University Teaching Quality Evaluation Technology Based on OLAP and SVM Algorithm

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Abstract. The focus of this research is to develop a new technology based on OLAP and SVM algorithm to evaluate the quality of university teaching. The main goal of this study is to find the best technology to measure the quality of teaching. This study will use descriptive statistics, correlation coefficient, regression analysis and cluster analysis and other data analysis techniques. The final results will be used to develop an effective evaluation system, which can measure the effectiveness of University Teachers' contributions to students' learning. In the research, we try to use OLAP and SVM algorithms to improve the quality of teaching evaluation. First, we used a large number of student data from different universities in China. We collect data from more than 20 universities every semester. Then, we build a large OLAP database based on this data set (about 1million records), which can be used as the input of SVM algorithm. Next, we designed three types of artificial neural network (ANN) models based on previous research. This method can be used for both undergraduate and graduate students. The results of this study will help universities evaluate their teaching quality, which will enable them to improve their teaching quality.

Keywords: College teaching · SVM algorithm · OLAP · Evaluation system

1 Introduction

Computer information technology has been applied to more and more colleges and universities and personal management business, which brings great convenience to various management of colleges and universities. At present, the efficiency of teaching evaluation management in most colleges and universities is very low, the management of information related to teaching evaluation cannot be effectively managed, and there are many flaws in a series of processes of teaching evaluation information management. Therefore, it is urgent to use the teaching evaluation system to assist colleges and universities to scientifically manage and control the information related to teaching evaluation, so as to improve the efficiency of teaching evaluation management [1], The purpose of scientific, accurate and convenient management teaching evaluation.

Teaching evaluation system is an indispensable part of a school. Its content is very important for school managers, so it should be able to provide users with sufficient

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information and fast query means. However, people have been using the traditional manual method to manage the relevant teaching evaluation information. This management method has many shortcomings, such as low efficiency and poor confidentiality. In addition, over time, a large number of documents and data will be generated, which brings a lot of difficulties to find, update and maintain.

It is required to investigate the teaching evaluation management platform and select the appropriate programming language and database management system. The whole system can be logically divided into data addition, deletion, modification and query functions.

The system manages different user roles according to their permissions. The main functions provided by the system for students' roles include personal information maintenance, teachers' teaching evaluation, and viewing their own evaluation information; It provides teachers with the ability to view the curriculum of their courses and their own evaluation information, evaluate students, view and manage class evaluation information; The functions provided for administrators (background users) include viewing and managing all departments, majors, courses, students, teachers' teaching evaluation information, class evaluation information management, and teachers' information. Through these management modules, we can effectively improve the management level of teaching evaluation. Based on this, this paper studies the evaluation technology of college teaching quality based on OLAP and SVM algorithm.

2 Related Work

2.1 SVM Algorithm

Support vector machine (SVM) is an important algorithm of statistical machine learning. It is a new machine learning method based on the statistical learning theory and the principle of structural risk minimization. It can effectively solve the problems of high dimension and nonlinearity, and effectively carry out classification and regression. Compared with other classifiers, SVM has better generalization [2].

The essence of SVM algorithm is to classify the collected two sample groups into two categories, which are expressed by the positive and negative values of kernel function respectively, and isolate the positive and negative categories. That is, the distance between heterogeneous vectors closest to the hyperplane is the largest. Figure 1 below shows the intuitive understanding of SVM algorithm.

In the figure, there are some two-dimensional data points and three straight lines belonging to two categories respectively. If the three straight lines represent three classifiers respectively, which classifier is better?

We should think that the answer is H3 by intuition. First of all, H1 can't separate categories, and this classifier is definitely not good; H2 is OK, but the separation line is only a small distance from the nearest data point. If the test data has some noise, it may be misclassified by H2 (that is, it is sensitive to noise and has weak generalization ability). H3 separates them at large intervals, so that it can tolerate some noise of the test data and classify correctly. It is a classifier with good generalization ability.

$$\min f(x_1, x_2, ..., x_n) = \frac{1}{m} \sum_{i=1}^{m} \left[Y_i^0 - Y_i \right]^2 \tag{1}$$

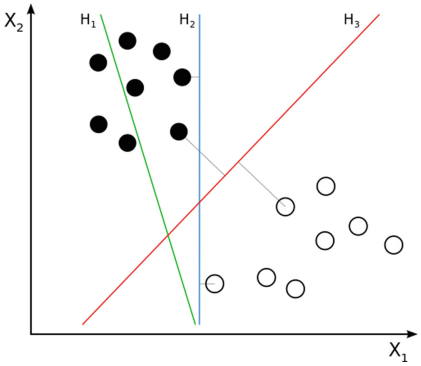

Fig. 1. Intuitive understanding of SVM algorithm

$$\Delta w(i, y) = -\eta \frac{\partial e}{\partial w(i, y)} \tag{2}$$

For support vector machine, if the data points are p-dimensional vectors, we use the hyperplane ° of P-1 dimension to separate these points. But there may be many hyperplanes that can classify data. A reasonable choice of the optimal hyperplane is the hyperplane that separates the two classes at the maximum interval. Therefore, SVM selects the hyperplane that can maximize the distance from the nearest data point to the hyperplane.

2.2 Teaching Evaluation

This paper analyzes the requirements of university subject core literacy on university classroom teaching, and based on the existing evaluation tools and expert interview results, constructs an index system. The index system is composed of six first-class indicators, which are "teaching objectives", "teaching content", "teaching organization", "teacher-student communication", "cognitive needs" and "literacy cultivation". Each index corresponds to three observation points, When establishing the weight, the analytic hierarchy process is used to assign values to each index. The evaluation index system constructed has fewer observation points and strong operability, but the effectiveness of evaluating core literacy is low. The three observation points of the "teaching organization" index are "whether the teaching language is clear and standardized", "whether the teaching methods are flexible and effective" and "whether the questioning and feedback are effective and timely" [3]. The determination of the observation points reflects the scientific concept, and there is no detailed description of how the index system reflects the core quality of disciplines in Colleges and universities.

The evaluation index system is completely constructed. In the process of construction, the requirements of the core quality of disciplines in Colleges and universities are combined, the core quality of disciplines in Colleges and universities is fully penetrated, and the classroom evaluation index system is transformed into the opinions of questionnaire survey experts on each index. After several rounds of expert opinion consultation,

the correction of the index system is completed, and then the weight of each index system is constructed by logarithmic weighting method [4]. Finally, the developed evaluation index system is composed of two-level indicators and twenty evaluation standards. The evaluation index system constructed by this research institute comprehensively and accurately reflects the requirements of core literacy, as shown in Fig. 2:

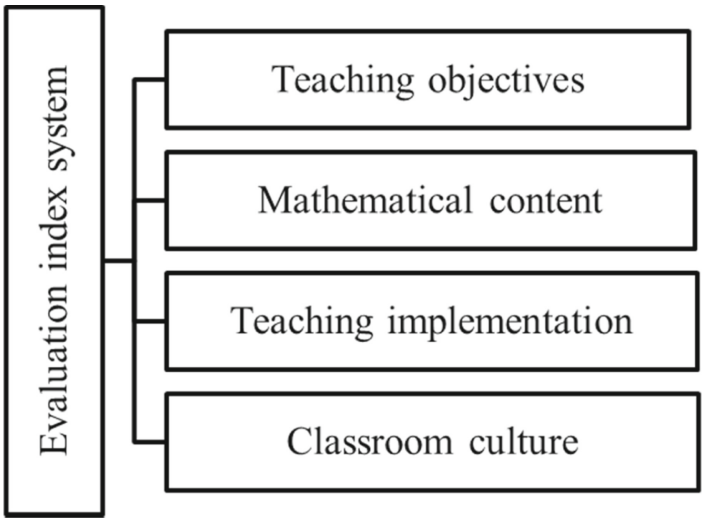

Fig. 2. Classroom evaluation system in Colleges and Universities

Through the multi-level evaluation form of the classroom evaluation scoring system (class) and the research of various scholars, it can be found that the classroom evaluation index system established by different scholars from different angles is different, but through the analysis, it can be found that the establishment of the index can be mainly divided into two perspectives. The first is from the perspective of teachers and classrooms: teachers should fully analyze the teaching content of this class before class to determine what abilities to develop students What qualities to cultivate students, etc. In classroom teaching, teachers should pay attention to the construction of students' thinking and communicate with students more. Second, from the perspective of students: what abilities students want to develop through this class, and whether students' abilities have been developed through the guidance of teachers [5]. But no matter from which angle, the ultimate goal is to implement students' core qualities and provide scientific guidance for teachers to adjust their teaching behavior through evaluation.

3 Research on University Teaching Quality Evaluation Technology Based on OLAP and SVM Algorithm

In the traditional teaching mode, only in the formal, open and strict teaching activities such as classroom teaching competitions, combined with student feedback, can the

expert group give a more authoritative performance evaluation, so as to evaluate the teaching quality of a teacher or a class relatively accurately. However, in daily teaching activities, there is no condition to conduct a perfect evaluation of each teaching activity through an expert group, and a complete quality evaluation of a course from beginning to end naturally cannot be achieved. Teachers can understand the requirements of learning for teaching content through the teacher-side educational administration system, which can not only break the limitations of time and space, but also facilitate the school's management of teachers. Performance management performance management is actually to input the students' academic achievements of various disciplines in the teaching system [6]. There are many kinds of disciplines of college students, and the statistics of examination results is a very cumbersome work. The application of computer network technology into performance management can not only reduce the errors in the process of statistics, but also facilitate students to view it at the first time. When students have doubts, they can give feedback in time, which enhances the tightness of performance management. Evaluation and feedback college management is not only the unilateral management of teachers for students, but also the right of students to evaluate teachers. Of course, this evaluation refers to the evaluation of teachers' teaching content and quality during the semester. Computer network technology is also widely used in college management.

The learning methods of SVM include supervised learning and unsupervised learning. Supervised learning is called supervised learning when samples are given by input/output pairs. The example of input-output relationship is called training data. Input/output pairs usually reflect a functional relationship that maps input to output. When there is an intrinsic function from input to output, this function is called the objective function. The estimation of the objective function output by the learning algorithm becomes the learning solution. For classification problems, this function is also called decision function.

The above problems can be reasonably solved by combining the data mining method of support vector machine to deal with the data of teaching quality evaluation. Those data that deviate greatly from the actual results are often treated as dirty data or outliers in the process of data preprocessing, or when passing through the operation system, some dimensions or attributes correspond to a low weight, so they cannot have a fundamental impact on the final result, so a relatively accurate classification result is obtained [7]. In addition, SVM overcomes the shortcoming that the neural network structure depends on the designer's experience, solves the problems of high dimension, local minimum and small samples, and takes into account the advantages of neural network and gray model. Through the study of the existing classroom teaching quality evaluation samples, we can get the dependence between the classroom teaching quality and the influencing factors, and then we can make an accurate and objective judgment on the quality of a specific classroom teaching activity.

4 Simulation Analysis

Data preprocessing is an important step in the process of data mining, which refers to some processing of data before the main processing. When data mining, the amount of

data is often very large, and it takes a long time to mine and analyze a small amount of data. Data reduction technology and other methods can be used to obtain the reduced representation of the data set, but it is still close to maintaining the integrity of the original data, and the result is the same or almost the same as that before reduction [8]. The original data sources include the online evaluation data submitted by students on the course in the existing teaching database and the data in the expert group evaluation report in the classroom teaching competition. Establish the teaching data warehouse of a school, unify and summarize the data format of the data source through extraction, conversion and other operations, divide it into daily teaching data and classroom teaching competition data, and load it into the data warehouse. Use the OLAP tool of data warehouse to drill and flip the data, which is convenient for the next step of data processing, and provide some parameters and preprocessed data for data mining [9]. The data preprocessing project code is shown in Fig. 3 below.

```
def entropy(y_label):
    counter = Counter(y_label)
    ent = 0.0
    for num in counter.values():
        p = num / len(y_label)
        ent += -p * log(p)
    return ent
```

Fig. 3. Data preprocessing item code

SVM algorithm is used to train the sample data from the data set of classroom teaching competition, and the classifier is obtained. It is verified on the data of other classroom teaching competitions, and better classification results can be obtained. The classifier obtained by SVM algorithm through sample training is applied to new data, that is, it can evaluate daily teaching activities that have not been evaluated by experts. Provide the results to teaching managers and decision makers as the evaluation results of this daily teaching [10]. That is, through machine learning, using computers instead of experts to evaluate teaching, and get more accurate results at the same time.

5 Conclusion

This research aims to develop a teaching quality evaluation system based on OLAP and SVM algorithm. In order to achieve this goal, we first collect data from different university websites in China, including the following: (1) data collection forms; (2) Data analysis table; (3) Textbook database; (4) Textbook database; (5) University website information database. Then, we use these databases as input data for training and testing algorithms respectively.

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