global extreme value derived from the number of calculations when the particle i moves from the original position to the current position. By analyzing and evaluating content information, user preferences can be effectively mined [4]. Therefore, modeling the comment content can capture user interest-related features (such as semantic information such as categories), thereby improving the recommendation effect, and defining user A's evaluation of a certain point of interest B as a document C. In this document C, the number of words is used according to N. Then the scoring matrix F can be approximated by the inner product of the two real number matrices D and E:

$$\mathrm{F} = Y_i^{m+1} X_i^{m+1} - \sum \mathrm{D} - \left(U^m - X_i^m\right) + \mathrm{E}^{\mathrm{N}} \tag{3}$$

Minimize the above formula to obtain the following formula:

$$\mathrm{MinP} = \frac{(U^m - X_i^m)^2}{2\sqrt{\mathrm{F}}} \tag{4}$$

Combining the formula with minimizing the weighted square error, the reform evaluation extraction function θ:

$$\theta = \mathrm{MinP} - z_{1i} \times r\left\|\mathrm{F} - \bar{\mathrm{F}}\right\|_N^2 \tag{5}$$

According to the above function, we can extract the teaching reform and realize the reconstruction of the values of the educated.

2.2 Evaluation Indicators for the Reform of Ideological and Political Teaching

Firstly, the index system should be divided into two parts: teaching and learning. Teachers and students, as evaluators and evaluators at the same time, have self-evaluation and other evaluation.

Secondly, the index system should be well organized, detailed and focused, and can effectively extract the information needed in the classroom [7].

Thirdly, according to the characteristics of activity-based classroom, the index system should have both qualitative evaluation and quantitative evaluation, both generation standards and unified standards (Table 1).

Table 1. Student classroom learning evaluation table

Category A indicators	Category B indicators	Evaluation content	Evaluation grade		
Accomplishment achievement	Explore problems through economic field	Independently summarize the values of creating social wealth, such as the influence of supply and demand on prices and the awareness of efficiency	A	B	C
Participation status	span	Most students participate in exchange activities	A	B	C
	depth	Participate in solving problems in the classroom			
emotional state	Active atmosphere	Have a moderate sense of tension, pleasure and desire to explore	A	B	C
Thinking state	Agility, criticism, uniqueness	When expressing, the language is fluent, ask questions from many aspects, and find solutions to the problems	A	B	C
AC status	Cooperation and exchange	Students can cooperate to explore and solve problems together	A	B	C

When evaluating the learning status of students, teachers do not need to stick to the use of scales, but should combine multiple evaluation methods to use [8] (Table 2).

Table 2. Teacher's classroom teaching evaluation form (other evaluation)

Category A indicators	Category B indicators	Evaluation content	Evaluation grade		
Generating behavior	Value orientation	Improve students' ability to explore the essence of problems and identify with wealth values such as efficiency and competitive consciousness	A	B	C
	Stimulate motivation	Create problems with moderate difficulty; Encourage more guidance; Stimulate students' independent participation and guide students to explore actively	A	B	C
	Adaptive teaching	Adjust teaching strategies and methods according to students' situation; Pay attention to individual differences	A	B	C
	Timely feedback	Having depth can inspire students; Pay attention to students' differences and give timely feedback	A	B	C
	Classroom environment	Relaxed classroom atmosphere; Good relationship between teachers and students	A	B	C

The ideological and political theory course teaching evaluation activity has the inherent characteristics of general teaching evaluation. At the same time, it also has three important functions: development orientation, diagnostic feedback, and incentive development, as shown in the table.

The ideological and political theory course has the characteristics of extensive, rich and integrated, which makes the content of teaching evaluation also present a diversified trend. See Table 3 for the main contents.

Table 3. Content of evaluation

Category	Content
Knowledge evaluation	It includes concept learning, rule learning and problem solving learning
Capability evaluation	It includes the evaluation of students' intelligence and skills and the evaluation of students' practical application ability
Evaluation of emotion, attitude and values	Including students in the learning process and after learning
Behavior performance evaluation	It refers to how to make efforts to achieve effective results after learning

To sum up, the classroom teaching evaluation standard that can really promote the core quality of Ideological and political discipline should aim at promoting the professional quality of teachers and the generation of students' core quality; Since the new curriculum reform, it has been proposed to take students as the basis for development. The new curriculum standard also proposes that learning in the high school stage is to enable students to have the key abilities they should have when facing various choices and contacting the society in the future. The evaluation standard should take students as the main body, and the premise of evaluation construction should be to evaluate teaching based on learning [9].

2.3 Realization of the Effect Evaluation of Ideological and Political Classroom Teaching Reform

In order to complete the teaching activities and achieve the teaching goals, a variety of teaching methods have been produced. Generally speaking, they can be divided into two categories: injection and heuristics. The injection method is a kind of duck-filling teaching method, which mainly means that teachers start subjectively and treat students simply as containers for receiving knowledge, ignoring the subjective initiative of students. The heuristic is to start from the actual situation of the students, and take effective ways to mobilize the enthusiasm of the students in order to better play the subjective initiative of the students [10]. In modern teaching concepts, advocating heuristics and opposing injections are irreversible: but there are both professional curriculum elements in curriculum ideology and politics, and it also contains the quality of ideological concepts. In ideological and political education, we should adhere to certain " Instill principles". The so-called "indoctrination" is not infusion teaching, but the socialist theory and moral education content that students should master in a variety of vivid and interesting ways to infuse and convey to students, so that they can become qualified socialist builders and successors. Therefore, in the course of curriculum ideological and political implementation, different teaching methods should be carefully evaluated, and different teaching methods should be used for different contents, especially the teaching methods used in professional ethics education should be carefully evaluated. According to the actual needs of students, as shown in the figure.

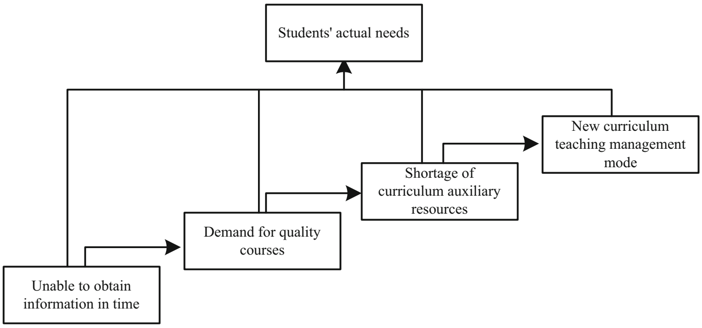

Fig. 2. The learning evaluation model of students who die in teaching

In the face of new problems, educational institutions should actively take countermeasures. The evaluation framework is shown in Fig. 3.

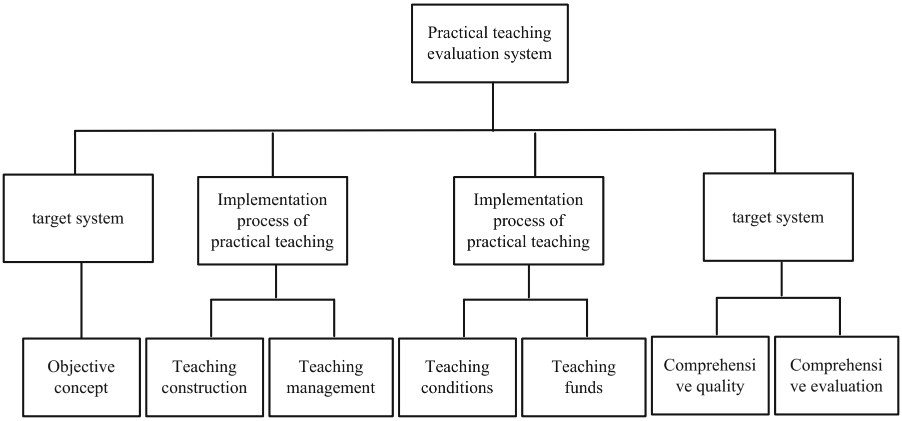

Fig. 3. Evaluation framework of ideological and political courses

Teaching design is carried out according to the teaching objectives and teaching materials. It is an innovative arrangement process of teachers. Due to the different life experience, values and thinking mode of each teacher, even if it is the same teaching content, different teachers will make different designs. Teaching design always reflects the views and opinions of teachers, so teachers should be good leaders of professional courses. The teaching design should not be limited to the explanation of professional knowledge and the demonstration of professional skills, but also transfer the correct world outlook, outlook on life and values to students, and explain the special professional ethics that each specialty should follow. In the design process, the three are not progressive, but parallel. The three should be organically integrated and skillfully displayed. When evaluating the content of teaching design, we should focus on the integration degree and display method of emotion, attitude and values, formulate hierarchical standards, evaluate the level of teaching design, and point out improvement suggestions. On this basis, the evaluation weights and evaluation indexes of different levels of Ideological and theoretical practice courses are adjusted and standardized, as shown in the table below (Table 4):

Table 4. Evaluation weights of ideological and theoretical practice courses

Weight	Target system	Operation process	Operation guarantee	Teaching quality
Target system	1	1	3	2
Implementation process	2	3	4	1
Implementation guarantee	3	2	1	3
Teaching quality	4	5	0	4
Score value	5	4	5	5

The evaluation system of Ideological and political teaching first plays a guiding role. Guidance means to control the general direction and leave small details. All subjects can carry out their own activities according to the system, which is the basis rather than copy mechanically. The second is to feed back the information in time in the process of practice. The feedback information is objective and practical, and has great reference value. If the behavior deviates from the standard or violates the standard, it shall be adjusted in time, so that the teaching can be carried out continuously according to the standard system. Finally, according to the feedback information, the analysis and guidance stage is the key period to analyze the crux and find countermeasures. We should correspond the standards at different levels, carry forward the advantages and overcome the shortcomings on the basis of practicality (Table 5).

Table 5. First-level evaluation indicators of ideological and theoretical practice courses

Primary index	Influencing factors	Total
Variance contribution%	49.658	49.658
Weight%	100	100
Adjusted weight	3	3

Students are the main body of learning. The ideological and political development of the curriculum is precisely to train excellent students with high moral quality and strong professional skills. It should be adjusted organically according to the achievements and difficulties encountered by students in learning, so as to better serve the development of students. Teachers are the first promoters. It is necessary to change teaching concepts and make developmental changes according to the existing teaching situation of teachers, so that teachers can better integrate value guidance into professional teaching. Third, we should focus on the teaching managers. As the main personnel of the top-level design, the teaching managers are responsible for promoting the work and innovating the personalized curriculum mode (Table 6).

Table 6. Second-level evaluation indicators of ideological and theoretical practice courses

Secondary index	Construction of practical teaching objectives	Objective management of practical teaching	Total
Variance contribution%	43.652	23.65	49.658
Weight%	68.25	31.75	100
Adjusted weight	0.52	0.35	1

Teaching reflection is one of the core links in the teaching link. It can analyze the current curriculum implementation process and understand the possible problems in the teaching link. Therefore, ideological and political teaching should also build a quality assurance system under this requirement, start with the learning of basic theoretical knowledge, pay attention to the construction of students' innovation ability and thinking ability, especially the inspiration and research of some knowledge, and unify internalization and externalization in the combination of theoretical knowledge and practical ability. If necessary, we can introduce relevant current affairs hot spots and typical cases to organize teaching, optimize teaching methods in the process of research and thinking, clarify the main direction of future curriculum education structure adjustment, examine and standardize the teaching evaluation model in combination with CIPP principle, and obtain relevant information such as evaluation information, teaching effect, teaching efficiency and teaching benefit (Fig. 4).

Based on the above architecture, due to the relatively complex network environment, ideological and political teaching is inseparable from reasonable planning and judgment from the initial curriculum scheme design to the final curriculum practice. The systematic design of teaching evaluation is also an indispensable content in the quality assurance system. From the requirements of the evaluation system, we can divide it into three main parts: the first is the implementation scheme, then the implementation process, and finally the implementation result. The implementation plan is not only the basis of the teaching system, but also the basic content to ensure the effect of teaching practice. In general, it is necessary to clarify the rationality and education of subject teaching objectives in the formulation stage of teaching content. At the specific implementation stage, knowledge education should be carried out in a planned way from the perspective of students; In the implementation result link, it is the overall evaluation of subject teaching. The whole teaching evaluation system continuously guides the rational development of Ideological and political teaching through the cooperation between

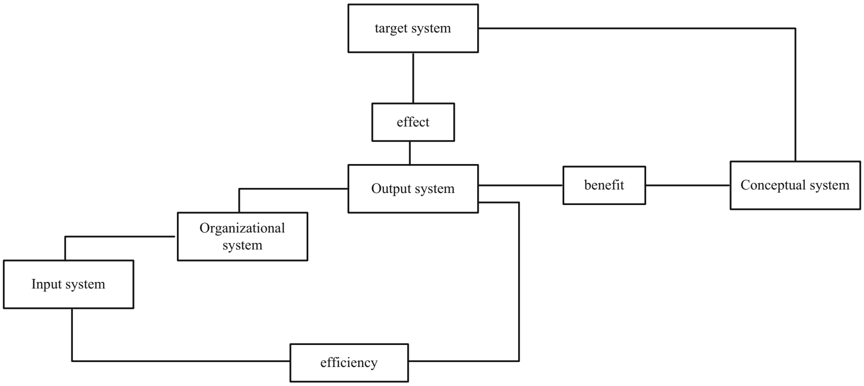

Fig. 4. The evaluation process of ideological and political courses

different subsystems. In the future quality assurance system, teachers should also clarify students' ideological characteristics, knowledge mastery, values and emotional attitudes, pay attention to the details in the system and improve the teaching quality as a whole. To sum up, the evaluation of Ideological and political teaching is not only a reasonable analysis of teaching work, but also a process of adjusting the ideological and political quality of social members. At this stage, the social model changes rapidly and various interest relations become more complex. The teaching evaluation standard based on this social background should also keep pace with the times. Its internal structural elements should meet the objective requirements of the development of the times and clarify the functional orientation and basic requirements of the discipline.

3 Analysis of Experimental Results

In order to ensure the authenticity of the primary sample statistical results, the ideological and political education adaptability of all students in freshman, sophomore, and junior year can be calculated uniformly according to the following formula.

$$\overline{p} = \frac{\sum_{u=0}^{\dot{w}} f_i}{n} \tag{6}$$

Among them, $\overline{p}$ represents the average ideological and political education adaptability of students, n represents the total number of students, u represents the physical value represented by the students with the worst ideological and political education adaptability, $\dot{w}$ represents the physical value represented by the students with the strongest ideological and political education adaptability, f_i represents the standard level of students' ideological and political education adaptability, and i represents the actual position parameter of the student. The ideological and political education adaptability parameters of all the freshmen, sophomores, and juniors are put into the formula respectively, and the integrated calculation results can be obtained in the following table.

Table 7. Primary sample questionnaire

School year	Freshman	Sophomore	Junior
Number of people	1000	1000	1000
Basic ideological and political adaptation	0.765	0.725	0.752
Emotional ability	0.565	0.612	0.562
Self ability	0.701	0.712	0.713
Ideological and political curriculum development level/(%)	98.65	98.65	98.65
P value	3.925	3.462	3.415

It can be seen from Table 7 that with the increase of age, the educational adaptability of students decreases, and that of grade 3 students decreases by 0.606 compared with that of grade 1. This group of data shows that the adaptability of first-year students is the best. In order to obtain further experimental results, 1000 students were tested. Table 8 gives the relevant design parameters.

Table 8. Parameter setting

Experimental object	Video frequency	Number of Teachers	Number of students attending class	Comparison of video frequency between teachers and students
Group 1	68	150	150	1:2
Group 2	150	250	350	3:4
Group 3	250	250	550	3:6
Group 4	350	350	750	3:8

This empirical study takes 1000 students majoring in computer science and technology in a famous domestic university as the experimental object for one year. Before the start of the study, their knowledge level shall be counted. See Table 9 for the specific results.

Table 9. Knowledge level of subjects

	Basic level	Expected level
Ideological and political quality	0.92	3.21
Basic knowledge	0.45	1.81
Specific learning contents	0.55	3.21

According to the data in the above table, the professional curriculum design is carried out, and the students' knowledge mastery is investigated once every three months. The political level of the experimental subjects is shown in Fig. 5

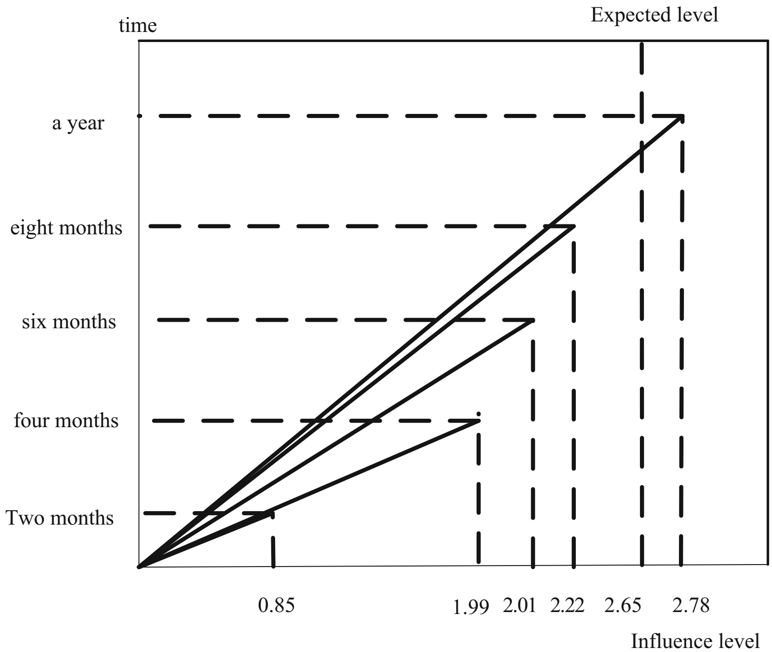

Fig. 5. The influence of ideological and political quality on the level of ideological and political education

It can be seen from the analysis of Fig. 5 that the ideological quality of the students is low at the initial stage. Through the completion of education and training through new media technology, the quality of students has improved significantly, and one year later, it exceeded the expected level of improvement. This shows that the new media can effectively improve the political level of students (Fig. 6).

It can be seen from the analysis of Fig. 2 that the new media method can effectively improve the teaching effect, be more targeted, and improve the evaluation effect. To analyze the accuracy of the evaluation results, the results are shown in Fig. 7.

It can be seen from Fig. 7 that the accuracy of this research method is up to 92%, while the accuracy of the other two methods is less than 68% and 50%. It shows that the evaluation result of this method has higher reliability.

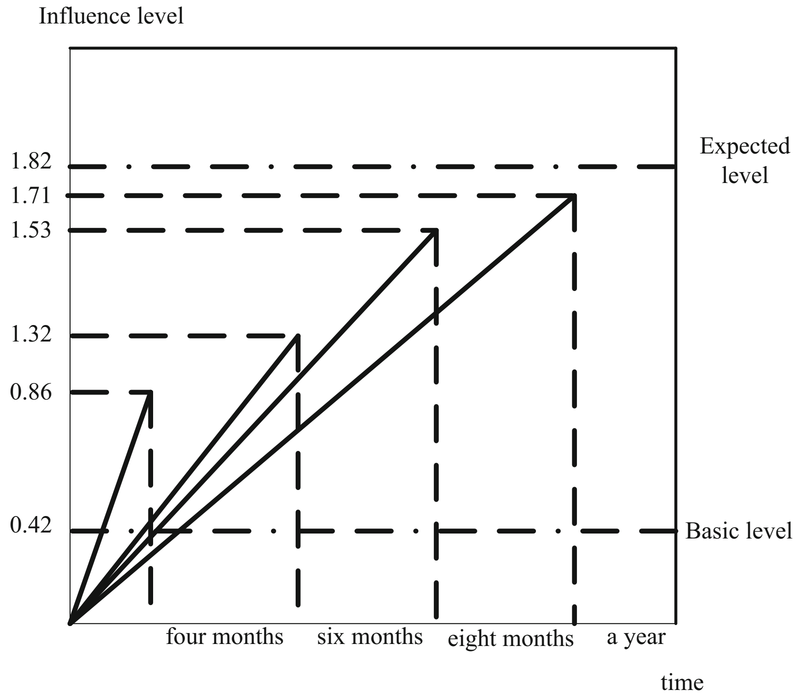

Fig. 6. The influence map of the reform level of ideological and political education

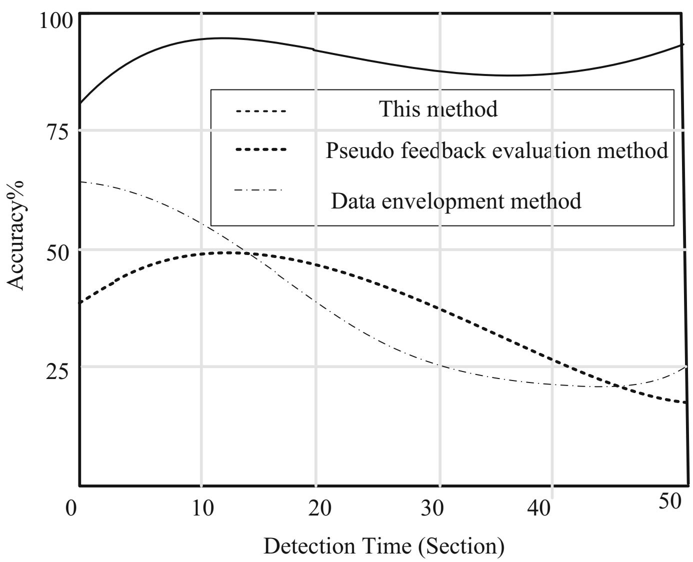

Fig. 7. The accuracy test of the evaluation of the influencing factors of the teaching effect

4 Conclusion

The improvement of the quality of ideological and political teaching has become the focus of research in the field of education in the future. Under the design system of the new curriculum standard, we will jointly create a logical model of internal knowledge points, and attach importance to the development of educational resources and the effective use of curriculum resources. We need to realize that the teaching arrangement at this stage still needs more perfect organizational plan as support, and the content of ideological and political education will continue to be reformed with the development of society.

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Evaluation Method of Classroom Teaching Quality of Marxist Theory Course Based on Deep Learning

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Abstract. The traditional evaluation method of Marxist theory course has the problem of long evaluation time. Therefore, this paper proposes a evaluation method of Marxist Theory Course Based on in-depth learning. First of all, it analyzes the current situation of classroom teaching of Marxist theory course, designs the evaluation index of, determines the weight of evaluation index, extracts the characteristics of evaluation index by using deep learning algorithm, and constructs the evaluation system of Marxist Theory Course in combination with the principles of scientificity, systematization, independence and operability of index selection, According to the analytic hierarchy process, the weight of teaching quality evaluation index is calculated, and evaluation of Marxist theory course is realized. The experimental results show that this method can effectively shorten the time of evaluation and has better evaluation performance.

Keywords: Deep learning · Marxist theory · Classroom teaching · Teaching quality · Evaluation method · Weight determination

1 Introduction

Due to the influence of various factors, the evaluation system for Marxist theory courses has not been formed. Most schools have not built a comprehensive and operable evaluation system for the teaching of Marxist theory [1]. This does not match with the country's increasing emphasis on the teaching of Marxist theory and the requirement to improve the teaching effect, so that the Marxist theory course can become a course goal that satisfies students [2]. Therefore, constructing an objective evaluation of the Marxist curriculum and making it a long-term means of "promoting construction and reform through evaluation" is an urgent problem in the teaching of Marxist theory.

It was proposed in the "18th National Congress" that "at present, our society is in a period of transformation, so the ideological and political education in Colleges and universities also needs to keep up with the new situation, educate the contemporary college students in a new mode and attitude, and make them the main force to promote social transformation."With the continuous development of higher education, the construction and reform of the Marxist theoretical evaluation system has achieved remarkable

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results. However, in the social transition period, the party and the government continue to emphasize the importance of Ideological and political education. This has provided impetus for domestic scholars to continuously deepen their research [3]. At present, college students mainly acquire knowledge and carry out education through the teaching of Marxist theory. Through teaching, it is not only helpful to promote the implementation of the party and government policies, but also helpful to cultivate the moral quality of college students.

The reference [4] method proposes a Delphi method based evaluation method for Marxist theory courses, obtains teaching quality data through hierarchical data clustering, calculates the weight of teaching quality data using fuzzy theory, and realizes teaching quality evaluation through Delphi method. This method can shorten the time of teaching quality evaluation, but the accuracy of teaching evaluation is low. Reference [5] proposes a method for evaluating of Marxist theory courses based on analytic hierarchy process. It mines the classroom teaching data of Marxist theory courses according to the big data analysis method, uses the data clustering method to determine the classroom teaching evaluation indicators of Marxist theory courses, and realizes the classroom teaching evaluation of Marxist theory courses through analytic hierarchy process. This method can improve the effect of classroom teaching evaluation, But the evaluation takes a long time.

In view of the above problems, this paper introduces the deep learning method to evaluate the Marxist theory curriculum, and improves the efficiency of curriculum evaluation.

2 Marxist Theory Course Evaluation Method Design

2.1 Choose the Evaluation Index of Marxist Theory Course

Textbook study refers to teachers' grasp of the teaching materials before classroom teaching, and their understanding of the value, principles and operation methods of the teaching materials can help teachers more clearly grasp the teaching contents. The analysis of the technical structure and key and difficult points of the teaching contents is a necessary preparation process before classroom teaching. For teachers of Marxist theory courses, they should also grasp the teaching materials from the aspects of physical fitness, skills, cognition and behavior, and excavate the thinking mode, methods and technical principles behind the teaching materials at multiple levels.

Learning situation analysis means that teachers have a certain understanding of the physical and mental characteristics and change laws of the students before teaching design, and know the characteristics and laws of the formation of students' sports skills. For the teaching design of Marxist theory course, before teaching design, teachers of Marxist theory course need to understand the Marxist theory course foundation of the teaching object, understand their interest and needs in learning Marxist theory course, pay attention to the differences of teaching objects, and study and analyze the students with weak special physical ability, And formulate corresponding intervention measures.

The implementation of classroom teaching is mainly manifested in four aspects, namely:

Organization and management. The main body of classroom organization and management is the teacher, and students' subjective thinking and subjective wishes as participants of classroom organization and management are inseparable from classroom organization and management. At the same time, effective classroom organization and management will also be affected by many factors such as social atmosphere, teaching atmosphere and learning atmosphere.

Scenario creation. Learning is the process of constructing one's own cognitive experience and finding the correlation between knowledge and knowledge. In the learning process, if the teacher's teaching content cannot be related to the students' existing or life experience, it will become rigid and boring, which will cause students to learn. Inertness, lack of interest in learning or difficulty in cognition.

Study guidance. The use of teaching methods should be based on the formulation of teaching syllabus, the reasonable arrangement of teaching contents in combination with teaching objects, the implementation of teaching according to the characteristics of the course, and the teaching methods should be diverse and full of characteristics.

Teacher-student interaction. In the classroom teaching, teachers set some theme forms according to the existing technical level of students and the existing teaching content, cultivate students' innovation and creativity, enhance the cooperation and communication between teachers and students, and enhance students' thinking and understanding of the learned content.

The classroom teaching effect is mainly manifested in three aspects, namely:

Classroom assessment refers to the test conducted by teachers according to teaching needs after teaching. Its purpose is to help teachers understand more clearly the students' mastery of the knowledge. In the teaching of Marxist theory courses, teachers' assessment in class is conducive to students' understanding of the learning objectives and tasks of Marxist theory courses, and to students' forming a good learning atmosphere of comparison, learning, catching up and helping.

The assessment of Marxist theory course includes: professional skill assessment, theoretical knowledge assessment, practical ability assessment, teaching ability assessment, etc.

The methods of teacher evaluation are mainly divided into two categories: one is explicit evaluation and the other is implicit evaluation. Explicit assessment includes verbal assessment, written assessment and situational assessment; Invisible evaluation mainly includes introduction evaluation, interactive evaluation, reference evaluation and so on.

After class teaching reflection is mainly reflected in two aspects, namely:

After class summary. It refers to the analysis and explanation of teachers' lesson preparation before classroom teaching and the comprehensive situation in the process of classroom teaching after classroom teaching. Its purpose is to affirm the advantages, find out the shortcomings, explore more effective teaching means and methods, improve teaching quality and enhance individual teaching ability. Marxist Theory Teachers' after-school summary after classroom teaching is a re analysis of the teaching content, which can help Marxist Theory Teachers obtain more effective teaching methods and help Marxist theory teachers play the role of inspiration, Finally, improve the teaching ability of teachers of Marxist theory course and the teaching effect and quality of Marxist theory course classroom.

Teaching reflection. It refers to teachers' self observation and Reflection on teaching activities. On the one hand, it gives teachers the opportunity to re understand the special cases in teaching activities. On the other hand, it gives teachers the important task of reflection on their own thoughts, emotions, hearts, theoretical cognition and operation methods, so as to form a comprehensive value re cognition and judgment. In their daily teaching activities, teachers of Marxist theory course should not only reflect on the problems encountered in the classroom, but also strive to analyze them from the aspects of personal experience, teaching relationship, teaching theory and so on.

2.2 Extracting the Characteristics of Evaluation Indicators Based on Deep Learning

Using the deep learning algorithm, extract the characteristics of Marxist theory courses evaluation indicators, use the characteristics of Marxist theory courses, and calculate the corresponding weights of the Marxist theory courses evaluation indicators:

$$\phi = \sqrt{\frac{m_k}{2M_{k+1}}}, k = 1, 2, \cdots, k \tag{1}$$

Among them, m_k represents the quantitative value of Marxist theory courses, and M_{k+1} represents the estimated function of Marxist theory courses.

Combining the network structure of the deep learning algorithm to study of Marxism theory courses [6], set the Marxism theory course evaluation index characteristic as T_x, according to the learning results of Marxism theory courses The evaluation of the characteristics of the j characteristic of the k category index of Marxist theory courses, and the comprehensive degree function of evaluation of the Marxist theory courses is:

$$S = M_{k+1} \cdot P_k \phi \tag{2}$$

Let φ_z denote the coefficient of the Marxist theory course evaluation index vector, and combine the deep learning algorithm to carry out the correlation analysis of the Marxist theory course [7], and obtain the correlation function of the Marxist theory course evaluation index characteristics $L(k)$, so as to obtain the significant relevance factor of Marxist theory course, namely:

$$\gamma_k = G_{k+1} \sum_{j}^{k} L(k) - \frac{P_k}{R_k} \tag{3}$$

In the above formula, R_k represents the correlation coefficient.

According to the deep learning algorithm, set the time as k, revise the evaluation of Marxist theory courses, and obtain the estimated value R_{k+1} of the characteristics of evaluation index characteristics of the Marxist theory courses, which are described as follows:

$$R_{k+1} = \frac{\gamma_k}{d_k} + \left(z_{k+1} - \sum_{i=1}^{m} \frac{h_{k+1}}{P_k} \right) \tag{4}$$

Through the description of the characteristic estimation value of evaluation index of Marxist theory course, the characteristics of evaluation index of Marxist theory course are extracted.

2.3 Determining the Weights of Teaching Quality Evaluation Indicators

According to the purpose of theoretical course evaluation, combined with the scientific, systematic, independent and operable principles of index selection, multiple evaluation factors can be classified and combined to form a hierarchical structure. The steps of weight determination are as follows:

Step1: Construct a judgment matrix.

For the same level of indicators, compare them in pairs to construct an n level judgment matrix, namely:

$$B = \left(b_{ij}\right)_{n \times n} \tag{5}$$

Among them, b_{ij} represents the relative importance of the i index and the j index.

Step2: Calculate the weight of each indicator.

Calculate the product of each row element in the judgment matrix B, namely:

$$G_i = \prod_{j=1}^{n} b_{ij}, \quad i = 1, 2, \cdots, n \tag{6}$$

Then calculate the n root value of each row G_i, the formula is:

$$\overline{W_i} = \sqrt[n]{M_i} \tag{7}$$

Among them, n represents the matrix order.

To normalize vector $\left[\, \overline{W_1}\ \overline{W_2} \cdots \overline{W_n} \,\right]^T$, the formula is:

$$W_i = \frac{\overline{W_i}}{\sum\limits_{i=1}^{n} \overline{W_i}} \tag{8}$$

Among them, $W = \left[\, W_1\ W_2 \cdots W_n\right]^T$ represents the weight vector of each index.

Step3: Consistency check.

The use of analytic hierarchy process to calculate the index weight [8] is closely related to the comparison of the importance of each factor (indicator) by each judge, and emphasizes internal consistency. For the judgment matrix B, if each element has the following relationship: $b_{iv} = b_{ik} \cdot b_{kj}$, $(i, j, k = 1, 2, \cdots, n)$, then this matrix has complete consistency. The weight distribution based on the consistency evaluation results is scientific and reasonable [9]. The specific process is as follows:

Find the largest characteristic root of the judgment matrix, the formula is:

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i} \tag{9}$$

To calculate the consistency index CI, the formula is:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{10}$$

where n is the order of the judgment matrix.

Calculate the consistency ratio CR, the formula is:

$$CR = \frac{CI}{RI} \tag{11}$$

In the formula, RI is the average consistency index of the same order matrix.

If $CR < 0.1$, the consistency of the judgment matrix can be accepted, and the obtained $\{W_i\}(i = 1, 2, \cdots, n)$ is the weight set. If $CR \geq 0.1$, the judgment matrix needs to be adjusted.

According to the above steps, the Analytic Hierarchy Process is used to determine the weight of the Marxist theory course evaluation index.

2.4 Constructing the Evaluation System of Marxist Theory Course

According to the above evaluation indicators, the evaluation framework of Marxist theory course is preliminarily determined, as shown in Table 1.

Table 1. Evaluation framework of Marxist Theory Course

Target	First level indicator	Secondary indicators	Three-level indicators
Classroom evaluation system of Marxist Theory Course	Classroom preparation	Instructional design	Textbook study
			Academic analysis
			Target setting
			Process arrangement
		Lesson plan writing	Formal specification
			Accurately stated
	Classroom teaching implementation	Organization Management	Organization norms
			Reasonable regulation
		Situation creation	Contact experience
			Multiple perception
			Deep wake up
		Teaching Guidance	Problem guide

(*continued*)

Table 1. (*continued*)

Target	First level indicator	Secondary indicators	Three-level indicators
			Stimulate interest
			Cooperative learning
			Exploring innovation
		Teacher-student interaction	Classroom atmosphere
			Experience sharing
		Evaluation feedback	Reasonable assessment
			Incentive guidance
	Classroom teaching effect	Knowledge comprehension rate	Knowledge
			Theory application
		Skill mastery rate	Skills mastered
			Professional level
		Subjective performance of students	Subjective description of inner psychology
			Subjective performance of external behavior
	After-school teaching reflection	Teaching log	After class summary
			Organize regularly
		Teaching reflection	Problem reflection
			Case study

The teaching evaluation system is mainly to evaluate the significance of Marxist Theory Education [10]. Some hidden or other factors that affect the quality of education, such as school running conditions, teachers' team, teaching process, etc., are not described in this paper. The main reason is that if these contents are involved, this is not a simple teaching quality evaluation system, but a school level evaluation system; At the same time, it will not be able to reflect the core content of the evaluation of the effect of Marxist theory curriculum.

In this way, the evaluation of Marxist theory course is realized.

3 Experimental Analysis

3.1 Data Acquisition of Marxist Theory Course Evaluation

In the process of the experiment, the data of the Marxist theory course of a university is used as the experimental data source, and the analytical evaluation method and comprehensive evaluation method are used to evaluate the Marxist theory course. The sample characteristics of the experimental data are shown in Table 2.

Table 2. Characteristics of data samples

Sample number	Index name	Eigenvalues
1	Textbook study	1
2	Academic analysis	3
3	Target setting	2
4	Process arrangement	2
5	Formal specification	4
6	Accurately stated	2
7	Organization norms	2
8	Reasonable regulation	3
9	Contact experience	1
10	Multiple perception	1
11	Deep wake up	1
12	Problem guide	3
13	Stimulate interest	3
14	Cooperative learning	4
15	Exploring innovation	4
16	Classroom atmosphere	2
17	Experience sharing	3
18	Reasonable assessment	4
19	Incentive guidance	3
20	Knowledge	3
21	Theory application	2
22	Skills mastered	1
23	Professional level	1

(*continued*)

Table 2. (*continued*)

Sample number	Index name	Eigenvalues
24	Subjective description of inner psychology	4
25	Subjective performance of external behavior	4
26	After class summary	3
27	Organize regularly	2
28	Problem reflection	1
29	Case study	3

3.2 Calculation of Evaluation Weight of Marxist Theory Course

If the proportion of a third level indicator in the evaluation index system of Marxist theory courses is obtained, the proportion of the third level indicator in the third level dimension can be multiplied by the proportion of the second level indicator in the second level dimension, and then multiplied by the weight value of the first level indicator in the evaluation index system and dimensions of Marxist theory courses, that is, the weight value of the third level indicator in the evaluation index system of Marxist theory courses, The weight value of all indicators in the dimension indicator is 1. The weight calculation results of Marxist theory evaluation indicators are shown in Table 3.

Table 3. Weight

First level indicator	Weights/%	Secondary indicators	Weights/%	Three-level indicators	Weights/%
Classroom preparation	22.4	Instructional design	12.2	Textbook study	3.2
				Academic analysis	2.5
				Target setting	3.5
				Process arrangement	3.0
		Lesson plan writing	10.2	Formal specification	4.9
				Accurately stated	5.3
Classroom teaching implementation	22.4	Organization Management	4.2	Organization norms	2.1
				Reasonable regulation	2.1

(*continued*)

Table 3. (*continued*)

First level indicator	Weights/%	Secondary indicators	Weights/%	Three-level indicators	Weights/%
		Situation creation	3.7	Contact experience	1.2
				Multiple perception	1.4
				Deep wake up	1.1
		Teaching Guidance	5.1	Problem guide	1.1
				Stimulate interest	1.0
				Cooperative learning	1.3
				Exploring innovation	1.7
		Teacher-student interaction	4.6	Classroom atmosphere	2.8
				Experience sharing	1.8
		Evaluation feedback	4.8	Reasonable assessment	2.3
				Incentive guidance	2.5
Classroom teaching effect	27.6	Knowledge comprehension rate	10.2	Knowledge	6.1
				Theory application	4.1
		Skill mastery rate	8.3	Skills mastered	3.5
				Professional level	4.8
		Subjective performance of students	9.1	Subjective description of inner psychology	5.0
				Subjective performance of external behavior	4.1
After-school teaching reflection	27.6	Teaching log	13.3	After class summary	5.4
				Organize regularly	7.9
		Teaching reflection	14.3	Problem reflection	6.7
				Case study	7.6

3.3 Result Analysis

Teaching Quality Evaluation Efficiency

In order to verify the feasibility of the evaluation methods in this paper, the evaluation methods based on Delphi method and analytic hierarchy process are introduced for comparison, and the evaluation efficiency of the two evaluation methods is tested. The results are shown in Table 4.

Table 4. Evaluation efficiency test

Number of iterations	Evaluation efficiency	
	Improved Delphi method	Deep learning method
1 Time	67.32%	99.16%
2 Times	64.42%	98.63%
3 Times	80.37%	95.38%
4 Times	68.16%	97.34%
5 Times	78.74%	98.53%
6 Times	75.68%	99.42%
7 Times	79.41%	98.14%
8 Times	81.23%	96.28%
9 Times	69.37%	97.83%
10 Times	82.76%	96.48%

It can be seen from the results in Table 4 that the evaluation efficiency of the improved Delphi method is low, only 82.76% at the highest, while the efficiency of the deep learning method can reach 96.48% and 99.42% at the highest. The reason is that this method uses deep learning to train the classroom data and calculate the weight of teaching indicators, which improves the efficiency of teaching evaluation.

Accuracy of Teaching Quality Assessment

In order to verify the feasibility of the evaluation methods in the paper, the improved Delphi method is introduced for comparison, and the efficiency of the two methods is tested. The results are shown in Fig. 1.

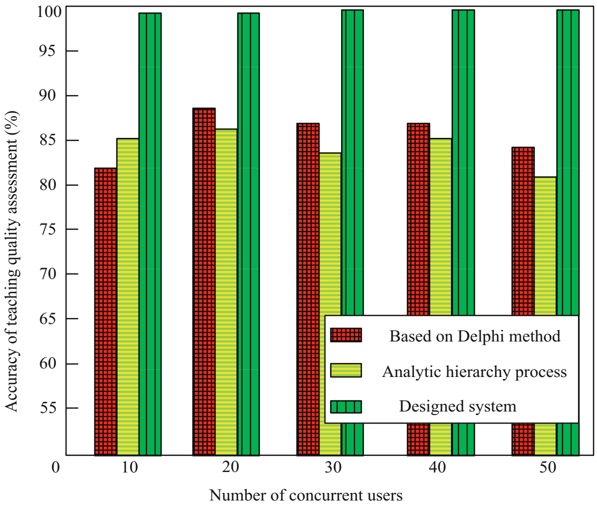

Fig. 1. Accuracy of teaching quality assessment

According to Fig. 1, when the number of experimental iterations is 20, the accuracy rate of Delphi method is 87%, the accuracy rate of analytic hierarchy process is 86%, and the accuracy rate of this method is 98%; When the number of experimental iterations is 50, the accuracy rate of Delphi method is 84%, the accuracy rate of analytic hierarchy process is 81%, and the accuracy rate of this method is 99%; This method always has a high evaluation effect.

4 Conclusion

This paper uses the deep learning method to evaluate the quality of Marxist theory course. Through the experimental test, it is found that this method can improve the evaluation efficiency when evaluating the quality of Marxist theory teaching.

In the future research, we will discuss how to enable teaching management personnel, teachers, students and other teaching stakeholders to evaluate the teaching quality according to the detailed rules formulated by relevant departments, so as to realize the systematization and procedural evaluation and greatly improve the work efficiency.

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Research on Teaching Effect Evaluation of Innovation and Entrepreneurship Based on Collaborative Filtering Algorithm

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Abstract. Entrepreneurship plays an important role in economic development and social progress. Innovation and entrepreneurship teaching for college students is an important part of cultivating innovative talents. However, the evaluation of the teaching effect of innovation and entrepreneurship is not comprehensive enough. Therefore, based on collaborative filtering algorithm, an evaluation method of the teaching effect of innovation and entrepreneurship is designed. Firstly, according to the teaching practice, the evaluation index of innovation and entrepreneurship teaching effect is selected to comprehensively determine the teaching effect. On this basis, the evaluation model of innovation and entrepreneurship teaching effect based on collaborative filtering algorithm is constructed. The experiment shows that the designed evaluation method of innovation and entrepreneurship teaching effect is accurate, with an average error of 0.03%, which has certain application value.

Keywords: Collaborative filtering algorithm · College students · Innovation and entrepreneurship · Teaching effect evaluation

1 Introduction

On May 4, 2015, the General Office of the State Council promulgated the Implementing Opinions of the General Office of the State Council on Deepening the Reform of Innovation and Entrepreneurship Education in Colleges and Universities [1] to mobilize and deploy the work of deepening the reform of innovation and entrepreneurship education in colleges and universities. The new version of the Administrative Provisions on Students of Ordinary Institutions of Higher Education promulgated by the Ministry of Education on February 4, 2017 and implemented as of September 1, 2017 encourages college students to innovate and start businesses [2]. Carrying out the innovation and entrepreneurship education of college students plays a vital role in cultivating innovative talents and arousing the innovation potential of the whole nation.

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In terms of research on innovation and entrepreneurship education, existing studies generally believe that innovation and entrepreneurship education can encourage and cultivate innovation and entrepreneurship talents to a certain extent [3]. It is worth emphasizing that innovation and entrepreneurship courses play a very important role in developing the innovation and entrepreneurship intention of educatees, strengthening innovation and entrepreneurship behaviors and improving their innovation and entrepreneurship performance. The aim of college innovation and entrepreneurship education is to cultivate and inspire students' innovative consciousness, stimulate their innovative thinking, and improve their comprehensive quality. [4] The mechanism of innovation and entrepreneurship education in colleges and universities should also construct an education framework with innovation and entrepreneurship awareness and innovation and entrepreneurship ability.

For example, through the implementation path of innovation and entrepreneurship education mechanism, actively take measures to improve the traction, security and evaluation mechanism, from the education subject, curriculum content, innovative teaching and other aspects of innovation education [4]. The quality of innovative and entrepreneurial teaching activities needs teaching evaluation. Innovation and entrepreneurship teaching evaluation needs to respect the objective facts, coordinate the differences of opinions among different subjects, and improve the quality of teaching as a common logical starting point. Innovation and entrepreneurship teaching evaluation adopts qualitative and quantitative evaluation methods [5]. At the same time, based on the different characteristics of different stages of innovation and entrepreneurship teaching, a comprehensive evaluation system of teaching quality is established.

The existing research has made certain attempt in the innovation and entrepreneurship teaching appraisal target, the appraisal model and the appraisal system establishment aspect. Scholars at home and abroad have made great contributions to the research of innovation mechanism and innovation and entrepreneurship teaching evaluation. The final goal of innovation and entrepreneurship education is teaching. The existing research is inadequate in the innovation and entrepreneurship education research, mostly focused on the characteristics and experience of innovation and entrepreneurship education to explore the development model. This kind of research has the strong model and the instruction significance to our country innovation and entrepreneurship education's theory development and the practice way.

Therefore, an evaluation method of innovative and entrepreneurial teaching based on collaborative filtering algorithm is proposed. This paper analyzes the economic indicators and individual indicators that affect enterprises' innovation and entrepreneurship, and constructs an efficiency evaluation model by using collaborative filtering algorithm, so as to efficiently mine data and reflect the classification rules of data, and thus accurately evaluate the relationship between college students' education level and entrepreneurial effect.

2 Design of Innovative and Entrepreneurial Teaching Evaluation Method Based on Collaborative Filtering Algorithm

2.1 Analyzing the Evaluation Level of Innovation and Entrepreneurship Teaching Effect

Before evaluating the teaching effect of innovation and entrepreneurship, it is necessary to analyze the evaluation level of innovation and entrepreneurship teaching effect [6]. The most direct way to evaluate the effect of innovation and entrepreneurship teaching is to directly evaluate the results of innovation and entrepreneurship, which can reflect the effect of teaching.

With the innovation and entrepreneurship activities of college students in the whole society, and gradually become the first choice of employment for college students, the evaluation index of entrepreneurship effect is different. What kind of standard and how to measure the effect of college students' innovation and entrepreneurship is related to the healthy development of college students' innovation and entrepreneurship.

Most scholars regard the success of business start-up as the basic point to study the effect of business start-up [7], which mainly involves the following three aspects: First, economic factors refer to the macro-economic conditions of enterprises that affect their marketing activities, mainly including economic development, economic structure, income and other aspects; Second, some scholars think that the entrepreneurial effect is more inclined to be measured by economic activities, which refers to the marketing activities held by enterprises for benefit under a certain organization and order. Some entrepreneurs, such as female entrepreneurs, can not be measured solely by economic factors, but by realizing their own intrinsic characteristics or personal values. In this paper, the effect of business start-up is defined as the benefits of economic activities of college students in the process of business start-up, including nine indicators such as profits, turnover, corporate profits and losses, corporate liquidity and employee turnover, which can reflect the effect of business start-up to be studied in this paper.

The theory of human capital extends capital from material wealth to human itself for the first time in the research history of economic and social development. Therefore, this paper classifies the human capital as the total amount of capital that is formed by the human capital bearer's investment in the fields of intelligence, physical strength, skills and health, attached to the laborers themselves [8] and can generate value through production and practice activities. Human capital and material capital have similar attributes. As different forms of capital, both of them can bring certain benefits to the owners of capital through certain forms of development and investment.

At the macro level of national development, human capital plays an important role in intellectual support for economic development and industrial upgrading [9], and is the core driving force for long-term and sustainable development of modern countries. At the micro level, human capital plays an important role in improving personal economic income and quality of life, and is an important strategic resource for personal development. The effect evaluation diagram based on this design is shown in Fig. 1 below.

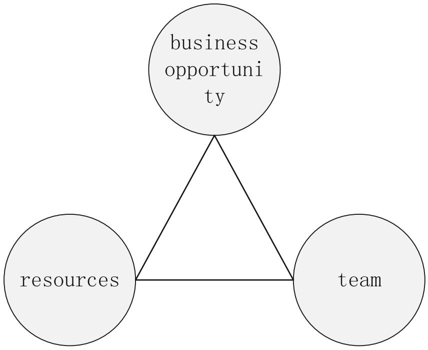

Fig. 1. Effect evaluation diagram

As can be seen from Fig. 1, the entrepreneur or the entrepreneurial team shall first observe and analyze the potential demand in the market and then, after analyzing the market demand, draw up the corresponding ideas and products through the entrepreneurial team, excavate the entrepreneurial opportunities, find the owner of the entrepreneurial resources in accordance with the relevant plans developed in the previous period and the lack of resources in the process of entrepreneurship, and through communication and persuasion, invest the resources in the production activities, and after obtaining the resources, make unified allocation of resources through the entrepreneur or the leader of the entrepreneurial team so as to maximize the use of resources. On this basis, adjust the entrepreneurial activities of opportunities, resources and two elements of the team to achieve a dynamic balance among the three.

Opportunity is an important factor to promote entrepreneurship. Opportunities present different changes and forms as the market changes and fluctuates. However, good business start-up preparation and ideas do not mean that a good business start-up opportunity can be obtained, because the business start-up ideas of entrepreneurs may not meet the actual needs and market needs in business start-up activities. A good business start-up opportunity needs to go through the market demand assessment first, and then, according to the assessment results, carry out the ideas that are in line with the market demand and the economic interests of the entrepreneur, so as to serve as the basis for manufacturing products and providing services. The products and services produced on this basis are bound to meet the market demand and will have a longer life cycle. When assessing the entrepreneurial opportunities, the following three principles may be followed, namely, judging the degree of customer demand, the potential purchase of customers, and the development of the growth rate of the market and consumers' demand for the products and services according to the market and the information obtained from the circulation of resources, namely, the resistance to the entry of the products and services into the market, the development and potential after the entry of the products and services into the market, and finance, namely, whether the goods or services can bring sufficient profits in the entrepreneurial activities, and when the profits can help consumers realize profits.

Teams determine the opportunity for entrepreneurial activity. In addition, the entrepreneur often decides whether to invest or not according to the performance of the team, and the evaluation of the team's operation ability depends on the leader's leadership and the team's quality. Entrepreneurial leadership refers to the ability of the entrepreneur to promptly communicate the latest situation and development trend to the entrepreneurial team, and how to communicate with the team to encourage team members to help the team recover from adversity.

Entrepreneurial team quality refers to the entrepreneurial team members experience, cooperation, such as tacit understanding. In the process of entrepreneurship, a good team determines the outcome of entrepreneurship to a large extent. A good team can not only discover and make use of opportunities, but also realize the breakthrough of self-potential of its members. Thirdly, how to collect enough entrepreneurial resources before starting a business is an important problem that needs to be solved for those entrepreneurs and teams who lack entrepreneurial experience. Before the implementation of the entrepreneurship plan, it is necessary to have sufficient entrepreneurship resources, especially entrepreneurship funds. In the process of starting a business, some entrepreneurs or large enterprises can use adequate funds to cope with the potential crisis in the workplace. For the vast majority of entrepreneurs, as long as they can find a profitable venture project, the capital needed to start a business will naturally have investors and investment teams to inject capital.

3 Constructing Teaching Effect Evaluation Model of Innovation and Entrepreneurship Based on Collaborative Filtering Algorithm

Collaborative filtering algorithm is a well-known and commonly used recommendation algorithm. It discovers user's preference based on the mining of user's historical behavior data, and predicts the product that user may like to recommend. Among the many technologies of data mining, classification mining is an important part. Classification is to classify the data samples according to some rules or standards according to the pre-defined classification categories. The model for effect evaluation has 4 evaluation coefficients. Therefore, it is necessary to calculate the coefficients of the model in advance before designing the model. The calculation formulas are as follows (1).

$$\begin{cases} r = \dfrac{h}{w} \\ r_0 = \dfrac{h_0}{w} \\ r_1 = \dfrac{h_1}{w} \\ r_2 = \dfrac{h_2}{w} \end{cases} \tag{1}$$

In the formula, r, r_0, r_1, r_2 represent the calculation coefficient of the model, h, h_0, h_1, h_2 represent the innovation weight, and w represent the innovation base. In this case, the evaluation index P of the model shall be required, as shown in (2) below.

$$p = \sqrt{\frac{h + h_0 + h_1 + h_2}{w}} \tag{2}$$

The rules and criteria in the evaluation indicators need to be extracted based on the so-called data mining model, where the classification rules are as follows (3) and the weight differences are as follows (4).

$$C = \frac{h}{h_0 + h_1 + h_2} \tag{3}$$

$$d = 1 - \sqrt{\frac{h + h_0 + h_1 + h_2}{w}} \tag{4}$$

Based on the calculated weight difference, the evaluation coefficient m and evaluation error n can be calculated as shown in (5) and (6) below.

$$\mathrm{m} = \frac{P}{C} \tag{5}$$

$$n = P - C \tag{6}$$

Based on these rules, future samples can be predicted. Based on these rules, the effectiveness evaluation model is shown in (7).

$$q = \frac{\left(\frac{p}{m} - 1\right) + n}{\sqrt{\frac{m}{n}}} \tag{7}$$

In model (7), p represents the evaluation index, m the evaluation coefficient, and n the evaluation error. The designed collaborative filtering algorithm has the following advantages: First, the collaborative filtering algorithm has no requirement for the probability distribution of the target to be measured; Secondly, the computational complexity of collaborative filtering algorithm is less than that of ID3 and C4.5, so the efficiency of data mining is higher; Thirdly, collaborative filtering algorithm can realize the processing steps of missing data in calculation; Fourthly, collaborative filtering algorithm can process continuous data, which is the same as C4.5 algorithm, and to some extent, it expands the scope of data collection; Fifth, the structure generated by collaborative filtering algorithm is clearer, more intuitive and easier to find classification rules.

Collaborative filtering algorithm can be used for classification and regression analysis. This article only discusses its use in classification. The Gini coefficient minimization criterion is adopted to seect features and generate binary tree [10]. The problem of this paper is the evaluation of the teaching effect of college students' entrepreneurship. According to the difference of college students' educational investment, the final effect is also different. Through the analysis of questionnaire data, a collaborative filtering algorithm model reflecting the mapping relationship between college students' education level and entrepreneurial effect is obtained. In addition, the input and output variables studied in this paper contain not only discrete data but also continuous data, so ID3 algorithm is eliminated at first. In addition, the collaborative filtering algorithm has higher generation efficiency, is more intuitive and clear, and is convenient for the research and analysis of visual models.

3.1 Forming the Elements of Innovative and Entrepreneurial Teaching Ability of College Students

Innovation and entrepreneurship education has three basic characteristics: innovation, creativity and practicality. Many colleges and universities began to carry out the teaching reform and adopted the method of non-standard answer test for assessment and evaluation. So how to objectively evaluate the students' innovative and entrepreneurial knowledge and ability and the effect after learning courses? It is necessary to subdivide the various factors of innovation and entrepreneurship ability, and adopt a relatively objective analysis method to evaluate them. To evaluate college students' knowledge and ability of innovation and entrepreneurship, we must form a sound evaluation system of innovation and entrepreneurship. It mainly selects indicators from the aspects of evaluating various types of schemes, projects, people's knowledge and ability, etc. Taking a complex multi-objective decision-making problem as a system, the objectives are decomposed into multiple objectives or criteria, and then into several levels of multiple indicators, which are sorted according to their weights.

According to the decision tree and the analysis of the results, we can divide the factors of college students' teaching ability into several types. The first is that the academic degree has obvious influence on the choice of college students' entrepreneurial industry. Education level will affect the entrepreneur's choice of different entrepreneurial projects, and based on the level of education, the preference for entrepreneurial risk is not the same. The entrepreneur of higher education is inclined to the high- tech industry, the entrepreneur of other industries is mainly the technical university, and then is the education and teaching university. Through education entrepreneurs can systematically learn the skills and knowledge needed for entrepreneurship. The higher the degree of education represents the higher the degree of education, the broader the scope of entrepreneurial knowledge and technology, the higher the level of education, the more accurate the professional content of learning, and the more capable of carrying out business management after entrepreneurship. The faster you learn about the new hot spots in entrepreneurial teaching, the better your problem-solving ability will be. However, education is not a decisive factor in promoting college students' self-employment.

The second is the school level. The students' school level also has some difference in the tendency and effect of the students' self-employment. The university is the basic knowledge, the basic skill, the basic quality raise place, is the enterprise ideal formative period. With the growth of students' knowledge and experience, their entrepreneurial consciousness grows and develops, thus forming clear entrepreneurial ideals, enrich their knowledge, skills and other comprehensive qualities, and thus generate the desire to start their own businesses. It is found that the higher the level of schools, the stronger the teaching atmosphere of innovation and entrepreneurship, the more advanced and perfect the teaching equipment, and the richer the organizations and activities of mass organizations.

The third is the school type, which is mainly influenced by the characteristics and environment of the individual. Therefore, the school type environment is also a key factor affecting college students' entrepreneurship. Different types of schools, their innovation and entrepreneurship teaching methods, school atmosphere there are significant differences. The academic atmosphere is very strong, and the students' thinking and understanding are quite profound, but for entrepreneurship, a lot of things can not be put into practice, the school can not learn the theoretical knowledge into practice, the practical ability of individuals to be improved, affecting the results of entrepreneurship. Most of the students will arrange internship courses to connect with the society, cultivate their basic ability, and have rich experience in the industry. At the same time, this type of school will pay more attention to entrepreneurship education training, business simulation competitions, such as operational planning competition, Internet competition. In the schools with strong entrepreneurial atmosphere, students' entrepreneurial tendency and entrepreneurial effect will be deeply affected. Therefore, it is very important to study the entrepreneurial situation of different types of schools.

The fourth is academic achievement. Students' innovation and entrepreneurship teaching effect is significantly related to their basic knowledge. However, students' academic performance is not the only factor that affects the success of entrepreneurship. Generally speaking, those with entrepreneurial qualities are not the best in the current education system. Starting your own business is not about receiving an education. All knowledge has been arranged in the best order by your predecessors. All the students have to do is to absorb it quickly. These fragmented knowledge reserves need to establish a framework to unify them. Students themselves take the initiative to understand and cultivate. Students are not only involved in the learning process, but also connected with the society, and have the ability to communicate, communicate and manage. But also cannot rule out, the person with better result, professional knowledge is more down-to-earth, logical thinking ability is stronger, also be very advantageous to own undertaking.

Next is the double degree, the university student own quality and grasps the skill, is deciding whether it can start a business successfully to a great extent. Not everyone can succeed in starting a business. Only outstanding people can gradually become successful. In this case, college students in the university to learn the knowledge, the level of skills is also an important factor affecting the effect of self-employed college students. One of the important ways to widen the scope of knowledge is to choose the minor of double degree. The students who choose the minor of double degree have less spare time, and most of the time is devoted to the study of knowledge.

Fifthly, the matching degree between the major and the entrepreneurial field is very positive, and most of the students choose the field related to their major to start their own business, and as the manager of the entrepreneurial company, having the corresponding professional knowledge is conducive to the rapid integration of students into the industry, their entrepreneurial path will be smoother, and the success rate will increase accordingly. However, the students' professional knowledge has a limited impact on helping college students to start their own businesses. Some of them are engaged in industries that are not related to their majors. In the process of entrepreneurship, if too much emphasis on their major, they will miss a lot of opportunities, so in this concept, its matching effect on entrepreneurial effect and entrepreneurial trend still need real data research.

Subsequently, with the diversification of social and economic development, a variety of new entrepreneurial projects to a lot of graduates to be employed has brought a broader development platform. For a college graduate with entrepreneurial passion, it is very important to choose a suitable field. Choosing operable and easy-to-use projects and combining with the actual situation will greatly increase the probability of success.

3.2 Evaluation of Teaching Effect of Innovation and Entrepreneurship of College Students

Based on the definition of college level, we can find that the essence of the influence of college level on college students' entrepreneurial ability and entrepreneurial effect is the different requirements of college students' entrepreneurial ability according to their own characteristics of education and teaching. There is no difference between the development of entrepreneurship education and the cultivation of entrepreneurship ability in colleges and universities and the cultivation of students' general ability to a certain extent.

The reality is that different levels of colleges and universities affect students to form different entrepreneurial abilities and entrepreneurial behavior choices. The relationship among entrepreneurial ability, entrepreneurial knowledge and professional ability are mutually transformed and promoted. The cultivation of entrepreneurial ability is a process of internalizing professional skills and knowledge into the entrepreneur himself through school education, and the cultivation and guidance of entrepreneurial knowledge and skills can greatly promote the formation of entrepreneurial ability, which is based on the differences at the university level. It is of great significance for the follow-up research to sort out the differentiated ability training of universities at different levels. The development of entrepreneurial ability of research-oriented universities and teaching-research-oriented universities emphasizes the ability to judge entrepreneurial activities through logic education. Based on the entrepreneur's personal entrepreneurial knowledge, we seek the optimal choice of entrepreneurship. However, in the cultivation of entrepreneurial ability of students in skillful universities, productive practice ability is the most important ability that students in skillful universities need to rely on in the process of starting an undertaking. Therefore, students in the course of starting an undertaking are required to explore based on their own professional practice ability, and entrepreneurs are required to have a clearer understanding of the entrepreneurial opportunities grasped and discovered in the employment activities, so that students can carry out entrepreneurial practice through learning professional ability in the course of starting an undertaking.

Secondly, the entrepreneurial ability based on productive practice ability. The cultivation of entrepreneurial ability and entrepreneurial quality of students in skillful universities comes not only from the teaching of knowledge in class, but also from the productive practice. For the students of skillful universities, ignoring the influence of practical ability on entrepreneurial ability will make entrepreneurial activities become a mere formality, and attract them to integrate the education system of innovation and entrepreneurial ability into the whole process of talent training, so as to improve the quality of education comprehensively and efficiently. Therefore, it is necessary to integrate all entrepreneurial factors to achieve accurate evaluation of entrepreneurial effect.

4 Case Analysis

The entrepreneurial ability is directly proportional to the entrepreneurial teaching effect, and the entrepreneurial effect is the outward manifestation of the innovative teaching ability. In this paper, through the analysis and verification of the entrepreneurial effect of college students, the different characteristics of entrepreneurial ability of research-oriented college students. On the basis of constructing the model of the influence of college level on college students' entrepreneurship, this chapter firstly analyzes the effect of college students' entrepreneurship in research-oriented, teaching-research-oriented and skill-oriented universities by using the data obtained from questionnaires and the CART decision tree language algorithm.

4.1 Overview

Based on the survey data of innovation and entrepreneurship of college students in 2020. The main questions include the student's basic information, study and research, family situation, social relations, entrepreneurial fields and results. In this study, all the samples are divided into three types: research university, teaching and research university and technical university. Therefore, the three types of college recycling samples are almost the same.

Before analyzing the results, this paper makes a brief outline of the orientation and function of running a school for three different levels of colleges and universities, distinguishing them from the training objectives, knowledge structure, professional ability requirements and other aspects, so as to better analyze the data results presented by the decision tree, and facilitate the in-depth study of the relationship between the levels of colleges and universities and the average profit rate of entrepreneurship at different professional education levels as shown in Table 1 below.

Table 1. Profit relationship table

Profit number	Research university	Skilled university	Teaching-oriented university
Under 100,000 yuan	17%	24%	23%
10–500,000 yuan	27%	50%	50%
51–1 million yuan	8%	8%	5%
Over 100,000 yuan	40%	16%	20%
More than 200,000 yuan	8%	2%	2%

Using the data mining method of decision tree, the input index and output index are determined. At the three levels of colleges and universities, the ranking problem of the influence degree of education factors on college students' entrepreneurial effect is mainly solved. And by constructing the decision tree model, it is predicted which entrepreneurial effect three different levels of colleges and universities are more inclined to obtain. At this time, the capital flow table of the three colleges and universities is shown in Table 2 below.

It can be seen from Table 2 that the ranking prediction results of the decision tree model only reflect the order of the influencing factors under certain circumstances, but the analytical power of the degree of influence factors is not detailed enough, that is, the

Table 2. Statement of capital flow

Profit degree	Research university	Skilled university	Teaching-oriented university
Abundant	23%	17%	12%
Safe	53%	62%	65%
Nervous	17%	15%	16%
Risky	6%	7%	7%

degree of influence factors needs further analysis. In order to better compare and analyze the differences of comprehensive entrepreneurial results among research universities, skilled universities and teaching and research universities, this paper will further specifically verify the relevance degree of entrepreneurial input indicators and entrepreneurial output indicators produced by different universities at different class levels by chi-square test method according to actual research data, and play the complementary role of the two research methods, which will be more conducive to improving the conclusion and credibility of decision trees. At this time, the cross-flow table of personnel is shown in Table 3.

Table 3. Cross-flow table of personnel

Profit number	Research university	Skilled university	Teaching-oriented university
Abundant	23%	17%	12%
Safe	53%	62%	65%
Nervous	17%	15%	16%
Risky	6%	7%	7%

According to the data in Table 3, this paper first carries out the correlation and chi-square test between the input indicators and output indicators of college students' entrepreneurship in three levels, and compares the entrepreneurial effects among different levels of colleges and universities. Then, the decision tree algorithm is used to sort the influencing factors of single input and single output, which is conducive to the comprehensive analysis from the overall effect to the sub-effect and draws credible and scientific conclusions. Chi-square test is a commonly used hypothesis test method in statistics. Its main purpose is to study the correlation between two variables, that is, whether there is significant difference between one variable and another. Take the universities of the same level as a whole observation object, and whether the entrepreneurial results of college students are different due to different levels of universities. The role of Chi-square test in this paper is to supplement the lack of decision tree results, that is, decision tree is a single-output feature. Through Chi-square comprehensive test, the two methods can complement each other to further verify the scientificity of decision tree conclusions.

4.2 Application Results

According to the general situation of the above research, this paper analyzes the differences between the evaluation method of innovation and entrepreneurship teaching effect of college students designed in this paper and the traditional evaluation method of innovation and entrepreneurship teaching effect, and compares it with the standard profit. The results are shown in Table 4 below.

Table 4. Application results

Sample number	Actual profit (10,000 yuan)	The evaluation method of innovation and entrepreneurship teaching effect for college students designed in this paper evaluates the profit (10,000 yuan)	The traditional evaluation method of innovation and entrepreneurship teaching for college students evaluates the profit (10,000 yuan)
1	12.65	12.65	12.89
2	25.14	25.15	25.88
3	50.46	50.45	50.16
4	112.64	112.65	110.26
5	49.54	49.55	49.97
6	16.87	16.88	16.21
7	20.17	20.17	20.99
8	16.35	16.33	16.94
9	44.89	44.90	45.21
10	88.47	88.49	89.21

From Table 4, it can be seen that the profit evaluated by the evaluation method of innovation and entrepreneurship teaching effect designed in this paper is more accurate, which proves that the method designed in this paper is accurate and has certain application value.

5 Conclusion

Entrepreneurship education has trained talents for the development of China's socialist market economy. As an important institution for cultivating students' innovative and entrepreneurial abilities, colleges and universities play a significant role in China's innovative and entrepreneurial talent training system. According to their own characteristics and the understanding of entrepreneurial students' own abilities, colleges and universities provide specialized entrepreneurship education for students who are willing to start their own businesses, which ultimately leads to the differentiation and specialization of entrepreneurial abilities of students in different colleges and universities. Therefore, this paper designs an evaluation method of college students' innovation and entrepreneurship effect based on collaborative filtering algorithm, and an example analysis proves that the designed method is accurate and has certain application value.

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Design of Teaching Quality Evaluation System for Law Major Education Based on Fuzzy AHP

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Abstract. Traditional teaching quality evaluation mainly selects qualitative evaluation as the main method, and quantitative evaluation is the supplementary method. The selection of indicators is complicated, and the weight of evaluation indicators is usually set based on experience, which leads to low evaluation accuracy and efficiency of the evaluation system. Aiming at the above problems, a fuzzy AHP-based legal education and teaching quality evaluation system is designed. Design the hardware architecture in which the embedded microprocessor collects the evaluation data of professional education and teaching quality, and the FPGA processes the evaluation data. Use association rules to mine the correlation between factors in the evaluation information, and establish an evaluation index system for the teaching quality of law majors. The AHP method is used to determine the index weight, and the fuzzy theory is used to determine the index membership degree to realize the evaluation of teaching quality. The system test results show that the response time of the designed system is within 2.45 s, the average evaluation accuracy is 90.48%, and the user satisfaction is more than 80%. The evaluation response speed is faster, the efficiency is higher, and the user satisfaction is better.

Keywords: Fuzzy theory · AHP · Law major · Quality of education and teaching · Evaluation system · FPGA · Data mining

1 Introduction

With China's higher education moving from popularization to popularization, the development mode of colleges and universities is gradually changing from scale expansion to connotation development. The improvement of college education and teaching quality has gradually become the focus of the society, the government and even colleges and universities. Teaching evaluation is one of the main methods to guide teaching reform. Teaching quality evaluation can measure and evaluate the teaching process and test whether the teaching work is carried out according to the plan. Through evaluation, we can understand the team structure, quality and work situation of teachers, find out problems in time, find out deficiencies and make targeted adjustments to the team of teachers. Foreign countries use the teaching quality evaluation system to judge effective teaching,

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which provides a reference for China's classroom teaching quality evaluation [1]. As one of the disciplines in higher education, law specialty aims to cultivate high-quality legal professionals to meet the needs of the society for legal services and professionals. Teaching and scientific research constitute the main part of law higher education. Teaching is the main way to achieve the purpose of education, and teaching work is the central work of colleges and universities. Therefore, improving teaching quality is the focus of teaching work in Colleges and universities. In the classroom of legal education, teachers introduce legal texts, describe and evaluate classic cases, interpret the latest legal theories, guide students to measure different legal interests with the support of rich legal theories, and students learn to apply legal theories to real life in class, and use theories to interpret legal texts. In recent years, the development of law education in Colleges and universities has made historic achievements. The comprehensive reform of higher education of law specialty has been promoted in an all-round way. Colleges and universities focus more on talent training, and remarkable results have been achieved in Building Morality and cultivating people. In order to better obtain the effect of law education and teaching, it is necessary to evaluate the quality of law education and teaching. The evaluation based on the law specialty in China is based on the evaluation of the overall law education. At present, there are few law teaching evaluation activities based on the professional background, and the law teaching evaluation system has not been formed. Most colleges and universities give the evaluation based on the law specialty, which involves a wide range of aspects and the evaluation is relatively general [2]. Literature [3] studies the teaching quality evaluation system using the deep learning algorithm, but the system has limitations when applied to the evaluation of law specialty due to the problems in the selection of indicators and the differences between the education and teaching of law specialty and other specialties. Although the evaluation system based on analytic hierarchy process can build the evaluation index system, the professionalism of index selection is insufficient, and the weight given to the index is inconsistent with the actual situation, resulting in large evaluation error of the evaluation system.

The fuzzy comprehensive teaching quality evaluation system can save data for a long time, share information resources, diversify the evaluation purposes, avoid the inconsistency between the evaluation results and the actual situation caused by the diversity and fuzziness of teaching quality indicators, and realize the fair, open and fair evaluation of teachers' teaching quality [4]. According to the above analysis, this paper will design a law education and teaching quality evaluation system based on Fuzzy AHP. The hardware part of the system takes FPGA as the core, designs the evaluation data processing acceleration platform, collects the professional education and teaching quality evaluation data information by the embedded microprocessor, establishes the law professional teaching quality evaluation index system on the basis of mining the law professional education and teaching quality evaluation data, obtains the evaluation indicators, uses the AHP method to calculate the index weight, and determines the index membership by the fuzzy theory to complete the teaching quality evaluation. The purpose of this paper is to make use of the feedback and incentive functions of the evaluation to improve the role of law classroom teaching, provide materials and information for the communication and exchange of teachers in law schools, and promote the unified development of law education.

2 The Hardware Design of the Evaluation System for the Quality of Legal Education and Teaching Based on Fuzzy AHP

The system designed in this paper is mainly used to collect information on the teaching content, process, and feedback behavior of the law major education, and form the information index parameters, and finally obtain the evaluation result of the law major. The hardware part of the system takes FPGA as the core, and designs an evaluation data processing acceleration platform, and an embedded microprocessor collects professional education and teaching quality evaluation data information. Figure 1 below is a schematic diagram of the hardware part of the overall framework of the fuzzy AHP-based legal education and teaching quality evaluation system designed in this paper [5].

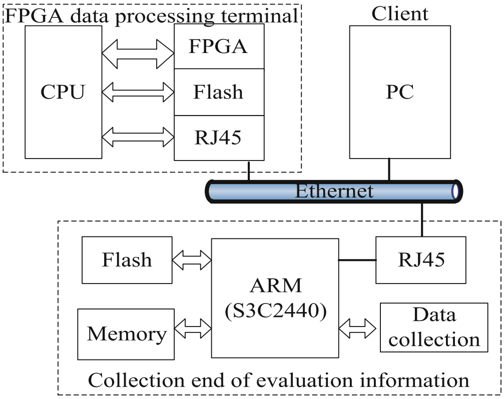


Fig. 1. Schematic diagram of the overall framework of the hardware part of the education and teaching quality evaluation system

The FPGA accelerated processing data end adopts a hardware platform with a CPU + FPGA architecture, and seamlessly connects the CPU and FPGA through PCIe bus and QPI protocol, so that FPGA can obtain a higher bandwidth and lower latency data path, which makes the FPGA more compact Ground provides acceleration for the CPU. The CPU uses the Intel Xeon processor, and the FPGA part uses a programmable accelerator card equipped with Arria 10 GX FPGA chips. The CPU and the accelerator card are seamlessly connected through the PCIe interface and QPI protocol. The core module of the micro system is composed of a 32-bit embedded microprocessor S3C2440A based on ARM9, SDRAM, NandFlash and a bus interface. Two pieces of 32 MB HY57V561620 constitute a 64 MB SDRAM memory, which is mainly used to run and store the main program of the system [6]. The storage capacity of Nand FlaLshK9F1208UOM is 64 MB $\times$ 8B . Because it has the function of power failure protection, it is mainly used to store the kernel of the operating system and the startup code of BootLoader and user applications. FPGA chip downloads the debugging program through JTAG interface, carries on the chip debugging processing.

Each part of the hardware communicates via Ethernet and multi-function communication interface component FC-AE-1553. The legal education and teaching quality evaluation system designed in this paper needs to collect evaluation data from different sources, so many communication interfaces are designed. The protocol data of these communication interfaces needs to be mapped to each node through the reflective memory network. In order to reduce the number of links from protocol data to the computer system, software encoding and decoding, and from the computer system to the reflective memory card, the process overhead is reduced and the efficiency of data transmission in the system is improved. This system uses a two-layer structure for high-speed information transmission for data transmission. The information transmission is divided into an interactive mapping layer and a network exchange layer in a layered manner. The interactive mapping layer realizes the 1553B, RS422, RS485, CAN interface and PXI-E interface with the external acquisition equipment to realize the information interaction between the processing end and the client; the network exchange layer realizes the data communication based on the reflective memory network. This architecture forms a complete structure that integrates multiple communication methods, and realizes the direct mapping of 1553B, RS422, RS485, CAN and other interface protocol data to reflective memory network data, which improves the efficiency of information transmission based on reflective memory. Each node can be connected to multiple types of data collection devices, or each node can be connected to one type of collection device to form a distributed structure.

In order to realize the function of evaluating the teaching quality of law education, the fuzzy AHP theory is used to evaluate the teaching quality of law education, and the software function part design is completed on the basis of the above-mentioned hardware design.

3 Design of the Software Part of the Evaluation System for the Teaching Quality of Legal Education Based on Fuzzy AHP

3.1 Data Mining for the Evaluation of Teaching Quality of Legal Education

The teaching process of law major is complex, and the data collected by the teaching quality evaluation system contains a large amount of information. Using data mining technology can accurately obtain useful data from a large amount of information, so as to improve the accuracy of evaluation. Educational data mining is divided into two dimensions: technical means and business types, and each dimension can be divided into several data types. According to the differences of technical means in educational activities: it is divided into traditional education data and distance education data; According to the different business activities in educational institutions, it is divided into teaching data, management data and scientific research data. When data mining is applied to the basic activities of educational institutions, namely teaching, management and scientific research, the needs and activities of data mining are different due to the differences of business processes and objects of concern.

By mining association rules, we can find the influencing factors that can effectively explain that the teaching quality is excellent, and get the association rules that can effectively explain that the evaluation results of teaching quality are excellent, so as to provide a strong scientific basis for school leaders and managers to reform the teaching quality. In this paper, Apriori algorithm based on association rules is used to mine the education and teaching information of law specialty [7].

Only by realizing frequent pattern mining first, can it be possible to realize association rule mining. When evaluating the quality of legal education and teaching, it is assumed that all factors that affect the quality of legal education and teaching constitute a project set $YI = \{yi_1, yi_2, \cdots, yi_k\}$, the data corresponding to the influencing factors constitute set $D_s = \left\{s_1, s_2, \cdots, s_q\right\}$, and each transaction data s_i corresponds to a subset of YI.

Let the support S of item set $YI_1 \subseteq YI$ on data set D_s be the percentage of transaction data containing YI_1 in D_s, namely

$$S(YI_1) = \frac{\|s_i \in D_s | YI_1 \subseteq YI\|}{\|D_s\|} \tag{1}$$

In the formula, $\|\ \|$ represents the number of elements in the set. For item set YI, all item sets that meet the minimum support specified by the user in transaction database D_s, that is, the non-empty subset of YI that is not less than the minimum support, are called frequent itemsets. Association rules are defined by satisfying a certain degree of credibility, trust, or confidence. The so-called credibility of the rule refers to the ratio of the number of transactions containing YI_1 and YI_2 to the number of transactions containing YI_1, namely [8]

$$C[YI_1 \Rightarrow YI_2] = \frac{S(YI_1 \cup YI_2)}{S(YI_1)} \tag{2}$$

When the Apriori algorithm performs data mining, it adopts an iterative search method from bottom to top, the former set Q will be used in the latter set $Q + 1$. The first step is to scan the database, calculate the specific number of each item, filter out items less than the minimum support, and then get the frequent 1-item set, and treat it as F_1; next, use F_1 Based on this, locate the set F_2 corresponding to frequent 2 itemsets, and use F_2 as the basis to locate the set F_3 corresponding to frequent 3 itemsets, repeating it continuously, and finally can not find the F_Q of frequent Q itemsets. Figure 2 below is the flow chart of Apriori algorithm using association rules to mine teaching quality evaluation information.

Based on the mining results of the above algorithm, the influencing factors affecting the evaluation of law education and teaching quality and the correlation degree between the factors are determined. According to the mining results of the above association mining algorithm and the relevant principle of analytic hierarchy process, the evaluation index system of law education and teaching quality is established.

3.2 Establish an Evaluation Index System for the Quality of Legal Education and Teaching

The purpose of teaching quality evaluation of law specialty education is to promote the construction, reform and management of law specialty through evaluation. At present, the subjects of education and teaching evaluation in Colleges and universities can be divided into four categories: first, students who directly participate in teaching activities

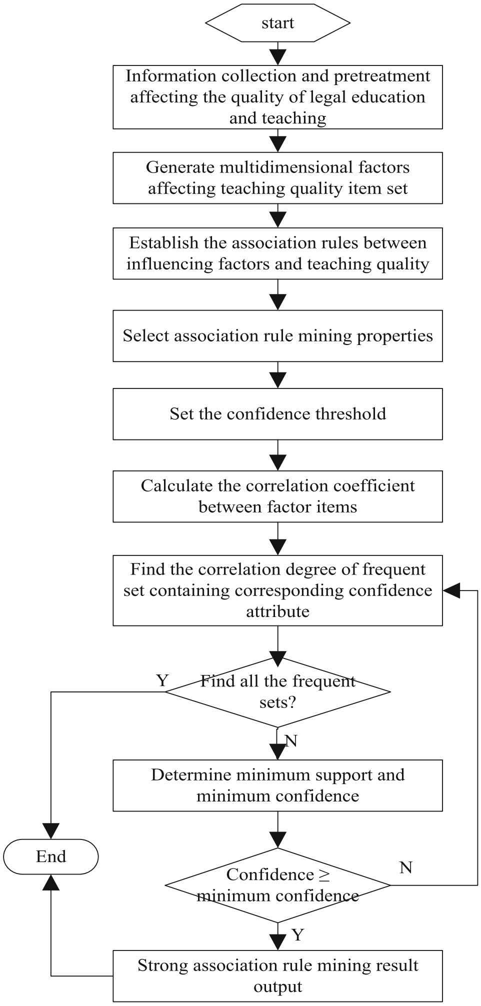


Fig. 2. Flow chart of teaching quality evaluation information mining

(student evaluation); Second, as one of the subjects of classroom teaching, peers and pedagogical experts or experts in fields related to classroom teaching content (experts, peer evaluation); Third, the superior competent department carries out evaluation (superior evaluation); Fourth, the teachers who participate in teaching activities (teacher self-evaluation). In order to comprehensively evaluate the education and teaching quality of law specialty, this paper establishes the evaluation index system of education and teaching quality of law specialty from the evaluation perspective of the above four evaluation subjects, focusing on student evaluation [9].

Teachers and students are the basic elements of teaching activities. Under the guidance of teaching objectives, teachers and students conduct communication activities through intermediary media, which is the teaching content. The presentation of teaching content is that teachers present the teaching content to students stably and scientifically with their own teaching wisdom, so that students can experience and construct knowledge and skills in the classroom atmosphere. Too wide or too narrow division of teaching elements is easy to make teaching evaluation in trouble. Therefore, the author divides the teaching system into teaching objectives, teaching content, teaching art and teaching effect. The activities of students and teachers are based on the above contents. According to the analysis of the above classroom teaching elements, the evaluation indicators include indicators related to teaching objectives, indicators related to students' factors, indicators related to teachers' factors, indicators related to teaching contents, and indicators related to teaching methods and management.

The following Table 1 is the evaluation index system of law education and teaching quality established in this paper. All evaluation indexes in the table are selected from the perspective of students as the evaluation subject.

After the establishment of the evaluation index system for the education and teaching quality of law major as shown in Table 1 above, we can obtain the evaluation indexes for the education and teaching quality of law major, such as the correctness and standardization of the teaching content, the conformity of the educational purpose with the legal education objectives and the requirements of the national syllabus, and the diversity of teaching means. The weights of each index in Table 1 are determined by using the fuzzy AHP theory to evaluate the teaching quality of law education.

3.3 Fuzzy AHP Evaluates the Quality of Education and Teaching of Law Majors

According to the evaluation index system established above, firstly, the factors in the factor concentration are compared in pairs, and the importance of the comparison results is expressed by the 9-level scale method 1, 2, 3,..., 8, 9. By comparing each evaluation factor, a paired comparison matrix is constructed, and the interpretation matrix J is shown below.

$$J = \begin{bmatrix} j_{11} & j_{12} & \cdots & j_{1n} \\ j_{21} & j_{22} & \cdots & j_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ j_{n1} & j_{n2} & \cdots & j_{nn} \end{bmatrix} \tag{3}$$

In the above judgment matrix, j_{pq} represents the importance of evaluation factor J_p relative to J_q, and the value of the relative importance of each element in each criterion layer is determined by the expert evaluation team.

According to the proportion of various teaching quality evaluation factors in the whole, experts compare each factor in the same criterion layer and each criterion layer belonging to the same teaching quality evaluation, and then determine it according to the scale of the relative importance value table [10].

Take the average of each row vector of the judgment matrix J, assume that the average vector $\overline{V} = [\overline{v}_1, \overline{v}_2, \cdots, \overline{v}_n]$ is obtained, and then standardize it according to

Table 1. The evaluation index system of legal education and teaching quality

Evaluation elements	First level indicator	Secondary indicators
Teaching objectives	Teaching	Correctness and standardization of teaching content
		Educational objectives meet the requirements of legal education objectives and national syllabus
	Technical	Diverse teaching methods
		Use a variety of teaching techniques
		Interactivity of instructional technology
Teaching content	Theoretical ability	Professor's legal content professional, science
		Teaching legal knowledge is correct, systematic and coherent
		The key issues of law are prominent, and the difficult issues are broken through, reflecting the cutting-edge knowledge and latest achievements of law
		Shows the basic situation of other disciplines related to this discipline and the relationship between them
	Practical ability	Can stimulate students' interest, mobilize their initiative and enthusiasm
		Effectively control the teaching process and allocate teaching time rationally
		Skilled use of teaching equipment
Teaching art	Teaching methods	Pay attention to cultivating students' basic knowledge of law, forming legal thinking, and exercising legal skills
		Pay attention to the cultivation of students' professional temperament and professional ethics
		Starting from the foundation of students, comprehensively use analysis, comparison, induction, and reasoning to form correct legal concepts
		When teaching, pay attention to the cultivation of legal thinking and legal methods, and guide students to solve problems in the way of legal persons

(*continued*)

Table 1. (*continued*)

Evaluation elements	First level indicator	Secondary indicators
	Teaching process	Timely feedback, proper regulation and strong adaptability
		Reflect the leading role of teachers and the main role of students in the teaching process
		Teaching is holistic and procedural
Student learning effect	Teaching effect	Good interaction between teachers and students
		Correctly understand and master the content and basic structure of the course
		Can develop students' ability to analyze and solve problems
		Can use legal concepts and norms to solve practical problems
		Master the legal concepts, norms and principles taught by the teacher

the following formula.

$$\hat{V}_i = \frac{\overline{v}_i}{\sum_{j=1}^{n} \overline{V}_j} \tag{4}$$

After the average vector of the judgment matrix is standardized, the eigenvector of the matrix is solved according to the principle of linear algebra. The eigenvector solution is the importance ranking of each teaching quality evaluation factor in its corresponding level, that is, the weight value of each education and teaching quality evaluation factor in its corresponding level.

On the basis of determining the factors in the teaching quality evaluation factor criterion layer and using the AHP method to obtain the weight value of the teaching quality evaluation factors in each criterion layer, the fuzzy comprehensive evaluation method is used to determine the fuzzy membership relationship of each factor corresponding to each weight coefficient.. Under the same evaluation standard, the evaluation object can be divided into d and denoted as $P = \{p_1, p_2, \cdots, p_d\}$. According to the usual experience of classifying teachers' teaching quality levels, the value of d is determined to be 5, and the evaluation level set can be recorded as V = {very good, good, fair, poor, poor}, and the corresponding scores are 100, 80, 60, 40, 20. In the hierarchical teaching quality evaluation factor set, the number of experts with the same level of one of the factors is selected and added, and the result is divided by the total number of experts participating in the evaluation, and it can be concluded that the affiliation of each factor in the sub-criteria level is the affiliation of each level In this way, the fuzzy relationship matrix of the evaluation matrix between each factor and each level in the sub-criteria layer can be formed.

$$R_t = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{15} \\ r_{21} & r_{22} & \cdots & r_{25} \\ \vdots & \vdots & \ddots & \vdots \\ r_{nt1} & r_{nt2} & \cdots & r_{nt5} \end{bmatrix} \tag{5}$$

For the evaluation index, the fuzzy calculation is performed on the weight value calculated by the fuzzy relationship matrix R and the largest eigenvector, and the result membership vector L is obtained, which represents the membership relationship of the evaluation factor set at all levels relative to the teaching quality evaluation level set P. According to the maximum subordination principle of fuzzy comprehensive teaching quality evaluation, the teaching quality evaluation grade is the grade corresponding to the largest component in the evaluation set in the evaluation grade set. So far, the construction of the fuzzy AHP-based legal education and teaching quality evaluation system has been completed. The system realizes teaching feedback, helps teachers improve teaching, and also builds a bridge for communication between law teachers.

4 System Experiment

In the above, the education and teaching quality evaluation system of law specialty based on Fuzzy AHP is designed. In this section, the performance of the system will be tested.

4.1 Experiment Content

The teaching quality evaluation system designed in this paper is compared with the evaluation system based on deep learning algorithm, and the law major of a university is selected to test the performance of the system. The two systems are used to evaluate the professional teaching quality. The performance of the system is measured by comparing the processing response speed of the system processing different input data and the evaluation accuracy of the system under different input information conditions. This paper selects the data in the education and teaching database of law major as the experimental sample, including 6 training sets and 1 test set. The sample data set information is shown in Table 2:

4.2 Experimental Results

Table 3 below shows the comparison between the system's evaluation response speed and evaluation accuracy when the system evaluates the quality of education and teaching of the target.

It can be seen from Table 3 that the response time of the system in this paper is within 2.45 s, that of the evaluation system based on deep learning is within 3.41 s, and that of the evaluation system based on analytic hierarchy process is within 4.85 s. The response time of this system is less than that of the evaluation system based on deep learning and the evaluation system based on analytic hierarchy process, that is, the evaluation

Table 2. Experimental data set information

Data set	Data scale	Number of attributes	Number of categories
Learning interest	101	17	7
Experience	138	29	2
Course categories	124	6	2
Course difficulty	169	6	2
Curriculum bias	300	16	2
Study time	490	15	2
Degree of satisfaction	683	35	19

Table 3. Comparison of response time and accuracy of system evaluation

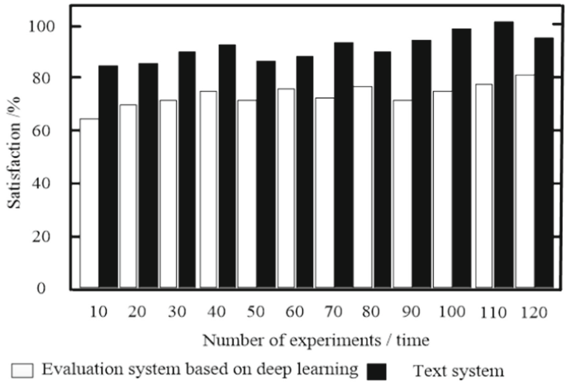
Numbering	Text system		Evaluation system based on deep learning		Evaluation system based on Analytic Hierarchy Process	
	Response time/s	Accuracy/%	Response time/s	Accuracy/%	Response time/s	Accuracy/%
20	1.78	87.6	2.34	79.9	3.52	66.2
40	1.63	89.5	2.95	78.8	3.66	66.8
60	2.45	92.1	3.41	82.7	4.02	67.0
80	1.86	89.8	2.77	84.1	4.32	67.9
100	1.97	93.4	3.16	84.6	4.85	68.4

response speed of this system is faster. The average evaluation accuracy of this system is 90.48%, and the average evaluation accuracy of the evaluation system based on deep learning is 82.02%, which is at least 8.5% points higher than the average evaluation accuracy of this system.

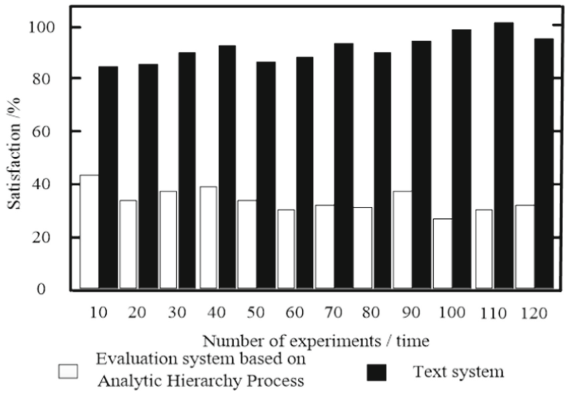
In order to further verify the effectiveness of this system, the user satisfaction of this system and the comparison system are compared and analyzed. The comparison results are shown in Fig. 3.

As can be seen from Fig. 3, the user satisfaction of the system is more than 80%, while that of the evaluation system based on analytic hierarchy process is more than 30%, and that of the evaluation system based on deep learning is more than 60%. The user satisfaction of the system is higher than that of the control system.

It can be seen from the above analysis that in the process of practical law education and teaching, the application of the law education and teaching quality evaluation system based on Fuzzy AHP designed in this paper can obtain reliable evaluation results more accurately. Compared with the traditional teaching quality evaluation system, it can provide guidance for guiding the teaching reform of law specialty.



(a) The comparison results between this system and the evaluation system based on deep learning



(b) The comparison results between this system and the evaluation system based on Analytic Hierarchy Process

Fig. 3. Comparison results of user satisfaction of three systems

5 Conclusion

Higher education is an important indicator of the country's development level and development potential. Nowadays, the country's need for higher education, scientific knowledge and outstanding talents is more urgent than ever. Legal education bears the responsibility of cultivating high-quality legal professionals with ideals, capabilities, and responsibilities. Therefore, the quality of legal education and teaching will directly affect the quality of legal students.

This paper designs the evaluation system of law education and teaching quality based on Fuzzy AHP, designs the hardware and software of the system through FPGA accelerated processing data terminal, Intel Xeon processor and FPGA chip, constructs the evaluation index system of law education and teaching quality, and uses the fuzzy

AHP theory to evaluate the law education and teaching quality. To scientifically feed back, guide and motivate the teaching work, so as to improve the teaching quality.

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Assessment and Evaluation System of Preschool Education Curriculum Based on Big Data

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Abstract. The current pre-school education curriculum assessment and evaluation system is easily affected by other factors in the implementation process, resulting in poor evaluation results and affecting the evaluation efficiency. Therefore, this paper proposes a pre-school education curriculum assessment and evaluation system based on big data, optimizes the pre-school education curriculum objective system structure, constructs a pre-school education curriculum assessment and evaluation algorithm in combination with big data technology, constructs a standardized pre-school education curriculum management system, supervision and evaluation system, and verifies through experiments that the pre-school education curriculum assessment and evaluation system based on big data has high practical value and fully meets the research requirements.

Keywords: Big data · Preschool education · Assessment and evaluation · Evaluation system

1 Introduction

The balanced development of preschool education refers to the policy and legal system in which preschool education institutions and school-age children enjoy the same rights and obligations according to law. Its most basic connotation refers to the equal enjoyment of educational resources between preschool education institutions and educatees, access to fair educational opportunities, and achieve the relative balance between educational demand and educational supply. Curriculum contains profound educational wisdom and professional skills, which is the basic way to achieve educational objectives [1]. At present, the most common confusion in the implementation of preschool curriculum in China is that we don't know how to find the problems existing in the curriculum, or feel that there are problems but can't judge the root of the problems. Because practitioners are limited by the real environment, lack of theoretical intuition and few targeted curriculum evaluation tools, these factors greatly restrict the continuous improvement of preschool curriculum. Therefore, preschool students have the strongest demand for curriculum diagnosis and improvement [2]. From the perspective of educational evaluation, drawing on the existing achievements of multiple disciplines, this paper makes a

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research on the combination of reality and necessity of today's Chinese preschool curriculum, and constructs a diagnostic evaluation system for curriculum improvement, in order to provide diagnostic paths and solutions and improve curriculum quality, Based on the existing curriculum evaluation model, this paper attempts to put forward the local diagnostic evaluation model of preschool curriculum [3]. The existing curriculum evaluation system integrates pre-school curriculum objectives, curriculum design, curriculum resources and curriculum outcome evaluation, and helps pre-school students enhance the rationality of curriculum planning and implementation. However, in the actual implementation process, it is easy to be affected by other factors, which will reduce the evaluation efficiency and affect the teaching quality. In order to solve this problem, this paper proposes a pre-school education curriculum assessment and evaluation system based on big data in order to improve the quality of pre-school education.

2 Pre-school Education Curriculum Assessment System

2.1 Optimization of the Target System Structure of Preschool Education Curriculum

The curriculum objective of preschool education can be used as the standard of curriculum evaluation. Other elements of the curriculum are connected with the curriculum objective and become an organic whole. We need to rely on big data technology to obtain the objectives of preschool education courses and convert the objectives into specific content, that is, qualitative decomposition and quantitative provisions. If it is for the purpose of identification, it focuses on the stipulation of quantity. For the purpose of diagnosing problems, it can mainly focus on the decomposition of quality and weaken the stipulation of quantity. Of course, the two evaluation purposes can also pay equal attention to the stipulation of "quality" and "quantity" [4]. It can be seen that the target system is a systematic and closely related index group formed by the combination of individual indicators. It is a specific, measurable and behavioral criterion reflecting the essential attributes of things. It is an important guiding tool for the implementation of things. Therefore, the logical structure of the target value system, which can also be called "value index system", can be divided into three parts. The functional objectives, efficiency objectives and performance objectives are shown in the figure below (Fig. 1):

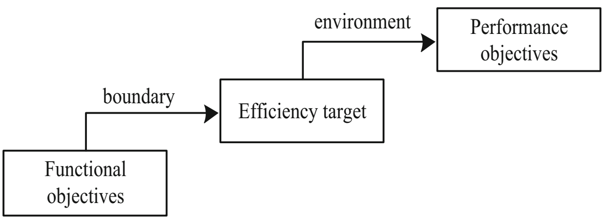

Fig. 1. The logical structure of the preschool education goal value system

In the pre-school education goal system, the functional goal is the value judgment of the entire pre-school education, reflecting the comprehensive requirements of the external environment for pre-school education, and belongs to the overall function. The realization of the functional goal is to penetrate the boundary and enter the preschool education system in the form of instruction information [5]. The instruction information is for execution, and it will be meaningless if it is only used for display. It is planned to use curriculum big data to diagnose the problems existing in the preschool curriculum and ways to improve it to improve the quality of preschool education. The big data diagnosis model can provide a self-evaluation reference model for preschool, with the help of this model to diagnose various system factors, processes and results, and finally improve the course [6]. The application of the results of this research in the improvement of pre-school curriculum can be shown in the following figure (Fig. 2):

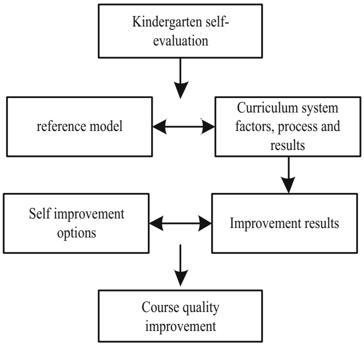

Fig. 2. The self-evaluation process of pre-school education courses

The big data model of preschool courses constructed is not intended to evaluate all preschool courses with a universal evaluation model, but to provide a reference model, just like a mirror. At the same time, the reference model is also a tool or means. Its purpose is to help preschool students find problems in the process of curriculum diagnosis, improve problems according to technical guidelines, and make the curriculum more suitable for their own reality [7]. This process is not "optimal" as the value orientation, but "optimal" as the value orientation, that is, the ultimate pursuit is suitable for children, teachers and local reality. The criterion for quality improvement proposed here is whether the improvement is more suitable for their preschool reality than before, whether it makes the children in the kindergarten happier, teachers more comfortable, parents more assured and the community more satisfied [8]. Therefore, the realization of functional objectives requires certain means for support. In other words, there should be corresponding structures and processes to prepare for the realization of functions. For the practice of preschool education, it is important to design the target value system of preschool education. According to the logical structure of the goal value system, the goal system of preschool education should include three parts as shown in the figure below (Fig. 3).

It can be seen from the figure that the goal of preschool education needs to be realized by corresponding educational institution system. Many subsystems and their operations in preschool are to prepare for the realization of the national goal of preschool education. National preschool education goals and preschool education goals limit the

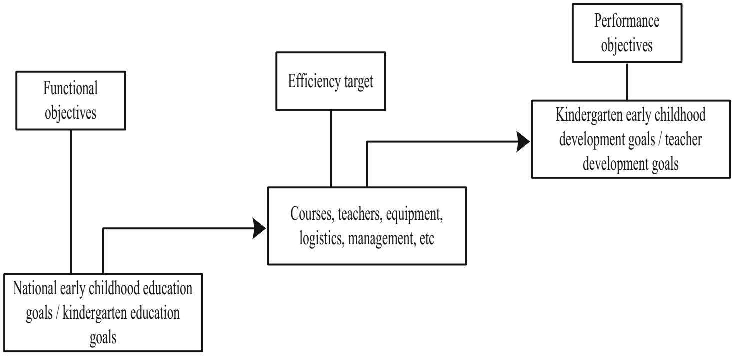

Fig. 3. Early childhood education goal value system

possible choice of preschool structure and process, and once the structure of preschool system is determined and operated, it will in turn affect the realization of educational function [9]. In the creation stage of man-made things, the choice of function determines the conception of structure. Once the structure is formed, begins to operate and enters the working state, the structure has decisive significance for the realization of function. Therefore, for man-made things, the realization of function depends not only on the choice of function, but also on whether the requirements of function can be transformed into structure.

2.2 Pre-school Education Curriculum Evaluation Algorithm

The value orientation of the pre-school curriculum is manifested in the value orientation of each element of the pre-school curriculum, but the focus is manifested as a tendency held when choosing the curriculum goal. The value of preschool education curriculum is a reflection of a specific (positive or negative) relationship between the object curriculum and the subject's needs. If the preschool education curriculum can meet the needs of a certain society and certain students, then this kind of curriculum has value; otherwise, it has no value [10]. The value orientation of preschool curriculum stipulates what problems should be solved before school and where students will develop. The value structure of the preschool curriculum mainly has two levels. Different choices are made at different levels, that is, the basic value orientation is formed (Table 1).

The research on the model of preschool education curriculum evaluation provides people with a general outline of how to implement a specific evaluation. Based on this, this paper analyzes these evaluation models in order to find a model that can be used for reference. When combing the development context of curriculum evaluation theory and model, it can be seen that many curriculum evaluation models emerged after the target model of big data, some inherited, developed and improved Taylor model, and some criticized Taylor's target model to form a new curriculum evaluation model. No matter from which angle, it is inevitably influenced by Taylor model. This paper makes a rough classification, that is, target based evaluation model and other evaluation models. The so-called goal based evaluation refers to the evaluation centered on educational objectives and curriculum program objectives. Other evaluations are those other than the "objective

Table 1. Value structure of kindergarten curriculum

Name	Relationship	
Value structure of preschool curriculum	Relationship between curriculum and other systems	The value relationship between kindergarten curriculum and society
		The value relationship between kindergarten curriculum and individual development
	System between curriculum and internal subsystems	teacher
		student

based evaluation model". The following table illustrates the basic differences between the two types of evaluation (Table 2).

Table 2. Target-based evaluation mode and other evaluation modes in course evaluation

Pattern classification	Objective based evaluation model	Other evaluation models
Mode characteristics	Centered on educational objectives and curriculum program objectives	Weaken the importance of objectives, put forward multiple evaluation dimensions, and respond to the needs of multiple values
Representative mode	Taylor model, CIPP model, CSE evaluation model	Scrivin's target dissociation model, Stark's response model, Eisner's educational appreciation and educational criticism model
Basic procedure	Behavior goal - curriculum implementation process - Evaluation Based on behavior goal	Overall goal - creative curriculum activity process - judgment and evaluation against general goals
Evaluation method	Objective based evaluation - overall evaluation framework - psychometric test - sampling method	Objective powerful evaluation - multiple interpretation perspectives - common sense description - case method

Preschool education measurement usually causes some reactions of students through examinations or tests, and then evaluates these reactions through quantitative or qualitative descriptions. These descriptions are the results of education measurement. The measuring tool of educational measurement is called scale, which is commonly used. The theoretical basis of classical test theory is true score theory. The so-called true score is the expected value of the actual score of the test, which is expressed by the following formula:

$$T = E(X) - \overline{x} + x_n \sum_{i=1}^{n} a_i + \frac{1}{n} \sum \overline{x} \tag{1}$$

In the formula, $E(X)$ is the actual score in the test, $\overline{x}$ is the teaching expectation, and x_n is the true score. Due to the existence of measurement errors, the true score a_i cannot be directly measured, and the average score V of multiple tests is usually used as the estimated value of the true score. The measured score is the actual score x_{ij} obtained in a test. It includes two parts: the effective score $\overline{x}_i$ and the measurement error $\overline{x}_j$. The measurement error is composed of two parts: the system error and the random error. Therefore, the measured score S_j and the effective score (Q), the relationship between random error (W) and systematic error (λ).

$$X = W \sum V + Q \frac{\left| x_{ij} - \overline{x}_i - \overline{x}_j \right|}{S_j - T} - \lambda \tag{2}$$

In the formula, the effective score a_n and the system error x_n usually appear steadily, and the sum of the two is called the true score and recorded as I. From this, the formula.

$$T = V + \frac{a_1 x_1 + a_2 x_2 + \ldots a_n x_n}{X - I} \tag{3}$$

Random error ϖ is caused by accidental factors. There is no obvious regularity in the magnitude and sign of a single random error k. As a result, the measured score s will fluctuate within a certain range, but it conforms to the statistical law as a whole. Therefore, the classic measurement theory It is the process of getting the estimation of the true score by removing the accidental factors of measurement by some method. There are many methods for calculating reliability, and the commonly used ones include test-retest reliability, homogeneity reliability, and rater reliability. One of the most commonly used is homogeneity reliability, also called internal consistency coefficient, which refers to the same degree of content measured in an exam. Reliability calculation methods include half method, Coulomb method, Korotkoff formula, etc., this system uses Korotkoff formula to calculate the reliability, see the following formula.

$$\mathrm{R} = \varpi \frac{k}{\lambda - 1} \left(1 - e \frac{\sum_{i=1}^{n} s_i^2}{s^2 - \eta} \right) - T \zeta \sum_{i=1}^{n} L(x_i - \overline{x})^2 \tag{4}$$

In the formula, R is the reliability of an exam, ζ is the reliability coefficient of the exam, η is the number of exam questions in the exam, S is the variance of each test question score, e is the variance reliability coefficient of the total teaching score The value range of L is between 0–1, the closer to 1, the more realistic the score is. The evaluation criteria for the value of the reliability coefficient are shown in the table (Table 3):

Table 3. Evaluation criteria for the value of the whole reliability coefficient

Reliability coefficient	Evaluation criterion
0–0.7	Low credibility
0.7–0.9	Moderate credibility
0.9–1	High reliability

Further use the pass rate or average score rate to calculate the teaching difficulty. The greater the difficulty value, the more students who can correctly answer the question, which means that the question is easier. The extreme grouping method is usually used to calculate the difficulty value, and the difficulty of the whole teaching process is obtained according to the weighted average of the difficulty of each test question, as shown in the following formula.

$$U = R * \frac{x_n}{m} - Y \sum_{i=1}^{n} \left(p_i * \frac{X - 1}{TX - m} \right) \tag{5}$$

In the formula, m is the difficulty of teaching, Y is the difficulty of each test question in teaching, p_i is the total score of each test question, which can also be regarded as weight, and μ is the total teaching score. Generally speaking, test questions with a high degree of discrimination can distinguish high-level subjects from low-level subjects. Therefore, the value y of such test questions is great. The correlation method is usually used to calculate the degree of discrimination. The specific formula is as follows:

$$G = r_n = \frac{U \sum_{i-1}^{k} v \sum_{p \in C_i} |\mu - m_i|^2}{\sqrt{\sum (x - \overline{x})^2 \sum (y - \overline{y})^2}} \tag{6}$$

In the formula, $\overline{x}$ is the score of the test question, $\overline{y}$ is the corresponding student's score, and v is the total number of students. The calculation is performed between students (high grouping) and students with scores in the last 27% (low grouping), which is called the two-end method, and the calculation formula is:

$$D = Gp_H \sqrt{\frac{1}{n} \sum_{i=1}^{n} (x_i - \overline{x})^2 - p_L \frac{\overline{X}_H}{a} - \frac{\overline{X}_L}{a}} \tag{7}$$

In the formula, p_H is the degree of discrimination of the question, p_L and G represent the ratio of the number of people answering the question in the high and low groups respectively, $\overline{X}_H$ and $\overline{X}_L$ represent the average scores of the high and low groups on the question, and a is the full score.. The development of children from basically relying on teachers to learn independently is a gradual and staged process. The process is neither carried out in isolation nor happens naturally. Behind it is another process of echoing each other. This is the process of teachers from focusing on teaching to focusing on learning. The transformation of children's learning methods is inseparable from the transformation of teaching methods, and the development of learning ability is inseparable from the development of teaching ability. In the teaching process, teachers and students are constantly developing and improving, but some teachers are aware of it, some are not aware of it, some are conscious, and some are unconscious. Teachers, students, and courses are the three basic elements in the teaching process. Only when teachers skillfully and appropriately handle the relationship between these three can they freely transfer their attention from one element to another according to the needs of teaching, and ensure the harmonious development of the teaching process.. However, the harmonious relationship of the three elements of teaching is not so easy to form as usually imagined. Needless to say, young teachers cannot achieve this step at the beginning, and not all older teachers can achieve this step. Teachers need to master superb teaching skills and deal with the relationship between students, subjects and self proficiently and appropriately. Generally, they need to go through three major stages and five small stages. As shown (Fig. 4):

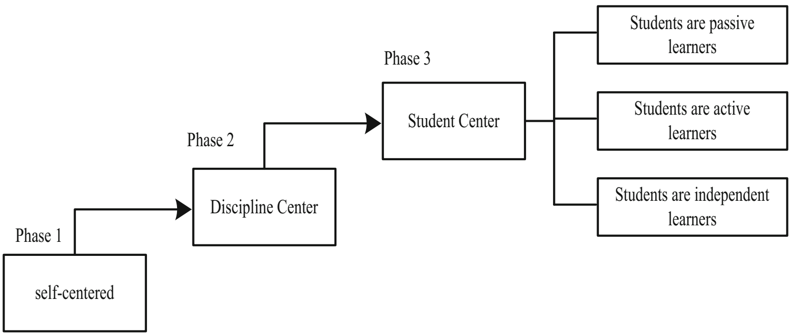

Fig. 4. The development model of pre-school education teacher training

This teacher development model must be the path of all teachers' development. Some teachers may stay at a certain stage and delay their development, while some teachers may develop by leaps and bounds, but it is likely to be the general path of most teachers' development. This model can explain the development process of young teachers' teaching ability, and to a certain extent, it can explain the development process of teachers implementing a new curriculum.

2.3 Realization of Pre-school Education Curriculum Assessment and Evaluation

There are many similarities between the process of curriculum diagnosis and the process of curriculum quality management. From the perspective of management and control, appropriate reference to the quality management concept of enterprise management is helpful to establish the curriculum quality assurance system. The assessment can be conducted during the student's internship. For some students who lack the sense of time when dealing with young children, remind them to be more patient and try to consider problems from the perspective of others. During the assessment, some scenarios can be set to assess and evaluate the students, or in the process of internship, assess and evaluate the students' usual performance. The purpose of assessment and evaluation is to make students better and better and gradually meet the talent standards required by their careers. For example, the assessment of students' ideological understanding and moral behavior can be evaluated with reference to the following table (Table 4):

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Table 4. Pre-school curriculum teaching evaluation indicators

Primary index	Secondary index	Evaluation content	Evaluation object	Evaluation method	Evaluator	Score
Understanding and understanding of occupation	Understanding of preschool education	Visit kindergarten	Grade 1 and grade 2	Specific behavior	Head of kindergarten	Excellent, good, average, poor
		Preschool education expert	Grade 1 and grade 2	Experience and experience	Students' self-evaluation and mutual evaluation	Excellent, good, average, poor
		About professional ethics courses	Grade 1, grade 2 and grade 3	Peacetime performance and application ability	Self evaluation or mutual evaluation of counselors and students	Score quantization
	Professional identity and sense of responsibility	Debate	first grade	Communication mode	Students' self-evaluation or mutual evaluation	Awards can be set
		speech contest	Grade 1 and grade 2	Professional identity	Students' mutual evaluation, self-evaluation and counselors	Awards can be set
		Theme class meeting	Grade 1 and grade 2	Group discussion and speech	Student self-assessment, counselor	-

In order to ensure the quality of pre-school courses and implement total quality management, the next step of the study is to consider the following control methods for course management (Fig. 5):

Refer to the existing quality assurance system research and propose a quality assurance system for preschool courses. The development of the pre-school curriculum system and the development of the pre-school curriculum quality assurance system, the general characteristics of the system, Professor Wang Peimin proposed the "system approach" of analyzing the system. He believes that the system can be placed in the time domain to examine its dynamic process attributes, and at the same time it needs to be put in place. Investigate its static state properties in the spatial domain. From this, we get the five most basic concepts of the system, namely process concepts, environmental concepts, functional concepts, structural concepts and hierarchical concepts. The whole system concept is an organic whole constructed in a certain way, that is, the system way. Based

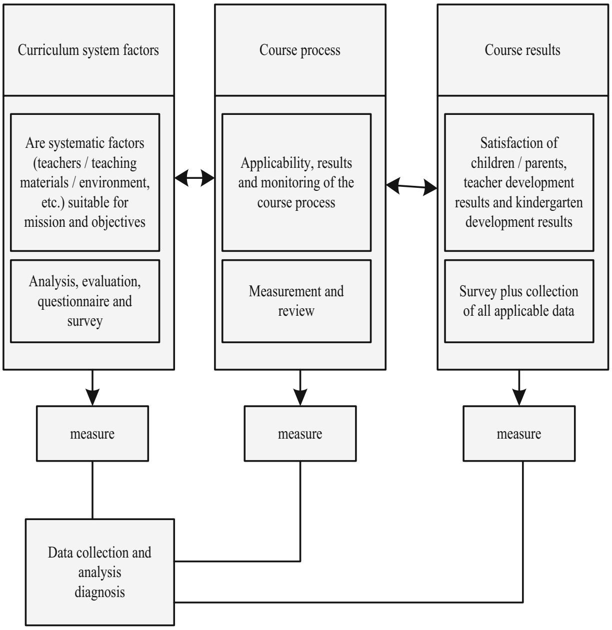

Fig. 5. Pre-school curriculum content evaluation management platform

on the understanding of the system-like characteristics, the author uses the "system approach" to research, generate and run the preschool curriculum evaluation system of this article. See below (Fig. 6).

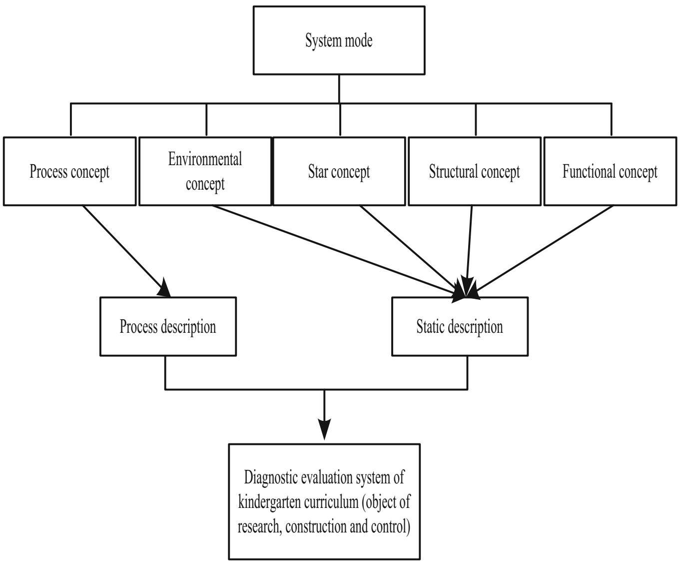

Fig. 6. Basic concepts of the diagnostic evaluation system of kindergarten curriculum

The diagnostic evaluation system of preschool curriculum is regarded as an organization with a certain function, which is composed of interrelated functional points. In the early childhood curriculum evaluation system, the function of evaluation is related to the goal of evaluation. Setting the goal of the evaluation system is to put forward functional requirements for the evaluation system: the function is also related to the structure of the system. Given the structure of the evaluation system, it is possible to realize the function or achieve the goal. Ideally, the evaluation function realized is completely consistent with the desired evaluation function, but it can not be done in fact. According to the actual survey data, students have a certain demand for individual evaluation, and the corresponding weight needs to be improved compared with the current situation, which should be obviously related to the students' demand for expert guidance or information feedback with rich teaching experience. To this end, this study has conducted in-depth thinking on the assessment module and constructed the following evaluation model, as shown in the figure below (Fig. 7).

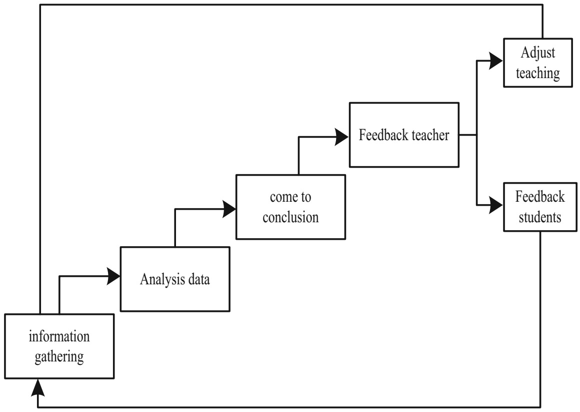

Fig. 7. Pre-school education supervision and evaluation route model

In order to solve the contradiction between the desired function and the realized function, the method of compromise and coordination is often adopted: choose the appropriate goal and choose the satisfactory structure. The functional concept has a basic concept, which is the function point. After different function points are organized, the overall function of the system is achieved. When setting the "improvement-oriented" overall function of the preschool curriculum diagnostic evaluation system, this article also decomposes the realization of the overall function into four functional points, namely, "combined value orientation", "combination of logic and law", and "combination". Reality" and "comprehensive goals", completing these sub-functions can effectively achieve the overall function—improving the pre-school curriculum.

3 Analysis of Experimental Results

Due to the influence of knowledge-based thinking in my country's traditional culture, in vocational education, the memory test of principle and structural knowledge is often emphasized, although the assessment of skills such as artistic skills and teaching skills is gradually being emphasized., But often ignore the assessment and evaluation of students' ideological and moral quality. The theoretical examination is separated from the pre-school practice, which leads to the simplification of students when thinking about problems, the one-sided analysis and judgment of some practical problems, and the lack of imagination. Therefore, when students go to the society, there is still a big gap between their ideological and moral level, practical skills and operation level and the actual needs of their posts. Therefore, the assessment contents of pre-school education majors are scored and counted. The specific results are shown in Fig. 8.

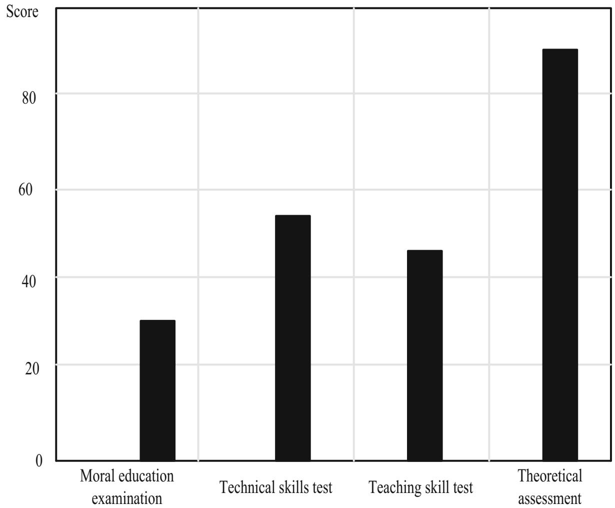

Fig. 8. The scoring chart of pre-school education curriculum assessment content

It can be seen from Fig. 8 that in the course assessment of pre-school education students, the moral education examination score is 30, the technical skill test score is 55, the teaching skill test score is 45, and the theoretical evaluation score is 90. The score of theoretical knowledge is relatively high, but the connection with practice is not strong, so it may lead to the separation of pre-school or educational institutions' job needs. Because everyone has different backgrounds of growth and experience, their personality characteristics are also different, and their learning methods, learning approaches, learning processes and learning speeds are also different. They all have individual personality characteristics. Based on this, the quality of preschool education courses is evaluated, and the results are shown in Fig. 9.

As can be seen from Fig. 9, among all colleges and universities, the most important thing is the way of learning, followed by the way and process of learning, and the attention to learning speed is low. It can be seen that autonomous learning can help students to carry out effective self-learning management. In order to further prove the scientificity and effectiveness of the pre-school education evaluation index system based

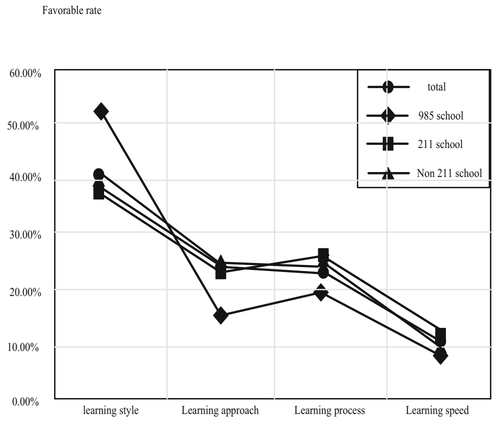

Fig. 9. Evaluation of the quality of pre-school education courses

on big data technology, the operation efficiency is compared with the traditional pre-school education evaluation index system, and the results obtained are shown in the figure (Fig. 10).

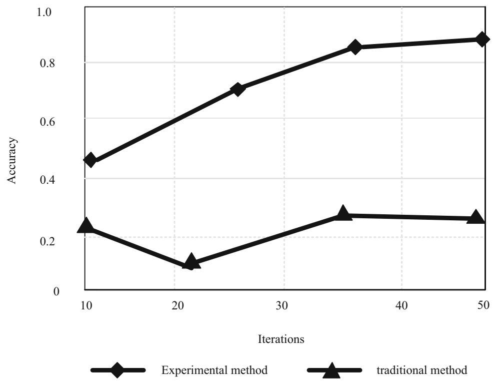

Fig. 10. Evaluation efficiency comparison test results

The experimental results show that the evaluation efficiency of the traditional preschool education evaluation index system is low, basically between 0.1–0.3; However, the research on pre-school education evaluation index system based on big data technology proposed in this paper has higher operation efficiency, which is always above 0.4 and can reach 0.9 at most; And the operation is simple and easy to control, which objectively reflects the evaluation indicators of preschool education.

4 Conclusion

Starting from the orientation of curriculum evaluation research, this paper traces the evolution of preschool curriculum in China from a historical perspective, and at the same time, from the standpoint of current social evaluation, judges the problems and root causes of current preschool curriculum. In order to solve the problems that the current pre-school education curriculum assessment and evaluation system is easily affected by other factors in the implementation process, the evaluation effect is poor and the evaluation efficiency is affected, this paper uses the big data method to design the pre-school education curriculum assessment and evaluation system, which can effectively solve the problems existing in the pre-school curriculum, and has important practical significance.

In the following research, the evaluation of teachers by students and their parents will be added to this evaluation system to enrich the evaluation indicators of the evaluation system, in order to provide a better teaching environment for preschool curriculum education.

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Application of Artificial Intelligence in Pre-school Education Professional Talent Training in the Era of Big Data

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Abstract. Aiming at the problem that there are few preschool teachers with scientific and technological literacy and the training of preschool education professionals does not conform to the natural trend, in order to make the training of talents more convenient and more conducive to the formation of personalized education programs, the application of artificial intelligence in the training of preschool talents is studied. What the society needs now is preschool teachers with scientific and technological literacy. These preschool teachers can cultivate children's awareness of innovation and technology. As future kindergarten teachers, they should be compound talents with "content + technology + education" and "pre-school education + artificial intelligence". The training of pre-school education professionals with "pre-school education + artificial intelligence" should pay attention to the integration of artificial intelligence and training programs, and adhere to the educational vision of artificial intelligence education; The integration of artificial intelligence and personality teaching, in-depth excavation of the "embodiment" of the current situation of artificial intelligence education; Combine artificial intelligence with teaching evaluation to highlight the era value of artificial intelligence education; The integration of artificial intelligence and labor spirit will promote the spirit of Chinese model workers and craftsmen.

Keywords: Artificial intelligence · Preschool education · Personnel training · Talent · Cultivation

1 Introduction

In March 2017, "artificial intelligence 2.0" was added to the 13th five year plan for the development of national strategic emerging industries, and artificial intelligence was further upgraded to the national strategy. For the first time, "artificial intelligence" was written into the national government work report, confirming the significance of artificial intelligence. In April 2018, the Ministry of Education issued the "action plan for innovation of artificial intelligence in Colleges and universities", which proposed a new training mode of "artificial intelligence + X" and implemented the "artificial intelligence

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+ " action. Therefore, "artificial intelligence + preschool education" has its time value. In January 2019, China education modernization 2035 innovates educational service formats and establishes a mechanism for co construction and sharing of digital education resources. In February 2020, according to the notice of the Ministry of education on publishing the filing and approval results of specialty setting of Higher Vocational Education in 2020, 171 Higher Vocational Colleges in China have successfully applied for the major of artificial intelligence technology service. In March, the Ministry of education, the national development and Reform Commission and the Ministry of Finance jointly issued several opinions on the construction of "double first-class" universities, promoting the integration of disciplines and accelerating the cultivation of graduate students in the field of artificial intelligence (hereinafter referred to as the opinions). In April 2021, the Ministry of Education issued the Notice of the General Office of the Ministry of Education on the Recommendation and Selection of the Second Batch of Pilot Projects for Artificial Intelligence to Promote the Construction of Teachers, promoting the deep integration of artificial intelligence and other new technologies with the construction of teachers. It can be seen that the future is the era of artificial intelligence and big data, and there is a corresponding need for talents in this field. The major of preschool education in Colleges and universities should also keep up with the pace of the times and cultivate new people of the times. Education should be reformed, but also returned [1]. Reform is the driving force and method, and return is the original intention and direction. Literature [2] shows that, under the background of intelligent education, the research on the training of preschool education professionals in educational institutions can, to a certain extent, promote the deepening development of the education industry as a whole. However, the low scientific and technological literacy of preschool teachers and the training of preschool education professionals do not conform to the natural trend. These problems exist for a long time and are difficult to solve, therefore, the online education platform resource matching method has low matching accuracy, at present, how to efficiently utilize artificial intelligence products to conduct professional education has become the focus, difficulty, highlight, turning point and growth point of higher education in the new era.

2 Application Value of "Preschool Education + Artificial Intelligence" Deep Cross Fusion

Under the deep cross integration of "preschool education + artificial intelligence", it broadens the employment direction of students majoring in preschool education, caters to the future market situation of preschool education, and is more conducive to the professional development of teachers.

2.1 Keep Up with the Market Demand and Broaden the Employment Direction of Students

After the opening of China's two-child policy, the preschool education market has a large capacity space. The early education based on mobile Internet, including home education, smart security, and education enlightenment, has developed rapidly. With the strong intelligence related courses, etc. Among them, high- quality content and products will stand out in many products, such as the combination of Artificial intelligence and VR with teaching scenes, children's reading, short video services, etc. To provide a rich, professional and comprehensive multimedia resource database and online course editing environment, or to provide artificial intelligence education course services for 0–6-year-old children, or to better cooperate with artificial intelligence products in teaching, we need not only educational talents, technical talents, but also content-based talents. Cross fields will more easily produce new employment opportunities.

2.2 Meet the Professional Development of Preschool Teachers Based on Professional Practice

The future preschool education is no longer just taking children to play games, singing and dancing. Now artificial intelligence products have entered the life. The products of pre-school education, such as tablet computers, intelligent whiteboards, etc., which are mainly digital and information-based, have become the new force in the basic education market. Many intelligent robots, somatosensory education, Internet plus, client APP and other related products have been introduced into kindergartens [3]. At this stage, children can use VR electronic products to describe life, express their demands,organize activities and solve problems in the virtual world. Although this process is to be explored by children themselves, it is also necessary for kindergarten teachers to explore the world and solve problems. To form the awareness of programming and digital, and to guide children through the design of various program games and activities, which means that the professional development of kindergarten teachers in the future is closely related to artificial intelligence. Besides the regular knowledge and skills they need, it is necessary to constantly improve the skills related to artificial intelligence.Prepare Your Paper Before Styling.

3 Prepare the Demand of Artificial Intelligence for the Cultivation of Preschool Education

It is inevitable that artificial intelligence will go to the field of education. Artificial intelligence is also popular in the field of preschool education. According to the survey, there have been artificial intelligence future kindergartens in Shanghai, Shenzhen and other places, and a large number of artificial intelligence courses and hardware equipment have entered kindergartens. For example, the application of temperature measuring robots in kindergartens during the epidemic period has been praised, and the future direction of preschool education is " Artificial intelligence + Preschool education ". The emergence of artificial intelligence products can help children form the sense of the times of artificial intelligence when they are young, so as to become scientific and technological talents who grasp the new trend and the new era.

3.1 Application of Artificial Intelligence in Preschool Education (0–6 Years Old), as Shown in Table 1

At this stage, there are five applications of artificial intelligence in preschool education (0–6 years old). First, early education robot. Mainly for small robots[4], widely used

Table 1. Application of artificial intelligence in preschool education

Due fields	Remarks
Early education robot	0–3 years old, family, small
Kindergarten intelligent sensor game equipment	3–6 years old, intelligent sensor, chip
Morning inspection, Hello, temperature measurement, teaching robot	3–6 years old, regular service, medium and large
Artificial intelligence course in kindergarten	3–6 years old, children 3D printing, fun programming, etc
Artificial intelligence classroom in kindergarten	3–6 years old, children's Intelligent environment

in the home, a wide variety. Voice interaction, dialogue Q & A, face recognition, video surveillance, environment perception, autonomous positioning and navigation and other functions have almost become the standard configuration of robot products; second, kindergarten intelligent sensor game equipment. All the game areas in the kindergarten have been intellectualized. They are connected with intelligent chips and sensors. There are screens on the walls. When children play games, the artificial intelligence products have captured information, such as face recognition and motion recognition, and generated game experience reports. Third, the kindergarten morning inspection, Hello, temperature measurement and teaching robots. In the kindergarten, daily morning check, Hello, temperature measurement and other routine services have been carried out by using artificial intelligence robots, which ensure accurate detection, backstage storage and detailed records, greatly reducing manpower and shortening the routine service time. Among them, the teaching robot is a content material library, rich in knowledge, good at singing and dancing, astronomy and geography, omniscient; fourth, the kindergarten artificial intelligence course. The artificial intelligence courses in kindergartens mainly include children's 3D printing course, children's interesting programming, children's computer guidance, children's vr virtual course, AR game experience course, etc.[1], which mainly cultivate children's scientific literacy and innovation ability; fifth, the artificial intelligence classroom in kindergartens. Kindergartens have created conditions for the implementation of the artificial intelligence curriculum, specially built the artificial intelligence classroom for them, provided a scientific and technological environment for the smooth development of the engineering intelligence curriculum activities, and inserted the wings of science and technology into the classroom.

3.2 Training Orientation of Preschool Education Talents Under the Background of Artificial Intelligence, as Shown in Table 2

The future preschool education professionals are those who adapt to the market situation, and the future direction of preschool education is " Artificial intelligence + Preschool education", which is beyond doubt. By analyzing the application fields of artificial intelligence in preschool education (0–6 years old) at the present stage, we can better position

Table 2. Training orientation of preschool education talents under the background of artificial intelligence.

Due fields	The orientation of pre-school education talents training
Early education robot	Content talents
Kindergarten intelligent sensor game equipment	Content talents and educational talents
Morning inspection, Hello, temperature measurement, teaching robot	Content talents and educational talents
Artificial intelligence course in kindergarten	Content, technology and education talents
Artificial intelligence classroom in kindergarten	Content, technology and education talents

the training objectives of Preschool education professionals in the future. Content talents of preschool education major refer to the professionals who provide content materials for Artificial intelligence products. Only professional talents have a better understanding of relevant professional knowledge, especially in Artificial intelligence products, the selection, editing and organization of content should be the embodiment of the deep integration of " Artificial intelligence + Preschool education". Only good content can attract children and have a better market. Preschool education professional and technical talents refer to the professionals who can provide artificial intelligence courses for preschool children aged 0–6. Because kindergartens need to have the corresponding teacher qualification certificate to be admitted, it is difficult for talents in other fields to enter kindergarten teaching, and the salary situation is relatively low, so other professionals are not willing to enter kindergartens, such as computer professionals, so in the future, it is difficult for them to enter the kindergarten It still needs kindergarten teachers to complete the Artificial intelligence course for preschool children. Educational talents of preschool education major refer to professionals who can make better use of artificial intelligence products and carry out teaching activities purposefully and systematically. Emphasis on human-computer cooperation, the construction of Artificial intelligence double teacher classroom. To sum up, under the background of artificial intelligence, the training orientation of preschool education talents should be "content + technology + education" deep cross compound preschool education professionals[5].

4 A Survey on the Willingness of Private College Students to Accept Artificial Intelligence Products to Participate in Course Learning

Variables in this questionnaire design main reference Venkatesh UTAUT model, and on this basis, the appropriate adjustments, the adjusted model mainly includes nine variables, respectively is performance expectations, effort expectation, social influence, facilitating conditions, perceived cost, Perceived trust, use intention, hedonic motivation, usage habits. Four control variables were set, namely, gender, age, experience and voluntary. In this study, the control variables were not studied too much.

4.1 Research Hypothesis

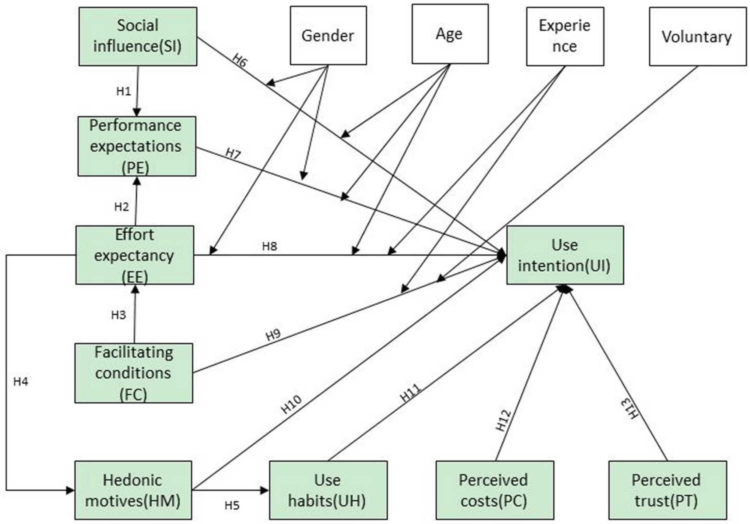

Fig. 1. Hypothesis model

H1: Social influence will positively affect the performance expectation of college students using artifIcial intelligence products to participate in course learning.(SI,PE) (See Fig. 1).
H2: Effort expectation will positively affect the performance expectation of college students using artifIcial intelligence products to participate in course learning.(EE,PE).
H3: Facilitating conditions will positively affect college students' expectation of using artifIcial intelligence products to participate in course learning.(FC,EE).
H4: Effort expectation has a positive impact on college students' hedonic motivation to use artifIcial intelligence products to participate in course learning.(EE,HM).
H5: Hedonic motivation has a positive impact on college students' habit of using artifIcial intelligence products to participate in course learning.(HM,UH).
H6: Social influence will positively affect the willingness of college students to use artifIcial intelligence products to participate in course learning.(SI,UI).
H7: Performance expectation has a positive influence on the willingness of college students to use artifIcial intelligence products to participate in course learning.(PE,UI).
H8: Effort expectation has a positive impact on college students' willingness to use artifIcial intelligence products to participate in course learning.(EE,UI).
H9: Facilitating conditions have a positive impact on college students' willingness to use artifIcial intelligence products to participate in course learning.(FC,UI).
H10: Hedonic motivation has a positive impact on college students' willingness to use artifIcial intelligence products to participate in course learning.(HM,UI).

H11: Usage habits have a positive impact on college students' willingness to use artifIcial intelligence products to participate in course learning.(UH,UI).
H12: Perceived cost has a positive impact on college students' willingness to use artifIcial intelligence products to participate in course learning.(PC,UI).
H13: Perceived trust has a positive impact on college students' willingness to use artifIcial intelligence products to participate in course learning.(PT,UI).

4.2 The Specific Situation of the Object Under Test

In order to further understand the willingness of students in private colleges to accept artificial intelligence products to participate in course learning, this study took Boda College of Jilin Normal University as the object of study and used Wenjuanxing as the questionnaire distribution platform. In this study, Pearson correlation coefficient was adopted to analyze the correlation among performance expectation, effort expectation, social influence, facilitating condition, perceived cost, perceived trust, use intention, hedonic motivation and use habit with the help of SPSS software. A total of 1327 questionnaires were issued, with 1327 valid questionnaires and effective recovery rate of 100%, This study mainly uses SPSS software for statistical analysis. The main information of the subjects is shown in Table 3:

Table 3. Basic information of the subjects

Variable	The child variable	Frequency	Accounted for%
Gender	Male	202	15.2
	Female	1125	84.8
Age	Under the age of 18	39	2.9
	18 to 20 years old	839	63.2
	20 to 25 years old	447	33.7
	25 years of age or older	2	0.2
Experience	Have	787	59.3
	Don't have	540	40.7
Voluntary	Yes	903	68
	No	424	32

As can be seen from Table 3, there are 202 male students and 1125 female students, nearly 5 times as many as male students, which conforms to the male-female ratio characteristics of normal universities. The majority are between 18 and 25 years old. Half of the students have artificial intelligence products or not, and two-thirds of them can voluntarily use artificial intelligence products.

4.3 Study Variable Items

Based on the UTAUT model, trust theory and relevant research results, this study designed the questionnaire, which is mainly divided into two parts. The first part is the basic information of the subjects, including gender, age, experience and voluntariness. The second part is the formal item, containing a total of 35 item, nine variables including performance expectations part there are four item, effort expectancy part there are five item, social influence part there are five item, contribute to conditions part has four item, perceived cost part has four item, perceived trust part has three item, part use habits have three item, There were 3 items in hedonic motivation and 4 items in acceptance intention, which were compiled by likert five-level scale. See Table 4 for details.

Cronbach's Alpha coefficient is generally used to test the internal consistency of the questionnaire. In this study, Cronbach's Alpha coefficient is detected to be 0.951, and the coefficient is greater than 0.9, indicating good reliability. At the same time, factor analysis was used to detect the reliability of the structure. The results showed that the KMO value was 0.945, and the Sig value was 0.00, indicating that the factor differentiation was obvious and the reliability was good.

4.4 The Results of the Study

The correlation coefficient is shown in Table 5.

As can be seen from Table 5, the variables involved in the hypothesis of this study are significantly correlated at the level of 0.01. In this study, after the correlation analysis, further use of multiple linear regression analysis method for data analysis (Table 6).

Adjust the R square of the regression model was 0.828, indicating that through regression analysis, each independent variable could explain 82.8% of college students' use intention, and the model fitting effect was good. This is because this model accurately analyzes whether students can voluntarily use AI products on the basis of a large number of observation data, which provides a reference for the construction of AI dual teacher classroom and the complete and efficient generation of pre-school talent training strategies (Table 7).

Sig is considered as significant, and the following values are the statistical P values. The difference between 0.01 and 0.05 is significant, and the difference less than 0.01 is extremely significant. All in all, Performance expectations, Social influence, Facilitating conditions, Perceived Trust, and Hedonic walk forward through empirical data. However, Effort Expectancy, Perceived costs and Usage habits did not meet the requirements. The beta value of Performance Expectations was 0.155, positive and significant 0.000, less than 0.01, which proved that the hypothesis H7 proposed in this study was valid. The beta value of Effort Expectancy was 0.003, positive and significant 0.890. The beta value of Social influence is 0.132, which is positive, and the significance is 0.000, which is less than 0.01, which proves that the hypothesis H6 proposed in this study is valid. Facilitating conditions are correct: the beta value of this study is 0.057 (positive) and 0.022 (significance < 0.05) Facilitating conditions are correct: H9 is correct. The Beta value of the Perceived costs is -0.007 (negative) and the significance is 0.610. The beta value of Perceived Trust is 0.187, which is positive, and the significance is 0.000,

Table 4. Study variable items

Variable	The serial number	Item
Performance expectations (PE)	PE1	I think it is more convenient to obtain learning information through artificial intelligence products
	PE2	I think more abundant learning information can be obtained through artificial intelligence products
	PE3	I think I will get the learning services I need through artificial intelligence products
	PE4	I believe that artificial intelligence products will improve my learning efficiency
Effort expectancy (EE)	EE1	I think the operation method of artificial intelligence products is easy to grasp.
	EE2	I think I will be able to skillfully use artificial intelligence products when I need service
	EE3	I think it's easier to participate in the course through artificial intelligence products
	EE4	I think the function description of artificial intelligence products is clear
	EE5	I think artificial intelligence products are versatile and will satisfy every learning process
Social influence (SI)	SI1	My friends at other universities are already using artificial intelligence products to get services
	SI2	The people who matter to me recommend that I use artificial intelligence products
	SI3	I think it is a social trend to use artificial intelligence products to obtain learning services in course learning
	SI4	I think the university will support me to participate in the courses through artificial intelligence products in the future

(*continued*)

Table 4. (*continued*)

Variable	The serial number	Item
	SI5	I will be proud to complete the course through artificial intelligence products
Facilitating conditions (FC)	FC1	I think when I encounter problems in using artificial intelligence products, I can find professionals to help solve them
	FC2	The network construction of my school is relatively stable
	FC3	I think artificial intelligence products are a suitable way for me to obtain learning services
	FC4	I think artificial intelligence products are rich in content and resources, which is conducive to future employment
Perceived costs (PC)	PC1	I think it will take me more time to use artificial intelligence products than to study regular courses
	PC2	I think it will cost me more energy to use artificial intelligence products than to study regular courses
	PC3	I think using artificial intelligence products requires me to pay a higher data fee
	PC4	I think the use of artificial intelligence products in the course requires a special mobile device, which costs a lot
Perceived trust (PT)	PT1	I believe that the university can provide good services for me through the participation of artificial intelligence products in the course teaching in the future
	PT2	I believe artificial intelligence products will get better and better
	PT3	I believe artificial intelligence products are safe and stable
Usage habits (UH)	UH1	I think using various artificial intelligence products has become my habit

(*continued*)

Table 4. (*continued*)

Variable	The serial number	Item
	UH2	I think I've become obsessed with all kinds of artificial intelligence products
	UH3	I think all kinds of artificial intelligence products are my daily necessities
Hedonic motives (HM)	HM1	I think there must be many functions in artificial intelligence products that I am interested in
	HM2	I think it is very enjoyable to use artificial intelligence products to participate in the course learning
	HM3	I think artificial intelligence products can bring me a lot of happiness
Use intention (UI)	UI1	I am willing to try artificial intelligence products to participate in the course learning
	UI2	Would I like to learn how to use artificial intelligence products
	UI3	I will recommend artificial intelligence products to my friends
	UI4	If possible, I will often use artificial intelligence products to study

which is less than 0.01. The Beta value of Usage habits is -0.024, which is negative. Significance is 0.175, greater than 0.05, which proves that the hypothesis H11 proposed in this study is not valid. The beta value of Hedonic outdated is 0.476, which is positive, significance is 0.000, less than 0.01, which proves that the hypothesis H10 proposed in this study is valid.

As can be seen from Table 8, research hypotheses of H1, H2, H3, H4 and H5 are all valid respectively. To sum up, research hypothesis H1, H2, H3, H4, H5, and H6, H7 and H9, H10, H13. H8, H11, H12 are not true. Through the investigation and research of the students' willingness to use artificial intelligence to participate in the course learning, it can provide the basis for artificial intelligence to participate in talent training (Fig. 2).

Table 5. Correlation analysis

Research hypothesis	Pearson correlation	Significance (bilateral)	N
H1(SI,PE)	.778**	.000	1327
H2(EE,PE)	.813**	.000	1327
H3(FC,EE)	.813**	.000	1327
H4(EE,HM)	.748**	.000	1327
H5(HM,UH)	.720**	.000	1327
H6(SI,UI)	.812**	.000	1327
H7(PE,UI)	.774**	.000	1327
H8(EE,UI)	.759**	.000	1327
H9(FC,UI)	.796**	.000	1327
H10(HM,UI)	.877**	.000	1327
H11(UH,UI)	.661**	.000	1327
H12(PC,UI)	.417**	.000	1327
H13(PT,UI)	.830**	.000	1327

Table 6. Model summary

Model	R	R party	Adjust the R square	Error of standard estimate
Paper model	.911a	.829	.828	.32555
Literature [1] model	.584	.452	.598	.71142
Literature [2] model	.910	.758	.685	.69584

5 Talent Cultivation Strategy of Preschool Education Major Under the Deep Cross Integration of "Preschool Education + Artificial Intelligence"

5.1 The Combination of Artificial Intelligence and Training Program, Adhere to the Perspective of Artificial Intelligence Education

For example, the establishment of preschool education major (artificial intelligence direction), preschool education major needs to optimize the talent training program, need to discuss with relevant professionals of preschool education major and artificial intelligence major, brought the training plan to relevant experts for review, and hired a third-party evaluation agency for evaluation. Combined with the needs of social development, to construct the training goal of talents suitable for school, students and situation. In addition, the training objective is revised as "training content + technology + education depth interdisciplinary preschool education professionals" In the course content, in addition to the original training program of art skills, kindergarten management, early

Table 7. The dependent variable is the coefficient analysis of Use Intention

Model		Nonstandardized coefficient		The standard coefficient	T	Sig.
		B	Standard error of	A trial version		
1	(constant)	.203	.053		3.857	.000
	Performance expectations	.155	.022	.155	7.135	.000
	Effort expectancy	.003	.024	.003	.139	.890
	Social influence	.127	.025	.132	5.138	.000
	Facilitating conditions	.056	.024	.057	2.295	.022
	Perceived costs	−.007	.013	−.007	−.509	.610
	Perceived trust	.193	.024	.187	7.977	.000
	Usage habits	−.021	.015	−.024	−1.357	.175
	Hedonic motives	.454	.023	.476	19.697	.000

Table 8. Coefficient analysis of other dependent variables

The dependent variable	The independent variables	Beta	Sig
Performance expectations	Social influence	.778	.000
Performance expectations	Effort expectancy	.813	.000
Effort expectancy	Facilitating conditions	.813	.000
Hedonic motives	Effort expectancy	.748	.000
Usage habits	Hedonic motives	.720	.000

childhood education theoretical knowledge and five major areas of knowledge, try to add digital, scientific and technological curriculum elements, such as mixed learning, children's interesting programming, children's computer operation guidance, children's 3D printing course, VR course, etc., and further increase the corresponding course hours, credits, to ensure a certain number of artificial intelligence examination courses, further strengthen students' understanding of knowledge, and appropriately increase the artificial intelligence product experience courses, the practice training under the background of the integration of production and teaching is specifically implemented in the talent training program, and the order training is carried out. Will artificial intelligence education into the order of labor education, not only because the country attaches great

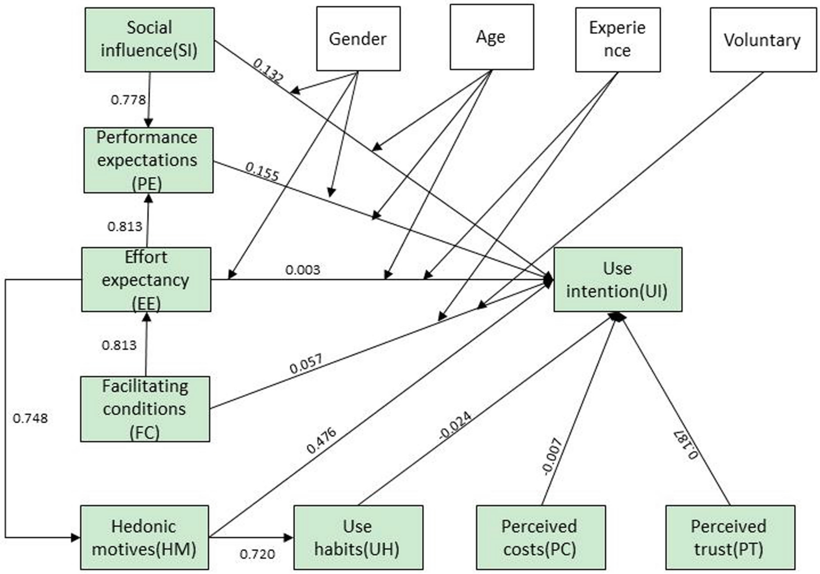

Fig. 2. Regression analysis results

importance to labor education now, but also because of labor education in contemporary students can have a good education effect, labor into the artificial intelligence in education has become a reality, teachers only insist on labor education and moral education, intellectual education, physical education, aesthetic education, the combination of Through the combination of artificial intelligence and labor education, labor education "tree morality, increase intelligence, strengthen the body, and cultivate beauty" can be realized. Students use artificial intelligence products to participate in labor, not only can sharpen their will and quality, enhance labor skills, but also can temper their will, temper their spirit in labor, and help students create, experience and appreciate beauty in labor[6].

5.2 The Integration of Artificial Intelligence and Personality Teaching, Deeply Explore the "Embodied" Artificial Intelligence Education Situation

After Artificial intelligence education should pay attention to students' physical experience and "embodied cognition" of their activities. "Communicating with life" provides the possibility of "embodied" Artificial intelligence education. In the daily teaching of preschool education major, artificial intelligence devices are used to let students experience the performance of artificial intelligence products, and provide teaching resources to meet the personalized needs of students. For example, the school establishes an artificial intelligence education center, purchases special practice course programs, plays "children's Literature" with artificial intelligence devices, and provides teaching resources to meet the personalized needs of students "Handmade", "Piano", "vocal music", "professional skills training" and other professional practice video and audio. After watching the video, students record and upload audio and video using artificial intelligence products[7].Artificial intelligence products automatically identify and analyze deficiencies and problems, and form a test report. Students continuously improve according to the test report, and finally achieve the requirements of success. This is more accurate and objective than the teacher's. In the teaching process of music theory and sight singing, children's song accompaniment, playing and singing and other related courses, we can integrate electronic class creation, encourage students to use the music production software in the artificial intelligence device to create their own style, interest and mood music, upload learning platform or learning community, so that music courses are no longer limited to the practice of a certain track and the development of vocal music knowledge Learning, but from the students' life experience, cultivate students' art appreciation ability, expression ability and creative ability. Moreover, in order to make students better practice in the kindergarten, each student is required to have no less than 30 h of kindergarten vr virtual course before they go to the kindergarten, which is more conducive to the smooth transition of students' roles, more familiar with the working conditions of the kindergarten, and more quickly integrated into the kindergarten work.

5.3 The Integration of Artificial Intelligence and Teaching Evaluation to Highlight the Value of the Times of Artificial Intelligence Education

Artificial intelligence products are the most faithful evaluation means, which are very objective and comprehensive. Preschool education majors can use the purchased products for teaching evaluation. This kind of teaching evaluation can run through the whole process, because the biggest advantage of artificial intelligence products is that they can automatically identify and record. It provides convenient conditions for assessment, liberates teachers, and enables them to better devote themselves to observing students and enlightening them. For example, technologies such as intelligent recognition of learning scenarios and intelligent push of learning materials are integrated into the process assessment, making the process assessment reasonable and evidential. With the help of artificial intelligence technology, teachers can not only make accurate evaluation on students' professional skills, practical ability, moral quality and career direction, but also make accurate evaluation on students' information literacy, digital literacy, scientific and technological literacy and innovation literacy. This kind of evaluation can be summarized or diagnostic, which is the most widely used in teaching evaluation Most of them should be diagnostic evaluation. Diagnostic evaluation runs through the whole process, all-round and full personnel training.We can use the voice interaction, dialogue Q & A, face recognition, video monitoring, environment perception, autonomous positioning navigation and other functions of artificial intelligence products to build Artificial intelligence dual teacher classroom. In this way, teachers can answer any student's doubts at any time. Similarly, they can also conduct comprehensive evaluation on teachers, such as teaching methods, teaching enthusiasm and teaching content We can also use artificial intelligence products to carry out teaching and research activities. The application of artificial intelligence products is inevitable with the development of the times. The most important thing of evaluation is accuracy. The emergence of artificial intelligence products has provided convenience for our education and highlighted the era value of artificial intelligence education.

5.4 The Integration of Artificial Intelligence and Labor Spirit Promotes the Spirit of Chinese Model Worker and Craftsman

The “Labor is the source of all happiness.“ General secretary Xi Jinping pointed out at the commendation conference of the national model workers and advanced workers that in the long term practice, we have cultivated the spirit of labor that advocates labour, loves labour, works hard and works honestly. Advocating work, loving work, hard work and honest work are the golden keys to life and the only way to create a better life. To strive for the “14th five year plan” and forge ahead on a new journey, we must vigorously carry forward the spirit of labor [8]. The connotation of the spirit of labor is stratified, among which “on the comprehensive strengthening of the new era of the labor education opinions” on the connotation of the spirit of labor, first, to establish a good concept of labor. Second, we should advocate thrift, hard work and dedication. Third, we need to foster the spirit of model workers and craftsmen. It is not difficult to see from the recent policy documents issued by the state that labor education will be the main melody of education at all stages in the future. The spirit condensed in labor education is helpful to play an exemplary role better. Pay attention to the condensed and permeated spirit in each stage, the example demonstrates the public, drives the public. We should use all kinds of channels, all kinds of means, all kinds of methods to spread our spirit of craftsmen and model workers, and influence students of all stages imperceptibly. The use of artificial intelligence has the same primary purpose as the cultivation of universities, which is to provide convenience for people’s life and labor, because labor is an important way to achieve a happy life. Using Artificial intelligence products to broadcast the stories of outstanding scientific and technological talents, we can pass on the concept of Chinese intelligent manufacturing to every student of preschool education major, Trigger their deep thinking and reflection, and understand that today’s happy life is hard won, cherish the present life, carry forward China’s spirit of hard work, master the importance of building a community of shared future for mankind, and through the cooperation of a large number of excellent Chinese enterprises in Artificial intelligence products Content materials to understand the development process from made in China to created in China and wisdom in China. At the same time, we can use artificial intelligence products to integrate labor education courses and innovation and entrepreneurship courses, and implement labor training into courses, life and experience. The labor skills of preschool education students should be guided by the spirit of labor, so that the professional skills training process can reflect the spirit of labor, and the spirit of model workers and craftsmen can shine in the use of tools and skill training.

6 Conclusion

Artificial intelligence has been introduced into preschool education. In future preschool education institutions, artificial intelligence products share part of the work. At the same time, children will also learn some artificial intelligence courses. Market demand is changing, talent training should also change, the training of preschool teachers should be in response to the situation, to cultivate timely, suitable for school, suitable for students, suitable for the situation of applied skills.

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Effect Evaluation of Online Basic Japanese Lessons Based on Data Mining Algorithm

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Abstract. Aiming at the problem of inaccurate evaluation of traditional Japanese teaching ability, an online education effect evaluation algorithm of basic Japanese course based on data mining algorithm is proposed. Using data mining algorithm to collect the online education content of basic Japanese course; Establish the constraint parameter index, optimize the evaluation algorithm, improve the quality of teaching evaluation, and achieve the goal of Japanese teaching ability evaluation. Finally, experiments show that the online education effect evaluation of basic Japanese course based on data mining algorithm has good evaluation ability, and improves the accuracy and efficiency of teaching ability evaluation.

Keywords: Data mining · Basic Japanese · Online education

1 Introduction

Under the background of network informatization, online education learners of basic Japanese courses can learn independently through various intelligent terminals, and online education resources learning is more “ubiquitous”. In the past, the single flipped classroom teaching mode using multimedia teaching means has gradually become inferior. The online education mode integrating online and offline teaching is more and more widely used in college education and Teaching [1]. Online education combines the advantages of classroom teaching and online learning, and effectively mixes various elements such as learning media, learning mode, learning environment and learning content. Using information processing technology and big data analysis technology for teaching evaluation and resource information scheduling is of positive and important significance to improve the quantitative management and planning ability of teaching process. The traditional Japanese teaching ability evaluation method is influenced by the restriction factors of Japanese teaching ability evaluation, and there is no quantitative test and analysis of Japanese teaching level, so the evaluation results of Japanese teaching ability are not accurate. In this regard, this paper studies the evaluation of Japanese teaching ability based on big data analysis [2]. Because there are many restrictive factors in the evaluation of Japanese teaching ability, it is necessary to quantitatively test and analyze the Japanese teaching level. This paper innovatively build a parameter model and big data analysis model that restrict the Japanese teaching level, use big data information

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fusion and clustering processing methods to evaluate the Japanese teaching ability, and build an objective function and statistical analysis model for the evaluation of teaching ability, Improve the quantitative prediction ability of Japanese teaching ability evaluation. Realize the quantitative planning of Japanese teaching ability evaluation and realize the accurate evaluation of Japanese teaching ability [3].

2 Evaluation of Online Education Data in Basic Japanese Courses

Combining the nonlinear information fusion method and time series analysis method, the information sampling model of Japanese teaching ability constraint parameters is established; The evaluation model of Japanese teaching ability based on data mining algorithm and information fusion clustering algorithm is designed. The problem of Japanese teaching ability evaluation is transformed into the problem of data mining objective function into least square estimation; Using regression analysis algorithm to build a data mining model for teaching quality evaluation; Partial correlation analysis and factor analysis are used to analyze the influencing factors of the indicators, and multiple linear regression algorithm is used to obtain the impact evaluation indicators, so as to realize the online Japanese basic course teaching effect evaluation.

2.1 Online Education Data Mining for Basic Japanese Classes

The traditional teaching process includes two stages: imparting and internalizing knowledge. Teachers impart knowledge through classroom explanation, and students internalize knowledge through homework after class. According to the definition of online education, online education combines the advantages of traditional classroom teaching and online learning [4]. The online education of basic Japanese course integrates learning resources, learning media, learning environment, learning methods and other elements to optimize the learning effect. Online education of basic Japanese course completes knowledge transfer before or after class with the help of multimedia such as online education, and internalizes knowledge in class with the guidance of teachers and the assistance of students, thus forming an online education model [5]. With the mixing of teaching process, all teaching links also change. See Table 1 for the comparison of elements between traditional classroom and mixed Classroom:

This module mainly includes pre class design module and classroom activity design module. The main input in data mining comes from the commands input by users through the graphical interface, the data in the data warehouse and the knowledge stored in the data mining knowledge base [6]. The data selected from the data warehouse is processed in the data mining tool, which provides a large number of mining algorithms in order to find the knowledge of hidden patterns and relationships in the data. Some knowledge should be added to the knowledge base for subsequent discovery extraction and evaluation [7]. The typical architecture of data mining is shown in Fig. 1.

According to Fig. 1, the functions of each module are described separately:

The interface of online education manager of basic Japanese course. The manager controls and manages the whole process of data mining. The input of analysts and the information in the knowledge base are used to control the data preparation process, the

Table 1. Comparison of elements between traditional and traditional Japanese classes

	Traditional classroom	Mixed classroom
Teacher	Impart knowledge and manage the classroom	Guide and promote students' learning
Student	Passive acceptance	Active learning knowledge
Teaching form	Classroom explanation and after class practice	Autonomous learning before class, internalization in class and consolidation after class
Classroom content	Explain and impart knowledge	Explore problems and internalize knowledge
Technology application	Ppt content display	Micro class video
Evaluation method	Paper test	Diversified evaluation of network platform

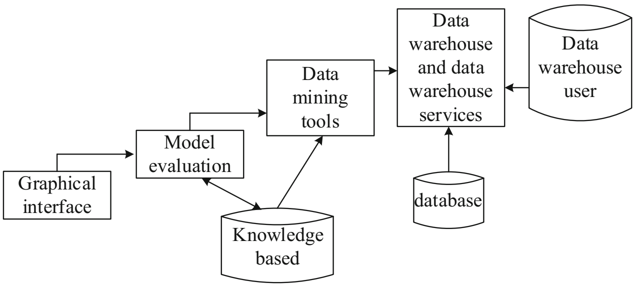

Fig. 1. Data mining architecture

selection and use process of mining algorithms, and the evaluation process of patterns. The manager outputs the mining results through the graphical interface, and stores the appropriate mining results in the knowledge base for the next mining. The manager must provide two basic functions: one is to assist users in analysis based on pattern evaluation and save interested mining results in the knowledge base; The second is to maintain the communication between the mining process and users and reflect the state of the whole mining process in real time. The data warehouse service of data warehouse is the interface between mining tools and data warehouse. Data mining tools use the query mechanism of data warehouse and SQL query language to obtain data through the interface. The knowledge base guides the mining tools to correctly organize the data structure and how to store the data structure in the data warehouse. According to the excavation tools. The data mining tool applies the mining algorithm in the knowledge base to mining the data in the knowledge base, and its purpose is to mine the patterns and relationships between data elements. The main algorithms used in data mining are: information theory method of data mining, set theory method of data mining, bionic method of data mining, formula discovery, statistical analysis method and so on. Model evaluation. Analysts look for key data patterns and present them to users in a way that users can understand. Techniques used to analyze critical patterns include statistical focus, confidence factors at coverage levels, and visual analysis. Data warehouse is not a prerequisite for data mining, because many data mining can mine information directly from operational data sources. Figure 2 describes the basic process and the main steps of data mining.

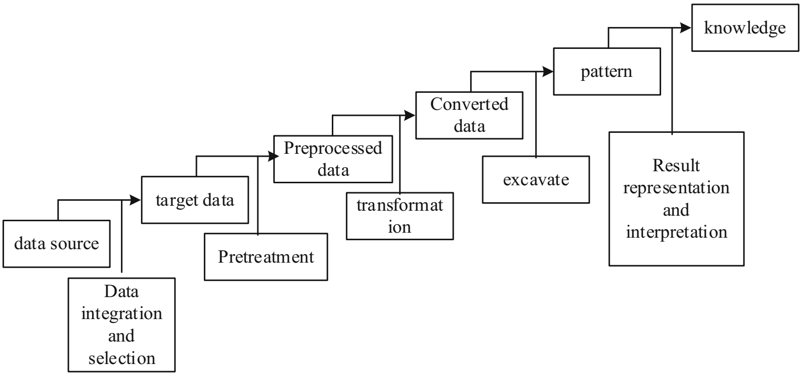

Fig. 2. Basic process and main steps of data mining

As shown from Fig. 2, data mining objects are the basis of the whole mining process. The relationship of mining objects determines the entire data mining process. It is also the basis and consultant to test the final results and guide analysts to complete data mining. Each step of the excavation is completed in a certain sequence, as shown in Fig. 2. Of course, there will be feedback between steps in the whole process. The process of data mining is not automatic, and many tasks need to be completed manually.

2.2 Online Education Evaluation Index of Basic Japanese Courses

Online education evaluation of basic Japanese course is not only an important content of teaching quality monitoring in Colleges and universities, but also a complex project. Because the teaching phenomenon has the characteristics of complexity, fuzziness and multi factors, qualitative analysis is the main way to evaluate the quality of classroom teaching, but it has some limitations. How to scientifically, reasonably and fairly make a comprehensive quantitative evaluation of classroom teaching quality plays an important role in ensuring and steadily improving teaching quality. In classroom teaching quality evaluation, the construction of index system is a key step for the success of classroom teaching quality evaluation, and whether the setting of index system is scientific, reasonable, fair and fair, It is directly related to the accuracy and credibility of the evaluation results. An important aspect of the scientificity of the classroom teaching quality evaluation index system is that its evaluation index system must be able to reflect the teaching quality comprehensively and without omission. The selection of evaluation indicators is divided into two stages: the establishment of initial index system and the selection of index system. The first stage is the establishment of initial index system. In order to establish a complete initial index system, the "affinity map" method in quality management technology is desirable.

First of all, experienced teaching management experts, teachers and students in the front line of teaching are invited to put forward evaluation indicators, and everyone will record every indicator they think of one by one. Then, the indicators proposed by students, experts and teachers are classified into two categories, and classified according to the content, so as to achieve a preliminary usable level, that is, they have quite good scalability, measurability, comparability, completeness and good simplicity. Finally, further investigate the opinions of the three parties, set the initial index system of teachers and students, and select the initial index system. The initial index system questionnaire is distributed to corresponding experts, teachers and students respectively, and they are allowed to independently select important indicators as the final evaluation indicators. Data mining is to make a comprehensive evaluation or decision on the evaluation object according to the learning degree of the research object and the number of evaluation factors involved, based on certain objectives or standards, considering the influence of various factors in a fuzzy environment. See Table 2 for the specific index system.

Table 2. The quality evaluation index of classroom teaching and its code names

Primary index	Secondary index
Teaching attitude	Prepare lessons carefully; Dignified appearance; Be patient with students
Content of courses	Clear teaching purpose; The teaching content is easy to understand; Handling of key and difficult points
Teaching art	Good at enlightening thinking; Take care of individual differences; Guidance on learning methods
Classroom structure	Design of teaching links; Connection between old and new knowledge
Classroom management	Attend and finish classes on time; Strict requirements for students; Class record status
Teaching effectiveness	Completion of class hour plan; Students' mastery of knowledge and skills in class

In order to realize the accurate evaluation of Japanese teaching ability, it is necessary to construct the information sampling model of Japanese teaching ability constraint parameters. Combined with nonlinear information fusion method and time series analysis method, this paper makes a statistical analysis of Japanese teaching ability. The constraint index parameters of Japanese teaching ability are a set of nonlinear time series. A high-dimensional characteristic distribution space is constructed to represent the parameter index distribution model of Japanese ability evaluation. The main index parameters restricting Japanese teaching ability include teacher level, teaching facility investment, policy relevance level and so on. Build an information flow model of differential equation to express the constraint parameters of Japanese teaching ability as follows:

$$x_n = h[(t_0 + \Delta t) - 1] + \omega_n \tag{1}$$

In the formula(1): h is the multiple value function of Japanese teaching ability evaluation; t_0 is the evaluation error measurement function.

In the high-dimensional feature distribution space ω_n, the solution vector Δt of Japanese teaching ability evaluation is calculated by correlation fusion method to obtain the feature training subset $(\delta_1, \delta_2, \cdots, \delta_r)$ of teaching ability evaluation, which meets the following conditions:

$$p_{K,n} = x_n \mathrm{diag}(\delta_1, \delta_2, \cdots, \delta_r) \tag{2}$$

For the statistical characteristic distribution sequence $X(n)$ of Japanese teaching ability evaluation of a group of multivariate variables, the data information flow model of Japanese teaching ability evaluation is constructed according to the previous statistical measurements as follows:

$$\begin{cases} c_{1x}(\tau) = p_{K,n} - E\{x_n + \delta_r\} \\ c_{2x}(\tau) = E\{x_n - \delta_r\} - p_{K,n} \\ c_{bx}(\tau) = (\delta_1, \delta_2, \cdots, \delta_r) - 1 \end{cases} \tag{3}$$

The level of Japanese teaching ability evaluation teachers and the distribution level of teaching resources meet the $(2+1)$ dimensional continuous functional condition, that is, the Japanese teaching ability evaluation has a convergence solution, and the constraints are:

$$\Psi_x(\omega) = \ln p_{K,n} - \frac{1}{2}|c_{1x}(\tau) - c_{2x}(\tau) - c_{bx}(\tau)| \tag{4}$$

Based on the above algorithm, a constraint parameter index analysis model for Japanese teaching ability evaluation is constructed Based on the analysis of big data information model for Japanese teaching ability evaluation by using quantitative recursive analysis method, in order to improve the quantitative evaluation ability of Japanese teaching level, a Japanese teaching ability estimation method based on data mining and information fusion is proposed. The Japanese teaching ability evaluation problem is transformed into solving the data mining objective function into the least square estimation problem. The least square problem is to find the consistency estimation value of Japanese teaching ability evaluation resource constraint vector B to minimize p_0, where $\|$ is the F-norm in the European norm, and the entropy feature extraction value of Japanese teaching ability constraint feature information is:

$$P_{\text{lees}} = \Psi_x(\omega) - \frac{1 - p_0}{B} - \sum_{N=1}^{N} p_{K,n} \tag{5}$$

According to the data information flow model of Japanese teaching ability evaluation, a set of scalar sampling sequence components into a big data distribution model is constructed to provide an accurate data input basis for Japanese teaching ability evaluation. In order to realize the evaluation of basic Japanese online education, the first work is to establish a measurement and evaluation model. The function of this model is to verify the effectiveness and correctness of basic Japanese online education evaluation through relevant theoretical knowledge. First, we should put forward a theoretical conception, and then carry out subsequent measurement and evaluation based on this theory, so as to obtain a better solution. The model of basic Japanese online education evaluation is mainly used to evaluate the training programs, teaching methods The teaching content and teachers' teaching attitude are evaluated. Its ultimate goal is to evaluate whether the setting of teaching in Colleges and universities is reasonable and whether the effect is ideal. The specific implementation is: randomly select college students, classify the set evaluation contents according to the primary and secondary indicators, determine a set of evaluation index system, and finally let these randomly selected students evaluate the basic Japanese online education according to the evaluation system.

Through the analysis, the identified basic Japanese online education assessment system is shown in Table 3:

Table 3. System table of basic Japanese online education evaluation indicators

Primary index	Secondary index
Teaching attitude	Teaching responsibility; Adequate lesson preparation; Abide by the teaching order; Proper selection of homework topics; Patient and enthusiastic tutoring and Q & A
Content of courses	Correct concept and clear concept; Theory linked design; The content is rich and novel; The key points are prominent and easy for students to understand; Appropriate difficulty
Teaching method	Flexible and changeable methods; teach students in accordance with their aptitude; Can use heuristic teaching
Teaching effectiveness	Students' mastery of knowledge; Problem solving ability; Overall harvest

According to the current classroom teaching quality evaluation index system of undergraduate colleges, the proposed evaluation indicators are shown in Table 4:

The evaluation indicators in Table 4 involve teaching attitude, teaching content, teaching level, teaching methods, teaching research ability and other aspects. There are differences in the impact of the evaluation indicators on the overall evaluation results. Therefore, to further determine the weight of various indicators, the evaluation system can be adjusted according to the results, so as to pay more attention to teaching attitude, teaching ability and teachers' own level. The questionnaire method is simple to calculate the weight, and the size of the weight is affected by the subjective factors of participants, so it can be comprehensively evaluated with reference to expert opinions or other weight calculation results.

Table 4. Classroom teaching quality evaluation indicators

Evaluation index	Connotation and standard of evaluation index
A	High teaching enthusiasm, rigorous scholarship and strong sense of responsibility
B	The teaching content is advanced, the arrangement is reasonable and the key points are prominent
C	Accurate teaching expression and good Mandarin
D	Be able to properly practice the actual selection of examples during teaching
E	Teaching methods are flexible and diverse, with scientific research ability
F	Be good at inspiring students to think actively and cultivating students' ability of independent thinking
G	Be good at adjusting the classroom atmosphere and have appeal
H	Broad knowledge, teaching can absorb multi-disciplinary theory
I	The blackboard writing is neat and the design is reasonable
J	Rational and effective use of advanced teaching methods
K	Strictly observe the class time
L	Students have high attendance and good classroom discipline

2.3 The Implementation of the Basic Japanese Online Education Assessment

The traditional data analysis and mining model of teaching quality evaluation directly uses regression technology to deal with various factors. In this paper, a Japanese teaching ability evaluation model based on data mining algorithm and information fusion clustering algorithm is proposed, and a new data mining model for teaching quality evaluation is constructed by using regression analysis algorithm; Using partial correlation analysis and factor analysis to analyze the influencing factors and data characteristics of the indicators; The multiple linear regression algorithm is used to obtain the impact evaluation index to realize the online Japanese basic course teaching effect evaluation. The data feature mining process is shown in Fig. 3:

According to Fig. 3, the new mining mode designed in this paper is based on the data mining database, which uses the data mining library to analyze and transform the data, and forms a data preprocessing module. The data preprocessing module transforms the data from relational database, multidimensional database, data warehouse or file. For large data sets, the amount of data processed can be reduced through data sampling, and then unreasonable data can be removed by means of data cleaning, so as to integrate the data into data that can be used by mining algorithms and store it in the data mining database. At the same time, the concept hierarchy tree can be used to abstract the original data, so that the mining module can deal with each abstraction level of data, rather than only mining the detailed data. The establishment of data mining database is an iterative process. Once we learn something from the results of data mining, we are likely to modify the data to get better results. Therefore, we need to carry out data

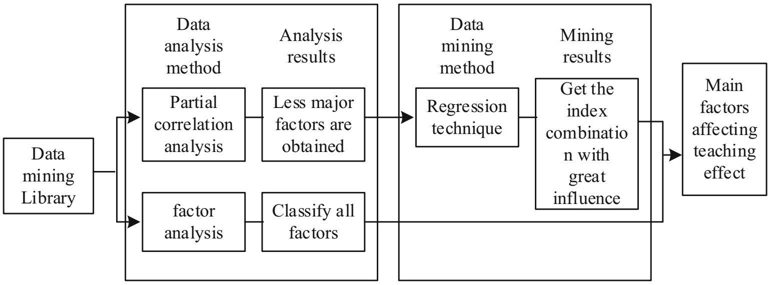

Fig. 3. Analyzes the new pattern of digging and feature number selection

preparation and data mining repeatedly. On the basis of the existing databases in the campus network, that is, on the basis of the current teaching management and teaching evaluation, data analysis and mining are carried out by using certain data analysis methods and data mining technology. Because in this example, the amount of data to be mined is not large and the data is not complex, all the excavated data are collected in the same Oracle database. First, collect data for the data mining library. The data sources are the existing "teacher information database", "teaching management database" and "Teaching Evaluation Database". The attribute list of various data sources is shown in Table 5:

Table 5. Data source information table

Data source	Teacher information base	Teaching management library	Teaching evaluation database
Open Source	Dean's office	Dean's office	School of computing
Powerless storage mode	The server	The server	The server
Security requirements	High	High	Low
Performance requirements	High	High	Low

Online education can create a real teaching situation, provide rich language information and strengthen language practice, make classroom teaching, online learning and student interaction complement each other, and create a collaborative and personalized learning environment. After class, students conduct self-test through network independent test and question bank, and use network communication tools such as wechat group and QQ group to discuss, learn and communicate with teachers and students. Teachers evaluate students' learning achievements and conduct teaching reflection according to students' feedback information, as shown in Fig. 4:

It can be seen from Fig. 4 that the teaching objectives of the network teaching mode of Japanese basic courses cannot be clearly distinguished in the three aspects of teaching

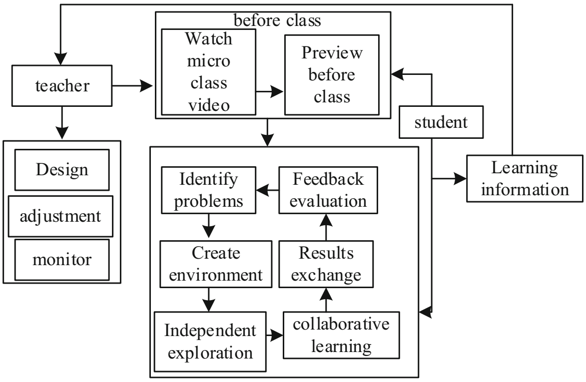

Fig. 4. Online education model of basic Japanese courses based on online education

ability, teaching method and teaching arrangement. In view of this, the evaluation sub objectives are combined here. According to the actual situation of teaching evaluation, an example of four-tier teaching quality evaluation index system is determined, as shown in Fig. 5:

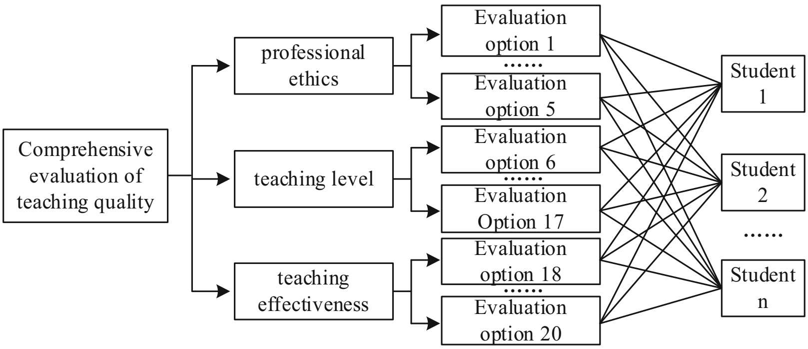

Fig. 5. Hierarchical model of the teaching quality assessment system

In Fig. 5, the target layer is the comprehensive evaluation result of teaching quality, the criterion layer includes professional ethics, teaching level and teaching effect, the scheme layer includes the specific sub items of each evaluation criterion, the lowest layer is the evaluation students, and each student will score the evaluation options.

3 Analysis of the Experimental Results

When developing the data mining module of teaching quality evaluation, this paper selects Microsoft SQL Server 200 as the tool to build the data warehouse; Using Microsoft Visual Basic6.0 The data mining module developed by 0 processes the relevant data in the teaching quality evaluation, and the processing results are also saved in the database of SQL server.

Taking 2019 Japanese majors in a university as the test object, the basic Japanese course of the class is taught in the online education mode. One year later, the teaching effect of this mode is investigated and analyzed by means of investigation and final comprehensive evaluation. Two surveys were conducted to analyze the survey results. The online education satisfaction of the first survey is shown in Table 6.

Table 6. Online education satisfaction survey in basic Japanese

Survey items	Student satisfaction
Feasibility and effect of integrating micro class into classroom teaching	87%
Autonomous learning before class	82%
Group collaboration	88%
Rationality of learning activity design	89%

The second survey investigated the effect of online education, using a five-paragraph evaluation method, and designed five problems. The survey results showed that online education has achieved good teaching results, as shown in Table 7.

Table 7. Teaching quality of basic Japanese online education

Problem	Very much	Agree	No	Opposition	Totally opposed
Is blended teaching suitable for the teaching of "basic Japanese course"?	27%	62%	9%	1%	1%
Can classroom instruction + micro class help you better understand and master the learning content?	35%	55%	8%	2%	0%
Is hybrid teaching better than traditional classroom teaching?	29%	53%	13%	5%	0%
Does blended teaching help improve academic performance?	35%	35%	18%	12%	0%
Can blended teaching cultivate your autonomous learning ability?	37%	50%	12%	1%	0%

According to Table 6 and Table 7, this method can effectively evaluate the effect of online education of basic Japanese course. Satisfaction with online education is higher than 82%. Then test the evaluation effect of this method and traditional methods.

In order to mine the association rules of some students' evaluation data extracted from the database table, we need to give the degree of support and matching. It is assumed that the minimum support is 0.3 and the matching degree is 0.6. Since only the evaluation data of 12 students are extracted, $M = 12$, so it is known that the minimum support number is the matching degree of each non empty subset of the final frequent itemset. The data mining effect and resource utilization results of the two methods are reflected by the matching degree value, as shown in Table 8.

Table 8. Test comparison of the utilization rate of teaching resources

Evaluation cycle	Paper method		Traditional method	
	Assessment accuracy /%	Utilization /%	Assessment accuracy /%	Utilization /%
A	98.22	98.25	87.65	89.25
B	97.08	98.65	85.62	87.24
C	97.32	99.08	88.65	89.65
D	98.56	96.65	89.65	87.35

As can be seen from Table 8, the teaching resource utilization rate of this method reaches over 99.08%, and the teaching data mining accuracy reaches over 98.56%, with high teaching data mining accuracy and high teaching resource utilization rate. However, the teaching resource utilization rate and teaching data mining accuracy of the traditional methods are lower than 90%. Combining the evaluation data, the evaluation accuracy of both methods is tested, and the results are shown in Fig. 6.

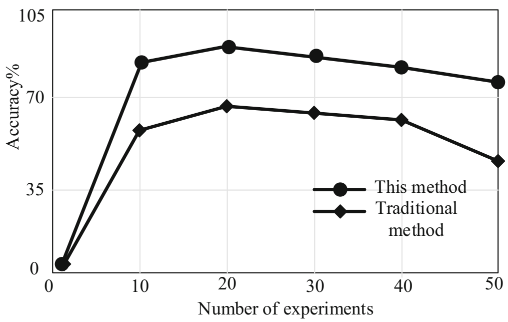

Fig. 6. Accuracy detection of the teaching effect evaluation

As can be seen from Fig. 6, the online Japanese teaching effect comprehensive evaluation method designed in this paper is a network-based comprehensive evaluation method, and its accuracy is higher than 70% and much higher than the traditional evaluation method.

The reason why this method improves the accuracy results is that this method makes a quantitative test and Analysis on the Japanese teaching level, and uses data mining algorithm to mine the online teaching content data of Japanese basic courses; The parameter model and big data analysis model that restrict the level of Japanese teaching are established, and the evaluation algorithm is optimized, so as to improve the quality of teaching evaluation.

The evaluation time of both methods was tested, and the test results are shown in Fig. 7.

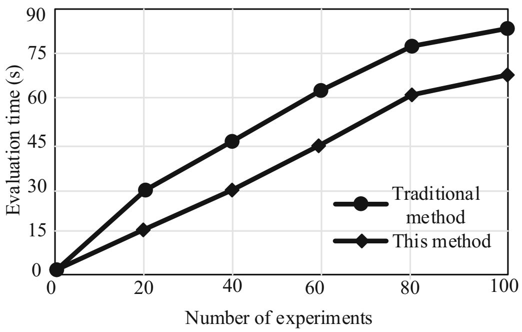

Fig. 7. Evaluation of time comparison

From the research results of Fig. 7, it is not difficult to see that in the case of high loudness, using the conventional evaluation method for Japanese comprehensive evaluation will take more time. The experimental results show that the influencing factors of the Japanese comprehensive teaching effect evaluation method designed in this paper are correct and timely. The evaluation time of the present method is less than 70 s, but the traditional method takes around 75 s to complete the evaluation. The online education of basic Japanese course improves students' learning enthusiasm and initiative.

4 Conclusion

In order to better ensure the teaching effect of basic Japanese and improve the accuracy of teaching evaluation, an online teaching effect evaluation method of basic Japanese course based on data mining algorithm is proposed. The experimental results show that optimizing the teaching scheme according to the evaluation results of this method can improve the teaching quality. Using this method in practical teaching can adjust the teaching mode and teaching content according to the evaluation results, so as to improve the teaching effect. However, due to the limited conditions, the method of this paper mainly evaluates the effect of basic Japanese teaching, and the applicability of the method is insufficient. Future research can expand the application scope of the evaluation and evaluate more courses.

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Research on Online and Offline Mixed Teaching Quality Evaluation of Higher Mathematics Based on Hierarchical Analysis Method

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Abstract. With the extensive development of network teaching, it has become one of the most important teaching methods at present. It is necessary to evaluate its teaching quality and give better play to its effect. This paper introduces analytic hierarchy process into this field and designs a new online and offline mixed teaching quality evaluation method of higher mathematics. First, the evaluation index is selected. Based on the judgment matrix constructed by AHP, the corresponding hierarchical weights are obtained by maximizing the eigenvalues of different matrices. The evaluation model is established. When the number of iterations reaches the maximum, the evaluation results of teaching quality are obtained. The experiment shows that the average evaluation accuracy of this method is 97.26%, and the effect is good.

Keywords: Hierarchical analysis method · Higher mathematics · Internet + education · Mixed teaching · Evaluation model

1 Introduction

With the rise of the Internet, "Internet + education" has developed rapidly. Driven by big data, education evaluation has become more scientific and objective. The educational evaluation index system has gradually changed from the original qualitative evaluation to the educational evaluation mode that emphasizes the combination of qualitative and quantitative evaluation. The outbreak of COVID-19 in 2020 has made online teaching a major teaching method and played a positive role in ensuring students' normal learning. At the moment when the COVID-19 epidemic continues to affect, it can effectively ensure the teaching progress, enable students to study at home, and greatly improve the convenience of teaching. During the pandemic, it showed its strong advantages and was widely accepted by people. Even in the current post epidemic era, most colleges and universities have resumed offline teaching, but still regard online teaching as an important auxiliary teaching method. In this case, online and offline hybrid teaching methods have been rapidly developed. Especially in the face of the current situation of multi-point spread of the epidemic, it is more necessary to promote the development

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of online education, so as to respond to unexpected problems at any time, give play to the advantages of online teaching, and form an important complementary role. Under the guidance of constructivism and behaviorism, the online and offline mixed teaching mode optimizes, integrates, presents and applies teaching resources through Internet technology, information technology and modern education technology. This means that in the future education, online teaching will also be combined with classroom teaching and become one of the effective teaching methods. In the face of the strong advantages of this model, it is necessary to make clear that this model also has its weaknesses. Once the weak links can not be effectively evaluated, it is possible to apply this model incorrectly, so that its due value can not be brought into full play, and even hinder students' learning. In order to give full play to the advantages of this model, we must evaluate the teaching quality, find out the weak links in the practice process, and make targeted improvement.

At present, some scholars have studied the teaching quality evaluation methods. For example, Yue Qi introduced the improved GA-BP neural network method into the field of teaching quality evaluation and designed a teaching quality evaluation method based on the improved GA-BP neural network [1]. Zhang Yaqing established a classroom learning quality evaluation model to complete the design of teaching effect evaluation method [2]. Xu Shiqiang designed an online teaching quality evaluation method for colleges and Universities Based on the deep learning network, and completed the construction of the evaluation system by analyzing the main factors affecting the online teaching quality of colleges and universities [3]. The above teaching quality evaluation method has the advantages of systematization, flexibility and operability, but there is still the problem of inaccurate definition of the relationship between the evaluation factors.The characteristics of higher mathematics discipline determine that higher mathematics is a relatively difficult subject.Therefore, in the process of the continuous construction of online and offline mixed teaching, it is necessary to study the online and offline mixed teaching pointing to higher mathematics subjects.At present, there is a rare research on the evaluation index system and teaching quality evaluation of higher mathematics subjects, and this study aims to strengthen this aspect.Hierarchical analysis is a combined quantitative and qualitative approach.The characteristic of the hierarchical analysis method is to simplify the complex problems.It can well sort out the internal relations between various different factors, and can make a hierarchical classification of influencing factors, so as to organically combine and process quantitative and qualitative analysis to make effective scientific decisions.Therefore, this paper introduces it into this field, and the following will carry out specific research.

2 Teaching Quality Evaluation Method Based on AHP

2.1 Establish a Mixed Online and Offline Teaching Mode of Higher Mathematics

With the in-depth development of Internet technology, online teaching methods have emerged and applied. In the process of application, its advantages are more clearly seen by people, and its importance is self-evident. Especially in the period under the influence of the epidemic, online and offline joint teaching of high school mathematics courses will gradually become an important teaching research and teaching practice in the future education field, which will become an inevitable development trend.

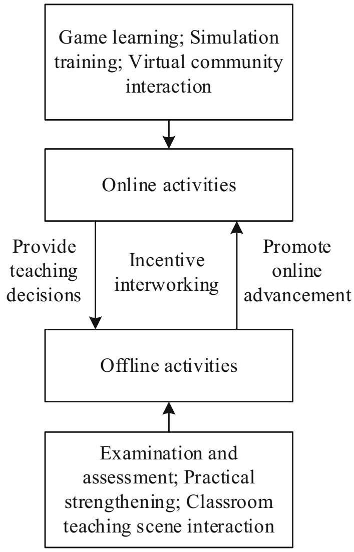

Fig. 1. Mixed online and offline teaching mode of higher mathematics

It can be seen from Fig. 1 that the online and offline hybrid teaching mode of higher mathematics is popular. Game learning, simulation training and virtual community interaction can be carried out through online activities, and inspection and evaluation, practical strengthening and classroom teaching scene interaction can be carried out during the offline activities. On this basis, the online and offline activities can play a role in providing teaching decisions for each other and promoting online progress, so as to truly bring the utility of this mode into play. In addition, in higher mathematics teaching, teachers should put people-oriented, pay attention to students 'learning ability and progress, and should plan the teaching progress reasonably, so that they can take into account most students in the student group and students' learning personality.The learning environment under online education and offline education mode is a combination of students 'learning in the traditional classroom and students' learning at home or through the classroom. It makes it more convenient for students to learn and acquire new knowledge under such conditions.On the one hand, the current mathematics classroom teaching is mainly about heuristic teaching, cooperative teaching, inquiry teaching and other teaching methods, to cultivate students' ability in learning, research and other aspects [4]. On the other hand, with the help of online teaching, students can cross the boundary of time and space, with the help of many excellent resources on the Internet, according to their own needs and teachers' teaching requirements, learning anytime and anywhere.The teaching strategy of higher mathematics is the teaching ideas, methods and techniques adopted by teachers in the teaching process in order to achieve the ideal learning effect, including interactive teaching and learning [5]. In addition, this teaching method can strengthen communication and improve students' mathematical literacy, which makes it very popular in many teaching in today's society.

2.2 Select the Higher Mathematics Teaching Quality Evaluation Index

The first principle that must be followed by in the process of establishing the evaluation index system is the scientific principle. The scientific principle is the scientific perspective of the index builders, based on the deep understanding of the meaning of each indicator, guided by the advanced theories of psychology and modern pedagogy, and put forward the scientific and targeted rules for the evaluation indicators.Hierarchical analysis method expresses the relationship between influencing factors in the form of numbers. This method is based on big data-driven consideration by evaluating decision choices, methods, plans, etc. [6]. First, the evaluated objects are ranked according to their advantages and disadvantages, and evaluated and selected according to the order of the ranking.In general, the problems to be handled are divided into three stages: target layer, standard layer, and index layer.For the construction of the evaluation index, the index content should not be repeated and contradictory, and the credibility of the evaluation index should be maximized. The starting point and destination of education should return to the students. The essence of education is to cultivate people with all-round development [7]. Therefore, the evaluation index should be constructed according to the principle of development. This paper takes the mixed teaching evaluation as the target layer, and the established index system is shown in Table 1.

Table 1. Quality evaluation index of online and offline mixed teaching in higher mathematics

The standard layer	Symbol	Indicator layer	Symbol
Teaching preparation	A1	Selection of teaching resources	B1
		Use of teaching resources	B2
		Teaching scheme design	B3
Knowledge and skill	A2	Platform operation capability	B4
		Higher fundamentals of mathematics	B5
		Advanced mathematics and basic skills	B6
		Higher mathematical thinking quality	B7
		Advanced mathematics basic activity experience	B8
Teaching interaction	A3	Teacher-led	B9
		Student subject	B10
		Time management	B11
		Assignment and comments	B12
		Answer questions and personalized tutoring	B13
Teaching feedback	A4	Higher mathematical value	B14
		Student assessment	B15
		Teacher summary and reflection	B16

COVID-19 outbreak in 2020, make online teaching become the focus of education, students 'learning methods and teachers' teaching methods have undergone obvious changes, online hybrid teaching will become an inevitable trend of future teaching, in line with the vision of development, the construction of online hybrid teaching evaluation index has a certain necessity.The upper factors play a leading role in the lower factors, and the research objects can be divided into multiple factors. For relatively simple system indicators, the two are compared one by one, and the importance of relevant indicators is evaluated by comparison, and then the relevant ranking is obtained, which provides a quantitative theoretical basis for decision makers.

2.3 Construct the Evaluation Index Weight of the Judgment Matrix Based on Hierarchical Analysis

For different levels, the different elements of the same layer are compared according to different criteria and techniques, and the matrix is formed according to the fixed quantification.The corresponding weights for this element are obtained by judging the different matrices to maximize the eigenvalue. Use quantitative indicators, ideas and methods to make the decision-making process form a model (Fig. 2).

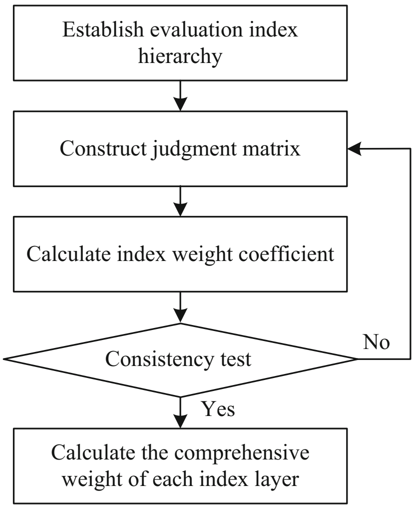

Fig. 2. The hierarchical analysis process

According to the importance of the secondary index, the proportion weight of the primary index is determined to form an important ranking and construct a matrix by pairwise comparison. (6) In the judgment of different decision makers, the proportion of different criteria varies between different levels. The hierarchy reflects the relationship between factors, but its proportion is different.The main difficulty encountered in determining the proportion of factors affecting a given factor is that these proportions are generally not easy to quantify.In this process, usually speaking, the expert scoring method or the scaling value method should be used.After the hierarchical model is constructed, the elements in the model are compared pairwise. For the different elements, because the different elements come from the different databases, the comparison should be made after a unified quantification of the data. Taking two factors P_x and P_y, the judgment matrix can be regarded as the judgment of the impact of two factors on the index. The comparison results of each can be displayed through a matrix. The judgment matrix can be expressed as:

$$W = \left(Q_{xy}\right)_{m\times m} \tag{1}$$

In the formula, W represents the judgment matrix; Q_{xy} represents the ratio of P_x and P_y to the influence of the index; m is the order of the matrix. In this paper, the index of the analysis model is within 9, so the 1–9 scale method is adopted. The weight coefficient corresponding to the calculation index should be based on the importance of the index, and each index should be divided to different degrees according to the degree of importance.Hierarchical ranking is to normalize the importance of a hierarchical factor more than the previous factor and its ranking weights.The consistency test is to avoid illogical phenomena and test the importance of an index. After substituting the data provided by the experts, we use mathematical methods to sort the matrix and sort the importance.There is a certain relationship between the judgment matrix and the weight. The specific expression is that the vector corresponding to the maximum characteristic root of the judgment matrix is the weight vector, and the weight vector is normalized to obtain the index weight.

According to the positive reciprocal matrix of order m, W is a uniform matrix if and only if its maximum eigenvalue is m. Therefore, whether the judgment matrix W is a consistent matrix is tested according to whether the maximum eigenvalue is equal to m. Only when each layer of matrix passes the consistency test can it have the corresponding persuasion and feasibility. The calculation formula of consistency index is as follows:

$$\vartheta = \frac{\gamma - m}{m - 1} \tag{2}$$

In formula (2), ϑ is the consistency index; γ represents the maximum characteristic root. Then calculate the consistency ratio as follows:

$$\chi = \frac{\vartheta}{\varphi} \tag{3}$$

In formula (3), χ represents the consistency proportion; φ represents the consistency index of the average value of the maximum eigenvalue. When $\chi < 0.10$, the judgment matrix can not be modified. At the same time, the integrated weight coefficient refers to the product between the specific proportion of the coefficients of each influencing factor and its corresponding criterion layer and the highest layer factor of that criterion layer.

2.4 Mixed Teaching Quality Evaluation Model

Throughout the research of education evaluation in China, most of them are still in the stage of qualitative evaluation, which increases the difficulty and uncertainty of

Table 2. Grade of the evaluation results

Order number	Grade	Numeric value
1	Outstanding	[100, 80]
2	Good	[80, 70]
3	Qualified	[60, 69]
4	Unqualified	[0, 59]

evaluation, and the research of quantitative evaluation standards is still a weak link of education evaluation in China (Table 2).

Each neuron in the convolutional neural network is connected only to the local neurons in the previous layer.Thus the connections between neurons is greatly reduced, thus substantially the number of parameters [12]. At the same time, local connectivity allows each neuron in the latter layer to process only the information of a small amount of relevant neurons in the previous layer, making each latter layer more targeted and having a more clear division of labor between neurons. The neurons in the same layer are grouped according to the connection association, and through the convolution operation, the neurons in the same group use the same weight, which further greatly reduces the network parameters. Pooled layers are usually placed after the convolutional layer, and the size of the convolutional layer neurons is reduced by the downsampling technique. The pooling layer uses sampling check input data, and the sampling kernel is essentially a weight matrix. The input data is then divided into pooling regions based on the sampled kernel size. The sampling calculation formula is as follows:

$$h_a = \varpi_h k_a \tag{4}$$

In formula (4), h_a represents the a-th element of the sampling layer; ϖ_h represents the size of the sampling core; k_a represents the pool area corresponding to h_a. If more experimental samples can be used for experimental verification, the accuracy of the final results will be higher.

3 Experimental Research

3.1 Acquisition and Processing of the Experimental Data

To verify the effectiveness of the design method, teaching data was collected for experimental testing from four levels: teaching preparation, knowledge and skills, teaching interaction and teaching feedback.The experiment was 562 students taking a higher math course in a university.In order to ensure the reliability and effectiveness of teaching quality evaluation index, test reliability and validity.This paper performs reliability tests using the "Cronbach a" coefficient method, and the following results can be obtained (Table 3):

According to the results of the reliability test, the Alpha for the Cronbach of this data collection was 0.838, and the Alpha was 0.841 for the Cronbach based on the normalization term. The reliability coefficient above 0.8 indicates that the overall reliability

Table 3. Results of the reliability tests for the collected data

Test times	Alpha, of the Cronbach	Alpha of Cronbach based on the normalization term
1	0.814	0.842
2	0.857	0.875
3	0.828	0.858
4	0.855	0.866
5	0.846	0.833
6	0.802	0.805
7	0.837	0.824
8	0.864	0.858
9	0.828	0.816
10	0.851	0.829

Table 4. The validity test results of the collected data

Test times	KMO coefficient	Test times	KMO coefficient
1	0.892	6	0.893
2	0.904	7	0.895
3	0.918	8	0.882
4	0.905	9	0.871
5	0.886	10	0.864

of the data is good, and the corresponding results are consistent, which can reflect the reliability of the measured index (Table 4).

According to the results of the structural validity test, the KMO coefficient of the data collected was 0.891. In general, the KMO coefficient greater than 0.8 reaches the degree of factor analysis, which can evaluate and measure the model as input data. According to the reliability and validity test results, it can be proved that the above data collected in this paper are effective, and on this basis, specific teaching quality evaluation can be carried out.

3.2 Experimental Results

The weight results of evaluation indicators are as follows (Table 5).

A total of 1000 groups, 800 groups were used to train the model to obtain the optimized model structure.The evaluation results of higher mathematics teaching quality output based on hierarchical analysis method are compared with those based on improved GA-BP neural network and those based on active learning SVM, the results are as follows (Table 6).

Table 5. Weight of the evaluation indicators

Symbol	Weight	Symbol	Weight
A1	0.1621	B1	0.0082
		B2	0.0075
		B3	0.0091
A2	0.4172	B4	0.1025
		B5	0.1046
		B6	0.1124
		B7	0.1238
		B8	0.1331
A3	0.3903	B9	0.0809
		B10	0.1106
		B11	0.1022
		B12	0.0827
		B13	0.0048
A4	0.0304	B14	0.0032
		B15	0.0027
		B16	0.0117

Table 6. Evaluation accuracy is compared with (%)

The number of experiments	Evaluation method based on the hierarchical analysis method	An evaluation method based on the improved GA-BP neural network	Evaluation method based on the active learning of SVM
1	97.44	84.04	87.44
2	96.87	88.48	88.87
3	97.58	86.55	85.68
4	98.65	87.66	84.96
5	96.26	85.25	91.85
6	95.53	86.32	90.72
7	96.95	88.53	88.53
8	97.63	85.05	87.65
9	98.52	86.81	88.22
10	97.21	89.57	86.01

It can be seen from the above that the average evaluation accuracy rate of the design method is 97.26%, which is 10.43% and 9.27% higher than the other two methods. It can be proved that the design method has better evaluation effect on higher mathematics teaching quality.

4 Conclusion

In the current educational environment, the way of learning and teachers are teaching changes dramatically, which is more reflected by the epidemic in 2020. Therefore, the new teaching reform standards put forward new requirements for higher mathematics teaching. However, the traditional method is difficult to ensure the accuracy of quality evaluation. In order to solve this problem, this paper designs a new evaluation method. After testing, the average evaluation accuracy of this method is 97.26%, which is 10.43% and 9.27% higher than the other two evaluation methods. It is more scientific and feasible. In the process of analyzing the indicators of online and offline mixed teaching of higher mathematics, this study uses the literature analysis method to investigate and interview some teachers. Therefore, the composition of the indicator system still contains the subjective factors of the author. This needs to be slowly tested and popularized in future practice. At the same time, teaching quality evaluation is a complex topic, and a few evaluation indicators will restrict the accuracy of evaluation methods and evaluation results. Therefore, in the next research process, more quality evaluation indicator systems will be designed to make the evaluation content more comprehensive and give more accurate quantitative scores, and comprehensively evaluate teachers' teaching attitude, teaching content and methods, teaching effects and teaching concepts; It is also necessary to expand the evaluation subject as much as possible, so that the evaluation subject includes education departments, education supervision departments, teachers, professionals and students. Finally, we need to adhere to the principles of objective, objectivity, comprehensiveness, mutual independence and operability when constructing the education quality evaluation indicators.

The objective principle means that the evaluation index must be set in strict accordance with the evaluation purpose. Since the purpose of any teaching mode is to promote the teaching quality, it should also be guided by this purpose when constructing the index; The principle of objectivity means that the formulation of indicators must be able to grasp the essence and connotation of teaching and objectively reflect the law of mixed teaching; The principle of comprehensiveness means that the index should not only reflect one aspect of teaching, but should reflect the whole picture of the teaching mode from different angles; The principle of mutual independence means that the indicators with low correlation should be selected as far as possible, so that the indicators are mutually exclusive and complementary; The principle of operability means that the determined indicators should be simplified as much as possible under the premise of ensuring the accuracy as possible, so as to facilitate the acquisition of relevant data. In addition, the index weight must be scientifically formulated in the process of selecting the index. This paper has considered the above aspects, so it has achieved a good teaching quality evaluation effect. In the future, it will continue to start from the above aspects and continue to conduct in-depth research to improve the teaching quality of Higher Mathematics together.

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An Intelligent Evaluation Method of MOOC Learning Efficiency Based on Koch Model

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Abstract. In view of the poor application effect of current MOOC learning efficiency evaluation methods, this study proposed an intelligent evaluation method of MOOC learning efficiency based on Corleone model. Firstly, corleone model is used to select evaluation indexes of MOOC learning efficiency, and an intelligent evaluation system of teaching learning efficiency is constructed. Then optimize the teaching efficiency intelligent assessment steps. The experimental results show that the method has high practicability and accuracy in practical application, and the students can master the knowledge better after applying the method.

Keywords: Kirkpatrick's model · Mu class learning · Index system · Efficiency evaluation

1 Introduction

With the development of economic globalization, Hyundai faces more and more fierce market competition and personalized needs of customers. Only through continuous training can the competitiveness be improved. Therefore, a lot of money, time and manpower have been invested in training. The question is whether training can effectively improve the quality and work efficiency of employees and achieve the expected results. This economic input-output analysis must be carefully considered [1].

It is an important content in learning theory to measure the learning effect of individuals based on the Korotkoff model. MOOC education has the characteristics of adult education and vocational education, and has its own uniqueness in teaching objects, teaching objectives, teaching methods, teaching organization, and evaluation. With the gradual expansion of education in China, how to construct a course learning effect evaluation mechanism that conforms to the characteristics of students is of great value to ensure the quality of teaching and improve the social reputation of educational programs. Obviously, the intelligent assessment of MOOC learning efficiency is an important measure and means to test the effect and quality of training, but it is also the most important and difficult link in the training cycle [2].

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At present, intelligent evaluation methods for MOOCs learning efficiency are generally ineffective, such as big data-based MOOC learning efficiency evaluation methods and cloud model-based MOOC learning efficiency evaluation methods. The reasons for this are as follows: First, estimates can be influenced by many variables; Second, the assessment may be influenced by students' trust in the teacher; Thirdly, the sensitivity of teachers to students' response and the political factors of the organization will affect the evaluation effect to varying degrees.

To solve the above problems, this study designed an intelligent evaluation method of MOOC learning efficiency based on Koch model. Based on the systematic analysis of MOOC learning management process, this method builds a set of indicators to meet the needs of evaluation, so as to promote scientific and standardized training evaluation and improve the quality and efficiency of evaluation.

2 Intelligent Evaluation Method of MOOC Learning Efficiency

2.1 Collection of MOOC Learning Efficiency

Kirkpatrick takes the trainees as the object of evaluation. According to the depth and difficulty of evaluation, the training effect is divided into four progressive levels, namely reaction level, learning level, behavior level and result level [3]. Among them, the most representative is Koch's four-level assessment model. Assessment refers to students' opinions on training programs, including their views on learning materials, teachers, teaching methods, content, environment and organization. Secondary assessment (learning level assessment) is the most common and commonly used parity method at present. It measures students' mastery of knowledge and skills. The three-level evaluation (behavior level evaluation) occurs after the training project. The superior, colleagues, subordinates or customers observe whether the trainees' behaviors are different before and after the training, and whether they have applied the knowledge learned in the training to improve their work performance. Level 4 assessment rises to the height of the organization, that is, whether the organization operates better because of training can be measured by some indicators.

Based on this, the structure of Kirkpatrick's four-level training evaluation model is analyzed, as shown in Table 1.

Table 1. Korotkoff four-level training evaluation model

Evaluation level	primary coverage	Assessable issues	Evaluation method
Level 1 assessment: reaction layer	Observe participants' reaction	Did the trainees like the training course? Is the course useful to you; What's your opinion on teachers and training facilities;	Questionnaire, questionnaire and interview

(*continued*)

Table 1. (*continued*)

Evaluation level	primary coverage	Assessable issues	Evaluation method
Level 2 assessment: learning level	Check learning results	What did the trainees learn from the training program;How much did the trainees improve their knowledge and skills before and after the training?	Questionnaire, written examination, case study
Level 3 assessment: behavioral level	Measure performance before and after training	Has the student's behavior changed? Can the trainees use the training knowledge in their work?	360 performance appraisal, testing and observation
Level IV evaluation: result level	Measuring changes in the company's operating performance	Is the impact of behavior change on the organization positive?	Investigate the accident rate, production efficiency and economic benefits

Kirkpatrick's training evaluation model has been widely recognized in the West and has certain technological advancement [4]. However, this model focuses on qualitative research on training evaluation, and has great limitations in training practice.

In order to solve this problem, this paper is guided by the four-level evaluation model of Koch, combined with the implementation and management process of the mid-level management personnel training program, according to the needs of the trainees and the needs of the trainees, using scientific theories and systematic analysis methods, from the response The analysis and research are carried out layer by layer at four levels: layer, learning layer, behavior layer and result layer to determine the corresponding evaluation methods and evaluation indicators. For the design of information technology teaching reform in the context of MOOCs, it is necessary to activate the MOOC perspective, so that MOOCs play a leading role in teaching reform [5]. The content is introduced into the teaching curriculum, the use of large-scale open online courses to integrate educational resources, improve the professional quality of teachers, adjust teaching methods, and carry out MOOC teaching activities.

At present, the design of information technology teaching reform is still based on teachers' teaching, under the active guidance of teachers to activate students' perspective of MOOC [6]. The first mock exam is to improve the traditional teaching mode, and to introduce the content of MOOC into the teaching courses. Combining theory teaching with practice teaching not only enriches the teaching contents, but also ensures the diversification of information technology teaching. Activate the perspective of Mu class from the perspective of students and cultivate students' interest in the teaching content of information technology under the background of Mu class; Activating the teaching perspective from the perspective of teachers can greatly improve teachers' ability of information technology teaching, timely adjust teaching means according to the development trend of various industries in society, and integrate educational resources by using large-scale open online courses. Mu class teaching model is a teaching model biased towards science. According to the connotation of Mu class, constructivist learning theory and systematic teaching design theory, the theoretical basis is added on the basis of the implementation of Mu class, the specific process of classroom teaching is refined, and a more perfect Mu class teaching model is constructed, as shown in Fig. 1.

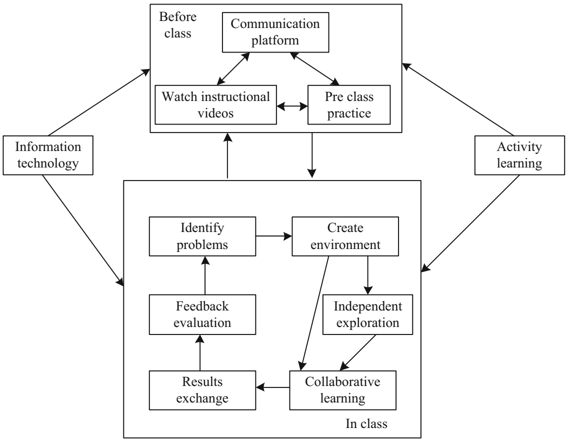

Fig. 1. MOOC learning teaching model

Inheritance and development of MOOC learning teaching model. The teaching model just stays on the main process of teaching and lacks the support of teaching theory. In addition to adding the support of teaching theory, it further refines the two teaching processes in the pre-class and class [7]. On the basis of the original two parts, the pre-class lesson is divided into three parts: "watching teaching video", "platform communication" and "pre-class practice". These three parts are further divided into six parts: "problem determination", "environment creation", "independent exploration", "collaborative learning", "achievement exchange" and "feedback evaluation".

From the perspective of classroom teaching, we will find that due to the universality of this model, the pertinence of its discipline and education level is not strong. If it is used to evaluate the quality of subject courses, it needs to be further processed [8]. The teaching process is generally divided into four parts: checking preview and introducing new courses; Learning the content of the text; Knowledge consolidation and expansion. Compared with the traditional classroom, the flipped classroom is more efficient, intuitive, highly oriented and predictable in the pre class stage, so students have a deeper understanding of what they have learned. Teachers only need to make comments in the link of "checking preview and introducing new courses". When learning each course, teachers should first grasp the context of the teaching design of each article, grasp the key problems and link them, that is, the "determined problems" mentioned in the model.

The design of the model is biased towards science teaching. In science teaching, there will be a single goal in each class. The explanation, application and scope of application will be discussed around this goal. Moreover, in the classroom teaching, each class will reflect the three-dimensional objectives of the new curriculum. Then, under the guidance of three-dimensional objectives, the teaching will produce a main line of explanation, and this main line will include all knowledge points. So far, this class teaching is perfect. "Check and preview, introduce new courses", "learning of text content" and "knowledge consolidation and expansion" are taken as the secondary indicators of evaluation, which are clearly reflected in the teaching model.

2.2 Construction of an Intelligent Evaluation System for Learning Efficiency

The student's learning state index corresponds to three secondary indexes, namely emotional state index, communication state index and participation state index. The emotional state in the secondary indicator corresponds to three tertiary indicators of unquantifiable facial expressions, voice expressions, and gesture expressions; the communication state in the secondary indicator corresponds to the tertiary indicator of whether students are willing to participate in group learning; participation in the secondary indicator the status corresponds to four three-level indicators: the number of class attendance, the number of students looking up at the blackboard, the situation of the students themselves asking questions, and the number of face-to-face exchanges between the students themselves and teachers. The quality of the evaluation index system is the premise of the success of teaching quality evaluation. Among them, facial expressions, voice expressions, and action expressions in the three-level indicators can be obtained instantly by computer through emotional calculation. Other part of the three-level indicators can be calculated by computer in real time and fed back to teachers, and can also be observed and recorded by the evaluator by the on-site observation method. The distribution of secondary and tertiary indicators under the specific learning state indicators is shown in Fig. 2.

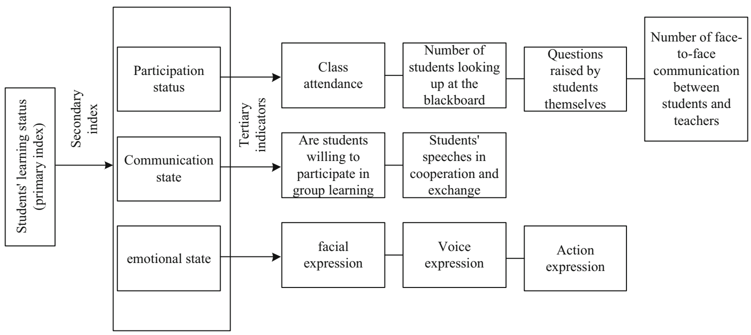

Fig. 2. Student's learning status indicator system

The three secondary indicators corresponding to students' learning level are students' expression, students' degree of thinking, and whether students have the courage to explore. Among them, the second level indicator is the sum of the number of times students answer questions, which corresponds to the third level indicator; The degree of students' thinking about problems in the secondary indicators corresponds to the two tertiary indicators: whether students can put forward different views and whether students dare to question; Whether the students in the secondary indicators have the courage to explore the corresponding two tertiary indicators: hands-on ability and practical ability. The distribution of specific students' learning level index system is shown in Fig. 3.

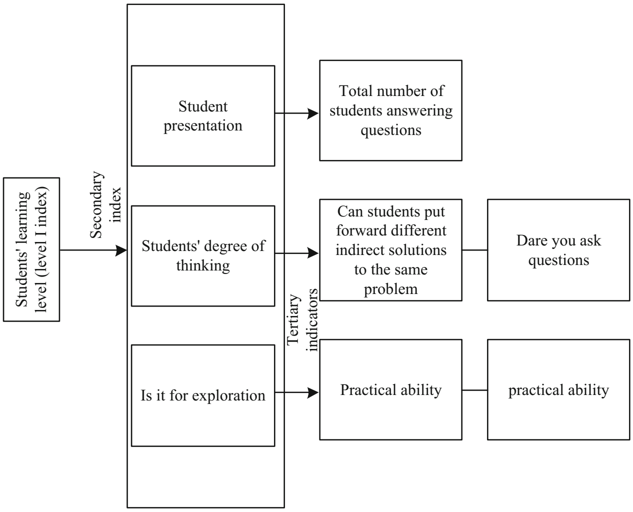

Fig. 3. Students' learning level indicator system

Before the comprehensive evaluation of online learning efficiency, the evaluation set is first determined by the expert group, which mainly evaluates (comments) on each factor of learning efficiency evaluation [9]. The evaluation of each factor can be divided into multiple levels, and the specific evaluation and modeling are related to the goal to be achieved. Suppose the comments of each factor are m grades, which constitutes the judgment set $V = \{V_1, V_2, ..., V_m\}$. All factors in this model use five grades of comments: high efficiency, high efficiency, medium efficiency, low efficiency and very low efficiency, which are recorded as:

$$p_{ij} = (1 + V) / \sum_{i=1}^{m} \left(1 + r_{ij}\right) - m \tag{1}$$

The entropy weight of the comprehensive available online English learning efficiency evaluation index is r_{ij}. In order to evaluate and investigate the five major factors that affect the efficiency of online learning, the degree of influence of each factor is divided into five levels: very high, high, medium, low, and very low [10]. The mean value of each survey influencing factor is taken as the influence rate of a certain student, and the specific content is shown in Table 2.

Table 2. Statistics that affect the efficiency of online learning

Influence factor	Very high	High	Secondary	Low	Very low
S1	0.2314	0.3526	0.3452	0.0798	0.2510
S2	0.2435	0.4565	0.2865	0.0389	0.0136
S3	0.1705	0.4465	0.3515	0.0435	0.0101
S4	0.2565	0.4135	0.2985	0.0535	0.0101
S5	0.2215	0.3256	0.3565	0.0568	0.0135

The single factor fuzzy evaluation matrix can be determined after the relevant data are obtained from the survey. Then, according to Corleone model, the MOOC teaching quality evaluation is divided into four parts: input evaluation, process evaluation, feedback evaluation and result evaluation. Among them:

Input evaluation part mainly evaluates the initial level before the MOOC starts by collecting information such as students, teachers, teaching environment and facility support;

Process evaluation part mainly evaluates the performance and teaching activities of students and teachers in the MOOC learning process, and objectively reflects The efficiency and quality of MOOC teaching practice;

Feedback evaluation part mainly reflects their satisfaction with the MOOC teaching effect by evaluating the subjective feedback of students and teachers after the course;

Outcome evaluation part mainly evaluates the objective results after the MOOC course, Compare initial input and subjective feedback to provide valuable improvements.

The specific evaluation index system is shown in Table 3.

Table 3. The index system of MOOC teaching quality evaluation based on Korotkoff model

Classification	Primary index	Secondary index	Specific indicators (examples)
Input evaluation	Teaching preparation	Teachers' ability and willingness	Understanding of MOOC teaching Frontiers
		Students' ability and willingness	Subjective questions involved in MOOC learning
		Teaching management and facility investment	Matching degree of development courses with MOOC teaching model

(*continued*)

Table 3. (*continued*)

Classification	Primary index	Secondary index	Specific indicators (examples)
Process evaluation	Teaching process	Student performance	Do students participate in online courses with quality and quantity
		Teacher performance	Production level of online courses
		Teaching management performance	Can we timely absorb the opinions and suggestions of teachers and students and make targeted adjustments
		Interactive performance	Online interaction enthusiasm of teachers and students
Reflection evaluation	Teaching feedback	Student feedback	Feedback on MOOC teachers' teaching level after the course
		Teacher feedback	Feedback on students' learning level after the course
Outcome evaluation	Teaching achievements	Student growth	Degree of self-awareness
		Teacher growth	Cumulative teaching experience

The original data of assessment and evaluation is the assessment content that the evaluation object fills in the results of his actual work or study according to the evaluation and evaluation system, plus the evaluation object and the assessment to form a piece of original data for the assessment and evaluation. The formal definition of the assessment and evaluation raw data is $\mathrm{OD} = (\mathrm{Object}, \mathrm{C}, \ \mathrm{Content})$, where OD is the assessment and evaluation original data, Object is the assessment object, C is the assessment, and Content is the assessment content filled in by the assessment Object. The assessment and evaluation raw data collection method M. As follows: First, determine the specific evaluation relationship according to the evaluation relationship model corresponding to the evaluation model, that is, determine who should fill in the original data of the evaluation and evaluation, and then, the evaluation object fills in the results of his actual work or learning according to the evaluation and evaluation system. For the assessment content, the software system finally stores the assessment and evaluation raw data in the database. The processing method Ma of the assessment and evaluation raw data is as follows: Summarize the assessment and evaluation raw data of the same evaluation object, and calculate the value of the evaluation object in each evaluation object according to formula (3, 4). The workload on the assessment, and then add up the workload on each assessment to get the total workload, thus forming the assessment result, as shown below:

$$w = p_{ij} + \sum_{i=1}^{n} w_i \times q_i \tag{2}$$

The primary index of process evaluation index is mainly divided into three aspects: teaching design, teaching process and teaching effect. Using the fuzzy Kirkpatrick's model and according to the scores given by the expert group, the fuzzy consistency is established through definition 2:

$$A = \begin{pmatrix} 0.5 & 0.3 & 0.7 \\ 0.7 & 0.5 & 0.9 \\ 0.3 & 0.1 & 0.5 \end{pmatrix} \tag{3}$$

The specific method of constructing the judgment matrix: take the criterion, that is, each element with downward subordinate relationship as the first element of the judgment matrix, place it in the upper left corner, and then arrange the elements belonging to it in the following first column and first row in order. The method usually used to fill in the judgment matrix: repeatedly ask the expert as the filling person for many times, According to the criteria of the judgment matrix, the elements are compared in pairs, the important elements are selected, and their importance degree is evaluated. The importance degree is assigned according to 1–9 using the importance scale value table (see Table 4 for the importance scale value).

Table 4. Ratio scale

Factor ratio factor	Quantized value
As important as	1
It's a little important	3
Very important	5
Very important	7
Extremely important	9
Intermediate values of two adjacent judgments 2, 4, 6, 8	

Apply necessary mathematical methods to rank the judgment matrix filled in by experts. The hierarchical single ordering is essentially the calculation of the weight vector, which refers to the calculation of the relative weight of each factor in each judgment matrix for its criterion. The weight vector has the sum method, the power method, the root method, etc. matrix, and the desired weight is obtained by normalizing each column of it. For the judgment matrix with non-consistency, the result obtained by normalizing each column is only approximate to the corresponding weight, and the arithmetic mean of the n column vectors needs to be calculated as the final weight. The corresponding formula is:

$$W_i = \frac{1}{n} - A \sum_{j=1}^{n} \frac{w}{\sum_{k=1}^{n} a_{kl}} \tag{4}$$

In some special cases, the judgment matrix can have consistency and transitivity. Generally, this property does not require the judgment matrix to be strictly satisfied. However, a correct ranking of the importance of judgment matrix needs a certain logical law from the perspective of human cognitive law. Therefore, in the process of practice, the judgment matrix requirements generally meet the consistency, and the consistency test is required. Only when the judgment matrix passes the test, can it be logically reasonable, and then continue to analyze the results.

2.3 Realization of Intelligent Evaluation of MOOC Learning Efficiency

Phillips' five-layer evaluation model is a more representative one in the improvement of the Korotkoff model. Jack Phillips is as famous as Donald Kirkpatrick in the field of training evaluation. Phillips believes that since the training usually only counts data such as cost, time, personnel, and achievements, it does not prove how much value the training brings to the organization and the return on investment brought by training, which is what policymakers are concerned about. Therefore, Phillips The fifth layer of return on investment is added to the original model, trying to convert the training results into specific benefits and returns. Kirkpatrick recognizes the supplement of the fifth layer to a certain extent, but it is difficult to directly convert the training results into monetary values, and a sufficient practical foundation is still needed. The evaluation model designed by Phillips is shown in Fig. 4.

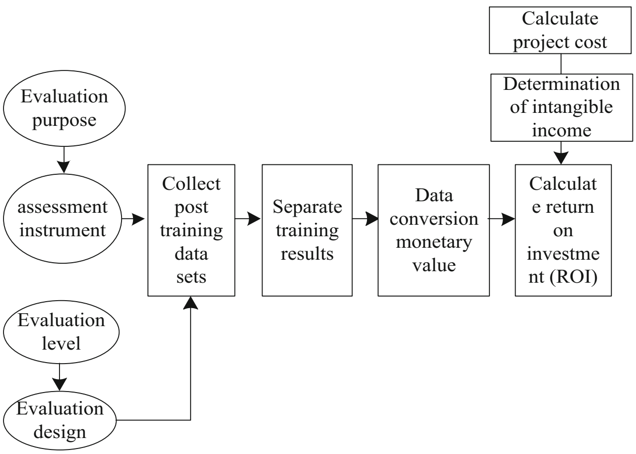

Fig. 4. Assessment and evaluation model

In the instantiation method, it is necessary to call the appraisal system creation method, appraisal original data collection method, appraisal original data processing method and appraisal result display method. The process evaluation model is shown in Fig. 5.

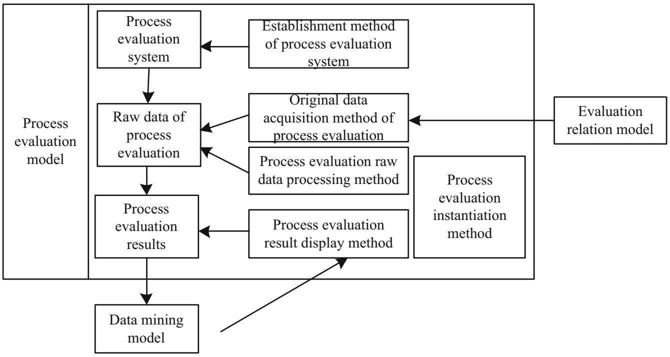

Fig. 5. Process evaluation model

The evaluation model abstracts and describes the procedural (formative) evaluation in the pluralistic evaluation. As shown in Fig. 6.

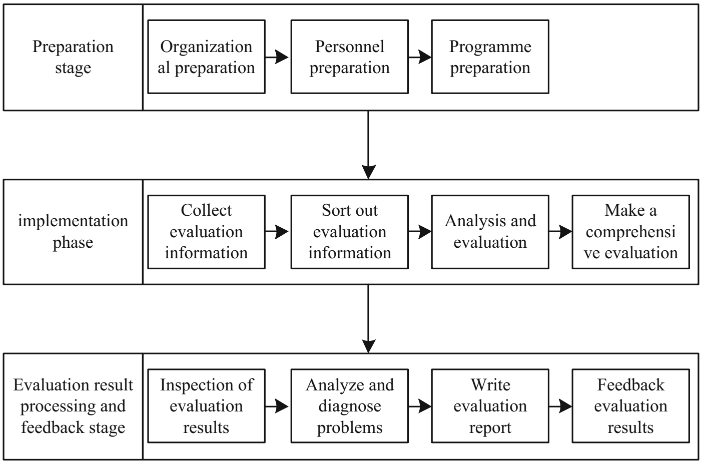

Fig. 6. Process of diversified teacher evaluation

The process evaluation model includes process evaluation system and its creation method, process evaluation raw data and its collection and processing method, process evaluation results and their display method, and process evaluation instantiation method.

Among them, data mining model and evaluation relationship model do not belong to process evaluation model. They are preparation stage, implementation stage and evaluation result processing and feedback stage respectively. Evaluation preparation stage is the initial link of evaluation activities. Sufficient preparation in this stage will lay a good foundation for follow-up work and ensure the smooth progress of evaluation work. This stage mainly includes organizational preparation, personnel preparation and program preparation. Among them, organizational preparation and personnel preparation are mainly to organize the evaluation implementers to study theory and complete the evaluation work scientifically and correctly. Scheme preparation is the core part of this stage, and the main task is to determine the evaluation model.

This research adopts the Korotkoff model to establish an evaluation model that meets the evaluation objectives and suits the evaluation object on the basis of the existing evaluation system. The processing and feedback of the evaluation results are the last stage. This stage is mainly to extract useful information from the evaluation results through data mining tools, which can analyze and diagnose problems in teaching, help leaders to make relevant decisions, and can also motivate the evaluated objects to continuously improve and perfect themselves. The process of diversified evaluation is closely linked and closely linked. By collecting evaluation data, processing evaluation data, and analyzing evaluation data, feedback is given to leading decision-makers in an intuitive form.

3 Analysis of Experimental Results

In order to verify the application performance of the intelligent evaluation method of MOOC learning efficiency based on the Korotkoff model, the following experiments are designed.

First, the scores of each dimension of the excellent group and the ordinary group using the MOOC model are listed in Table 5.

Table 5. The mean and standard deviation of the excellent group and the ordinary group in four dimensions

	Excellent group	General group
Dimension A	3.65 ± 0.18	0.71 ± 0.81
Dimension B	3.71 ± 0.35	0.91 ± 1.05
Dimension C	3.68 ± 0.15	2.25 ± 0.85
Dimension D	2.95 ± 0.61	1.65 ± 0.31

Through repeated measurement and analysis of the data in Table 5, the main effect of classroom type is significant (P = 143.6p (0.001). The score of excellent Mu class teaching is significantly higher than that of ordinary Mu class teaching, and the main effect of each dimension is significant ($25.6 < 0.001$), that is, there are significant differences in the scores of each dimension. The interaction between classroom type and each dimension is significant. The specific results are shown in Fig. 7.

The scores of the excellent group in all four dimensions are significantly higher than those of the ordinary excellent group. The excellent group scored higher in micro-video, self-learning task list, and teaching behavior, and lower in student behavior, but

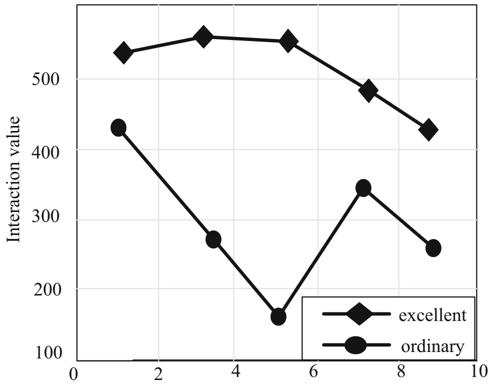

Fig. 7. Interaction between the excellent group and the ordinary group in four dimensions

overall there was little change. Comparing the scores of the ordinary group on the four dimensions, it can be found that the ordinary group has little changes in micro-video and teacher behavior, and has a lower score in the self-learning task.

In the gap between the excellent group and the ordinary group in the autonomous learning task unilateral analysis, the reason for the difference between the excellent group and the ordinary group in the "autonomous learning task list" is due to the inconsistency of the teaching sequence after the flip. In view of the improvement of teachers' teaching methods, it is necessary to refine the teaching time and strengthen the effective interaction between teachers and students. Following the teaching reform concept of the 19th National Congress of the Communist Party of China can promote the teaching system to adapt to the current teaching policy reform.

On this basis, the traditional assessment method is compared with the method in this paper to analyze the ability of students to master information technology by different methods. The results are shown in Table 6. Among them, the two evaluation methods are Traditional method 1 based on big data and Traditional method 2 based on cloud model.

Table 6. Comparative results of different assessment methods on students' information technology mastery

	Experiment group	Improper teaching schedule	Less interaction between teachers and students	Mastery/%
Traditional method 1	A	Nothing	Have	41
	B	Have	Nothing	36
	C	Nothing	Nothing	63

(*continued*)

Table 6. (*continued*)

	Experiment group	Improper teaching schedule	Less interaction between teachers and students	Mastery/%
	D	Have	Have	11
Traditional method 2	A	Have	Have	64
	B	Have	Nothing	38
	C	Nothing	Nothing	60
	D	Have	Have	11
This paper method	A	Have	Have	74
	B	Nothing	Have	73
	C	Have	Nothing	86
	D	Nothing	Nothing	61

By analyzing the results in Table 6, it can be seen that there is a great difference between the three methods on students' information technology mastery. In contrast, the method in this paper has better grasp ability. To expand the analysis, improving teaching methods can improve students' ability to master information technology. In traditional classroom teaching, the order of teaching is teaching before learning. The mooC teaching method has changed the traditional teaching method.

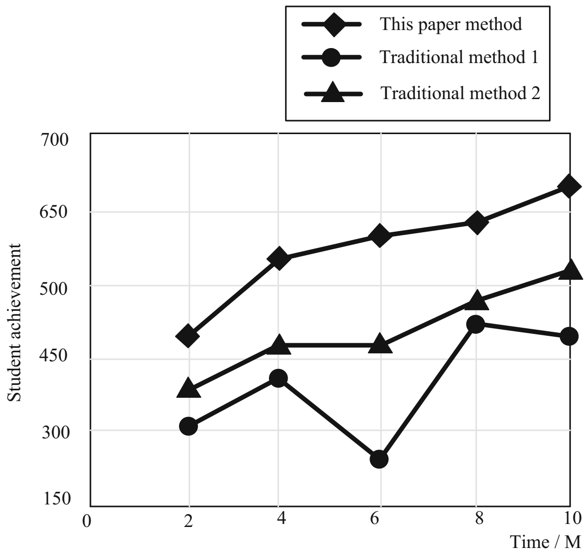

Fig. 8. Comparison of teaching effects under different methods

The full mark of the student's total subject score is set at 700. The advantages of this approach can be seen more clearly in Fig. 7.

Analysis of the results shown in Fig. 8 shows that the application of the method in this paper can improve students' scores, because the intelligent evaluation method of MOOC learning efficiency designed in this paper can effectively analyze MOOC learning efficiency, so as to make intelligent adjustments to the learning progress according to the analysis results.

4 Conclusion

As a widely used training effect evaluation model, Kirkpatrick's model has internal consistency between its evaluation idea and the requirements of students' multiple balance. In order to improve the evaluation of curriculum effect, this study is carried out from four aspects: response, learning, behavior and result.

In the future research, further optimization will be carried out from the following aspects: first, MOOC education should not be greedy for more and faster, but should follow the teaching value orientation and scientifically build a high-quality course platform; Second, we should pay attention to the connection between teaching materials and courses, and design the teaching objectives of classification and stratification; Third, urge students to learn independently before and during class, and encourage students to share and feedback communication, so as to improve students' autonomous learning efficiency and self-confidence.

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