Lecture Notes in Electrical Engineering 1133

Jason C. Hung
Neil Yen
Jia-Wei Chang *Editors*

Frontier Computing on Industrial Applications Volume 3

Proceedings of Theory, Technologies and Applications (FC 2023)

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Editors

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Contents

The International Workshop on Advanced Information Technology (ADINTECH 2023)

Application of Parametric Generation Technology in Landscape Architecture Planning and Design

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Abstract. Parameterization is developed on the basis of the development and application of computer technology to a certain level. Driven by digital technology, parametric design has started and discussion in the fields, providing a new way of thinking to solve problems. It is the process of using parametric generation technology to design and plan landscape architecture. This is a technology to generate different types of landscapes from a set of parameters defined in the form of mathematical equations. Parametric generation technology has been used in landscape architecture for many years, but it has not been widely used until recently due to its complexity and high cost. However, with the development of computer capabilities and software tools, it has become an affordable solution for creating landscapes and other applications, such as urban design.

Keywords: Landscape architecture · Parameterization · Generation technology · Planning and design

1 Introduction

With the development of the times, human beings continue to develop and consume nature, which has caused a serious ecological crisis. The living environment of human beings and other creatures has been damaged. At the same time, the development of urban projects has caused the destruction and disharmony of the urban landscape. As one of the three pillar disciplines of residential environmental science, landscape architecture plays an important role in improving the living environment, maintaining the natural ecological environment, and promoting the sustainable development of human beings and cities, As an important part of public open space, it can provide good ecological environment and habitat conditions for human beings and other creatures, and can inherit excellent traditional culture, continue the memory of places, and highlight local characteristics [1]. Professor Wang Xiangrong once said: "The positive significance of landscape architecture does not lie in what form and landscape it creates, but in its positive role in social development". Therefore, landscape architecture is of great significance to natural ecology and human settlements. The design method of landscape architecture is the basis to ensure the role. The design process architecture is the and

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technology and humanistic arts. It requires not only the objective factors of the site, such as terrain, vegetation, road traffic, etc., but also a certain art form to carry and express the site culture and humanistic values [2].

The logic of computer design software itself is to find the key to solving problems through programming. The logic of programming and landscape architecture design complement each other, affecting the design field, and it enables human beings to have unprecedented ability in dealing with complex environmental problems. BIM, parametric design, algorithm generation and other digital technologies have begun to be applied to the disciplines and industries of architectural design, urban planning and other related fields. Computer technology has gradually changed from auxiliary drawing to auxiliary design, and the technology has also become increasingly practical [3]. The relevant design software based on computer technology itself is an accurate program synthesis under the programming logic. Therefore, using computer technology can help us analyze and establish design logic more accurately and form more scientific design results.

2 Related Work

2.1 Research on Parametric Design of Landscape Architecture

In recent years, under the continuous exploration of many domestic scholars, parametric design has been gradually applied. It is hoped that parametric design, a new method, can be introduced into landscape architecture design, change the thinking of landscape architecture design, and make bold innovations in design methods. Based on parametric design, data and facts, the design is carried out through a logical concept of system theory, so as to make the design results more scientific and reasonable. In the research on parametric design of landscape architecture, scholars from Tsinghua University, Beijing Forestry University and Tongji University have studied the parametric design method [4].

The application of parameterization in the whole design process in China is mainly realized in small scale. For example, in the parameterized layout design of an exhibition park, a parameterized design is carried out for a smaller scale exhibition park. However, overseas countries have been able to use a variety of parameterized design theories and software platforms for different scales of practice. On the basis of combing the examples and theories of parametric design at home and abroad, this paper sorts out a whole set of parametric design process of landscape architecture, which can be used for reference.

2.2 Landscape Parametric Design

The design method is to analyze and digitize the terrain, hydrology, soil, vegetation, space, economy and culture and other factors that affect the design on the relevant software platform. The parameter information attributes shall be unified during data processing to facilitate the determination of parameter relationships later. These data information will be input into the established parameter relationship as parameters, and the design system will be constructed. After calculation and constant adjustment of parameters, the design results that are suitable for the site will be obtained. This is an innovative design method from top to bottom. In the parameterized design method of landscape architecture, the influencing factors analyzed in the earlier stage effectively control the generation of design results, and make the parameter factors interact through the setting of parameter relations and rules [5]. At the same time, the process of formulating the parameter relationship is also the process for designers to discover and understand the logical structure and spatial order of the internal regularity of landscape design. Therefore, landscape parametric design is a design generation based on logical construction.

The traditional design method of landscape architecture emphasizes inspiration design, and the design results lack integrity and relevance with the preliminary design analysis. The parametric design method generates the design by relying on the parameter relationship between the influencing factors. The influencing factors directly control the generation of the design results. With the adjustment of the parameters, the design results will change constantly. This is a dynamic process, and the design results are also generated dynamically, It is no longer the only design result.

3 Advantages of Parametric Design Applied to Landscape Planning and Design

(1) Changes in design thinking
The traditional design method is that the designer constructs a design phrase in his mind based on the preliminary analysis, and then starts to design. However, the later design is always disconnected from the preliminary analysis, and the same is true in the later modification process. The designer modifies the content of the scheme, but has ignored the data of the preliminary analysis. However, the parametric design process is bottom-up. First, we refine parameters according to the design requirements, and calculate them through the set rules. The generation of the results is dynamic. If the design results are not what we want, we can change the parameters or adjust the rules to affect the generation of the design results. Parametric design is that the influencing factors of preliminary analysis directly control the generation of design results through system rules. Parameters, parameter relationships and design results form a system that is interrelated. The parameter factors of preliminary analysis are always related to the design results, which makes the design more precise and sustainable.

(2) Improved design efficiency
Parametric design process is a dynamic design process. Different parameter inputs will form different design results, which can provide customers with a variety of alternatives. In traditional design, every alternative is a repetition of the design process. The key of parametric design is to establish parameter relations. The establishment of parameter relations indicates that the construction of the design system has been preliminarily completed. Therefore, changing the parameter relations in this design system will output a variety of design results. The number of design schemes only depends on the number of input parameters. At the same time, most of the time, the scheme design is improved and improved after communication with Party A, and it is refined and deepened on the basis of the general plan. However, each revision and deliberation is a repetition of the previous design process. In parametric design, the design process is realized through the parameter relationship system. If it is necessary to modify the design results, the design results can be changed by re judging the parameter factors or adjusting the parameter values; If the desired result cannot be obtained only by modifying parameters, you can add the required design script to the design relationship to improve the parameter relationship, which can also play a role in modifying the design result. In this way, the design becomes faster and more efficient. However, the premise of parametric design is that it is required to fully consider various factors and their relationships in establishing parameter relationships, and it is necessary to build rigorous logical relationships.

(3) Advantages of parametric software application
At present, there are many kinds of parametric software, and parametric software has advantages in landscape planning and design. For example, grasshopper, processing, rhinoscript, etc. can be used to establish parameter relationships; Particle flow in MAYA software can be used for fluid simulation. ArcGIS can analyze terrain, landform, water body and other influencing factors, and digitize these factors. These parameter software can process a large amount of data in terms of parameter data or parameter relationship determination, and form scientific data results, which improves the scientific nature of the design.

The architecture is shown in Fig. 1.

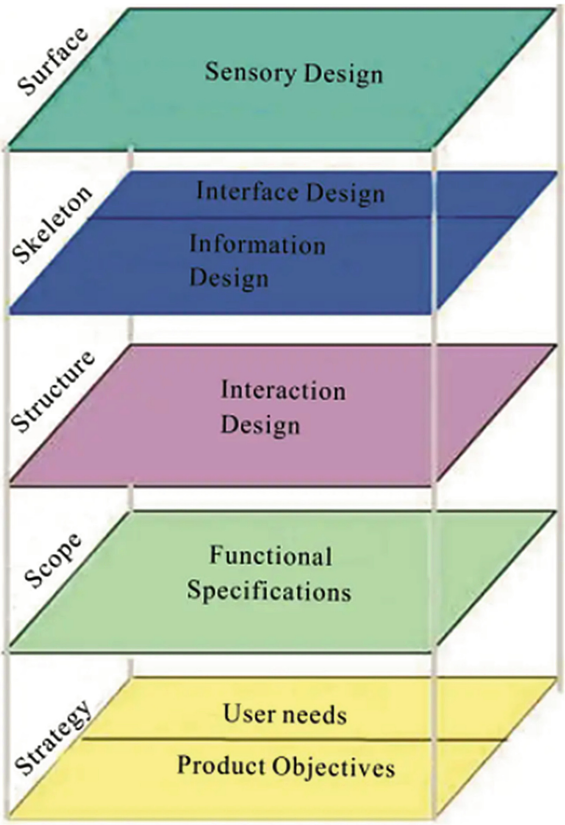

Fig. 1. Parametric Design Framework of Landscape Architecture

4 Application of Parametric Generation Technology in Landscape Architecture Planning and Design

Parametric generation technology is mainly based on the digital technology platform, relying on computers to establish scale parameter indicators. The generated design results can build a perfect and effective landscape planning system while having a modern art form, making the landscape planning more scientific and artistic. The application of parametric generation technology will break the structural oneness and apply it to landscape architecture planning and design in a more scientific experience mode. Landscape architecture planning and design is a "bottom-up" design process, which includes structural elements such as location information, natural factors, preliminary design and in-depth expression. Parametric generation technology can scientifically and accurately conduct location analysis through computer intelligent algorithm, which makes designers avoid the restriction of objective factors and greatly improve their work efficiency [10]. In the process of practical operation, We can carry out reasonable location regulation based on individual subjectivity to realize the combination of sensibility and rationality in the real sense.

Parameterization, also known as parametric quantitative design, is to establish a derivative relationship between the model and data. That is, based on the formation of the design thinking logic, the parametric model is constructed according to the numerical value. The application of the parametric generation technology can form a chain reaction by adjusting a single numerical value, that is, the generation result will change according to the change of the numerical value. As shown in Fig. 2, two different location planning models are generated based on different values.

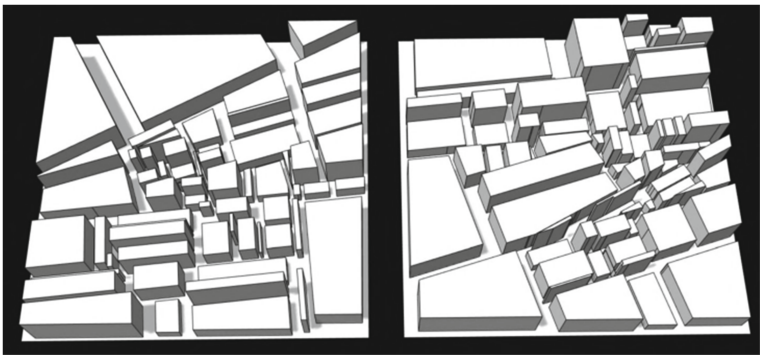

Fig. 2. Parametric landscape architecture planning model

It can be seen that the application of parametric generation technology has improved the scientificity of planning and design, made model modification more convenient and saved a lot of time. In terms of platform selection, designers can use different parametric design software according to personal task settings, such as using GIS for data analysis in the early stage of design, including some large-scale terrain, landform, slope and aspect analysis; Using GRASSHOPPER to model landscape topography and regional landscape sketches can also give complex skin texture to special-shaped structures. Of course, for the application of parametric generation technology, we should not blindly pursue visual perception, but should combine regional culture and modern science and technology to balance the relationship between modern and classical, science and art.

5 Conclusion

The parameterized design method of landscape architecture provides designers with an open and dynamic view, which is a change in design thinking. It enables designers to deal with complex landscape architecture design systems with a changing and discovering vision. On the other hand, parameterization enables landscape architecture design to gain a more scientific, objective and rational understanding and the ability to analyze the operation and development of things. The development of parametric design method in the landscape architecture industry is a long-term and long process, which represents a trend of landscape architecture design in the future. This requires the joint efforts of designers in the industry and software developers outside the industry to constantly

practice and improve the parametric design method, so that it can become an operational system of theory. At the same time, parametric design methods and related software development should be gradually introduced in college education.

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Evaluation Method of Skilled Personnel Based on Factor Analysis and BP Neural Network

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Abstract. Skilled talents are the core of any organization; They are the people who make or break the company. A successful enterprise depends on the skills and knowledge of its employees. Therefore, it is very important to select the right employees for your company. One of the most common ways to assess an individual's skills and knowledge is through the Assessment Centre. However, this method has some disadvantages, such as time-consuming, difficult to evaluate specific skills, and methodical errors when using different methods to measure certain skills. The evaluate technicians, and determine the most effective method to select technicians. The goal is achieved by using model to analyze the data obtained from companies with high demand for employees with specific skills. Factor analysis was used to evaluate technicians according to age, education level, gender, experience and other factors. The skill level of personnel is determined by using Bp neural network. The results show that both methods can identify some suitable candidates, but there are differences between them.

Keywords: Talent evaluation · Factor analysis

1 Introduction

The personnel department is the core of any organization. It plays in determining business and efficiency. A good management system depends on a strong and effective personnel department. To achieve this goal, you need to select qualified individuals for employment positions. This means that you need to have a process to determine who should be hired to which position. Without an effective evaluation method, you will not be able to effectively manage human resources. Is it for recruitment? Or promotion? Or year-end evaluation and performance appraisal? Before conducting talent evaluation, enterprises must be clear about the purpose and specific application scenarios of talent evaluation [1]. They should fully understand the needs of each position in the enterprise, especially the characteristics of each position, the needs of people and the focus of evaluation. Whether it is recruitment or team assessment, these contents will be important references. Only in this way can we ensure that we have a definite aim and that good steel is used on the blade. The traditional selection method has a strong subjectivity and randomness, which often leads to the adverse consequences of employees being unfit for their jobs and

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overstaffing. The use of talent evaluation technology can fully understand the quality of people, so as to select people according to the situation and match people with jobs. When enterprises need to recruit talents from outside, they can master the quality of candidates through talent evaluation, so as to select the best candidates. When an enterprise needs to make personnel adjustment internally, talent evaluation can be an important reference for such adjustment, which is conducive to making the best use of talents [2]. Therefore, aiming at the above problems, this paper studies the evaluation method of skilled talents.

2 Related Work

2.1 Trend Analysis of Technical Talents Evaluation

In order to correctly the evaluation of technical and skilled talents, we also need to have a clear understanding of the talent evaluation mechanism. Talent evaluation mechanism includes systematic talent evaluation system, evaluation institution, evaluation standard, evaluation content, evaluation object, etc. Therefore, it can be considered that the talent evaluation mechanism is a socialized mechanism based on occupational classification and post analysis, relying on professional talent evaluation institutions, setting scientific and reasonable evaluation standards, building practical evaluation indicators, and using multiple evaluation techniques and methods to reasonably measure and evaluate the level and ability of professional talents. Since the 18th National Congress, the Party and the state have paid more attention to talent evaluation than ever before, and the evaluation of technical and skilled talents has also shown a new trend of development, mainly including: first, the clarity of strategic objectives. The fundamental goal of talent evaluation is to form a good talent development orientation through evaluation, tap talent potential, stimulate innovation vitality, and help the development and allocation of human resources. In the new economic development situation, the core strategic objective of China's evaluation of technical and skilled talents is to focus, give play to the role of the "baton" and wind vane of talent evaluation, stimulate the innovation and creativity of technical and skilled talents, improve the ability to tackle key technologies in key areas, and promote high-quality economic development. Second, the evaluation subject is diversified. From the context of historical policy documents of talent evaluation, we can find that the subject of talent evaluation has gradually moved from official to diversified, socialized and market-oriented [3]. This trend is formed with the basic establishment of the enterprise's decision-making power, the expansion of the employees' independent employment space and the gradual growth of the labor market. In fact, talent evaluation has become one of the important contents of human resource service industry. According to statistics, various human resources service institutions provided 28.418 million person times of talent evaluation services in 2017, an increase of 11.8% year on year. Third, the evaluation object is subdivided. With the development of market economy and the continuous refinement of social division of labor, China's talent structure is becoming increasingly complex [4]. Only scientific classification of talents can ensure the rationalization of the development of evaluation standards and the setting of indicators. In fact, promoting the reform of talent classification and evaluation is one of the important trends of the national talent evaluation reform, which is in line with the requirement of "professional expertise". Especially for technical and skilled

talents, only by subdividing the evaluation objects can we respond to the demand for talents from industrial development in a timely manner, can we focus on each other in the talent evaluation link, and feed back the talent evaluation orientation to the talent training link, so as to help the national talent training reform.

2.2 BP neural Network

BP one of the more mature neural networks currently developed. It is also that compares the awesome nonlinear differentiable function for weight correction and adjustment. It can withstand rigorous mathematical logic deduction and is widely recognized in many pattern recognition books and many data compression papers. The main feature is the forward transmission of input signals, Back propagation of error. The essence of the learning algorithm of BP network. There are three layers of network structure, including [5]. A typical network structure can be composed of the following parts, as in Fig. 1:

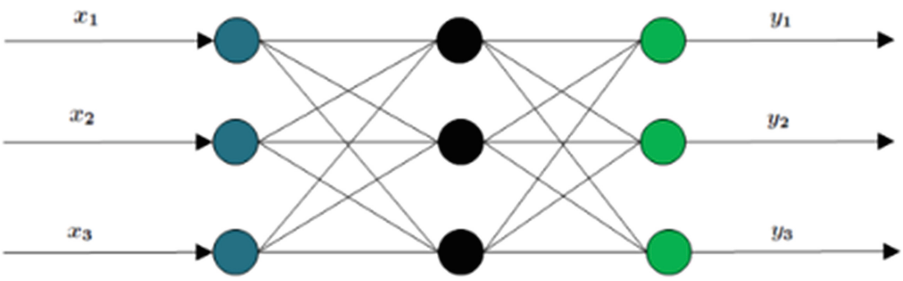

Fig. 1. Structure of network model

In the neural network, we have many activation functions to choose from, but we still choose to use the sigmoid function here. Why do we choose this function? Because I have collected a lot of resources. If we use some other activation functions or give up using activation functions directly, but how many times we use hidden layers, we finally get a linear function. But after using nonlinear sigmoid functions, this problem will not occur. Our network can also fit nonlinear functions.

3 Skilled Personnel Evaluation Method Based on Factor Analysis and BP Neural Network

Applying BP theory to the competency of skilled talents can simplify the process, and ultimately achieve the goal of improving the efficiency of talent evaluation. In the process of creating the model, the network model needs to have a good generalization ability, that is, the network model constructed must be able to have a strong tolerance for various samples. Therefore, the network structure, the number of neurons, the initial value, the target error, the learning algorithm and other factors must be considered when building the network model.

The general steps to evaluate the skilled talents are: select a scientific and reasonable evaluation method, measure the indicators of each skilled talent, and comprehensively obtain the level of competency of scientific and technological talents. According to the mapping network existence theorem, the linear or nonlinear mapping. According to the above BP neural network structure characteristics, scholars usually use a BP neural network containing a hidden layer in practical applications can meet the needs of research. Based on this, when building the evaluation model of skilled talents, this one hidden layer. When building the model, it only needs to set the optimal. The BP neural network structure of skilled talents is shown in Fig. 2.

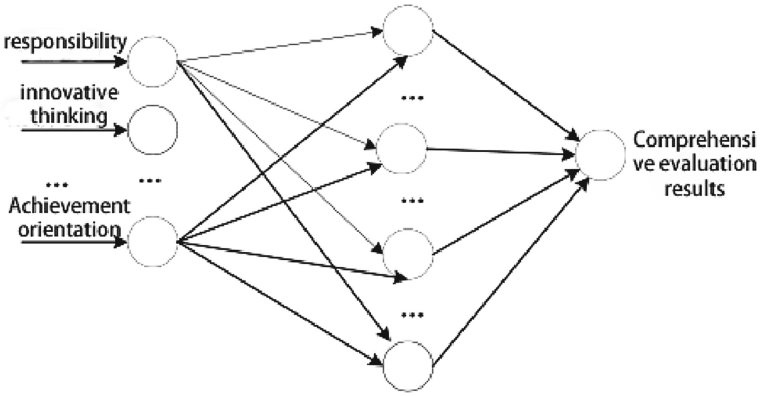

Fig. 2. BP Neural of Talent Evaluation Model

After the BP neural network structure is determined, the next step is to design the network layers, parameters, training methods, etc. of the model to form a complete evaluation model for skilled personnel.

This paper studies the evaluation of skilled talents, drawing on the selection method of transfer function in previous scholars' research on talent evaluation and personnel post matching evaluation. When studying talent evaluation.

Training function: It is training according to the specific requirements of the research problem itself and the size of training samples. Considering that the training samples for the evaluation of skilled personnel studied in this paper are relatively small, the gradient descent algorithm with adaptive adjustment, and the traingda is selected accordingly.

The setting of error value will directly affect the effect of network training. If the error value is not selected properly, the network may converge too quickly, the network may be unstable, or it may not converge all the time. Therefore, the selection of error value is very important. If the error value is set too large, rapid convergence may occur in the network training process, and the number of training times and training time will be greatly reduced. If the error value is set too small, the convergence speed will slow down, but the learning effect will be a little better than the case of large error value. Through experimental verification, the error the skilled personnel evaluation model established in this paper is 0.001, that is, when the error value reaches 0.001, the network stops training and outputs the results.

4 Training Sample Establishment

The evaluation index of skilled personnel in this paper includes qualitative index and quantitative index. Due to the selection of different index measurement methods, the dimension of the index measurement data obtained is quite different and not comparable. BP can better identify the number between 0 and 1. The original data of each evaluation index should be standardized first, and the data should be standardized to the number between 0 and 1, so that the data can be comparable, thus improving the network performance and training efficiency.

The evaluation indicators constructed in this paper tend to be consistent on the whole. The larger the number of patent licensing and scientific and technological projects, the better the evaluation results. For qualitative indicators, the higher the score, the better the scientific and technological talents' performance measured by the evaluation indicator, and the higher their competence in the job.

The sample training programming code is shown in Fig. 3 below.

```
net = newff(minmax(P),[12,1],{'logsig','purelin'},'traingda')
net.trainParam.show = 1000;
net.trainParam.lr = 0.01;
net.trainParam.epochs = 5000;
net.trainParam.goal = 1e-3;
[net,tr] = train(net,P,T);
```

Fig. 3. Sample training programming code

5 Conclusion

Skilled talent evaluation is an important link in enterprise management and human resource development. Currently, commonly used methods such as grading and balanced scorecard have certain limitations. Therefore, factor analysis and BP neural network based skilled talent evaluation methods have emerged. The factor analysis based evaluation method for skilled talents mainly focuses on the multidimensional attributes of skilled talents, transforming various indicators into a few comprehensive factors, thereby achieving simplification and effectiveness improvement of evaluation indicators. The BP neural network, on the other hand, establishes a neural network model to achieve adaptive nonlinear transformation of input data, thereby achieving precise positioning and optimization of the evaluation model for skilled talents. This skill talent evaluation method based on factor analysis and BP neural network has the advantages of high accuracy, strong comprehensiveness, and wide application, and has been applied

in many enterprises, institutions, and research institutions. In the future, this evaluation method will continue to develop and promote further scientific and systematic talent evaluation work.

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Design of Oscillation Controller for Camera Damping System Based on Particle Swarm Optimization

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Abstract. The damping system will oscillate during the operation of the adjusting camera, which is not conducive to the operation stability of the adjusting camera. Therefore, in order to suppress the oscillation, the corresponding controller can be designed with the help of particle swarm optimization algorithm, which will be studied in this paper. Firstly, the basic concept and application advantages of are introduced. Secondly, the controller design is carried out around the controller design idea. Finally, the optimize the control and the simulation. The simulation the controller optimized is more prominent in damping oscillation suppression effect.

Keywords: Particle swarm optimization · Adjust the camera · Oscillation controller for damping system

1 Introduction

As an important device in modern power grid system, the main function of the adjusting camera of power grid operation. However, the damping system oscillation phenomenon may occur during the operation of the adjusting camera itself, which will lead to the instability of the adjusting camera itself and indirectly lead to the instability of the power grid. In the face of this situation, people initially tried to deal with it by means of constant pressure control, but soon found that constant pressure control means could not suppress the damping generated during system oscillation, indicating that other damping suppression means should be adopted on the basis of constant pressure control. It is under this background that the oscillation suppression controller of damping system was proposed. The damped oscillation of the adjusting camera mainly refers to the regional oscillation and inter-regional oscillation occurring in the power system. Such oscillation images generally have a large frequency difference, which is the main reason that the constant voltage control cannot be effective. However, the oscillation controller of the

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damping system can suppress the damped oscillation by means of parallel compensation to maintain the voltage amplitude. At the same time, the damping system oscillation controller also has good robustness, which makes it applicable to different structure and form of the camera adjustment system. However, at present, in the research on damping system oscillation controller, the proposed oscillation controller models of damping system are nonlinear models, so the realization of the controller is very difficult, so it is adopt design the controller, particle swarm optimization algorithm is a good choice.

2 Basic Concepts and Application Advantages of Particle Swarm Optimization

2.1 Basic Concepts

Particle algorithm, which originated in 1995, and was invented by Eberhart and kennedy. Particle algorithm is created by the inventor inspired by the foraging behavior of birds [1]. That is, through observation, the inventor learned that the foraging behavior of birds is actually a goal optimization process, and its basic process is as follows: Each bird does not know the exact location of the food, but it knows how far away it is from the food. The best way to find food under this condition is to first identify the location of the bird closest to the food in the flock, and then search the surrounding area of that bird. And then expand and expand and eventually find food. According to the mechanism of this process, particle swarm optimization algorithm (PSO) should be developed [2]. The basic model of this algorithm mainly consists of four elements, namely foraging range, search range, birds and food, as in Fig. 1.

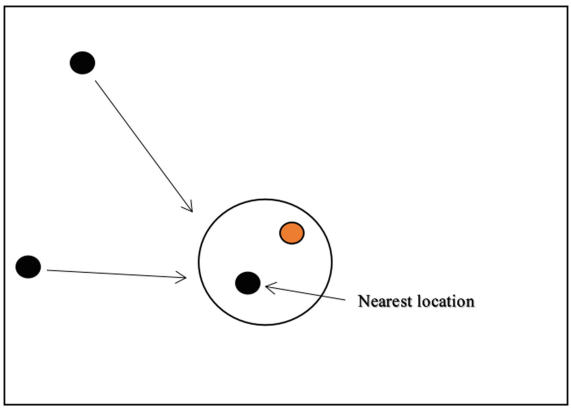

Fig. 1. Particle optimization model

(In the picture, the black circle is the bird, the orange circle is the food, the large border is the foraging area, and the white circle is the search area).

As can be seen from Fig. 1, when the nearest bird to the food is identified, other birds will move closer to this bird, and then quickly find the food in the surrounding area of

this bird, and so on. On this basis, the four elements of foraging range, search range, birds and food are brought into the algorithm, and the four elements will be converted into other elements, as shown in Table 1 for details.

Table 1. Elements after foraging range, search range, birds and food conversion in the algorithm

Before conversion	After the conversion
Range of feeding	Global scope
Scope of search	Local range
The bird	The particle
Food	Optimal solution

It is worth mentioning that the basic particle swarm optimization algorithm model is not complete, which ignores the update of the moving speed and position of each particle. Therefore, in the subsequent development of the algorithm, researchers improved the model and got a new particle swarm optimization algorithm model, which is the main reason for the wide application of particle swarm optimization algorithm in modern times. Particle movement and position update elements are added to the improved model, and specific parameters can be confirmed by formula (1) in the algorithm.

$$v[\,] = v[\,] + c1 * rand() * (pbest[\,] - prsesnt[\,]) + c2 * rand() * (gbest[\,] - present[\,]) \quad (1)$$

Usually c1 is equal to c2 is equal to 2.

2.2 Application Advantages

Particle algorithm the optimization, in addition to other optimization algorithms, such as genetic algorithm, the two algorithms have many similarities in the head, such as the basic operation steps and some rules of the two are the same, see Table 2 for details. However, PSO has its own unique application advantages compared with other optimization algorithms in different scenarios. This paper will compare PSO with genetic algorithm [3].

In Table 2, individual fitness values have different meanings in genetic algorithm. In the individual fitness value refers to whether the moving speed of particles conforms to the mean moving speed of particle swarm, which is translated into the foraging behavior of birds, that is, whether the flying speed of a bird in the flock enables it to enter the search area before the food is eaten. If it fails to enter the search area before the food is eaten, it means that the bird's fitness value is low; otherwise, the fitness value reaches the target [4]. And so on. In genetic, the adaptability of an individual of the previous generation to the environment. If an individual does not adapt to the environment, he will be eliminated by the population. In such a cycle, good genes can be inherited to the previous generation. It can is a method to purify the particle swarm through the individual fitness value, and then use the optimal to find the optimal solution [5]. Controller design.

Table 2. Common points of basic operation steps and some rules between PSO and genetic algorithm

The serial number	Steps and Rules
1	The population is randomly initialized
2	All individual fitness values are calculated. The fitness values are directly related to the distance between the optimal solution
3	The population can be replicated according to the fitness value
4	Stop when the termination condition is met, otherwise return to the second step

2.3 Power System Model Construction

According to the controller design idea in this paper, the controller design must be specific, so the power system model should be built in advance. The model design work is mainly completed on the modeling software. During the process, the main function of the adjusting camera is to adjust the voltage, and the adjustment method is to adjust the reactive load of the protection conforming. Therefore, in the model design, it is assumed that the power system detects the conforming voltage changes, and compensation is needed to ensure that the voltage amplitude of the bus is stable in a reasonable range, and the single-machine system is infinite. The input mechanical power of synchronous generator is 1, and the model is shown in Fig. 2.

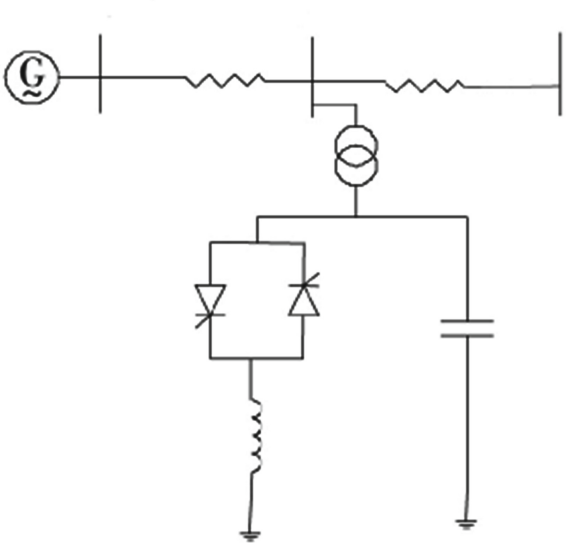

Fig. 2. Power system model

(G in the figure is the generator).

2.4 Controller

According to Fig. 2, the controller is designed in this paper. The control logic of the controller is as follows: when the tuning camera is connected to the single-machine infinite bus system, preset control parameters are adopted to control it, so as to make the voltage change and damping oscillation may occur. In the face of this situation, the gain parameters of the additional damping controller, the time constant of straightening and the time lead and lag are selected as the control, and adjusted according to the standard values in the automatic logic, so that new oscillation damping can be generated in the original system. The new oscillation damping will impact the other oscillation damping and then cancel each other out. Combined with this logic, the controller in this paper is a two-stage controller, the first stage is mainly used to output the velocity deviation signal, which can set the total power of the system at the specified position, and then compare the total power with the existing mechanical power at the set point to obtain the error integral of the two, and then multiply the error integral with the 1/M standard parameter to obtain the velocity deviation signal. In this process, the output velocity deviation signal can replace the measured velocity deviation signal, which means that the adjusting camera may not be able to get the conventional velocity deviation signal at the current position. The structure of the second stage is very similar to that of the PSS, including the lead and lag compensator.Therefore, the function can effectively improve the damping performance of the power system oscillation, so as to generate phasor torque with velocity deviation. Then, the lead and lag compensator can be used to offset the damping oscillation. It should be noted that the parameters of the lead lag compensator must be set in the second-level operation, otherwise it will not be fully compensated due to the phase shift and velocity deviation between the compensation control signals.

2.5 Algorithm Optimization

The specific optimization methods are as follows: Because the characterized by global search for the best solution, strong adaptability, fast convergence and high accuracy, the algorithm can quickly calculate the actual required oscillation values of the new damped oscillation, and ensure that the oscillation values of the old and new damped oscillation are equivalent, indicating that the algorithm can play an optimization role. In the conventional value control parameters is first set as the initial parameter of particle swarm optimization, and different parameter groups are optimized in the specific search space. During the optimization, the fitness of each particle swarm and each particle within the particle swarm should be judged by means of performance evaluation for the purpose of updating. In this paper, the ITAE performance evaluation index is selected, and the control logic is introduced after programming, so that each particle in the controller will appear two states of adaptation and inadaptation, to achieve particle swarm and particle individual update. In this way, if the particle swarm in a certain search space is composed of several particles, formula (1) should be adopted to calculate the velocity of each particle. This process will be repeated continuously, and the specific number depends on the total number of particles in the particle swarm. For example, there are N particles in the particle swarm, then formula (1) will be repeated for N times to ensure the completeness of the calculation results. After completion, because of the fast speed

of the adjusting camera can quickly understand the changes, promote the particle swarm update, so the optimized controller has a better damping suppression effect.

3 Conclusion

The camera damping system is a mechanical system composed of the camera lens, pan head, and bracket. Its main purpose is to reduce the impact of vibration and shaking during shooting and improve the quality of photography. Vibration control of camera damping system has always been a research hotspot. At present, the design of oscillation controller based on particle swarm optimization algorithm has become an effective solution. The main idea of the design of the camera damping system oscillation controller based on particle swarm optimization is to introduce the particle swarm algorithm into the vibration controller, and achieve accurate control of the vibration system by optimizing the controller parameters. In addition, this method can be easily combined with other controller design methods to further improve the vibration control effect. In general, the design method of the camera damping system oscillation controller based on particle swarm optimization is an effective vibration control method, which can help the research of the camera damping system, and has broad application prospects in other fields of vibration control.

Acknowledgements. Study and application of adaptive optimization and oscillation suppression of distributed condenser in high proportion new energy area (NO: 522807210008).

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Research on Summer Bird Investigation and Bird Damage Control in the Substation

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Abstract. With the improvement of environmental conditions, human awareness of environmental protection is constantly improving, and the number and activity range of birds are also constantly expanding. At the same time, with the system, the operation system, and the operation of power system is more and more frequent. Due to the bird activities in the substation, it is easy to cause equipment failure and short circuit, thus affecting the substation. Therefore, the study and analysis of the occurrence law and hazard characteristics of poultry in the substation can effectively reduce the occurrence of poultry accidents.

Keywords: substation · summer · bird survey · bird damage control

1 Potential Nesting Birds of Suzhou Power Grid Substation

Suzhou is located in the hinterland of the Yangtze River Delta, with rich forests, wetlands and other ecological resources, and is the best habitat for birds. With the acceleration of the urbanization process, the continuous growth of the population, the destruction of forest resources is increasingly serious, leading to the continuous decline of wildlife resources in China, the continuous deterioration of the ecological environment, resulting in many rare species are on the verge of extinction. According to statistics, 346 bird species, 21 orders, 63 families, and 346 species [1]. This paper shows that the birds of the same family also have similar characteristics, and a representative bird of each family is selected to investigate the morphology, the living environment, and the characteristics of the nest. Finally, through the comprehensive analysis and mathematical modeling of its ecological environment, the habitat and habitat area of the main birds in the area are obtained, according to the nest characteristics of the substation.

Investigation revealed no birds of prey attack after the nest was damaged. Field investigation and bird body anatomy research have shown that there are birds with direct or indirect connection with people in all parts of the substation. It is speculated that some of the birds in the substation are aggressive. The hazards of birds are frequent and should be noticed. Crows in the passerines, similar to other species, should be noticed.

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2. Statistical analysis of bird damage in Suzhou power grid substation

Through the comprehensive analysis of the field data, it is found that the bird nest problem of the substation is more serious, and the bird damage refers to the harm to the bird nest. Because the substation is in a relatively closed environment, in practice, when poultry invade, it is easy to lead to the failure of the power system to trip. From 2019 to 2020, the data was collected according to the hidden danger bird nest situation of 220 kV and the voltage grade substations below 110 kV in the urban area [2], 371 potential bird nests were found in 79 substations. According to the type of the outdoor/the semi/home station, the voltage level, the location of the nest, and the time when the nest was found. The bird's nest refers to those easy easily cause equipment failure and trip.

1.1 Outdoor/Semi/Indoor/Indoor Station Type of Substation

Find out the hidden dangers. The statistical results of outdoor/half household/house type substations are shown in Fig. 1.

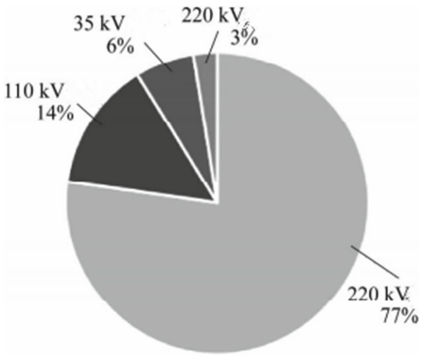

Fig. 1. The number ratio of outdoor/half household/indoor substations in the Bird's Nest

As can be seen from Fig. 1, the most 220 kV outdoor Bird's Nest type substations were found with hidden dangers, accounting for 77%, followed by 110 kV outdoor, 35 kV outdoor and 220 kV semi-indoor type substations, and no potential indoor substations were found as bird nest risk. Overall, 97% of the potential substations found to be dangerous are home decoration. Compared with the semi-indoor-indoor substation, it has more substation facilities and better power supply facilities, and it is more prone to appear dangerous bird nest.

1.2 The Substation Voltage Level

The statistical results of the number of potential bird nests identified in substations with different voltage levels are shown in Fig. 2.

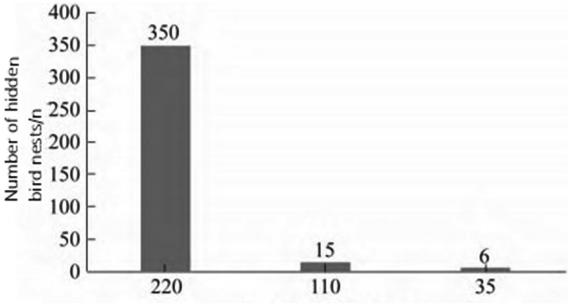

Fig. 2. The relationship between voltage level and number of hidden danger nests

As seen from Fig. 2, the potential bird nests existing in 220 kV substations is 350 higher than that in 110 kV and 35 kV substations. Considering that most substations with potential nest are outdoor or half indoor, the outdoor equipment of 220 kV substation has a large area and many equipment, and the holes and holes suitable for birds to nest, there are more hidden nests [3].

1.3 Location of the Bird's Nest

The top ten nests by the number of nests from large to small are shown in Fig. 3:

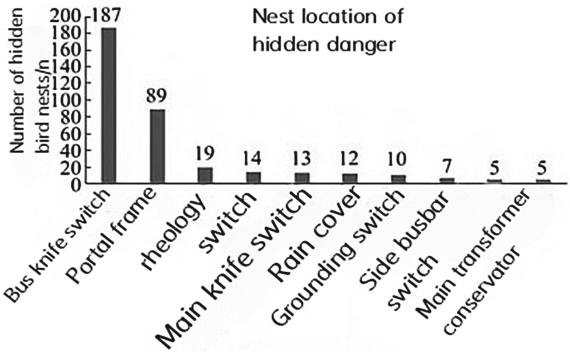

Fig. 3. Location and number relationship of hidden danger nests

As shown in Fig. 3, more possible bird nests were obviously found at the bus switch and in the gate frame, with 187 and 89, respectively, 50.4% and 24.0%, respectively. Therefore, special attention should be paid in the monitoring of bird damage of the substation.

1.4 Discovery Time of the Nest

The number of hidden danger nests found each month is shown in Fig. 4.

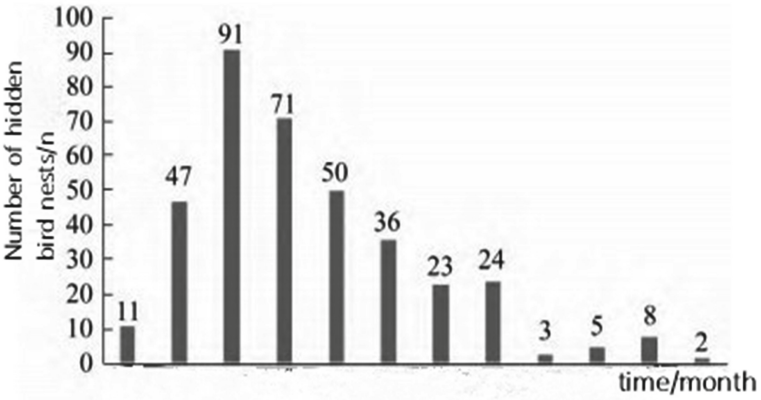

Fig. 4. Number of hidden danger pits

As shown in Fig. 4, the number of potential bird nests gradually increased from January to March, with a peak in March, followed by a decline, and a significant decrease in the number of problematic nests from September to December. Mainly in spring, most birds breed in summer with a strong demand for nesting, with autumn and winter being a transitional period.

2 Bird Damage Prevention and Control in the Substation in Summer

There are two main methods of bird damage prevention and control in the substation: one is the bird damage monitoring in the substation, and the other is equipped with a set of bird prevention facilities. Monitoring of bird harm is the most basic work of bird control [4]. Through the monitoring of the substation, the problematic bird nest can be found and handled in time to eliminate the danger. Setting up the bird guard can effectively reduce the habitat density of the birds, reduce the occurrence of bird strike accidents, and thus improve. The quality of bird damage monitoring is directly related to the degree of the birds on duty in the substation.

2.1 "Drive Away" the Birds

The laser drive bird is used to emit a 532-nm green laser that is so sensitive that the "rod" green laser swings regularly and escapes when a big green rod passes over the bird's body.

Laser bird drive technology is suitable for nearby substations with less personnel to carry out bird damage control at night, but the use range is limited, and the bird drive equipment is expensive.

2.2 Ultrasonic Drive of Birds

Ultrasonic bird drive device can emit ultrasound wave randomly in a certain frequency range, but it is less regular and more adaptable to birds. However, bird-repellent equipment is more expensive.

The human auditory range is roughly between 20 and 20,000 Hz. When the sound pressure level exceeds this value, people can detect and hear it. Sound waves beyond this frequency band is ultrasonic. Ultrasound has good penetration and directivity, and can drive birds in different environments. A high-decibel ultrasound drives the bird away without its regularity. The equipment of the present invention has the advantages of simple structure, simple operation and remarkable effect, which can effectively prevent the harm of birds [5]. Due to the power supply of the substation, the ultrasonic drive bird device can also obtain power directly from inside the station, thus saving the cost of the solar panels. The sound of ultrasonic bird drives is not heard by humans, but can be heard by most birds and emitted at higher decibels, aggravating the intermittent shock. Therefore, both the use distance of the device and the effect of driving the bird are improved.

2.3 Sound Drives Away the Birds

The so-called bird drive, is to use the sound of the ears of birds and the calls of natural enemies, to stimulate the hearing of birds, so as to achieve the effect of bird drive.

Sound drive bird is mainly used in nearby substations with small population, which has the advantages of convenient installation and maintenance, large noise and easy adaptation of birds.

2.4 Windmill Mirror to Drive the Bird

Windmill mirror bird drive principle is that when there is a breeze, by rotating the bird drive device, in the mirror to produce various angles of reflection, thus interfering with and threatening the bird, to achieve the effect of bird drive.

Mirror windmill drive birds, low cost, easy to install, the disadvantage is its movement law, birds are easy to adapt. Moreover, the effect of birds is is ineffective in the absence of wind.

2.5 "Blocking" the Birds

(1) Door-type frame bird-proof net

Substation gate frame bird net is a closed metal bird net cover with holes, it is a kind of folding net door, triangular side cover, gold and other parts of the cage, mostly installed on the door bracket. The bird guard cage of the present invention adopts a closed door frame that removes the bird's nest and reduces the risk of the bird's nest. At present, with the continuous construction, the reform system, and the improvement of the equipment upgrading speed of substations, the conventional bird control method has been difficult to adapt to the needs of the market, and it is urgent to adopt new methods to control poultry. However, due to the maintenance

of the main substation, the establishment of bird-proof network restricts the pace of technology promotion.

(2) Blgate bird baffle
The nesting of the knife gate has a great impact on the nesting of birds, including the cavity inside the knife gate, the body base, and the supporting porcelain bottles, etc. In the field operation, in case of the switch damage caused by bird strike or other reasons, the normal use of the switch will be affected, and it must be strengthened accordingly. An internal cavity used to seal the knife gate and reduce the nesting space for birds.

However, there are many kinds of switch, which must be customized according to its structural characteristics of bird guard, which is difficult to mass production. In addition, the material of bird guard also has very high requirements, which will increase the cost of bird guard.

(3) "Lead" the bird
Inside and outside of the substation, artificial nests are built to guide the birds away from the operating site facilities to build their own nests to reduce the harm to the flock. In recent years, with the national industry and the expansion of the network, a new demand is proposed for the prevention and control of poultry disasters on the transmission lines. It can not only realize the coordination between man and nature, but also reduce the harm of birds, which has natural advantages. In today's social and economic development and the people's environmental protection, artificial bird nest has been widely used in the power system. But this approach also faces some difficulties. For example, in areas where birds are frequent, how to coordinate the number of artificial nests with the area occupied, and too many artificial nests can easily attract more birds to nest around substations.

3 Suggestions on Bird Damage Prevention and Control in Substation

At present, the power supply companies have taken corresponding prevention and control measures for the bird damage of the substation. Although the good control effect has been achieved, there is still room for improvement:

3.1 To Realize the Early Warning of the Hazards of the Substation, and Improve the Control Quality of Poultry Disasters

The effect of the substation characteristics in the bird cage is studied quantitatively, and the trap performance of the substation in each month is compared, and the corresponding hazard index is given. In order to classify the hazards caused by the substation, the corresponding control method are developed to realize the active control of poultry hazards. This paper takes the substation with great harm to birds as an example, focuses on cleaning up the electric wires, steel wires and other dangerous nesting objects in the outdoor equipment area, increases the inspection of bird hazards, installs bird-drive facilities for temporary activities, and the focus of dismantling bird nests.

3.2 To Achieve the Comprehensive Application of Various Methods

Such as "lead the first, prevent the resistance also, and do not lead to go", to improve the control of birds. In view of the characteristics of substation, take "pioneer, resistance, and stop" comprehensive countermeasures, make full use of the advantages of various measures, maximize the control effect of birds, such as using "drive" to reduce the number of substation, in the form of "blocking" knife switch, gantry and other key position, to "lead" the birds to a safer location, such as station outside the nest. In addition, in order to better tap the potential of the instrument, strengthen the control of bird harm, such as: the development of automatic optimization of ultrasonic bird drive device, the design of integrated bird drive efficiency and energy consumption monitoring system.

3.3 The System Can Effectively Observe the Bird Activity of Each Site and Provide Reliable Information for Bird Damage Control in the Future

By investigating the behavior records of substation birds, especially images and videos, to understand the species, habits and other characteristics of birds in the substation can provide a scientific basis for the future bird control work, and it is very difficult to observe the behavior of birds. Therefore, while arranging the observers, we can also innovate the data collection methods. For example, holding a bird shooting contest for the staff on duty can not only enrich the spiritual life, but also collect the bird data in the substation.

4 Conclusion

In a word, the bird hazard control work of the substation is a long and arduous task. Through the specific analysis of birds, a single technique is adopted. The control of bird damage should vary from person to person, scientific and reasonable, ecological and reasonable, and adopt effective prevention methods of bird damage. Adopt the corresponding governance countermeasures, in order to improve the utilization rate of technical means, drive and prevention simultaneously, fundamentally curb the harm of the substation birds.

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Research on Image Processing Algorithm of Placement Machine Component Location Based on Machine Vision

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Abstract. As one of the core equipment of surface mounting system (SMT), SMT integrates many disciplines such as machinery, control, information. Because high precision, other advantages, it is widely used in the production process of cutting-edge electronic technology products, and is specifically included in one of the core development technologies of equipment manufacturing under the "Made in China 2025" plan. The research on the image processing algorithm of placement machine parts positioning based on machine vision is an algorithm development and application research aimed at solving the problems related to the production line process, which is called "placement machine parts positioning". The main goal an efficient algorithm for precise placement of components in different locations. In addition, it aims to solve other problems, such as: only using one camera to place components; Accurately place components; Quickly place components; Place components accurately without any manual intervention or supervision.

Keywords: Chip mounter · Element positioning · Machine vision · Image processing algorithm

1 Introduction

With the pursuit of miniaturization, lightness and high reliability in the electronic industry, highly integrated ICs and various new devices generally adopt surface mount packaging, and more and more thin pitch and micro pitch technologies are used. The specifications of chip components have also developed from 0402 to 0201 or even 01005. The connection of surface mounted components (SMC) and surface mounted devices (SMD) with PCB must use surface mounted technology (SMT).

SMT is a comprehensive technology involving components, assembly equipment, welding methods and assembly auxiliary materials, which is used to assemble electronic components (also known as mounting) onto printed circuit boards (PCBs). It is the most popular new generation of electronic assembly technology in the world since the 1980s, and is considered to be a revolution in electronic assembly technology [1]. SMT assembly line is mainly composed of screen printing machine, mounting machine and welding machine, and the mounting machine is the most critical equipment among them, and also the equipment with the highest technical content. Its price usually accounts

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for 50% of the total price of the assembly line, so it has always been the focus of SMT technology research. Signs There are three main indicators of the development level of the placement machine: 1) placement accuracy; 2) SMD speed; 3) The range of mountable components. Foreign manufacturers of medium and high-end mounters mainly include FUJI, YAMAHA, Panasonic, Sony in Japan, Universal Instrument in the United States, Siemens in Germany, Philips in the Netherlands and Samsung in South Korea [2]. At present, in the field of SMT abroad, the technology has been basically mature, the development of equipment has also been completed, and gradually toward the direction of intelligent and highly centralized management. Many SMDs can also mount special-shaped components, SM connectors, FCPs and direct chips [3].

2 Related Work

2.1 Research and Development Overview of Mounter

According to the SMT Equipment Technology, China has already surpassed the United States to become the world's largest SMT application country at one fell swoop. Every year, tens of millions of yuan is invested in the research and development of SMT mounters in China. Therefore, for a large industrial country like China, the electronic manufacturing industry is absolutely an indispensable part of the national economy. It can not only drive economic growth, It can better reflect a country's comprehensive strength [4]. At present, certain scientific research achievements have been made in the research and development of the placement machine, but it is still a weak point in the field of cutting-edge electronic placement [5]. The technical difficulties that cause the weaknesses of the placement machine lie in the complex movement of the overall mechanism of the placement machine and the high requirements for detection accuracy and speed.

In order to improve the slow operation speed of the moment method, the parameter model of the edge detection operator based on the fourth order direction angle is derived, so as to achieve fast and accurate positioning. However, this algorithm can only achieve rough positioning for the deflection angle of the chip, which can not achieve true accurate positioning.

This algorithm performs rough Hough line detection with large step distance on the chip contour, and then selects the optimal straight line to perform fine Hough line detection with small step distance in the adjacent interval, so as to achieve the precision positioning of the deflection angle of the patch element. When the anti noise ability of the algorithm is weak.

2.2 Research Contents of Machine Vision System

The early work of machine vision mainly focused on two-dimensional image analysis and recognition. In 1965, Roberts initiated the research of three-dimensional machine vision to understand three-dimensional scenes, and successfully explained the three-dimensional building block world. Guzman introduced symbolic processing and heuristic methods in the research of visual processing. Later, Huffman, Clowes and others

studied the building block world and solved the problems of interpreting scenery by line segments and dealing with shadows.

Marr theory is an epoch-making achievement research, but it is not very perfect, and many aspects are still controversial. For example, the visual processing framework established by this theory is basically bottom-up without feedback. Moreover, the theory does not pay enough attention to the application of knowledge. Nevertheless, Marr theory has given us many precious philosophical ideas and research methods for studying computer vision, and has also created many starting points for research.

3 Chip Mounter System Composition and Working Principle

3.1 Composition of Vision System

Finally, the precise difference between the components and the mounting position is found through the coordinate transformation between cameras to complete the mounting task. In addition to the camera distribution mode shown in Fig. 1, another situation is that the detection centering camera can also be installed on the suction head, which turns the dynamic problems during the centering detection and imaging process into static problems, but at the same time, the number of cameras needs to be increased (each suction head corresponds to a camera), which increases the mechanical complexity and weight of the entire patch and is not conducive to the dynamic accuracy of the system.

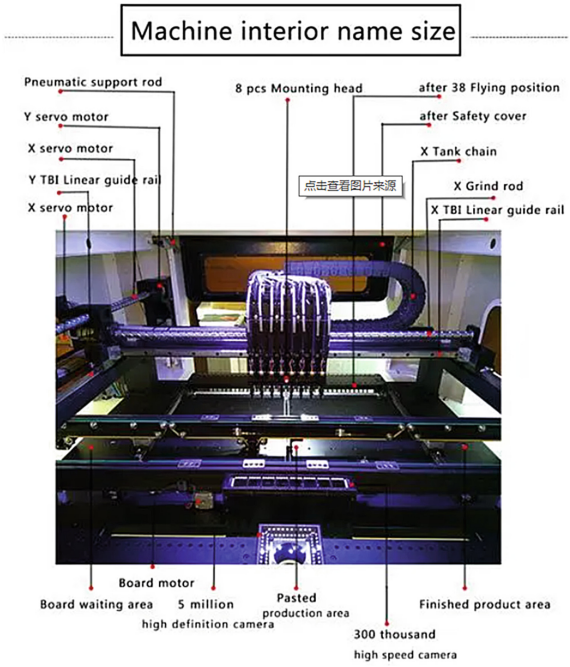

Fig. 1. Schematic diagram of camera distribution in the vision system of the placement machine

In the research of this project, the traditional method is adopted, that is, the camera distribution mode as in Fig. 1.

3.2 Working Process of the Chip Mounter

When a PCB to be pasted is transferred to the designated position through the board feeding mechanism and fixed, the reference camera installed on the patch head searches for the Mark point in the corresponding area through the image recognition algorithm, and calculates its coordinates in the Euclidean world coordinate system through the three-dimensional reconstruction technology. Next, send the position data of the corresponding components to the master computer. Use the centering detection camera (small field of view for Chip components, large field of view for large ICs) to detect components and devices and obtain their coordinates and corner values in the display screen coordinate system. The coordinates under the corresponding world coordinate system are obtained through 3D reconstruction technology, and the compensation values of the nozzle in the (x, y) and 0 direction of the rotation angle are obtained through coordinate transformation. Send it to the master computer, and the control system will complete the placement task. Repeat this process until the whole board placement task is completed. The specific process is shown in Fig. 2.

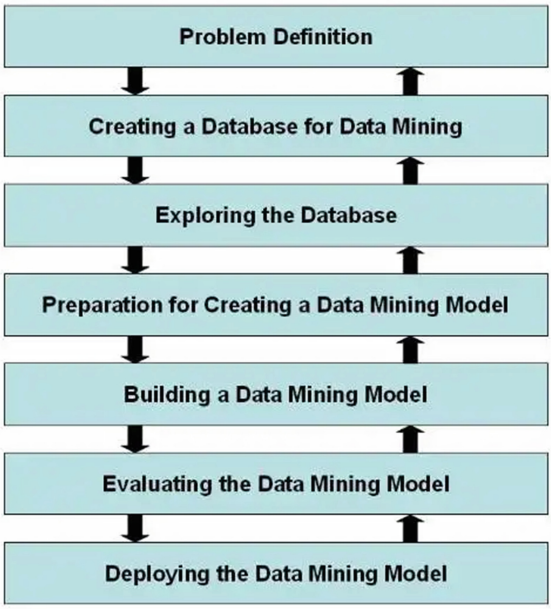

Fig. 2. Working process of chip mounter

4 Image Processing in Machine Vision System

4.1 Image Filtering

Images are often polluted by random signals (usually called noise) in the process of acquisition. Noise is also an important factor to reduce image quality. Common noises include Gaussian white noise and impulse noise. Among them, Gaussian white noise refers to the noise whose brightness follows Gaussian or normal distribution, such as the electronic interference noise obtained by the camera. The impulse noise only contains random positive impulse noise or negative impulse noise.

Image filtering (also known as local preprocessing) is a technology to eliminate noise to a certain extent, and the main method is image smoothing. Image smoothing uses the redundancy of image data to suppress image noise, which can effectively eliminate impulse noise, but has the problem of causing obvious edge blur in the image, such as mean filtering. Median filtering and edge preserving filtering are two nonlinear smoothing methods that can reduce edge blur.

As shown in Fig. 3, the author conducted experiments on common surface mount SO package type components. The median filtering method and the edge preserving filtering method have good filtering effects for the noise in the image. Because of the high real-time requirements for image acquisition and processing in the mounter system, and the relatively complex edge preserving algorithm, the median filtering method is selected in this paper.

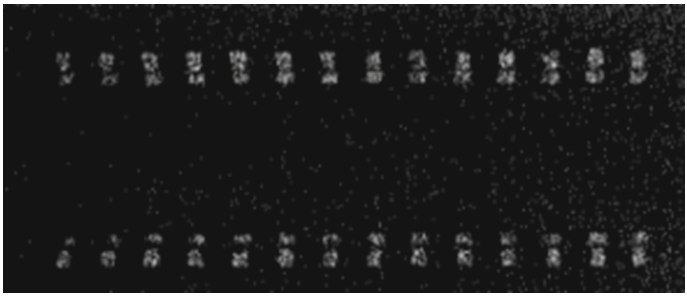

Fig. 3. Median filtered image

4.2 Threshold Segmentation

In the actual placement production process, different types of components have different shapes, so the recognition algorithms are different. However, it is necessary to separate the mounting component image from the background image in order to further feature recognition of the component image. This process is called image segmentation.

There are many methods for image segmentation, among which threshold segmentation (that is, selecting an appropriate gray level threshold to separate the target to be identified from the background in the original image) is the simplest and most effective.

Objects with interesting items in the interior have uniform gray values and are distributed in: when one has another background with uniform gray values, the threshold method can obtain a good segmentation effect. There are many methods to select the threshold value. The global threshold method means that the whole image is binarized by using a unified threshold; since.

Adaptive thresholding method is to segment each part of an image with a set of thresholds related to coordinates (that is, the threshold is a function of coordinates); local thresholding method can be seen as a general case of global thresholding method.

The key of image segmentation using threshold method is to select threshold. According to the characteristics of the motion control of the placement machine system, because the contrast between the components to be mounted (target) and the suction nozzle (background) collected by the vision system is high and there is no shadow on the components during the visual alignment detection of the placement machine, the global threshold method can achieve good results. The commonly used global threshold methods are iteration method and maximum variance between classes method.

5 Conclusion

This paper focuses on the main process and implementation of machine image processing in the machine vision system of the placement machine. This system analyzes several common image smoothing techniques and selects the median filtering method to realize image filtering on the basis of simulation experiments. For the threshold image segmentation technology, the selection methods of the global threshold are analyzed and compared. The experiment shows that the maximum. Therefore, the maximum inter class variance method is selected in the vision system of this placement machine to determine the threshold.

Acknowledgements. Anhui University Scientific Research Project: Research on intelligent detection and marking system of flexible PCB surface defects based on machine vision (KJ2020A0703).

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Research on Automatic Test System of Optoelectronic Equipment Based on PC Bus and GPIB Bus

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Abstract. General Interface Bus (GPIB) is a widely used way to build automatic test system at present. It integrates virtual instrument technology, computer technology and powerful test instruments together. It test speed, powerful function and scalability, so it has test work. The research of automatic test for photoelectric on PC bus and GPIB bus has been carried out as a part of the research project of "automatic test system for automatic detection and maintenance". The purpose of this research is to develop an automatic testing system for photoelectric equipment based on PC bus, which can be used for automatic testing and maintenance process. The main goal is to develop an automatic test system, which can realize the test and diagnosis functions by using the information provided by the control unit (PC). In addition, it should also have the following characteristics: high-speed data transmission; Flexible configuration.

Keywords: Photoelectric equipment · GPIB bus · Computer PC bus · automatic test system

1 Introduction

In the past 10 years, optoelectronic technology has developed rapidly and has been widely used in various fields. The optoelectronic detection system and weapon equipment developed by using optoelectronic technologies such as optical television, infrared and laser have promoted the innovation and development of modern equipment, and have a great impact on modern warfare. With the development of optoelectronic detection technology, more and more optoelectronic detection systems have been introduced into the systems of advanced fighter aircraft [1]. The combined use of detection systems and optoelectronic guided weapons has greatly improved the ground attack capability, night combat capability, air warning, target detection and operational effectiveness of fighter aircraft. Optoelectronic equipment technology covers a wide range of disciplines, including optics, machinery, electronics, computers, automatic control, navigation and positioning. The research on this technology in foreign countries has been relatively mature, and related products have been more and more applied in military and other fields [2]. At present, relevant domestic departments, such as the public security system,

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have actively applied this technology in the field of police use, which is expected to have a great market prospect.

Today, the testing work is in an important position in the production, use and maintenance of various modern equipment systems. At present, the testing cost has reached 50% of the cost of developing equipment systems and even 70% of the cost of optoelectronic equipment testing is also facing this problem [3]. With the arrival of the information, era and network era, the development of test system instruments has reached the level of digitalization, intelligence and virtualization.

2 Related Work

2.1 Development Process of Automatic Test System

The development process of automatic test system can be generally divided into three stages:

(1) The test system - special type

The early mostly special systems, which are developed. They are mainly used for repeated tests with large test workload and complex tests with high reliability, as well as high-speed tests completed in a short time, and tests in harsh environments that are difficult for personnel to enter. The shortcomings of the first generation automatic test system are highlighted in the communication and standardization of interfaces [4]. When building such a system, the designer should solve the interface problems between instruments and between instruments and computers in the system. When the system is complex, the development workload is large, and the time to build the system also increases accordingly. In addition, because such systems are specific to the object under test, the adaptability of the system is not strong, and the interface is not universal, so it is often necessary to redesign the circuit when changing the test content.

(2) The Second Generation Automatic Test System Desktop Instrument

The is based on the standard interface bus GPIB (General Interface Bus) and CAMAC (Computer Aided/Automated Measurement And Control). Each device in the system is equipped with a standard interface circuit. When building the system, all devices in the system are connected together with standard interface bus cables to form the system. This kind of system is easy to build. Generally, it does not need to design interface circuits by itself. The system has good reusability. It can flexibly change, add or delete test contents according to different requirements [5]. The main disadvantages are that the bus transmission rate is not high enough (the maximum GPIB transmission rate is 1 MB/s), and it is difficult to build.

(3) The third test system - modular and integrated

The third generation, PXI and other test buses, mainly composed of modular instruments and equipment. It has the advantages of high data transmission rate, large data throughput, small size, light weight, flexible system construction, easy expansion, good resource reusability, and high degree of standardization. It is the mainstream construction scheme of the current advanced automatic test system, especially the military automatic test system.

2.2 Status Quo of Photoelectric Equipment Testing System

Optoelectronic devices refer to devices that use the conversion of light, electricity, or other radiation energy to complete signal processing, information transmission, or control functions. With the continuous development of optoelectronic technology, optoelectronic devices are increasingly widely used in modern society, including communication, medical treatment, industrial automation, security and other fields. In order to ensure the quality and performance of optoelectronic equipment, the detection of optoelectronic equipment has become an important link.

At present, there are various forms of detection systems for optoelectronic devices, which can be roughly divided into the following categories:

(1) Manual detection: refers to the detection conducted through manual visual inspection or other means. The advantages of this method are intuitive and easy to implement, but the quality of labor varies, making it prone to missed tests and misjudgments.
(2) Traditional testing instruments, such as oscilloscopes and multimeter, are often used for testing electrical parameters, but their detection effect on optical performance is poor.
(3) Fully automatic testing instruments: including photoelectric parameter testers, optical characteristic testers, automatic optical detection systems, etc., have the advantages of fast testing speed and high accuracy, but the price is high and the skill requirements for operators are also high.
(4) Machine vision detection system: uses computer vision technology, image processing algorithms, and other technologies to perform non-contact detection of optoelectronic devices. This method has the advantages of good real-time performance, high detection quality, and high efficiency, and has become the mainstream technology for modern optoelectronic equipment detection.

In short, with the development of optoelectronic technology, the detection system of optoelectronic equipment is constantly improving and tending towards automation and

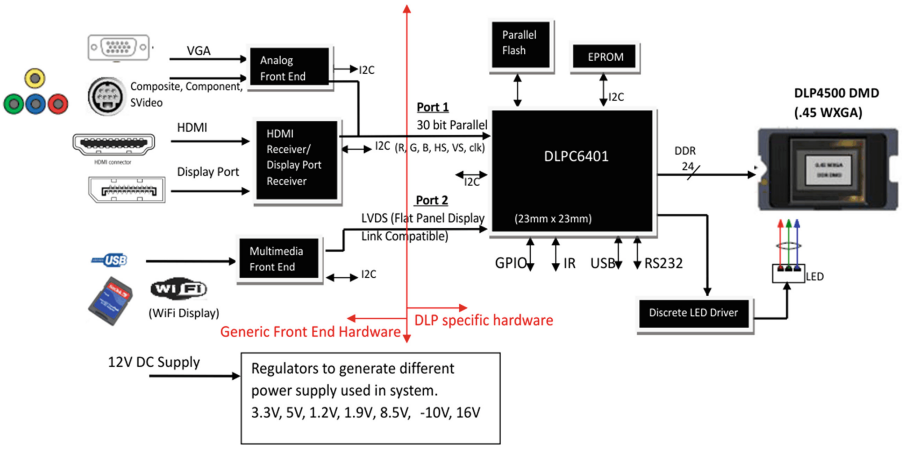

Fig. 1. Typical Photoelectric Equipment Hardware Connection Diagram

intelligence. In the future, optoelectronic equipment detection systems will continue to develop, striving towards higher accuracy and reliability to meet the constantly changing market demands.

3 Establishment of Photoelectric Equipment

The photoelectric universal test system is used to measure, collect, display and record the physical parameters of the test object under the conditions of laboratory and field tests. These tasks need a variety of sensors, measuring devices and data acquisition hardware systems to complete. Verify whether the accuracy of data meets the technical requirements of relevant products according to data analysis. Only through analysis can the overall concept of system function and performance be described as specific software and hardware descriptions, thus laying the foundation for the development of the entire system. The control processing system is displayed on the, as shown in Fig. 1.

4 Automatic Test System for Photoelectric Equipment Based on PC Bus and GPIB Bus

4.1 Structure and Characteristics of Automatic Test System

Automatic testing. It combines computers, measuring instruments, firmware and testing software. In addition to realizing the measurement functions of traditional instruments, it also adds many analysis and processing functions that traditional instruments cannot achieve.

The basic automatic test in Fig. 2, application software and measuring instrument hardware. The general computer and the measuring instrument are combined through the application program. The user can operate the computer through a friendly graphical interface to complete the tasks of data acquisition, analysis, judgment, display, storage, etc. of the measured object. The computer and measuring instruments are called the hardware platform of the automatic test system. Surveyors no longer directly operate the instrument itself. Instead of using the computer screen, keyboard and mouse to replace the actual instrument panel buttons, they can control the startup, operation and shutdown of the instrument, and complete the functions of data acquisition, signal analysis, waveform and spectrum display, fault diagnosis, data storage, data playback and control output of the measured signal.

The biggest advantage of automatic testing is its flexibility. Users can change the functions of the instrument as required to complete various test tasks. The functions of traditional instruments are determined by the hardware of the instrument. The functions that users can realize after purchasing the instrument are also fixed. Automatic testing can break through the hardware limitations of instrument manufacturers. Users can select different instrument software according to actual needs to achieve the purpose of achieving different testing functions on the same instrument. After the hardware platform, I/O interface equipment and computer are determined, the test instrument with this function can be realized by compiling the software with a certain measurement function.

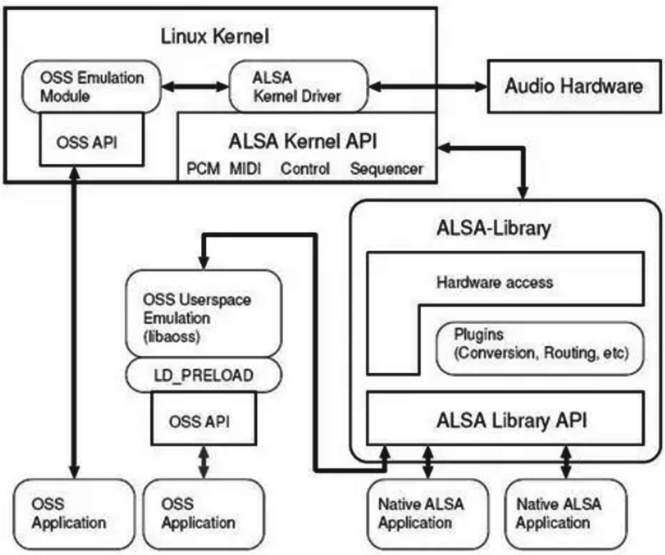

Fig. 2. Basic structure of automatic test system

4.2 Automatic Test System Architecture of Photoelectric Equipment

The photoelectric equipment is shown in Fig. 3.

The structure testing for photoelectric actually uses the connection of all hardware parts. The RS232 and RS422 of the industrial computer are mainly used for serial communication. The realization method of multi-channel serial communication between the main control computer and the photoelectric equipment and the control rod occupies an important position in the design of this test system. The network communication is mainly through the network hard disk video recorder to collect the experimental images.

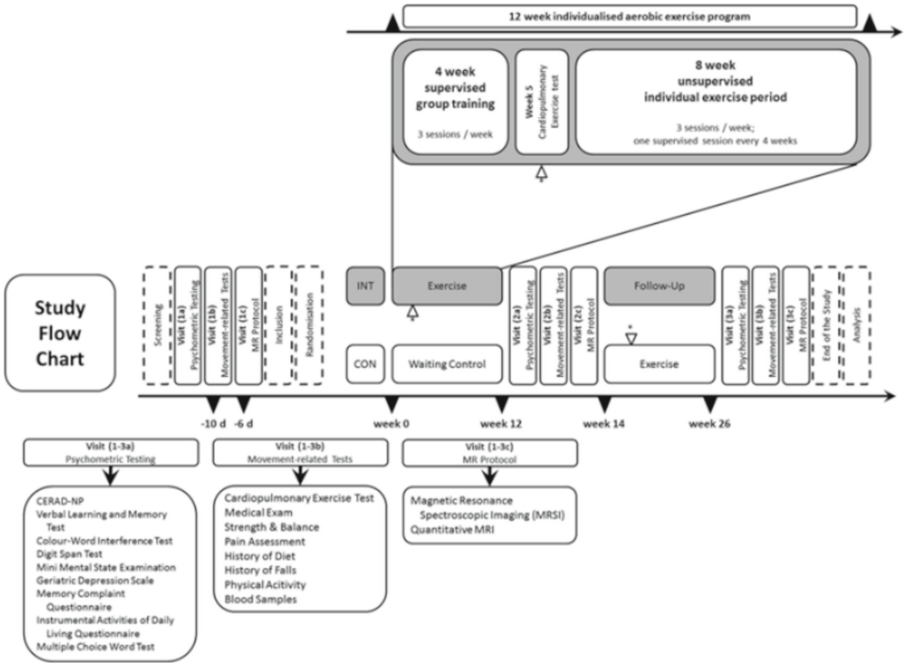

Fig. 3. Framework of general testing system for photoelectric equipment

5 Conclusion

In the process of design and development of this subject, I have consulted a large number of technical data, analyzed and studied the latest testing technology at home and abroad. After careful design and repeated debugging, the test system has been put into measurement test, and each measuring instrument can be monitored in real time no matter on the server or on the client. The system runs stably and basically meets the design requirements. The successful development of distributed automatic test system provides a certain method for the development of virtual instrument, and makes a great step towards networking, modularization and user oriented development of the test system.

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Application of AHP Algorithm Based on Data Mining in Higher Education Teaching Evaluation System

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Abstract. The higher education teaching evaluation is receiving increasing attention. AHP (Analytic Hierarchy Process) is a multi domain and multi-level analysis method for decision-making problems, which is also widely used in higher education teaching evaluation. This article proposes a higher education teaching evaluation. The system is evaluated based on multiple indicators such as students' academic performance, teachers' teaching abilities, teaching environment, and teaching facilities. DM algorithm is used to mine data, and AHP algorithm is used to perform hierarchical analysis and weight calculation on indicators. The experimental results indicate that the system can provide useful information and decision support for higher education teaching evaluation.

Keywords: Data mining · Teaching evaluation · AHP algorithm · Higher Education

1 Introduction

With the in higher education is becoming increasingly important. Teaching evaluation is an important task aimed at evaluating the results of teaching practice and providing guidance for future improvements. However, in the evaluation of higher education teaching, there are many factors to consider, including students' academic performance, teachers' teaching abilities, teaching environment, and teaching facilities. Therefore, a scientific and effective method is needed to help teachers and decision-makers understand and process these complex information [1].

Widely used in the field of educational evaluation. In the AHP method, the hierarchical structure is composed of factors and standards at different levels, and the importance of each factor and standard is determined by establishing a comparison matrix [2]. However, the AHP method has a high dependence on weight calculation, so a reliable method is needed to determine weights.

The in higher education teaching evaluation is receiving increasing attention. Data mining is an automated data analysis method that can extract useful information and knowledge by mining and analyzing a large amount of data. In higher education, data mining can help teachers and decision-makers understand the impact of factors such as

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students' academic performance, socio-economic background and gender, and course difficulty on students' academic performance.

Therefore, a higher education teaching evaluation has emerged. This system combines the hierarchical structure of AHP method with the weight calculation of various indicators and the characteristics of data mining. This system can evaluate multiple indicators such as students' academic performance, teachers' teaching abilities, teaching environment, and teaching facilities, and use AHP algorithm to perform hierarchical analysis and weight calculation on the indicators [3]. At the same time, the system uses data mining algorithms to mine data and provides multiple views and data interaction, which can provide efficient information and decision support for teachers and decision-makers, thus achieving the scientific and effective evaluation of higher education teaching.

2 Related Work

2.1 Problems in the Current Teaching Quality Evaluation System

Currently, education quality evaluation has become an important standard for evaluating the level of schools, teachers, and students. In practical applications, there are some problems in the construction system. Firstly, generally suffers from unclear indicators and unscientific weights. The lack of standards for setting indicators and determining weights may lead to a certain degree of subjectivity in the evaluation system. Secondly, there are certain limitations. Most evaluation systems only rely on students' academic performance and teachers' teaching evaluations, while ignoring other factors such as teaching resources and teaching environment. Secondly, the current evaluation system adopts the same evaluation indicators and methods for different disciplines, teaching stages, student backgrounds, and other situations, which cannot be distinguished and analyzed for different situations [4]. The current evaluation system lacks scientific and practical results. Due to the unscientific evaluation indicators and methods, as well as the incomplete data collection, the evaluation results obtained by the evaluation system may have certain distortions and errors, which cannot provide useful guidance and reference for teaching practice.

First of all, the evaluation of teaching quality often involves multiple indicators, and the selection of these indicators should fully reflect the working conditions of teachers. It is not fair and unscientific to evaluate only one or several indicators.

Secondly, in order to pay attention to democracy and fairness, the school evaluates the teaching quality through the method of students scoring for teachers. This score plus the leader scoring, and carries out to take. This evaluation method seems to be "all inclusive", but in fact, it ignores the and importance of various. Because not every indicator is of equal importance in the empirical perspective, it takes time and effort to use manual methods to make statistics of teaching quality evaluation scores with a large workload, but the objective and fair of teachers'.

Finally, the evaluation index system and its weight are not scientific. In an evaluation system, there are two aspects that have the greatest impact on the evaluation object. On the one hand, the appraiser the evaluation with an objective attitude, but under the existing technical conditions, it cannot guarantee that the appraiser can participate in the evaluation of the evaluation object with a completely objective attitude; On the other

hand, it is to evaluate whether the indicator system and its weight value are reasonable [5]. On the other hand, some indicator systems and their weight values of the evaluation system are added to the system according to the user's requirements during the system development, and cannot be changed during the user's use, lacking flexibility.

2.2 Technical Principle of Multi-level Fuzzy Evaluation

Multilevel fuzzy is an mathematics, which is widely used (such as real estate evaluation). It is composed indicators and the indicator. Multilevel does not mean that there are many evaluation indicators, but that there is a hierarchy between indicators. They as shown in Fig. 1.

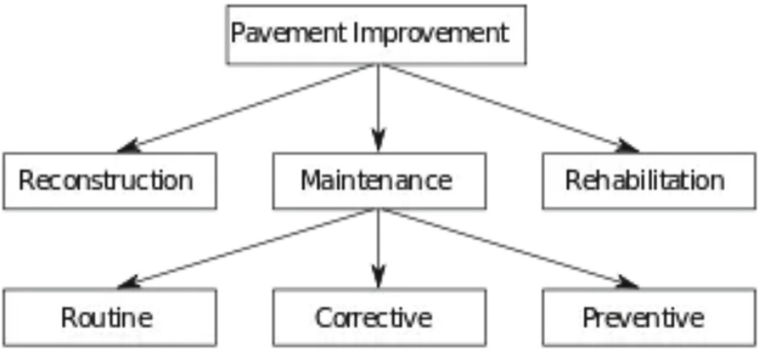

Fig. 1. Typical hierarchical structure model diagram

3 AHP Algorithm Design

3.1 Overview and Workflow of AHP Algorithm

AHP is a commonly used multi criteria decision analysis algorithm. The main idea is to decompose a complex decision-making problem into multiple levels and form a corresponding judgment matrix based on the hierarchical structure, with each element representing the importance of various factors at different levels. The AHP algorithm determines the weights between various factors by calculating feature vectors and eigenvalues, thereby achieving the sorting and optimization of decision plans.

The workflow of the AHP algorithm is as follows: first, clarify the decision problem and determine multiple key factors; Secondly, construct a decision-making hierarchy and form a judgment matrix; Then, eigenvectors and eigenvalues are calculated through vector normalization; Finally, the priority of each factor the feature vectors, and the decision plans are sorted and optimized.

The AHP algorithm has the advantages of wide applicability, simple and easy to understand methods, and fast calculation speed, and is widely used in decision-making evaluation, resource allocation, risk analysis, and other fields.

The workflow this to determine the index:

a) Invite experts to of the decision-making evaluation and establish the hierarchical.
b) Experts the importance of each indicator (or element, or criterion) at the same level relative to a certain indicator at the upper level, compare them in pairs, and determine the pairwise judgment matrix.
c) Calculate the relative weight on the corresponding to an indicator on the previous level.
d) Calculate the relative each indicator on the criteria, and finally value of all leaf indicators level. Weight is the specific on the evaluation object. The weight of the an important the rationality and scientificity of the evaluation results of the object, and the index directly affects the results.

3.2 Construct Pairwise Comparison Judgment Matrix

The workflow of AHP algorithm, experts should first be invited to establish the hierarchical structure. Therefore, we assume that the evaluation architecture has been established, as shown in Fig. 2.

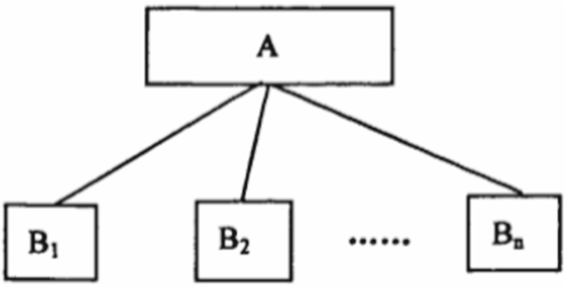

Fig. 2. A-B indicator hierarchy diagram in evaluation architecture

4 AHP Algorithm Based on Data Mining in Higher Education Teaching Evaluation System

That is, students choose the curriculum, and teachers are the teachers of the curriculum; Teachers in the whole system are not only the object to be evaluated, but also the subject to participate in the evaluation, that is, teachers' own evaluation; Experts are the subjects participating in the evaluation, and also the users who determine the weights of the evaluation system indicators; Leaders and peers can evaluate teachers based on their administrative relationship with them. Expert module (expert evaluation module and indicator weight determination) and leader evaluation module according to the type of users.

Only administrators can log in at the background, so sub modules can be divided according to different functions of administrators. The sub modules include: system

management, system maintenance (data backup and data recovery), basic information (student information management, expert, leadership and curriculum), and evaluation management. The system structure is shown in Fig. 3.

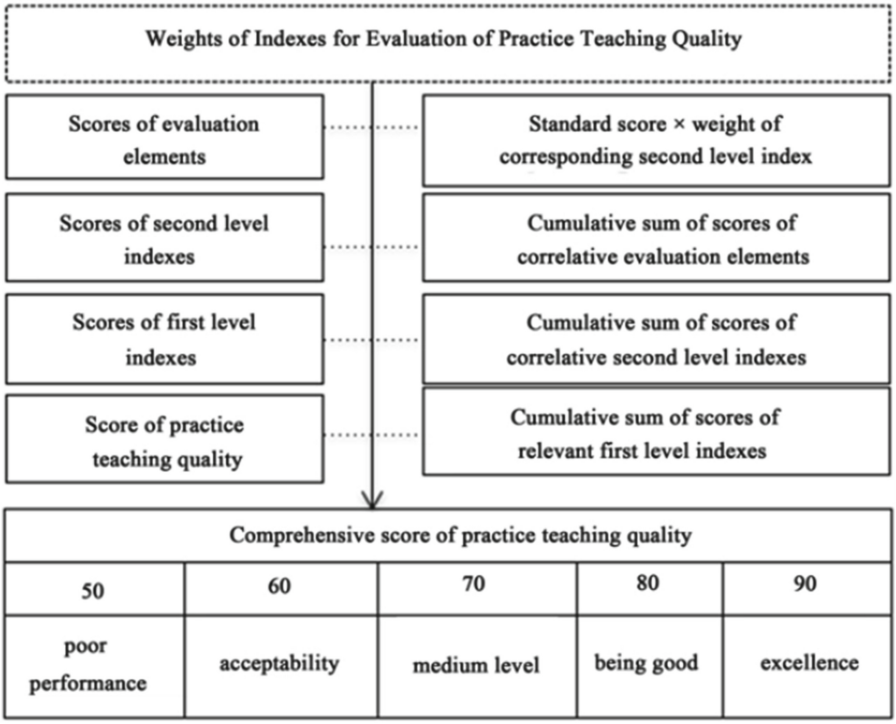

Fig. 3. The structure of higher education teaching evaluation system

5 Conclusion

This system mainly uses AHP algorithm. Developed has changed the index weight value that was finally determined by experts' collective discussion in the past, and it may not be a very scientific index weight value. In this system, experts can express their opinions, and finally the system calculates the weight of each index according to the algorithm. Can be changed according to needs, because different schools may have different emphasis on teachers' teaching quality, leading to different evaluation index systems, so that each school can change system of the system according to its own needs. Secondly, it is realized in this system that multiple users participate in the evaluation, that is, students, teachers themselves, teachers' peers, experts and leaders, etc. It implements the management of the administrator's background data, mainly including basic parameter settings (information about schools, departments, majors, classes and courses), system

maintenance, user information management (referring to users participating in the evaluation), management of teachers' timetables, management and management of teachers' evaluation information.

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Optimization Design of Optical Film System Based on Ant Colony Algorithm

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Abstract. With the performance of optical films is required to be higher and higher in optical instruments. The design of optical thin films optical instruments. The optical characteristics of the film system are determined quantitatively by the evaluation function in the film system design. The is a method to solve the problem. This method has been applied in many fields such as engineering, economics and biology. The main idea of this method is to use ants to find the shortest path between two points. In other words, ants move from one place to another to obtain food or other resources. If there are many ants moving around, they will form a path, which can be called the best solution to the current problem. In this paper, some new ideas thin optimization design are proposed.

Keyword: Ant colony Membrane system optimization

1 Introduction

Optical thin films have rich spectral characteristics, which can change the amplitude, phase and polarization state of reflected light or transmitted light on the surface of various optical materials. They are more and more widely used in aerospace, communications, energy, computer and scientific research and many other fields. With the fabrication process, the spectral performance of optical films is required to be higher and higher in optical fiber communication, displays, artificial satellites, semiconductor lasers, optical information storage and various optical components. Optical thin film is an indispensable component of various optoelectronic elements and plays an extremely important role in modern optical engineering [1].

The theoretical basis of optical film design is the principle of light, so the relationship between various quantities in optical film design is very complex. Only in simple cases can there be a clear and concise mathematical relationship, and in more cases, it is difficult to express the relationship between them with intuitive formulas. Therefore, the design of optical films is a difficult subject. After a long period of exploration, its design theory and methods have also experienced three types of changes: the design of optical films was first used trial and error method and graphical method, but this can only solve some simple film system design problems [2]; Subsequently, based on some special film system structural units, such as symmetrical film system, periodic structure

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and quarter wave stack, various analytical design methods have been developed, such as admittance matching technology, double effective interface method, equivalent refractive index method, achromatic design technology, etc. However, when using analytical method to design various film layers, different film design methods are very different; By the 1970s, the design of optical thin films had made greater progress by using various computer-aided design methods, especially the optimal design of optical thin films [3].

2 Related Work

2.1 Overview of Optical Film Design Methods

The theoretical basis of optical film design is the principle of light, so the relationship between various quantities in optical film design is very complex. Only in simple cases can there be a clear and concise mathematical relationship, and in more cases, it is difficult to express the relationship between them with intuitive formulas. Therefore, the design of optical films is a difficult subject. After a long period of exploration, its design theory and methods have also experienced three types of changes: the design of optical films was first used trial and error method and graphical method, but this can only solve some simple film system design problems; Subsequently, based on some special structural elements of the film system, such as symmetric film system, periodic structure and quarter wave stack, various analytical design methods have been developed, such as admittance matching technology, dual effective interface method, equivalent refractive index method, achromatic design technology, etc. [4]. However, different film design methods are very different when analytical methods are used to design various kinds of films; By the 1970s, the design of optical thin films had made greater progress by using various computer-aided design methods, especially the optimal design of optical thin films [5].

The of optical thin films first emerged and early Baumeister put forward the concept of optimal design of film system in 1958, some scholars realized the great potential of optimal design of optical films, engaged in research work and compiled programs in this field, and optimized design of film system developed vigorously in this period. However, since the appearance of computer was only in 1946, the situation was that it was in the early stage of computer development, and its number was small and its operation speed was slow, which could not reflect the excellent characteristics of many optimization algorithms, which seriously affected the development of optimization design of optical films.

By the 1990s, the performance and price of microcomputers had been greatly improved, which gave scientific researchers and even ordinary people the opportunity to contact and use them, and the computing speed was unimaginable in the early stage of development. In addition, the emergence of many new programming languages reduced the difficulty of programming. The optimization design of optical thin films has entered a vigorous development stage again. From the foreign references, we can also see that during this period, there were more and more articles about the optimization design of membrane systems, and the optimization design of membrane systems again became a research hotspot.

2.2 Introduction to Popular Algorithms for Optical Film Design

Film system design is an old and young subject closely related to practical application. Fraunhofer formed the world's first antireflective films by acid etching in 1817, and optical film design was born and gradually developed from then on. The main method of membrane system design in the early stage was the trial and error method relying on experience. With the maturity of vacuum technology and the advent of commercial diffusion pumps in the 1930s, the increasing demand of various optical devices for optical films has also promoted the development of film system design, forming various analytical design methods with the periodic structure of quarter film system and symmetrical film system as the research object. Such as equivalent interface method, vector synthesis method, equivalent refractive index method, admittance diagram method, etc. These analytical design methods have been applied, band-pass filters and interference cut-off films with good design results. However, this analytical method requires high design experience, and is limited to regular films with a thickness of integral times of quarter wavelength. With the rapid development of computer technology and the growing maturity of industrial monitoring technology, especially the successful application of arbitrary film thickness monitoring technology, as well as the maturity and development of spectral technology, irregular film systems have begun to become the preferred form of optical thin films with increasingly diversified and complex optical characteristics. The automatic design method of film systems suitable for irregular film systems has also developed vigorously. Various numerical optimization algorithms in the computer field have been introduced and applied to film system design, such as the steepest descent method, Newton method, least square method, simplex method, simulated annealing method, needle method, genetic algorithm (GA) and other numerical optimization algorithms. However, most of these numerical optimization methods need a film system that is close to the spectral characteristics of the designed film, and the design is completed by optimizing its structural parameters and finding the minimum value near it. This method largely depends on the selection of the initial value. A good initial membrane system can ensure that a satisfactory solution close to the design requirements can be found as soon as possible, and still depends on the design experience to a certain extent. However, it is very difficult to get a good initial film system for the film system with complex design requirements. In this case, it is usually advantageous to adopt the comprehensive design method to design. The comprehensive design method does not require the initial film system or is directly determined according to the design requirements, and can avoid falling into the local minimum to a certain extent.

3 Ant Colony Algorithm

Ant colony algorithm is an intelligent optimization algorithm inspired by the shortest path behavior of ants in finding food. In the basic ACO algorithm, all ants are initialized randomly and search for the possible optimal solution. All ants have the same number of pheromones, that is, the initial value of pheromones is set to a constant value, and ants will randomly find a better path and return to the nest. In each iteration, based on the pheromone concentration t (T) and the heuristic information NTJ (T) of the path, each ant builds a new solution by moving to the node that is not visited until it meets the goal. Ants achieve the above goals through the state transition probability formula p, (t). Xiao (t) represents the state at time t from service i to service j, as shown in Eq. (1).

$$p_{ij}^{k}(t) = \begin{cases} \dfrac{\tau_{ij}^{\alpha}(t)\eta_{ij}^{\beta}}{\sum_{j \in N_j^k} \tau_{ij}^{\alpha}(t)\eta_{ij}^{\beta}} \\ 0 \end{cases} \tag{1}$$

ACO algorithm steps and processes are as follows:

Step 1: Initialize parameters. The number of iterations N and the pheromone increment △ TIJ (T) on the path are set to 0.

Step 2: randomly initialize m ants at the initial position.

Step 3: According to the state transition probability, each ant uses the roulette wheel method to select the next service.

Step 4: according to the local pheromone update formula, each ant updates its local pheromone.

Step 5: after all ants have selected all services, enter step 6; Otherwise, go to Step 3.

Step 6: calculate the fitness value of the solution generated by each ant.

Step 7: select the best ant of this iteration according to the fitness value of the solution generated by each ant. According to the global pheromone update formula, the best ant updates the global pheromone.

Step 8: if the termination conditions are full, the optimal solution is output; Otherwise, enter Step 2 Basic ACO Algorithm Fig. 1.

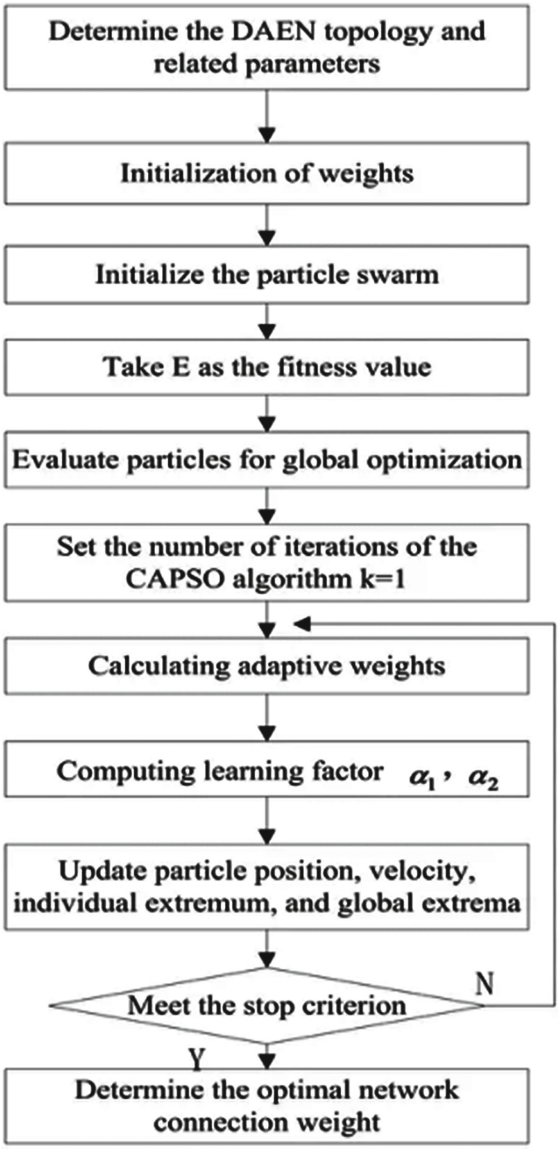

Fig. 1. Algorithm flow chart of basic ACO

4 Optimization Design of Optical Film System Based on Ant Colony Algorithm

When compiling the program for optimizing the initial structure of the number of film layers is m and the thickness of each film layer is/ 4. The characteristics of the film layer is a function of the combination of refractive index of each layer N = N (n1, n2,…, m), namely

$$R(\lambda_i) = R(\lambda_i, N) \tag{2}$$

The complexity of the algorithm is shown in that if the given number of film materials is k and the designed number of film layers is m, then there are k "combination forms. The search space increases rapidly with the increase of k and m. For example, when k = 8 and m = 10, the value of k" reaches nearly 1 billion. It is difficult to achieve this combination optimization problem with conventional mathematical algorithms.

The ant colony is as follows:

1) First, the settings of the update strength parameters r, Ar, initialization and iteration times are determined according to the simulation results. Since most optimization results occur within 500 times, the settings in this paper are 500;
2) Put 50 ants in their initial neighborhood, and each ant searches for a set of feasible solutions correspondingly. The neighborhood is mainly the value range of each independent variable, and then each ant moves according to the probability PIJ (taking 0.7) or performs neighborhood search to obtain 50 sets of feasible solutions.
3) Substitute the feasible solution obtained in 2) into the objective function formula (5), find 50 objective function values of the first group, and compare these 50 objective functions to retain the "optimal solution" and corresponding objective function values calculated this time.
4) Update Eqs. (2) and (3) according to the intensity to modify the trajectory intensity parameters ty, and At, so as to facilitate the ants' mobile search, that is, to obtain a new feasible solution value. At the same time, replace the value of the previous cycle with the new trajectory intensity parameters t, and △ t, and repeat 2) ~ 4).
5) Check the stop condition, and output the optimal solution and corresponding objective function if it is satisfied; Otherwise, go to 2).

5 Conclusion

Ant is used the initial structure of the optical film system. The algorithm is feasible, not only with simple process, but also with clear programming ideas. It has good versatility, and can be used to optimize the design of various complex film systems l8%. In the application of ant colony algorithm, it does not need the derivative, continuity and other information of the optimization object, and has a good ergodicity to the search area, which is especially suitable for engineering technicians to use in optimization design.

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Multi View Reconstruction Algorithm of Subway Space Design Based on Virtual Reality Fusion Technology

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Abstract. Multi view reconstruction algorithm of subway spatial design based is a new method of 3D model visualization simulation. The application program is used to simulate the construction process of underground space (such as tunnel, station, platform, etc.). The technology can be applied to a variety of situations, including urban planning and architecture. It can better understand how the underground space is built by using different methods such as traditional computer aided design (CAD), computer drawing and even 3D printing. In this paper, we will discuss the application of multi view reconstruction algorithm in Kanpur IIT subway space design project. Digital media art is involved in the subway space, breaking through the traditional art form of subway space, and embodying the interactive, interesting and novel art, which makes the research in the design and research of subway space artistry of the times significant.

Keywords: Metro space design · Virtual reality · Multiple perspectives

1 Introduction

The city image is the externalization of the city culture. The cultural differences between different cities form a unique city image. In the process of rapid development of subway construction, as an integral part of public space, subway station space should play a role in spreading urban culture, shaping urban image and extending urban memory. At present, the people's material living standard is constantly improving and their spiritual and cultural needs are growing. Strengthening the integration of regional culture in the subway space design and giving consideration to cultural and artistic perspectives will become the focus of the sustainable development of subway construction [1].

With the subway construction, Qingdao subway space design is facing unprecedented challenges. Looking back on the rapid growth of Qingdao Metro in the past two decades, both from the design and management levels, we are looking for a standardized approach as a guide to maximize the coverage of the metro. Therefore, in the design of the subway space interface, modular processing is often used, resulting in the standardization of decoration techniques and the assimilation of decoration styles [2]. As a designer of

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subway projects, it is easy to be constrained by the blind convergence of standardized design, ignoring the spiritual needs of passengers, and it is difficult to break through the conventional design paradigm. Although the development of Qingdao Metro has guaranteed the obvious benefits of construction speed, it has caused the cost of losing the city's cultural characteristics.

The improvement of social needs, and the emergence of digital have greatly enriched the field of art. It is a new urban public transport to involve digital media art in the subway space. This new art form, compared with the static and traditional expression form in the subway space, the dynamic, interactive, interesting and experiential art form of digital media art will break through the traditional single art form in the subway space. Therefore, it is of epoch-making practical significance to explore the design and research of digital media art in the art of subway space.

2 Related Work

2.1 Concept of Subway Space

(1) Underground space: underground space refers to the space and potential space that can be excavated and used below the surface layer, mainly defined in relation to the three-dimensional building space above the ground; The rapid population growth makes the ground space crowded, and the development of underground space space shortage.

(2) Metro space: according to the definition of terms in Code for Design of Metro (GB50157–2003), the so-called metro, in cities. Trains operate on totally, usually in underground tunnels in the area of the city, usually on viaducts or on the ground outside the city center.

Metro is the abbreviation of "subway" or "subway" (Subway, Tube, Underground). In Taiwan, it is called "Rapid Transit". Metro space includes train track area, platform area, station hall area, rest area and equipment management area.

The subway entrance and exit space is the main entrance and exit for passengers to enter the station hall space through the ground space, which is composed of entrance, corridor, escalator, etc. Its main function is to evacuate people from the emergency channel, which can provide road guidance [3]. The design of subway entrance and exit, in addition to meeting the psychological buffer brought by people's space conversion, is consistent with the surrounding environment in terms of integration with the environment. It is unique in design and can play a symbolic role in the city, so that users can quickly identify the location of the subway, as shown in Fig. 1.

The station hall is a transition hall, which is used to guide passengers from the ground to the station platform. The station hall passengers, guide passengers to transfer and sell ticket checking services. In this space, passengers are more diversified, and the visual focus is mainly considered as the main part of the head and diagonal [4]. There is no mandatory passing requirement for the station hall space, and passengers have strong autonomy in action.

Fig. 1. Different subway entrances and exits designed by different countries

2.2 Characteristics of Subway Space

The subway space is a human centered space open to the public. This is the social public attribute of subway space. The subway space bears the characteristics of cultural diversity and displaying the essence of the city image.

(1) Physical characteristics.

The subway space is an environment space with relatively closed space, lack of natural light, poor environmental identifiability, and easy to produce insecurity. It is impossible to see the ground in the underground space, and it is also far away from the familiar ambient sound, which will cause crowding, isolation, dullness, boredom and other feelings [5].

The environment of subway space should not only consider the decoration style, lighting design and use of subway space, color use of subway space building facade and other factors, but also understand the behavior of different passengers. Because after entering the subway space, the passengers lack the objective feeling of the entire space environment and lose the positioning of the objective reference, which makes the direction sense of the passengers weak and easy to cause misjudgment of the direction. In the absence of understanding of the underground space environment, when people take the subway in the subway space, they will not only make wrong judgments in the subway space, but also may bring negative effects to people.

(2) Psychological characteristics.

In modern urban life, the subway is the first choice for urban people to travel because of its low pollution, rapid, safe and other characteristics. With the increasing economic income of people, taking the subway is no longer a simple demand for speed, safety and convenience, and the space of the subway station is no longer a simple “node”.

In the closed and oppressive subway space, it is necessary to have a special space to alleviate the psychological characteristics of such depression, dullness and crowding. Secondly, the subway space is underground, far away from nature, lacking fresh air and depressing. People in cities with high pressure and fast-paced life often hope that the subway can bring people a sense of life, humanity and naturalization.

3 Multi View Reconstruction Algorithm of Subway Space Design Based on Virtual Reality Fusion Technology

3.1 Image Based 3D Reconstruction Theory

In the process of image matching, data dimensions have a great impact on the performance of nearest neighbor matching. Nearest neighbor matching with high-dimensional feature key points is the most time-consuming part. At present, there is no known accurate matching algorithm to solve this problem. How to improve the matching speed while ensuring the matching accuracy has always been the research direction. SIFT feature points contain 128 dimensional information. Using general matching methods (such as Brute Force algorithm), the matching speed is extremely slow. The existing precise matching algorithms have no speed advantage, so some scholars introduced the idea of approximate matching to improve the matching speed by sacrificing part of the accuracy. Experiments show that this method has achieved good results.

In general, the fast approximate nearest neighbor matching method (FLANN) proposed by Muja et al. has been able to achieve a significant reduction in matching time at the cost of very small matching accuracy. On this basis, this paper further seeks for fast matching methods. The cascading hashing nearest neighbor retrieval method proposed by Jian Cheng et al. can not only ensure the same accuracy, but also show great advantages in matching speed. Therefore, this paper uses cashashing nearest neighbor retrieval method to match feature points to improve the matching speed.

Although virtual reality is a new and high technology in recent years, it has developed rapidly because of its wide application. “Virtual” refers to a computer generated virtual world in three-dimensional space, which is generated by computer simulation, so that users can have a real, immersive feeling. In the natural scene simulated by virtual reality technology, trees are indispensable elements. Therefore, the simulation rendering of trees is a very important research content in virtual reality, augmented reality and other related fields. The simulation of trees usually includes L-system method, 3D texture method, polygon geometry surface construction method and fractal based method. Among them, the L-system method describes trees through certain syntax rules to achieve rendering. The simulation results of this method are relatively poor in space information, and the simulation results of more complex plants are relatively rough. The polygonal geometric surface construction method focuses on the three-dimensional space information of the simulation results. Because of the clear coordinate relationship, this method can further simulate with the help of OpenGL related functions, as shown in Fig. 2.

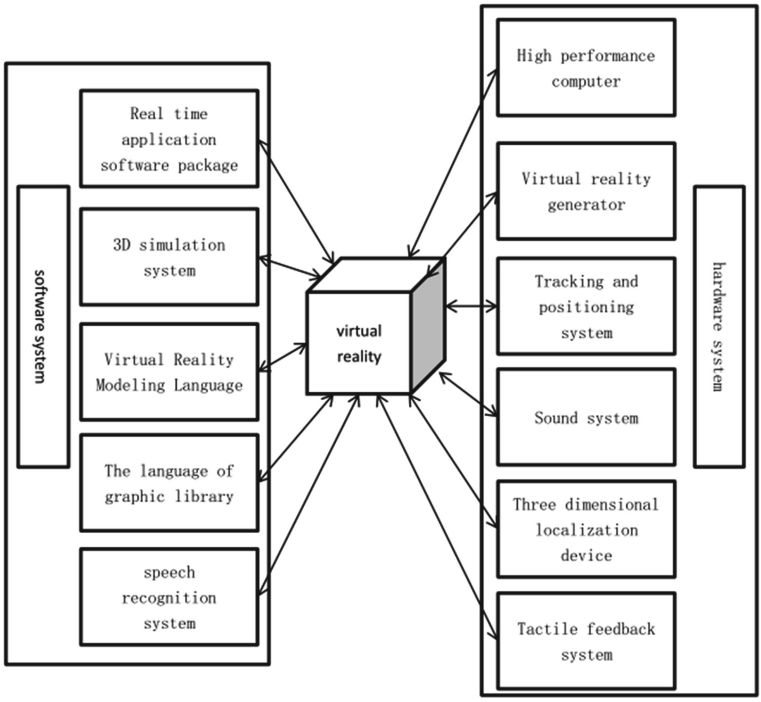

Fig. 2. Virtual Reality Fusion Technology

3.2 Metro Space Design Based on Virtual Reality Fusion Technology

It can be seen from the display interaction effect of Light Spell that interactive digital media art indirectly integrates Maslow's five psychological needs: physiological needs, construction and application of the whole space.

The whole interactive device is expressed in a variety of different combinations of words and languages, allowing people to interact with digital media art in a two-way way. In the subway space, it can better reflect people's psychological needs, and promote people to form a "language communication" relationship with the subway space. This design can not only meet the requirements of the space environment and the emotional needs of the public, but also enhance the passengers' comfort in the subway space, as shown in Fig. 3.

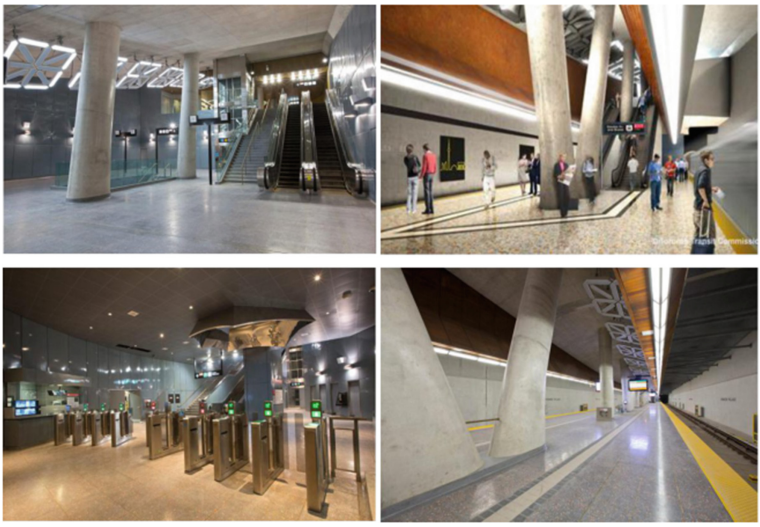

Fig. 3. The overall effect of virtual reality fusion technology in subway space

4 Conclusion

The accuracy of image reconstruction, an image reconstruction virtual reality technology is proposed. The virtual reality technology is introduced to extract image reconstruction features, and support vector machine is used to fit the mapping between image features to achieve image reconstruction. The comparative test results show that the image reconstruction accuracy of this high, the reconstruction, and the comprehensive performance of image reconstruction is significantly better than that of the comparative method, and the ideal image results are obtained.

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Multi-objective Optimal Control of Wastewater Treatment Process Based on Neural Network

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Abstract. The essential to reduce the loss in this stage and produce high-quality final products. First, to this end, a centralized model is developed using multi-objective optimization methods. The results show that these two objectives can be achieved simultaneously and satisfactorily by considering all the parameters and calculating the overall objective function value and each parameter affecting the final result respectively. The activated sludge wastewater treatment process mainly uses biological degradation and other methods to remove pollutants. It has the characteristics of multivariable, nonlinear, strong coupling, large lag and uncertainty. The process operates in an unstable state, making it difficult to measure process parameters in real time and control them very difficult. Therefore, the study of intelligent optimization control method and its application in sewage treatment process to achieve effective control of the treatment process can not only improve the effluent quality, but also have important significance for energy conservation and consumption reduction.

Keywords: Sewage treatment · Neural network · Multi-objective optimal control method

1 Introduction

Water pollution life of residents, so the country has formulated a series of relevant policies material resources to solve the problem of pollution. In response to national policies, various regions have established sewage treatment plants. By the end of September 2011, counties with a treatment capacity of 136 million m3/day. At present, there are about 1300 urban sewage treatment projects under construction nationwide [1]. In the proposed to improve the urban domestic sewage and garbage treatment capacity. However, at present, about 50% of the urban sewage treatment plants in China have effluent quality exceeding the standard, insufficient operating load or abnormal operation, and the operation situation is not optimistic [2]. Moreover, with the China's urbanization, the amount of urban sewage will increase with the increase of population, and the space for advanced sewage treatment is vast. In addition, the national policy of encouraging the use of recycled water also provides a broad market space for advanced sewage treatment [3].

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The high economic cost and high energy consumption of sewage treatment are the low average operating load sewage treatment plants. Corresponding to the second level discharge standard of GB18918, the power consumption. In addition, the number of operation and management personnel in China, which, combined with various factors, has resulted in the low efficiency of sewage treatment and high operating costs in China. The research and development of energy-saving technology has become the most urgent problem in the process [4]. The equipment of most plants in China is mostly imported from foreign advanced process equipment, and its basic theory and process flow are equivalent to those of developed countries, but the design of resource management and control system is obviously behind the developed countries. The imported equipment is not only expensive, but also difficult to operate and maintain, which hinders the actual treatment process, makes the efficiency of sewage treatment low, and brings huge losses in economic cost and time. Therefore, in order to break this situation and narrow the distance from foreign sewage treatment control research level, we urgently need to independently design the control system to achieve.

2 Related Work

2.1 Research Status of Sewage Treatment Control

The activated sludge method is a method to remove the organic matter in the sewage through the propagation and growth of the microbial population in the presence of dissolved oxygen in the reaction tank, with the main body. The method mainly uses the biochemical oxidation and adsorption of activated sludge to decompose the organic matter in the sewage, thus realizing the purification of sewage [5]. The typical activated sludge wastewater treatment process consists of five parts, as in Fig. 1:

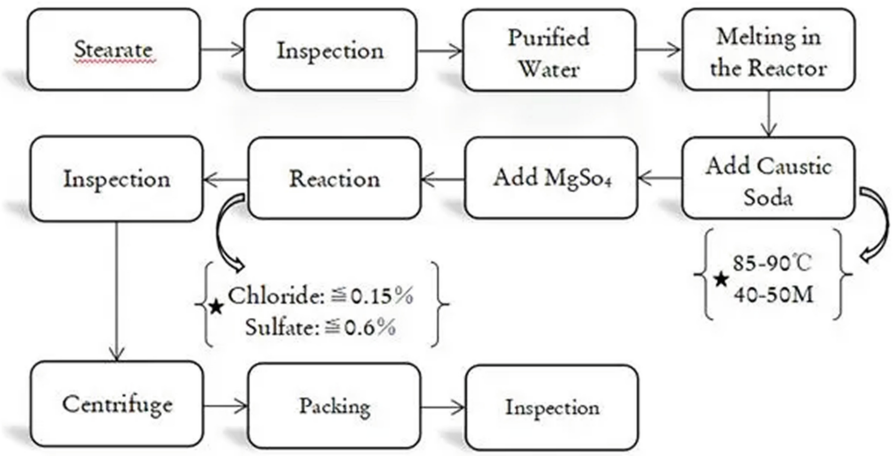

Fig. 1. Process Flow Diagram of Activated Sludge Process

In the figure, Qi is the inflow flow; Si is the concentration of influent substrate; V is the reactor; X is the reactor microbial; S is the substrate concentration in the reactor; Qw is sludge discharge; Qr is sludge return flow; Xr is the concentration of returned sludge; Se is the substrate concentration of effluent; Xe is the concentration of residual biosolids that have not been settled; DO is the dissolved oxygen concentration.

2.2 Status Quo of Sewage Treatment Control Objects

In the load disturbance is very large, the system often works in a non-stationary state, and there are many factors that affect the control objectives, including influent flow, pH value, concentration of mixed liquid suspended solids, dissolved oxygen concentration, nitrate nitrogen concentration and other factors. These factors are dynamic changes, and directly affect the concentration of effluent water.

In order to reaching the standard of sewage treatment, sewage treatment control generally includes the following categories according to different control objects:

1) Inflow flow control: In the the treatment system is determined by the inflow flow. During this retention time, microbial metabolism activities are mainly carried out, which biochemical. Therefore, changes in the inflow often affect other variables in the system. In addition, microorganisms in the aeration tank will be affected when the changes. Therefore, educe the impact of the change of the inflow flow and provide an adaptive environment for microorganisms, it is necessary to control the inflow.
2) PH value control: During the biochemical reaction process of activated sludge process, various fungi are constantly carrying out biodegradation and other reactions. There is a certain requirement for PH value, which is generally about 7. Not only is the limited by the PH value.
3) Dissolved oxygen concentration (DO) control: Dissolved oxygen concentration (DO) is the main influencing factor of wastewater treatment process efficiency, operation cost and stability in the activated sludge process. The living environment of microorganisms is affected by the too small or too large, the survival of microorganisms will be adversely affected. When the too low, filamentous bacteria will multiply in the aeration tank, causing sludge bulking; The decomposition effect of bacteria will also be reduced, leading to the prolongation of treatment time and even the invalidation of biological treatment. When the concentration of dissolved oxygen is too high, it will not only destroy the flocculant, resulting in poor sedimentation of suspended solids, but also lead to unnecessary consumption of energy consumption. Therefore, it is very important to control the dissolved oxygen concentration in an appropriate range by controlling the aeration input in the aeration tank.

3 Multi Objective Optimal Control Method of Sewage Treatment Process Based on Neural Network

The was jointly developed by IWA, Technology, providing a platform for evaluating the performance of systems. The general layout of BSM1 is shown in Fig. 2.

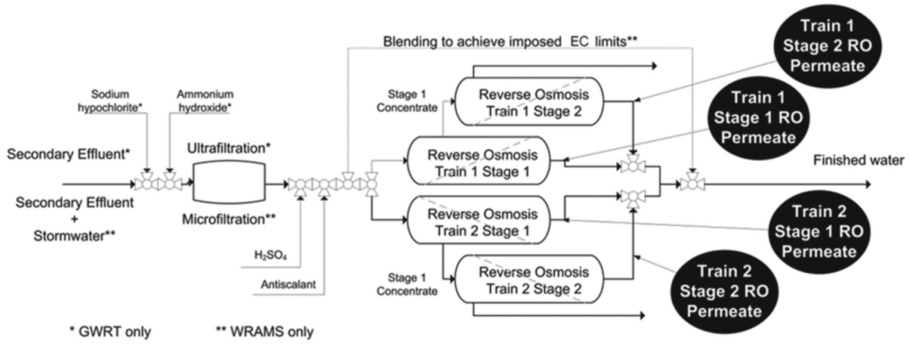

Fig. 2. Structure diagram of BSM1

As in Fig. 2, the tank in BSM1 consists of two units (units 1–2) in the anoxic zone and three units (units 3–5) in the aerobic zone. In BSM1, in order to keep the fifth unit at 2 mgL, it is necessary to adjust the oxygen conversion coefficient KLa, while in the third and fourth units, KLa is fixed (KLa = 10 h ' = 240 d'). In Fig. 2, V represents the volume of each unit (V = V = 1000 m3, V3 = V4 = V5 = 1333 m '), on is the flow, Z is the component concentration, and r is the reaction rate of component Z, where k = 1–5. The biochemical reaction tank model simulates ASM1, so its biochemical reaction is the same as that in ASM1.

According to the material balance rule, the material balance formula of each component in the biochemical tank is as follows:

$$P(S) = P(w_1, w_2, \ldots, w_t) = \prod_{t=1}^{t} p(w_t | w_1, w_2, \ldots, w_{t-1}) \tag{1}$$

The nitrate nitrogen concentration in the second zone of the biochemical reaction tank are the most important control variables in the activated sludge process of sewage treatment, which affect the nitrification and denitrification levels, and are also the direct parameters affecting the level consumption (AE).

4 Real Time Optimal Control Scheme for Sewage Treatment Process

4.1 Real Time Optimal Control

The idea of wastewater treatment process saving in wastewater. The most basic and important requirement of hierarchical optimal to ensure the normal operation system; Secondly, it is necessary the effluent quality; On the basis of the above two points, reduce. In the are also other important goals, such as reducing the sludge overflow of the system, maximizing the drainage capacity of the system, etc. Therefore, it is necessary to classify these needs according to the level. The research carried out in this topic is centered on the normal, the effluent of the sewage treatment system reaching the standard and reducing.

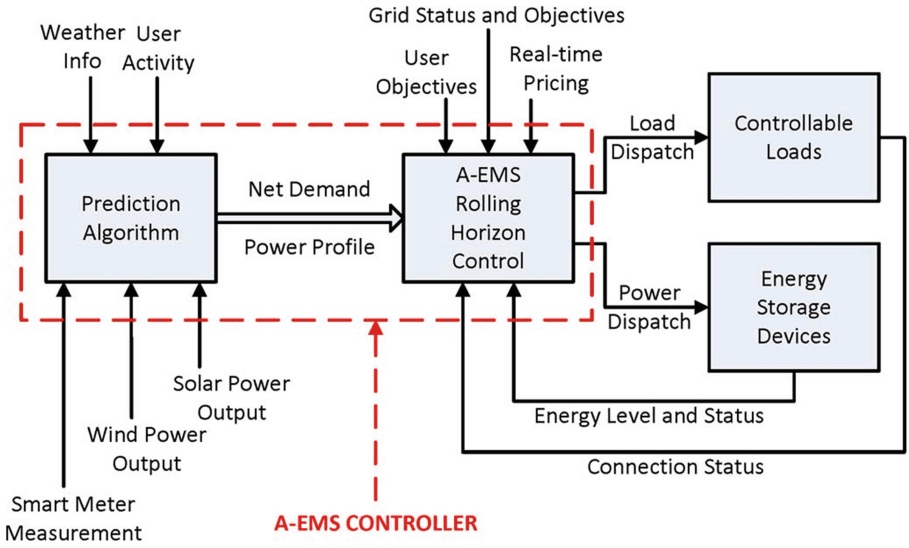

Fig. 3. Real time optimal control structure of sewage treatment process

For the real-time structure shown in Fig. 3, the real-time control process can two layers, the upper layer is the real-time optimization layer including the planning and scheduling module and the lower layer is the tracking control layer including the controller and the controlled process.

4.2 Real Time Optimization Layer

In the sewage treatment process, through the planning and scheduling of sewage treatment system and the information feedback p (t) ~ pn (f) of sewage treatment process, the optimization index, constraint and real-time information of the system are provided for the real-time optimization strategy.

For the wastewater treatment process, there are two scheduling conditions for the real-time optimization problem, one is that the effluent quality reaches the standard, and the other is that the system is reduced. The standard is based on the effluent quality standard given by BSM1 model, including the standard of total nitrogen, ammonia nitrogen, COD, BOD and TSS; The system comprehensively considers the energy consumption of aeration and pumping, so the total energy. The design idea of optimization strategy is based on the requirements of planning and scheduling, and online adjustment is made feedback information. Based on the idea of planning and scheduling, this paper constructs the inequality constrained optimization problem of wastewater treatment process, and designs an online augmented Lagrange multiplier method (NNALM) based on neural network modeling. While solving the constructed inequality constrained optimization problem, the optimization problem of wastewater treatment process is solved in real time based on the feedback of the system's effluent quality and energy consumption information.

5 Conclusion

Aiming at the problems of maintaining the stability and saving energy and reducing consumption in the analysis of the characteristics of the process of the pre denitrification process, this paper proposes a real-time optimal. In the real-time optimization layer, an optimization method modeling is proposed, which optimizes the online according to the planned scheduling and the real-time feedback of the system operation information; In the tracking control layer, a feedforward neural network online modeling and control (NNOMC) method is designed to track and control the optimized set point. The experiment shows that the real-time optimal control method can realize the smooth operation of sewage, and effectively reduce the energy consumption of the system under the effluent quality. Under different working conditions, the energy saving effect is more than 2.6%.

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Research on Reactive Power Optimization Control of Distribution Network with Distributed Generation Based on Genetic Algorithm

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Abstract. The distributed generation is aimed at optimizing the operation of distribution network to reduce losses. Many researchers have conducted this type of research and found that this method can be used to improve the performance of distribution networks. Some studies also show that this method can be used to improve the reliability and stability of power systems. It is also found that this method can be realized by using various types of distributed generation systems, such as wind, solar, hydropower, etc. This research includes three parts: (1) Overview of reactive power optimization control; (2) The relationship between distributed generation and reactive power optimization control is analyzed and summarized; (3) A case study of the application of this study in practice.

Keywords: Genetic algorithm · Distributed generation · optimize control

1 Introduction

In the demand for power on the load side is increasing. It is obviously difficult to meet the demand if the capacity transmission pressure on the transmission side is relieved only by expanding the scale and structure of the distribution system. The new distribution system costs a lot of investment, has a long construction period, will also cause some damage to the ecological environment, and land resources are increasingly scarce, leading to difficulties in the implementation of new distribution network projects [1]. Therefore, it is urgent to find a new method that can meet the needs of load growth at this stage, reduce the cost of power enterprises, and do not damage the natural environment as much as possible without changing the existing distribution system structure.

With the development of science and technology, demand side response (DSM) and distributed generation (DG) are widely used in power systems. Demand side response technology plays a more and more important role in relieving the capacity transmission pressure of distribution system due to its fast response speed and convenient control. At the appropriate of demand response and distributed generation technology in the distribution system can delay or reduce the construction of new distribution systems and the investment enterprises. Therefore, this paper proposes to integrate the demand side

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response. Using the characteristics of demand side response and distributed generation that are closer to the load side, more flexible and convenient, and less pollution to the environment, this paper finds a distribution network optimization strategy that considers demand side response and distributed generation. A multi-objective optimization model of microgrid, and the genetic is used to find the optimal solution. In this paper, the optimization strategy for each time period during grid connected operation and isolated operation the microgrid is specified. The used to the microgrid optimization model established in this paper, obtain the optimal output result of each distributed generation in the microgrid, and calculate the operation cost after optimization. It is concluded that the improved genetic algorithm has the characteristics of avoiding falling into the local optimal solution, fast convergence and high data accuracy [2]. The generation cost and environmental cost of microgrid have been greatly reduced, which has good theoretical basis and practical significance for the optimal dispatching of microgrid.

2 Related Work

2.1 Current Status of Power Grid Distribution Planning

Nowadays, the power industry is the foundation of the national economy for every country, and it is also a highly energy consuming industry with intensive investment. The reasonable planning of power supply is an important part of the planning, and the way of power supply planning a considerable the composition of units in the whole power system in the future. Therefore, the reasonable planning of power supply is a key issue. Power supply planning is the key content of the whole power system planning. The core content of the planning is how to determine the time, location, type and capacity of the system to be established in the planning period, so as to meet the demand of power load development in the most appropriate way. Once problems occur in this planning, it will affect the generation cost and power supply reliability of the entire power system, and even cause major power accidents, causing significant economic losses. Therefore, power supply planning factor affecting the normal the entire power, and even affects the economy of the whole society.

Moreover, if the microgrid grid connection planning is unreasonable, or even the distribution network system after grid connection lacks effective protection control, hardware conditions and energy management operation system, its high permeability will have a great impact and short circuit current, causing instability of the power grid, reducing the power of the entire distribution network, and may even lead to major grid accidents [3], The degree of influence is closely related to the location and capacity the microgrid. The grid connection planning of the microgrid, optimize the location and capacity of the microgrid, and complete the optimal configuration of the microgrid grid connection, so as and economy of the grid.

2.2 Overview of Genetic Algorithms

From the beginning, the content of genetic algorithm is the mapping from phenotype to genotype, that is, gene coding. When the initial population is generated in the genetic process, it will follow the evolutionary principle of survival of the fittest and start to evolve

layer by layer. After continuous reproduction, individuals with relatively good fitness will be produced and selected for replication. According to the process of crossover and mutation, a new population of the next generation will be produced. In this way, the transformation process of the population is like natural reproduction and evolution [4]. Generation after generation, the adaptability of each generation is always relatively higher than that of the previous generation. After the optimization process is completed, the optimal individual generated in the last generation population is decoded, and this solution is the similar optimal solution of the optimization problem. Based on the previous summary, the mathematical model of basic genetic algorithm as:

$$\arg\min_{SC} \sum_{i=1}^{k} \sum_{x \in C_i} |X - \mu_i|^2 \tag{1}$$

In the actual operation of genetic algorithm, there are many coding methods that can be applied, such as sequence coding, real number coding, etc. The most commonly used coding method is binary coding. In this method, a binary symbol string with a certain length is used as a symbol to represent an individual chromosome. The allele of the symbol string is composed of {0,1}, that is, I = {0.1}. If the individual is 9, the chromosome can be represented as 1001 by binary coding; if the individual is (2,5,6), the chromosome can be represented as (010101110) by binary coding. The genotype of an individual formed in this way will get its individual phenotype after the decoding step. In the initial state, the genotype of each individual has randomness.

In the genetic algorithm, the genetic probability of an individual completely depends on its individual fitness. There are a certain number of individuals copied to the next generation [5]. The determining factor is to determine an appropriate fitness function to establish the genetic probability proportional to the fitness, and through calculation, the converted into the fitness value. If and only if the fitness of all individuals is O Or a positive number.

3 Research on Reactive Power Optimization Control of Distribution Network

Distributed generation exists as an environment-friendly and flexible energy situation. It is widely distributed in the micro grid, and its penetration rate has a rising trend. The microgrid will be the traditional, and the planning field of the grid will meet new requirements and more difficult challenges. At the same time, its complexity and uncertainty will also be aggravated. When large-scale grid connection occurs, the line power flow, node voltage, power supply reliability, load forecasting and power supply security of the large grid will be affected to a considerable extent, and the extent of the impact is closely related to the access location and installation capacity of the micro grid.

Reasonable microgrid optimization can optimize the power flow of the whole and while improving economic benefits. When formulating its optimization objective function, both economic and technical indicators should be considered. Among them, the economic indicators can be divided into the minimum investment and operation cost of the microgrid, the minimum annual active loss cost, and the minimum active power

loss of the system. The technical indicators can include the minimum deviation of load node voltage in the system, and the maximum margin of static voltage stability. Some documents are more comprehensive. In some documents, the cost of pollution control will also be reduced after the distributed power generation in the micro grid replaces the conventional energy generation, and the reduced cost can also be used as an economic indicator for optimization. Therefore, the model used in this chapter is established based on the concept of economic and technical indicators:

$$D(x_i, x_j) = \sum_{l=1}^{m} d(x_{il}, x_{jl}) \tag{2}$$

Power to ensure system. The optimal power flow calculation can coordinate the quality control, safe dispatch, and is power system planning. In essence, the optimal power flow problem can adjust the control variables and simultaneously meet the physical and operational constraints of various variables, making the objective function optimal. Figure 1 below shows the distributed grid optimization topology.

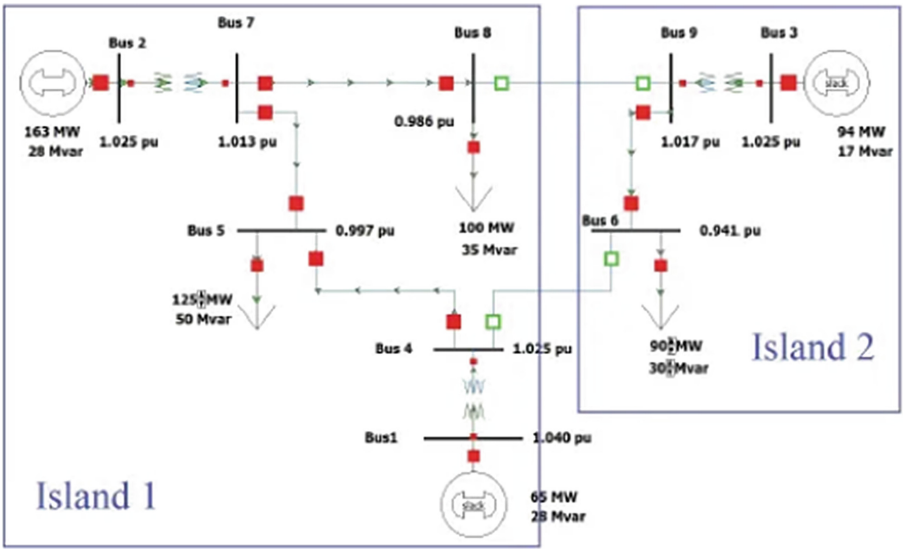

Fig. 1. Distributed power grid optimization topology

In PSASP software, the optimal power flow module can simultaneously meet the node power balance and a variety of security constraints. On this basis, the optimal power flow distribution with the goal of minimizing the network loss, minimizing the coal consumption or power generation cost, or maximizing the economic benefits of reactive power compensation can be obtained.

4 Grid Operation Optimization Strategy

When the connected to the grid, there is two-way interaction of electric energy. At this time, the electric energy exchanged between them can also be involved as an optimization variable Since the use of wind energy and solar energy for power generation does not need to worry about the depletion of energy and there is no pollution, wind power generation and photovoltaic power generation should be given priority in the distribution of distributed power generation output, and the next step is to judge whether the output power of distributed power generation is sufficient to supply the demand of micro grid load. If the demand cannot be met, then it needs the power support of the big grid to purchase power from the big grid; If the demand can be met, it is necessary to calculate the coordinated output of each power source in the microgrid, the charge discharge status of each energy storage system, the energy storage capacity, and the cost of power exchange with the large grid when the power generated by the microgrid meets the minimum in the state, with the goal of minimizing the operating the microgrid. Through the query of the relevant data of the power grid operation, we found that the daily load curve in a day is changing. We can divide the day into peak period, normal period and low period according to the daily change characteristics of the load volume. These three periods also correspond to these different selling and purchasing electricity prices. The formulation of micro grid operation strategy is to judge the transmission direction of power by comparing them according to the selling and purchasing prices in different periods on the basis of guaranteeing the basic load power consumption.

The separate operation after the micro grid and the large grid are disconnected is called isolated operation. At this time, the power supply of the micro grid depends on the power generated by each micro power source in the micro grid. Wind power generation is a kind of clean renewable energy with zero pollution emission and no fuel consumption. Therefore, when the micro grid operates in an isolated grid, wind power generation is preferred. Therefore, wind power generation should be fully absorbed as far as possible and not used as an optimization variable. When the active power generated by other power generation units such as wind turbines does not meet the load consumption of the whole system, the energy storage system is used as the standby.

5 Conclusion

It can not only optimize the parameters used in traditional methods, but also optimize other parameters that can be used to optimize reactive power in distribution networks. The main goal is to provide the best solution for control voltage, frequency and current through a single control loop. The proposed method does not require any additional equipment or devices, which greatly reduces the cost compared with the existing solution.

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Automatic Retrieval of UAV Tilt Image and Image Attitude Recovery

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Abstract. Automatic retrieval of UAV tilt images is a very important task in the field of aerial photography. The main goal behind this task is to capture images from a specific perspective, which is useful for document or mapping purposes. This task can be achieved by using a tilt-rotor aircraft equipped with cameras capable of capturing high-quality images. However, on the other hand, automatic retrieval of UAV attitude images is also very important because it is helpful to determine. In of automatic retrieval of UAV tilt image and image attitude recovery. The 3D point cloud model obtained from the airborne camera. The the use of dense 3D point cloud models obtained from airborne cameras. The obtained from the airborne camera to retrieve the tilt image and restore the attitude information under the following conditions.

Keywords: UAV image · Flight attitude · Automatic retrieval

1 Introduction

With unmanned aerial vehicles, the tilt photography industry has ushered in a new wave. More and more people use unmanned aerial vehicles to engage in relevant data collection work in the surveying and mapping industry. Due to its high mobility, low cost It has been widely used for its high resolution image acquisition and the ability to quickly and real-time survey and monitoring the ground ". However, the quality of UAV low-altitude remote sensing images is greatly affected by flight conditions, and due to the limitations of load, cost and other factors, it is impossible to load high-precision navigation and balance control system, which makes the aircraft position and attitude information cannot be accurately recorded. This also determines that there is likely to be a large yaw angle and up and down dislocation between adjacent images, which makes it difficult to automatically complete the identification of the same name points and image matching between adjacent images. In the process of data acquisition All kinds of problems have been encountered in, resulting in the data flying out of the standard and unable to complete the model reconstruction [1]. Here, based on my own contact, I will make a simple carding of the parameters such as overlap, sensor, focal length, flight speed, photographing interval and the relationship between them in the process of tilt photography. Please correct any improper or wrong places.

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Use the six external orientation elements (spatial position and attitude) during the shooting to predict the matching initial point, and carry out gray correlation matching within a certain range near the predicted point (this range should not be too large, otherwise it is easy to mismatch) to obtain the matching point. However, if this method cannot obtain accurate aircraft position and attitude information, the predicted initial point may have a large system deviation, which is difficult to ensure the matching accuracy; The image itself is directly processed, that is, matching is carried out by searching for the same name feature points on the image. The matching accuracy and stability of this method largely depend on the selection of feature points and the matching algorithm.

2 Related Work

2.1 Automatic Image Matching

Under the guidance of different theories and ideas, various matching measures have been defined, and then different image matching methods and implementation algorithms have been formed. People are more concerned about some basic methods based on statistical theory. Several commonly used measures include: correlation function measure, covariance function measure, correlation coefficient measure, sum of squares of difference measure, absolute value and measure of difference [2]. The correlation coefficient measure is the best because it eliminates the influence of gray linear distortion in the process of matching. The relevant coefficient measures are introduced as follows:

The correlation coefficient is the ratio of the covariance function and the variance of two signals. The process of calculating the correlation coefficient is the process of standardizing the covariance function.

The correlation coefficient is defined as follows:

$$p(p,q) = \frac{C(p,q)}{\sqrt{C_{sg}C_{g'g'}(p,q)}} \tag{1}$$

Including:

$$C_{gg} = \iint\limits_{(x,y)\in D} \{\mathrm{g}(x,y) - E[\mathrm{g}(x,y)]\}^2 dxdy \tag{2}$$

When p (poq) > p (p, q) (p ≠ Po, q ≠ q), it is considered that p0 and q0 are the displacement parameters of the search area image relative to the target area image. If the correlation is one-dimensional, there is q three 0.

When gray data is discrete, the estimation formula of its correlation coefficient is:

$$\mathrm{p(c \cdot r)} = -\frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\left(g_{i,j} - \overline{g}\right)\left(g_{i+r,j+c} - \overline{g}'_{r,c}\right)}{\sqrt{\sum_{j=1}^{n}\left(g'_{i+r,j+c} - \overline{g}'_{r,c}\right)^2}} \tag{3}$$

When there is linear distortion between the target and the gray level of the search image, the application of correlation coefficient for matching evaluation can still get

better evaluation results [3]. However, there are not only gray scale distortion but also geometric distortion between the target image and the search image. So the least squares image matching method, which is also considered to reduce the interference between the two, carries out the overall adjustment calculation according to the principle of least squares, so that the image matching can reach the high accuracy of 1/10 or even 1/100 pixels, that is, the image matching can reach the level of sub-pixels. Therefore, least squares image matching is called "high-precision image matching" or "high-precision image correlation".

2.2 UAV Tilt Photogrammetric Data Processing

1. After the completion of the office 3D modeling field photography operation, the data needs to be exported and transferred to the office processing in a timely manner, including: (1) data inspection: mainly check the flight quality of the aerial photography operation and the quality of the captured image, such as the actual image overlap, the inclination and rotation angle of the image, the curvature of the route, the coverage of the acquisition, the definition of the image, and the displacement of the image point. (2) Space-three encryption: At present, in the process of UAV tilt photogrammetry office data processing, the beam method regional network joint adjustment method, also known as joint adjustment, is usually used [4].

2. Office data collection

After the production of the real 3D model is completed, the model accuracy shall be checked using the image control points and check points. After the relevant specifications, the relevant data is used the terrain, and the operation mode is the mode of "first inside then outside". The main operation process is shown in Fig. 1:

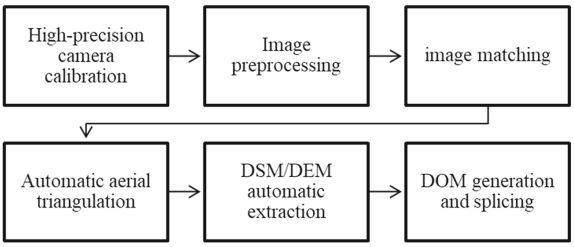

Fig. 1. Operation process

It provides the reflection intensity information of point cloud data, and can separate specific types of data targets independently. For example, in the process of automatic driving high-precision mapping, TopoDOT point cloud data processing software has the function of extracting road markings based on reflection intensity, which is to separate the road markings with high of point cloud data, so that the road surface with relatively low reflection intensity can be hidden [5]. So as to facilitate the efficient and accurate automatic extraction of road markings.

3 Automatic Retrieval of UAV Tilt Image and Image Attitude Recovery

The UAV tilt photogrammetry system consists of six parts: UAV flight platform, data transmission system. The flight platform is composed of engine, takeoff and landing equipment, UAV collective and other parts, and is the carrier of carrying mission equipment, carrying equipment for relevant operations; Flight control and control system is the core part of UAV tilt photogrammetry, which mainly controls the flight attitude and trajectory of UAV to ensure the safe flight of UAV; The mission equipment includes camera, camera control system and related components and devices, whose function is to acquire and store aerial photographic data; The ground monitoring system is the control core of the UAV, and its main role is to formulate the flight mission and emergency flight handling to ensure.

The geometric deformation of the left and right image windows includes not only relative displacement, but also graphic changes. Although the mathematical model of geometric deformation of two images is very complex, because the size of image matching window is very small, only the affine deformation of two image windows is generally considered:

$$\mathbf{X}_2 = \mathbf{a}0 + \mathbf{ax} + \mathbf{a}2\mathbf{y} \tag{4}$$

$$\mathbf{Y}_2 = \mathbf{b}0 + \mathbf{x} + \mathbf{by} \tag{5}$$

The least-squares image matching method has the characteristics of flexibility, reliability and high accuracy. Of course, there are also imperfections in this system. First, the initial value is required for the system calculation, and second, it is difficult for the system to converge when the initial value is inappropriate.

In order to realize image mosaic, the transformation between the images to be spliced. On the basis of image feature extraction, the one-to-one correspondence between feature points is established, and then the perspective transformation model between two images is calculated. The normalized cross-correlation coefficient is selected as the matching measure to complete the rough matching of feature points. The normalized cross-correlation coefficient can effectively resist the linear change of the image, and has high accuracy and adaptability. Using the RANSAC method based on geometric constraints to finish the refinement of matching points can obtain more stable results.

4 Simulation Analysis

In verify the accuracy, reliability and practicability of the, automatic aerial triangulation and 3D reconstruction method proposed in this paper, especially for the applicability of this method to image processing in different areas obtained by different cameras, three sets of oblique image data sets are selected (see Fig. 1 for the basic information of image set coverage), and the algorithm is implemented using VC + + 2015 64-bit OS development environment (Fig. 2).

Fig. 2. Tilt image data set

Auxiliary data, image matching uses the content-based image retrieval retrieve the unordered, from the construction project to the final uncontrolled space solution, which takes 8 h, with a mean square error of 0.32 pixels. The test results verify and applicability the algorithm in this paper (Fig. 3).

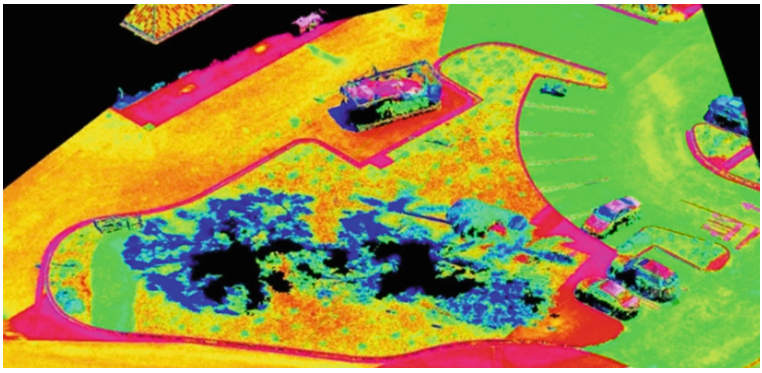

Fig. 3. 3D reconstruction effect of image set

The processing and application of slant photogrammetric point cloud data will provide you with an idea guide. When applying the slant photogrammetric technology, there can be another way to make the processing of real 3D data more convenient, and to give full play to the value of spatial real 3D data! One of the reasons why the results of oblique photography are exported to point cloud data format (usually *. Las format is the majority) is that the point cloud data processing and application software are relatively mature, and it is easier to mine and play the due value of spatial 3D data!

5 Conclusion

Automatic retrieval of UAV tilt image and image attitude recovery are two important tasks in the field of UAV. This new realize automatic retrieval of UAV tilt image and attitude recovery. The proposed method uses a new combination of feature extraction, clustering and classification techniques to achieve this task. A series of experiments have been carried out on different types of images to evaluate. Experimental this method is effective in retrieval.

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QSBR Prediction Model for Anaerobic Biodegradation of Chemicals

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Abstract. Mathematical models the theoretical research and practical application of anaerobic biological processes. In this paper, the anaerobic bioreactor is taken as the research object. Through experimental analysis and mathematical model, the operating conditions of anaerobic reactors treating different types of substrates are simulated. The QSBR prediction model is a mathematical equation used to predict the amount of chemical degradation in the anaerobic biodegradation process. The QSBR prediction model was established through a large number of experiments. The experiments showed that the chemical degradation rate increased with the increase of temperature and decreased with the increase of pH value. QSBR prediction model can be used to predict the degradation rate of different chemicals under different conditions. The figure below shows how we can use QSBR prediction model to predict the degradation rate of different types of chemicals during anaerobic biodegradation.

Keywords: Anaerobic organisms · chemical · Degradation · QSBR prediction model

1 Introduction

In the wastewater biological treatment process, the traditional aerobic biological treatment needs to consume a lot of energy, while the anaerobic biological method not only saves energy, but also converts organics into bioenergy. Anaerobic biological treatment technologies, including hydrogen production by anaerobic fermentation and methane production, mainly transform organic matters in wastewater into new microbial cells and gas products (CO2, H or CHa) through the action of anaerobic microorganisms. Both Hz and CH are high-energy carriers with high combustion heat values (H: 286.4 kJ/mol, CH4: 802.3 kJ/mol). Therefore, as a kind of wastewater biological treatment method that can remove organic pollutants and can produce energy, anaerobic biological method has attracted more and more attention [1].

The demand for energy and development has led to rapid development of anaerobic biological treatment technology in recent decades. After years of research by experts from various countries, great progress has been made in basic research methods such as anaerobic microbiology and biochemistry, and a number of new anaerobic biological

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treatment processes have been successfully developed. This has completely changed the idea that anaerobic biological method can only be used to treat high concentration wastewater and that anaerobic biological method is inefficient [2]. The newly developed modern anaerobic biological treatment technology not only has good efficiency and high efficiency, but also can treat various kinds of wastes and low concentration wastewater.

Anaerobic biodegradation is a very important organic matter decomposition process. However, in chemical risk assessment, anaerobic degradation of organic compounds, especially at the screening level, has not received much attention. Similarly, although the research and discussion on the model of aerobic biodegradability are ongoing, the computer model for estimating the molecular structure of anaerobic biodegradability has not been studied and applied. So far, the only anaerobic model with universal practicability requirements has been developed by RORIJE, etc., but its prediction ability is limited due to the small number of organic compounds in its training set.

2 Related Work

2.1 Basic Principles of Anaerobic Biotechnology

Anaerobic digestion process has experienced three main understandings. The first is that Buswell and Neave affirmed the view of Thumm and Reichie (1914) and Imhoff (1916) in 1930. The second understanding is the three-stage theory proposed by Bryant (1979) based on the experimental research results of methanogens and hydrogen and acetic acids, which is currently a more recognized theoretical model [3]. The schematic diagram of the three stages in Fig. 1. The three theory includes:

At this stage, complex organics are decomposed into simple organics under the action of extracellular enzymes, and then converted. Anaerobic bacteria and facultative bacteria are mainly involved in the hydrolysis and fermentation process.

The second stage: hydrogen production. In this stage, produced in the accompanied by the production of CO2. The bacteria involved in this process are mainly anaerobic bacteria and facultative bacteria [4].

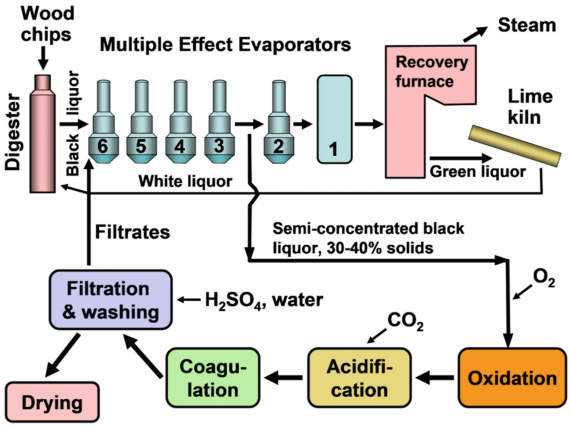

Fig. 1. Schematic Diagram of Three Stage Anaerobic Digestion Process

In this stage, H2 and CO2 generated. There are two conversion pathways, namely, the degradation of acetic acid to produce methane and the degradation of hydrogen to produce methane. Anaerobic bacteria are involved in this process.

2.2 Research Progress of Anaerobic Biotechnology

The first generation of anaerobic reactor: the earliest anaerobic digestion treatment began with the automatic sludge purifier created by Mouras, a Frenchman, in 1881. In 1895, Donald designed the world's first anaerobic septic tank. The creation of anaerobic septic tank is an important milestone in the development history of anaerobic treatment process. Thereafter, Travis tank, Imhoff tank, hidden tank, traditional digestion tank and heated wastewater treatment process [5]. Until the 1950s, reactors were generally considered as the first generation anaerobic reactors. The first generation anaerobic reactor is mainly used to treat sludge. The characteristics of this type of reactor are that the sludge age (SRT) is equal to the hydraulic retention time (HRT), the reactor volume is large, and the treatment efficiency is low. Generally, the volume load is less than 4–5 gCOD/L/d.

The second generation anaerobic reactor: In the 1950s and 1960s, especially in the late 1970s, with the intensification of the worldwide energy crisis, people's research on the use organic wastewater has been strengthened, and a number of treatment processes called modern high-speed anaerobic digestion reactors have emerged. These anaerobic biological treatment processes are collectively referred to as "the second generation anaerobic bioreactor", including, anaerobic fluidized bed (AFB), anaerobic biological turntable (ARBC) and anaerobic baffled reactor (ABR).

The 1990s, with the wide application of QSBR reactor with granular sludge as the main feature, granular sludge expanded bed (EGSB) reactor and anaerobic internal circulation (IC) reactor with granular sludge as the basic have been developed. These reactors are collectively called "the third generation anaerobic bioreactor". This type of reactor is characterized by solving the problems of short flow, dead angle and blockage that may occur in the second generation of reactors, further strengthening the mass transfer process and accelerating the biochemical reaction rate.

With the continuous development of these novel anaerobic treatment processes, the traditional concept that anaerobic treatment processes have low treatment efficiency, require high temperature, long treatment time, and can only treat high concentration organic wastewater has been broken. Anaerobic treatment processes are used in more and more fields.

3 QSBR Prediction Model of Anaerobic Biodegradation

QSBR describes the complex substrate with the main components (carbohydrate, fat, protein, carbohydrate, amino acid, and has the processes of decomposition, hydrolysis. The biochemical process of anaerobic degradation of complex organic compounds is analyzed in detail. The transformation of each substance in QSBR is shown in Fig. 2. As solid particles cannot enter the cell interior, the decomposition and hydrolysis process in Fig. 2 occurs outside the cell, and other processes occur inside the cell. Dead microorganisms exist in the reaction system as composite particulate organic matter and enter the cycle again.

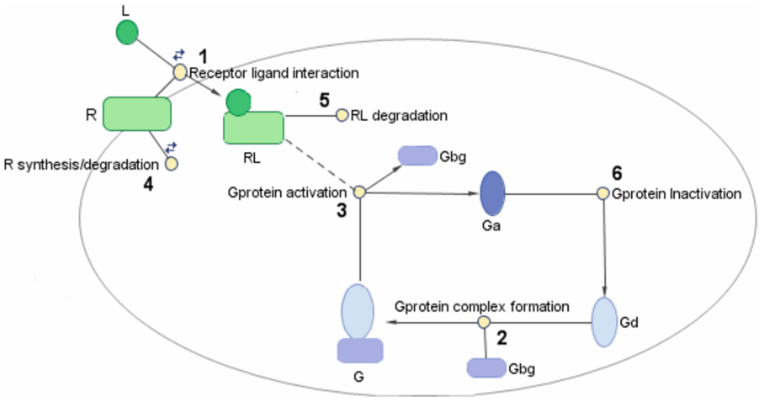

Fig. 2. Biochemical transformation process in QSBR

In QSBR, except that the concentration unit of CO2 is mol, the concentration unit of other substances is COD; In terms of kinetic form, QSBR is based on the kinetic equation of substrate degradation rather than the kinetic equation of microorganism proliferation. However, these are not the biggest characteristics of QSBR. The biggest feature of QSBR is that it is a structured model with good scalability and provides an open general modeling platform. Therefore, for the actual wastewater or special degradation process, the corresponding mathematical model can be established through some simplification, expansion or modification based on QSBR.

4 Anaerobic Biodegradation of Chemicals Based on QSBR Prediction Model

Simulation of hydrolysis process. Hydrolysis process is the speed limiting step in anaerobic digestion of solid substrate. Many researchers have studied the hydrolysis process of solid substrate through experiments and modeling methods. Yasui and his research team used the modified ADM1 to simulate the hydrolysis process of primary sludge in urban sewage treatment plants. According to the methane generation rate curve obtained from 17 groups of experimental data, he believed for hydrolysis during anaerobic digestion. Ristow et al. studied the hydrolysis and hydrolysis rate of primary sludge when HRT is 60 d to 5 d and COD concentration of influent water is 40, 25, 13 and 2 gCOD/L.

This mathematical model is helpful for further research on anaerobic biological treatment theory and system design and optimization, as shown in Fig. 3. At present, the established mathematical model of anaerobic digestion includes the hydrolysis of sludge, the inhibition of hydrogen on methane generation, the inhibition of pH, the reduction of sulfate, and the degradation of different substrates (sludge, beer wastewater, food waste, livestock manure). However, currently, some anaerobic processes lack modeling work; The simulation of QSBR reactor is too simplified; The locality and one-sidedness of inhibitory substances and processes, as well as the inhibition of certain substances, are only considered in certain processes during the modeling process. In addition, there are still some gaps in some areas, such as the lack of models for the start-up process of

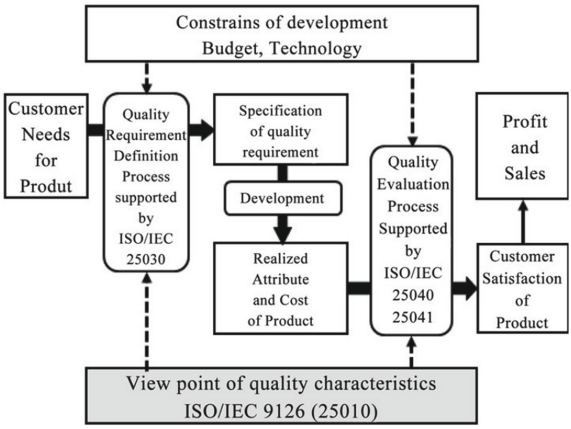

Fig. 3. Optimized QSBR prediction model

anaerobic reactors and the lack of simulation research on the rumen degradation process of lignocellulose.

5 Conclusion

To study the effects of various biochemical reactions of anaerobic digestion and the main inhibition forms of ammonia nitrogen, establish the corresponding free ammonia inhibition model, and introduce the inhibition of free ammonia into the simulation of acidification, butyric acid degradation, propionic acid degradation, methanogenesis with acetic acid consumption and methanogenesis with hydrogen consumption, so as to make the simulation results of the mathematical model more reasonable. The established mathematical model of QSBR reactor comprehensively considers the biochemical process and hydraulic action in the reactor, so it can well simulate the changes of components and gas production in the effluent, and the simulation results are better than those of ADM1; Organic load and axial flow rate have an important influence on the mixing degree in QSBR reactor. Under high organic load and axial flow rate, the mixing degree in the reactor is higher and the axial diffusion coefficient is smaller.

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Laser Cleaning Technology of Ultra-thin Deposition Layer on the Surface of Disconnector Moving and Stationary Contacts

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Abstract. The static contacts of disconnectors is to deposit ultra-thin films (about 0.1 μ m) Laser processing technology. It can be applied to rough surfaces such as contacts and connectors, which are not easy to be processed by other technologies. Its main advantages are low cost and high productivity; In addition, it can improve product quality and reduce production costs. At present, we are patrolling the contact parts of outdoor disconnectors in open substations. Due to the long-term exposure of dynamic and static contacts to the outdoors, the looseness of contact spring studs, dust haze and other reasons, the contacts is oxidized and rusted, contact resistance, heating and other defects, and the static treatment cannot be carried out in a timely manner. In view of the problems, the ultra-thin deposition layer on the surface of the double pulse laser induced breakdown spectrum defect elimination knife switch, which can be used for live maintenance and rust removal of high-voltage disconnectors. The laser spectrum is specially modulated to remove the oxidized and rusted parts, which will not damage the silver coating of human body and equipment and will not affect the operation of the power grid.

Keywords: Isolating switch · Laser cleaning · Dynamic and static contacts · Ultrathin sedimentary layer

1 Introduction

At present, there are three main types of contact surface cleaning devices for power system disconnectors: dry ice jet technology, ultrasonic cleaning technology and mechanical cleaning technology. The dry ice jet technology is mainly used to clean the external surface of power equipment, and also can be used to clean disconnectors. However, the method of equipment use is complex, equipment handling is troublesome, and the requirements for dry ice filling operation are high; Ultrasonic cleaning technology, complex technology, high equipment price, high operation and maintenance costs; Mechanical cleaning technology has low price and is convenient for maintenance and use [1]. However, the contact pressure cannot be adjusted during use, and the pressure between the cleaning brush and the cleaning surface cannot be effectively controlled. The cleaning effect is not ideal, and different cleaning equipment structures are used for the contact

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fingers, so the versatility is not strong. As far as the industry knows, there is no mechanical cleaning technology that can be applied to the cleaning of wedge type disconnector contacts with various voltage levels. In the maintenance of disconnector, the traditional method is to polish the contact surface with sandpaper [2]. The contact and silver coating are greatly worn, which affects the service life of the equipment.

2 Related Work

2.1 Development History of Laser Cleaning Technology

In the early days, people usually placed the objects to be cleaned directly in the range of laser irradiation, which is called laser dry cleaning. Later, it was found through experiments that the surface of the object to be cleaned was covered with a liquid film with a thickness of only a few millimeters, and then the liquid film was directly exposed to the laser. This method can also be used for cleaning, and the cleaning efficiency is higher. This cleaning method is called laser wet cleaning, E Y. Assendelcft et al. used the sound wave generated by laser in water to remove the pollutant particles stuck on the silicon surface [3]. In 1991, Professor Andrew conducted a comparative test between laser wet cleaning and laser dry cleaning, and found that the laser wet cleaning method was more efficient. Although many efforts have been made for the research and application of laser wet cleaning, it has not been popularized in production and life due to its inherent defects [1].

With the maturity cleaning, the application in various fields has been gradually discovered. At the end of the 1980s, lasers began to be used in paint removal. Germany and Japan began to use TEA CO2 lasers developed by them for paint removal, but this technology was not applied in actual industrial production for various reasons. In addition, in industrial production, laser is gradually used to clean tire mold, and the effect is good. Compared with foreign countries, domestic laser cleaning technology started relatively late. In 2002, Luo Hongxin and Cheng Zhaogu published an article on the depainting of aircraft by high-power CO2 laser with continuous output. In 2005, Zheng Guang, Tan Rongqing, Zheng Yijun and others began to use TEA CO2 laser for laser paint removal experiment and research [2]. In 2012, Shi Shudong of Nankai University and others conducted a corresponding study on the influence of 1064nm quasi continuous laser steel substrate surface paint removal, laser peak power density and laser scanning overlap ratio on laser cleaning.

2.2 Principle of Laser Cleaning Machine

The laser cleaning machine mainly includes laser system, beam integration system, workpiece transmission system and laser motion control system. The laser system is mainly responsible for the generation of laser, the beam integration system is mainly responsible for the integration of laser beams, the workpiece transfer system is mainly responsible for the transport of workpieces to be cleaned, and the laser motion control system is mainly responsible for the motion control of laser.

The laser cleaning process is shown in Fig. 1, including several steps: workpiece moving into the cleaning area, laser auto focusing, laser cleaning, and workpiece moving

out of the cleaning area. Among them, the realization of laser auto focusing mainly uses the size of the light spot as the closed loop signal, and the size light spot is detected through the processing method. When the laser head is at the focus, the area of the light spot is at the maximum. With the increase of the focus, The area of the facula decreases gradually.

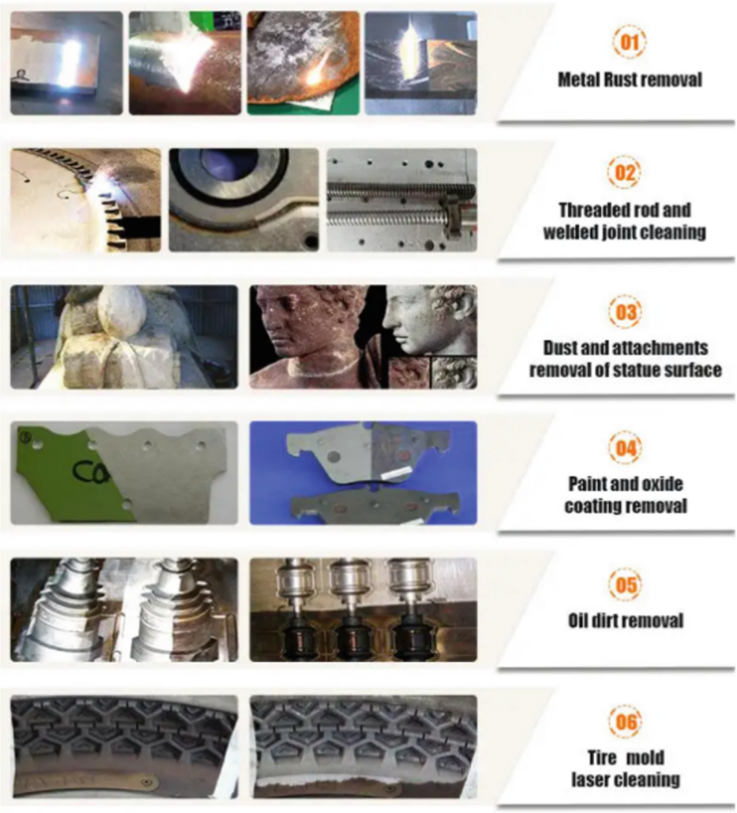

Fig. 1. Technical process of laser cleaning

The reason why laser can remove dirt is that it can make pollutants leave the surface of objects by using the high energy generated by laser per unit area. The reason why pollutants can adhere to the surface of an object is that there are a series of forces between pollutants and the surface of the object. These forces include capillary force, van der Waals force, etc. The essence of laser decontamination on the surface of the object to be cleaned is to use the energy generated by the laser to overcome the interaction between the surface of the object to be cleaned and the pollutant particles.

3 Laser Cleaning Technology for Ultra-thin Deposition Layer on the Surface of Movable Disconnectors

The technical scheme of this paper is realized through the following measures: a contact cleaning device for disconnector includes a base, a cleaning agent storage cylinder, a first support rod, a second support rod, a liquid pipe, a cleaning head, a torsion spring and a cylindrical insulating rod. The base includes an upper cone cylinder, a cylinder part and a lower cone cylinder part with upper small and lower large parts. The upper cone cylinder is provided with a hollow cylindrical connecting pipe, a connecting pipe, an upper cone cylinder part The cylinder part and the lower cone cylinder part are connected in turn from top to bottom and are coaxial. The connecting pipe is equal to the inner diameter of the upper end of the upper cone cylinder part, the inner of the lower end of the upper cone cylinder part, the diameter and the diameter of the upper end of the lower cone cylinder part are equal. The upper end of the outer wall of the cylinder part is provided with an external thread, the upper end of the insulating rod is inserted in the base, and the side wall of the insulating rod is provided with a vertical chute with an opening at the upper end, The side wall of the insulating rod is coaxially provided with an arc chute connected with the lower end of the vertical chute in the horizontal direction. The upper end surface of the connecting pipe is a certain distance from the top wall of the detergent storage cylinder. The outer side of the cylinder corresponding to the position between the detergent storage cylinder and the lower cone cylinder is

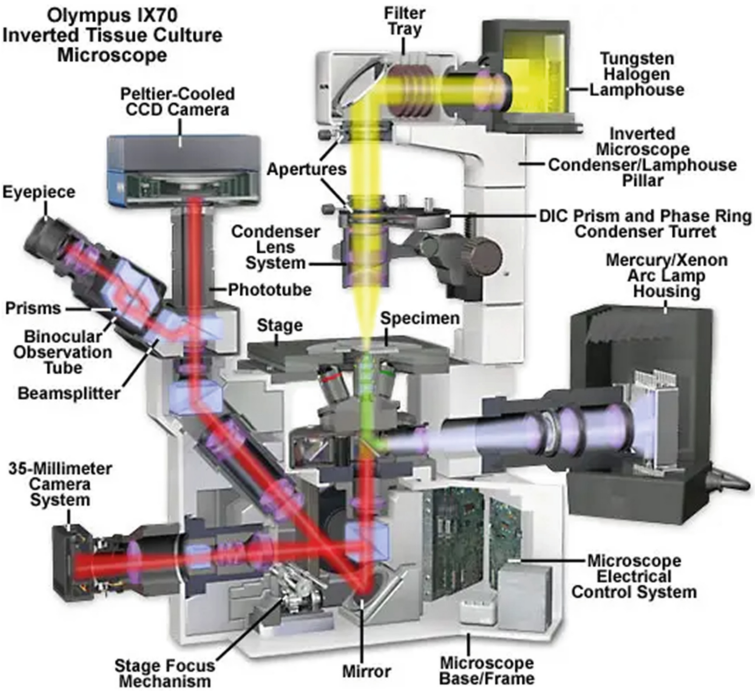

Fig. 2. Structure diagram of laser cleaning equipment

movably sleeved with an upper ring and a lower ring. A certain included angle is formed between. The cleaning head includes a sponge block and a mounting base. One the first support the lower ring and one end of the second support the upper ring can be disassembled and installed with a mounting base. Each mounting base is provided with a sponge block arranged vertically, and the sponge blocks on the two mounting bases are parallel. A contact cleaning channel of the disconnector is formed between the two sponge blocks, Each mounting base can be disassembled and installed with a liquid drain pipe for delivering cleaning agent to the sponge block. One end of the liquid drain pipe is connected with the cleaning agent storage cylinder. The first support rod is provided with a number of first adjustment holes spaced along the length direction. The second support rod corresponding to the position of each first adjustment hole is provided with a second adjustment hole. A torsion spring for adjusting the included angle between and the is installed between the first and the second, One pin of the torsion spring is inserted into the first adjusting hole, and the other pin is inserted into the corresponding second adjusting hole. As shown in Fig. 2.

4 Brief Introduction of Cleaning Equipment for Ultra-thin Deposition Layer of High-Voltage Disconnector Contact

The cleaning equipment for ultra-thin deposition layer of high-voltage disconnector contacts mainly includes all solid state dual wavelength laser, laser transmission and high-speed scanning system, refrigeration system and control system, as shown in Fig. 3. The dual wavelength laser output laser beam is combined into the optical fiber for transmission. The laser beam output by the optical fiber is collimated by the collimation system and then incident onto the mirror of the scanning galvanometer. The reflected laser beam forms a focused spot on the focal plane after passing through the mirror, so as to realize the scanning of the beam. The cleaning of the surface coating of the workpiece is realized by adjusting the distance between the surface of the workpiece to be cleaned and the mirror.

(1) Design of side pump module for high efficiency semiconductor laser. The structural design of the semiconductor pump module determines the energy utilization rate of the semiconductor pump laser and the beam quality index of the laser. Due to the thermal effect during laser operation, it will affect the beam quality of the laser, so the main consideration when designing the pump module is the pump uniformity. According to the luminous characteristics of semiconductor lasers and the absorption characteristics of laser crystals, the three-way uniform pumping module is selected to reduce the thermal effect and depolarization effect of laser crystals and improve the energy conversion efficiency.

(2) Laser crystal design. The commonly used 1064nm laser crystals are Nd: YAG and Nd: YV04. Nd: YAG is the laser gain medium with the best overall performance so far, belonging to the cubic crystal system. This structure is conducive to generating low threshold, narrow fluorescence spectral lines and high gain. Nd: YAG has the advantages of stable chemical properties, high hardness, high thermal conductivity, good optical and mechanical properties, and is very suitable for the laser gain medium of DPSSL. In recent years, Nd: YVO4 is a very competitive laser product, because its absorption coefficient

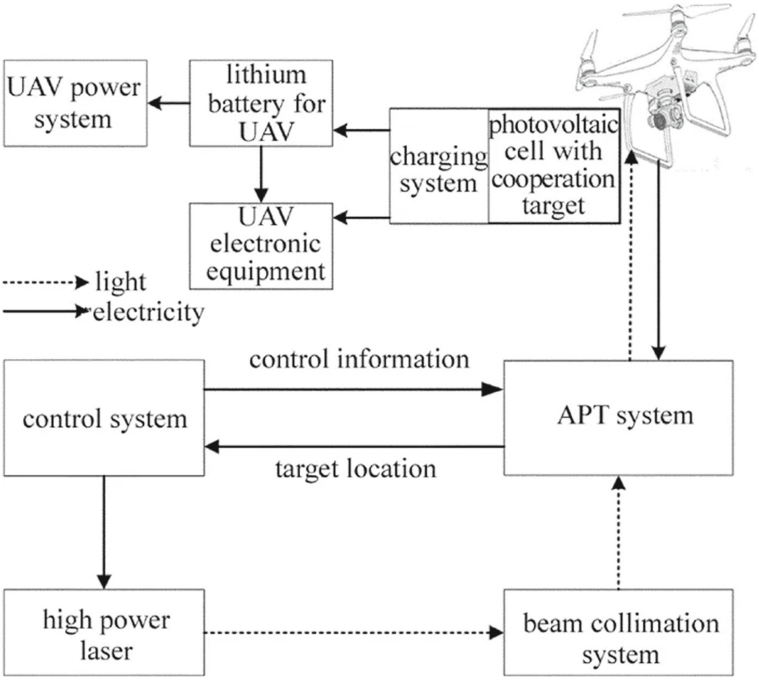

Fig. 3. Structure Diagram of Laser Cleaning System

near 808nm is 3.5 times that of Nd: YAG, and its absorption spectrum is wide, which can obtain higher pumping efficiency. It has a large stimulated emission area, so the threshold is low, making it more suitable for low-power small laser devices. Nd: YV04 can realize polarized light output, so it can greatly reduce the thermal birefringence effect. However, its upper level life is low, which limits its energy storage characteristics. Moreover, its thermal conductivity is low, and its physical and mechanical properties are not as good as N: YAG. Therefore, N: YAG is used as the medium of laser gain in this system.

(3) Design of frequency doubling crystal parameters. By comparing the characteristics of commonly used nonlinear frequency doubling crystals used for 1064 nm laser frequency doubling, we decided to use KTP crystal for laser frequency doubling experiment. In order to prevent the common KTP crystal from appearing gray trace under the long-term high-power laser irradiation, the GTR-KTP of HAITAI Optoelectronics was used as the frequency doubling crystal in the experiment. The crystal size is 4 * 4 * 7mm. Both ends of the crystal are coated with 1064nm and 532nm two-color antireflection films. The frequency doubling crystal is placed in a copper fixture and the fixture is cooled with water.

5 Conclusion

Compared with western countries, the manufacturing technology and advanced level of laser cleaning equipment in China are still at a disadvantage, and the application coverage of laser cleaning technology in China is also relatively low, which cannot completely

replace the traditional cleaning process. It is an important problem for Chinese scientists and technicians to develop supporting laser cleaning equipment and make it practical and industrialized in a short time, which to promote the high-tech industries.

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Research on the Technology of Laser Derusting and Design of Portable Laser Derusting System

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Abstract. Derusting is a common process for protecting steel products. In daily use, steel products often rust. If the rust is not removed in time, it will bring great losses to the production. Traditional rust removal methods have many shortcomings, such as mechanical rust removal is easy to damage the surface of the workpiece, and chemical rust removal is easy to cause environmental pollution. Laser derusting is a new derusting technology proposed in recent decades. Due to its unique advantages, laser has received great attention in recent years. The research of laser derusting technology and the design of portable laser derusting system are carried out by using high-power laser. Laser rust remover can be used to remove stains and other residues on glass, metal, plastic and other surfaces. The main function of the equipment is to remove stains or residues on various materials without damaging them. It also has another function that can be used in many cases to prevent corrosion. In addition, it also helps us clean clothes more easily than before, because we no longer need to use any detergent when washing clothes.

Keywords: Rust removal process · Portable · Pulse laser · Laser derusting system

1 Introduction

Steel will rust after being used for a long time. Rust is a loose and porous material, which can easily absorb water in the air to accelerate the corrosion of steel. Over time, steel products will become a pile of useless waste due to corrosion. When iron and steel products work in solutions containing acid, chlorine or electrolyte, corrosion is particularly serious. According to statistics, tens of millions of tons of steel products are discarded due to corrosion in the world every year. The corrosion of iron and steel products has caused product quality degradation, production stoppage, environmental pollution and even harm to people's health, and the resulting losses are incalculable [1]. Therefore, it is very necessary to remove rust and maintain iron equipment used for a long time, such as iron frames, iron bridges, power transmission towers, ships, mechanical lathes, etc. after a period of use.

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The rust removal methods currently used are generally as follows:

1) Sand blasting for rust removal

It is mainly composed of particle jet erosion to achieve surface cleaning and appropriate roughness. The equipment includes open sandblasting (shot) rust remover, closed sandblasting chamber and vacuum sandblasting (shot) machine. Sand blasting, but the working conditions are bad, which is easy to damage and pollute the nearby devices. Moreover, due to the huge volume and weight of the equipment, it is impossible to enter the narrow space, and the scope of application is also limited [2]. In addition, due to the difficulty in precise control of the sandblasting area, it is also easy to damage the devices in the vicinity of the rusted parts. Therefore, this method is only applicable to the environment with low requirements for rust removal.

2) Shot blasting for rust removal

Shot is to use the the abrasive to the surface of the rusty steel, and to clean the workpiece surface, especially the dead corner of the inner cavity. At the surface roughness of the parts, and greatly improves the service life and aesthetics of the parts [3]. However, this method can only be used indoors and can not completely remove the rust, which also pollutes the environment and damages the surface of the derusted parts.

2 Related Work

2.1 Development and Status Quo of Laser Cleaning Technology

Laser cleaning technology is involved in many industrial fields, such as microelectronics, aerospace, ships, automobiles, etc. Typical applications include rust removal, paint removal, oxide film removal, particulate pollutants removal, oil contamination removal, etc. As a new surface treatment technology, its principle of action is different from the traditional cleaning technology. The cleaning process has no damage to the substrate, which has been highly valued by relevant researchers at home and abroad and has made rapid development in theory and technology [4].

Andrew C. Tam et al. successfully removed 0.1 um particulate pollutants on the solid surface by using short pulse ultraviolet laser radiation. They proposed that the short pulse laser cleaning method is a promising new method to remove particulate pollutants on the solid surface, pointing out the direction for the expansion of the application field of subsequent laser cleaning, and classified it into dry cleaning and wet cleaning according to the form of laser cleaning. Y. F. Lu et al. used the ultraviolet pulse laser to dry clean the surface contaminants of copper, stainless steel and aluminum [5]. They found that the laser energy density and the number of laser pulses are important technical parameters that affect the quality and efficiency of surface cleaning. They proposed that the application of laser dry cleaning can replace traditional chemical cleaning and ultrasonic cleaning. They found that the mechanism of surface color change during laser cleaning of stainless steel is thermochemical reaction. P. In order to improve the adhesion of the low carbon steel sheet surface to the coating, E. Lafargue et al. a process laser cleaning of residual pollutants, and studied the effect of laser decontamination at different wavelengths, revealing that the laser power density needed to increase when the wavelength of the laser increases in the process of decontamination on the steel surface,

It is considered that high power and high repetition rate lasers are the precondition for industrial application of this technology.

2.2 Research Status of Laser Cleaning Mechanism

Laser cleaning is a non mechanical contact surface pretreatment method. The laser beam can act on the sample surface according to the specified scanning method. After absorbing the laser energy, the dirt, rust layer and coating on the surface provide the required thermal, chemical and mechanical energy for cleaning in the form of energy conversion. The process of pulsed laser cleaning is a complex optical, thermal, mechanical and other comprehensive physical change process. At present, the mechanism of pulsed laser cleaning mainly includes laser ablation mechanism and thermoelastic expansion mechanism.

The ablation mechanism of thermal action during pulsed laser cleaning is closely related to the laser power density. Under the ablation mechanism, the surface temperature of materials in the irradiation area increases rapidly after absorbing laser energy. After reaching the melting point and vaporization point of pollutants, the contaminated layer will be removed from the sample surface in different physical states such as melting, gasification, thermal cracking, etc. When the cleaning than 108-109W/cm2, the contaminated layer on the material surface may undergo plastic deformation and produce explosive rebound stress after absorbing the laser energy; When the cleaning is 109 W/cm2, the contamination layer on the material surface absorbs high-energy laser and generates gasification or generates plasma due to optical breakdown to form plasma explosion shock wave to accelerate the separation of pollutants from the substrate surface.

The research on laser ablation mechanism mainly focuses on the modeling analysis and experimental research on the heat conduction and heat effect of laser energy in materials. Considering the influence of plasma shielding in the process of laser cleaning, Liyang Yue simulated the process of excimer laser (wavelength 248 nm, pulse width

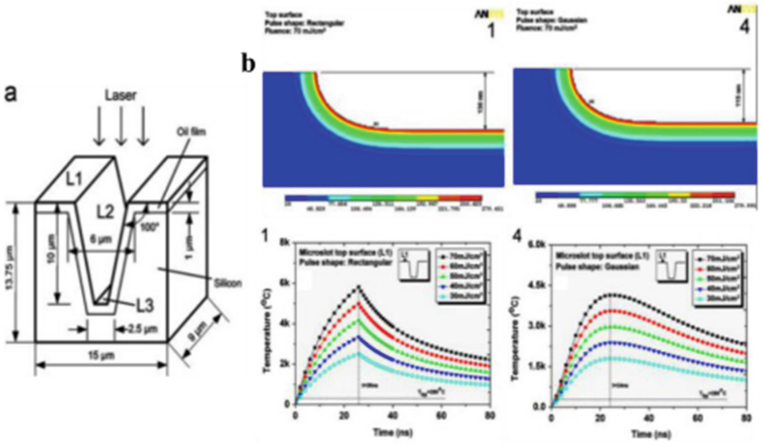

Fig. 1. Simulation analysis of oil stain on laser cleaning surface

28 ns) cleaning flat plate and silicon V-shaped groove, and analyzed the surface temperature rise rule of Gaussian and square beams under different laser energy densities and the influence of the depth of the cleaning oil film, The cleaning thresholds of 20 mJ/cm2 and 40 mJ/cm2 under the action of two kinds of spatial distribution beams are obtained. As shown in Fig. 1.

3 Laser Derusting Mechanism

Laser cleaning is actually a process of interaction between laser and material, including a series of complex chemical and physical effects. The results show that there are mainly covalent bond, capillary interaction, van der Waals force and electrostatic force between the pollutants and the substrate surface. Laser cleaning is to use the characteristics of high energy density of laser to destroy the effect of these forces so that pollutants can leave the surface of the substrate without damaging the substrate. Because of the complex composition and structure of pollutants, the mechanism of laser removal is also different. Researchers have established a variety of theoretical models to explain. The following explanations have been widely accepted:

(1) Focused laser energy is highly concentrated, which can generate extremely high temperature near the focus, making the dirt instantly evaporate, vaporize or decompose after being irradiated;
(2) The divergence angle, and the size of the focused spot is controllable to a certain extent. High energy density can be obtained by controlling the size of the focused spot. The light spot acts on the dirt to make it expand rapidly and get rid of the adsorption of the substrate;
(3) When the laser interacts with the material, it will generate ultrasonic wave and mechanical resonance, making the dirt separate from the surface of the substrate.

The laser cleaning process is the result of the interaction of various mechanisms, which depends on the physical and chemical properties of the matrix materials and pollutants, the physical properties of the laser beam, the cleaning environment and other factors. The evaluation indexes of laser cleaning include: cleaning effect, cleaning efficiency and damage degree of the cleaned object surface.

The schematic diagram of the experimental device used in this experimental process research in Fig. 2. The air cooling system, fiber laser, optical path system (including optical fiber, scanning galvanometer and f- θ Focus mirror), processing platform and computer control system.

4 Design of Laser Rust Removal System

A 20W pulsed fiber laser of the same model as the process experiment is used as the light source. The laser does not need water cooling, so the huge and bulky water cooling system can be removed. The central wavelength of the laser is 1.06–1.07um, which can be transmitted by optical fiber. In order to ensure good beam quality, single-mode optical fiber is used. The optical fiber is most afraid of large bending during use, so

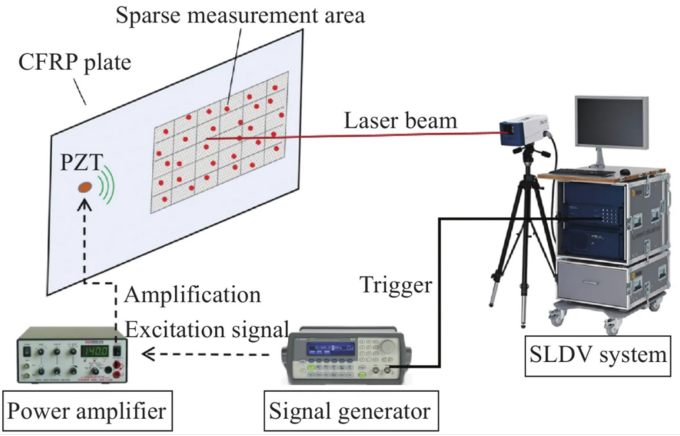

Fig. 2. Schematic Diagram of Laser Derusting Experimental Platform

the method of binding the transmission optical fiber with the control line and power supply system is adopted to improve its bending resistance. The device uses a small galvanometer and a short focus lens, so the derusting head can be portable and enter a narrow space for derusting. To ensure the constant focus position during manual use, the focus holder is designed. At the same time, in order to avoid using a computer and reduce the weight of the device, an offline control system based on DSP and FPGA is developed to automatically control the laser on, parameter setting and scanning galvanometer movement.

The whole device is composed of laser, transmission fiber, light guide head and control system, and its schematic diagram is shown in Fig. 3. The light guide head includes collimating beam expander system, galvanometer, focusing field mirror and focus holder.

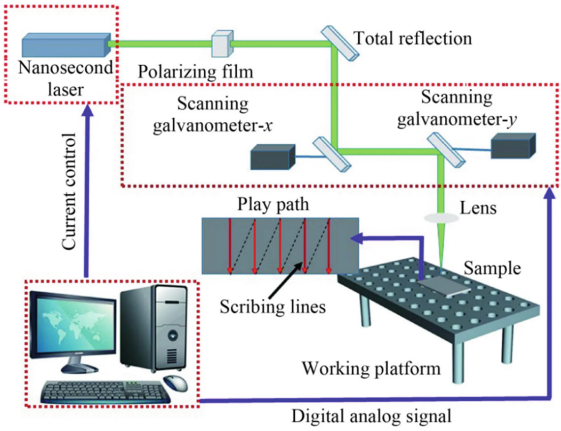

Fig. 3. Schematic diagram of laser rust removal system

After the laser is focused, the light spot on the focus is very small, so if you want to ensure that the working surface is scanned by the laser, you must have an automatic scanning device to achieve point by point scanning. The scanning galvanometer is a good choice. The control card can control the scanning galvanometer. Two galvanometers can realize two-dimensional scanning. Through the development of the control card software, the settings of different speeds, different shapes and different filling methods can be realized.

5 Conclusion

On the basis of summarizing the research status of laser derusting inside and outside, this paper studies the laser derusting process, obtains the optimized process parameters, and on this basis, designs a portable laser derusting device that can be used in a narrow space. The scanning speed has a great influence on the derusting effect. A better laser derusting effect can be obtained by using the slow/fast combination scanning method, that is, first use a slower scanning speed to process the rust samples, and then use a higher scanning speed to remove the newly formed oxide layer in the derusting process. If the repetition rate of the pulse laser is too high, the rust cannot be removed because the single pulse energy is too low. If the repetition rate is too low, the secondary oxidation will occur because the single pulse energy is too high. The corrosion resistance of the sample surface after laser derusting treatment has been significantly improved, about two to three times that of the traditional derusting method.

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Laser Far-Field Focal Spot Measurement Method Based on Multi-step Phase Recovery

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Abstract. Laser far-field focus measurement is an important method for measuring laser beam power. The measurement of optical power is a key problem in many fields, such as laser technology, metrology, etc. In multi-step phase recovery on for high-precision measurement of the position and size of the far-field focus. The method can be divided into two steps: firstly, the spatial intensity distribution of laser beam is calculated by using the fast Fourier transform (FFT) algorithm; Secondly, it uses laser far-field focus measurement to measure the size of laser beam spot on an object. This method is based on phase recovery technology, which uses two or more measurements to determine the size of the object. The first measurement is carried out at a certain distance from the object, and then another measurement is carried out at a relatively close distance from the same object. If the size between these two measurements does not change, it can be assumed that the size of the focus itself does not change.

Keywords: Phase recovery · Laser · High-precision measurement

1 Introduction

Laser far field focal spot diagnosis has gone through the research process from direct measurement to indirect reconstruction. Direct measurement methods mainly include scanning method, photosensitivity method, ablation method, long focal lens imaging method, wedge beam splitting method, array camera method and schlieren method. The scanning method has poor real-time performance and requires high stability of the light source. Photosensitivity method and ablation method cannot be measured quantitatively [1]. The limited by the linear response of CCD, and cannot obtain complete focal spot distribution. In the wedge beam splitting method, the surface error of the wedge leads to additional wave aberrations and the two reflections of the beam on the wedge lead to additional optical path differences. The light spot obtained by CCD detection is not the real far-field focal spot. The array camera the dynamic range measurement and the size of the target plane, and still cannot measure information the focal spot completely. Schlieren method requires high stability of optical path and high performance of occluder.

In order to avoid the disadvantages of the direct measurement method, the indirect measurement method realizes the high-precision diagnosis the -energy by measuring the complex amplitude of the laser near field [2]. According to Kirchhoff diffraction theory,

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the process of laser near-field transmission to far-field transmission is Fraunhofer diffraction process, that is, the intensity laser is related to the power spectrum of laser near-field complex amplitude distribution, so the accuracy of high-energy laser near-field complex amplitude measurement affects the measurement accuracy. The intensity distribution of laser spot laser beam. At the same time, the ICF system measurement method has gradually developed to indirect measurement method. First, the direct measurement method of laser far-field focal spot diagnosis is introduced [3].

2 Related Work

2.1 Laser Far-Field Focal Spot

SHWS is used on the laser device to reconstruct and PIB measure the distribution the target point. The working principle is shown in Fig. 1. The laser is divided into the main beam and the sampling beam through the spectroscope. The main beam is incident into the interior of the target and focused. The sampling beam is incident into the laser parameter diagnosis system. The near-field wavefront phase is measured by SHWS, and then the far-field focal spot intensity of the laser is calculated by Fourier transform. This method makes up for the traditional direct measurement method, which is easily affected by the aberration of additional optical elements and the dynamic range of the detector. However, due to the frequency response characteristics of SHWS itself, the wavefront information of the full frequency band is lost to varying degrees, which affects the measurement [4]. At home, Duan Yaxuan of the and the gave the spatial frequency response model of the SHWS wavefront measurement system. On this basis, he proposed a wavefront reconstruction method with optimized frequency response characteristics, which greatly improved the wavefront measurement accuracy in the middle and high frequency band of the measurement bandwidth, and further improved the accuracy of laser diagnosis.

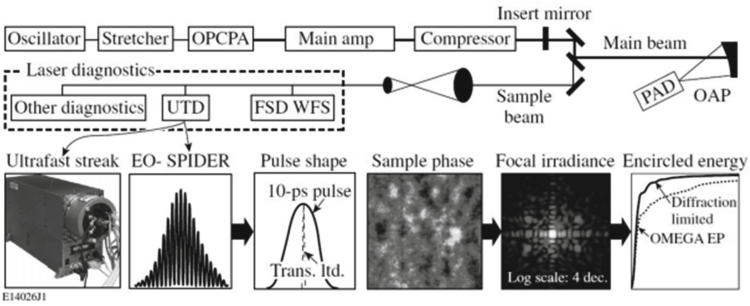

Fig. 1. Working principle of laser far-field focal spot

The light field to be measured diverges after being focused by the lens and is transmitted to the focal plane, and then the CCD receives the diffraction intensity modulated by the random phase plate. Finally, the light field distribution at different positions can

be obtained through the phase recovery algorithm. The field results and at different defocused positions. Keep the low, medium and high frequency information of the focal spot to the greatest extent, and avoid the shortcomings of the direct measurement method or the loss of high frequency information in the measurement of Shack-Hartman wavefront sensor [5]. However, how to improve the convergence speed of the iterative phase recovery method and realize the high-precision diagnosis of the energy is still a problem to be solved at present.

2.2 Laser Beam Characterization

The two-dimensional light field in the object plane can be expressed as:

$$E_1(x_1, y_1) = \rho_1(x_1, y_1)e^{i\phi(x_1,y_1)} \tag{1}$$

among $\rho(x_1, y_1)$ represents the two-dimensional amplitude distribution of the incident field $\phi(x_1, y_1)$ is the phase distribution. Similarly, the outgoing light field of the image plane can be expressed as:

$$E_2(x_2, y_2) = \rho_2(x_2, y_2)e^{i\phi(x_2,y_2)} \tag{2}$$

In the Fraunhofer diffraction and lens focusing model, there is a reversible transformation relationship between the incident light field and the outgoing light field, where the forward transformation is:

$$E_2(x_2, y_2) = F\left[E_1(x_1, y_1)\right] \tag{3}$$

Reverse transform to:

$$E_1(x_1, y_1) = F^{-1}\left[E_2(x_2, y_2)\right] \tag{4}$$

In phase recovery, amplitude distribution $\rho(x_1, y_1)$ and $\rho(x_2, y_2)$ is known, GS algorithm uses multiple iterations to solve the unknown phase distribution $\phi(x_1, y_1)$ and $\phi(x_2, y_2)$. The iterative process is shown in Fig. 2 below.

1. Initialize the randomly, and synthesize the incident light field with the known amplitude distribution $\rho(x_1, y_1)$ and the random initial;
2. The phase of the incident light field is calculated by Fraunhofer diffraction (F transform);
3. The output light field is synthesized from the new phase in the previous step and the known output light field amplitude distribution $\rho(x_2, y_2)$;
4. The is calculated by the inverse transformation of the outgoing light field through Fraunhofer diffraction;
5. The incident light field is synthesized from the new phase in the previous step and the known amplitude distribution $\rho(x_1, y_1)$ of the incident light field;

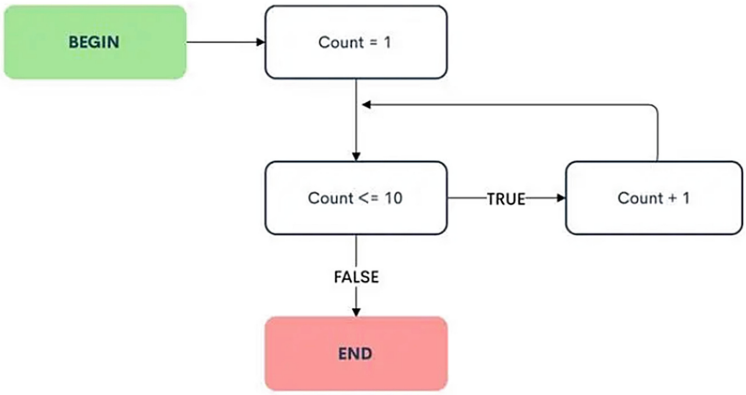

Fig. 2. W Iterative process

3 Laser Far-Field Focal Spot Based on Multi-step Phase Recovery

GS algorithm is of great significance in the development history of phase recovery. This algorithm uses the known light intensity distribution and the frequency domain plane to solve the unknown n of the object plane to be measured by alternating projection and the frequency domain plane. However, GS algorithm is very easy to stagnate and has poor convergence. GS algorithm is the earliest iterative phase recovery algorithm, and subsequent iterative phase recovery algorithms such as ER and HIO are improved and derived on the basis of GS algorithm. Therefore, the principle of iterative phase recovery is introduced based on GS algorithm. According to the amplitude constraints and the frequency domain plane, the GS algorithm uses to iteratively calculate the phase to be measured in the object plane. Because the algorithm uses the detection light intensity of the object and the domain plane to constrain, it is a dual-intensity phase recovery algorithm. As shown in Fig. 3 below, it is a focused light field phase ray recording.

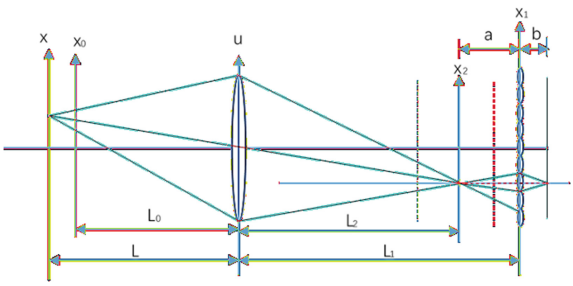

Fig. 3. Focused light field phase ray recording

The physical means is to obtain multiple detection light intensities. Compared with the single iteration of GS algorithm, the single iteration of physical means includes multiple amplitude replacement on different detection surfaces and the constraint of phase reservation, while the single iteration of GS algorithm only performs one amplitude replacement on one detection surface and the constraint of phase reservation. Among the existing iterative phase recovery methods, the common physical modulation methods include multi-range modulation, stacked scan modulation and random phase modulation.

In the single-beam multiple-intensity phase recovery method, the CCD is translated several times to obtain n different diffraction intensities. The single iteration of the method contains several different amplitude constraints, while the single iteration of the GS algorithm only contains one amplitude constraint. Therefore, the introduction of physical modulation into the phase recovery method can effectively accelerate the convergence of the iterative phase recovery method. Similar to the convergence proof of GS algorithm, the convergence of single-beam multi-intensity phase recovery method can be proved as follows.

In the k-th iteration of the single-beam multi-intensity phase recovery method, the objective function can be written as the following general formula:

$$E_k = \sum_{i=1}^{n} \frac{1}{2} \| \rho_{AS}\left[U_0(x_0, y_0), z_i\right] \| - \sqrt{I_i(x_i, y_i, z_i)} \|^2 \tag{5}$$

The subscript i represents the ith transmission distance or diffraction intensity, a total of n diffraction intensities, and the subscript k represents the kth iteration, representing the Frobenius norm.

4 Simulation Analysis

In this simulation, the detection step size is Az = 5mm and the number of detection steps is n = 10. In that the can optimize the distance parameters, on the basis of the theoretical distance values, the recovery results of the proposed and SBMIR method are simulated respectively under five sets of range error values oz = ± 0.1, ± 0.2, ± 0.3, ± 0.4 and ± 0.5 mm. When error is 8z = ± 0.1mm, it distance guess, a disturbance (<102) is guess. For method, the convergence results of all simulation iterations after 100 times are compared with PE-SBMIR method. For method, the evolution t.ma = 100, a population contains K = 20 individuals, and the quantum bit number of each gene m = 20. During the whole simulation process, the software used was on a desktop computer with 3.40GHZ central. The shown in Fig. 4 below.

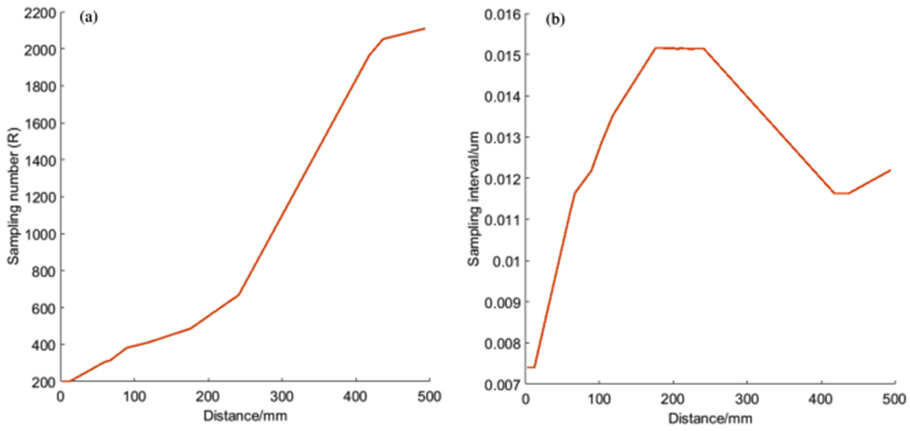

Fig. 4. Simulation result

In this method, the complexity parameter is used to evaluate the difficulty of the recovery of the object to be measured, so the following three requirements are put forward for the known modulation phase: (1) the complexity of the object to be measured needs to be included in the complexity of the known modulation phase; (2) The modulation phase requires continuous distribution; (3) The modulation phase needs to contain different frequency band information. Under the condition that the modulation phase meets the above three requirements, the PRSPM method can quickly converge to solve the object to be measured.

5 Conclusion

Laser beam is a very complex wave phenomenon. The laser beam is composed of light particles, called photons. The wavelength of light determines its color, and its intensity determines its brightness. A single photon has no mass, but it does have momentum and energy. When photons hit an object, some energy is transferred to the object, while some energy is reflected back to the source (photons do not always transfer all energy to the object). This process is called "absorption" or "scattering", depending on whether they pass through or reflect back from the object. Starting from GS algorithm, the basic principle of iterative phase recovery and the mathematical essence of convergence are described. According to the sampling theorem, the applicable conditions for accurate numerical calculation of diffraction field transmission in frequency domain are derived when the Nyquist sampling interval is satisfied.

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Application of Computer Algorithm in Fault Diagnosis System of Rotating Machinery

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Abstract. The application of computer algorithm in the fault diagnosis system of rotating machinery is a tool for analyzing data and making necessary calculations to determine the cause of the fault. Computer based technology can help identify defects, detect faults, predict future faults and evaluate maintenance measures. Fault diagnosis tools are very helpful in identifying problems with rotating machinery that can cause significant economic losses due to reduced production or downtime on the production line. In order to ensure continuous operation of industrial equipment, all machines must be regularly checked for abnormalities that may affect overall performance and productivity.

Keywords: Computer algorithm · Equipment failure · Fault diagnosis · repair

1 Introduction

Fault diagnosis is a state recognition technology, which finds equipment abnormalities through some analysis methods based on equipment history and current operation state, and studies and analyzes the causes of equipment abnormalities or faults. Condition maintenance is different from current transformer, and its detection method is excellent. It will be the mainstream of transformer detection methods in the future to detect and analyze the state of transformer at the moment. The early troubleshooting technology began in the 1960s. For the reason of commercial profits at that time, NASA and American Airlines promoted the Naval Research Institute to establish a mechanical fault prevention team to eliminate research faults. In recent years, and intelligent fault diagnosis technologies such as expert system, neural network, Petri network and fuzzy theory set have been gradually formed. Cai Zefan, Huang Daoping proposed an intelligent fault diagnosis system expert system based on neural network with complex neural network parameters and fuzzy control theory. Yu Hongjie and others proposed a new diagnosis system, which combines expert system and information theory to overcome the interference of signal in the diagnosis process [1].

With the continuous development of power equipment, its complexity is higher and higher, which makes its diagnosis more and more difficult. In recent years, machine learning and deep learning have made a breakthrough in the field of classification and feature extraction, which is also the performance of the improvement of fault diagnosis

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methods and theories. Deep learning can automatically extract more complex feature information from self-learning, and then extract from simple features, so it can well solve the related problems such as feature extraction and classification. In this way, the accuracy of fault diagnosis results is improved by one level.

2 Related Work

2.1 Overview of Data Asset Management

Equipment asset management develops with the development of equipment. So far, there have been five stages, namely, post event maintenance stage, preventive maintenance stage, equipment comprehensive management stage, comprehensive production maintenance system and whole life cycle management.

(1) Post maintenance phase. Post maintenance, that is, when the equipment fails or the equipment is low, it is suitable for maintaining simple equipment. Through this stage, the service life of components with equipment failure can be extended. However, post maintenance is usually unplanned maintenance, which requires shutdown maintenance and will bring some economic losses. When diagnosing the main parts of some equipment.
(2) Preventive maintenance phase. With the migration of time, in the 21st century, the complexity and complexity of many equipment have exceeded the expectations of the system at that time, which makes the whole maintenance process more and more difficult. Therefore, prevention and system optimization and upgrading are very important [2]. By improving the system, The failure rate of some equipment can be reduced, but preventive maintenance is relatively conservative and blind, and there are often many unnecessary repairs and maintenance, resulting in waste of cost.
(3) Equipment comprehensive management stage. Integrated equipment management is a management method. Through the reform of the whole system and the improvement of the quality of operators, the efficiency will be maximized at the limited cost. Integrated equipment management has three different characteristics: one is the whole process management of equipment; Second, all employees involved in the project, from company leaders to equipment production, participate in management; The third is to estimate and manage the value of equipment.
(4) Full production and maintenance system. After combining the excellent and advanced achievements of foreign countries, on the basis of technology_ In combination with the technology beyond the same period proposed by the comprehensive equipment management method, and then improve their own personnel quality, the company puts forward the requirements of production and maintenance system for all employees.
(5) Life cycle management. The feature of equipment life cycle management is to manage the whole survival process of the equipment, from the moment the machine is produced, to installation, use, operation and maintenance, until scrapping. Someone collects and monitors the data in the whole process. Through the monitoring time and steps, it is divided into three stages: pre management, in-service management and post management. Through the analysis and management of these stages, the goal

of reducing equipment failure rate and improving equipment operation reliability is realized.

2.2 Data Processing Flow of Power Equipment

At present, data presents the characteristics of large amount of data, high value, fast speed and many kinds. The use of traditional methods is outdated, and new analysis methods must be adopted to deal with the needs of business development. Expand memory storage and data analysis through new IT technologies. The related algorithms of computing, data mining and machine learning are combined.

This paper borrows the traditional Hadoop platform, combined with data mining and machine learning algorithms. A new processing flow is established, and its processing flow is shown in Fig. 1.

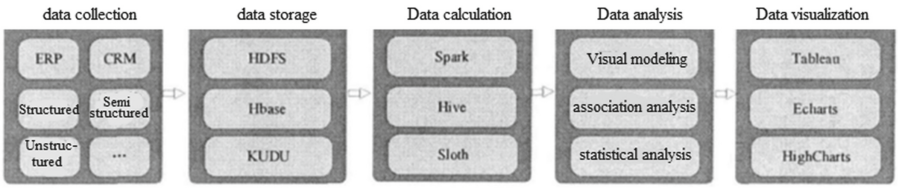

Fig. 1. Full cycle processing flow

The data source management of equipment includes not only multiple business fields, but also many system data. These data have different structural patterns, unstructured and semi-structured data. Complete the collection of relevant data in the data collection stage. Then the distributed and heterogeneous storage of data is realized by related technologies.

3 Fault Diagnosis System

3.1 Current Situation of Data Management Platform in Power Enterprises

Since this century, the informatization level has reached a rapid improvement and application. Thanks to this, the informatization level of power companies has been greatly improved. It mainly includes the real-time monitoring values of node voltage, node current, node power and other data. The current state information of all equipment in power system is equipment data. Customer service data refers to data related to users near the user side, such as customer information, customer power use, etc.

Although some enterprises have established data centers and related organizations to deal with them, compared with other it and financial industries, they are obviously not qualified to compete with them. Its specific performance mainly has three aspects. Firstly, although the amount of data is huge, the problem is that the data is too messy to get useful data. In many current power system businesses. Secondly, many data formats are not unified, which makes many data unable to be cross used or integrated, resulting

in the inability to integrate multi-source data [3]. Finally, the fuzziness of the data use location leads to the insufficient reflection of the data value of these swimming, leaving most of the favorable data idle and hidden.

With such particularity, power companies are developing a complete information management system. This system should be different from the data system of ordinary IT industry, not only reflected in the management and analysis of data, but also reflected in the use of data [4]. Therefore, there is still a big gap. With the continuous delay of time and the continuous improvement of the company's own information level, the company's data management level will also have a new high level.

3.2 Data Platform and Architecture

So data management is the inevitable development of information construction. Facing the increasing amount of data, if you want to better manage data, only by developing data management technology can you better support analysis and operation.

It has reliability. One of the most important factors is its simulation failure. Therefore, it has multiple backup data, so that it can be repaired accurately after a node has an error; At the same time, Hadoop adopts parallel operation, which makes its processing speed faster than the traditional method; It also has scalability because it can process Pb level data smoothly. It is especially suitable for application scenarios dealing with large data sets.

The concept of cloud computing data platform is used to integrate the actual business requirements of equipment data asset life cycle management and related big data analysis and processing technology. Combined with the whole life cycle theory, the architecture of equipment data management cloud platform is constructed to ensure the mutual transformation of physical and logical resources.

4 Research on Power Equipment Fault Diagnosis Model Based on Machine Learning

When it comes to equipment fault diagnosis, it can be associated with a hot academic research topic. In recent years, especially in the computer field, data analysis technology and artificial intelligence technology have sprung up, giving a new life to the long silent field of fault diagnosis. Qualitative empirical diagnosis and quantitative empirical fault diagnosis system mode are also gradually developed. In the traditional industrial technology, a large number of it methods have been added. Today, the running in of these two technologies is getting better and better. Industrial system equipment is also evolving in a more and more complex direction. What can best reflect this is not the more and more complex internal mechanical structure, but the more and more data quantity and types used and output.

For the traditional neural network model, we know that it has three layers: input, output and hiding. These three layers are connected between layers, but for each different layer, there are few node connections between them. Based on this structure, the result is that for a sequence, it can not well solve the relationship between the current unit result and the previous unit output. Therefore, a cyclic neural network model is proposed. This

model performs very well in solving such problems. In recurrent neural networks, the output of a unit is not only limited by the current input, but also has a great relationship with the output of the previous unit. Because of this, this model can deal with sequence data better. For the fault diagnosis of power equipment, there are still a large number of sequential data, such as equipment operation data, station monitoring data, etc. These data have time series. Therefore, in case of equipment failure or abnormality, it can be well displayed through the time series, and we can make decisions through the current state combined with early problems.

In a typical RNN recurrent neural network, the input and output layers account for an important part. According to this conclusion, the whole network can be regarded as a cyclic replication of a unit. The result structure is shown in Fig. 2.

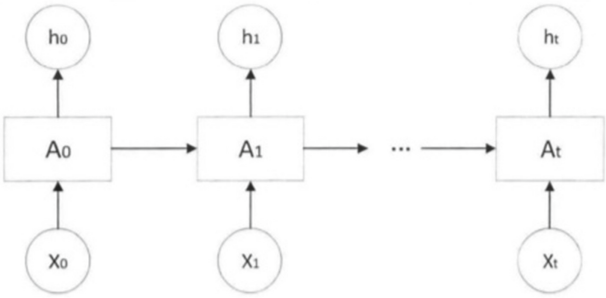

Fig. 2. RNN structure diagram

As we can see in Fig. 2, the whole structure has an input X_t at different time nodes, and the output of this node provides the data needed by the next node A_t, i.e., an output X_t. The next node receives this output, uses it, and then combines it with the A_t state at this moment to jointly decide the new result. Using this circular model, a time series problem can be solved very well.

5 Conclusion

A machine is a complex mechanism composed of many components. Each component is connected to another component through joints, gears, rods, etc. The main function or purpose of the machine is to perform the required tasks without any human intervention. Therefore, in order to achieve this goal, all components must always coordinate with each other. The machine has some inherent defects, such as damaged parts, worn bearings, loose or damaged parts, etc. If the diagnosis is incorrect, unexpected consequences may result. The computer algorithm is applied to the fault diagnosis system of rotating machinery. It provides engineers with more accurate data, reduces the time to find problems by hand, and therefore reduces most human errors when finding errors. Computer algorithms help to reduce human errors, which is the main reason for machine defects, because when the operator fumbles and makes mistakes, the machine will be damaged or damaged or damaged or may lead to loss of business income. Therefore,

the application of computer algorithms in rotating machinery can help to reduce these errors by providing accurate accuracy.

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Complex Network Community Discovery Algorithms Based on Node Similarity and Network Embeddings

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Abstract. This paper briefly analyzes the summary of network embedding and node similarity, emphasizes the discovery, and takes numerical simulation as the entry point to study the evaluation index, real network and artificial network, which is expected to provide reference for relevant personnel.

Keywords: network embedding · parameter-free community discovery · node similarity · preferred network

1 Introduction

1.1 Network Embedding

Network embedding, is a method to learn network representation, mainly showing sparse, high-dimensional vector space through dense, low-dimensional vector space. Whose learned features can be used in learning tasks such as clustering, classification and classification. The Word2vec algorithm mainly uses the skip- -gram model to transform the words into low-dimensional embedding vectors, but it should be noted that even if the two words have similar meanings, they can not be expressed by a unified vector, but should be expressed by a similar vector. The DeepWalk algorithm learns the network node vector by integrating the random walk into the skip- -gram model [1].

1.2 Node Similarity

Node similarity can judge the degree of similarity between network nodes. Generally speaking, network nodes within the same community have high similarity, while different communities have low network node similarity. At present, more and more node similarities are used in the community discovery algorithms, mainly including the following categories: The same community node similarity indicators, random walk indicators, and path indicators [2].

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2 Complex Network Community Discovery Based on the Similarity of Network Embedding Methods and Nodes

2.1 Problem Description

The complete preference network using the similarity of nodes, acquire the central nodes from the original network, set the center nodes and number as the center and cluster number, and then divide the community with the help of k-Means algorithm. This algorithm can automatically extract different node parameters of the network without setting parameters. Belongs to the parameter-free community discovery algorithm [3].

2.2 The S N V Algorithm Framework

When calculating, the staff should keep the connecting edges of all the nodes, and then delete the other connecting edges to establish a perfect preference network. Preference networks can be divided into several separate subnetworks, and each has a corresponding primitive community. The largest complete node within the original community was considered as the central candidate node. The algorithm to realize the distribution of the network nodes in the community [4].

2.3 Preference Network

In the community discovery, the influence of adjacent network nodes with connected edges is much greater than that of non-connected network nodes, that is, the similarity between nodes and their adjacent network nodes is much greater than that between non-adjacent. The similarity between the different and the adjacent network nodes is calculated by the cosine similarity. It should be noted that this method is not calculated for any node. The cosine similarity index is shown in Eq. (1), where Mi represents the network node and i is a vector representation.

$$\mathrm{Sim}(i, j) = \frac{M_i \times M_j}{\|M_i\| \times \|M_j\|} \tag{1}$$

If all nodes in the network can be obtained by connecting to the most similar network nodes^p(V,E^p), The set of network nodes is V, while the associated edge set is $E^p = \{e_{i,j}, | \text{The i, j V}\}$, when the $e_{i,j} =$ At 1, the maximum similar node representing this network node is j. Taking the Karate network as an example, all network nodes only connect to the most similar network nodes and delete other connection edges. As shown in Fig. 2 and (Fig. 1)

In the whole preference network, the network does not have overall connectivity, so the community network in the connected subgraph of the community network and divides the initial community. For example, in Fig. 2, the preferred network has 9 connected subgraphs, which means that the initial number of communities in the preferred network is 9.

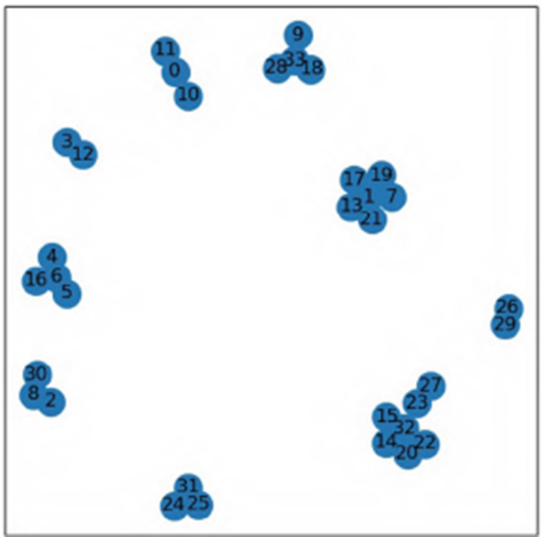

Fig. 1. The preference network plot of the Karate

2.4 Central Node Selection Policy

Combined with preference network can obtain the network original community, but it should be noted that this community is not as a community division result, so in the community division, we should combine the selection scheme from the original community set, and the central node vector as K-Means algorithm center of mass, and then the specific number of the network center nodes as K-Means algorithm cluster number, and then the data clustering operation, convenient center node selection.

We designed the node selection scheme by calculating the average degree between the network nodes and the length of the shortest path. First, the connectivity between the preferred networks should be combined to obtain the original community set, C = {c1, c2,… The cn}, but it should be noted that the maximum node within each original community can only be treated as an alternative network node set Vpo.

Through the candidate node set, the aspi threshold is calculated according to formula (2), so that the shortest path of each candidate node i in vp remains at three, delete the node j where the shortest path distance (i, j) is less than the asprthreshod threshold, and update the candidate node set v μ, i. e., the central node set v, and the port p2.

$$\mathrm{ASP}_{\mathrm{rthreshold}} = \min(\mathrm{AWN}, \mathrm{ASPi}) \tag{2}$$

The number vector corresponding to the central node in VP2 was taken as the number of initial centroids and clusters, data points represented by this vector. Thus, the corresponding network nodes are divided into communities.

Finally, the low-dimensional vectors corresponding to the V-shaped center node and their number are taken as the initial centroid and cluster number. The obtained community division results are shown in Fig. 2.

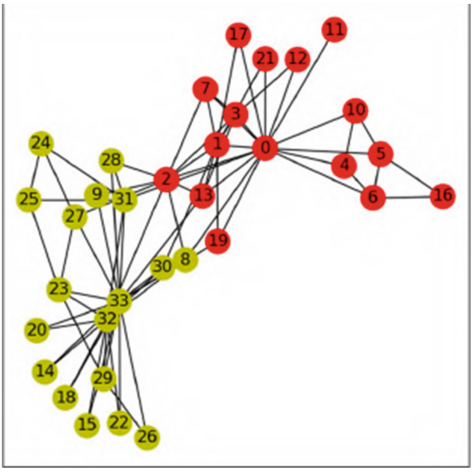

Fig. 2. The Karate Network Community Discovery Fig

3 Numerical Simulation

3.1 Evaluation Indicators

The higher the degree of modularity, the more reasonable the structure of the community is. In contrast, the less modularity, the less effective community segmentation is.

Standardized mutual information (inm) and adaptive mutual information (ami) are usually used to measure the degree of coincidence between the two data distributions. They are often used as metrics to assess clustering algorithms and can also be used to calculate the accuracy of community distributions. 3.2 Real network. In this paper, we test the effectiveness and correctness of the SNV algorithm by using four real partitions and four real partitions. Record types include human social networks, communication networks, infrastructure networks, vocabulary networks, and data are shown in Tables 1 and 2. Where, Network represents the network name.

Table 1. Network statistics with real labels

Network	Node	Edge
Karate	32	76
Football	113	612
Dolphins	60	157
Polbooks	103	439

Table 2. Network statistics without real labels

Network	Node	Edge
Jazz	197	2600
Email	1131	5449
Lesmis	75	252
David	110	611

3.2 Artificial Network

The artificial network used in the text uses the LFR as the reference network. These networks all have node-level and community-level power distribution, which can truly reflect the characteristics of the network.

Figure 3 shows the NMI comparison of the SNV algorithm with the other five algorithms on an artificial LFR network. With the network community range as well as the mixing parameters. And with the increasing mixing of parameters, the network structure will become more blurred and complex. Thus, with increasing mixing parameters, accurately identifying communities becomes increasingly difficult. Figure 3 (a) and Fig. 3 (b) show the NMI index results for LFR networks with nodes of 1000 and a community size distribution index of 1.2. The parameters of the LFR network are: The network node number is $N = 1000$, the average network size is 20. The K-Means and SpectralClustering algorithms perform relatively poorly in LFR networks because this paper does not optimize the K-Means and Spectral-Clustering algorithms.

The Fig. 3 (c) and Fig. 3 (d) show the distribution and size of the nearly 3,000 network nodes in the community. The so-called power law distribution index refers to the NMI results of LFR network in 1.2. The LFR network parameters mainly include: network node number $n = 3000$, the average network size is 50, while the mixing parameters are about 0.1–0.7. It should be noted that although the network size is very different from the community size and the original network, it is not difficult to find from the figure below that when SNV and the other five algorithms perform on the 3000-node LFR network is basically the same as that on the 1000-node LFR network.

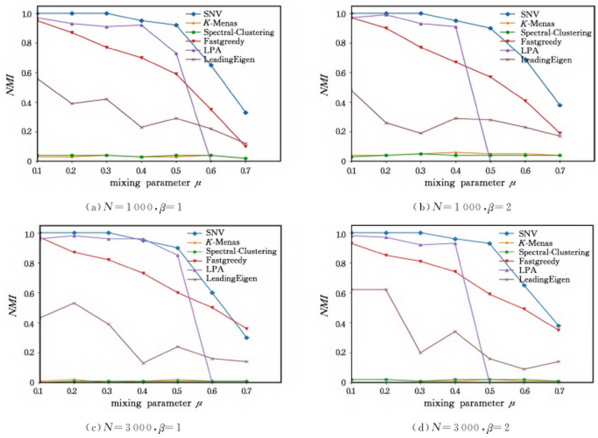

Fig. 3. Comparison of the NMI values of the S N V and other algorithms on the LFR artificial networks

4 Conclusion

This paper proposed the SNV algorithm of the traditional network community node similarity and network embedding method together, and quickly identify the complex network community, help users to obtain the corresponding information, so is widely used in electricity network community and social network, has a very broad prospect.

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Education Dynamic Early Warning System Based on Collaborative Filtering Algorithm

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Abstract. The main contradiction of education is the conflict between school education and social interests. Actively adapting to social needs is the basic direction of higher education development and reform. The social impact of talent training is an important indicator to test and evaluate the performance and curriculum quality of colleges and universities. A complete higher education early warning system must cover the whole process related to quality. From the perspective of the whole process of higher education project activities, the process, process and production of higher education system are closely related to the quality of higher education system. The purpose of this paper is to study the research on education dynamic early warning system based on collaborative filtering algorithm. This paper takes the university as an experimental point, discusses the key factors affecting the quality control of the university from the four dimensions of organization, teachers, educational activities and students, and builds a powerful and dynamic early warning system.Experiments have proved that under the influence of the education dynamic early warning system in this paper, the excellent completion rate of the course has increased by 30%. In addition, in the case of parallel login and operation of 300 users in this paper, the system response speed is about 0.3s, and the response is relatively low. Fast and stable performance.

Keywords: Collaborative Filtering Algorithm · Dynamic Early Warning · College Education · Teaching Quality

1 Introduction

The main function of education is to train people, and the training process of people is long, labor-intensive, and complicated. For the planning and implementation of the higher education system, teachers and students are not unrelated, but are interconnected, promoted, restricted and influenced each other. The attention of school leaders inevitably leads to important school functions and policies being subject to curricula and instruction, so that the flow of funds and programs shifts in the direction required by curricula, university education and learning environments, and improvements in education and software. And teaching materials and stability, trainers improve students' learning environment; teachers adopt critical and responsible teaching methods in the learning process, improve students' understanding and stimulate students' curiosity; through organization and work process, students' quality is improved As a result, adjustments are made to their management activities [1, 2].

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Discusses the key factors affecting the quality control of the university from the four dimensions of organization, teachers, educational activities and students, and builds a powerful and dynamic early warning system. The higher education early warning management system provided in this paper can be designed and constructed with reference to some SAS software models, analyze the characteristics and laws of higher education operation, as well as the relationship and growth trend among various higher education, monitoring and early warning agents, and provide suggestions.

2 Research on Education Dynamic Early Warning System Based on Collaborative Filtering Algorithm

The higher education system emphasizes the need for a systematic review of the quality of research because "textbooks are widely used to refer to relevant scientific methods designed to deal with complex problems". Diagnosis of quality problems is not based on occasional innovations, but requires the introduction of general redesigns. This paper examines the quality of higher education from two perspectives [3]:

(1) To evaluate the quality of higher education as a whole, it should also be noted that there are two main interaction mechanisms between the whole and part of the system evolution process: the general conservative effect and the new effect. The generally conservative effect of higher education quality is manifested in the following aspects: Although the performance of each element of the higher education system is built on an overall stable basis, when the stability changes, each element may occur. From a variety of different qualifications, All innovation achievements prove that when the internal and external conditions of higher education change, the new changes created by various elements and development are "synergistic", and can provide a reliable environment for incremental innovation in various fields, so that all parties A harmonious, good working environment is taking on a new role in the higher education system.
(2) The consolidation of personal development is a strategic process of complex projects, seeking a systematic optimization platform for the sustainable survival and development of projects, where quality is the goal of creating higher education projects through individuals [4].

To alleviate the effect of sparsity, traditional matrix filling methods populate the matrix by predicting the ratings of user-unrated items in the item union I u ∪ v. First calculate the similarity and set the common scoring item threshold λ to adjust (1):

$$sim_1(u,v) = \frac{\sum_{i \in I_{u,y}} \left(r_{u,i} - \overline{r_u}\right)\left(r_{v,i} - \overline{r_v}\right)}{\sqrt{\sum_{i \in I^1_{u,y}} \left(r_{u,i} - \overline{r_u}\right)^2} \sqrt{\sum_{i \in I^1_{u,y}} \left(r_{v,i} - \overline{r_v}\right)^2}} \times \frac{\min\left(\left|I^1_{u,y}\right|, \lambda\right)}{\lambda} \tag{1}$$

Then the prediction score is performed, and the matrix is filled, as shown in formula (2):

$$r_{u,i'} = \overline{r_u} + \frac{\sum\limits_{v \in N(u)} sim_1(u, v) \times \left(r_{v,i} - \overline{r_v}\right)}{\sum\limits_{v \in N(u)} sim_1(u, v)} \tag{2}$$

3 Design Experiment of Educational Dynamic Early Warning System Based on Collaborative Filtering Algorithm

Higher education system early warning. Education is a special project, and quality assurance measures must take into account the following key conditions: (1) Content. The quality of teaching is affected and limited by multiple stages, which is a multi-level production of multiple exhibitors. It is not determined by specific factors, it reflects the overall level of the school, not only the school's level of academic excellence, but also the overall level of attitude, body, beauty and performance; it represents both levels of teachers. And undergraduate education. (2) Change. The quality of education varies. Not all schools have the same quality of education. Different schools have different academic quality levels and different rules and regulations due to the differences in the teaching structure, teaching staff level, student quality, teaching materials and procedures of working schools. (3) Compare. Comparisons can also be made if there are differences in the quality of education.

dynamic early warning system of university education is a system that combines statistics of cohesion that can reflect the quality of higher education and the actual classroom. It not only has to meet the basic requirements of a general bar system, but also due to its specific nature and function, it should also meet the following requirements:

(1) Complementarity means that the elements complement each other. Indexing systems need to adhere to the following guidelines: Citations may be relevant and relevant.
(2) Comprehensiveness, that is, the early warning signal requires a high degree of universality, which can fully and carefully reflect the perspective and development of social problems that threaten social order, and reflect the most important and important events that have occurred. Complex quality issues in the education system.
(3) Functionality, that is, each indicator needs to be able to be represented by conventional numerical values.

The early warning system management system presented in this paper can be designed and written with reference to a specific SAS software template to analyze the characteristics and regularities of higher education performance, relationships and developmental culture in various higher education programs, monitoring and alerting agents. And offers suggested methods, including:

(1) data management. Provide users with data entry functions, so that users can accurately and conveniently enter multiple indexes and raw data into the higher education model and perform functions such as browsing, modifying, adding, and deleting.

(2) data processing. The function of the model is to analyze the variance of higher education, so that data such as long-term trends, periodic changes, and random changes can be collected for monitoring and attention.
(3) Human-machine communication. During the development and operation of the program, it provides users with a view to monitor the accuracy of internal and external concepts and that the value, content and density of the indicator system can change as the implementation needs.
(4) Alarm demonstration. By predicting and providing advanced higher education operation trends, and judging whether the overall and some key indicators of higher education operation are in the state of no warning, light warning, moderate warning, heavy warning or giant warning. And through the siren system represented by five colors of green, blue, yellow, orange and red, multimedia alarm information is released to relevant departments.
(5) Countermeasure extraction. The system searches, accumulates, stores and edits a large number of cases dealing with educational accidents and problems. Users can quickly select corresponding countermeasures and suggestions from the case database according to the nature, type and severity of educational police situations.

4 Experimental Analysis of Educational Dynamic Early Warning System Based on Collaborative Filtering Algorithm

In order to study the intention of the educational dynamic early warning system the educational indicators of a class using the modified system with the educational indicators that did not use the system last year, mainly from four aspects., course pass rate, course attendance, teaching satisfaction and excellent course pass rate. The comparison data is shown in Table 1.

Table 1. The impact of education dynamic early warning system on course teaching

	pass rate	Attendance	teaching satisfaction	Excellent rate
System impact	97	92	96	67
Last year's results	82	77	91	32

Figure 1 that the teaching indicators of the course teaching using the education dynamic early warning system constructed in this paper are higher than those that have not used the system. The difference between the two in the course excellence rate is particularly obvious, the difference between the two is about 30%, which proves that the educational dynamic early warning system constructed quality of teaching and meets the needs of building a system.

This paper evaluates the performance of the education dynamic early warning system constructed in this paper, mainly judged by the system response speed of multiple users' parallel login and parallel. The average response speed of the system is recorded as shown in Table 2.

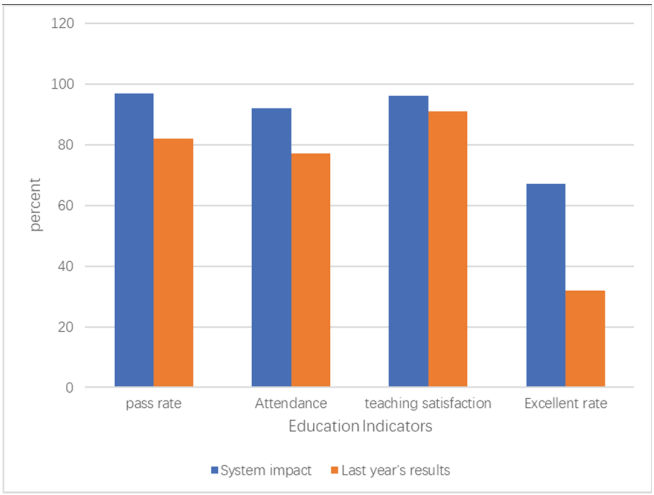

Fig. 1. The impact of education dynamic early warning system on course teaching

Table 2. The impact of education dynamic early warning system on course teaching

	50	100	200	300
Parallel login	0.3	0.33	0.31	0.31
Parallel operation	0.22	0.23	0.19	0.22

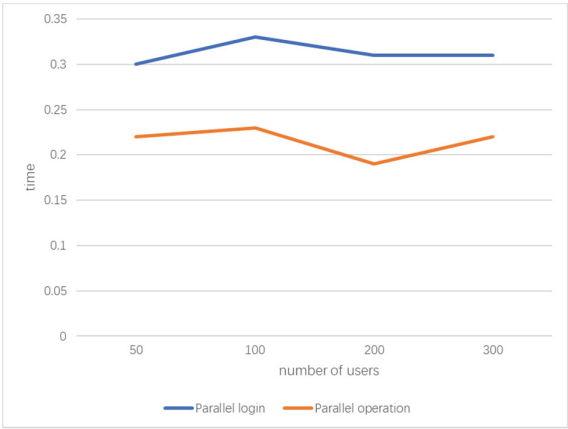

Fig. 2. Response time of the system with 300 users logging in in parallel and operating in parallel

As can be seen from Fig. 2, login response time of the system is about 0.3s. The performance is stable and the response speed is fast, which can meet the needs of daily education.

5 Conclusions

The quality of education is a common problem faced by all countries and regions that have entered the popularization of higher education. Such as organizational and operational structure, teachers, courses, and students, as well as the relative decline in the quality of students with the increase in gross enrolment ratios, have all constituted a significant impact. Establishing and improving a systematic, scientific and efficient dynamic early warning system and strengthening the supervision and evaluation of the quality of higher education, this paper can only construct the dynamic early warning system of university education from the theoretical level, which needs to be further discussed and studied on the practical level.

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Research on Secure and Encrypted Transmission Method of Electric Power Data Based on National Security Algorithm

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Abstract. Another problem at present is that a large amount of data is transmitted electronically. This includes not only personal information, but also confidential business information and financial records. With our increasing dependence on computers and other digital devices, the risk of these data being leaked or stolen is increasing. Fortunately, many organizations have recognized the need for better network security measures to protect their most valuable assets from external threats, as well as internal attacks by malicious employees or contractors. The increasing use of mobile devices makes it easier for bad actors to intercept sensitive information. With the emergence of potential threats to real-time data security, and the need for real-time and quasi real-time data transmission through the network in electricity metering and billing systems and power markets, the research on real-time data security of power information systems has been put on the agenda.

Keywords: Data security · National secret algorithm · Electricity · Encrypted transmission

1 Introduction

In the era of Internet communication, with the wide access of various massive data, power information is generally transmitted to each other, and the possibility of malicious attacks from all aspects is greater. It is an important research content to build a safe, reliable, real-time and efficient intelligent power user electricity information acquisition system. In addition, reliable and stable communication network transmission is also an important guarantee for users to interact with the acquisition terminal [1].

For the security encryption protection system, RSA is mostly used as the mainstream public key algorithm at present. The key design part of such algorithm has not been disclosed [2].

The tentacles of this network security threat are not only limited to the scope of public networks, but also frequently appear in the financial, commercial, banking and other industries directly related to economic interests, and there is a trend to enter the government, military, diplomatic, transportation, electricity and other industries related to national security and security [3].

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In order to monitor, dispatch and manage the production process, electric power enterprises have applied network technology early, on a large scale, and have a strong real-time dependence on the network. Due to the particularity of power system security, any subtle network security problems will lead to catastrophic accidents, which will cause huge political impact and economic losses to power enterprises. It is urgent to establish a network security protection system for electric power enterprises, formulate appropriate security strategies, and improve the security guarantee capability of enterprises.

2 Related Work

2.1 Research Status of Power Data Network Information Security

At present, China's power dispatching data network SPDnet has been built, which is a power communication transmission trunk network mainly composed of optical fiber communication and supplemented by microwave communication, It provides a network platform for high-speed data communication". The information network is divided into two major parts. One is the power real-time dispatching information network, which is mainly composed of the national power dispatching data primary network, the secondary dispatching information network of regional power grids and provincial networks, the three-level dispatching information network built by districts and cities, and the power dispatching information fourth level network of county-level power supply companies. It covers dispatching centers at all levels, power plants and substations, and mainly transmits real-time power dispatching information [4]. Dispatching automation is equipped for national dispatching and dispatching at all levels For the system, real-time information of dispatching, plants and stations at all levels shall be sent to relevant dispatching according to dispatching jurisdiction. The second is the electric power management information network, which is mainly composed of the first level electric power information network of the State Grid Corporation of China, the second level electric power information network of regions and provinces, the third level electric power information network of (regions and cities) and the fourth level electric power information network of county-level power supply companies.

Between the current real-time network and non real-time network, firewall products mainly provide access control between the protected network and the external network. At present, most electric power communication networks are configured with routers and firewalls for secure access to ensure that the internal network is protected from external attacks.

In recent years, electric power workers have studied communication of power. In the process of power system communication data network construction, people began to think about the information security of power industry. Since then, with the promulgation of the national regulations on the security protection of the secondary power system, people have started to discuss the security protection architecture of the secondary power system. In recent years, the information security of electric power industry has begun to conduct large-scale application research. With strong computer and network theory and technology as the backing, not only the application research of various technologies has become mature, but also many practical projects are already in operation.

2.2 Research and Development of Information Security Technology Application in Power System

With the improvement of computer computing performance, the laying of optical fiber network, and the continuous improvement of power communication protocol, to meet the requirements of communication data type, flow and real-time. The IEC60870 protocol series stipulates the communication protocols of power telecontrol, relay protection data, electric energy billing and other aspects, and even the 104 network communication protocol appears to adapt to the application of network RTU in power system. Various information security technologies have also begun to be widely used, but they are still carried out based on the following views. The research on information security of power data network should make a breakthrough:

(1) Two isolation of power communication network. As an explicit national regulation, physical isolation is established when the network conditions are not satisfactory and the network threat is still serious. It is necessary to see that the openness of the power information system will be the mainstream direction. Basic research should break through this framework and carry out some forward-looking work.
(2) It focuses on the protection of monitoring system, and pays insufficient attention to the information security of communication data network. Although the security threat of communication network is relatively small, due to the real-time and reliability requirements of power communication, the information security of communication data network and power monitoring system is equally important.
(3) It is believed that there is no security problem in power real-time communication, or it is not worth further study. Power information makes any security research can not ignore the real-time requirements, so the information security research of real-time communication is basically not carried out, which is the blank of domestic power information security research at present.

3 National Secret Algorithm

According to different algorithms, encryption and decryption methods are different. At present, there are three popular encryption algorithms, namely symmetric encryption, asymmetric encryption and identity based encryption.

(1) Symmetric encryption algorithm

Symmetrical encryption is also the most traditional encryption method. The so-called symmetry means that the encryption and decryption of data must use the same key. Symmetrical encryption is generally fast, efficient, and requires a small amount of computation. However, it is difficult to securely transmit the key between the sender and the receiver. If all data are encrypted using the same key, the loss will be great once the key is disclosed. However, if different keys are used for encryption, the burden on key management will be large.

At present, SM4, Blowfish, etc. Among them, the AES algorithm is an international symmetric encryption standard called Advanced Encryption Standard, which is used to replace the previous DES encryption. The key length can be up to 256 bits, and its security is very high. SM4 algorithm is a symmetric encryption algorithm issued by

the State Encryption Administration of China. Its algorithm is open source. Its plaintext grouping is 128 bits, and the specified key length is also 128 bits. It has the characteristics of high efficiency and security, and has been widely used in various security fields.

(2) Asymmetric encryption algorithm

which can be obtained by anyone. The private key is not public, but only held by myself. Asymmetric encryption key distribution is simple, and then there are fewer keys. Users only need to keep their private keys securely. Both parties can encrypt communication without negotiating the key in advance. In addition, the use of asymmetric encryption algorithm can also achieve digital signature and identity authentication, which is widely used in communication, digital finance and other fields. However, the large amount of computation, the encryption and decryption speed is relatively slow, the efficiency is relatively low, the burden on the CPU is heavy, and it is not suitable for the encryption of large amounts of data.

At present, the common asymmetric encryption algorithms include RSA, SM2, ECC, D-H, among which RSA algorithm is the most widely used. The RSA algorithm was proposed in 1978, and its security has been proved through years of attack tests. However, due to the existence of supercomputers, if the key is lower than 1024 bits, it is considered insecure. The SM2 algorithm is an asymmetric encryption algorithm released by the State Encryption Administration of China in 2010, which is used to replace the RSA algorithm. The algorithm is implemented based on ECC elliptic curve. Compared with the RSA algorithm, the encryption and decryption are faster, the key generation speed is more than 100 times faster, and the performance consumption of the machine will be smaller.

4 Power Data Security Encryption Transmission Based on National Security Algorithm

The method of power data security encryption transmission can solve the problem of power data transmission without security guarantee. Technical solution: both peers negotiate the session communication protocol, and select the protocol acceptable to both parties in the session communication before starting the SSL session; Set up with instruction bound socket; During the session handshake, the communication parties negotiate and ask for the certificate information of the communication parties for corresponding verification; After the handshake, the data is encrypted.

A preferred scheme of power data security encryption transmission method based on national security algorithm, including:

The SM3 is a message digest algorithm, which includes hash processing when the amount of power information data to be processed is large to generate a fixed length digest output to provide data tamper protection. The calculation and processing method is as follows:

Where, + represents connection, is shown in Fig. 1.

The identities of both parties need to be verified, and the information to be processed should be signed for verification and signature processing to provide identity confirmation and anti repudiation protection.,ensuring the confidentiality of communication data, integrity of exchange information loss.

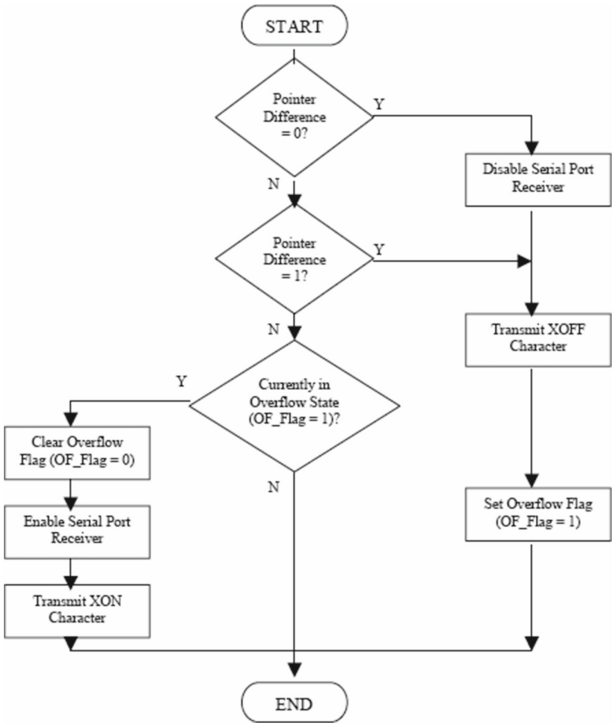

Fig. 1. Power data security encryption transmission process

5 Conclusion

IP based transmission of real-time data in plaintext has attracted the attention of power security researchers, and the state has also formulated a security protection scheme for power secondary system. On this basis, researchers have taken many computer network security measures to protect the data network. But the security consciousness can not stay in the current network security pattern, nor can it simply transplant the computer network technology to the power data network. The field of electric power real-time data communication is a blank spot of information security research. In order to solve the potential security threats, after analyzing the data requirements of power information network, this paper proposes a security communication scheme of real-time data network, which uses simple and direct encryption technology to complete the security challenges of real-time data communication.

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Improvement and Simulation of PID Model Predictive Control Algorithm Based on Time Domain

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Abstract. In the model predictive control scheme, the PID cascade control structure is introduced. By using conventional PID control at the bottom, the interference into the system is suppressed, and MPC at the top, excellent tracking and robustness are obtained. PID controller is a feedback control system, which uses proportional integral derivative (PID) model to estimate the process variables and their derivatives at each time. Then, the output of the PID controller is used as an input of another control loop that controls the process variable in response to the change of the error signal. In this way, it can be said that there are two cycles: one is used to estimate process variables, and the other is used to control process variables. This type of control scheme has been widely used in industrial applications, such as power plants and chemical plants. It has also been successfully applied in many other engineering fields.

Keywords: PID · Model predictive control algorithm · time domain

1 Introduction

The basic idea of predictive control can be traced back to the 1960s. Zadeh and Whalen proposed the control problem of minimum time optimization in 1962. In 1963, propoi proposed the core idea of predictive control - rolling optimization, which is the so-called "open-loop optimization problem". However, it was not until the late 1970s that richalet and others formally proposed model predictive heuristic control (MPHC) on the basis of developing idcom software based on predictive control algorithm. Since then, Mehra et al. Have proposed model algorithm control, both of which are modeled using impulse response [1]. Since 1974, dynamic matrix control, as a constrained multivariable optimization control algorithm, has been applied to the production units of shell oil company in the United States. In 1979, Cutler et al. First introduced this algorithm at the American Chemical Industry Annual Conference [2]. Due to the relatively large amount of online computation, their application was limited to the control of slow processes at the beginning. In order to meet the requirements of fast systems, richalet et al. Proposed predictive function control, which is applied to the control of electromechanical fast-changing processes such as industrial robots, artillery, radar and metallurgical rolling

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[3]. The above algorithms belong to the predictive control of nonparametric models. The characteristics of such control algorithms are: the nonparametric models are directly obtained in the industrial field through system identification and modeling, and the predictive models have clear physical meanings; The online rolling optimization based on feedback correction replaces the traditional optimal control, overcomes the influence of uncertainty in industry, and enhances the robustness of the system; Online calculation is relatively simple. The main disadvantage is that this kind of algorithm is applied to stable systems [4]. When the controlled object is unstable, it is difficult to directly apply this kind of algorithm, and it needs to consider the combination with conventional control algorithms.

2 Basic Principle of Model Predictive Control Algorithm

For different control objects, different types of MPC algorithm structures will be different. At the same time, MPC has multi-step prediction ability, which can reflect the change trend of the control process in multiple time domains in the future. In this way, not only the controllable range of the control system can be expanded, so as to enhance the observability and controllability of the system, but also the amount of information reflecting the control system can be increased, and more performances of the controlled system can be predicted, such as coupling. Feedback is the essence of control theory. Feedback correction can make the whole algorithm overcome the influence of human or non-human factors, including disturbance, uncertainty and other factors on various performance indicators. reduce the error, and make it reach the expected control goal. MPC algorithm can obtain good control quality, ideal stability, robustness and other performance, especially in complex process production industrial processes, it has become a benchmark of complex process control, is shown in Fig. 1:

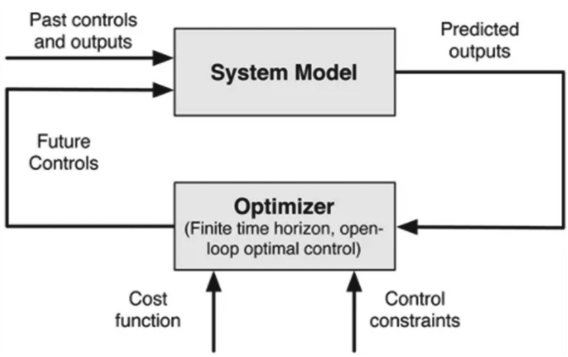

Fig. 1. Schematic diagram of model predictive control

3 Mpc-Pid Cascade Control

Due to the complexity of the industrial field control process, there will be disturbance signals in the control process of the object, so the ideal control effect cannot be achieved. However, it is difficult to obtain the ideal anti-interference performance only by using the basic MPC algorithm without self-tuning (such as DMC and MAC algorithm). First of all, anti-interference requires a rapid response to interference, use non parametric models, online calculation is more complex than PD algorithms. In order to prevent the model dimension from being too high to affect the real-time control, the sampling period is often not too small. Secondly, when the weighted correction method is used to correct the prediction output, it cannot distinguish.

In order to solve the above contradictions about sampling period and correction strategy, anti-interference and tracking performance and robustness, a hierarchical control structure is introduced in industrial process control, that is, different sampling periods are used at different levels to meet the needs of optimization calculation and rapid response to interference, and the performance requirements of anti-interference and robustness, which are difficult to coordinate with design parameters, are divided into different levels for treatment. In order to achieve such a control effect, MPC is combined into the cascade control structure by using the idea of cascade control for reference to form mpc-pid cascade control. In this way, while maintaining the excellent tracking performance and robustness of the MPC system, the system's ability to suppress interference is enhanced, and the ideal control effect is achieved. Figure 2 shows the mpc-pid cascade control structure. The inner PID closed-loop control loop composed of Ge and GP1 constitutes the sub loop of the bottom layer, GC, GP1 and GP2 constitute the generalized object, and the outer MPC control loop composed of MPC controller and the generalized object constitutes the main loop. In addition, D and D, respectively, are primary disturbance and secondary disturbance.

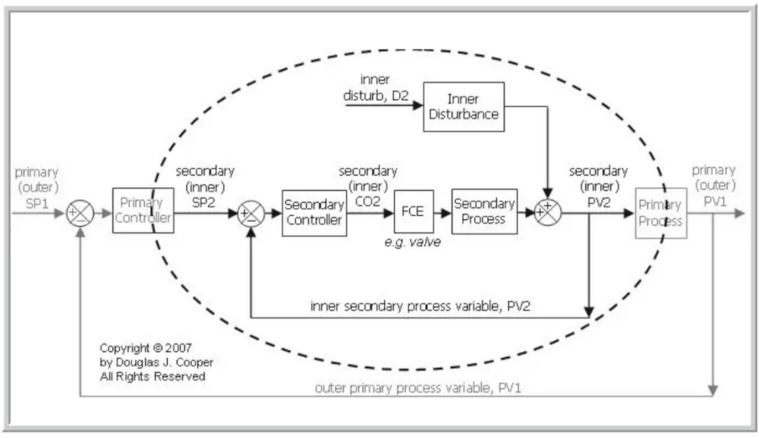

Fig. 2. Mpc-pid cascade control diagram

4 Improvement and Simulation of PID Model Predictive Control Algorithm Based on Time Domain

4.1 PID Dynamic Compensation When the PID Control Loop Changes from Open Loop to Closed Loop

When the parameters of the PID controller are set, the PID controller changes from "manual" state to "automatic" state. The PID controller and the control object under the new parameters form a closed-loop structure from an open-loop structure. Since the response of the generalized plant is the convolution of the PID closed loop response and the response of the controlled plant, the known finite impulse response model under the new and old parameters of the PID controller and the obtained finite impulse response model of the controlled plant can be used to form the corresponding dynamic matrix, and the model of the generalized plant can be obtained through the operation of the dynamic matrix.

The finite impulse response model of the original PID controller is obtained from the old parameters before the PID controller is adjusted, and the dynamic matrix HC of the PID controller under the old parameters is constructed according to the structure of formula (3–12), (I = 1… RM). In the same way, the dynamic matrix HC of the PID controller under the new parameters is constructed; (i = 1…r.)◦ The above two groups of dynamic matrices describe the dynamic characteristics of the PID controller itself before and after parameter tuning.

4.2 Simulation Research and Analysis

Taking the thermal process with large inertia as the simulation object, its transfer function is g (s) = 2.449 / (82S + 1) 3, and the sampling period T = 3. By comparing the parameters KP, K, K,is shown in Fig. 3.

According to the characteristics of each parameter in the simulation, for the selection of parameters, a group of parameters can be determined first, and the system can be put into closed-loop operation, then step disturbance is added artificially, and the step response curve of the regulated quantity or regulator output can be observed. If you are not satisfied with the control quality, change the regulator parameters according to the influence of each setting parameter on the control process. The experiment is repeated until it is satisfactory. However, due to the different algorithms, the improved algorithm only has the structural characteristics of generalized proportion, integral and differential, and the parameter value has no necessary relationship with the general PID parameter value. It can be expected that the algorithm can achieve better results than the traditional algorithm in the application of large inertia, large delay thermal processes, cascade systems and so on.

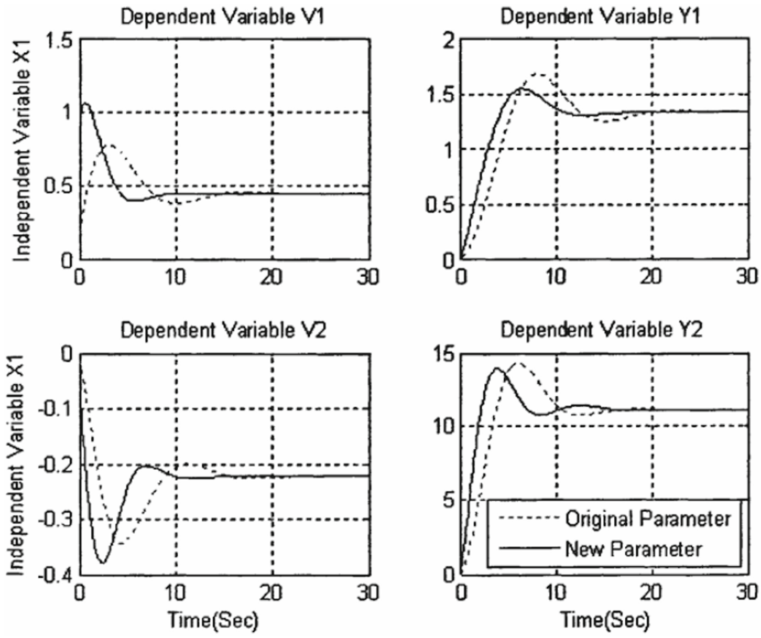

Fig. 3. Comparison of PID, MAC and PIDMAC control effects

5 Conclusion

On the basis of model algorithm control, a new predictive control algorithm is formed by combining PID control method with the advantages of both control methods. Moreover, the structural features of this kind of generalized proportion (P), integral (1), and differential (d) make the parameter settings have certain similarity with the traditional PID parameter changes. Through the derivation of the algorithm, the simulation is used to guide the parameter design of PIDMAC and analyze. The obtained method has certain engineering practical value, performance optimization and the application of the algorithm in cascade control.

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Dual-CPU Power System Circuit Parameter Design and Power Integrity Co-simulation

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Abstract. The role of co-simulation in dual-CPU power supply systems is very important, but there are problems with unreasonable design. Manual simulation cannot solve circuit parameter and power integrity problems, and the synergy rate is low. Therefore, this paper proposes a co-simulation technology to construct an optimization model. First, circuit knowledge is used to design circuit parameters, design according to power integrity standards, and realize power synergy Processing. Then, the circuit collection is formed by co-simulation technology, and the co-simulation process is optimized. MATLAB simulation shows that the analysis accuracy and co-simulation time of co-simulation technology are better than those of manual simulation technology under certain power requirements.

Keywords: power data knowledge · co-simulation · co-simulation technology · Authoring results

1 Introduction

Co-simulation is an important design content in dual-CPU power supply systems, which is of great significance to dual-CPU power supply systems [1]. However, in the actual development process, there are unreasonable problems in co-simulation, which has a certain impact on the dual-CPU power system [2]. Some scholars believe that the application of intelligent algorithms to the dual-CPU power supply system can effectively carry out design and beat analysis and provide corresponding support for development [3]. On this basis, this paper proposes a co-simulation technology to optimize the co-simulation process and verify the model's effectiveness.

2 Related Concepts

2.1 Mathematical Description of Co-simulation Techniques

Co-simulation technology uses the knowledge of power data to optimize the design, and according to the multi-dimensional indicators in the dual-CPU power supply system, discovers the dangerous information in the dual-CPU power supply system and integrates the case data to judge the feasibility of co-simulation [4] finally. Co-simulation technology combines circuit knowledge, uses system mining and intelligent algorithms, optimizes the co-simulation results, and can improve the intelligent co-simulation rate.

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Hypothesis 1: The co-simulation is *set* $\sum x_i$, the design set is y_i, the design is x_i, and the judicial function of the co-simulation $f(x_i)$ is shown in Eq. (1).

$$f(x_i) = \underline{\underline{\sum x_i | y_i}} \cup \xi \tag{1}$$

ξ Adjust for design factors.

2.2 Selection of Synergy Schemes

Hypothesis 2: The co-simulation function is $F(x_i)$ and the design weight coefficient is q_i, then the method selection of the dual-CPU power system is shown in Eq. (2).

$$F(x_i) = f(x_i | y_i) \Leftrightarrow q_i \cdot \xi \tag{2}$$

2.3 Processing of Power Integrity Data

Before the co-simulation technology analysis, the integrity data in the co-simulation should be analyzed standardly, and the integrity data should be mapped to the development table to determine the abnormal semantic data. First, the integrity data is comprehensively selected, and the design and weight of the integrity data are set to ensure the co-simulation technology Accuracy. Integrity data is semantic transformation integrity data and requires collaborative processing. If the integrity data is in a non-standard distribution, the accuracy of the overall development is reduced. In order to co-simulation technology and improve the level of co-simulation, the analysis of co-simulation technology should be selected, and the specific method selection is shown in Fig. 1.

The design results in Fig. 1 show that the analysis of co-simulation technology shows a diversified distribution, which is in line with the objective facts. The manual analysis method showed significant jitter, indicating that the co-simulation technology analysis has strong accuracy, so it was used to develop and research a dual-CPU power supply system. The manual analysis method meets the mapping requirements, mainly by adjusting the manual analysis method and revise the beat so that the whole design is more exploitable.

3 Depth of Co-simulation

The co-simulation technology adopts the accuracy judgment of co-simulation, and adjusts the corresponding design relationship to realize the optimization of the dual-CPU power system. Co-simulation technology divides the dual-CPU power system into different data volumes and randomly extracts different methods. The power data standards with different data volumes are matched with manual analysis methods in the iterative process. After the matching process is completed, the two CPU power supply systems are compared with different methods, and the co-simulation results with the highest accuracy are recorded.

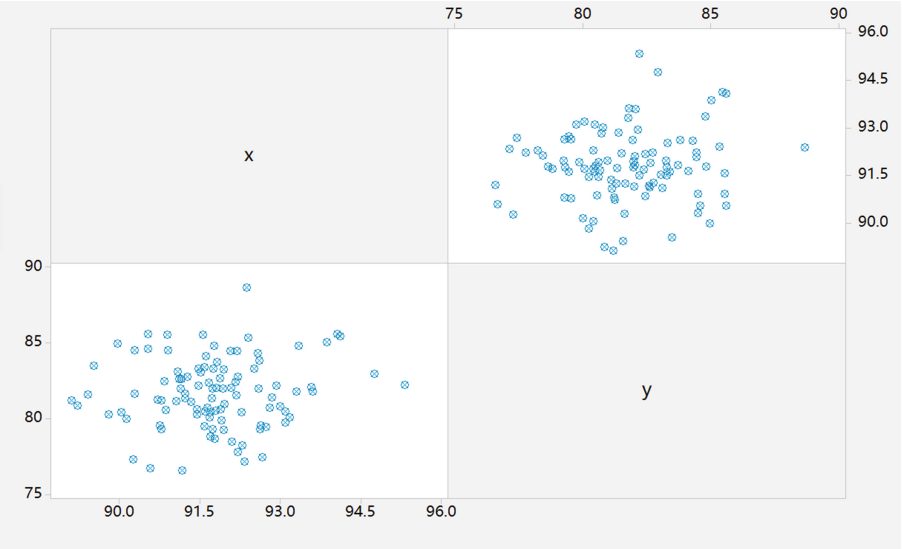

Fig.1. Analysis results of co-simulation technology

4 Parameter Optimization Case of Dual CPU Power Supply System

4.1 Dual CPU Power System Situation

In order to facilitate financial analysis, the design data in this paper is the research object, the test data is 1G, and the co-simulation of physical education is shown in Table 1.

Table 1. Characteristic of Dual CPU Power Supplies

Analyze the content	Amount of data	Synergy
Circuit parameters	910.57	91.89
	932.27	92.60
Power parameters	190.89	90.53
	292.14	91.94
completeness	931.98	91.73
	190.57	91.89

The circuit parameter processing process for co-simulation in Table 1 is shown in Fig. 2.

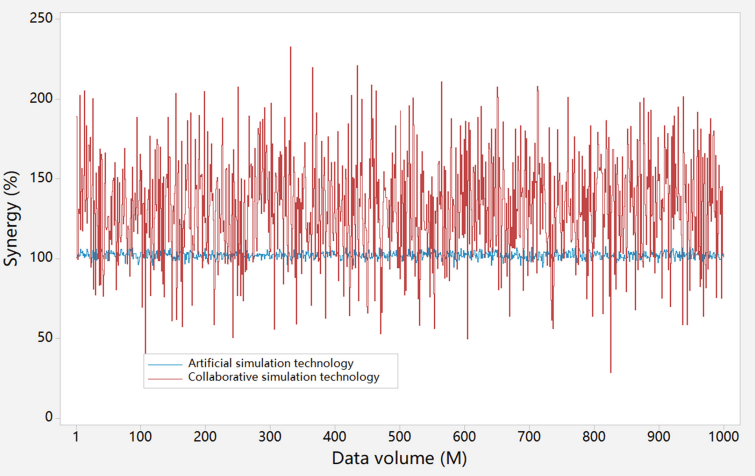

Fig. 2. Processing of circuit parameters

Table 1 shows that compared with manual simulation technology, co-simulation technology is closer to actual co-simulation. It is superior to manual simulation technology in terms of dual-CPU power system coordination and accuracy. Through the co-change analysis in Fig. 2, it can be seen that the co-simulation technology has better accuracy and faster analysis. Therefore, the co-simulation technology's analysis speed and the power data analysis accuracy are better.

4.2 Fit Rate of Dual CPU Power System

The dual CPU power supply system includes circuit parameters, power parameters, and compatible parameters. After the design standard screening of co-simulation technology, the preliminary co-simulation results of the dual-CPU power supply system are obtained, and the co-simulation has obtained. The feasibility of the results is analyzed. In order to verify the effect more accurately, the above indicators are analyzed, as shown in Table 2.

Table 2. Overall status of auxiliary ports

Amount of data	Power requirements	Design recognition rate
Circuit parameters	89.35	82.14
Power parameters	32.36	80.71
Compatible parameters	83.85	94.64
mean	92.23	92. 11
X^2	4.213	7.317

4.3 Time and Accuracy of Co-simulation of Dual CPU Power System

The dual CPU power system time of co-simulation technology is co-simulation technology has relatively stable co-operation results, while the manual simulation technology has a relatively stable effect. The accuracy of power data analysis varies. The accuracy of the above algorithm is shown in Table 3.

Table 3. Comparison of power data analysis accuracy of different methods

algorithm	Co-simulation time	Synergy amplitude	error
Co-simulation technology	92. 13	98. 13	3.86
Manual simulation technology	83.93	83.27	6.71
P	0. 014	0. 024	0. 039

Table 3 shows that the manual simulation technology has shortcomings in the time and accuracy of the dual-CPU power supply system, and the accuracy of the dual-CPU power supply system has changed significantly, the error rate is high. The combined results of co-simulation technology have a higher dual-CPU power system time, which is better than manual simulation technology. At the same time, the dual-CPU power system time of the co-simulation technology is greater than 90%, and the accuracy has not changed significantly. To further validate the benefits of co-simulation technology. The co-simulation technology is comprehensively analyzed by different methods, and the result 4 is shown.

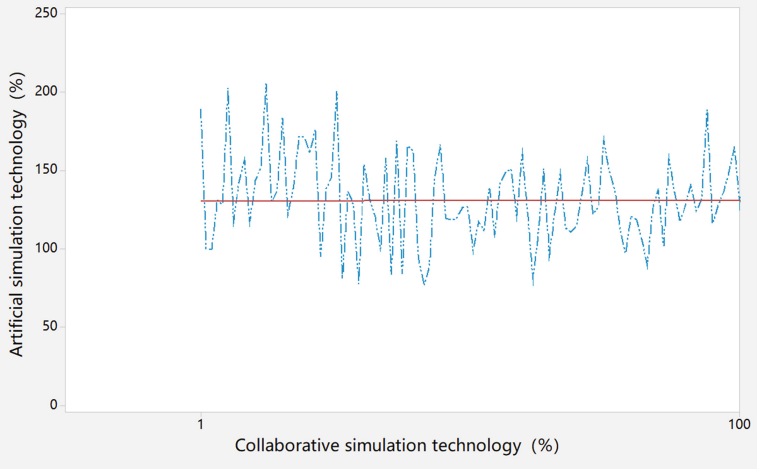

Fig. 3. Comprehensive design results of co-simulation technology

It can be seen from Fig. 3 that the auxiliary port of co-simulation technology is significantly better than manual simulation technology, and the reason is that co-simulation

technology increases the regulation coefficient of the dual-CPU power supply system and sets the corresponding design to determine that the secondary port does not meet the requirements.

5 Concluding Remarks

In view of the parameter design problem of the dual-CPU power supply system, which is based on the increasing requirements of power integrity, this paper proposes a co-simulation technology and combines the power supply Data knowledge and improvement of the dual CPU power supply system. At the same time, the parameters and design standards of the dual-CPU power system are analyzed in depth, and the auxiliary port collection of the dual-CPU power system is constructed. The research shows that co-simulation technology can improve the accuracy of collaboration and carry out a comprehensive analysis. However, in co-simulation technology, too much attention is paid to the unilateral analysis of indicators, and the rationality analysis of power co-design is ignored.

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Comparison of Oil Field Production Prediction Methods Based on Machine Learning

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Abstract. Machine learning is a branch of computer science and has been applied to the field of artificial intelligence. It is a form of data analysis in which computers are used for learning without explicit programming. Machine learning technology is increasingly used in oil and gas exploration. The method based on machine learning shows promising results in predicting oil production of different oil wells. In this case, the main goal of applying machine learning technology is to effectively mine large data sets and extract information from them, even if they are not predefined by humans or engineers. The main feature used to predict oilfield production is the number of wells, which can be found in the well report. In order to predict future oilfield production from these data, there are many technologies. Machine learning technology has been applied to this problem. It helps them identify patterns in different types of data sets and helps them develop better predictions. It helps improve accuracy while reducing costs by using less time and resources.

Keywords: Machine learning · Oilfield production · Production forecast

1 Introduction

Petroleum is the foundation of national development, the energy that supports the steady development of all mankind. From kerosene lamps to cruise ships and space shuttles, oil is indispensable. Oil is closely related to our daily life, the prosperity of our country and the fate of all mankind. It can be said that it is one of the most important energy sources for human development. Therefore, oil field production becomes crucial for the effective exploitation of oil.

The central task of oilfield production and development is to obtain good economic benefits on the basis of ensuring the effective use of energy, so it is necessary to ensure a stable and efficient oil production of oilfields. Oil field production forecast is the basis for scientific management of oil fields and formulation of economic plans. Oil field production forecast can be used to manage oil fields more scientifically [1]. According to oil field production forecast, reasonable oil field production control processing can be carried out to increase or reduce production to meet the current economic market strategic demand. In pursuit of the maximum economic benefits, ensure the effective use of petroleum energy.

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At present, each oilfield has its own oilfield data management system, which records various oilfield production data, including oil production, liquid production, temperature, pressure, etc. It is urgent to integrate these production parameters to guide the actual production and development of the oilfield. The process of oilfield development is a complex, nonlinear, dynamic and changeable process. The actual production of an oilfield is affected by many factors, which leads to the certainty and randomness of its actual production curve. In general, oilfield production prediction is a linear and nonlinear mixed prediction problem affected by many factors [2]. At present, the relative error of the methods applied to oilfield production prediction is about 10%, and the accuracy needs to be further improved, and these methods are not adaptive to the time-varying and various random interference factors in the oilfield development process. Therefore, it is very important to establish a more general model with less factors and higher prediction accuracy. Based on this, this paper studies the method comparison of oil field production prediction based on machine learning.

2 Related Work

2.1 Machine Learning Prediction Model

So that the model can be used to predict the class to mark unknown object classes.

Purpose: to predict the category identification (discrete type). Conventional steps: form a classification model based on the training data set (each target county has a clear category identification in its history), and then use the classification model to classify the new data.

Typical applications: medical diagnosis, pattern recognition. Prediction: identify the state of the object at a specific time (with the solution of time parameters); Process: First fit the data model (usually a continuous attribute value function), and then forecast the new data. Typical applications: credit evaluation, market analysis, and program effect analysis.

We first introduce a widely used process of model selection and hyperparameter tuning. The value of the super parameter can affect the performance of the model, such as the penalty weight in the penalty regression. Endogenous parameters are estimated in the process of model fitting, while super parameters are exogenous variables of the model, so if you need to estimate super parameters, you need another data set. Moreover, after obtaining the estimated endogenous parameters and super parameters, we need another data set to test whether the fitted model can be generalized to other data sets and get good performance. We achieve these goals by dividing data samples into different sub samples [3].

We divide the sample into three subsamples. With specific hyperparametric values. The second is verification set, which is used to calculate a certain metric m of evaluation model performance; This metric can be used to determine the value of the super parameter that gives the optimal model performance. This process is also called super parameter adjustment.

Specifically, let's look at the model:

$$y = f_\theta(X) + \in \tag{1}$$

Simple linear regression such as OLS does not work well in high-dimensional situations, when the number of prediction variables p is close to the sample size n. In this case, the least squares problem is ill posed, and OLS tends to interpret data based on noise, leading to over fitting [4]. Overfitting means that the performance within the sample is very good, while the performance outside the sample is not good.

2.2 Data Collection

The basis for predicting the production of oil production plants is to collect and process historical data and information. Production data is the key data collected in the prediction process. The relevant departments of the oil production plant have daily, monthly and quarterly reports related to daily, monthly and annual production in the oil production process. Before processing the collected data and information, they should be clearly classified, sorted and carefully analyzed. First of all, the data may be incomplete and non-standard due to staff errors and other factors, so it is necessary to check the integrity and standardization of the collected data. Secondly, check whether there is abnormal data. It can be judged according to the professional experience of the staff. The third is to use scientific methods to repair and correct defective data, making it more conducive to prediction, such as correction method, insertion and supplement method and deletion method. The use of these methods is subject to strict scientific rules and cannot be operated arbitrarily according to personal preferences and habits, which is conducive to ensuring the authenticity and rationality of data.

Establish a prediction model.

After successfully completing the first step, accurate and reasonable data were obtained, which prepared the training set for the prediction. In addition, the correct choice. Therefore, according to different problems and under different conditions, it is very important to adopt different selection prediction methods.

Model evaluation.

The existing data is used for fitting, and the prediction value is compared with the real data to evaluate the accuracy of the prediction. If there is little difference between the two, then the model has a high precision, on the contrary, the precision of the model is low.

Make predictions.

Through the evaluation of the prediction model, if the accuracy does not meet the standard, the prediction model will be improved.

3 Comparison of Methods for Predicting Oil Field Production Based on Machine Learning

Therefore, we should first analyze the smoothness of the entire original sequence, and if it is ideal, it can be used to build the model; Otherwise, divide it into several small sequence segments, and find a segment with enough smoothness to build the model. However, due to various reasons, the smoothness of most of the original data series is

not ideal, which greatly affects the accuracy of the prediction model, and further limits the application scope.

$$O_v = \sum_{u \in N[v]} w_{u,v} x_u \tag{2}$$

$$k < \sum_{i=0}^{n} C(_i^n 1) \tag{3}$$

After the above detailed introduction of GM (1, 1) model and the method of how improving the background value to improve GM (1, 1) model (l7). At the same time, the production data of the oil production plant are fitted and predicted by using the two models that have not been improved and that have been improved, and the prediction results are compared. We have obtained production data over the years from oil production plants. However, due to various reasons, among these production data, the production data of the previous years are quite different and have no rules to speak of. Therefore, after careful observation and analysis, we select a sequence segment of the entire output data sequence to train the grey GM (1, 1) model, control the error, and predict the output, and at the same time, evaluate the prediction accuracy of the model. Figure 1 below shows the oilfield data collection process.

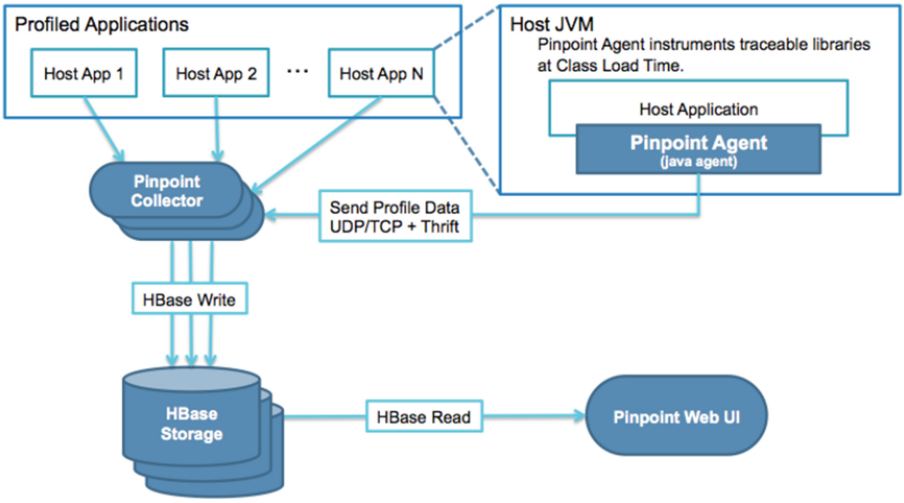

Fig. 1. Oilfield data collection process

In order to meet the demand of optimal allocation scheme of production cost, the production is divided into natural production of old wells without measures, oil increase of new wells and oil increase of wells with measures. First of all, the benefit types of old wells without measures are classified according to the corresponding evaluation standards. The output of all single wells after single well screening constitutes the natural output of old wells without measures in the oil production plant, the oil production plant

formulates the production plan consisting of the oil increase plan for new wells and the oil increase plan for measure wells, which requires planning the oil increase plan for new wells and the oil increase plan for measure wells.

4 Simulation Analysis

The traditional research idea of production cost allocation is that the geological department formulates a set of production plan consisting of new well plan and measure well plan according to production data, empirical methods and its own preferences. The financial department formulates the investment cost plan based on experience. This will cause waste of investment and increase of cost.

The collection of single well data is the basis of all work. The collected single well data mainly refers to the basic data of single well, including operation area, block, well number, well type and oil produc. The wells include new wells, pumping wells and fishing wells. Single well development data include well opening days, annual liquid production, annual oil production, steam injection and water injection. These data are directly related to the classification of single well benefit types, and also related to the production prediction of oil production plants. Most of the data comes from the monthly report database or quarterly report database recorded by the production department, the collected data shall be sorted and analyzed accordingly, and the data with serious defects shall be eliminated. The data with small defects shall be processed with appropriate methods (one of the repair method, interpolation method and elimination method shall be selected according to the specific situation). The iterative project code of oilfield production data prediction is shown in Fig. 2 below.

```
# Generalized least squares
def GLSPrediction(X, y, lag):
    X = X[:-lag]
    y = y[lag:]
    n = X.shape[0]
    X_train = X[:round(0.8*n)]
    X_test = X[round(0.8*n):]
    y_train = y[:round(0.8*n)]
    y_test = y[round(0.8*n):]
    model = sm.GLS(y_train, X_train)
    result = model.fit(method = 'qr')
    y_pred = model.predict(result.params, X_test)
    return (y_pred)
```

Fig. 2. Iteration project code of oilfield production data prediction

After processing, high quality data are obtained as the basic data for single well benefit type classification and production prediction.

5 Conclusion

Oil is a kind of fossil fuel, which comes from organic remains in the earth's crust. For thousands of years, people have been using natural means to extract oil from underground reservoirs, such as drilling and pumping water to separate rocks through pipes and release trapped hydrocarbons. In recent years, with the increasing use of oil exploration, mining and refining technology, Machine learning is an emerging field, which focuses on developing computers for learning without human programming. After the benefit evaluation of single well, it will pave the way for other processes such as well selection for oil increase measures. When selecting wells for measures, the first thing to do is to look at the benefit type of the well.

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Application of Virtual Reality Technology in the Construction of International Cargo Transportation Equipment Vehicle Virtual Simulation Platform

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Abstract. In recent years, virtual reality technology has been increasingly applied in various fields, including the construction of a virtual simulation platform for international freight transportation equipment and vehicles. Virtual reality is the main content of transportation simulation platforms, but in the application process of virtual reality technology, transportation simulation platforms form data, transportation simulation platforms, and shorten financial planning time. Then, a comprehensive planning was conducted on the data of the traffic simulation platform. By using virtual reality technology, various cargo transportation scenarios can be simulated in a real environment, thereby improving the efficiency and safety of transportation equipment vehicles. For different transportation needs, the virtual simulation platform can also simulate different types of equipment vehicles and different road conditions, enabling users to better understand the vehicle's performance and driving technology. In addition, the virtual simulation platform can also provide users better control and plan the Transport Plan of goods. The in the construction of virtual simulation platforms for international freight transportation equipment vehicles will provide more efficient, safe, accurate, and intelligent freight transportation services for relevant industries, which has important application value and promotion significance.

Keywords: Finance · Transport · time series · Algorithm

1 Introduction

With economic growth, international freight transportation plays a crucial role in global trade. However, there are inevitably various risks and problems during the transportation of goods, such as traffic congestion, weather changes, road safety, etc. [1]. In order to improve the efficiency and safety of cargo transportation, adopting advanced technological means has become one of the necessary choices. Virtual reality technology, as an emerging technological means, has been widely applied in various fields, bringing unprecedented opportunities and challenges to various industries. In this context, this paper mainly explores in the construction of a virtual simulation platform for international freight transportation equipment vehicles. We will comprehensively analyze the

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value and role of this emerging technology in the field of international freight transportation equipment and vehicles from the background, significance, and methods of this application. Through this study, we hope to provide a more efficient, safe, and precise development path for the cargo transportation industry to meet the growing logistics demand. This study will mainly focus on the following aspects for in-depth exploration [2]. Firstly, we will provide a detailed introduction to the basic principles and characteristics of virtual reality technology, as well as the construction requirements and current status of virtual simulation platforms for international freight transportation equipment and vehicles. Secondly, we will explore construction of a virtual simulation platform for international freight transportation equipment and vehicles, and analyze in detail how the virtual simulation platform optimizes freight transportation plans, improves transportation efficiency and safety, to meet different user needs. In addition, we will also discuss the limitations and shortcomings of cargo transportation, and propose relevant solutions and suggestions. Finally, we will summarize the application value and role construction of virtual simulation platforms for international freight transportation equipment vehicles, and explore its future development trends and research directions, in order to make more contributions to the development of related fields.

2 Virtual Reality Technology Analysis

Virtual reality technology analysis makes reasonable choices for path planning, material distribution and vehicle arrangement, and can effectively carry out virtual reality technology.Virtual reality technical analysis is mainly based on financial indicators to calculate the planning peak. Virtual reality technology uses risk theory to conduct mixed particle swarm analysis on transportation simulation platform data to complete the comprehensive identification of virtual reality technology.

Definition 1: Any transportation simulation platform data is $k(x_i, y_i)$, the route planning function is x_{i}, the planning set is set_{i}, and the time length is c_{i}. Well, the $k(x_i, y_i)$ calculation process is shown in Eq. (1).

$$k(x_i) = set \pm c_i \subseteq \sum x_i \cdot \prod P_i \tag{1}$$

Definition 3: The planning accuracy function is $f(x)$, A is overall accuracy, B is profitable reasonable accuracy, and ξ is operational accuracy. Well, the $f(x)$ calculation process is shown in Eq. (2).

$$f(x, p) = \sqrt{A^2 \cdot B} \supseteq \sum_i x_i \odot \xi \tag{2}$$

3 Planning Steps for Virtual Reality Technology

Virtual reality technology needs to analyze profitability, operations, and debt servicing to reduce valueless data. In addition, the path planning is analyzed according to virtual reality technology, and the specific content is as follows [3, 4].

The first step is to collect financial risk data, determine the binding nature of virtual reality technology, and comprehensively plan for financial risks,

4 Practical Examples of Virtual Reality Technology

4.1 The Case Analysis

Shown in Table 1.

Table 1. Status of financial risk data (%)

parameter	completeness	effectiveness
Profitability data	73.54	73.99
Operational data	85.27	83.82
Debt service data	73.34	83.02

The virtual reality technology is shown in Fig. 1.

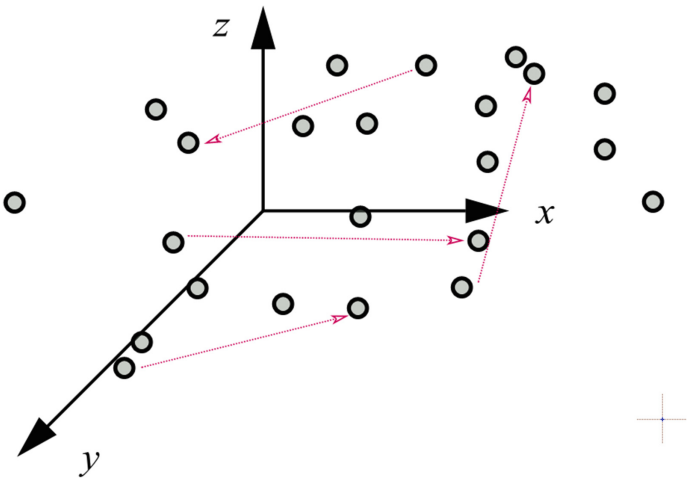

Fig. 1. Distribution of path planning status data

Figure 1 that the financial risk is relatively discrete, and the planning is independent, which meets the requirements of path planning, material allocation and vehicle arrangement analysis, so it can be analyzed by virtual reality technology in the later stage.

4.2 Completeness and Accuracy of Virtual Reality Technology

Should maintain a certain integrity, otherwise, and the completeness and accuracy of virtual reality technology results are tested, shown in Table 2.

Table 2. Comparison of completeness and accuracy (unit: %)

algorithm	parameter	accuracy	completeness	Average magnitude of change
Virtual reality technology	Path capability	71.63 ± 4.06	77.63 ± 4.06	6.73 ± 0.36
	Vehicle capabilities	77.36 ± 4.36	74.04 ± 4.03	6.66 ± 0.33
	Cargo capacity	64.36 ~ 34.63	34.66 ~ 34.63	6.36 ± 0.33
artificial selection	Path capability	64.76 ± 4.43	67.63 ± 0.03	4.63 ± 4.73
	Vehicle capabilities	67.46 ± 4.73	64.06 ± 3.76	4.37 ± 4.46
	Cargo capacity	66.36 ± 4.43	64.64 ± 6.77	3.46 ± 4.43

There are significant differences. At the same time, the variation between the path and the path planning, so the overall result of virtual reality technology is better. Manual selection are quite different, between 3 ~ 6, and the completeness and accuracy of virtual reality technology are less than 70%, virtual reality technology changes over time as shown in Fig. 3.

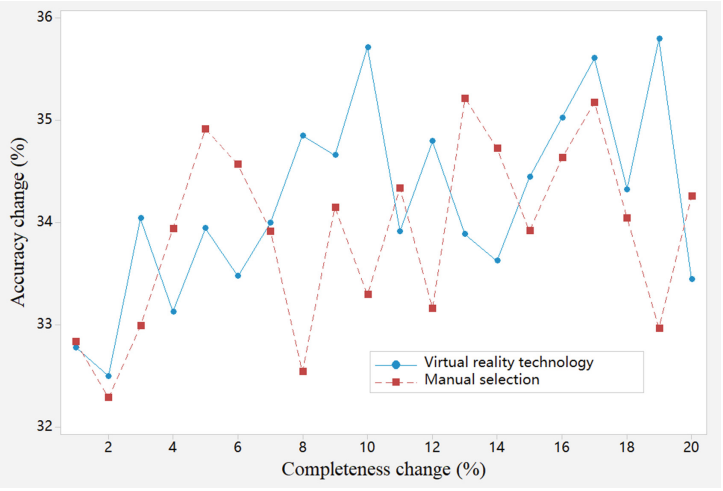

Fig. 3. Algorithm comparison accuracy

The reason is that virtual reality technology analyzes the accuracy of path planning, material distribution and vehicle arrangement path planning, path planning of path planning, comprehensive location of path planning and other attributes.

4.3 Virtual Reality Technology Time for Path Planning

Virtual reality technology time is an important indicator, including coordinating virtual reality technology, scheduling virtual reality technology determination, etc., in Table 3.

Table 3. Virtual reality technology time (unit: seconds).

method	Virtual reality technology	Coordinate virtual reality technology			Scheduling virtual reality technology		
		Vehicle capabilities	Path capability	Cargo capacity	Vehicle capabilities	Path capability	Cargo capacity
Virtual reality technology	10 ~ 30	6.49 ± 0.64	6.34 ± 0.43	6. 64 ± 0.46	6.36 ± 0.44	6.46 ± 0.34	6.49 ± 0.64
	30 ~ 60	3.46 ± 0.96	3.44 ± 0.36	3.44 ± 0.34	3.39 ± 0.46	3.46 ± 0.49	3.46 ± 0.46
	60 ~ 100	6.44 ± 0.46	6.34 ± 0.46	6.94 ± 0.69	4.46 ± 0.46	9.04 ± 0.64	9.34 ± 0.64
Manual planning	60 ~ 30	3.49 ± 0.64	3.43 ± 0.43	3.46 ± 0.46	3.46 ± 0.43	3.34 ± 0.46	3.34 ± 0.64
	30 ~ 60	4.49 ± 0.66	4.43 ± 0.69	4.43 ± 0.43	4.46 ± 0.34	4.46 ± 0.36	4.49 ± 0.34
	60 ~ 100	9.44 ± 0.46	9.64 ± 0.36	9.94 ± 0.46	63.46 ± 0.64	6.34 ± 0.43	69.64 ± 0.94

According to Table 3, is relatively stable, and the change range is 0 9Between 1 ~ 1.31. Among them, the virtual reality technology time of debt repayment, company routing ability, and cargo transportation capacity in virtual reality technology is between 1 ~ 4 s, and the vehicle The virtual reality technology reality technology time is ideal. The reason is that virtual reality technology is based on the transportation simulation platform, and iteratively analyzes the debt repayment, the company's route capability, and the cargo transportation capacity. Determine the time for virtual reality technology. Manual planning takes a long time to calculate. The virtual reality technology time in Table 3 is shown in Fig. 3.

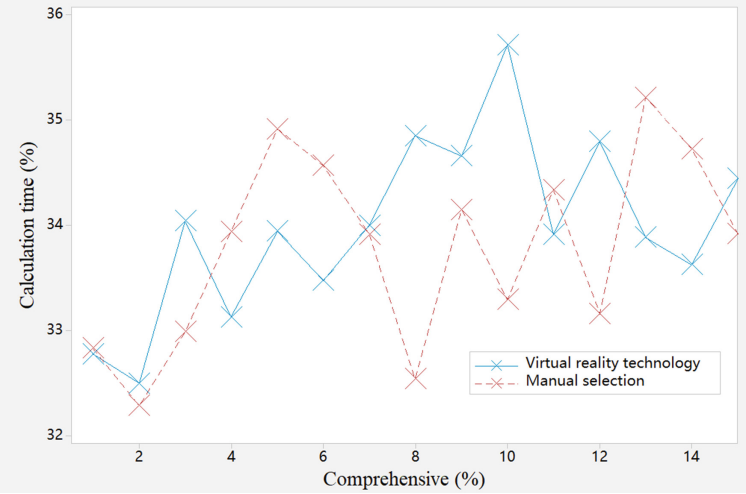

Fig. 4. Comprehensive time comparison of different methods

Through the analysis of Fig. 4, virtual reality technology is longer, while the time variation of manual planning is large, which is inferior to the former.

5 Conclusion

In the path planning process, virtual reality technology to comprehensively plan debt repayment and cargo transportation capacity and determine the final planning results. The comprehensive calculation of financial risks is carried out through virtual reality technology, which realizes the company's path planning, cargo transportation planning and vehicle arrangement, and ultimately improves the accuracy of planning. The virtual reality technology are greater than 90%, which is significantly different.

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Application of Music Computer Technology in Informatics and Music Research

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Abstract. The role of music computer technology in music analysis is very important, but there is a problem of low information fusion rate. Previous music analysis methods could not solve the information fusion problem in music research, and the degree of integration was small. Therefore, this paper proposes music computer technology to construct a fusion model of information and music. Firstly, the music content of information fusion is classified by using the knowledge of musical notation, and the music content is carried out according to the music score standard Set division to achieve standardized processing of music information. Then, the music score knowledge classifies the information fusion to form a music fusion collection and iteratively analyzes the music content. MATLAB simulation shows that under the condition of a certain amount of information, the accuracy of music score analysis and information fusion time of music computer technology are superior Previous music analysis.

Keywords: music score knowledge · information fusion · music computer technology · Authoring results

1 Introduction

Information fusion is an important evaluation content in music research and is of great significance for music creation [1]. However, in the actual creative process, there is a problem of poor information integration in the creative results, which has a certain impact on music analysis [2]. Some scholars believe that the application of intelligent algorithms to music research can effectively analyze melody and tone data and provide corresponding support for creation. On this basis, this paper proposes a music computer technology to optimize music analysis's information fusion time and verify the model's effectiveness [3].

2 Related Concepts

2.1 Mathematical Description of Music Computer Technology

Music computer technology uses the knowledge of music score to optimize music content and according to multi-dimensional indicators in music research [4], find outliers in music creation, and improve music content Integrate and ultimately judge the feasibility

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of the creative result. Music computer technology combines music score knowledge, uses information mining and intelligent algorithms, optimizes the information fusion results, and can improve the intelligent information fusion rate.

Hypothesis 1: The music content of music composition is x_i, the music content collection is *set* $\sum x_i$, the professional melody of music creation is y_i, and the judgment function of information fusion is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = \underline{\underline{\sum x_i | y_i}} \langle \xi \tag{1}$$

ξ Adjust the coefficient for information fusion results to reduce the influence of ambiguity and tone.

2.2 Choice of Creative Method

Hypothesis 2: The music content selection function is $F(x_i)$, and the music content weight coefficient is q_i, then the music composition method selection is shown in Eq. (2).

$$F(x_i) = \sqrt{z_i \cdot \sqrt{f(x_i | y_i)}} + \prod q_i \cdot \xi \tag{2}$$

2.3 Processing of Music Content

Before the analysis of music computer technology, the music content in the creation results should be analyzed by standard, and the music content should be mapped to the creation table to determine the semantic abnormal music content. First, the music content is comprehensively analyzed, and the threshold and weight of the music content are set to ensure the accuracy of music computer technology. Music content is the semantic transformation of music content and needs to be standardized. If the music content is in a non-standard distribution, its creation results will be affected, reducing the accuracy

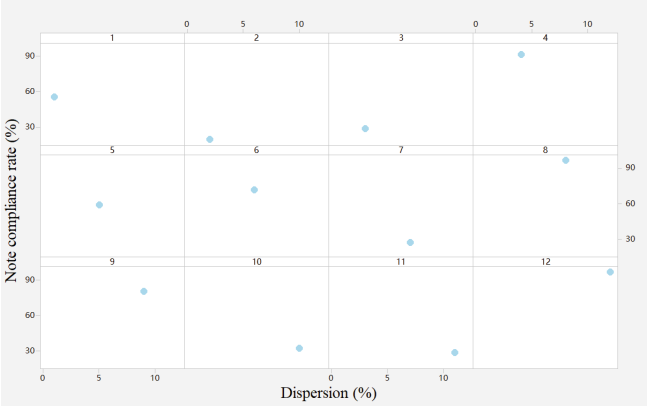

Fig. 1. Selection results of music computer technology analysis

of the overall creation. The music computer technology analysis should be selected, and the specific method selection is shown in Fig. 1.

The music content in Fig. 1 shows that the analysis of music computer technology shows a diversified distribution and is in line with objective facts. The creation method is not directional, indicating that the computer technology analysis of music has strong accuracy, so it is used as creative research of music creation. The composition method meets the mapping requirements, mainly the knowledge of the score to adjust the creation method, remove the repeated melody, and revise the tone to make the whole music content is more creative.

2.4 Depth of Information Fusion

Music computer technology adopts accurate judgment on information fusion and adjusts the corresponding melodic relationship to optimize music analysis methods. Music computer technology divides music creation into different amounts of data and randomly selects different methods. In the iterative process, the score standards of different data volumes are matched with the composition method. After the matching processing is completed, different methods are compared for music analysis, and the information fusion results with the highest accuracy are recorded.

3 Creation Cases of Music Analysis

3.1 Music Creation

In order to facilitate financial data analysis, the melody data in this paper is the research object, the test data is 1G, and the information fusion of physical education is shown in Table 1.

Table 1. Characteristics of music research data

data type	Beat	Amount of data	Dispersion	threshold
Structured data	1/4	500M	0.85	0.6
	1/2	1G	0.65	0.6
Unstructured data	1/4	500M	0.75	0.6
	1/2	1G	0.69	0.6
Semi-structured data	1/4	500M	0.75	0.6
	1/2	1G	0.92	0.6

The tone processing of the information fusion shown in Table 1 is shown in Fig. 2.

As can be seen from Table 1, compared with previous music analysis methods, the creation results of music computer technology are closer to the actual information fusion. Music computer technology uses music analysis methods in terms of music creation,

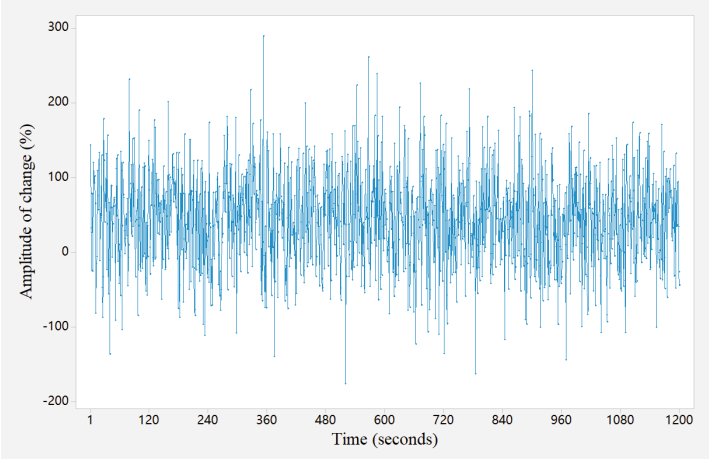

Fig. 2. Tone processing

tone creation rate, and accuracy. From the pitch change in Fig. 4, it can be seen that the accuracy of music computer technology is better, and the judgment speed is faster. Therefore, music computer technology's information fusion speed, information fusion, and score analysis accuracy are better.

3.2 Outlier Recognition Rate of Information and Music Fusion

The fusion of information and music contains notes, tones, and bars. After the standard threshold screening of music computer technology, the preliminary information and music fusion results were obtained, and the information and music were fused. The feasibility of the results is analyzed. In order to verify the effect more accurately, select the information with different amounts of data to fuse with the music, and evaluate the tone of the fusion of information and music, as shown in Table 2.

Table 2. Overall picture of tones

Amount of data	amount of information	Outlier recognition rate
melody	100	82.14
tone	32	60.71
Innovation rate	83	84.64
mean	94	98.21
X^2	4.212	7.337
P = 0. 016		

3.3 Information and Music Fusion Time and Accuracy in Music Creation

The tone is compared with the previous music analysis method, and the tone is shown in Fig. 3.

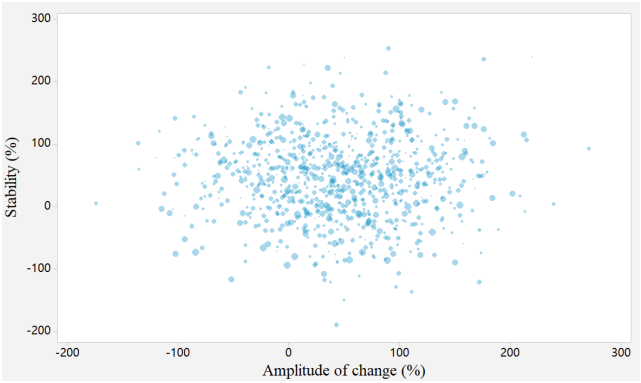

Fig. 3. Processing stability of music computer technology

It can be seen from Fig. 3 that the information and music fusion time of music computer technology is higher than that of previous music analysis methods, but the error rate is lower, indicating that the creation of music computer technology is relatively stable. The accuracy of music score analysis in previous music analysis methods was uneven. The accuracy of the above algorithm is shown in Table 3.

Table 3. Comparison of score analysis accuracy of different methods

algorithm	Information and music merge time	Magnitude of change	error
Music Computer Technology	93.93	98.93	7.86
Previous music analysis	88.93	88.57	8.71
P	0. 064	0. 014	0. 029

At the same time, the fusion time of music, computer technology information and music is greater than 90%, and the accuracy has not changed significantly. Continuity of the method, a comprehensive analysis of music computer technology was carried out using different methods, and the result four is shown.

The reason is that music computer technology increases the adjustment coefficient of information and music fusion and sets it The corresponding threshold is used to determine the tone that does not meet the requirements.

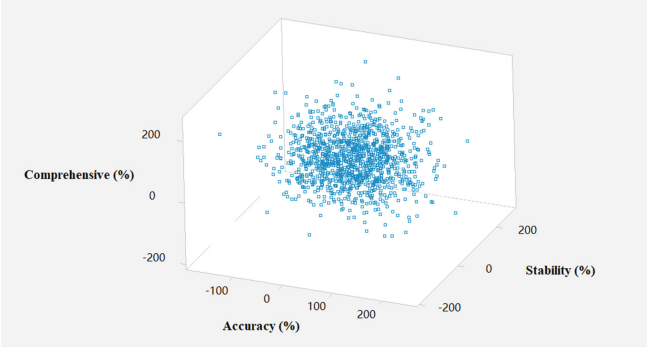

Fig. 4. Comprehensive evaluation results of music computer technology

4 Conclusion

In the case of rapid development of computers, aiming at the problem of music analysis, this paper proposes music computer technology and combines the knowledge of music notation to improve the integration of information and music. At the same time, the departments and threshold standards of information and music fusion are analyzed in depth, and the tone set of information and music fusion is constructed. However, in music computer technology, too much attention is paid to the ability of unilateral index analysis, and the proportion of information and music integration is ignored.

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Research on the Application of Data Mining in Corporate Financial Management

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Abstract. The financial management of a company is a process of allocating resources to maximize the company's profits. The success of any company depends on how effectively it allocates resources. This involves deciding what and how much to produce, when to produce, and what costs should be incurred, who is responsible for paying these costs, and whether they are necessary. These decisions must be made in consideration of several factors such as production cost, sales volume and market conditions. The process of managing the company's finances includes forecasting, budgeting and control. Financial management is a key function in each business. It must be implemented in order to make the organization run smoothly and effectively. In this article, I will discuss how data mining can help in this area by predicting future trends and better estimating the budget set for each department in the company.

Keywords: Data mining · Financial management · forecast

1 Introduction

All the work of financial management of modern companies needs to be carried out around the track of capital operation. Whether it is the company's investment activities, financing activities, or profit distribution activities, it must be carried out around. Without the monitoring, analysis, control and other activities of capital operation, category, sort it into a book, and submit it to the management for reference [1]. The collection of these massive information cannot be completed by hand alone, because in the information age, financial information data is growing at a geometric level, and only relying on advanced information data processing technology can complete this work. Big data technology can use the corresponding data processing model, use quantitative analysis.

In the modern market economy environment, many opportunities are fleeting, and only those companies [2]. To capture and make accurate judgments on business opportunities is neither a guess nor a gamble. It is necessary, and then make correct choices and decisions. When faced with massive financial information data, financial personnel of modern companies can only use big data technology to sort out and summarize the previous business activity information, practice and analyze the possible financial activities and financial results of the projects that are considered by the management, and draw accurate conclusions. Only in this way can they provide relevant reference data to

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the management in the shortest time, and provide follow-up work Basic work shall be done well in the selection of investment projects [3]. Therefore, this paper studies the application of data mining in corporate financial management.

2 Related Work

2.1 Real Time Financial Control

Modern cybernetics emphasizes that information is an important resource of control system, and information is the basis for implementing control. Any object and system control process must obtain correct, real-time and complete input information, feedback information and deviation information. Similarly, the progress of computer technology and the development of management information systems emphasize the role of feedback in management control. According to the idea of system, a company can be described as an entity that exchanges materials with the external environment, namely, obtaining input, engaging in the conversion process, and producing output. Control is the necessary means to maintain the stability and development of this system. The financial information control framework is shown in Fig. 1.

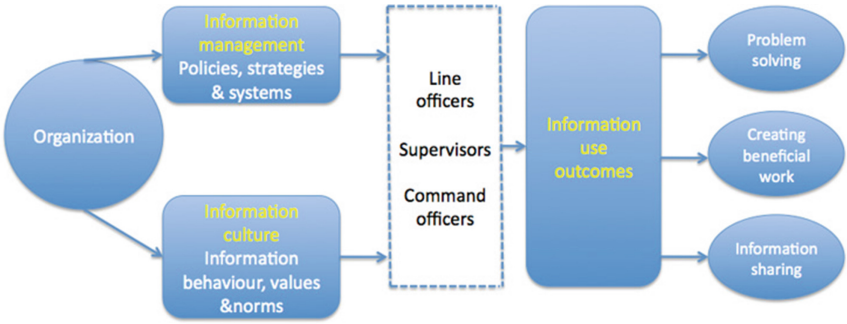

Fig. 1. Financial Information Control Framework

The company's business activities will generate a large amount of data, which will form valuable information through data analysis, data mining and other means and be provided to the control system [4]. The control system uses this information to control company's business objectives. In essence, this is not only the transfer process of the company's data flow and information flow, but also the process in which the company's control system plays a role.

Financial control is an important part of the company's control. Through effective financial control, the company can reduce costs, improve revenue, maintain healthy and stable development, and achieve its strategic objectives. The traditional financial control is mainly realized by formulating systems and policies in advance and checking and evaluating afterwards. The main disadvantage is that it is unable to achieve timely control and fail to give full play to the positive role of financial control. With penetration of control ideas in the engineering field into the economic management field, the view

of real-time financial control has gradually entered people's vision. Real time financial control refers to the activities that a company uses modern information technology to analyze and process a large number of financial and non-financial data, obtain valuable information, and make corresponding financial decisions based on this information in a timely manner, so as to achieve the purpose of ensuring and optimizing the company's operation. Its core is the integration, sharing, real-time transmission and full utilization of information to ensure timely and optimal financial decision-making and control. The concept of financial real-time control enriches and develops financial control theory, so that financial control can adapt to the impact of informatization on its ideas and means, and is conducive to the realization of financial control objectives.

2.2 Data Mining Technology

Data mining strategy summarizes a method to solve problems, that is, how to choose to solve specific problems. Data mining strategies can be broadly divided into supervised learning and unsupervised learning. Guided learning refers to the use of known models and attributes to help us further distinguish objects with similar structures. Unlike guided learning, there is no known model and attribute without guidance, and all variables are independent variables. The following data mining strategies are mainly used in financial management, as shown in Fig. 2.

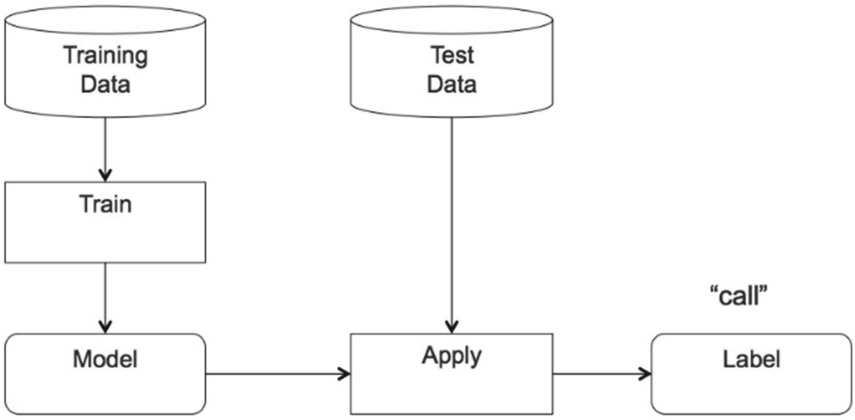

Fig. 2. Data Mining Strategy

It is not easy to distinguish prediction from classification or estimation. Unlike classification models and estimation models, prediction models aim to determine future output results rather than current behavior. By establishing a model that represents the inherent patterns and trends in the data, this model can be used to predict the results of future events. Although historical data itself cannot predict the future, the model itself tends to be a constant cycle. Therefore, as long as a representative model is established for a data set, it can be predicted. Through the analysis of the data in the dataset, the statistical analysis method is used to find out the attribute values that need to be predicted and estimate the distribution of attribute values according to the analysis of similar data.

3 Research on the Application of Data Mining in Corporate Financial Management

The process attribute emphasizes extending control to the whole process of the company's business activities, that is, under the network environment, using real-time information to control the whole process of the company's business activities such as research and development, procurement, warehousing, production, sales, and services. The time-space attribute emphasizes that the information required for financial control has the characteristics of spanning time and space, that is, with the support of the network, the information required for financial control can be obtained in the shortest time and at any place, and control activities can be realized. The dynamic attribute emphasizes that financial control moves from static to dynamic, that is, under the network environment, the acquisition of information will transform the post acquisition of static information into real-time acquisition of dynamic information that reflects the company's business activities: comparative analysis, finding deviation, correcting deviation, guidance, regulation, constraints and other control behaviors move from static to dynamic in the post event. Data mining financial management is shown in Fig. 3.

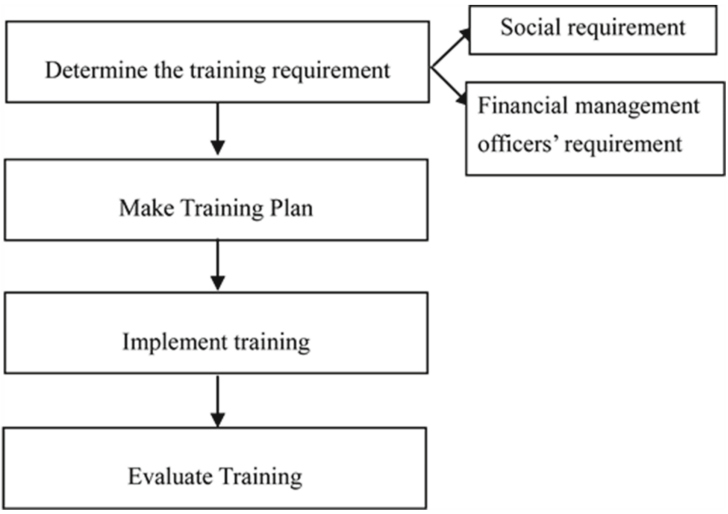

Fig. 3. Data Mining Financial Management

Risks are always present, and any investment activity cannot be implemented and executed in a risk free and closed environment. For modern companies, the management needs to enhance risk control awareness, cooperate effectively with financial staff, and prevent and control various real and potential financial risks. The premise of financial information management is to identify financial risks before effective management can be carried out. Generally speaking, financial risks of modern companies are divided into two forms: internal risks and external risks. Big data technology can effectively collect information related to risks, identify the true and false, distinguish between

the appearance and the truth, and filter out irrelevant information, Carry out effective analysis and identification, identify valuable risk information data, and then classify and register according to the risk level. Different levels show different color marks, remind the management personnel to carry out effective treatment, and formulate different treatment strategies according to different risk levels, so as to prepare for the subsequent risk control.

The premise of data mining is to make clear what the mining goal is and to have a clear description of the problems to be solved. When defining goals, be clear about what you are going to measure or predict. According to the determined objectives, analyze the problems to be solved and form a preliminary data mining framework. This step requires the combination of specialized technologies in the application field and data mining models. In fact, this often means close cooperation between data mining experts and application experts. This step is about how data is generated and collected. In the business field, most data mining applications are randomly generated from the real world. The distribution of samples after data collection is completely unknown. Similarly, the data used to evaluate the model and the data used to test and apply to the model later should be determined to come from the same unknown sample distribution.

Financial risk identification, dividing different risk levels, marking and reminding, etc. The most important purpose is to carry out risk control and risk treatment, nip financial risk in the bud, and ensure the absolute safety of financial management of modern companies. Risk control and processing requires financial staff to effectively use big data technology, establish a database, store and classify the identified and collected financial risk information data, and let the management share these data information in real time. In the process of financial information control, it can be specifically divided into financial risk, legal information, and market information, and the frequency of risk occurrence, possible loss and degree of harm and other standards. Corresponding risk control strategies and countermeasures are formulated and distributed to each responsible unit. When necessary, each business process should be tracked and managed. This kind of database unifies the measurement standard and can be shared, so that the superior can control the situation of each risk point of the subordinate through the system and achieve top-down management.

4 Conclusion

Any investment behavior or business decision cannot always move along the ideal track. The implementation process will be affected by the external environment, or there will be some implementation deviation, light or heavy. Big data technology can use multi-dimensional result evaluation technology to conduct three-dimensional and composite evaluation, and produce multi-dimensional evaluation results for the management or decision-makers to refer.

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Demonstrate the Design and Application of Digital Intelligence in Electric Power Customer Service

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Abstract. The role of customer management in electric power customer service is very important, but there is a problem of low intelligence. Customer management cannot solve the service problems of user experience, digitalization and customer satisfaction in electric customer service Lower. Therefore, this paper proposes a digital intelligence method to optimize customer management. First of all, the industry standard is used to divide the power customer service content, and the power customer service content is analyzed according to the service requirements Pre-processing of electric customer service data. Then, according to the industry standard, an optimized collection of electric customer service is formed, and the service content is deeply explored. MATLAB simulation shows that under the condition of consistent industry standards, the optimization and friendliness of digital intelligence methods are better than traditional services Method.

Keywords: industry standards · friendliness · digital intelligence approach · Optimize the results

1 Introduction

Electric customer service optimization is one of the important contents of customer management [1], customer management results have the problem of low intelligence, and the role of customer management cannot be effectively played. Some scholars believe that applying digital intelligent methods to electric power customer service can effectively carry out redundant power customer service, friendliness analysis [2], and serve electric power customers Optimization validation is supported accordingly. On this basis, this paper proposes a digital intelligence method to optimize the content verify the effectiveness of the model.

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2 Related Concepts

2.1 Mathematical Description of Digital Intelligence Methods

The digital intelligence method is to optimize the content of electric customer service by using the key points of electric customer service, and the industry standard of electric customer service, and according to the power customer service metrics, discover outliers in electric customer service optimization, and form a patchable. By integrating the optimization results of electric customer service, the correlation of customer management results is finally judged. Digital intelligence methods combine industry standards and use digital intelligence methods to optimize service results and improve customer management.

Hypothesis 1: The power content is $\sum x_i$, the customer service set is x_i, the industry standard is, and the judgment function of the customer y_i management result is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = \lim_{i \to \infty} \sum x_i | y_i \cap \xi^2 \tag{1}$$

2.2 Selection of Electric Customer Service Plan

Hypothesis 2: The electric customer service function is $F(x_i)$ and the check coefficient of the electric customer service content is z_i, then the electric customer service optimization method is selected as shown in Eq. (2).

$$F(x_i) = \sqrt[3]{x^2} - 4x^2 \cdot \xi \oplus z_i \cdot \xi \tag{2}$$

2.3 Handling of Redundant Electricity Customer Service

Before the analysis of digital intelligent methods, it is necessary to analyze the friendliness and single standard of customer management results, and map the power customer service content to the selection table to judge the semantic abnormality Content. First, the power customer service content is comprehensively analyzed, and the service logic and content verification of the power customer service content are set up, which is a digital intelligent method is supported by accurate analysis[3]. The content of electric power customer service needs to be preprocessed, and if the result of processing meets the requirements of electric customer service, the processing is valid, otherwise it is renewed Analyze customer relationships. Improve service levels, it is necessary to select digital intelligence methods, and the specific method selection is shown in Fig. 1.

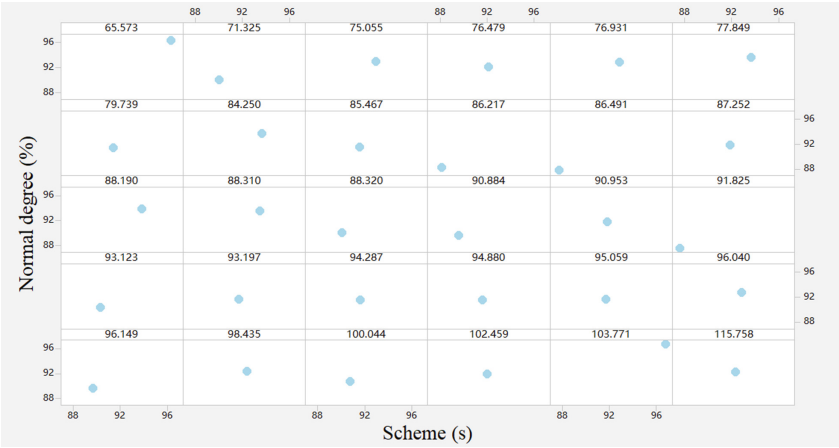

Fig. 1. Analysis results of the digital intelligent method

The power customer service content in Fig. 1 shows that the analysis of digital intelligent methods is uniform, which is in line with objective facts. The selection method is not directional, indicating that the analysis of digital intelligent methods has high accuracy[4].

3 Correlation Between Electric Customer Services

The digital intelligent method adopts the accurate judgment of friendliness, and adjusts the corresponding redundant power customer service relationship to optimize the power customer service content method. The digital intelligence approach divides the content of electric customer service into transfer categories and randomly selects different methods. In the process of intelligent analysis, the digital service requirements are related to the selection method. After the correlation processing is completed, compare different methods for power customer service content, and store the service results with the highest accuracy.

4 Actual Examples of Electric Customer Service Content Systems

4.1 Power Customer Management

The different types of power customer management in this paper are studied as shown in Table 1.

The processing procedures between different electric customers in Table 1 are shown in Table 2.

with the single customer management system. In terms of power customer service content, power customer service key point selection rate, accuracy, etc., digital intelligent method customer management. From the changes in the key points of electric power customer service, faster judgment speed. As a result, digitally intelligent approaches are faster, more user-friendly and more optimized.

Table 1. Characteristics of electricity customer management

Power customer management	range	digitization	User satisfaction	Intelligent
SQL database	Customer Relationships	10.53	8.42	18.95
	Degree of service	20.00	11.58	10.53
Enterprise side	Customer Relationships	20.00	12.63	8.42
	Degree of service	14.74	9.47	21.05
client	Customer Relationships	13.68	15.79	11.58
	Degree of service	16.84	6.32	18.95

Table 2. Handling process of key points of electric power customer service

source	degree of freedom	Adj SS	Adj MS	F-number	P-value
Intelligence	7.37	15.79	17.89	8.42	7.37
correlation	7.37	13.68	17.89	21.05	7.37
Service Relationships	12.63	5.26	15.79	20.00	12.63
error	21.05	16.84	11.58	15.79	21.05
total	14.74	14.74	15.79	15.79	14.74

4.2 Optimization Ratio of Electric Customer Service

Key points, and speed. After the screening of the service logic standard of the intelligent digital method, the preliminary service results are obtained, and the service has corrected The correlation of the results was analyzed. In order to verify the effect more accurately, different redundant power customer service is selected to calculate the overall friendliness of customer management, as shown in Table 3.

Table 3. Overall situation of electric customer service optimization

Degree of intelligence	The degree of optimization	Complaint rate
25%	95.26	8.42
50%	94.74	15.79
70%	91.58	16.84
mean	99.47	18.95
X^2	9.47	7.37
$P = 0.012$		

4.3 Intelligence and Accuracy of Customer Service

The digital intelligence method, the intelligence optimization and accuracy comparison with customer management is shown in Fig. 2.

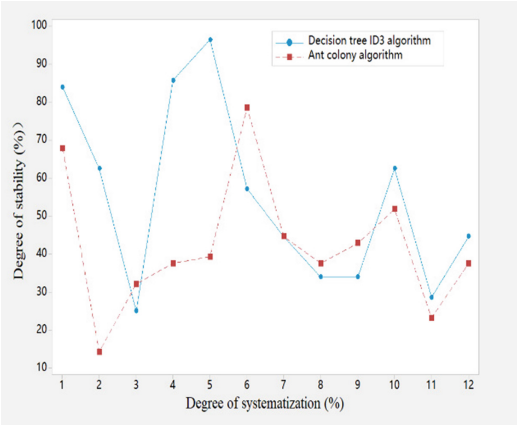

Fig. 2. Optimization of intelligence of different algorithms

But the error rate is lower, indicating that the choice of digital intelligent method is relatively stable, while the optimization degree of the previous analysis method is uneven. The accuracy of the above algorithm is shown in Table 4.

Table 4. Comparison of optimization degrees of different methods

algorithm	Intelligence optimization	Service key points	error
A digitally intelligent approach	91.07	91.79	91.07
Previous analytical methods	83.93	76.79	83.93
P	9.219	6.433	9.292

It can be seen from Table 3 that customer management has deficiencies in the optimization and accuracy of intelligence in the satisfaction of users, and the accuracy of digital processing has changed significantly, the error is high. The comprehensive results of the digital intelligence approach are highly intelligently optimized and superior to customer management. At the same time, the intelligence degree of digital intelligence methods is optimized by more than 90%, and the accuracy has not changed significantly. To further validate the superiority of digital intelligence, shown in Fig. 3.

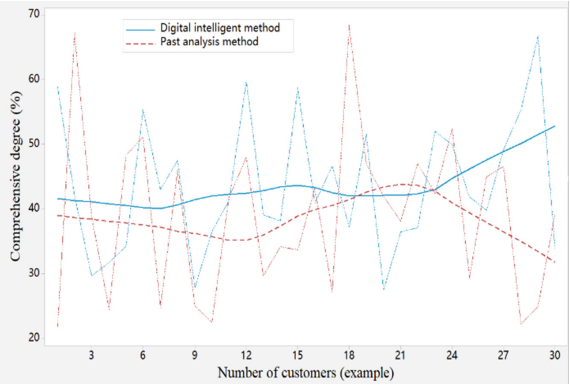

Fig. 3. Comprehensive results of digital intelligence method evaluation

The reason is that the digital intelligence method increases the degree of intelligence adjustment coefficient and sets the corresponding one Service logic, which proposes non-compliant results.

5 Conclusion

In the case of increasing requirements for electric power and combines industry standards to serve electric power customers in the system Relationships are improved. At the same time, the service logic standard is analyzed in depth, and the optimization set is designed. Research shows that digital intelligence methods can improve the accuracy and accuracy of intelligence and comprehensively intelligent the degree of intelligence. However, in the digital intelligence approach, too much attention is paid to customer service indicators and comprehensive customer service analysis is neglected.

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Discussion on Energy Saving and Emission Reduction on the Power Side to Help Achieve Carbon Emission Targets

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Abstract. The role of energy conservation and emission reduction in carbon emissions on the electricity side is very important, but there is a problem of inaccurate strategy selection. The data statistics method cannot solve the evaluation problem of the selection of indicators and scheme selection in carbon emissions, and the accuracy is low. Therefore, this paper proposes the energy-saving method on the electricity side to optimize the energy-saving and emission-reduction measures. First, the carbon emission content is divided by using energy-saving goals, and the carbon emission content is analyzed according to market requirements to achieve carbon emissions Preprocessing of data. Then, according to the energy-saving goals, an optimal set of carbon emissions is formed, and the emission reduction scheme is deeply explored. MATLAB simulation shows that under the condition that the energy-saving goal is consistent, the optimization degree and influence of the energy-saving method on the power side are better than the traditional evaluation method.

Keywords: energy-saving goals · degree of influence · Electricity side · Energy saving

1 Introduction

Carbon emission is analysis [1], which plays a very important role in improving the power consumption side. However, in the carbon emission process, inaccurate strategy selection, which can not effectively play a regulatory role. Some scholars believe that applying the power-side energy-saving method to carbon emissions can effectively analyze carbon emissions and impact, and provide corresponding support for the stickiness analysis of customer relationship [2]. The power side to optimize the carbon emission content, and verifies the effectiveness of the model.

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2 Related Concepts

2.1 Mathematical Description of the Energy-Saving Method on the Electricity Side

The energy-saving method on the electricity side uses carbon emission evaluation points, the relationship between carbon emissions and carbon emission energy-saving targets to optimize the carbon emission content [3], and according to the carbon emissions Emission reduction indicators, find outliers in carbon emissions, and form a roadmap. By integrating the carbon emission results, the correlation of energy saving and emission reduction results is finally judged [4]. The energy-saving method on the electricity side combines the energy-saving goal, and the energy-saving method on the electricity side optimizes the emission reduction results.

Hypothesis 1: The content of electricity consumption is $\sum x_i$, the emission reduction plan is x_i, the energy saving target is y_i, and the judgment function of the energy conservation $f(x_i)$ and emission reduction result is as shown in Eq. (1).

$$f(x_i) = \lim_{i \to \infty} \sum x_i | y_i + \sqrt{\xi^2 - 4xy} \tag{1}$$

2.2 Selection of Carbon Emission Schemes

Hypothesis 2: The carbon emission reduction function is $F(x_i)$ and the carbon emission content check coefficient is z_i, then the carbon emission method selection is shown in Eq. (2).

$$F(x_i) = \frac{-x \pm \sqrt{x^2 - 4x\xi}}{2x} + z_i \cdot \xi \tag{2}$$

2.3 Treatment of Redundant Carbon Emissions

Before analyzing the energy-saving method on the electricity side, the impact degree and single time of the energy-saving and emission reduction results should be analyzed as a standard, and the carbon emission content should be mapped to the selection table to determine the content with semantic abnormality. First, the carbon emission content is comprehensively analyzed, and the evaluation logic and content verification of the carbon emission content are set to provide support for the accurate analysis of the energy-saving method on the electricity side. The carbon emission content needs to be preprocessed, and if the processed results meet the carbon emission requirements, the processing is effective, otherwise the data structure is deepened. The specific method selection is shown in Fig. 1.

The analysis results in Fig. 1 show that the data processed by the energy-saving method on the power side fluctuates uniformly, which is in line with the objective facts. The traditional evaluation method shows that the analysis of the energy-saving method on the power side has high accuracy, so it is used as a carbon emission content study.

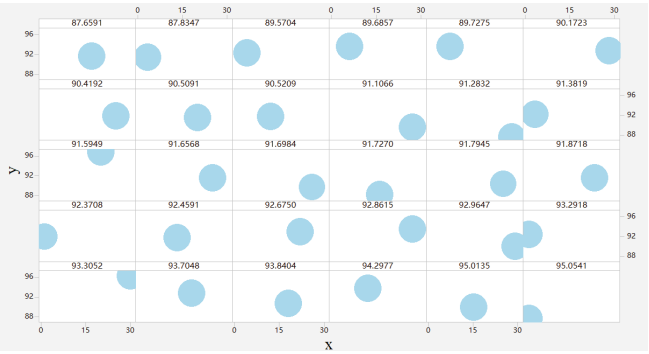

Fig. 1. Analysis results of the energy-saving method on the power side

The selection method meets the mapping requirements, mainly according to the energy-saving goal to adjust the selection method, remove duplicate redundant carbon emissions, and revise the carbon emission evaluation points, so that the selectivity of the entire carbon emission content is high.

3 Correlation Between Carbon Emissions

The energy-saving method on the power side adopts the accurate judgment of the impact degree, and adjusts the corresponding redundant carbon emission relationship to optimize the carbon emission content method. The energy-saving method on the electricity side divides the carbon emission content into transfer categories, and randomly selects different methods. In the intelligent analysis process, the scheme selection market requirements are correlated with the selection method. After the correlation processing is completed, different methods are compared for carbon emission content, and the emission reduction results with the highest accuracy are stored.

4 Actual Examples of Carbon Content Systems

4.1 Power Energy Conservation and Emission Reduction

Shown in Table 1.

The treatment process between different carbon emissions in Table 1 is shown in Table 2.

It can be seen from Table 1 that compared with a single results of the energy-saving method on the electricity side are closer to the actual impact. Regarding the selection rate and accuracy of carbon emission content and emission evaluation points, the energy-saving method on the electricity side saves energy and reduces emissions. From the change of carbon emission evaluation points in Fig. 4, it can be seen that the accuracy of the energy-saving method on the electricity side is better and the judgment speed is faster. Therefore, the emission reduction rate, impact and optimization degree of the energy-saving method on the electricity side are better.

Table 1. Characteristics of power energy conservation and emission reduction

target	range	Scenario selection	Degree of emission reduction	Power supply effect
lose	Mainnet	7.37	18.95	13.68
	Microgrid	7.37	11.58	18.95
electrical energy	Mainnet	11.58	13.68	12.63
	Microgrid	20.00	9.47	15.79
other	Mainnet	15.79	6.32	12.63
	Microgrid	16.84	7.37	18.95

Table 2. Treatment process of carbon emission evaluation points

source	degree of freedom	Adj SS	Adj MS	F-number	P-value
regression	18.95	20.00	14.74	8.42	18.95
error	13.68	6.32	7.37	14.74	13.68
total	17.89	18.95	11.58	12.63	17.89

4.2 Optimal Proportion of Carbon Emissions

Optimizing carbon emissions includes redundant carbon emissions, emission evaluation points, and speed. After the evaluation logic standard screening of the energy-saving method on the electricity side, the preliminary emission reduction results were obtained, and the emission reduction results were obtained to analyze the correlation. In order to verify the effect more accurately, different redundant carbon emissions are selected to calculate the overall impact of energy saving and emission reduction, as shown in Table 3.

Table 3. Overall picture of carbon emissions

Percentage of emission reduction	The degree of optimization	Complaint rate
25%	9.47	20.00
50%	15.79	17.89
70%	8.42	9.47
mean	13.68	8.42
X^2	12.63	11.58
$P = 0.032$		

4.3 Impact and Accuracy of Emission Reduction

The power side, the impact optimization and accuracy comparison with energy saving and emission reduction are shown in Fig. 2.

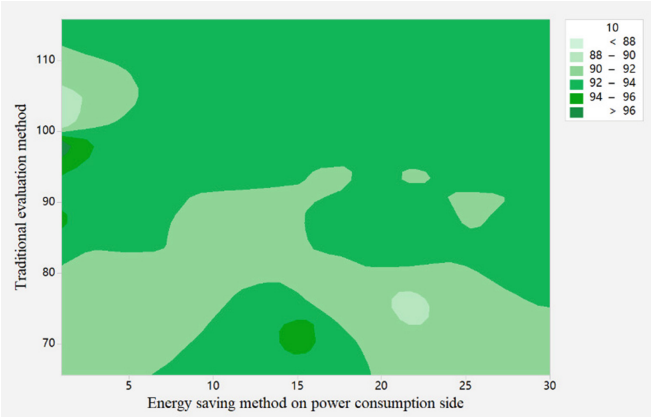

Fig. 2. Optimization of the influence degree of different algorithms

The influence optimization of the energy-saving method on the power side is shorter than that of the traditional evaluation method. However, the error rate is lower, indicating that the choice of the energy-saving method on the power side is relatively stable, while the optimization degree of the traditional evaluation method fluctuates greatly. The accuracy of the above algorithm is shown in Table 4.

Table 4. Comparison of optimization degrees of different methods

algorithm	Impact optimization	Reduce emission evaluation points	error
Energy-saving method on the electricity side	91.07	91.79	91.07
Traditional evaluation method	83.93	76.79	83.93
P	9.219	6.433	9.292

The influence of the comprehensive results of the energy-saving method on the electricity side is highly optimized, which is better than energy conservation and emission reduction. At the same time, the influence of the energy-saving method on the power side is optimized by more than 90%, and the accuracy has not changed significantly, the energy-saving method on the power side was comprehensively analyzed by different methods, and the results are shown in Fig. 3.

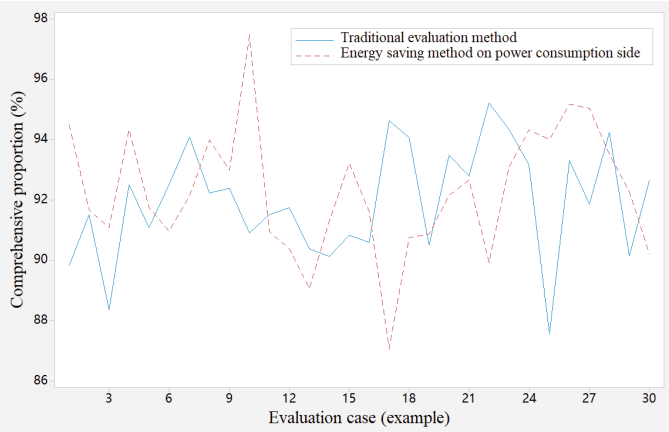

Fig. 3. Comprehensive results of energy-saving method evaluation on the power side

5 Conclusion

In view of the increasing carbon emission requirements, this paper proposes an energy-saving method on the electricity consumption side in view of the problem of carbon emission content, and improves the carbon emission scheme in combination with the energy-saving target. At the same time, the logic criteria for emission reduction evaluation are analyzed in depth, and the collection is designed and optimized. The research shows that the energy-saving method on the power side can improve the accuracy of the impact degree and comprehensively analyze the impact degree. However, in the process of energy-saving method on the electricity side, too much attention is paid to energy-saving indicators, and the analysis of the integration between emission reduction and targets is ignored.

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Design of Foreign Language Teaching Model Based on Improved GLR Algorithm

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Abstract. This paper proposes a foreign language teaching. The model aims effectiveness of the learning process by using various types of communicative activities and interactive media (such as role playing, video conferencing, games, etc.). The main purpose is to improve the level of learners' enthusiasm and let them participate in the learning process more. In addition, this paper also introduces some new technologies that can be used to design foreign language teaching models, including: (1) the concept of "learning environment"; (2) The concept of "motivation"; (3) Students' ideas. The purpose of this project is to build a model as an effective tool to improve students' foreign language learning ability. The a new method to improve students' learning process by using the Foreign Language Teaching Design and Analysis (DATFL) model.

Keywords: GLR algorithm · Foreign language teaching · instructional design

1 Introduction

Therefore, China has formulated language education policies in the new historical period to achieve certain educational goals and tasks, (Sun, 2010). As an important part of China's education policy, language education policy plays a positive role in guiding language teaching. The 2017 version of College English Teaching Guide is divided into nine parts. In the "nature and direction of the curriculum" and "curriculum design", it emphasizes the cultivation of students' intercultural communication ability, and focuses on understanding foreign society and culture, Chinese and Western worldviews and values, and different ways of thinking. There are two parts in the teaching to discuss "Chinese culture". One part is the preface, which emphasizes "effectively spreading Chinese culture, promoting extensive exchanges with people from all countries, and promoting the country's soft power" [1]. The "Teaching Objectives and Requirements" section requires students to develop the ability to use dictionaries to translate in-depth introductions of Chinese and foreign social conditions or cultures. Therefore, integrating Chinese culture into English teaching is the needs of our country and the requirements of the times.

Any kind of natural language has its own grammar rules, and English translation is no exception. The research theory of rule-based syntax analysis is relatively mature.

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The main methods are Earley algorithm, Tomita algorithm and Chart algorithm. The GLR algorithm mainly adopts two parts: the analysis table and the operation stack program. The analysis table is constructed through preprocessing, and the operation program is realized through the GLR algorithm through the graph stack structure. The research on English translation syntax analysis is relatively few. We can only improve the implementation of syntax analysis by studying Chinese and English syntax analysis methods, It will lay a foundation for natural language processing in future English translation. English translation belongs to Turkic language family. It is also an adhesive language [2]. This paper mainly discusses the syntax analysis of English translation based on GLR algorithm. As for the research of GLR algorithm, the current research is mainly based on DFA of finite automata and preprocessing based on LR analysis table. We adopt preprocessing based on LR (1) analysis table and LALR algorithm to generate the analysis table that cannot fully accept the expected analysis table of the generator; The analysis table generated by LR (O) algorithm is not very practical for natural language processing. In this paper, we mainly introduce the GLR algorithm to analyze English translation sentences when analyzing stack processing.

2 Related Work

2.1 Improved GLR Algorithm

Chinese English translation, natural language semantic processing, automatic summarization and other fields. At present, it has two main methods: rule-based and probability based parsing.

Parsing models and algorithms are inseparable from the study of statistical parsing. The former determines whether the parsing results are correct [3], The latter determines whether the results can be actually found within the effective time ". On the basis of GLR algorithm, combined with the head driven probabilistic syntax model, a new probabilistic model PCFG_HDSM is proposed, and a syntax analyzer applicable to small and medium-sized syntactic tagging corpora is implemented, which is proved to be available by experiments. The internal marks are customized and detailed, so that some ambiguities can be eliminated in the rule stage through detailed part of speech tagging information. Figure 1 below shows the GLR algorithm improvement process.

In the original GLR algorithm, a new stack (WordsStack) needs to be added symbols in the input string. When the rules are found and specified, they must be added to some programs to achieve the above functions [4]. First, the PP of each rule is required. In this process, this (P) is constantly multiplied into P (T).

$$\Delta w(i, y) = -\eta \frac{\partial e}{\partial w(i, y)} \tag{1}$$

$$D(x_i, x_j) = \sum_{l=1}^{m} d(x_{il}, x_{jl}) \tag{2}$$

The CLR algorithm uses the width first strategy to resolve the LR parsing table conflict. The GLR parser executes its words according to the predefined parsing table to

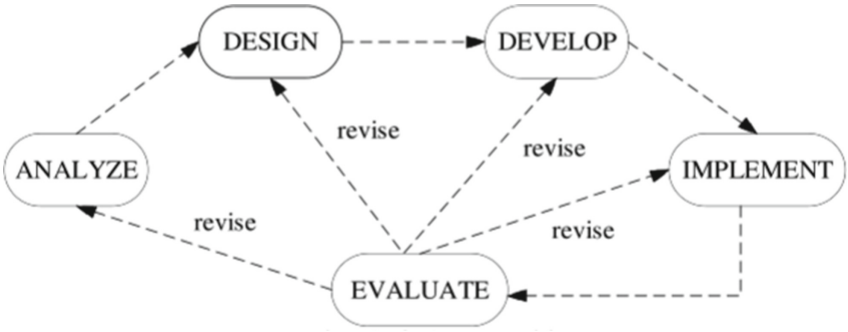

Fig. 1. GLR algorithm improvement process

"move" or "reduce". There is only one predicate verb in the English translation sentence, and the verb determines the necessary components in the whole sentence. The verb is the most critical and decisive in a sentence.

2.2 Intelligent Identification of English Translation

Sequence to sequence model is a deep learning model, which has achieved good results in machine translation, text summary, English translation and translation tasks. Google Translation has also used the Seq2Seq model since 2016. Seq2Seq model can be seen in these two articles (Sutskever et al., 2014, Cho et al., 2014).

However, I found that to understand and apply the Seq2Seq model, we need to understand a series of concepts that are built on each other. This is often a difficult thing for beginners. I think if we can visualize them, it will help us understand these complex concepts. This is my motivation for writing this article. To understand this article, you need some basic knowledge of deep learning. I hope this article can help you in your learning process (and the two articles mentioned above).

The input of the Sequence to Sequence model is a sequence of objects (words, letters, features of English translation, etc.), and its output is another sequence of objects. A trained model works like this: in the French English machine translation task, a sequence is a string of words, in this case, the French Jesus etudiant. The input word string will be processed by the model in turn. Similarly, the output is also a string of words. In this example, it is English l'm a student.

3 Design of Foreign Language Teaching Model Based on Improved GLR Algorithm

The aim is to improve the efficiency and effect of foreign language teaching through the effective application of GLR algorithm. This method is more practical than theory, so that teachers can use it as a reference tool when they need it most. In order to ensure that all students have equal access to resources, we should provide them with enough time to study and practice after class.The design involves three main components: 1) a computerized program for developing and testing teaching materials; 2) An algorithm for measuring students' foreign language learning achievements.

The analysis process of GLR algorithm is: first initialize a graph stack structure and shared forest, then find the part of speech of each word of this sentence through the dictionary and store it in the buffer, so that we can analyze faster, and then analyze it according to GLR algorithm, In case of conflict ("reduction - moving", "reduction - reducing"), take the exploratory method; in case of "moving - reducing" conflict, use "reduction" first This path is used for analysis. If the sentence can be analyzed completely, the analysis is considered correct. Continue to analyze the conflict from the place where the conflict was analyzed just now; If an error occurs, return to the conflict and continue to make other choices. Until the end of the sentence analysis. If the analysis is not successful, we will display the largest subtree of the sentence analysis. Otherwise, we will output the one with higher probability by calculating the probability of the analysis tree. However, the parallel LR analysis algorithm is split into two trees when conflicts occur, and the result may be more than one tree. We also use the same method to output the optimal rule tree. The process of English translation model is shown in Fig. 2 below.

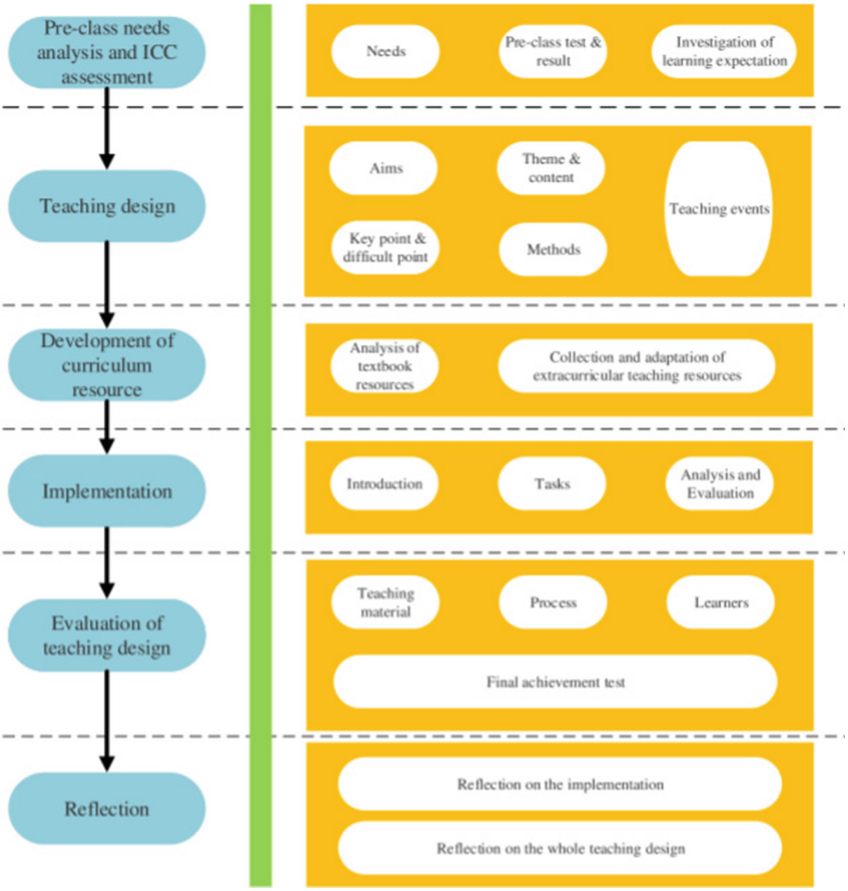

Fig. 2. English translation model process

The advantage of GLR algorithm is that its running time is shorter than that of the parallel LR parsing algorithm, and it can parse all syntax trees that conform to the syntax structure, but its disadvantage is that it does not give how to judge which parsing tree is better.

When it comes to the attitude towards English expression in Chinese culture (question 2), more than 93% of the students admit its importance, 64% of the students admit the necessity of learning it (question 3), 94% of the students think it is helpful to improve their ICC (question 4), and they will have more confidence in cross-cultural communication after mastering certain knowledge of expressing Chinese culture. In English learning, more than 60% of students deny that learning Chinese culture is not as important as learning Western culture (Question 8). According to the survey on the English expression of middle school students in Chinese culture, more than half of the students usually pay attention to relevant knowledge on the Internet, but they rarely take the initiative to learn (Questions 9–10). More than 91% of the students want teachers to supplement relevant knowledge in teaching (Question 11). It can be seen that students have a positive attitude towards learning Chinese culture and its English expression, but lack of initiative in learning..The biggest advantage of bidirectional RNN encoder is that the representation of each word in the source language sentence in the context vector already contains the semantic information.

4 Conclusion

The design of foreign language teaching model based on GLR algorithm is a new method to solve the problem of foreign language teaching scheme design. The basic idea of this method is to use GLR algorithm as an effective tool for planning and evaluating foreign language learning plans. This article describes a case study in which students are assessed using GLR technology and then use this information to plan their own courses. Students can now compare their actual performance with their planned performance to determine their ability to learn languages other than English. Teachers can use this method to improve students' listening, speaking, reading and writing abilities. In this way, students will be able to communicate easily with others. Therefore, they will better understand how others use their own language. They will also learn more about their own culture. This knowledge will help them develop a good attitude towards other cultures and how different cultures can work together to promote mutual benefit and development (OECD and Eurydice).

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Design of Engineering English Translation Intelligent Recognition Model Based on Improved GLR Algorithm

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Abstract. It is essential to improve the role and construct a translation recognition model. Firstly, the translation theory is used to segment the strings recognized by the translation, and the strings are performed according to the translation requirements Set division to reduce ambiguity in identification. Then, translation theory segments the translation recognition to form a collection of translation results and continuously recognizes strings. MATLAB simulation better than those under certain string recognition conditions Standard GLR algorithm.

Keywords: Translation theory · Translation identification · Improved GLR algorithm · Identifying the results

1 Introduction

Translation recognition is an important recognition content in engineering English intelligence [1], which is of great significance to engineering English. However, in the actual translation process, there is a problem of poor accuracy of the recognition results, which has a certain impact on the engineering of English translation. Some scholars believe that applying intelligent algorithms to engineering English recognition can effectively identify phrases and sentences and provide corresponding support for translation.

2 Related Concepts

2.1 Improved Mathematical Description of the GLR Algorithm

The improved GLR algorithm uses translation theory to optimize strings, and finds outliers in engineering translation according to various indicators in strings, integrates the corresponding strings. The advantages of translation theory and uses strings and intelligent algorithms to optimize the translation recognition results, which can improve the accuracy of intelligent recognition [2].

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Hypothesis 1 The English engineering string is y_i, the string set is $chax_i$, the engineering English professional phrase is $\sum x_i$, and the judgment function recognized by the translation is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = \sqrt{\sum char(\hat{x}_i|y_i)} \cdot \xi_i \tag{1}$$

2.2 Selection of Identification Methods

Hypothesis 2 The string selection function is r_i, and the string correlation coefficient is $F(x_i)$, then the engineering translation method selection is shown in Eq. (2).

$$F(x_i) = \left| z_i \cdot [[f(x_i|y_i) \ + \overbrace{r_i \cdot \xi}^{i}] \right| \tag{2}$$

2.3 Handling of Strings

Before the GLR algorithm is improved, the strings in the recognition results are analyzed by standard and mapped to the translation table Determines the semantic exception string. First, the string is comprehensively analyzed, and the threshold and association are set to ensure the accuracy of the GLR algorithm is improved. The string is a semantic transformation string and needs to be normalized. If a string is in a non-standard distribution, its recognition result is affected, reducing the overall recognition accuracy. English recognition, the translation recognition method should be selected, and the specific method selection is shown in Fig. 1.

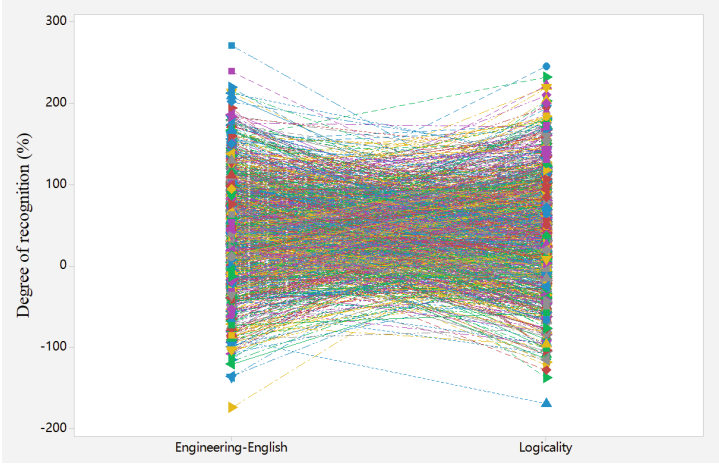

Fig. 1. Results of Translation Intelligent Recognition

The string in Fig. 1 shows that the translation recognition method presents a standard distribution corresponding to objective facts. The recognition method is not directional, indicating that the translation recognition method has strong logic, so it is used as a recognition study of engineering English [3]. The recognition method meets the mapping requirements mainly because the translation theory adjusts the recognition method, removes repeated words, and revises the slang so that the dynamic logic of the whole string is strong.

2.4 Depth of Translation Recognition

The GLR algorithm is improved to use logical judgment for translation recognition and adjust the corresponding word relationship to optimize the engineering English translation method. The improved GLR algorithm divides engineering English into different difficulty levels and randomly selects different methods. In the iterative process, translations of different difficulty requirements are matched with recognition methods [4]. After the matching process is completed, different methods are compared for engineering English translation, and the best translation recognition results are recorded.

3 Identification Cases of Engineering English Translation

3.1 Engineering English Situation

In order to facilitate identification, the identification of 12 sports indicators in this paper takes engineering English sentences as the research object, and the test time is 12 weeks, and the translation recognition of specific physical education teaching is shown in Table 1.

Table 1. Relevant word relationships identified by physical education translation

English type	difficulty	The number of statements	logicality	Statement form
Engineering majors	Level IV	17	89.29	Phrases, sentences, articles
	Specialized four	82	94.29	Phrases, sentences, articles
Related class engineering	Level IV	98	97.50	Phrases, sentences, articles
	Specialized four	57	90. 20	Phrases, sentences, articles
Edge class engineering	Level IV	85	97.50	Phrases, sentences, articles
	Specialized four	73	95.71	Phrases, sentences, articles

The sentence processing process identified by translation in Table 1 is shown in Fig. 2.

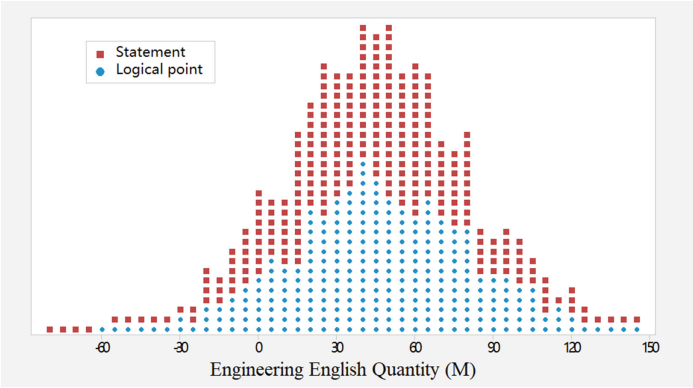

Fig. 2. The processing of a statement

In terms of engineering English sentence recognition rate and logic, improve the GLR algorithm standard GLR algorithm. From the statement changes, engineering English recognition speed, engineering English recognition, and translation logic.

3.2 Completeness of Translation Recognition

Engineering English recognition for translation recognition contains phrases, sentences, and articles. After the rough set screening, the preliminary translation recognition results are obtained, and the translations have been recognized. The feasibility of the results is analyzed. In order to verify the effect more accurately, select different difficulty translation recognition, and the sentence recognition sentence recognized by the translation is recognized, as shown in Table 2.

Table 2. Statement overview

difficulty	Professional level	The complete rate of translation recognition
Level IV	89.29	91.43
Specialized four	94.29	93.57
Professional English	97.50	99.64
mean	90.00	98.57
X2	7.502	7.150
P = 0. 026		

3.3 Accuracy and Logic of Translation Recognition

The recognition results are shown in Fig. 3 by comparing statements with the standard GLR algorithm.

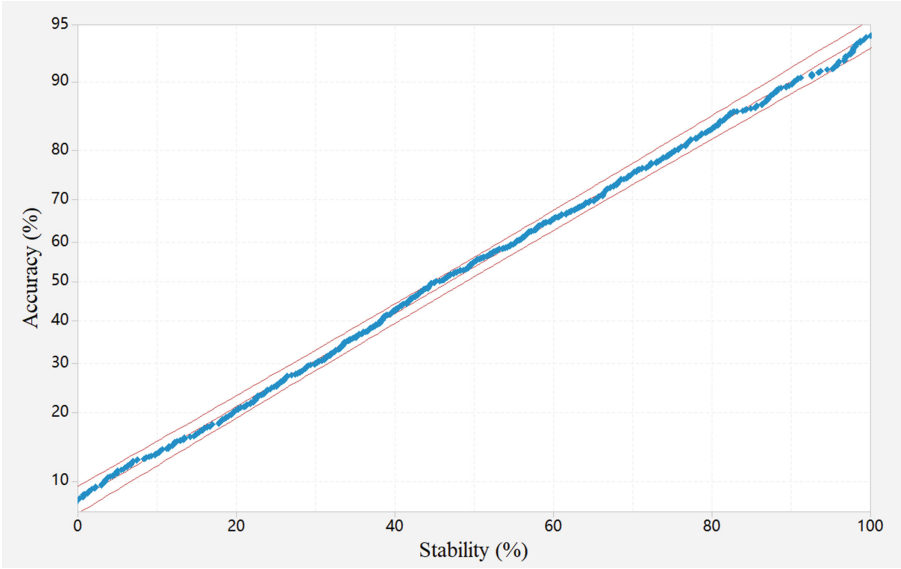

Fig. 3. Does not improve the accuracy of the GLR algorithm

But the error rate is lower, indicating that the recognition is relatively stable Uneven. Table 3 shows the average statements of the above three algorithms.

Table 3. Comparison of recognition accuracy of different methods

algorithm	Precision	Magnitude of change	error
Improved GLR algorithm	90.36	97.50	2.14
Standard GLR algorithm	72. 10	81.07	5.71
P	3.114	4.604	8.021

It can deficiencies in accuracy and logic in translation recognition, and the logic of translation recognition changes significantly, and the error rate is high. The complete results standard GLR algorithm. At the same time, the accuracy is greater than 90%, and the accuracy has not changed significantly. In order to further verify the superiority, the improved GLR algorithm was comprehensively analyzed by different methods, and result four is shown (Fig. 4).

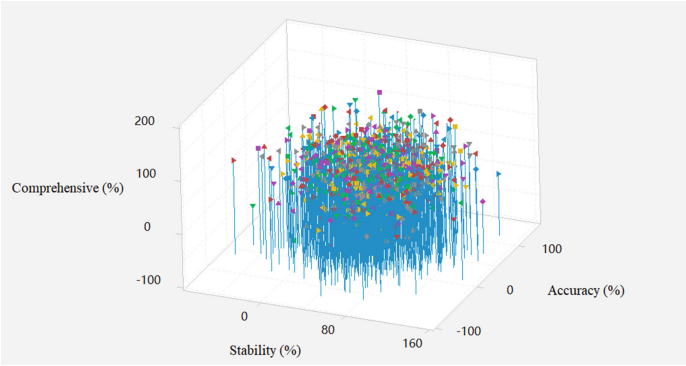

Fig. 4. Comprehensive improvement of the GLR algorithm

Studies show that the statements of the improved GLR algorithm are significantly better than the standard GLR algorithm because increases the translation recognition adjustment coefficient and sets the corresponding threshold to determine the statement that does not meet the requirements.

4 Concluding Remarks

Under the scenario of the prevalence of intelligent methods, translation and combines translation theory to improve translation recognition. At the same time, the departments and threshold standards of translation identification are analyzed in depth, and the sentence collection of translation recognition is constructed. Research shows that improving the GLR recognition Conduct comprehensive engineering English recognition. However, in improving the GLR algorithm, too much attention is paid to the analysis of recognition ability, resulting in a relative decrease in the accuracy of supervision.

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The Analysis on How to Continuously Enhance the Stickiness of Power Customer Relationship to Cope with the Impact of Power Market Reform

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Abstract. The role of customer relationship stickiness in market-oriented reform is very important, but there is a problem of inaccurate evaluation. Previous methods could not solve the evaluation problems of user stickiness and loyalty in market-oriented reform, and user satisfaction was low. Therefore, this paper proposes a digital intelligence method to optimize customer relationship stickiness. First of all, the industry standard is used to divide the market-oriented reform content, and the market-oriented reform content analysis is carried out according to the service requirements to achieve market-oriented reform Preprocessing of data. Then, according to the industry standard, an optimal collection of market-oriented reform is formed, and the service content is deeply explored. MATLAB simulation shows that under the condition of consistent industry standards, the optimization and friendliness of digital intelligent methods are better than traditional service methods.

Keywords: industry standards · friendliness · digital intelligence approach · Optimize the results

1 Introduction

Market-oriented reform and optimization is one of the important contents of customer relationship stickiness, which the improvement of market-oriented reform and optimization system [1]. However, in designing the market-oriented reform content system, there is a problem of inaccurate evaluation of customer relationship stickiness results, which cannot effectively play the role of customer relationship stickiness [2]. Some scholars believe that the application of digital intelligence methods to market-oriented reform can

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effectively carry out redundant market-oriented reform and friendliness analysis [3], and provide corresponding support for the optimization and verification of market-oriented reform [4]. On this basis, this paper proposes a digital intelligence method to optimize the market-oriented reform content and verify the effectiveness of the model.

2 Related Concepts

2.1 Mathematical Description of Digital Intelligence Methods

The digital intelligence method is to optimize the market-oriented reform content by using the key points, the relationship between and market-oriented reform industry standards, and find it according to the service indicators in market-oriented reform Outliers in market-oriented reform optimization, and form a path table. By integrating the results of market-oriented reform optimization, the correlation of customer relationship sticky results is finally judged [5]. The Digital Intelligence approach combines industry standards and uses a digital intelligence approach to optimize service outcomes and increase customer relationship stickiness.

Hypothesis 1: The power content is x_i, the customer service set is $\sum x_i$, the industry standard is y_i, and the judgment function of the customer relationship stickiness result is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = \lim_{i \to \infty} \sum x_i | y_i \wedge \sqrt{\xi^2 - 4xy} \tag{1}$$

2.2 Choice of Market-Oriented Reform Plan

Hypothesis 2: The market-oriented reform service function is $F(x_i)$ and the verification coefficient of market-oriented reform content is z_i, then the market-oriented reform optimization method selection is shown in Eq. (2).

$$F(x_i) = x^2 - 4x\xi + \prod z_i \cdot \xi \tag{2}$$

2.3 Treatment of Redundant Market-Oriented Reform

Before the analysis of digital intelligent methods, it is necessary to analyze the friendliness and single degree of customer relationship stickiness results, and map the market-oriented reform content to the selection table to judge the content with abnormal semantics. First, the market-oriented reform content is comprehensively analyzed, and the service logic and content verification of the market-oriented reform content are set up to provide support for the accurate analysis of digital intelligent methods. The content of market-oriented reform needs to be preprocessed, and if the results after processing meet the requirements of market-oriented reform, the processing is effective, otherwise the data structure is deepened. In accuracy of digital intelligence methods and service levels, it is necessary to select digital intelligence methods, and the specific method selection is shown in Fig. 1.

The market-oriented reform content in Fig. 1 shows that the analysis of digital intelligent methods is uniform, which is in line with objective facts.

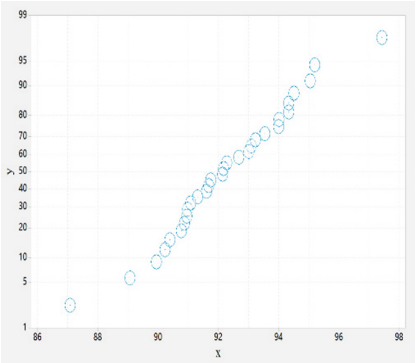

Fig. 1. Analysis results of the digital intelligent method

3 Actual Examples of Market-Oriented Reform Content Systems

3.1 Stickiness of Electricity Customer Relationship

In order to facilitate the analysis of electric power customer relationship stickiness, the different types of power customer relationship stickiness in this paper are studied as shown in Table 1.

Table 1. Characteristics of electric customer relationship stickiness

Power customer relationship stickiness	range	Loyalty	User satisfaction	Intelligent
SQL database	client	90.00	99.47	90.00
	Electric companies	91.05	93.68	99.47
Enterprise side	client	98.42	90.00	96.32
	Electric companies	96.32	96.32	99.47
client	client	91.05	95.26	95.79
	Electric companies	98.95	91.58	94.74

Table 1 shows the process of dealing with different market-oriented reforms, as shown in Table 2.

As can be seen from Table 1, compared with a single customer relationship sticky system, the customer relationship stickiness results of the digital intelligent method are closer to the actual friendliness. In terms of market-oriented reform content, market-oriented reform, key points, selection rate, accuracy, etc., digital intelligent methods customer relationship stickiness. From the changes in the key points of market-oriented reform in Fig. 4, it can be seen that the accuracy of digital intelligence methods is better and the judgment speed is faster.

Table 2. The process of handling the key points of market-oriented reform

source	degree of freedom	Adj SS	Adj MS	F-number	P-value
regression	9.47	18.95	18.95	9.47	9.47
relationship	16.84	16.84	10.53	8.42	16.84
correlation	17.89	11.58	20.00	18.95	17.89

3.2 Optimization Ratio of Market-Oriented Reform

The optimization of includes redundant market-oriented reform, key points and speed of market-oriented reform. After the screening of the service logic standard of the digital intelligent method, the preliminary service results are obtained, and the correlation of the service results is analyzed. In order to verify the effect more accurately, different redundancy marketization reforms are selected to calculate the overall friendliness of customer relationship stickiness, as shown in Table 3.

Table 3. Overall situation of market-oriented reform and optimization

Degree of relationship	The degree of optimization	Complaint rate
25%	17.89	5.26
50%	18.95	12.63
70%	21.05	21.05
mean	13.68	11.58
X2	8.42	14.74
P = 0. 102		

3.3 Friendliness and Accuracy of Customer Service

In the digital intelligence, friendliness optimization and accuracy comparison with customer relationship stickiness are shown, and the results are in Fig. 2.

Figure 2 that the friendliness optimization of digital intelligent methods is higher than that of previous analysis methods, but the error rate is lower, indicating that the choice of digital intelligent methods is relatively stable, while the optimization degree of previous analysis methods is uneven. The accuracy of the above algorithm is in Table 4.

It can be seen from Table 3 that customer relationship stickiness has shortcomings in user satisfaction of market-oriented reform content, friendliness optimization, accuracy, and loyalty accuracy changes significantly, and the error is high. The complete result of the digital intelligence method is more user-friendly optimization than customer relationship stickiness. In order verify the sustainability the method, the digital intelligence comprehensively analyzed by different methods, and the results are shown in Fig. 3.

Fig. 2. Friendliness optimization of different algorithms

Table 4. Comparison of optimization degrees of different methods

algorithm	Friendliness optimization	Analyze key points	error
A digitally intelligent approach	91.07	91.79	91.07
Previous analytical methods	83.93	76.79	83.93
P	9.219	6.433	9.292

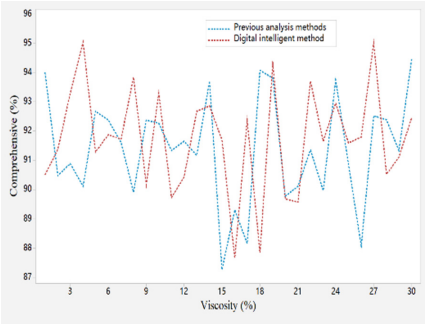

Fig. 3. Comprehensive results of digital intelligence method evaluation

Figure 3 that the results of the digital intelligence are the previous methods, and the reason is that the digital intelligence method increases the friendliness adjustment coefficient and sets the corresponding analysis logic Present results that do not meet the requirements.

4 Conclusion

Under the circumstance of increasing requirements for market-oriented reform, this paper proposes a digital intelligent method in view of the content of market-oriented reform, and combines industry standards to improve the market-oriented reform relationship within the system. At the same time, the analysis and analysis logic criteria

are analyzed in depth, and the optimization set is designed. Studies show that digital intelligence methods can improve the accuracy and accuracy of friendliness, and can comprehensively improve friendliness. However, in the process of digital intelligence methods, too much attention is paid to customer analysis indicators and comprehensive customer analysis is neglected.

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Analyze How to Build an Efficient and Competitive Power Business Environment

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Abstract. The role of competitiveness model in the creation of business environment is very important, but there is the problem of inaccurate construction plan. The online construction method cannot solve the problems of business indicators and environmental analysis in the construction of business environment, and the accuracy is low. Therefore, this paper proposes a competitiveness model to comprehensively evaluate the business environment. First, competitiveness mining is used to divide the construction plan and realize the standardized processing of business environment data. Then, according to the results of competitiveness mining, the evaluation set of business environment creation is formed, and the construction plan is deeply excavated. MATLAB simulation shows that under the condition that competitiveness mining is consistent, the comprehensive evaluation degree and construction degree of competitiveness model are better than online construction Law.

Keywords: Competitiveness mining · Degree of creation · Electricity side · Energy saving

1 Introduction

The creation of a business environment is an e-commerce condition for the development of electric power [1], which the improvement of the electricity market. However, in the process of creating a business environment, there are inaccurate problems in the construction plan, which cannot effectively play an analytical role [2]. Some scholars believe that applying the competitiveness model to the creation of the business environment can effectively carry out the creation and degree analysis of the business environment and provide corresponding support for the analysis of the business environment [3]. On this basis, this paper proposes a competitiveness model, comprehensively evaluates the construction scheme, and verifies the effectiveness of the model.

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2 Related Concepts

2.1 Mathematical Description of the Competitiveness Model

With the help of indicators such as the creation of evaluation points and the relationship between indicators of the business environment, the competitiveness model comprehensively evaluates the construction plan and builds according to the business environment, find outliers in the creation of the business environment, and form a path table [4]. By integrating the construction plan, the correlation of the construction plan is finally judged [5]. The competitiveness model combines competitiveness mining, and the comprehensive evaluation of the results can improve the level of energy conservation and emission reduction by using the competitiveness model.

Hypothesis 1: The business content is $\sum x_i$, the creation plan is x_i, the competitiveness mining is y_i, and the competitiveness judgment function is $f(x_i)$ shown in Eq. (1).

$$f(x_i) = \lim_{i \to \infty} \sum x_i | y_i \cup \sqrt{\xi^3} \tag{1}$$

2.2 Choice of Construction Scheme

Hypothesis 2: The business environment creation function is $F(x_i)$ and the verification coefficient of the creation scheme is z_i, then the business environment creation method selection is shown in Eq. (2).

$$F(x_i) = \frac{4x \oplus \xi}{2x} \cup z_i \cdot \xi \tag{2}$$

2.3 Processing of Construction Data

Before analyzing the competitiveness model, it is necessary to analyze the degree of construction in the construction plan, and map the construction plan to the content of the unfavorable factors in the selection table. First, the construction plan is comprehensively analyzed, and the environmental standards and content verification of the construction plan are set to support the accurate analysis of the competitiveness model. The construction plan needs to be standardized, and if the result of the treatment meets the requirements of business environment construction, it means that the treatment is effective. Otherwise, deepen the environmental structure. In improve the competitiveness model evaluation, it is necessary to select the construction plan, and the specific method selection is shown in Fig. 1.

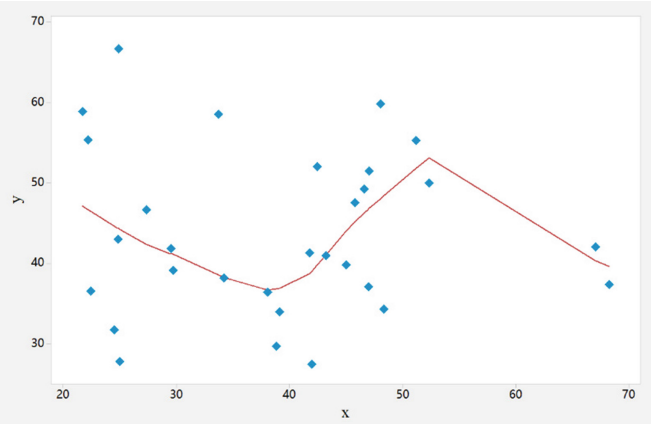

Fig. 1. Results of the competitiveness model analysis

The analysis results in Fig. 1 show that the data processed by the competitiveness model fluctuate uniformly, which is in line with objective facts. The online construction method shows that the competitiveness model analysis has high accuracy, so it is studied as a construction scheme. The selection scheme meets the mapping requirements, mainly according to the competitiveness model to adjust the selection plan, remove duplicate construction indicators, and adjust the business environment creation point, so that the whole The selectivity of the construction scheme is high.

3 Actual Examples of the Electric Power Business Environment

3.1 Business Environment

In order to facilitate the analysis of the business environment, the different types of business environment in this paper are studied as shown in Table 1.

Table 1. Characteristics of the electricity business environment

target	range	Environmental analysis	Degree of construction	Adjust the effect
Local environment	E-commerce	20.00	5.26	14.74
	platform	9.47	8.42	13.68
Overall environment	E-commerce	21.05	13.68	18.95
	platform	13.68	7.37	9.47
E-commerce environment	E-commerce	5.26	21.05	10.53
	platform	14.74	7.37	5.26

The processing process between the different construction indicators in Table 1 is shown in Table 2.

Table 2. The process of handling evaluation points for the creation of business environment

source	degree of freedom	Adj SS	Adj MS	F-number	P-value
regression	6.32	11.58	16.84	8.42	5.26
3	12.63	7.37	6.32	17.89	18.95
5	16.84	8.42	13.68	9.47	17.89
error	18.95	9.47	6.32	21.05	11.58
total	6.32	20.00	9.47	14.74	8.42

Table 1 shows that compared with the online construction method, the construction scheme of the competitiveness model is closer to the actual construction degree. In terms of the selection rate and accuracy of evaluation points for creating a business environment for creating a business environment, the competitiveness model saves energy and reduces emissions. From the changes in the evaluation points of the business environment creation in Fig. 4, it can be seen that the competitiveness model is better and the judgment.

3.2 Comprehensive Evaluation Ratio of Environmental Creation

The comprehensive evaluation of the creation of the business environment includes the creation index, the evaluation point and the speed of the creation of the business environment. In verify the effect, different construction indicators are selected to calculate the overall construction degree of energy conservation and emission reduction, as shown in Table 3.

Table 3. Overall situation of business environment creation

Create proportions	Comprehensive evaluation	Build rate
25%	13.68	15.79
50%	6.32	5.26
70%	17.89	12.63
mean	13.68	14.74
X2	17.89	11.58
P = 0.032		

3.3 Degree and Accuracy of Environment Creation

In the accuracy of the competitiveness model, a comprehensive evaluation and accuracy comparison with the energy-saving environment are shown in Fig. 2.

Figure 3 that the comprehensive evaluation of the competitiveness model is shorter than that of the online construction method, but the error rate is lower, indicating that

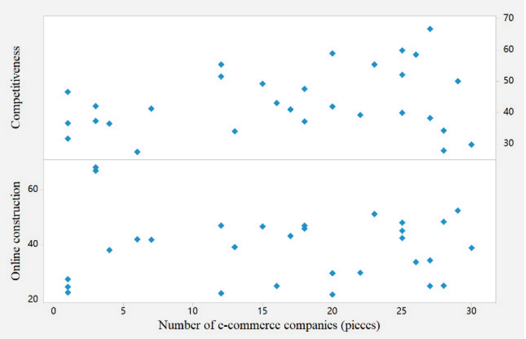

Fig. 2. Comprehensive evaluation

the choice of competitiveness model is relatively stable, while the online construction method is relatively stable the degree of comprehensive evaluation fluctuates greatly. The accuracy of the above algorithm is shown in Table 4.

Table 4. Comparison of the degree of comprehensive evaluation of different methods

algorithm	Comprehensive evaluation	Key creation points	error
Competitiveness model	93.68	15.79	0.01
Online construction method	96.32	28.42	7.89
P	12.63	6.32	15.79

It can be seen from Table 3 that there are deficiencies in comprehensive evaluation and accuracy in the enhancement of the energy-saving environment in the construction plan, the accuracy of environmental analysis and processing has changed significantly, and the target deviation rate is high. In order to verify the rationality of the method, the competitiveness model is comprehensively analyzed using different methods, and the results are shown in Fig. 3.

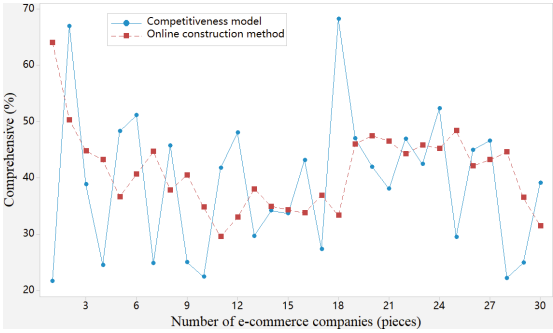

Fig. 3. Comprehensive results of competitiveness model evaluation

Figure 3, the competitiveness are significantly better the online construction method, and the reason is that the competitiveness model increases the adjustment coefficient of the degree of construction and sets it Corresponding environmental standards, and results that do not meet the requirements are proposed.

4 Conclusion

In view of the increasing requirements of electricity competitiveness, this paper proposes a competitiveness model in view of the business environment and improves the construction scheme based on the power situation. At the same time, the created environment is analyzed in depth, and the environmental evaluation collection is designed. Studies show that the competitiveness model can improve the accuracy of the degree of construction and comprehensively analyze the degree of construction. However, in the process of competitiveness modeling, too much attention is paid to environmental indicators and the analysis of environmental integration is neglected.

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The Application of Data Mining Technology in the Overseas Dissemination of Chinese Classics

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Abstract. The role of data mining technology in the overseas dissemination audience targeting of Chinese classics is very important, but there is a problem of low audience targeting accuracy. Standard communication analysis methods cannot solve the problem of audience targeting of many types of Chinese classics, and the targeting effect. Therefore, this technology and an audience positioning model for Chinese classics. Firstly, the theory of communication is used to classify overseas audience targeting, and the overseas audience positioning method is selected according to the requirements of Chinese classics. Implement preprocessing for audience targeting. Then, according to the degree of English translation, an audience targeting collection is formed, and the parameters are iteratively judged. MATLAB simulation shows that in Chinese classics, data mining technology can improve the scale of overseas audience targeting Reduce targeting time and results that outperform standard communications analytics.

Keywords: communication theory · Positioning time · data mining techniques · Audience targeting performance

1 Introduction

Chinese classics are an important part of overseas audience targeting [1], and data mining technology plays a very important role in audience targeting judgment [2]. However, in the process of translating from English to overseas audience targeting [3], overseas audience targeting has the problem of low audience targeting accuracy and cannot effectively play automatic Audience targeting [4]. Some scholars believe the application to the research on audience positioning of overseas communication of Chinese classics can effectively eliminate positioning data, analyze positioning time [5], and judge audience positioning Provide appropriate support. On this basis, this paper proposes a data mining technique to mine the audience positioning of Chinese classics overseas and verifies the effectiveness of the data mining technology.

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2 Related Concepts

2.1 Mathematical Description of Data Mining Techniques

Data mining technology is to use communication theory, the relationship between English translation indicators and the degree of English translation to judge audience positioning, and research on overseas communication audience positioning based on Chinese classics, discover outliers in audience targeting judgments, and form a pathtable. By integrating the audience targeting effect, the correlation of the results of is finally judged. Data technology combines communication theory, and uses data mining technology to judge audience positioning, improve the level.

Hypothesis 1: For audience targeting is x_i, the set of audience targeting effects is $\iint_i x$, the degree of English translation is y_i, and the judgment function of the data mining technique result is $T(x_i)$ shown in Eq. (1).

$$T(x_i) = \sum x_i | y_i \xrightarrow{+} \xi \tag{1}$$

2.2 Selection of Audience Targeting Judgment Scheme

Hypothesis 2: The audience targeting result judgment function is $F(x_i)$ and the audience targeting coefficient is w_i, then the audience targeting judgment method is selected as shown in Eq. (2).

$$M(x_i) = z_i \cdot T(x_i | y_i) \underset{+}{\leftrightarrows} w_i \cdot \xi \tag{2}$$

2.3 Processing of Audience Targeting

Before conducting data mining technical analysis, it is necessary to conduct standard analysis of positioning time and effect, and map audience targeting to positioning planning to determine the positioning data that does not meet the standard ◦ First, conduct a comprehensive analysis of audience targeting, and set the scheme and weight of audience targeting to support data mining technology ◦ The audience needs to be preprocessed, and if the processed result meets the requirements of university audience targeting, it means that the processing is effective, otherwise it is renewed Conduct analysis of Chinese classics. In the positioning of data mining technology and of audience targeting, the data judgment scheme should be selected, and the specific method selection is in Fig. 1.

The audience targeting shown in Fig. 1 the analysis techniques is uniform and in line with objective facts. The audience targeting criteria are not directional, indicating that data analysis has short positioning as a judgment method for Chinese classics. The audience targeting standard meets the mapping requirements, mainly according to the communication theory to adjust the audience targeting standard, remove duplicate positioning data, and revise the audience targeting. This makes the overall selectivity for audience targeting shorter.

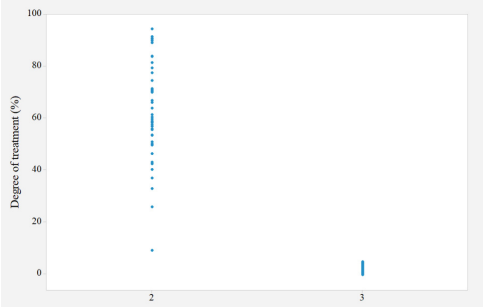

Fig. 1. Analysis results of data mining techniques

2.4 Correlation Between Different Positioning Plans

Data mining technology adopts positioning accuracy judgment on targeting time, and adjusts the corresponding audience targeting relationship to achieve accurate judgment of audience targeting. Data mining techniques apply standard processing to audience targeting data and randomly select different methods. In the process of self-learning, Chinese classics with massive data require correlation processing with audience targeting standards. Once the relevance processing is complete, compare different methods for audience targeting data to store the audience targeting with the highest accuracy.

3 Audience Targeting Cases Based on Data Mining Techniques

3.1 Audience Targeting Research

In order to facilitate the analysis of audience targeting research, different types of audience targeting research in this paper are used as research objects, and the test effect number is 2421 and the targeting time is 4 50 articles, as shown in Table 1.

Table 1. Characteristics of audience targeting parameters

Audience targeting	quantity	Accuracy	Compliance rate
Personal Targeting	36	87.55	68.37
	32	83.27	75.51
Group targeting	88	86.53	68.37
	34	87.35	64.29
Industry positioning	42	88.37	68.37
	55	85.31	76.53

Table 1 shows the processing between different positioning plans, as shown in Fig. 2.

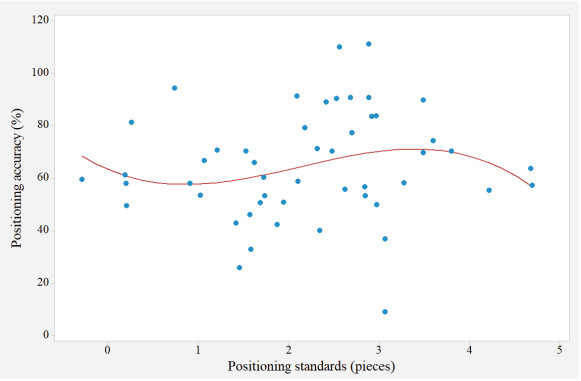

Fig. 2. Processing process of data mining

Table 1 that compared with the standard communication, the audience targeting results of the data mining technology of the actual standard. In the process of audience targeting, with the help of communication theory. Through the changes in communication theory in Fig. 4, it can be seen that the positioning accuracy and the positioning time. Therefore, data mining techniques have better audience targeting accuracy and compliance rate.

3.2 Overall Judgment of Audience Targeting

The judgment of audience targeting includes audience targeting, communication theory, and speed. After the screening of communication theory by data mining technology[21], preliminary audience positioning and correlation of audience targeting indicators are obtained Analyze. To verify the effect more accurately, select different audience targeting and calculate the overall targeting time of the data mining technique, as shown in Table 2.

Table 2. Overall picture of audience targeting

Crowd structure	Chinese classic compliance rate	Parameter compliance rate
1–1-3	79.59	74.49
1–2-2	64.29	73.47
2–3-1	78.57	77.55
P = 0.531		

3.3 Targeting Time for Audience Targeting Judgment

In the targeting accuracy techniques, audience targeting targeting time and targeting accuracy are compared with standard communication analysis methods, and the results are compared This is in Fig. 3.

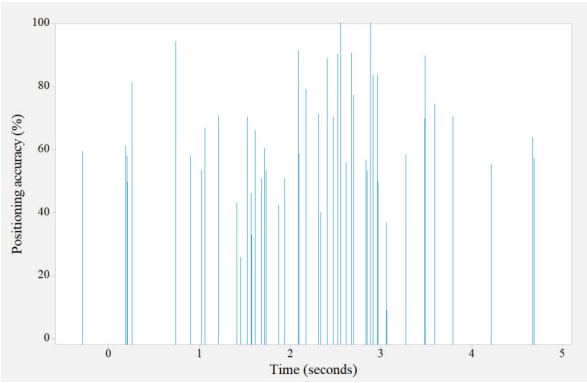

Fig. 3. Targeting time for different algorithms

Figure 3 that the positioning time shorter than that of standard propagation analysis methods, but the choice of data mining technology is relatively stable, while the standard propagation analysis methods are overseas Audience targeting is uneven. The positioning accuracy of the above algorithm is shown in Table 3.

Table 3. Comparison of overseas audience targeting by different methods

algorithm	Audience targeting time	Communication Theory	error
Data mining techniques	92.11	95.79	4.74
Standard propagation analysis methods	70.25	85.26	6.21
P	0.012	0.021	0.023

It can be seen from Table 3 that in terms of audience targeting of standard communication analysis methods, there are deficiencies in audience targeting targeting time and positioning accuracy, and the positioning accuracy of data processing has changed significantly, the error is shorter. Data mining techniques have a shorter positioning time and are superior to standard propagation analysis methods. At the same time, the audience targeting time is greater than 90%, and the has not changed significantly. To mining techniques. In the sustainability of the method, the data mining techniques were comprehensively analyzed using different methods, as shown in Outcome 4.

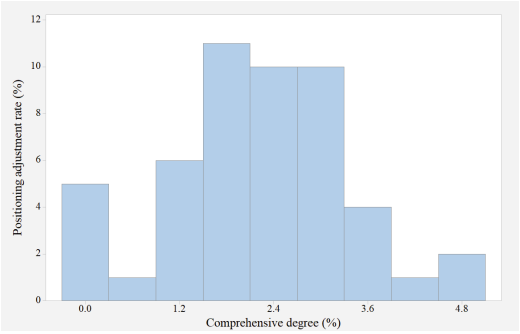

Fig. 4. Comprehensive evaluation results of data mining techniques

It seen from Fig. 4 that the mining technology the standard communication analysis methods, and the positioning judgment and sets the corresponding communication theory to present a result that does not meet the requirements.

4 Conclusion

In the case of the deepening, in view of the problem of audience positioning of overseas communication of Chinese classics, with communication theory Audience targeting to judge. At the same time, in-depth analysis of audience targeting solutions is carried out to build a collection of targeting results. Research shows that data mining techniques can improve the accuracy and time of audience targeting. However, in the adjustment of a single parameter and the proportion of different parameters is ignored.

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The Solution Study of Internet Channel in Improving Customer's Power Service Experience

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Abstract. The role of experience scheme in power service is very important, but there is a problem that the synopsis effect is not satisfactory. The experience solution cannot solve the problem of matching customer needs and power supply in power services, and the integration is low. Therefore, this paper proposes an Internet channel method to construct an experience solution optimization model. First, the experience standard is used to divide the power service content, and the power service content is carried out according to customer requirements to realize the power service of data processing. Then, the experience criteria are divided according to the power supply criterion to form an optimized set of electricity services, and the Japanese content is further explored. MATLAB simulation shows that the optimization degree and the Internet channel method are the online customer method under the power supply is quasi-consistent.

Keywords: experience standards · stability · Internet channel approach · Optimize the results

1 Introduction

Power service optimization is one of the important contents of the experience program, which the improvement of the power service optimization system [1]. However, in the process of constructing the power service content system, the summary effect of the experience solution is not satisfactory, and the role of the experience solution cannot be effectively played [2]. Some scholars believe that the application of Internet channel method to power service can effectively analyze power service data and stability, and provide corresponding support for power service optimization verification [3]. On this basis, this paper proposes an Internet channel method to optimize electric power service content and verify the model's effectiveness.

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2 Related Concepts

2.1 Mathematical Description of the Internet Channel Method

The Internet channel method is to optimize the content of power services by using the key points of power services, the relationship between power services and the power supply standards of power services, and match them according to the power services Metrics, which find outliers in electric service optimization and form a pathtable. By integrating the power service optimization results, the correlation of the results of the experience plan is finally judged. The Internet channel method combines experience standards, and uses the Internet channel method to optimize the matching results, which can improve the level of experience solutions [4].

Hypothesis 1: The power service content is y_i the power service optimization result set is $\sum x_i$, the power service power supply criterion is x_i, and the judgment function of the experience scheme result is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = \lim_{i \to \infty} \sum x_i | y_i \cup \sqrt{\xi^2 - 4xy} \tag{1}$$

2.2 Selection of Power Service Solutions

Hypothesis 2: The power service matching function is z_i and the power service content check factor is $F(x_i)$, then the power service optimization method is selected as shown in Eq. (2).

$$F(x_i) = 4x \cdot \xi \cdot z_i \cdot \xi \tag{2}$$

2.3 Processing of Electricity Service Data

Before analyzing the Internet channel method, the stability and single time in the experience solution results should be analyzed, and the power service content should be mapped to the selection table to determine the content with semantic abnormality. First, the power service content is comprehensively analyzed, and the customer logic and content verification of the power service content are set to provide support for the accurate analysis of Internet channel methods. The content of the electric power service needs to be processed, and if the result of the processing meets the requirements of the electric power service, the processing is valid [5]. Otherwise, re-deepen the service structure. In the accuracy of the Internet channel method and improve the matching level, the Internet channel scheme should be selected, and the specific method selection is shown in Fig. 1.

The power service content in Fig. 1 shows that the analysis of the Internet channel method is uniform, which is in line with the objective facts. The selection method is not directional, indicating that the analysis of Internet channel method has high accuracy, so it is used as a research on the content of electric power services.

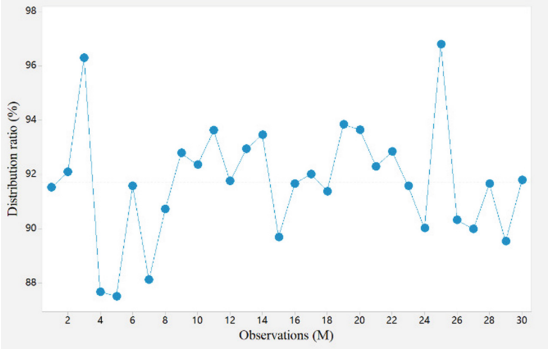

Fig. 1. Analysis results of the Internet channel method

3 Correlation Between Electric Power Service Content

The Internet channel method adopts the accuracy judgment of stability, and adjusts the corresponding power service data relationship to realize the optimization of the power service content method. The Internet channel approach divides electricity service content into experiential categories and randomly selects different methods. In the semantic mining process, the customer requirements of the experience class are related to the selection method. After the correlation processing is completed, compare different methods for power service content, and store the matching results with the highest accuracy.

4 Actual Examples of Electricity Service Experience

4.1 Electricity Service

In order to facilitate the analysis of power services, the different types of power service systems in this paper are studied as the research objects, and the number of test orders is 2421, and the stability is 450, as shown in Table 1.

Table 1. Characteristic of different structures

Electricity service content	range	Electricity supply	Binding	Customer logic
Power supply	channel	12.63	18.95	7.37
	experience	13.68	13.68	21.05
feedback	channel	18.95	10.53	7.37
	experience	14.74	9.47	16.84
survey	channel	10.53	5.26	6.32
	experience	13.68	5.26	14.74

The processing process between the different power service key points in Table 1 is shown in Table 2.

Table 2. Treatment process of key points of power service

source	degree of freedom	Adj SS	Adj MS	F-number	P-value
regression	7.37	11.58	5.26	13.68	5.26
coefficient	16.84	17.89	17.89	10.53	17.89
correlation coefficient	5.26	15.79	8.42	14.74	10.53
error	5.26	11.58	8.42	13.68	12.63
total	18.95	14.74	20.00	17.89	7.37

Table 1 shows that compared with the single-experience solution system, the experience solution results of the Internet channel method are closer to the actual stability. In terms of power service content, power service key point selection rate, accuracy, etc., Internet channel method experience scheme. From the changes in the key points of power service in Fig. 4, the Internet channel accuracy and faster judgment speed. Therefore, the Japanese language assistance speed of the Internet channel method is better, stable, and optimized.

4.2 Optimal Proportion of Electricity Services

The optimization of electricity services includes service data, service key points, and feedback speed. After the customer logic standard screening of the Internet channel method, the preliminary matching results are obtained, and the matching is matched The correlation of the results was analyzed. In order to verify the effect more accurately, select different power service data and calculate the overall stability of the experience solution, as shown in Table 3.

Table 3. Overall situation of electricity service optimization

The level of experience	The degree to which the experience is optimized	Customer complaint identification
25%	5.26	20.00
50%	16.84	18.95
70%	7.37	11.58
mean	10.53	12.63
X2	8.42	21.05
P = 0. 312		

4.3 Stability and Accuracy of Service Experience

The accuracy of the Internet channel, the degree of resolution and accuracy compared with the experience scheme is compared with the results shown in Fig. 2.

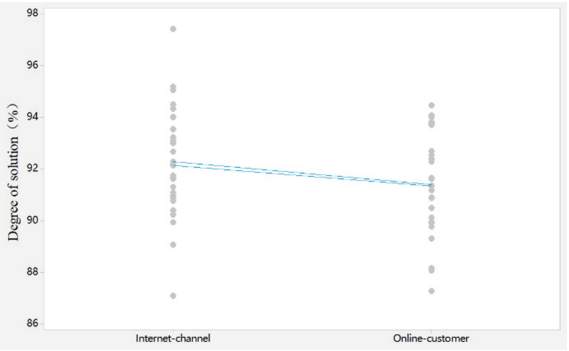

Fig. 2. The degree of solution of different algorithms

Figure 3 that the solution degree the Internet channel is shorter than that of the online customer method, but the error rate is lower, indicating that the choice of Internet channel method is relatively stable, while the online customer method is relatively stable The degree of optimization is uneven. The accuracy of the above algorithm is shown in Table 4.

Table 4. Comparison of optimization degrees of different methods

algorithm	Degree of resolution	Service key points	error
Internet channel approach	97.37	96.84	1.05
Traditional experience	86.84	89.47	6.84
P	15.79	5.26	8.42

It can be seen from Table 3 that the experience solution has deficiencies in the integration of power service content, the degree of solution and accuracy, and the accuracy of data processing has changed significantly, and the error is high. The Internet channel method's comprehensive results have a higher resolution than the experience solution. At the same time, the solution degree of the Internet channel method is greater than 90%, and the accuracy has not changed significantly. To further validate the superiority of the Internet channel approach. The sustainability, the Internet channel method was comprehensively analyzed using different methods, and the results are in Fig. 3.

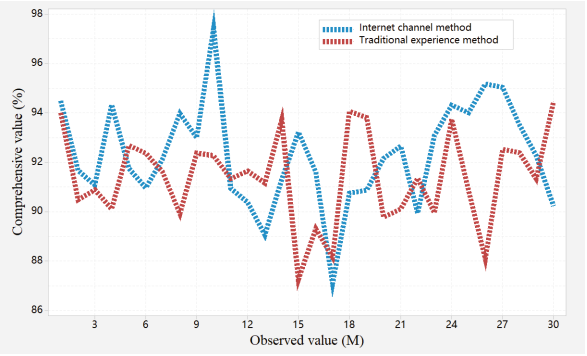

Fig. 3. Synthesis results of Internet channel method evaluation

As can Fig. 3, the results of the Internet channel are significantly better than the traditional experience method, and the reason is that the Internet channel method increases the stability adjustment coefficient and sets the corresponding customers logic, to propose results that do not meet the requirements.

5 Conclusion

In view of the increasing requirements of electric power services, this paper proposes an Internet channel method in view of the problem of power service content, and combines the experience standard to understand the power service relationship within the system Make improvements. At the same time, the Japanese auxiliary customer logic standard is analyzed in depth to construct an optimization set. Studies show that the Internet channel method can improve the accuracy and accuracy of stability, and can comprehensively stabilize stability. However, in the process of Internet channel approach, too much attention is paid to service indicators and comprehensive service analysis is neglected.

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Social Cognitive Psychology Research Towards Socio-ecological Orientation Based on Big Data Analysis

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Abstract. The role of big data analysis in social cognitive psychology is very important, but there is a problem of large analysis error. Previous psychological questionnaire analysis could not solve the problem of comprehensive analysis in social cognition, and there were few psychological scale indicators. Firstly, the big data theory is used to divide the psychological score of social cognition, and the psychological score is divided according to the degree of cognition to reduce the subjective factors in the scale analysis. Then, big data theory divides social cognitive scores into grades, forms a collection of psychological scores, and continuously analyzes psychological scores. MATLAB simulation shows that under consistent socio-ecological orientation, big data analysis methods' accuracy and analysis time are better than those of previous psychological questionnaire analysis.

Keywords: big data theory · social cognition · socio-ecological orientation · Psychology

1 Introduction

Scale analysis is one of the main evaluation methods for social cognition research. However, in the process of actual scale analysis, there is a problem of poor accuracy, which brings certain obstacles to the analysis of socio-ecological orientation [1]. Some scholars believe that the application of big data analysis to social cognitive analysis data support for socio-ecological orientation research [2]. On this basis, this paper proposes a big data analysis algorithm to accurately analyze social cognition and verify the validity of the results.

2 Related Concepts

2.1 Mathematical Description of Big Data Analysis

Finally obtain accurate social cognitive results. In this process, the advantages of big data theory are given full play, and the social cognitive psychological score scale is used to judge the social cognitive results, improving the accuracy of scale analysis [3].

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Hypothesis 1: The psychological score of social cognition is sco_i, the set of psychological score results is $\sum sco_i \neq 1$, the psychological score index is $F(ind_i \geq 0)$, and the judicial function of the accuracy of the ind_i psychological score is as shown in Eq. (1).

$$F(sco_i) = \sum sco_i \mapsto ind_i \cdot \xi \tag{1}$$

ξ Adjust the coefficient for the psychological score results to reduce objective random errors.

Hypothesis 2: The scale analysis scale selection function is $z(sco_i)$ and the order scale coefficient of the scale analysis scale is q_i, then the social cognition scale selection is shown in Eq. (2).

$$z(d_i) = \oiiint \frac{q_i \cdot F(sco_i, ind_i)}{q_i \cdot \xi} \tag{2}$$

2.2 Treatment of Social Cognitive Psychological Scores

The validity and reliability of the psychological score of the scale analysis results should be analyzed, and the psychological score should be mapped to the scoring list to eliminate the abnormal psychological score. First, the social cognitive psychological score is comprehensively analyzed, and the maximum value of the psychological score and the index order table are set to ensure big data analysis Accuracy [4]. If sociocognitive psychological scores are in a non-confidence distribution, the results of their scale analysis are affected. Accuracy of big data analysis and the level of scale analysis, the social cognition scale should be selected, and the specific scale selection is shown in Fig. 1.

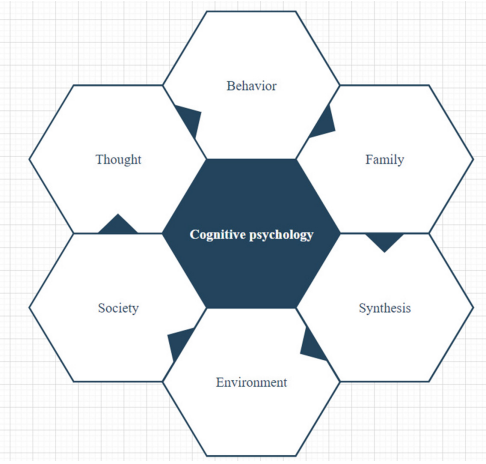

Fig. 1. Selection of social awareness scales

The psychological score showed that the social cognition scale showed a validity and reliability distribution, which was in line with objective facts. The scale analysis scale is not directional, indicating that the social cognition scale has strong randomness, so it is used as an analytical study for 3–4 weeks. The scale analysis scale meets the reliability requirements, mainly because the big data theory adjusts the scale analysis scale, removes duplicate and irrelevant scales, and sets the default. The scale is supplemented to make the indicators of the entire psychological score more independent.

The big data analysis method adopts a random strategy for social cognition, and adjusts the corresponding parameters to achieve the scale optimization of social cognition. Big data analysis methods divide social cognition into different periods and randomly select different scales. In the iterative process, social awareness scales of different periods are matched. After the matching process is completed, the level of scale analysis of different scales is compared to record the best social cognitive results.

3 Practical Cases of Social Cognition

3.1 Introduction to the Social-Cognitive Psychological Scale

In order to facilitate the scale analysis, the social cognitive psychological score of physical education in offline colleges and universities under complex circumstances, and the scale analysis of 12 behavioral sports indicators was analyzed. The test time was 12 Week, the scale analysis psychological scores for specific physical education.

The psychometric scoring process for social cognition in Table 1 is shown in Fig. 2.

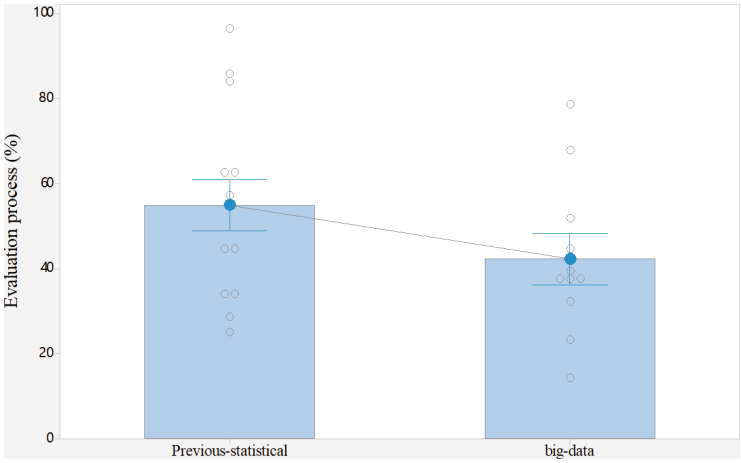

Fig. 2. Processing process of social cognitive psychological score

In terms of the rationality and fluctuation range of psychological score selection in scale analysis, big data analysis methods have been statistical methods in the past. Therefore, the scale analysis speed, social cognitive psychological score scale analysis, and summation stability of big data analysis methods are better.

3.2 Social Cognition

Scale analysis of social cognition includes unstructured, semi-structured, and structural information. After the pre-selection of big data analysis methods, the psychological score of the preliminary social cognition scale analysis results was obtained, and the feasibility of the psychological score of the social cognition scale analysis results was analyzed. In order to verify the effect of social cognition evaluation more accurately, social cognition and psychological score evaluation of social cognition in different time periods were selected as Psychological scores, as shown in Table 1.

Table 1. Overall picture of psychosocial cognitive scores

Period	Socio-ecological orientation analysis	The completion rate of the mental rating scale
1–4 weeks	92.86	93.57
5–8 weeks	94.29	90.00
3–4 weeks	93.21	94.29
mean	93.21	90.36
X^2	0.032	0.015
$P = 0.531$		

3.3 The Scale Analyzes the Accuracy and Stability of Psychological Scores

The psychological score is shown in Fig. 3.

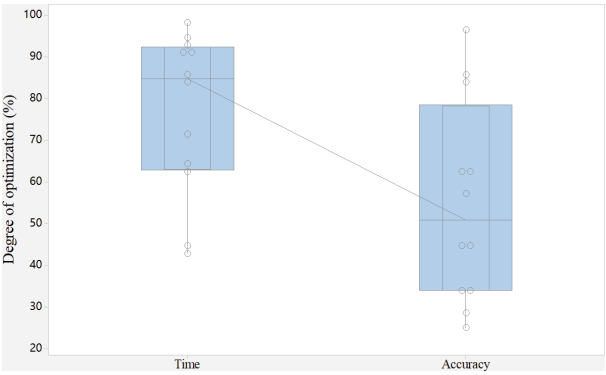

Fig. 3. Accuracy of big data analysis methods

Than that of previous statistical methods. However, the error rate is lower, indicating that the scale analysis of big data analysis methods is relatively stable, while the scale analysis of previous statistical methods is relatively stable Uneven. The average mental scores of the above three algorithms are shown in Table 2.

Table 2. Comparison of scale analysis accuracy of different methods

algorithm	Precision	Magnitude of change	error
Big data analysis methods	96.43	76.79	9.64
Previous statistical methods	39.29	51.79	2.86
P	62.50	30.36	3.93

It can be seen from Table 2 that the previous statistical methods had deficiencies in accuracy and stability in social cognition, the psychological score of scale analysis changed significantly, and the error rate was high. The complete results of big data analysis methods have high accuracy, which is better than previous statistical methods. At the same time, the accuracy of big data analysis methods is greater than 90%, and the accuracy has not changed significantly. In order to further verify the superiority of big data analysis methods, different methods are used to comprehensively analyze big data analysis, as shown in Fig. 4.

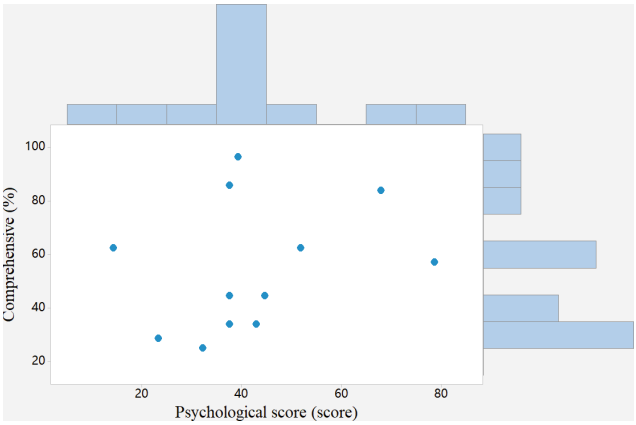

Fig. 4. Comprehensive evaluation of psychological scoring of big data analysis methods

It significantly better than the previous statistical method, and the reason is that the big data analysis method increases the social cognitive adjustment coefficient and sets the corresponding one Maximum, excluding non-compliant psychological scores.

4 Conclusion

Under the condition of socio-ecological orientation, problem of social psychological cognition and combines big data theory to improve social cognition. At the same time, the social cognition scale and maximum value standard are analyzed in depth, and the psychological score set of social cognition is constructed. Studies have shown that big data analysis methods can improve the accuracy and stability of social cognition and can perform comprehensive scale analyses of social cognition. However, too much attention is paid to the analysis of scale analysis capabilities, resulting in a relative decline in the accuracy of supervision.

Acknowledgements. Interpretation of College Students' Psychological Painting and Research on Psychological Intervention NO CSXL-202BO3.

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Research on the Application of Computer Intelligent Technology in Cost Accounting and Financial Management

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Abstract. The role of computer intelligence technology in financial management is very important, but there is a problem of low degree of optimization. Previous costing methods could not solve the financial management problems in financial costing, and there were fewer financial management indicators. Therefore, this paper proposes a computer intelligent technology method to construct a financial cost accounting model. First of all, intelligent technology is used to manage the financial cost accounting data, and the data collection and division are carried out according to the student accounting, so as to reduce the financial management Subjective factors. Then, intelligent technology will financial cost accounting financial management, form a financial management result data collection, and carry out continuous financial management of the data. MATLAB simulation shows that under certain financial management data conditions, the evaluation accuracy and financial management time of computer intelligent technology method are better than the previous cost accounting Method.

Keywords: intelligence · technology · Financial costing · Financial management

1 Introduction

Financial management results Financial management is one of the important evaluation contents of financial cost accounting [1], which is of great significance to financial cost accounting. However, in the actual financial management process, there is a problem of poor accuracy in the financial management results, which brings certain economic losses to power enterprises [2]. Some scholars believe that applying intelligent algorithms to financial cost accounting and financial management can effectively analyze the risks of financial management results and provide corresponding support for financial managers [3]. On this basis, this paper proposes a computer-intelligent technology algorithm to optimize the accuracy of financial cost accounting and verify the effectiveness of the model.

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2 Related Concepts

2.1 Mathematical Description of Computer Intelligence Technology

Computer intelligence technology uses dynamic theory to optimize the accounting data, and according to the indicators in the accounting data, find the outliers in the financial cost accounting results [4], integrate the corresponding data, and finally judge the feasibility of the financial cost accounting results. Computer intelligent technology algorithm combines the advantages of intelligent technology, uses accounting data, quantifies the financial cost accounting results, and can improve the accuracy of financial management [5].

Hypothesis 1: The financial data is d_i the financial data collection is set_i, the financial management indicator of the financial cost accounting result is y_i, financial management. The data judgment function is $F(d_i \geq 0)$ shown in Eq. (1).

$$F(d_i) = \sum x_i \cap y_i \cdot \xi \tag{1}$$

ξ is an adjustment factor for financial costing results, reducing the influence of subjective factors and subjective factors.

2.2 Selection of Financial Management Programs

Hypothesis 2: The financial management scheme selection function is w_i and the weight coefficient of the financial management scheme is $z(d_i)$, then the financial costing scheme selection is shown in Eq. (2) [6].

$$z(d_i) = z_i \cdot F(d_i, y_i) + \int w_i \cdot \xi \tag{2}$$

2.3 Processing of Financial Costing Data

Before carrying out computer intelligence technology [7], it is necessary to conduct discrete analysis of financial management result data, map the data to a two-dimensional plane, and eliminate abnormal data. First, the financial cost accounting data is comprehensively analyzed, and the data thresholds and index weights are set to ensure the accuracy of the accounting computer intelligent technology. Financial costing data is system test data and needs to be standardized. If financial costing data is in a nonnormal distribution, its financial management results are affected, reducing the accuracy of overall financial management. In order to improve the accuracy of accounting intelligent computer technology and improve the financial management level of financial management results, it is necessary to select the financial cost accounting scheme and choose the specific program This is shown in Fig. 1.

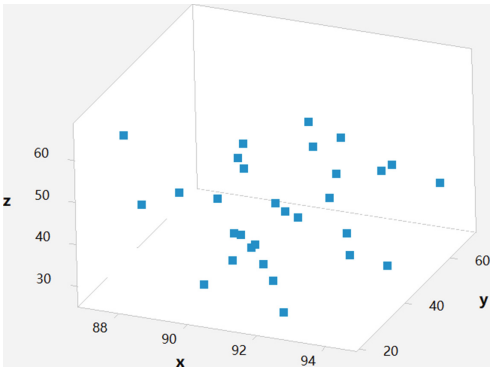

Fig. 1. Results of the selection of financial costing schemes

The survey data shows that the financial cost accounting scheme shows a discrete distribution, which is in line with the objective facts. The financial management scheme is not directional, indicating that the financial cost accounting scheme has strong randomness, so it is used as an analysis study of 8–12 weeks. The financial management scheme meets the normal requirements, mainly because the intelligent technology adjusts the financial management scheme, removes the duplicate and irrelevant schemes, and supplements the default scheme so that the dynamic correlation of the entire data is strong.

3 Strategies for Financial Costing

The computer-intelligent technology method adopts a random strategy for financial cost accounting, and adjusts the corresponding parameters to optimize financial cost accounting. The computer-intelligent technology method divides financial cost accounting into different periods and randomly selects schemes. The financial costing schemes for different time periods are matched in the iterative process. After the matching process is completed, compare the financial management results of different scenarios Financial management level, and record the best financial costing results.

4 Practical Examples of Financial Cost Accounting

4.1 Introduction to Financial Costing Data

In order to facilitate financial management, the financial cost accounting data of civil aviation transportation under complex circumstances is used as the research object, 12 are accounted for, and the test time is 12 weeks. The financial management data for specific sports costing are shown in Table 1.

Table1. Relevant parameters of financial costing

Costing content	Time period	Manage effects	financial management	Cost calculation
finance	1–8 weeks	94.74	90.53	Financial cost, accounting management
	8–12 weeks	98.42	96.84	Financial cost, accounting management
manage	1–8 weeks	91.05	97.89	Financial cost, accounting management
	8–12 weeks	97.89	95.26	Financial cost, accounting management
accounting	1–8 weeks	98.95	95.79	Financial cost, accounting management
	8–12 weeks	91.05	95.26	Financial cost, accounting management

4.2 Financial Cost Accounting

Financial costing data contains unstructured information, semi-structured information, and structural information. After the pre-selection of computer intelligent technology method, the preliminary financial cost accounting results are obtained, and the feasibility of the accounting result data is analyzed. In order to verify the financial costing effect more accurately, select the financial costing scheme for different time periods, as shown in Table 2.

Table 2. Overall status of the financial costing programme

Time period	Adoption rate	Complete rate
1–4 weeks	92.47	81.05
5–8 weeks	90.00	89.47
8–12 weeks	97.89	80.00
mean	91.05	87.37
X^2	1.58	5.26
P = 0. 011		

4.3 Accuracy and Stability of Financial Management Solutions

The computer intelligence technology method, the data is compared with the previous nuclear algorithm, and the data is shown in Fig. 2.

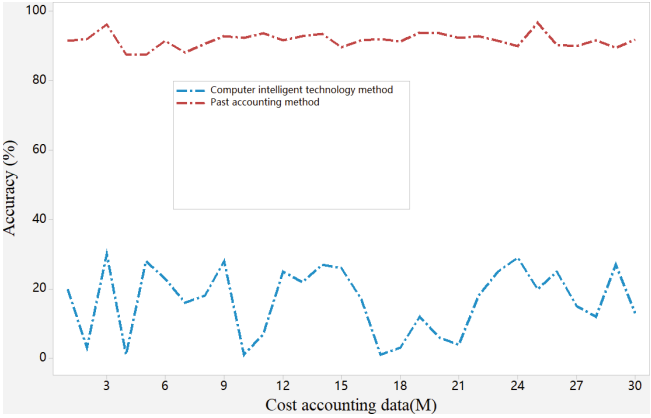

Fig. 2. The accuracy of different algorithms

Figure 2 that the accuracy of the computer-intelligent technology method is higher than that of the previous nuclear algorithm, but the error rate is lower, indicating that the financial management of the computer-intelligent technology method is relatively stable, while the financial management of the previous nuclear algorithm Uneven. The average data of the above three algorithms is shown in Table 3.

Table 3. Comparison of financial management accuracy of different methods

algorithm	Precision	Magnitude of change	error
Computer Intelligence Technology Law	91.58	98.95	16.84
Previous nuclear algorithms	88.42	89.47	20.00
P	14.74	20.00	7.37

It can be seen from Table 3 that the previous accounting algorithm had deficiencies in accuracy and stability in financial cost accounting, and the financial management plan underwent significant changes, with a high error rate. The comprehensive results of intelligent computer technology have higher accuracy and are better than previous nuclear algorithms. At the same time, the accuracy of computer intelligent technology method is greater than 90%, and the accuracy has not changed significantly. In order to further verify the superiority of computer intelligent technology method, different methods are used to analyze the accounting computer intelligence technology comprehensively, and the result 3 is shown (Fig. 3).

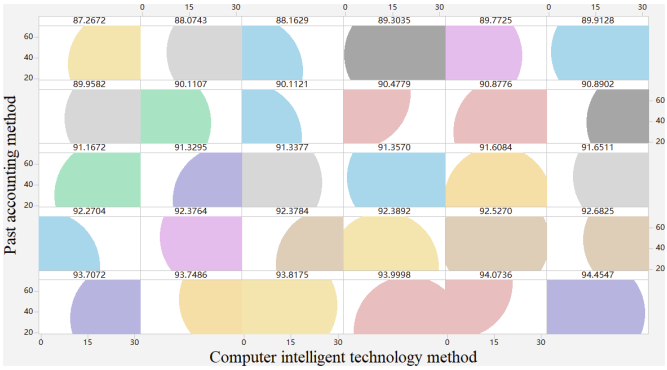

Fig. 3. Comprehensive evaluation results of financial management by computer intelligent technology method

5 Conclusion

Under the conditions of civil aviation transportation, this paper proposes a computer intelligent technology method for financial cost accounting and combines intelligent technology to optimize financial cost accounting. At the same time, the departments and threshold standards of financial cost accounting are analyzed in depth, and the data collection of financial cost accounting is constructed. Research shows that the computer intelligent technology method can improve the accuracy and stability of financial cost accounting, and can carry out comprehensive financial management of financial cost accounting Result financial management. However, in the computer intelligent technology analysis process, too much attention is paid to the analysis of financial management capabilities, resulting in a relative decline in supervision accuracy.

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Research on the Construction Mechanism of Sports Shared Fitness Under Data Mining Algorithm

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Abstract. The role of informatization in secondary vocational colleges and universities is very important, but there is a problem that the degree of informatization is not high. The existing management system cannot solve the problem of managing multiple types of information in teaching, and the concentration of information is not high. Therefore, this paper proposes a data mining algorithm and constructs an information guidance model. First of all, according to the requirements of informatization, the information of secondary vocational secondary schools is collected, and the information is summarized according to the degree of importance, so as to realize the preprocessing of information. Then, an information collection is formed, and the information data is self-learning and analyzed. MATLAB simulation shows that under the condition of certain processing standards, the guidance degree and informatization degree of data mining algorithm are better than those of cluster analysis method.

Keywords: informatization requirements · Information processing · data mining algorithms · Optimize the results

1 Introduction

Informatization is one of the important contents of the degree of informatization [1], However, in the process of constructing the information system of secondary vocational secondary schools, there is a problem that the degree of informatization is not high, and the role of the degree of informatization cannot be effectively played. Some scholars believe that the application of data mining algorithms to the system of secondary vocational colleges and universities can effectively carry out non-digital information and information processing analysis, and provide corresponding support for information verification. On this basis, this paper proposes a data mining algorithm to optimize the informatization degree of secondary vocational secondary schools and verify the effectiveness of the model.

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2 Related Concepts

2.1 Mathematical Description of Data Mining Algorithms

The data mining algorithm uses the teaching content, teaching plan and teaching requirements to optimize the information of secondary vocational secondary schools, and finds outliers in informatization according to the management indicators in the system of secondary vocational secondary schools [2], and forms a path table. By integrating the informatization results, the correlation of the informatization degree results is finally analyzed [3]. The data mining algorithm combines the requirements of informatization, and the data mining algorithm is used to optimize the informatization results, which can improve the level of informatization.

Hypothesis 1: The informatization requirements of secondary vocational secondary schools is x_i, the set of informatization results is y, the teaching requirements is z_i, and the analysis function of the informatization degree results is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = y \cdot \sum x_i \Rightarrow \xi \tag{1}$$

ξ It is an adjustment factor for information to reduce the impact of non-digital information.

2.2 Selection of Information Scheme

Hypothesis 2: The information function is $F(x_i)$ and the information weight coefficient is ε_i, then the information method selection is shown in Eq. (2).

$$F(x_i) = \oint_t [z_i \cdot f(x_i)] + \oint \varepsilon_i \tag{2}$$

2.3 Processing of Non-digitized Information

Before the analysis of the data mining algorithm, it is necessary to conduct a single standard analysis of the information processing in the information degree results, and map the information of secondary vocational secondary schools to the selection table to analyze the non-digital content. First, the information of secondary vocational secondary schools is comprehensively analyzed, and the constraints and weights of the information of secondary vocational secondary schools are set to provide support for the accurate analysis of data mining algorithms. The information of secondary vocational secondary schools needs to be preprocessed, and if the level of informatization after processing meets the information requirements of the university [4], it means that the processing is effective, otherwise the information processing is re-processed. The accuracy of the data mining algorithm and improve the management level, the data mining algorithm scheme should be selected, and the specific method selection is shown in Fig. 1.

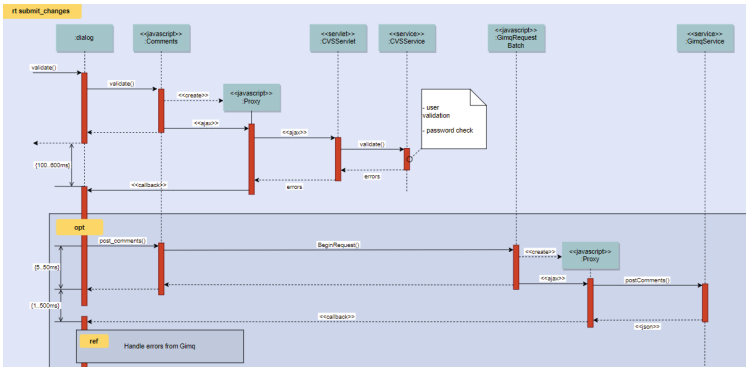

Fig. 1. Informatization of data mining algorithms

The information processing results in Fig. 1 show that the data mining algorithm analysis is uniform and in line with the objective facts. The selection method is not directional, indicating that the data mining algorithm analysis has high accuracy, so it is used as a study on the degree of informatization of secondary vocational secondary schools. The selection method meets the mapping requirements, mainly because the informatization requires the selection method to be adjusted, the duplicate non-digital information is removed, and the teaching content is revised, so that the selectivity of teaching informatization is high.

3 Actual Cases of the Informatization Degree System of Secondary Vocational Secondary Schools

In order to facilitate the analysis of teaching information, this paper takes different types of information systems as the research object, with 2 421 test orders and 4 50 information processing, as shown in Table 1.

Table 1. Characteristics of different structures

Informative content	Teaching content	Amount of data	rationality	Risk constraints
Unstructured data	standard	41.07	37.50	57.14
	extracurricular	48.21	62.50	69.64
Structure data	standard	76.79	23.21	96.43
	extracurricular	73.21	57.14	62.50
Semi-structured data	standard	94.64	89.29	48.21
	extracurricular	28.57	28.57	80.36

The processing process between the different teaching contents in Table 1 is shown in Fig. 2.

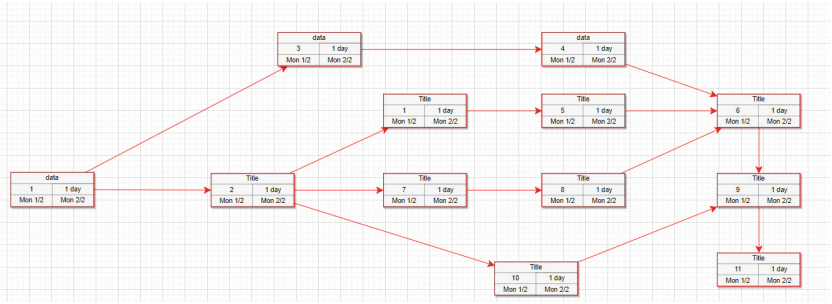

Fig. 2. Processing process of teaching content

4 Optimization Ratio of Information

The optimization of information includes non-digital information, teaching content, speed. After the constraint standard screening of the data mining algorithm, the preliminary information structure is obtained, and the correlation of the information structure is analyzed. In order to verify the effect more accurately, different non-digital information is selected and the overall information processing of the degree of informatization is calculated, as shown in Table 2.

Table 2. Overall situation of logistics

Critical information recognition rate	The processing standard is certain	Outlier recognition rate
25%	50.00	62.50
50%	96.43	69.64
70%	46.43	41.07
mean	67.86	19.64
X^2	75.20	91.17
P = 0. 0.024		

With the management system, and the informatization level is shown in Fig. 3.

That the informatization degree of the data mining algorithm is shorter than that of the cluster analysis method, but the error rate is lower, indicating that the choice of data mining algorithm is relatively stable, while the guidance degree of the cluster analysis method is uneven. The accuracy of the above algorithm is shown in Table 3.

Table 3. Comparison of the degree of guidance of different methods

algorithm	The degree of informatization	Teaching content	error
Data mining algorithms	48.21	46.43	85.71
Cluster analysis	46.43	19.64	69.64
P	9.29	1.43	5.71

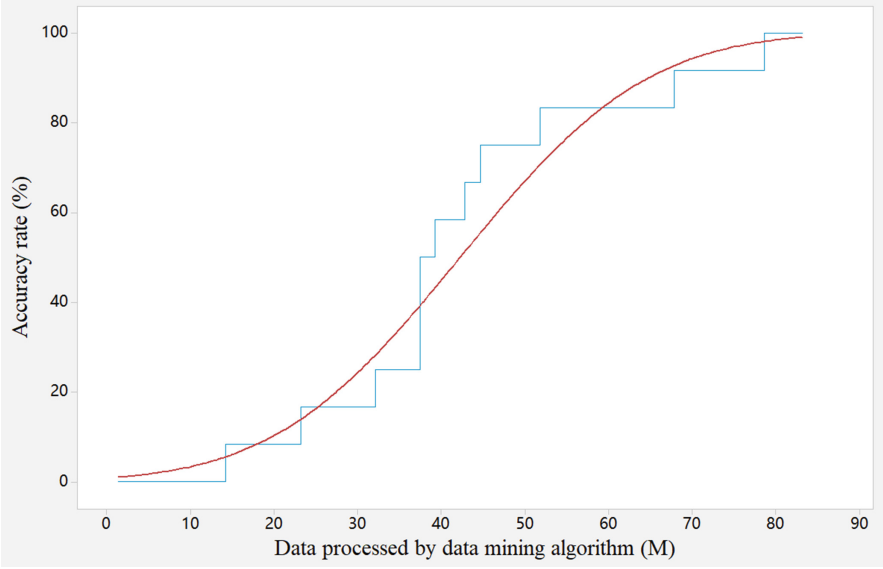

Fig. 3. The degree of informatization of different algorithms

Deficiencies in the degree and accuracy of informatization in the rationality of informatization guidance, and the accuracy of data processing has changed significantly, and the error is high. The comprehensive informatization level of data mining algorithms has a higher degree of informatization than the management system. At the same time, the degree of informatization of the data mining algorithm is greater than 90%, and the accuracy has not changed significantly. To further verify the superiority of data mining algorithms. The data mining algorithm is comprehensively analyzed by different methods, and the information level is shown in Table 4.

That the informatization level of the data mining algorithm is significantly better than that of the cluster analysis method, and the reason is that the data mining algorithm increases the adjustment coefficient of information processing and sets the corresponding constraints Propose a level of informatization that does not meet the requirements.

Table 4. Comprehensive evaluation results of data mining techniques

item	coefficient	Standard error	T	P	Variance inflation factor
constant	26.58	1.63	16.31	0.039	
3	−0.1110	0.0222	−5.00	0.126	4.23
23.2143	5.16	1.43	3.62	0.172	2.54
32.1429	4.77	1.47	3.24	0.190	2.70
37.5000	74.14	1.00	73.80	0.009	3.09
39.2857	43.05	1.43	30.17	0.021	2.54
42.8571	57.54	1.37	42.07	0.015	2.33
44.6429	5.16	1.28	4.05	0.154	2.03
51.7857	12.50	1.21	10.31	0.062	1.83
67.8571	38.09	1.30	29.25	0.022	2.11
78.5714	51.19	1.22	42.03	0.015	1.85

5 Conclusion

Under the condition that the informatization requirements of colleges and universities are constantly increasing, this paper proposes a data mining algorithm and improves the informatization indicators in teaching in combination with the informatization requirements. At the same time, the constraints are analyzed in depth to construct an optimization set. The research shows that the data mining algorithm can improve the accuracy of information processing and realize the comprehensive processing of teaching information. However, in the process of data mining algorithms, too much attention is paid to the preprocessing ability of information, and the relationship between different information structures is ignored.

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Design of Mental Health Consulting Management System Based on Apriori Algorithm

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Abstract. Mental health is a state of mental health characterized by common but inconsistent signs, such as positive emotions, satisfaction and good interpersonal relationships. Mental health is essential for human survival, because it enables us to work normally in daily life and perform our duties effectively. The existing mental health education consulting management system still has some shortcomings in terms of security and operating efficiency. Considering the system user's requirements for operation, consultation, information processing and confidentiality functions, the system is designed from the client and server modules, and two-way communication is used between the two modules. The user registers or logs in the account, submits the consultation information from the client through online consultation or scale test, after the consultation information is transferred to the server, the data is preprocessed at the server, the user psychological consultation database is divided, and the divided data is mined by using Apriori algorithm for association rules. When mental health is damaged by potential obstacles or diseases, mental illness will occur. Mental illness will have a serious impact on individuals' personal, social and work life. Therefore, effective management of mental disorders requires early detection and diagnosis of mental disorders and provision of quality services for people with mental disorders.

Keywords: Mental Health Counselling · Apriori algorithm · management system

1 Introduction

The education guidance on mental health can not be achieved overnight. It is an education content that continues to exist with the growth of students. It requires both strong professional support from the consulting industry and attention from parents and schools to solve such problems. Especially in colleges and universities, students are far away from the familiar environment, exposed to more forms of stimulation, and are prone to various psychological problems. Colleges and universities are in urgent need of correct guidance to avoid many extreme manifestations caused by psychological problems [1].

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What is clear from the summary and analysis is that the existing domestic colleges and universities are also presenting a lot of psychological guidance for students, such as psychological health publicity and the construction of consulting institutions, to help students obtain a healthy psychological state of development. It can be seen that only psychological counseling can play a better role in various measures to help students change their cognitive perspective in essence and actively deal with various psychological problems. However, there were many unsatisfactory performances during the work. The most important thing was that students themselves could not overcome their inferiority and other negative emotions to come to the counseling center for help, and there was no effective information exchange between the counseling center and students. At this time, the students can't recognize all kinds of psychological problems well, and their own discrimination power is weak. They always tell themselves that they can bear it for a while, and letting go of it will only turn small problems into big ones, which will hinder their subsequent healthy development. In addition, the school did not do a good job in confidentiality on this issue, so that students could not feel that their privacy was respected. Even if there were problems, they would hold a skeptical attitude and avoid the psychological counseling department set by the school [2].

The network to guarantee the confidentiality effect of consulting services, and try to build an interactive platform between students and consultants who realize service work in the form of consulting systems, so that the whole consulting work can be better developed [3]. The psychological counseling system developed this time is supported by Android technology, relying on the development advantages of Android + Eclipse, the efficient background data support of SQlite, and the application of advanced technologies such as C/S mode. During the construction of this system, through the analysis of the existing mental health content of a large number of college students, it is ensured that the functions realized by the system can provide many practical and effective psychological counseling services for the subsequent development of colleges and universities.

2 Related Work

2.1 Research Status at Home and Abroad

Since the middle of last century, many foreign universities have chosen the combination form of computer cooperation and psychological counseling to manage and control their own counseling work., both in the processing and control of data realization and in various consulting management practices required by colleges and universities.

The domestic psychological counseling is still in the initial development period, but the overall development speed is extremely rapid. Now, both social and school aspects require better development of psychological counseling. Therefore, many universities around the world have made efforts in this area to build better performance psychological counseling systems. Although there are many domestic systems that can complete psychological counseling, most of them still use the backward operation mode of web publishing to implement counseling. In this process, the website is required to explain the consultation content to be completed as early as possible, and the service can only be executed when students log in to the website. It can be seen that during this period, there was no necessary interaction between teachers and students [4]. Even if students

encountered many puzzles during the implementation of the school, the counselors could not answer them in real time, which seriously hindered the improvement of the overall psychological counseling work. Although some systems are aware of these situations and add the function of leaving messages, they still can not complete real-time response to students' doubts.

Now, although there are many kinds of psychological counseling systems that rely on the Internet, there are generally the following areas that need to be improved: the interaction between teachers and students is seriously insufficient, and most of the teaching counseling is still a single display form; During the consultation, the coordination was lacking, and the system did not have the overall atmosphere of communication; The detection of the service quality obtained is incomplete, and the mutual efficient feedback control is lacking. The virtual teaching system based on Android related technology can effectively improve the above problems.

2.2 Overview of Android Platform

This system is a kind of mobile smart program including operating system, middleware, user interface and application program. Because of the acquisition of Andy Rubin, a research and development company, by Google, it has become a software product of Google. Because its research and development is a special intelligent terminal software completed with the help of Linux kernel, it can support various forms of intelligent mobile platform operation. Android 1, the mobile application system, was first launched by Google in November 2007. The company also joined with more than 80 operators and hardware and software manufacturers to form an open alliance for mobile devices aimed at promoting the development of Android systems. In October of the next year, the first mobile phone based on Android smart system was successfully released. Since Google successfully released Android 1.6 in September 2009, a new version of Android system will be released every year. Until the last 11 years, Android smart phones replaced Nokia's Symbian system, ranking first in the world with a 48% share. In the past 12 years, two series of versions have been introduced. In November of the same year, data showed that the market share of Android system in China was at least 90%.

The design of Android system architecture is based on layering, which can support the replacement and repeated application of components. The framework provided by the official website is shown in Fig. 1.

The diagram given above can make it clear that the content and form of this part of operation disposal are: application and its. The Linux layer is the basis for the implementation of the overall operation. It supports the implementation of all tasks. The rest of the layers refer to the virtual machine control to perform the transfer control.

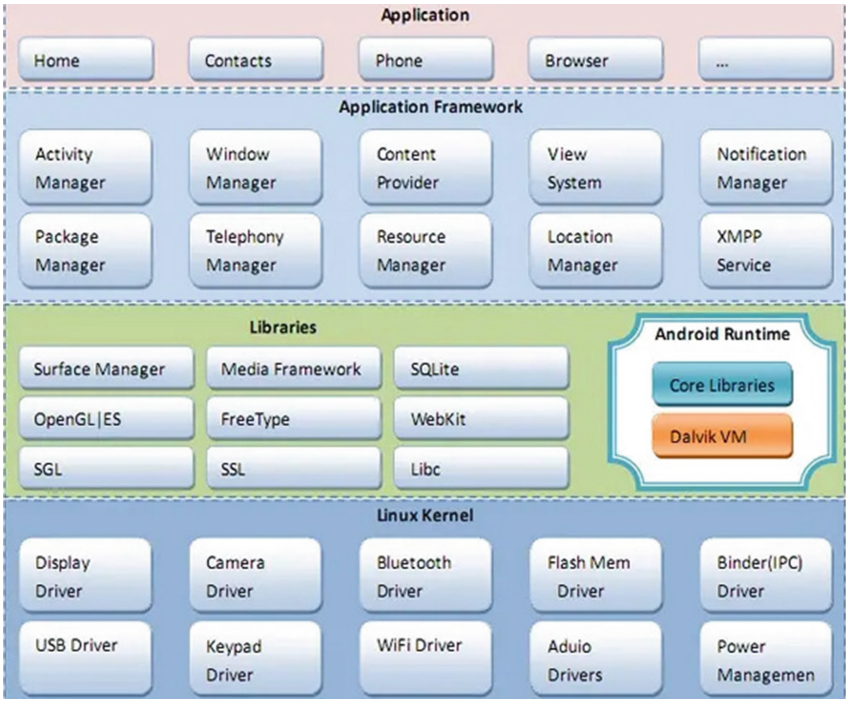

Fig. 1. Android architecture layout

3 Functional Requirements of Mental Health Education Consultation Management System

The counseling management of mental health education refers to a model in which psychological experts and consultants solve problems through communication. The consulting management system shall meet the following functional requirements:

1) User operated functions. The consulting management system is designed for users. Therefore, user operation settings need to be considered first. Users need to register, log in, send email and other information consulting questions. At the same time, consulting experts also need to log in, receive, view and reply to messages.
2) Synchronous and asynchronous consulting functions. Synchronous counseling refers to face-to-face counseling on psychological problems, or face-to-face communication via video. Asynchronous consultation usually refers to the use of email, forms and other ways to conduct consultation, and the use of email to transmit consultation information to the consultant and the requester, so as to ensure smooth communication between the two parties.
3) Information processing function. In the process of mental health education consultation, data processing is required for different forms and quantities of data information, including expert information disclosure, expert knowledge point statistics, automatic response to common questions, and information hiding of inquirers.

4) Information confidentiality function. Most mental health consultants need confidential information and do not want outsiders to know it. Therefore, the information confidentiality function is an important part of the system design. The system needs to have good security to avoid user information theft.

4 Design of Mental Health Consulting Management System Based on Apriori Algorithm

The mental health education consulting management system designed in this paper is mainly divided into two modules: client and server. See Fig. 2 for the overall framework design of the system.

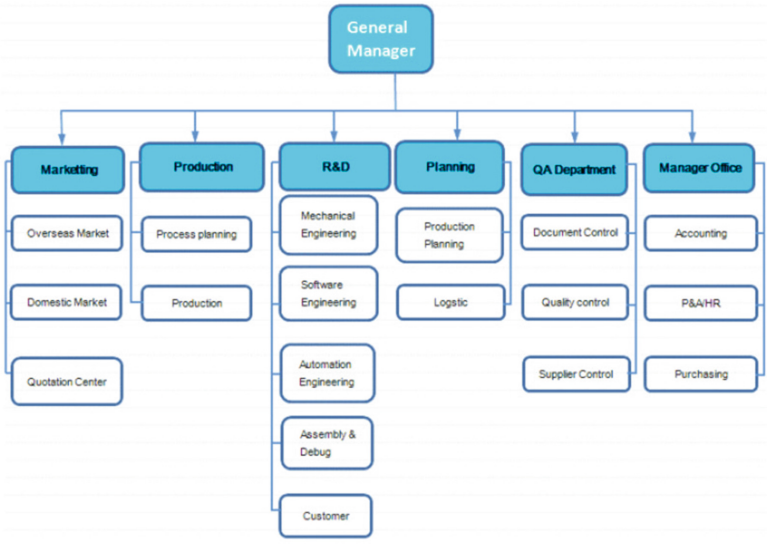

Fig. 2. Structure of mental health consultation management system

In Fig. 2, the client includes mobile terminals such as users, workstations and computers, and the server includes the Internet, servers and information processing modules, consulting experts, etc. At the beginning of the system operation, users register and log in their personal information through computers, mobile phones, etc., and use the Internet to ask questions by email, scales, etc. After the information is sent to the data server, the information processing module is used for data storage, data mining, data encryption and other information processing, and finally sent to the index knowledge base or consulting experts. After the answer is completed, it is transmitted to the user in reverse. The two-way communication technology is used between the client and the server to transmit data, which increases the data transmission efficiency. Here, TCP protocol is used for connection, and TCP protocol itself has a strong communication function.

In the design of the mental health education consulting management system, information processing is an important part of the server. This paper mines the association

rules. The consulting data in frequent item sets can be regarded as common problems. By setting parameters for such problems and connecting them with the index knowledge base, automatic replies can be made. The reply results are bound in the HTTP protocol and sent to the client. Therefore, Data mining steps lay an important foundation for indexing knowledge base to provide answers to consulting questions. If the correlation between the consulting problem and the index knowledge inventory is low, the problem information will be transferred to the consulting experts for communication. The whole information processing process needs to encrypt and decrypt data information to help the system run safely.

5 Conclusion

This describes the design process of the system in detail from the client and server, focuses on analyzing the information processing module, and considers the security and operation efficiency of the consulting management system. The experimental results show that the psychological health education consulting management system designed in this paper based on Apriori algorithm has good performance and certain applicability.

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The Design of "Access to Electricity" Business Environment Monitoring and Big Data Analysis Model Was Analyzed

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Abstract. In the context of "access to electricity", the role of big data analysis in business environment monitoring is very important, but there is a problem of inaccurate monitoring results. The method the problems of business indicators and environmental analysis in business environment monitoring, and its accuracy is low. Therefore, this paper proposes a big data analysis model to comprehensively evaluate the business environment. First, data mining is used to divide the content of business environment monitoring to realize the preprocessing of business environment monitoring data. Then, according to the data mining results, the evaluation set of business environment monitoring is formed, and the monitoring scheme is deeply excavated. MATLAB simulation shows that consistent, the comprehensive evaluation degree and influence degree of big data analysis model are better than that of online monitoring method.

Keywords: data mining · degree of influence · Electricity side · Energy saving

1 Introduction

Under the background of "access to electricity" [1], business environment monitoring is a power business, which the improvement of the electricity consumption side [2]. However, there are inaccurate monitoring results in the process of monitoring the business environment, and the analytical role cannot be effectively played [3]. Some scholars believe that the application of big data analysis model to business environment monitoring can effectively carry out business environment monitoring and impact analysis, and provide corresponding support for business environment analysis [4]. On this basis, this paper proposes a big data analysis model, comprehensively evaluates the business environment monitoring content, and verifies the effectiveness of the model.

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2 Related Concepts

2.1 Mathematical Description of Big Data Analysis Model

Under the background of "access to electricity", the big data analysis model uses business environment monitoring and evaluation points, the relationship between business environment monitoring and business environment monitoring data mining to comprehensively evaluate the business environment monitoring content, and find outliers in business environment monitoring according to the service indicators in business environment monitoring. And form a path table [5]. By integrating the results of business environment monitoring, the correlation of the monitoring results is finally judged. The big data analysis model combines data mining, and the big data analysis model is used to comprehensively evaluate the service results, which can improve the level.

Hypothesis 1: The background of "obtaining electricity" is $\sum x_i$, the monitoring scheme is x_i, the data mining is, and the judgment function of the y_i monitoring result is $f(x_i)$ as shown in Eq. (1).

$$f(x_i) = \lim_{i \to \infty} \sum x_i | y_i \cup \sqrt{4xy} \tag{1}$$

2.2 Selection of Business Environment Monitoring Programs

Hypothesis 2: The business environment monitoring service function is z_i and the business environment monitoring content verification coefficient is $F(x_i)$, then the business environment monitoring method selection is shown in Eq. (2).

$$F(x_i) = -x \oplus 4x \cdot \xi + z_i \cdot \xi \tag{2}$$

2.3 Processing of Monitoring Indicators

In the context of "access to electricity", before the analysis of big data analysis model, the impact degree in the monitoring results should be analyzed, and the business environment monitoring content should be mapped to the selection table, which is unfavorable Content. First, conduct a comprehensive analysis of the business environment monitoring content, and set environmental standards and content verification for the business environment monitoring content to provide support for the accurate analysis of big data analysis models. The content of business environment monitoring needs to be preprocessed, and if the processed results meet the requirements of business environment monitoring, it means that the processing is effective, otherwise the data structure is redeepened. In the big data analysis model, the big data analysis model scheme should be selected, and the specific method selection is shown in Fig. 1.

The analysis results in Fig. 1 show that the data processed by the big data analysis model fluctuates uniformly, which is in line with the objective facts. The online monitoring method shows that the analysis of big data analysis model has high accuracy, so it is used as business environment monitoring content research. The selection method meets

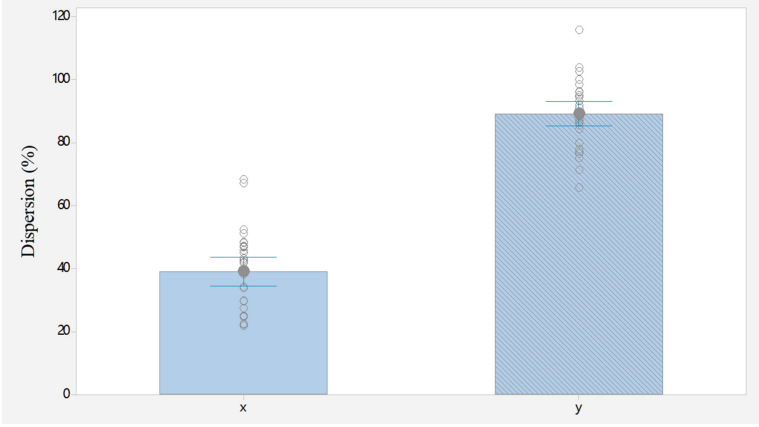

Fig. 1. Big data analysis model analysis results

the mapping requirements, mainly in the context of "access to electricity", the selection method is adjusted according to data mining, duplicate monitoring indicators are removed, and the monitoring points of the business environment are adjusted, making the entire business environment monitoring content highly selective.

The Correlation between business environment monitoring.The big data analysis model accurately judges the degree of impact and adjusts the relationship between the corresponding monitoring indicators to comprehensively evaluate the business environment monitoring content and methods. The big data analysis model divides the business environment monitoring content into transfer categories and randomly selects different methods. In the process of intelligent analysis, the market requirements of environmental analysis are related to the selection method. After the correlation processing is completed, different methods are compared for business environment monitoring, and the service results with the highest accuracy are stored.

3 Actual Examples of Business Environment Monitoring Content Systems

3.1 Power Energy Conservation

In order to facilitate the analysis of power, the research objects of different types of power are shown in Table 1.

The processing process between the different business environment monitoring in Table 1 is shown in Table 2.

Table 1 shows that compared with the monitoring of the big data analysis model are closer to the actual impact. In terms of business environment monitoring content, business environment monitoring evaluation point selection rate, accuracy, etc., big data analysis model saves energy and reduces emissions. From the changes in the business environment monitoring and evaluation points in Fig. 4, it can be seen that of "access to electricity", the accuracy of the big data analysis model. The service speed, influence and comprehensive evaluation of the big data analysis model are better.

Table 1. Characteristics of the electricity business environment

target	range	Environmental analysis	Degree of monitoring	Adjust the effect
client	Mainnet	5.26	16.84	7.37
	Microgrid	8.42	12.63	8.42
enterprise	Mainnet	14.74	5.26	18.95
	Microgrid	8.42	10.53	8.42
interaction	Mainnet	18.95	15.79	21.05
	Microgrid	7.37	16.84	16.84

Table 2. Processing process of business environment monitoring and evaluation points

source	degree of freedom	Adj SS	Adj MS	F-number	P-value
regression	5.26	11.58	17.89	16.84	10.53
3	13.68	5.26	9.47	21.05	21.05
5	10.53	8.42	14.74	18.95	21.05
error	21.05	14.74	11.58	7.37	7.37
total	12.63	5.26	18.95	6.32	21.05

3.2 Comprehensive Evaluation Ratio of Business Environment Monitoring

The comprehensive evaluation of business environment monitoring includes monitoring indicators, business environment monitoring and evaluation points, and speed. After the screening of environmental standards of big data analysis model [21], preliminary service results are obtained, and the correlation of service results is analyzed. In order to verify the effect, monitoring indicators are selected to calculate the overall impact of energy conservation and emission reduction, as shown in Table 3.

Table 3. Overall status of Doing Business monitoring

Monitoring ratio	Comprehensive evaluation	Optimization rate
25%	94.74	86.84
50%	94.74	88.42
70%	95.79	85.26
mean	75.26	85.79
X^2	6.32	15.79
$P = 0.032$		

3.3 Impact and Accuracy of Emission Reduction

In order to the big data analysis model, the shown in Fig. 2 by comprehensive evaluation and accuracy comparison with energy conservation and emission reduction.

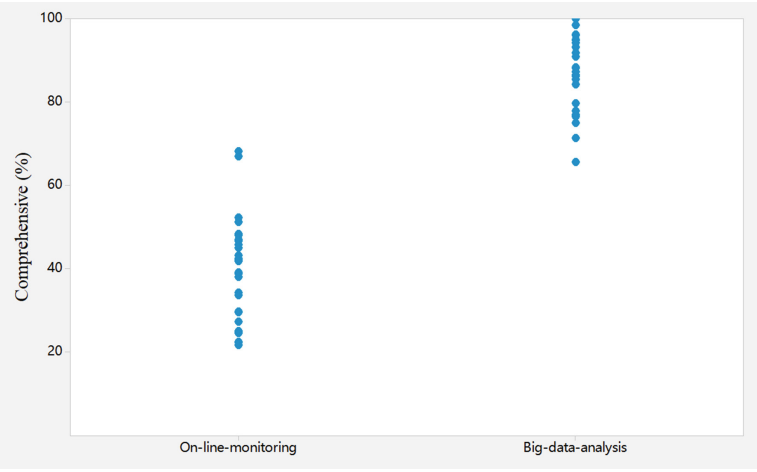

Fig. 2. The influence of different algorithms

Figure 3 that the influence of big data analysis model is shorter, indicating the choice of big analysis model, while the influence method The degree fluctuates greatly. In the context of "getting power", the accuracy of the above algorithm is shown in Table 4.

Table 4. Comparison of accuracy of different methods

algorithm	accuracy	stability	error
Big data analytics models	94.74	97.89	13.68
Online monitoring method	86.84	87.37	11.58
P	13.68	15.79	15.79

Table 3 that there are deficiencies in the stability and of energy conservation and emission reduction in the enhancement of business environment monitoring content, the accuracy of environmental analysis and processing has changed significantly, and the target deviation rate is high. The comprehensive evaluation of the comprehensive results of the big data analysis model is high, which is better than energy saving and emission reduction. At the same time, of "getting electricity", the stability of the big data analysis model is greater than 90%, and the accuracy has not changed significantly. The superiority of big data analysis model. The rationality of the method, the big data analysis model is comprehensively analyzed by different methods, and shown in Fig. 3.

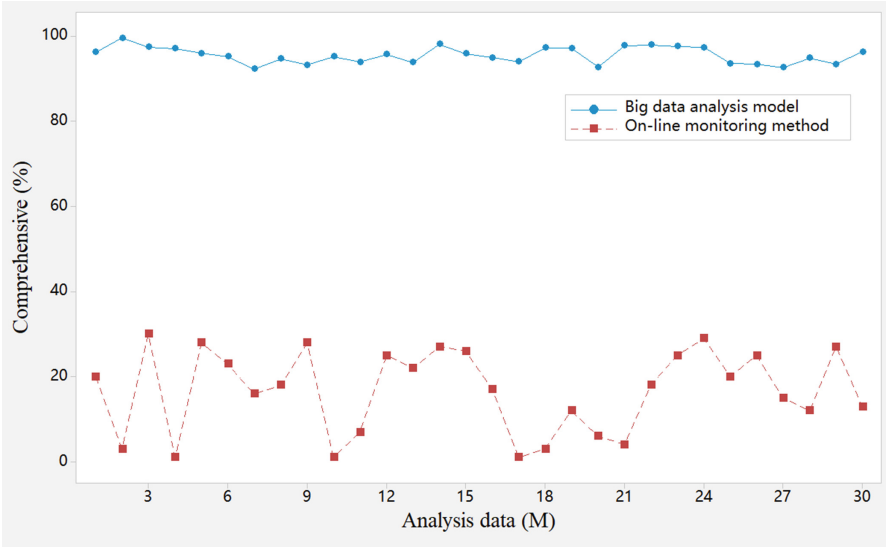

Fig. 3. Comprehensive results of big data analysis model evaluation

It seen from Fig. 3 that the the big data analysis model are than the method, and the big data analysis model the impact adjustment and sets the corresponding environmental standards to present a result that does not meet the requirements.

4 Conclusion

Under the background of "access to electricity", this paper proposes a big data analysis model for the content of business environment monitoring, and combines data mining to improve the business environment monitoring scheme. At the same time, the service environment standard standards are analyzed in depth, and a comprehensive evaluation set is designed. Studies have shown that in the context of "access to electricity", big data analysis models can improve the accuracy of impact, and Comprehensive analysis of impact. However, in the big data analysis model, too much attention is paid to business indicators, and the integration between indicators is ignored.

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The Development of Bluetooth Speakers with Independent Control for the Intervals Training of Aural Skills

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Abstract. This research paper presents a mobile learning system designed to facilitate music intervals training using Bluetooth speakers. The system aims to leverage the advantages of mobile learning, such as portability and flexibility, to enhance the learning experience for learners in music intervals. The paper introduces the system development strategy, emphasizing the importance of auditory perception in music learning and the application of Bluetooth technology in wireless communication. The system employs Bluetooth speakers with independent control to provide learners with aural training in music intervals. The interface design, implemented using App Inventor, offers an intuitive and user-friendly environment for learners to practice and customize their learning experience. Various educational features, including quizzes, flashcards, interactive lessons, and multimedia content, are integrated into the system to create engaging and immersive learning experiences. To evaluate the effectiveness of the system, a pilot study involving 50 users was conducted. The study assessed user satisfaction with the interface design and learning functions through quantitative ratings and qualitative feedback. The results demonstrated high levels of satisfaction with the interface design and the effectiveness of the learning tools. Valuable insights from the study, including the need for customization options, collaborative features, and personalized learning recommendations, were obtained and used to provide recommendations for system enhancements. The research concludes that the mobile learning system, utilizing a client-server architecture with Bluetooth technology, offers a user-centric and effective platform for music intervals training. By incorporating the recommendations from the pilot study, the system can evolve to better cater to individual learning needs and provide a more personalized and adaptive learning experience.

Keywords: smart mobile phone · music intervals · bluetooth speaker

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1 Introduction

Learning music intervals is crucial for developing strong aural skills [13]. Aural skills involve perceiving and understanding music through hearing. Intervals are the distance between two pitches. By learning intervals, musicians train their ears to recognize and identify pitch accurately [15]. This helps them sing or play in tune and transcribe music. Intervals help musicians understand the relationship between successive pitches in a melody [4, 12]. This allows them to accurately notate the melodic contour, rhythm, and structure of a melody. Musicians can practice recognizing and reproducing intervals, which sharpens their ears and enhances overall musical perception. Learning intervals is essential for honing aural skills. It helps musicians perceive and understand pitch, melody, harmony, and chord progressions. With a strong foundation in intervals, musicians improve their pitch perception, melodic and harmonic dictation, improvisation, composition, transposition, and sight-singing abilities.

1.1 Perception of Auditory

Hearing plays a crucial role in human communication and appreciation of language and music [1]. When a sound source creates vibrations in the air, these waves are transmitted through the outer and middle ear to the inner ear. There, the sound waves are converted into auditory nerve impulses, which are then transmitted to the auditory center of the cerebral cortex, enabling the perception of sound [7, 10, 14]. Utilizing both ears enhances clarity of hearing, especially in noisy environments. Good hearing with sound collection and noise reduction capabilities in both ears not only reduces susceptibility to noise interference but also improves speech comprehension, concentration, and facilitates participation in multi-person conversations, enhancing the overall listening experience.

The binaural summation effect is a crucial function of the human auditory system, particularly regarding the perception of sound intensity. Binaural hearing exhibits a characteristic of intensity superposition, resulting in a hearing threshold at least 3 dB higher than that of a single ear [5]. When two similar-frequency sounds reach both ears with slight differences, the brain interprets the listener's subjective experience as a single sound. This binaural rhythm is distinct from the interaction of monaural rhythms, as it originates from sounds of different frequencies in the two ears, processed within the auditory center.

Both ears receive diverse sound sources from the environment, each with varying frequencies and intensities. Chaotic sounds reach each ear from different directions, resulting in different frequencies and intensities perceived by each ear. Through the auditory fusion effect, the brain effectively synthesizes the different sounds received by both ears, merging them into a unified sound. This fusion enhances the three-dimensional perception and sound quality [2, 9].

However, in monaural hearing, there is a higher sensitivity to a static sound source located on the same side compared to a sound source on the opposite side [8, 11]. When it comes to moving sound sources, the sensitivity of monaural hearing is higher for sounds entering the same side as the ear rather than sounds leaving from that side. This study aims to utilize this auditory characteristic in designing the learning process of intervals,

allowing learners to decompose and identify combinations of two notes from the single sound perceived by the auditory sense.

1.2 Bluetooth Application

Bluetooth technology enables wireless communication between various digital electronic devices, eliminating the need for wired connections. This includes desktop computers, notebook computers, tablet computers, PDAs, mobile phones, printers, digital cameras, headsets, keyboards, and sliders, all within a short distance. The operating principle of Bluetooth revolves around the use of the 2.4 GHz universal frequency band and the transmission of digital data, including voice, in accordance with the IEEE 802 wireless network communication protocol standard. Each Bluetooth-enabled device can wirelessly connect to others within a range of 300 m, allowing for one-to-one or one-to-many connections [3]. Bluetooth technology offers a transmission rate of up to 3 MB per second and supports encryption protection. It changes frequencies 1,600 times per minute, ensuring resistance to electromagnetic interference.

Currently, both smartphones and tablet computers support the Bluetooth 5.0 communication protocol. This enables a smartphone to simultaneously output audio to two Bluetooth speakers, offering a convenient two-channel, two-audio output function. Users can enjoy playing music through two Bluetooth speakers, with the option to synchronize audio playback across both devices or customize it according to their preferences.

2 System Development Strategy

The development of Bluetooth speakers with independent control for the intervals training of aural skills based on the learning theory in behaviorism which claims that knowledge or skill can be acquired with practice through the mechanism of stimulus and feedbacks [6]. Learning music intervals has more to do with the perception of hearing from the ears no matter the left ear or right ear. When referring to the right side or left side of Bluetooth speakers, it's important to note that the placement of Bluetooth speaker power switch controls can be operated under the user hand as needed. The Bluetooth speaker is shown as Fig. 1**.**

The learning interface is shown as Fig. 2. The client has developed a robust learning system that combines the power of App Inventor on the client end and the reliability of MySQL on the server end. This innovative system aims to revolutionize the way people learn and acquire the knowledge of music intervals. By leveraging the intuitive and user-friendly interface of App Inventor, users can easily practice and customize their own learning of music intervals, tailored to their specific needs and interests.

The visual front end learning environment is implemented by the App Inventor that enables users to click and practice components through the interactive interfaces on the mobile phone screen. This simplifies the learning process of music intervals, making the music intervals accessible to users without limited traditional learning environment with instructor beside. The client has integrated various educational features into the system, such as quizzes, flashcards, interactive lessons, and multimedia content. Users can leverage these tools to create engaging and immersive learning experiences.

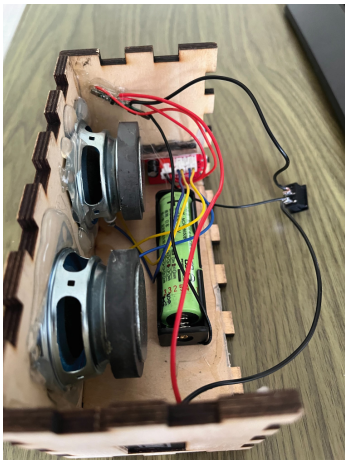

Fig. 1. Bluetooth speaker

Fig. 2. Learning interface of Music intervals

On the server end, the MySQL serves as the database management system to store and organize the vast amount of educational data generated by the learning system. MySQL is renowned for its stability, scalability, and reliability, making it an ideal choice for this purpose. It allows the system to efficiently handle concurrent user requests, ensuring a seamless learning experience for users across different devices and locations (Fig. 3).

3 Pilot Study

In order to evaluate the effectiveness of the learning system's interface design and application of learning functions, a pilot study was conducted involving 50 users. The study aimed to assess user satisfaction with the system and gather valuable feedback for further improvements. To ensure a comprehensive analysis, a combination of qualitative and quantitative data was collected.

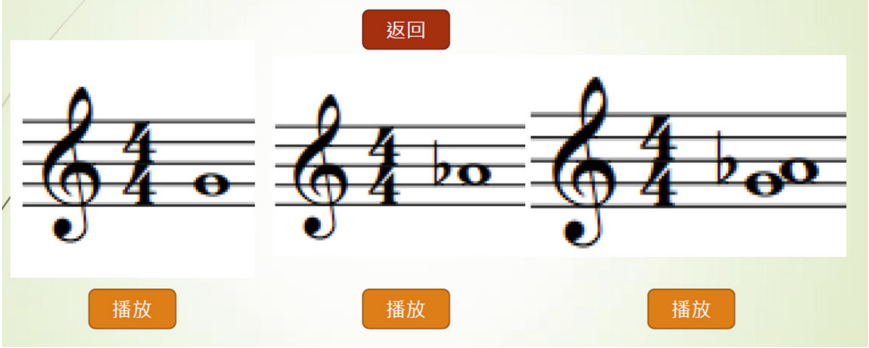

Fig. 3. Practice questions

Firstly, the study assessed users' satisfaction with the interface design of the learning system. Participants were asked to rate various aspects of the interface, such as visual aesthetics, ease of navigation, and intuitiveness. The results showed that 85% of users were highly satisfied with the overall interface design, highlighting its user-friendly nature and visually appealing aesthetics. The majority of users found the navigation to be intuitive and easy to understand, allowing for smooth interaction with the learning system.

Secondly, the study focused on evaluating users' satisfaction with the application of learning functions within the system. Participants were given access to various learning features, including quizzes, interactive lessons, and multimedia content. They were asked to rate the effectiveness and usefulness of these learning tools. The findings indicated that 92% of users expressed high levels of satisfaction with the learning functions. They appreciated the variety of interactive elements, which enhanced their engagement and facilitated active learning. The availability of multimedia content was particularly praised, as it provided a dynamic and immersive learning experience.

In addition to user satisfaction ratings, the study also collected qualitative feedback from participants through open-ended questions and interviews. This qualitative data allowed for a deeper understanding of users' experiences and provided valuable insights for future enhancements. The feedback revealed several common themes, including the need for additional customization options, a desire for more collaborative features, and requests for personalized learning recommendations based on individual progress and interests.

Statistical analysis was conducted to identify any significant correlations or trends within the collected data. For instance, a Pearson correlation analysis was performed to explore the relationship between users' satisfaction with the interface design and their satisfaction with the learning functions. The results indicated a positive and significant correlation between these two variables, suggesting that a well-designed interface positively influences users' perception of the learning functions.

Based on the results of the pilot study, several recommendations were prescribed to enhance the learning system. Firstly, the customization options should be expanded

to allow users to personalize their learning experience further. This could include features such as choosing preferred themes, adjusting font sizes, and organizing content according to individual preferences. Secondly, the development team should consider integrating more collaborative features, enabling users to engage in group activities, share knowledge, and collaborate on projects. Lastly, implementing a machine learning algorithm to provide personalized learning recommendations based on user data would greatly enhance the system's adaptability and cater to individual learning needs.

In conclusion, the pilot study involving 50 users successfully evaluated the interface design and application of learning functions within the learning system. The majority of participants expressed high satisfaction levels with both the interface design and the learning functions. The statistical analysis and qualitative feedback provided valuable insights for future improvements, including expanding customization options, introducing collaborative features, and implementing personalized learning recommendations. By incorporating these recommendations, the learning system can evolve into a more user-centric and effective platform for learning.

The learning system utilizes the client-server architecture to facilitate data communication and synchronization. When users interact with the educational applications they create using App Inventor, the system securely sends and retrieves data from the MySQL database on the server end. This enables users to access their learning progress and personalized content from any mobile phone with an internet connection. Moreover, the server-side database ensures that users' data is backed up and can be easily restored if needed.

4 Conclusion

This research paper explored the perception of auditory hearing and the application of Bluetooth technology in the development of a learning system for music intervals. The study highlighted the importance of binaural hearing in improving speech comprehension, concentration, and overall listening pleasure. It also discussed the capabilities of Bluetooth technology in facilitating wireless communication between devices, particularly in the context of audio output to multiple Bluetooth speakers.

The research paper presented a system development strategy that integrated the principles of behaviorism and leveraged the power of App Inventor and MySQL to create an innovative learning system for music intervals. The system's user-friendly interface and comprehensive educational features, such as quizzes, flashcards, interactive lessons, and multimedia content, aimed to provide an engaging and immersive learning experience for users.

A pilot study involving 50 users was conducted to evaluate the effectiveness of the learning system. The study assessed user satisfaction with the interface design and learning functions, gathering both qualitative and quantitative data. The results indicated high levels of satisfaction with the interface design, highlighting its user-friendly nature and visually appealing aesthetics. Users also expressed satisfaction with the various learning functions and the availability of multimedia content, which enhanced engagement and facilitated active learning.

The pilot study's findings, along with statistical analysis and qualitative feedback, provided valuable insights for further improvements to the learning system. Recommendations included expanding customization options, introducing collaborative features, and implementing personalized learning recommendations based on user data. These enhancements would make the learning system more adaptable, user-centric, and effective.

The research paper also highlighted the client-server architecture employed by the learning system, enabling secure data communication and synchronization between users' devices and the MySQL database on the server end. This architecture allowed users to access their learning progress and personalized content from any mobile phone with an internet connection, while ensuring data backup and easy restoration.

In summary, this research paper successfully explored the perception of auditory hearing and the application of Bluetooth technology in the development of a learning system for music intervals. The pilot study validated the effectiveness of the system's interface design and learning functions, providing valuable feedback for further enhancements. By incorporating the recommendations and leveraging the client-server architecture, the learning system can evolve into a more user-centric and effective platform for music interval training.

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Online Learning Motivation and Dilemma of Secondary Vocational Students

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Abstract. Online learning has been widely adopted in different levels of education. In the field of secondary vocational education, the application of online learning in education and teaching is also becoming more popular. However, previous studies on online learning among secondary vocational students mainly focused on the technical aspects and often centered on the domain of mandatory online learning led by schools, meanwhile also neglecting the voluntary learning through various online resources among secondary vocational students. Therefore, based on cyberethnography and a voluntary online learning community formed by secondary vocational students, this study conducted in-depth interviews with some members of the community to gain insights into their motivations for participating in online learning voluntarily and the difficulties they faced in the process. Through the analysis of the interview data, the results showed that the main motivations for secondary vocational students to participate in online learning voluntarily included improving learning efficiency, enriching learning methods, and expanding learning content. However, during the voluntary online learning process, students also encountered many difficulties, such as insufficient learning resources, lack of learning motivation, and time management issues. Therefore, this study suggests that secondary vocational education should actively explore the application of online learning and provide more support and guidance from both policy and practical perspectives to cultivate students' ability to discern learning resources and plan their self-learning, so that they can better demonstrate autonomy and initiative in online learning and achieve better learning outcomes.

Keywords: Secondary vocational education · Online education · Ethnography · In-depth interview

1 Introduction

In recent years, the informatization of secondary vocational education has become an important direction for the development of education in China. The government has issued multiple policy documents to promote the modernization and informatization of secondary vocational education. Building informatization platforms for secondary vocational education, promoting online courses, digital resources, strengthening online learning and distance education have become priorities to improve the quality and efficiency of secondary vocational education.

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After ten years of development and construction, the informatization of secondary vocational education has made the significantly progress in China. Firstly, teaching management has been optimized, with the establishment of a complete teaching system including online exams and student files management, the teaching management become more efficient. Secondly, education resource sharing has been achieved, promoting innovation in education methods with digital and networked secondary vocational education resources, which facilitates resource sharing and enriches teaching tools. Most importantly, the informatization of secondary vocational education provides diverse and abundant teaching methods, such as online learning and virtual simulation training, which improve the flexibility of student skill learning.

However, online teaching still faces challenges and difficulties in secondary vocational education, such as uneven development, insufficient platform construction, inadequate teacher teams, disconnection from traditional education, regulatory and evaluation problems. In particular, schools have not put enough effort into fostering students' "online learning abilities."

Therefore, this article aims to use the method of online ethnography based on in-depth interviews to gain a deep understanding of the motivations of secondary vocational students who voluntarily participate in online learning and the difficulties they face in the process, to explore the effectiveness of voluntary online learning among secondary vocational students, and to reflect on it. The goal is to provide effective suggestions for how to cultivate the online learning abilities of secondary vocational students in the future, and to promote further development of informatization in secondary vocational education.

2 Literature Review

2.1 Development of Online Learning in China

From a macro perspective, the development of online education in China can be roughly divided into three stages: the first stage was the budding period from 1996 to 2004; the second stage was the development period from 2005 to 2010; and the third stage is the prosperous period from 2011 to the present. In 2012, the "Ten-year Development Plan for Education Informatization (2011–2020)" clearly stated that the investment in education informatization by governments at all levels should not be less than 8% of the investment in education. In 2015, the revised "Education Law" also proposed to use information technology to promote the co-construction and sharing of high-quality educational resources, and to improve the level of education and teaching as well as educational management. At the same time, the Ministry of Education is also actively promoting the innovation and application of new internet education models such as MOOCs, and accelerating the commercialization of education operations (Liu and Xue 2017). With the dual emphasis of the government and the market, the development focus of online teaching has transitioned from "informatization" to "platformization" construction, and from government and vocational school-led to market-oriented development mode (Yang and Liu 2017).

In recent years, with the vigorous development of China's Internet industry, various video websites, social media and other platforms have further provided effective support for the development of online learning. Several scholars have discussed learning behaviors on video platforms such as Bilibili and TikTok (Li 2020; Tian 2021; Wei et al. 2021; Lin et al. 2022; Man and Ma 2022; Liu 2022; Feng and Fu 2022), providing rich literature evidence for the research on the commercialization of online learning.

2.2 Online Learning in the Field of Vocational Education in China

In the field of vocational education in China, the "National Vocational Education Reform Implementation Plan" clearly proposes to further improve and perfect the construction of professional teaching resource libraries in vocational education reform in the new era, and discusses and deploys relevant issues. As early as May 2010, the Ministry of Education issued a notice on "Launching the Application for the Annual Project of Higher Vocational Education Professional Teaching Resource Library", which opened the prelude to the construction of the national resource library for vocational education (Lu et al. 2018). After nearly 10 years of construction, the vocational education professional teaching resource library has achieved good results in terms of quantity, investment, number of users, and coverage, and has played an important role in the construction of professional and professional groups as an innovation in vocational education (Zhu 2020). The construction of professional teaching resource libraries has also provided online course resource guarantees for the development of online teaching in vocational education.

Due to the expansion of enrollment in regular high schools, more and more junior high school graduates are flowing into regular education, which further exacerbates the decline in the quality of students in secondary vocational schools. Most students who enter vocational education have weaker overall learning abilities, and it is indeed difficult for them to learn basic cultural knowledge and professional technical knowledge in vocational schools. For a long time, they have received more criticism from schools, families, and society, which has led to poor student learning interest, autonomy, attitude, and effectiveness (Zhang 2015). Therefore, they often maintain a relatively negative attitude towards learning behavior, which is even more evident in the online learning field. For most secondary vocational students, they are more likely to participate in online learning led by the school, and they are less likely to engage in online learning activities spontaneously using various internet resources. There is relatively little research on the online learning motivation and difficulties faced by secondary vocational students.

3 Research Methodology

3.1 Research Process

Firstly, based on the results of the relevant literature review, an interview outline was formulated as a reference for the interviews. Fourteen secondary vocational school students who spontaneously used internet resources for online learning were interviewed in-depth. The transcripts were organized and coded to explore the motivation for their spontaneous participation in online learning, as well as the difficulties they faced.

3.2 Research Coding

This study focused on fourteen secondary vocational school students who voluntarily participated in online learning in a certain online learning community (Table 1).

Table 1. Table captions should be placed above the tables.

Code	Interview Date	Background	Gender
S01	2023.4.17	Secondary vocational school second-year student	female
S02	2023.4.17	Secondary vocational school second-year student	male
S03	2023.4.18	Secondary vocational school second-year student	male
S04	2023.4.18	Secondary vocational school second-year student	female
S05	2023.4.19	Secondary vocational school second-year student	male
S06	2023.4.19	Secondary vocational school third-year student	female
S07	2023.4.20	Secondary vocational school third-year student	female
S08	2023.4.20	Secondary vocational school third-year student	male
S09	2023.4.21	Secondary vocational school third-year student	male
S10	2023.4.21	Secondary vocational school third-year student	female
S11	2023.4.22	Secondary vocational school fourth-year student	male
S12	2023.4.22	Secondary vocational school fourth-year student	female
S13	2023.4.23	Secondary vocational school fourth-year student	male
S14	2023.4.23	Secondary vocational school fourth-year student	female

3.3 Research Limitations

Due to the difficulty in directly observing online learning, the researcher could only rely on in-depth interviews with participants for self-reporting, resulting in a lack of more direct data to support the research findings.

4 Research Results and Discussion

In order to understand the motivation behind the voluntary participation in online learning, and to understand the challenges faced by students during the process of self-initiated online learning, the researcher conducted semi-structured interviews with the interviewed students, and compiled the interview content into transcripts for effective coding and organization.

4.1 What Are the Motivations and Purposes for Voluntarily Participating in Online Learning?

For most students, participating in online learning is often due to school requirements. However, voluntarily participating in online learning by utilizing various existing course resources on the Internet is a worthwhile topic for discussion. Regarding this issue, we found through coding the content of interviews with respondents that the answers from lower-grade students and upper-grade students pointed to two completely different levels.

For lower-grade students, their voluntary participation in various online learning is often driven by "interest." Some students learn new skills that are not taught by school education or are not sufficiently taught:

- *"I personally like Carlimba, but the courses in school do not teach these, and I don't have enough money to attend training classes, so I self-study online by following video content." [S01]*
- *"I am learning how to draw sketches online. Although the school has courses on this, the class time is too short, and many things still have to be learned by myself through online learning after class." [S04]*

Some students are simply driven by curiosity and will use Internet resources to extend the learning content in the classroom or make up for the shortcomings of school education in certain areas:

- *"When the teacher talks about some movies in class, sometimes due to time reasons, the content taught is not very complete. I will learn some background knowledge of the movies through Bilibili." [S02]*
- *"I personally like some history courses, but there are no history classes in school, so I will study online." [S03]*
- *"I will watch some literature courses and lectures at night…I think these courses have largely developed my cultural literacy." [S05]*

For middle and high-grade students, their motivation and purpose are relatively pure, and they already have clearer future plans. Some students choose to continue their studies, and some students prepare to enter the workforce directly. Therefore, their online learning will mostly revolve around the goals they have set for themselves.

- *"I want to open my own restaurant in the future, so I am preparing in advance. In addition to the basic knowledge taught in school, I also want to see which dishes are currently popular online." [S08]*
- *"After graduation, I want to go to university, but the cost of training courses is a bit high. My family's financial situation is not very good, so I can only look for free learning resources online." [S12]*
- *"I am majoring in digital media. I plan to work with film crews to make movies in the future. So, I will take courses related to this field to prepare for my future employment." [S14]*

It should be noted that although students of different ages have some differences in motivation and goals, when we carefully examine their interview content, we will find that there are two unique commonalities in their inner motivation, namely "insufficient

school education" and "difficulty in affording training fees." On the one hand, the teaching content of school education cannot meet the learning needs of these students, which is their subjective factor for choosing online learning; while for most students, the high fees of relevant training courses in society are difficult for them to afford, which is the objective factor for their choice of online learning.

4.2 What is the Biggest Gain from Participating in Online Learning?

Through interviews, it can be found that in addition to "improving their own abilities", social interaction is also a major issue that interviewees spontaneously participate in during the online learning process. Almost every interviewee mentioned that they "met like-minded friends" in the process of participating in online learning. In addition to that, "enhancing self-confidence" and "expanding horizons" are also frequently mentioned gains by the interviewees.

- *"The greatest gain should still be the improvement of one's own abilities and learning a lot of knowledge" [S1].*
- *"I have met many impressive people and regard them as role models for learning" [S2].*
- *"In addition to learning a lot of knowledge, the most important thing is to meet like-minded friends. Working hard together, encouraging each other, the learning effect can be very good" [S4].*
- *"Ability improvement is more obvious, and I have also met some seniors, from whom I have learned a lot of experience" [S7].*
- *"Online learning can be completed independently, and I feel that the efficiency is very high, and the learning process also enhances self-confidence" [S8].*
- *"My horizons have been expanded, and I have also made many friends" [S10].*
- *"First of all, personal ability has been improved, but the greatest gain is to make life more fulfilling" [S11].*
- *"Online learning has allowed me to learn many skills that the school did not teach, and the gains are great" [S13].*

It can be seen that the changes brought to the interviewees by online learning are undoubtedly positive, and unlike traditional learning behavior, online learning has a positive impact on students' interpersonal relationships, self-confidence, and perspectives.

4.3 What Difficulties Are Faced During the Process of Online Learning?

Although online learning has brought many positive impacts to the interviewees, they also expressed that they faced many difficulties in the process of self-directed online learning using internet resources. As the interviewees are all vocational students, their own learning ability is relatively weak. Therefore, when facing a large amount of learning resources, they often feel at a loss, specifically manifested in two aspects: "not knowing how to judge the quality of courses" and "finding it difficult to plan their own learning".

- *"There are many online courses, sometimes I don't know how to judge the quality of the courses, so I don't know which courses I can watch and which I cannot" [S2]*

- *"Sometimes I don't know where to start from and which courses are worth watching" [S3]*
- *"It's difficult to plan my own learning and I don't know how to allocate my time" [S4]*
- *"Sometimes I want to learn some new skills, but I don't know which course to start with and how to learn more efficiently" [S7]*
- *"For some courses with strong professionalism, I don't know whether my ability is sufficient and whether I can keep up with the progress of the course" [S8]*
- *"I don't understand the content of some courses, so I don't know whether it's worth spending time to learn them" [S11]*
- *"Although I want to learn many things, I don't know which courses can really help me. Sometimes I feel very confused" [S12]*
- *"In the process of learning, there are always difficulties and problems. If no one is there to answer questions, I don't know how to solve them" [S14]*

5 Conclusion

Online teaching provides more diversified and flexible teaching methods for secondary vocational education, and provides more learning opportunities and channels for secondary vocational students.

For secondary vocational students who voluntarily participate in online learning, their motivation is directly influenced by the stage of learning they are in: for lower-grade students, the main motivation for participating in online learning is often for the purpose of interests and hobbies, hoping to have more contact with and understanding of learning content beyond school education; while for higher-grade students, they often face the pressure of employment and further education, so their motivation for participating in online learning is more purposeful and targeted.

However, whether it is lower-grade or higher-grade secondary vocational students, they often face a "confused" dilemma in the process of voluntarily engaging in online learning. In particular, while facing a large number of online learning resources, they do not know how to judge the quality of resources. In addition, online learning also relies on relatively strong self-planning ability, which is the shortage of secondary vocational students. Therefore, it is necessary for schools to cultivate these abilities specifically during the school education stage.

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Reflecting on Integrating Team-Based Learning into Project-Based Practical Courses to Enhance Social-Emotional Learning

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Abstract. Taiwan's new 12-year basic education curriculum has been in place for four years. The development of the curriculum is based on the spirit of whole-person education, with "spontaneity, interaction, and mutual benefit" as its philosophy. The spirit of the new curriculum is echoed. Team-Based Learning (TBL) can be described as a unique and powerful form of small-group learning through which teachers can also develop the highest assessable performance of their students, prompting them to show all that they have learned and allowing them to demonstrate their learning. Social-Emotional Learning (SEL) has attracted attention and discussion in the field of K12 education, and in recent years, it has been gradually developed in higher education and adult vocational education and training. In this study, 15 students were divided into 5 groups to promote team-based learning method into the project-based practical course and to participate in project-based competition activities. At the end of the course, 15 students were interviewed qualitatively to observe the development of their SEL. From the qualitative interviews conducted after the activity, it was observed that the students grew in the process of accepting and embracing different ideas, and became more active learners and problem solvers, and the cultivation of cross-disciplinary talents could help develop students' core competencies. On the other hand, students' confidence in self-decision making is enhanced through effective interpersonal interactions in TBL. During the process, students explore themselves, increase self-discipline, demonstrate their self-worth, and use interpersonal skills in groups to foster and effectively enhance SEL.

Keywords: Team-Based Learning (TBL) · Social-Emotional Learning (SEL) · Cross-Domain Learning

1 Introduction

Taiwan's new 12-year basic education curriculum has been in process for four years. Its curriculum development is based on the spirit of whole-person education and the concept of "spontaneity, interaction, and mutual benefit". School education should induce

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students' motivation and enthusiasm for learning, cultivate their curiosity, exploration, thinking, judgment, and action, so as to nurture students with the core qualities of adapting to the present life and facing future challenges, and social Social Emotional Learning helps children develop good self-relationships, including understanding themselves, communicating with others, and interacting with society, which echoes the spirit of the new curriculum.

In Taiwan's technical vocational education, teachers often use traditional narrative teaching methods for the development of job skills and professional knowledge, but in recent years, the promotion of diversified education has led to the emergence of many different teaching methods, such as cooperative learning in groups, learning communities, learning to learn, and team-based learning. Therefore, it has been the goal of educational reform to create an ideal educational environment for students to develop appropriately and to have the right educational approach while inspiring children's intelligence.

The Technical and Vocational Education Policy Statement mentions that technical vocational education has the mission to cultivate quality technical personnel, and also expresses the importance of project-based practical courses, and uses practical application as the positioning of technical vocational education. Therefore, in setting the teaching objectives and implementing the curriculum, students are trained to collect information and apply their professional knowledge on their own, hoping to cultivate quality talents with practical and innovative abilities through technical vocational education, which will become an important pillar to drive industrial development and enhance industrial R&D and innovation.

Team-based learning (TBL) can be described as a unique and powerful form of group learning. When teachers are faced with the dual purpose of "teamwork" and "self-learning" in the teaching environment, TBL can be used to improve existing teaching methods so that students not only learn how to work with others through group interaction, but also train students to take responsibility and accountability for their own learning and that of the team (Shih, 2012). Through this method, teachers can also develop the highest assessable performance of students, motivate students to show all that they have learned, and finally develop teaching strategies that allow students to demonstrate their learning outcomes. This approach allows students to learn to build common goals with others, work with others, understand their own strengths and weaknesses, and develop the dual competencies of "self-learning" and "teamwork", which coincide with the nature of the core literacies expected of students in the 108 curriculum.

Social Emotional Learning (SEL) is attracting attention and discussion in the K12 education field, and schools and educational institutions at all levels are committed to designing curricula that incorporate SEL programs. In recent years, interest in social emotional learning has also moved to higher education and adult vocational training, where SEL is an educational approach designed to help students develop social-emotional skills. By teaching these skills, students can improve their emotional intelligence and it is believed that the development of these skills is one of the key factors in improving students' academic achievement, health and well-being. The Collaborative for Academic, Social, and Emotional Learning (CASEL) defines five social-emotional competencies that include: self-awareness, self-regulation, social awareness, social skills, and decision-making for responsible decisions (CASEL. 2017). The development of these

skills requires highly interactive and hands-on teaching methods such as group discussions, role plays, and simulated situations. SEL approaches have been widely applied in the areas of schooling, youth development, and community intervention. The implementation of this approach not only helps students develop important social-emotional skills, but also enhances their academic achievement, physical and mental health, and well-being.

Based on the importance of technical vocational education in the professional field and the innovative teaching from a "learner-centered" perspective, the authors apply a cross-disciplinary, heterogeneous collaborative work through a project-based practical course and use a team-based learning approach to allow students to develop their individual strengths, not only to perform better in the project-based work, but also to enhance the SEL of the participating students.

2 Literature Review

2.1 Technical High School Project-Based Practical Courses

The Project-Based Practical Courses is a course in which learners select real and valuable issues and use their knowledge to find answers in the process of exploration through group work, and finally present their learning outcomes (Lin, Mei-Chun, Wen, Ling-Yu, and Chen, 2011). As mentioned in the master plan of technical secondary schools, the spirit of the project-based practical courses should be in line with the objectives of cluster education and the principle of practical application, so as to demonstrate the learning outcomes of various cluster courses and skill area courses. The teaching objectives are to strengthen students' ability to integrate curriculum learning, to develop students' ability to work in teams, to build students' abilities in word processing, presentation of results, oral reports and expressions, and to enhance students' abilities in problem solving, team innovation, and practical integration (Ministry of Education, 2014). In summary, the teaching mode of the project-based practical courses has changed from the traditional "teacher-centered" to "student-centered" mode, so the change and adjustment of teaching methods cannot be delayed.

If the traditional lecture method is used for the teaching of project work, although professional skills can be developed, it is easy to create a learning attitude of students who are reluctant to take the initiative to think, and it is difficult to improve their learning performance, which eventually leads to the project course becoming a heavy burden for teachers and students. On the other hand, if the instructor collects information to provide to students, in the age of information explosion, there are abundant resources everywhere, which makes students underestimate the time and effort to collect data and organize them, and even get half the result with twice the effort. The author, with his own experience in the development of project-based practical courses over the past few years, deeply believes that there are still the following problems in the current education field that need to be improved: (1) insufficient professional knowledge of students; (2) low parental support; (3) variable implementation of project-based practical courses and poor self-management of students, which makes time more difficult to control and conflicts with academics; (4) frequent conflicts in student cooperation and cracks in interpersonal

relationships; and (5) the lack of cooperation among students. (5) when problems arise, it is often impossible to decide the direction to deal with them immediately.

In view of this, we encourage students to develop the characteristics of multi-disciplinary project work through cross-disciplinary collaborative learning. It is hoped that students will no longer be confined to fragmented knowledge, but will combine their expertise in various fields in order to cultivate cross-disciplinary talents and to learn from the industry's mode of operation, so that learning and industry can complement each other and open up students' horizons through cross-disciplinary project-based practical courses.

2.2 Social-Emotional Learning

Students are emotional beings, not intelligent learning robots, and emotions are the foundation of all learning, yet they are often overlooked. In our formative years, learning ability and academic performance are constantly emphasized, but individual states of mind and body, which are also extremely important to children's learning, are often neglected. Social and Emotional Education, or EQ in its broadest sense, is being actively promoted worldwide to help students develop in a more holistic and healthy way. In the traditional academic knowledge framework, if students have the motivation to learn, they can use technology and other tools to shorten their learning time, but emotional management and interpersonal relationships cannot be learned through technology, but must be learned in real life situations (Future Family, 2019).

SEL is attracting attention and discussion in K12 education, and schools and educational institutions at all levels are committed to designing curricula that incorporate SEL programs. In recent years, the focus on social emotional learning has also evolved into higher education and adult vocational training. The CASEL (The Collaborative for Academic, Social, and Emotional Learning) has proposed that SEL encompasses five major areas: (1) self-awareness; (2) self-management; (3) self-awareness; (4) relationship skills; and (5) responsible decision making (CASEL, 2017) (Fig. 1).

Fig. 1. Core competencies of social-emotional learning. Source: CASEL (2017).

Although the concept of SEL is relatively abstract, it is an important ability for children to respond to environmental changes. Especially in recent epidemics, schools have used distance learning, and students have spent long periods of time studying at home, reducing interpersonal interactions. In the post-epidemic era, when students return to school, they need to readjust to campus life and integrate interpersonal interactions with teachers and students, and SEL is of great importance. In today's efficient world, the key is trust, openness, and honest communication, and having excellent socialemotional learning is a prerequisite for effective communication.

2.3 Team-Based Learning Method Applied to Project-Based Practical Courses

(1) **Team-based learning (TBL)**

TBL can be described as a unique and powerful form of small group learning. When teachers are faced with the goals of "teamwork" and "self-learning" in teaching and learning settings, TBL can be used to improve existing teaching methods so that students can not only learn how to work with others through group interaction, but also train students to take responsibility for their own learning and that of their teams and learn to be self-responsible (Shih, 2012). Through this learning approach teachers can try to develop the highest assessable performance of students and allow students to demonstrate all that they have learned, and finally develop teaching strategies that allow students to demonstrate what they have learned. This learning approach is applied in a hands-on project-based practical course through a four-step process: strategically building teams, getting students to come to class prepared, helping students learn how to apply course concepts, and holding students accountable and providing frequent feedback.

The team-based learning approach turns the classroom into a laboratory, with the teacher as the navigator of the guided activities. Through well-designed team assignments, students work in small groups to solve problems and complete assignments using homework prepared in advance and working with other group members. In this way, they learn to establish goals with other group members, learn how to work with others and how to compromise, understand their own strengths and weaknesses, and develop their "team spirit" and "self-learning" abilities, which are two of the most important soft skills needed in the digital age.

Team-based learning is effective for teachers, students, and programs alike. For the teacher, one person can lead multiple group discussions, reducing teacher manpower and time, and avoiding teacher fatigue in implementing the same lesson over and over again for different groups (Tai & Koh, 2008); for the students, it helps individual self-learning and enhances their sense of accomplishment, especially for students with low grades (Vasan et al., 2009). The difference between the traditional teaching method and the team-based learning method can be seen in the figure below. Although the teacher's instructional time is reduced, the increase is not only the time for students to actively learn and think, but also more opportunities for students to practice.

(2) **TBL applied to project-based practical courses**
The TBL program began with the grouping of students (Michaelsen L.K., Knight A. B., Fink L.D., 2004), which was based on the content characteristics of the course andwas implemented in three phases by teachers:

1. *Organizational team cohesion focus - Preparation period*
   The design of the teaching activities focuses on two objectives for each in-classactivity, which are not only to provide students with a good understanding of the course content, but also to increase team cohesion and enable team members to manage their own teams. The instructor must have a clear idea of what knowledge and abilities the students will gain after the class.
2. *Guiding students to higher levels of learning - Reading Assurance*
   There are four major components to the pre-course assessment: Assigned Readings, Individual Test, Team Test, and Instructor feedback.
3. *Application*
   This phase is about applying what has been learned previously to solve problems. The final step encourages students to gain practical experience.

3 Methods

This study, in view of the long-standing problems encountered in project-based practical courses, through action research, prays that the integration of project-based practical through TBL and the application of its finished product to international volunteer service learning can effectively enhance the effectiveness of teaching between teachers and students and reduce the problems that arise, while encouraging students to learn through cross-disciplinary cooperation and goal-oriented completion of volunteer service needs, no longer confined to fragmented knowledge, but a combination of expertise in various fields. We hope to cultivate cross-disciplinary talents, and to learn from the industry's mode of operation, so that learning and industry can complement each other, and to open up students' horizons through crossdisciplinary project-based practical courses.

(1) **Research Process**
Based on the basic steps of the aforementioned action research, the flow of this study is shown in Fig. 2, with four stages of initiation, clarification, development and practice, and conclusion and disclosure. The details of each stage are described as follows:

1. *Beginning stage:*
   Due to the problems found in the teaching field, the project-based practical course is designed in a student-centered learning mode, and the knowledge content covers a wide range of interpersonal skills, with more emphasis on team communication and cross-disciplinary cooperation.
2. *Clarification stage:*
   After identifying the problems encountered in the project work, we will explore the relevant literature and find appropriate teaching methods. As problem-oriented learning is integrated into the course, the group work will foster interpersonal interaction and cooperation in the process of problem solving and active construction of new knowledge.

3. *Development and Practice Stage:*
   After identifying the problems, this study adopted the problem-oriented learning approach as a solution to the many shortcomings of the traditional lecture method of teaching, and combined it with the goal of international volunteer service across schools and fields. The researcher observed student growth and gains in the field and further explored whether students' SEL could be enhanced at the same time.
4. *Conclusion and disclosure stage:*
   At the end of the course, students will be able to demonstrate their ability to link knowledge and solve problems after completing the practical course through the demonstration of finished products and international volunteer service.

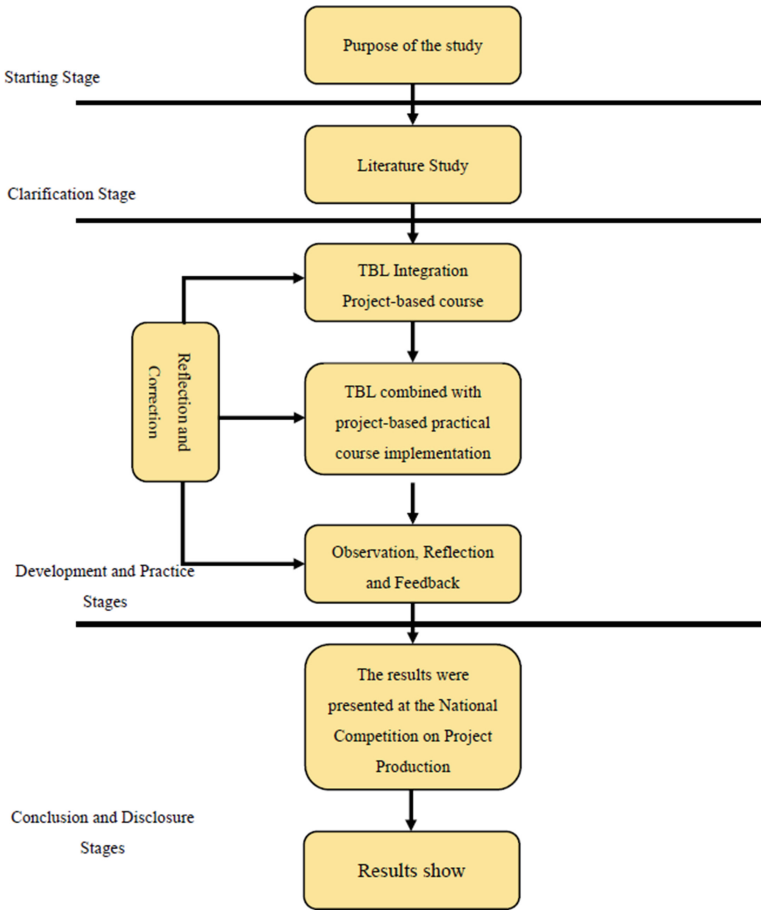

Fig. 2. Research process:completing the practical project course.

(2) **Course Design**

The TBL course will be divided into groups of 15 students, one group of 3 students, and a total of 5 groups according to the characteristics of the course in three phases:

1. *Organizational Team Cohesion Focus - Preparation Period*
   With this goal in mind, students will have the necessary knowledge to preparefor team discussions in the classroom.
2. *Guiding Students to Higher Level Learning - Pre-Lesson Assessment*
   There are four major components to the pre-course assessment: the student's individual preparation at the beginning of class to understand the level of knowledge of the learning:

   Assigned Readings: The group reads the competencies and skills that the seniors or the previous years' projects must learn.

   IndividualTest: Each group leader accepts the skills and abilities that the individual should learn and prepare for.

   TeamTest: Regular team discussions to understand the efficiency of the group learning approach and to achieve immediate feedback.

   Instructor feedback: Teachers can help solve problems and issues that are less than ideal for the team.
3. *The finished project is actually presented in the competition activity - applications*
   This stage is to apply the previously learned knowledge to solve problems. The final step encourages students to increase their practical experience in project work, so this study combines participation in project competition activities in order to increase peer communication and cooperation and to continue the teamoriented learning model. Through peer observation, the teams can give each other suggestions to stimulate more possibilities and sparks. The author also found that the participating members would observe and experience the viewpoints of their peers in different fields, and reflect on whether their own design ideas meet the needs, further accumulating the cohesion of teamwork and understanding the importance of cooperation.

4 Results and Discussion

In this study, 15 students were divided into 5 groups for group work in an action research approach, and the "learner-centered" perspective was used to innovate the teaching and learning model, promote the integration of team-based learning method into the curriculum, and open up students' horizons through participation in project competitions. The program will be able to demonstrate its uniqueness and professionalism in the development of the curriculum, and will not only have better application and experience in the practical work of the project. In the post-course qualitative interviews with all students, we observed the improvement of students' SEL, which mentioned that

Student A: *In the process of project work, they had to complete seemingly unlimited work within a limited time, and felt the importance of time management and self-discipline; they felt a sense of accomplishment when they saw that their project work was awarded in a national competition.*

Student B: *The students were able to demonstrate their professionalism. In the process of cooperation, although there were conflicts among the group members, they had to put aside their prejudices to find the best solution.*

Student C: *Seeing my skills demonstrated made me feel that even though I was tired, it was still very rewarding.*

Student D: *During the project, there are many problems that I have to solve by myself, so I know how to face the problems in the future.*

Student E: *During the competition, when I encountered problems with the judges, I needed to react quickly to respond to them, which made me more courageous to face the problems.*

Saw the growth of the students in the process, not only accepting and accommodating different ideas, but also being more proactive in learning and developing problem solving skills, as well as showing their enthusiasm for the technical profession and nurturing talents in different fields. On the other hand, from the service, the students also gained a sense of spiritual achievement, and from the perspective of "promoting self-development" and "practicing social participation", they also saw students exploring themselves, increasing self-discipline, expressing their self-worth, and using interpersonal skills in groups, which is more in line with the development of SEL. Subsequent paragraphs, however, are indented.

In order to increase students' practical experience and cultivate their ability to respond, we participated in a project production competition to present our project work. In this study, the team-based learning method is integrated into the project work. In terms of teaching principles, it is found that students are more able to apply their knowledge to solve real problems; in terms of teaching methods, because there are objects to discuss, the group can solve the problems set by the teacher through the knowledge they have; in terms of expected outcomes, students are more able to have the ability to think critically and further develop the experience of working effectively with others; from the teacher's role, they only need to prepare topics that can facilitate the discussion. Finally, in terms of student learning, the group was able to confidently defend the group's consensus results because of the consensus of the discussion. On the other hand, it is expected that students can think independently and learn from doing through the division of work among groups, and further understand the importance of teamwork and find solutions to new problems, so that the project is no longer just a project, but more closely resembles the industry's output model, hoping to cultivate students' creative thinking and active problem-solving skills for life experience.

In order to actively implement "whole-person education" and apply students' professional knowledge in service learning activities, we implement "learning by doing" and allow students to grow in character through meaningful, practical, challenging, and practical problem solving learning methods, effectively building a polite, warm, and friendly quality living and learning environment, cultivating students with good character and attitude, and strengthening their core competitiveness. Students will be able to apply their professional knowledge in the classroom, and through the cross-college and cross-group students, they will be able to create different sparks and think about how to use their professional skills to give back to society.

In summary, by leading students to participate in the competition with their own topics, students must be clear about their position in the group, their identity and self-knowledge, and their value in the group, which is in line with SEL's connotation of "self-awareness"; they have the ability to carry out the tasks and abilities given in the service, and in the process, students need to overcome pressure or frustration and carry out the goal setting autonomously, which is in line with SEL's connotation of "self-awareness". This is in line with SEL's connotation of "self-management"; respecting others' viewpoints, understanding and appreciating different norms and differences, which is SEL's "social awareness"; learning to communicate across domains in the process, and even learning to express their own viewpoints in case of conflict, which is SEL's "interpersonal skills"; and finally, reflecting at any time during the service process, exploring Finally, we must reflect on the causes of problems during the service process and make "responsible decisions" at the moment of the problem; this curriculum is designed to implement SEL in a solid way.

The team-based learning approach is a student-centered learning model that changes from the teacher-centered teaching model in the past. The most important difference between the project-based practical course and the theory-based course is that students have the opportunity to turn their imagination into reality, and the change in teaching strategy makes students' learning attitude more proactive, from only wanting to follow the teacher's instructions to being able to work in teams and face the project with a sense of responsibility. This process was a positive influence on the students, as the accumulation of skills strengthened their inner feelings and drove them to make more efforts to strengthen their abilities.

Secondly, teachers must design activities outside of the established framework to stimulate students' thinking, dialogue, and discussion, and to help students develop independent thinking and expression skills. Teachers must be competent providers of learning materials, reviewers of web-based materials, organizers and arbiters of course delivery, and help integrate the less skilled, the silent, and the isolated into the course. These roles are more challenging than in traditional lecture-based teaching, where the teacher unilaterally transmits knowledge to the students and has complete control over the voice and direction.

In addition, the burden on the students who participated in the course was increased by prior group discussions to solve group problems, and not everyone agreed with the team-based learning approach. Most of the students recognized the teachers' efforts at the end of the course and gave good feedback on this innovative course.

Teachers are faced with the challenge of new technology, and it is the primary task of teachers to make students interested in learning in the classroom, so it is important to design teaching modes and course contents that are interesting to students. It is of great value to the cultivation of students' core literacy.

On the other hand, through the innovative design of teaching activities, students will learn to protect themselves from negative emotions such as stress, discrimination, and violence, as well as to enhance their academic and professional abilities and interpersonal interactions.

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Technology-Assisted Self-regulated Learning: Practice in a Senior High School Classroom

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Abstract. Now that the world is changing, people should take control of their own learning and adopt self-regulated inquiry as a lifelong priority. People learn lots of things from different sources which influence to the way of life and decision making; hence, self-regulated learning takes an important role nowadays. At present, the Curriculum Guidelines of 12-Year Basic Education focus primarily on the core competency for curriculum development, emphasizing that students are proactive learners. Therefore, this study adopts the action research method, taking the three-year class and students of a senior high school in New Taipei City where the researcher teaches as the teaching implementation field and research objects. It is hoped that through the teaching model and strategy of self-regulated learning, the development of teaching and learning activities of self-regulated learning courses can be enhanced, and the reflection from theory to practice process can be proposed. Finally, it summarizes the research results in classroom teaching of self-regulated learning, and puts forward specific suggestions for the application of self-regulated learning for teachers in the future.

Keywords: Self-Regulated Learning · Teaching Model · Senior High School

1 Introduction

"Self-Regulated Learning" is an educational and learning method that also serves as a two-way learning contract between teachers and students. Teachers are not just instructors but also facilitators, mentors, and organizers. Under the guidance of the teacher, students need to establish their own learning goals, engage in learning, reflect on their achievements, adjust their learning methods and progress. The 21st century is an era of lifelong learning. We need to "teach students how to learn, enable them to master effective learning methods, manage and create knowledge, and apply what they learn to solve problems and improve their lives."

The "Curriculum Guidelines of 12-Year Basic Education General Guidelines " emphasizes that the core competency is based on the concept of "lifelong learners" who are people-oriented. It emphasizes that students are self-motivated learners and that school education should encourage students' learning motivation and enthusiasm. It also guides students to develop various interactive abilities with themselves, others, society,

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and nature, and teachers assist students in applying what they have learned in practice, experiencing the meaning of life, and being willing to contribute to the sustainable development of society, nature, and culture, seeking mutual benefit and common good (Ministry of Education, 2014). From the basic philosophy and curriculum objectives to the core competencies, it is even clearer that self-regulated learning is the future image of student learning.

This study adopts action research method, with the researcher's New Taipei City high school three-year class as the implementation field of the teaching plan, and 35 students in the class as the main research subjects. In addition, using data such as classroom observation records, student feedback learning sheets, teacher interview records, and student learning outcome questionnaires, the study conducts interpretation and analysis of multiple document data, hoping to incorporate self-regulated learning models and strategies through technology-assisted self-regulated learning classroom teaching practices, to enhance the development of the curriculum and learning activities. Furthermore, the study aims to verify and analyze the self-regulated learning classroom teaching and reflect on the process from theory to practice, and to provide suggestions and references for future applications of self-regulated learning.

2 Review of Literature

2.1 Related Meaning of Self-regulated Learning

The existing literature shows that "self-regulated learning" encompasses different semantics. What is the implication of self-regulated learning, which is the core competency of cultivating lifelong learners in the 21st century? In English, there are related terms such as autonomous learning, self-directed learning, and self-regulated learning. These different terms directly or indirectly reflect the divergent views of different researchers on the definition of self-regulated learning (Zimmerman, 1995). For example, some researchers emphasize the learner's initiative and independence in learning, while others focus on self-monitoring and self-directedness in learning. "Self-directed learning" emphasizes the personal will of "self-directed learning," while "self-regulated learning" focuses on "self-adjusting learning," but both are concerned with the learner as the subject of learning (Ko, 2018).

Self-regulated learning refers to the process in which learners, with varying degrees of assistance from others, identify their own learning needs, set goals, identify and utilize resources, apply appropriate learning strategies, and evaluate learning outcomes (Knowles, 1975). Self-regulated learning is also defined as the idea and action of self-initiated, cyclical, and continuous attainment of personal learning goals, and self-adjustment of learning. It is considered a core skill for 21st century citizens, and many countries have included it in their national curriculum standards (Cleary et al., 2017). Self-regulated learning is the process by which learners use their internal cognitive abilities and transform them into academic skills, ultimately promoting learner engagement in learning, which is an important indicator of effective teaching (Zimmerman, 2002). In the process of self-regulated learning classroom instruction, teachers should always bear in mind the forward-looking thinking of "teaching students how to fish instead of giving them fish to eat" (Wu, 2017).

2.2 Related Research on Self-regulated Learning Mode

To promote the goal of self-regulated learning in classroom teaching and learning, researchers and educators must incorporate the concept of self-regulated learning into the psychological framework, or seek effective educational methods and learner-oriented training (Benson, 2001, 2006). To assist students in gaining control over their learning process and taking charge of their learning objectives and content, teachers are advised to intervene in the classroom teaching by instructing students in the cyclical model of self-regulated learning. This includes four stages: "goal setting and strategy planning," "strategy implementation and monitoring," "strategy outcomes and monitoring," and "self-evaluation and monitoring," through repetitive operations and continuous practice, so that students can gradually develop their self-regulated learning abilities (Zimmerman & Shunk, 2001).

Researchers have analyzed three modes of self-regulated learning: the first is the "Mainland China Tutoring Case Model," which involves students completing pre-class learning sheets for reflection and organization, as well as in-class group learning and the development of autonomous learning abilities. The second is the "Taiwan Flipped Classroom Model," which includes video or data previewing, self-diagnosis through online assessments, and emphasizing collaborative learning in the classroom to increase learning motivation. Lastly, the "School-Wide Self-Regulated Learning Model" is exemplified by Shenzhen Elementary School in Keelung City, which teaches learning strategies and conducts topic-based learning (Ko, 2018).

3 Methodology

3.1 Research Strategy and Data Collection

The research methodology adopted in this study is action research, which is a method that emphasizes behavior as its foundation and focuses on discovering, solving, and verifying problems in practical work to achieve progress in practical work and growth for practitioners (Chen, 2003). Therefore, the researcher will use the data's events and timelines as an index to connect them. In addition to observing students' classroom performance, the researcher will collect and categorize data from learning sheets, feedback forms, interview records, observation records, and classroom recordings. The researcher will then repeatedly read and reflect on the collected data, select the most representative data, and systematically categorize and organize the selected data to complete a written report. Furthermore, the researcher will integrate, analyze, and interpret the presented data with an objective and appropriately evaluative attitude to truthfully and accurately respond to the related misconceptions and problems generated by the practice of self-regulated learning in the classroom.

3.2 Research Object and Design Implementation

The present study was conducted in a class of 35 third-year students in a private senior high school in New Taipei City where the researcher teaches. Therefore, self-regulated learning was applied in classroom teaching, where teachers can use four learning models,

including "student self-learning," "intra-group learning," "inter-group learning," and "teacher-guided learning" to establish a good self-regulated learning classroom teaching cycle (Ho, 2014). In addition to guiding students to self-learning, teachers can also design learning activities within and between groups to create different stages or higher-level learning experiences. Therefore, by following the steps and principles of self-regulated learning in the classroom, the study gradually guided students to participate in group cooperative learning programs (see Fig. 1).

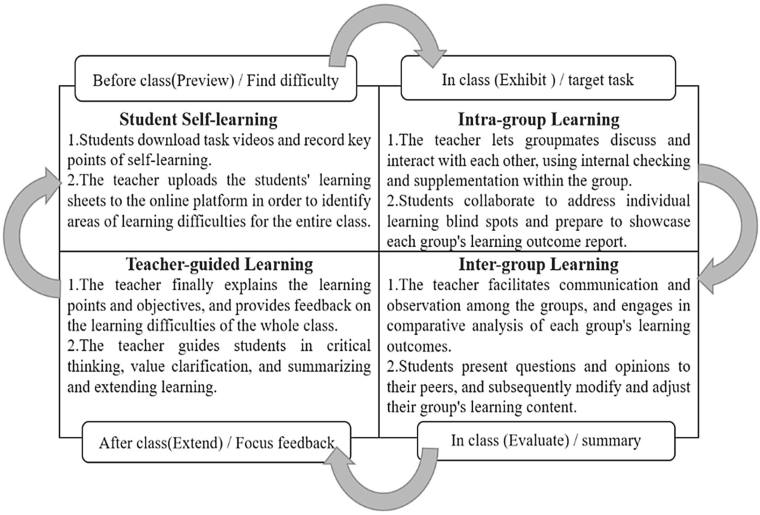

Fig. 1. Linking classroom teaching with the cycles of self-regulated learning.

4 Findings and Discussion

4.1 Survey Results and Learning Outcomes

In the process of transforming classroom teaching, it is urgent to listen to students' autonomous opinions and views, understand the curriculum content from their experiences, and adjust teachers' cognition and attitudes based on students' perspectives and performance, and value and clarify "what matters" in students' curriculum experiences (Chen, 2003). According to the results of the questionnaire survey on the learning effectiveness of self-regulated learning students (Table 1):

First of all, the average score of the five answering contents is greater than 3, and most of the students' answers are concentrated above 3 points. Moreover, the mode is also 3, which means that the most selected answer is 3 (agree), and the frequency distribution is mostly at 3 points, indicating that the performance and importance of implementing self-regulated learning activities in class have a concentrated trend, and most students agree that the application of self-regulated learning mode should be planned and arranged in the classroom teaching process.

Table 1. Questionnaire survey on the learning outcomes of self-regulated learning.

Questionnaire content and scope	Very much agree	Agree	No comment	Disagree (%)	M	Mo
1. constructing self-regulated learning goals	40	51	6	3	3.2	3
2. encouraging collaborative self-regulated learning	46	48	3	3	3.4	3
3. providing effective self-regulated learning feedback	23	68	3	6	3.2	3
4. supporting students' autonomous experiences	31	57	6	6	3.1	3
5. utilizing high-efficiency resources	29	62	3	6	3.1	3
6. overall classroom teaching evaluation	51	46	3	0	3.5	3

Secondly, in terms of "constructing self-regulated learning goals", "encouraging collaborative self-regulated learning", "providing effective self-regulated learning feedback", "supporting students' autonomous experiences", and "utilizing high-efficiency resources", the majority of students agree that under the guidance of teacher-led self-regulated learning classroom teaching, they can set stage-specific learning goals based on their own abilities and needs; experience and explore the process of cooperative learning and actively make progress; utilize peer review mechanisms to monitor and evaluate themselves; and use information technology tools to enhance the efficiency of self-regulated learning.

Finally, when the teacher mentioned the students' satisfaction with the "overall classroom teaching evaluation" in the questionnaire and interview, almost half of the students immediately expressed their agreement. This is mainly because the self-regulated learning classroom teaching, with the help of the teacher, allows students to have a full understanding of their basic abilities, strengths, and weaknesses. They then determine their learning goals and content, and work with their peers to choose appropriate learning strategies and systematically organize, allocate learning time, and solve problems.

This enables students to actively collect feedback from all sides and, through peer monitoring and evaluation in small groups, achieve effective assessment results and strategy implementation.

4.2 Student Feedback and Teacher Reflection

Reviewing students' classroom teaching experiences and understanding their learning satisfaction can help teachers cross-check and verify the significance of the curriculum and teaching for students. It also helps teachers reflect on the appropriateness and comprehensiveness of curriculum planning and teaching design through students' sharing and feedback (Chen, 2003). Below, we will share and examine students' perspectives on aspects such as "igniting passion and interest," "automatic and autonomous participation," "motivating teamwork," "achieving learning goals through assessment," and "expanding horizons."

First, the application of self-regulated learning mode in classroom teaching cultivates pre-learning and self-learning, ensuring that control returns to the students. Second, the application of self-regulated learning mode in classroom teaching stimulates students' potential for active learning through peer interaction and collaborative learning. Third, the application of self-regulated learning mode in classroom teaching emphasizes small group cooperation and mutual learning, promoting students' complete learning process. Moreover, the application of self-regulated learning mode in classroom teaching enables peer assessment through assessment mechanisms, effectively improving students' learning outcomes. Finally, the application of self-regulated learning mode in classroom teaching provides guidance and support for student learning progress, leading to visible changes in students' active learning.

5 Conclusion

Self-regulated learning emphasizes the ability of students to manage their own learning and time planning. Developing this ability requires constantly reminding oneself during the learning process to understand what they are learning, how they are learning, what they have learned, and how they can improve their learning. This gradually enables students to effectively manage and grasp their learning situation and outcomes, and adjust their self-regulated learning strategies or induce their self-regulated learning transfer ability. This study preliminarily validated the implementation of a "student-centered" self-regulated learning classroom teaching model, which includes four stages: "student self-learning," "intra-group cooperative learning," "inter-group collaborative learning," and "teacher-guided learning." This model is guided by teaching professional competencies such as "learning before teaching," "teaching according to learning," "teaching less and learning more," and "reducing workload and increasing efficiency." It can motivate students' learning motivation, promote active learning, realize the value of learners, and help students achieve more meaningful learning processes, thereby improving learning quality and outcomes.

The Ministry of Education promotes the "Internet for every class, tablet for every student" policy, increases digital hardware and software resources, and combines them

with digital content applications so that every student can have an individualized and adaptive digital learning experience, learning digital skills, collaboration, and innovation, developing interest and exploration, in order to enhance learning motivation and effectiveness (Ministry of Education, 2022). Therefore, this study suggests that in future classroom teaching practices, digital teaching strategies such as flipped classroom or group cooperative learning should be applied or integrated into self-directed learning. After all, digital tools and digital learning platforms can assist students in self-study, cooperative learning, and peer learning, and teachers can also use appropriate digital content to guide and teach. Because the classroom management system provided by the digital learning platform, the assignment of digital homework, interactive discussion functions, and real-time data feedback analysis functions enable teachers to more quickly and efficiently implement self-regulated learning models in classroom teaching, and promote students to develop metacognitive abilities.

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Exploring the Potential of Short Videos in Flipped

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Abstract. With the outbreak of COVID-19, external communication has been greatly restricted, which also indirectly affects the international communication of students in this major. At the same time, short videos represented by TikTok created the sensation all over the world, providing students with opportunities to broaden their knowledge to some extent. Based on the concept of flipped learning, the reasonable application of short video to the training of students majoring in travel management is an important issue that must be discussed and thought about in the post-epidemic era. This study carried out a two-month flipped learning based on short video for the junior students of the department of Tourism Management in a university, Taipei. After the teaching, 10 students were selected as volunteers for in-depth interview. According to the analysis of interview materials, the research found that: 1. Compared with text materials, the length and audio-visual of short videos can help stimulate students' interest in learning and improve their learning results. 2. Due to the limitation of its own time, the application of short video in flipped teaching cannot be separated from the explanation and supplement of teachers and other learning materials; 3. The use of short video in flipped learning runs through the whole process of pre-class preview and in-class learning, integrating students' learning behaviors into a whole, which is conducive to the cultivation of students' lifelong learning literacy.

Keywords: short videos · flipped learning · teaching mode · teaching reflection

1 Introduction

Since the end of 2019, countries around the world have been severely impacted by the COVID-19 pandemic. As an important response measure, online education has been widely adopted in the field of education, demonstrating significant achievements in teaching. Despite the gradual return to physical classrooms in schools at all levels in Taiwan as the pandemic situation improves, the global situation remains uncertain, and inconsistent pandemic control policies among countries have greatly restricted international mobility. For students majoring in travel management, the lack of international exchanges has seriously limited the quality of their learning, reduced educational standards, and particularly hindered the integration of practical experience and theoretical knowledge. In light of these challenges, innovative and improved teaching methods can be considered as potential solutions.

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Flipped learning, for example, emphasizes a shift from passive learning to active learning, with a focus on higher-order skills such as problem analysis, critical evaluation, and creativity (Li, J., 2018). Flipped learning emphasizes "moving lectures outside the classroom and shifting concept practice and application inside the classroom through learning activities" (Strayer, 2012). Based on this concept, the delivery of flipped learning is not limited to traditional teacher-led lectures, but expanded to a more diverse range of approaches, including the introduction and application of short videos in flipped learning.

This study focuses on junior students majoring in travel and tourism management at a university in Taipei, Taiwan. It conducted a two-month flipped learning program based on short videos. After the completion of the teaching intervention, ten students were selected voluntarily for in-depth interviews, and coding analysis was conducted. The purpose of this study is to enrich the research content in the field of flipped learning and provide valuable insights for the future application of short videos in teaching. Through reflective teaching practices, the study aims to optimize relevant teaching models for future development.

2 Literature Review

2.1 The Application of Short Videos in Education

Social Beta website defines short video as "a new form of video with a duration of seconds that is mainly shared instantly on social media platforms by using mobile smart terminals (Cai, Q., Ni, P., 2017)". According to Chinese scholar Zhao Yu, "Short video is an emerging form of video with video length measured in seconds, which can be shared and seamlessly docked on social media platforms by relying mainly on mobile smart terminals to realize fast shooting and beautification editing (Zhao Yu, Wang Yongze, Ma Xin, 2015)". According to Zhang Lijun, president of the Internet Society of China, short videos have both news and entertainment functions and can be easily disseminated on various communication platforms, which can meet the public's requirements for video communication nowadays, with a duration of 3–5 min. It is characterized by "interactivity", "variety", "low threshold" and "fragmentation" at the communication level (Li Jing, 2020; Wang Xiaohong, Bao Yuanyuan & Lu Qiang, 2015; Huang Yitong, 2022).

Related studies have also demonstrated that in addition to daily instruction, short videos can be applied to students' literacy development (Yang, B., et al., 2022), and the use of short videos helps to maintain students' ability to leap ahead in life while also improving their convenience in class (Kalanlar, B., 2021). The improvement of students' learning activities and their oral language skills were also significant (Herlisya, D., & Wiratno, P., 2022).

2.2 Flipped Learning

The Flipped Learning Network (FLN), a U.S. nonprofit organization that promotes flipped learning, has identified (2014) four key pillars (denoted by the acronym F-L-I-P) for implementing flipped classrooms: flexible environments, student-centered learning

culture, intentional content, and professional educators. F-L-I-P refers to flexible environments, student-centered learning culture, intentional content, and professional educator. For a long time, the flipped classroom teaching model, which combines technology and teaching videos, and the thinking teaching model, which emphasizes students' thinking skills, such as Xueshi Da, have been prevalent in Taiwan (Bai, 2014). Based on relevant theories, Chiu and other scholars (2015) summarized the activities corresponding to both sides of teaching in the implementation process of flipped learning, as follows (Table 1):

Table 1. Activities of both teaching parties in flipped learning

stage	Students	Teacher
Pre-Class	Complete pre-class learning activities through various digital learning tools 1. Read course related materials 2. Watch instructional videos 3. Conduct pre-class self-assessment	1.Design teaching activities 2.Answer students' questions and guide learning
In-Class	By engaging in activities such as discussions, debates, group discussions, case reports, homework writing, or practice questions, students can apply the knowledge they have learned	1.Key prompts and clarification of questions 2.Use feedback or group discussions to guide learning direction
Post-Class	Complete after-school learning activities through various digital learning tools 1.Read or browse course related materials 2.Participate in discussions in the course discussion area	1.Supplementary teaching information or explanations 2.Correct students' homework or reports

3 Research Methodology

3.1 Research Process

Based on the concept of flipped learning, integrating the contents of the teaching materials and the research framework, the following process was designed.

The research process is divided into three stages: the first stage is document collection and research, research framework design, the second stage is pre-class, pre-study, course conduct and post-course review, and the third stage is in-depth student interviews, data coding analysis, and research report writing.

3.2 Research Coding

In this study, students who participated in the short-video-based flipped teaching in the Department of Travel and Tourism Management of a university in Taipei were invited voluntarily to conduct in-depth interviews after the completion of the teaching (Table 2).

Table2. Basic information of the interviewees and interview dates

Code	Interview Date	Background	Gender
E1	2022.12.2	Junior student in the Department of Tourism Management at a university in Taipei	M
E2	2022.12.2	Junior student in the Department of Tourism Management at a university in Taipei	F
E3	2022.12.2	Junior student in the Department of Tourism Management at a university in Taipei	M
E4	2022.12.2	Junior student in the Department of Tourism Management at a university in Taipei	F
E5	2022.12.2	Junior student in the Department of Tourism Management at a university in Taipei	M
E6	2022.12.9	Junior student in the Department of Tourism Management at a university in Taipei	M
E7	2022.12.9	Junior student in the Department of Tourism Management at a university in Taipei	F
E8	2022.12.9	Junior student in the Department of Tourism Management at a university in Taipei	M
E9	2022.12.9	Junior student in the Department of Tourism Management at a university in Taipei	F
E10	2022.12.9	Junior student in the Department of Tourism Management at a university in Taipei	F

4 Research Findings and Discussion

In order to understand the effectiveness of the short video based on the concept of flipped learning in the teaching of the professional course of the Department of Travel and Tourism Management, after the two-month teaching period, the researcher conducted semi-structured interviews with the students who participated in the teaching, and compiled the contents of the interviews into verbatim scripts, which were then effectively coded and organized. Ten of the students were selected for in-depth interviews, and the interviews were coded and collated into verbatim transcripts.

4.1 A. What is the Impact (Positive/negative) of the Pre- and In-Class "Short Videos" on Learning?

During the teaching process, the researcher provided students with short videos before and during the lesson that were appropriate to the content of the lesson. Interviews after the completion of the lesson revealed that students consistently perceived the impact of the short videos on learning as positive, but there were subtle differences between the pre and post-lesson short videos in the teaching process. Specifically, the pre-class short videos can enhance the role of knowledge navigation and content preview, and students

will pay more attention to the content of the short videos; while the in-class short videos can alleviate students' learning fatigue to a certain extent, and guide students' attention back to the teaching content.

Short video before class:

- *The pre-class short video with the article given by the teacher helped me to play a role of pre-study [E01];*
- *gave me an initial understanding of what I needed to learn in the course [E02];*
- *felt like a guide [E03];*
- *watching these (short videos) is quite knowledgeable and can prepare me for the class [E04];*
- *is more interesting and entertaining…… to prepare for subsequent learning [E05];*
- *is much easier than reading text, convenient for pre-study [E07];*
- *After watching the short video, you will know what will be taught in the class, and you will have an understanding in your mind [E08];*
- *watching short videos before class is still a prep function [E09];*
- *feel that the teacher gave the short video is like a catalog, the role of the navigation course [E10].*

Short video before class:

- *watch short videos in class to be able to relax a little [E01];*
- *watch short videos when you want to sleep, and have a refocused attention [E02];*
- *when watching (short videos), people are more interested [E03];*
- *feel that the classroom atmosphere is obviously more lively when the teacher plays short videos [E04];*
- *the effect of that kind of funny short film in class is better than some serious celebrity speech, on the one hand, it is fun to teach, feel less bored, will be more serious in that period of time [E05];*
- *is quite interesting, especially sometimes watching some short videos on the funny side, there is a sense of relaxation for a moment, people do not want to sleep so much [E06];*
- *can be linked to the content of the teacher's lecture, so that you can have a more detailed and intuitive understanding of the course content [E08];*
- *can relieve the tension of the class [E09];*
- *can return attention to the class when watching short videos [E10].*

4.2 Advantages and Shortcomings of Short Videos in Literacy/competency Development

When asked about the advantages and shortcomings of short videos in helping students to develop their literacy/competency in the learning process, students focused on three noteworthy feed backs, which are: the "short and interesting" format of short videos enables students to acquire information more efficiently and acquire knowledge in fragments; the "short and quick" volume of short videos leads to "superficial taste", which may lead to "confusion" and "desire for knowledge" among students; the "edutainment" nature of short videos in teaching and learning has changed students' perception of the "fun" and "confusion" to a certain extent. The "confusion" and "desire for knowledge"

caused by the "short and quick" volume of short videos may make students "confused" and "eager to learn"; the "fun and educational" feature of short videos in teaching has changed students' cognition of short videos to a certain extent, so that students begin to get used to acquiring professional-related knowledge from short videos.

The form is short and interesting:

- *short videos are convenient and watched on the way to commute [E01];*
- *is interesting and more direct than text information [E02];*
- *is less stressful because of its shorter duration [E04];*
- *is more in line with the habits of young people, although it is a fragmented video, but also can really learn from it and their professional related knowledge [E05];*
- *(watch short videos) will not take up too much time, more relaxed, but also can learn knowledge [E07];*
- *teacher to give the video are quite interesting, so I will watch [E08].*

The capacity of the "shallow":

- *but compared to the textual information, I feel that the short video is too shallow and sometimes I don't understand it [E02];*
- *(short video) is very fast, sometimes it is finished without attention, sometimes you don't understand it [E03];*
- *(relatively short in length) makes me curious sometimes after watching, and some of the contents of the video are not explained in depth [E04];*
- *some short videos are really too short, so the content is not detailed enough, and after watching it, I will feel a bit confused [E06];*
- *I think the short video or play a role in stimulating interest, after watching the teacher to read the article, it will be easier to understand, but also more willing to read deep [E07];*
- *teacher to give a lot of short video although very interesting, but many are point to that, in order to better understand the relevant content, or necessary to see the teacher to the article, and is to listen to the classroom teacher's explanation [E09].*

Application of teaching with fun:

- *I think the biggest help is still to change my stereotype of Jitterbug (short video), so I learned to learn through Jitterbug [E01];*
- *developed the habit of learning in pieces, and now I sometimes watch some short videos in English on the MRT to strengthen my English ability [E02];*
- *has gained a lot of knowledge through short videos, although I can't go abroad yet, I can see a lot of interesting things abroad [E03];*
- *I think the most interesting thing is that the teacher shared some shaky videos from abroad, which let me see the living condition of foreigners and grow my insight through short videos [E05];*
- *made me feel that learning can be fun [E06];*
- *has helped me to develop the habit of watching short videos related to learning on ShakeYin [E08];*

5 Conclusion

5.1 Short Videos Can Help Stimulate Students' Learning Interest and Enhance Learning Effectiveness

Through the interviews with students, it can be seen that short videos are more easily accepted by young students than traditional textual materials because of their variety and interesting forms. Therefore, to a certain extent, it has the function of inspiring students' interest in learning and enhancing their learning effectiveness. However, there is a difference between the short videos that are delivered to students before class and those that are shown to students during the course based on the concept of flipped learning, although both have positive effects on learning. The content of the pre-class videos is more easily noticed and accepted by students, while the in-course videos are more used to calm the classroom atmosphere and help students' attention return to the classroom.

5.2 Short Videos Should be Combined with Text Data and Teachers' Explanations

Although students generally give relatively positive comments on the application of short videos in teaching, we also find that the "shortness" of short videos is a two-sided blade. On the one hand, it is in line with the habit of young students to receive "fragmented information", but on the other hand, due to the limitation of capacity, students may face the dilemma of "limited information and insufficient understanding" when short videos are used in teaching. Therefore, this also requires the combination of short videos, textual materials and teachers' explanations in the relevant teaching to help students complete their knowledge learning.

5.3 The Application of Short Videos in Teaching Helps Students Develop Lifelong Learning Literacy

During the study, one of the more unexpected points is that, through students' feedback, the application of short videos in teaching and learning has changed students' stereotypes about short videos to a certain extent. As a form of media that young people rely on nowadays, short videos have long been positioned as an "entertainment pastime". However, the creative use of short videos to assist students in professional learning in this teaching has helped students understand the feasibility of professional learning through short videos, thus helping them to partially develop "lifelong learning literacy", which may have a positive effect on their future learning and work.

5.4 The Control and Strengthening of Video Quality in Teaching in the Future of Short Video

Previous studies on flipped learning can be said to be full of cattle, but there is a relative lack of research on the application of short videos in flipped learning. Especially in Taiwan, it seems that the academic community has not yet noticed the educational

application value of short videos. This study focuses on the related courses of tourism management in higher education and goes deep into the front line of teaching, collecting students' feed backs based on the application of short videos in flipped learning, coding and then conducting a deeper investigation of the data, and then considering the advantages and shortcomings of short videos in teaching application from students' standpoint. Although, in the actual teaching process, due to the limitation of the number of students and their participation, as well as the varying quality of short videos, the promotion of flipped learning has brought a certain degree of instability, and students' feedback also found that some of the videos did not have a positive effect on the learning period. However, it is undeniable that short videos are a social media that young people rely on nowadays, and they have already penetrated into the field of students' learning and life. There is room for further exploration in future research on how to skillfully guide the use of short videos for teaching, turn negative effects into positive benefits, and explore more flipped teaching models that are more in line with Taiwan's reality on the basis of further developing the concept of flipped teaching.

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Development of a Wearable Sleep Airway Optical Monitor

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Abstract. OSA (Obstructive Sleep Apnea) is a condition in which there is repetitive partial or complete collapse of the pharynx during sleep, resulting in blockage of the airway and inadequate respiration. The resultant of syndromes is a leading cause of hypertension, cardiac disease, and sudden cardiac death, affecting up to 200 million people worldwide. Current remedies include CPAPs (Continuous Positive Airway Pressure), mouth braces, and surgeries. The most common diagnostic procedure is Drug Induced Sleep Endoscopy (DISE). Taking the above as a subject, the research is designed to not only minimize the risk to the patient, but also to improve diagnostic fidelity to the natural state of sleep. Aim to develop a product with a similar fashion to COVID self-tests, which can be inserted by the patients themselves without either anesthesia or a doctor's intervention. The design focus on comfort and reliability is driven by rigorous user experience research and anatomical analytics, and is to be worn overnight to monitor and acquire visual verification of obstruction with the most accurate representation of the airway during natural sleep.

Keywords: Obstructive Sleep Apnea · Drug-Induced Sleep Endoscopy · Micro Nasopharyngeal Observation Endoscopy · Endoscopy without Anesthesiairst

1 Study Background

Sleep Apnea is a symptom when breathing stops and starts while sleep. The airway is open during normal breathing but when airway gets obstruction, the airway collapse. The airway collapses temporarily which cause to obstruct the air during sleep. The most common type is called Obstructive Sleep Apnea (OSA), causing poor sleep quality in order to result daytime sleepiness or feeling tired. It affects healthy and the most serious symptom may cause sudden cardiac death. Treatment methods of OSA are various. Normally, doctor evaluates patient basing on health status, serious level of OSA and other clinical examination. The medical treatment includes: Surgery, Modality Therapy, Invasive procedure and Medicine (Fig. 1).

In the late of 1980s, several European medicine centers started to evaluate the upper airway of patient by using laryngoscope. In 2005, Keziriam and Hohenhors named the inspection of OSA as Drug-Induced Sleep Endoscopy (DISE)

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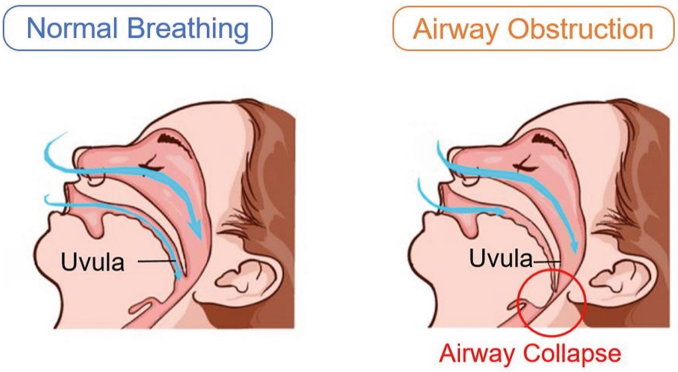

Fig. 1. The difference between the airway open and the collapse.

2 Literature Review

There are many researches of Obstructive Sleep Apnea or DISE (Fig. 2).

Author/year	Implant appearance	Summary
文整理 林天韻醫師 指導 許彥彬醫師 /201801	藥物誘發之睡眠內視鏡 （Drug-Induced sleep endoscopy）	The research resulted drug-induce sleep endoscopy can inspect the position of obstruction precisely than before. Further, throat obstruction may be one of the key points that can not wear the continuous positive airway pressure (CPAP) effectively or be failure of traditional operation.
Victor F. Certal, MD, PhD; Rui Pratas, MD; Lidia Guimaraes, MD; Rodolfo Lugo, MD; Yungan Tsou, MD; ~ Macario Camacho, MD; Robson Capasso, MD /2016	Awake Examination Versus DISE for Surgical Decision Making in Patients With OSA: A Systematic Review	This review emphasized the direct impact of DISE compared with that of awake examination on surgical decision making in OSA patients. However, it is also clear that the available published studies lack evidence on the association between this impact and surgical outcomes.
Huan-Yu Lin 1,† , Yi-Chih Lin 2,† , Ying-Shuo Hsu 3,4, Liang-Chun Shih 1,5, Tyler Nelson 6 , Wen-Dien Chang 7,* and Yung-An Tsou 8,9,*/202008	Comparison of Findings between Clinical Examinations and Drug-Induced Sleep Endoscopy in Patients with Obstructive Sleep Apnea Syndrome	The study revealed that physical examinations, i.e., Brodsky classification and Friedman staging, have a significant relationship with DISE, but the level of tongue base is uncertain between DISE and modified Mallampati score (MMS)

Fig. 2. Literature review list.

3 Motivation, Purpose and Hypothesis

The most similar endoscope for inspecting evaluate the upper airway of patient is laryngoscope or nasopharyngoscope. Practically, nasopharyngoscope is classified as CLASS II in the production classification of FDA. After field research and consulting with doctors, unlike DISE (Drug Induced Sleep Endoscopy), my idea inspection tool will provide accurate diagnosis of obstructive sites without general anesthesia and is able to improve the weak points of DISE as below:

1. The airway obstruction is difference from the natural state of sleep
2. Anesthesia is necessary
3. Professional operator is a must
4. Can not be Self-inspection by user
5. Medical treatment is expensive

The product of this research is called SOSA.

4 Design Concept and Method

4.1 Problem to Solve

Users may find self-insertion difficult and feel uncomfortable because afraid of self-insertion. However, owing to the Covid-19, people is getting use of rapid test by self which over-come the self-insertion difficult (Fig. 3).

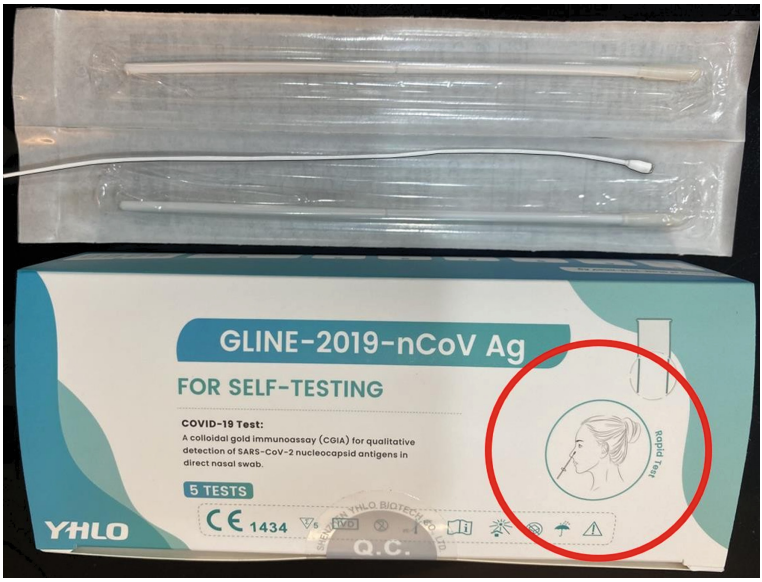

Fig. 3. SOSA will be much smaller and make user feel comfortable.

4.2 Material and Technology Application

Considering the size is one of the key points, we use the most advantage ultra micro CMOS image sensor. Tear shaped is the design concept for the camera of endoscope. With light weight and thin body shape, the recorder can be attached on the body and user can easily wear it during sleep. No matter head width or body thickness, the dimension of SOSA will be smaller than NI swab. With tiny size and dome design at the distal end, user can insert SOSA into nasal smoothly. All material and component must be biocompatible. Product should meet safety regulation, EMI/EMC and medical device regulation as well.

4.3 Reliability Test for Solutions

The study will use SOSA to measure the mass of the oropharyngeal anatomy by inserting into the mouth and throat. SOSA is designed with a standard operating procedure (SOP) that ensures fool-proof and easy to follow insertion. Owing to the experience of self-test during pandemic of Covid-19, people can do the self-insertion of the rapid test without problem than before. Therefore, the SOP design will follow the steps of Covid-19 self-test in order to reduce the discomfort and unfamiliarity. As SOSA is equipped with a camera module and a light source that allow user testing and visual quality verifications. The camera captures images of the upper airway in oropharyngeal anatomy during sleep, and the light source illuminates the area for better visibility. Image can be transferred to a computer for further analysis. Consequently, the reliability test includes:

1. Oropharyngeal anatomy mass study for measurement
2. SOP design for fool-proof, easy to follow insertion
3. User testing and visual quality verifications

4.4 Design Review and Verification

To evaluating the feasibility of product by building up the structure of nasal cavity model by 3D printing technology in order to monitor the status of upper airway collapse. Thru the output of 3D print, there are different structures of nasal cavity which simulate different scenarios of upper airway collapse, such as narrowing or obstruction of the nasal passage. By using these simulations, we will be able to measure the effectiveness of the prototype development (Figs. 4 and 5).

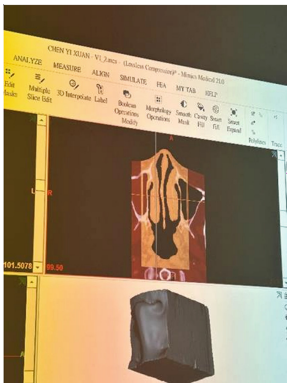

Fig. 4. Model simulation.

Fig. 5. 3D model and experiment.

5 Result

Patient who uses DISE treatment must be under anesthesia status, so DISE treatment is not able to provide online or home care medical service. To record the condition of internal oral and nasopharynx, DISE patient is not in natural sleep. The current product

is expensive and not for personal use exclusively. To avoid a possibility of causing cross infection, the endoscope of DISE treatment have to be cleaned and sterilization which request a space with special exhausted system. Hospital must reserve high budget for purchasing equipment (Fig. 6).

Features / Product	Dimension / Weight	Clinic (anesthesia)	Precise Observation	Safety	Expense
DISE endoscope	Big / Heavy	Necessary	Good	Good	High
SOSA	Small / Light	No need	Excellent	Excellent	Affordable

Fig. 6. The comparison between DISE endoscope and SOSA.

Using prototype of SOSA to test by self and wearing the product while sleeping every night for over 2 weeks without any problem. The effect is:

1. No anesthesia at all
2. Completed from home
3. Self-operation
4. No sneezing
5. Good image resolution and illumination

6 Conclusions

We expect the idea monitor of OSA includes: natural sleep status instead of anesthesia, record the upper airway obstruction automatically, safety inspection without invasion and affordable price for user. Therefore, suggestions for improving the evaluation tool for OSA in the future:

1. Can be self-inspection at home instead of operating by doctor in hospital
2. Patient can reduce medical spend.
3. Special for personal use to avoid cross-infection
4. Hospital has one more income as patients must purchase the product for personal use from hospital. Furthermore, the sterilization is no need, so hospital does not have to build up sterilization facility in order to save cost and space.

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The Development of an Endoscope-Assisted iMET to Improve the Distal Screw Hole Positioning Efficacy in Interlocking Nailing Procedures

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Abstract. Intramedullary nailing surgery is a pioneer indicator of surgical miniaturization such as traditional migration techniques Hand-Off Location, Fluoroscopic C-Arm Free Hand Method (FHM), Target Aiming Devices, Internal Drilling System, Magnetic, Electromagnetic Induction, Computer Navigation System and Light Transmission Method (screw hole positioning using a visible light source). It has been shown that intramedullary nailing surgery can be performed through intramedullary transillumination and intra-Medullary Endo-Transilluminating (iMET) Device for distal screw hole targeting. iMET is operated by a visible light source to shorten the operation time, increase positioning accuracy, avoid X-ray radiation exposure, and improve the drilling success rate. By adopting the endoscopic technology, it is expected to further improve the efficacy of the distal screw hole positioning in an intramedullary nailing surgery. In this research, a set of 2–4 LED light sources are used to establish pipeline access with an endoscope powered by a high-capacity lithium battery. With modular design such as wireless transmission, to refine the above mentioned four advantages in an intramedullary nailing surgery. Through the use of phantom and animal trials, we will show the improved surgical efficacy using the proposed design.

Keywords: Intra-medullary nailing procedure · Target-aiming device · Visible light source · endoscopic miniature image

1 Introduction

The global orthopedic market is experiencing steady growth. It's closely tied to the development of the medical device industry and the expansion of the healthcare sector. The top four global market segments are: in vitro diagnostics (13%), cardiovascular (12%), medical imaging (10%), and orthopedics (9%) [1]. Our study emphasized on the items 3 and 4.

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In 2018 the Research firm Evaluate Med Tech predicts that the orthopedic medical market was approximately $36.5 billion, and will continue to grow at an annual rate of 3.7%, reaching a market size of around $47.1 billion in 2024.

According to the 2021 statistics of the Taiwan Ministry of Health and Welfare, the number of outpatients and inpatients combined were over 270,000 cases of forearm, femoral, and tibial fractures, with a higher number of cases in females (the male to female ratio was about 40%:60% [2].

2 Literature Review

2.1 Positioning Technology Summary

Different surgical methods have been developed to perform distal screw hole targeting in an intramedullary nailing surgery. The advantages and disadvantages are shown in Table 1 [3–7].

Table 1. Advantages and disadvantages of different methods used in the positioning of distal screw holes in an intramedullary nailing surgery.

X-ray	Need X-ray			NO X-ray				
Category pros and cons	Hand-held positioning	Fluoroscopic C-Arm Free Hand Method (FHM)	Target Aiming Devices (TAD)	Internal Drilling System	Magnetic method	Electromagnetic Induction method	Computer Navigation System	Light Transmission Method
Advantage	mild symptoms	most commonly used	intermediate level	Positioning without radiation				low cost and no side effects
Disadvantages	Manually error	Hight cost • >= 20 min • high radiation • screw misplacement	<= 30 min	surgical instruments left in the body	• operation complex • high permeability materials	Need training		Certification procedures are cumbersome

2.2 Existing Technology Applications

The use of intramedullary nailing surgery to fix long bone fracture has become mainstream over the past decades. Although different methods have been developed, positioning distal screw holes on an interlocking nail remains to be a complicated task. Of all these different methods, the one that used a visible light source to pinpoint the location of a distal screw hole, the "intraMedullary Endo-Transilluminating (iMET)" device, has been shown to have [8–9].

IMET device [10] performs the distal screw hole targeting task using a visible light source and has the advantages of less radiation absorption to the patient and the surgical team members, reduced targeting time, improved drilling efficiency, and the procedure is almost identical to the conventional intramedullary nailing procedure (Fig. 1).

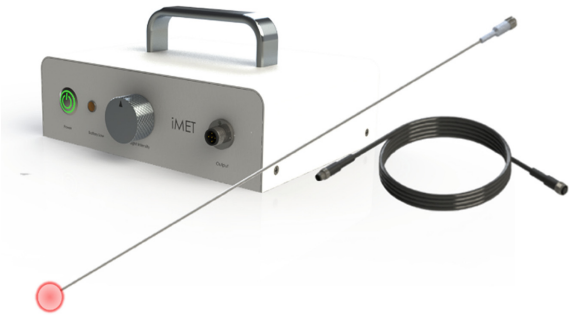

Fig. 1. A photo of the iMET device used in an IM nailing surgery. It consists a power (upper-left), the iMET with a high intensity light emitting diode at the tip of a metal rod (middle), and the power cord (right) that connect the power supply to the iMET.

3 Purpose

In order to accurately pinpoint the distal screw hole, the surgeon has to insert the iMET inside the interlocking nail and placed its LED light directly underneath the targeted screw hole. There are two degree of freedom need to be taken care of before an accurate location of the screw hole can be detected. In this study, we proposed to use a upgraded iMET-II to further improve its positioning efficiency.

We applied an array of four LED light sources to achieve a full viewing angle And with the endoscope to strengthen the judgment of the direction and the inspection of the environment when it is inserted inside the interlocking nail (Fig. 2).

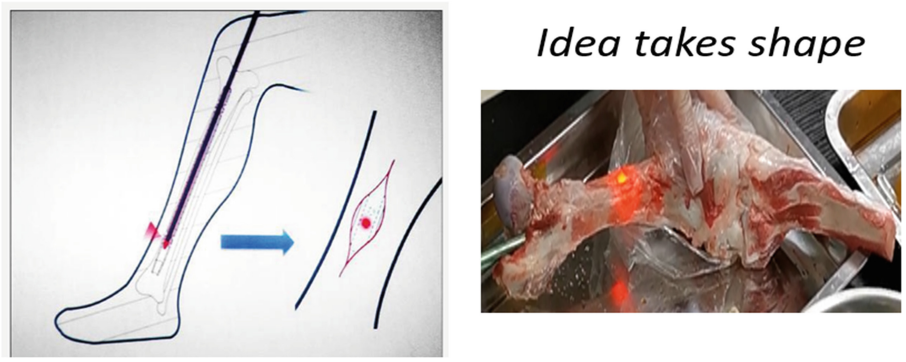

Fig. 2. Left: A schematic plot of how iMET reveals the location of a distal screw hole. Right: a pig bone phantom study that showed the red light spot projected on the bone surface that was emitted from the iMET.

4 Results

We have performed pig bone phantom experiments. The results are shown in Table 2.

Table 2. Functional and efficacy differences between iMET-I and iMET-II.

project	LED light source	Targeting	Endoscope function	transfer method	pipeline channel
iMET-I Existing features	1 red light (3mm)	Light source assistance is easily limited	NO	Wired transmission	Restricted pipe diameter
	Positioning time approx. 4.1 ± 1.8 min	keep looking for holes		Whisker light source system (machine)	less functional
iMET-II Improved function	2–4 red light LEDs (1 mm)	Reduce X-ray use Avoid human adiation	YES	Wi-Fi	Unlimited pipe diameter
	Reduce positioning time at least ½ or more	LED + endoscope More accurate positioning and time-saving		High capacity lithium battery >2 h	Compass function
Future refinement direction	Multi-directional (360°) ambient light	Modularization of GIS positioning	High-resolution lens imagingtechnology (4K–8K)	Wireless charging	Channel Multiple Functions

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Spatial Correlation Analysis of Accidents and Casualties Related to Drunk Driving

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Abstract. Traffic accidents in Taiwan are mainly caused by the negligence of drivers of automobiles (including motorcycles and vehicles). Motorcycles and vehicles are the main types of vehicles involved in accidents, and the main cause of accidents is the failure to pay attention to the conditions in front of the vehicle. However, as mentioned above, high temperature and air pollution may cause drivers to fail to notice the front of the vehicle, which may lead to traffic accidents. Considering that Taiwan has one of the highest vehicle densities in the world and the vehicle composition is different from other countries, this study will use data from Taiwan to investigate the effects of high temperature and air pollution on traffic accidents.

Keywords: Spatial Autocorrelation · Drunk Driving

1 Introduction

In recent years, as global concern about climate change has grown, research on issues related to global warming and extreme weather has developed rapidly. The impact of rising temperatures on society as a whole is wide-ranging, including reduced economic productivity, harm to human capital accumulation, as well as damage to human health [1–3]. In addition, studies have shown that high temperatures have an impact on the physiological state and cognitive ability of drivers, which can easily produce fatigue or distraction and lead to unstable driving speed, operational errors or more aggressive driving behavior [4–8]. At the same time, studies have shown that factors such as cognitive ability, concentration and physiological function are closely related to road safety [9, 10].

In addition, air quality also has an impact on the risk of traffic accidents. Numerous studies have linked air pollution to a number of human health problems, including cardiovascular disease, respiratory disease, and psychological conditions; air pollution may lead to cognitive decline; studies have shown a high correlation between air pollution and anxiety levels; while air pollution has been noted to affect work performance and

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decision-making ability. Nevertheless, in past studies on the effect of weather factors on traffic accidents, air quality has rarely been considered. Until recently, data from the United Kingdom and China have shown that the higher the concentration of air pollution, the higher the number of traffic accidents.

As mentioned above, global concern about climate change is increasing and research is growing rapidly. The impact of high temperatures and air pollution on traffic accidents has become a hot topic of research. No relevant research and studies have been conducted in Taiwan, however. Therefore, this study aims to investigate the effects of high temperature and air pollution on traffic accidents using data from Taiwan, while considering the differences between different types of drivers. Through the results of this study, we can gain a better understanding of the traffic safety situation in Taiwan and provide corresponding policies and measures to reduce the occurrence of traffic accidents and protect the lives and properties of the public.

2 Research Objectives

2.1 Literature Related to Temperature and Other Meteorological Variables

With the adoption and signing of the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement, climate change has indeed received great attention from governments and academics. It is also an issue that needs to be addressed with caution. Among the many effects of climate change, "global warming" is the most relevant to human life. A large number of studies have been conducted to investigate the effects of rising temperatures, including studies on the effects of temperature on traffic accidents.

Yajie et al. [11] Climate change and extreme weather adversely affect road traffic safety and lead to serious road traffic accidents. In this study, a negative binomial model and a log-change model were proposed to analyze the effects of various factors on fatal crashes. The data sets used in this study include fatal crash frequency, social development indicators, and climate indicators for California and Arizona. The results show that both models provide accurate fit results. Climate variables significantly affect the frequency of fatal crashes. Non-climate variables also have a significant effect.

Zhan et al. [12] analyzed data from Shenzhen from 2010 to 2016 and used time-stratified case crossover to control for all time-invariant confounders in the study to make the results more precise. The relationship between air temperature and traffic fatalities was found to be a J-shaped curve with a potential threshold of 10, where the number of traffic fatalities increased by 0.87% for every 1-degree increase in air temperature above 17 °C.

The disadvantage of using monthly data is that it is more difficult to reflect the effects of temporary changes in weather patterns or extreme temperature events; for example, typhoons in Taiwan in summer and autumn or cold fronts in winter, resulting in different daily average temperatures. Although the temperature variables used in most studies are in the form of "daily (or monthly) average temperature" to consider the negative effects of temperature on drivers, it is assumed that the peak period of traffic accidents may be concentrated in the period when the temperature is higher. Thus, this study concludes

that the daily average temperature approach cannot identify the extent of the impact of high temperatures on traffic accidents, with other conditions remaining unchanged.

2.2 Air Pollution Related Literature

Air pollution has been one of the most important issues in recent decades. For example, the World Health Organization (WHO) has listed air pollution among the top 10 threats to global health in 2019. The Health Effects Institute (HEI) published the 2019 State of the World's Air report, which ranked air pollution fifth among all health risk factors. In addition, the WHO [13] states that air pollution kills about 7 million people each year, and in 2016, up to 90% of the population lived in areas where air quality did not meet WHO standards. In recent years, the amount of literature on $PM2.5$ has increased dramatically [14], and a large number of reports and studies have confirmed the negative effects of $PM2.5$ on human health, including the onset and exacerbation of respiratory diseases [15], increased risk of cardiovascular diseases, and increased mortality and increased mortality.

In addition to the physical health effects, $PM2.5$ can also cause anxiety, stress, and even depressive symptoms [16]. In addition, many studies have found that $PM2.5$ also leads to reduced cognitive ability and is associated with an increase in violent crime [20]; another study by Archsmith et al. [17] showed that air pollution affects decision-making ability and leads to a decrease in labor productivity.

3 Data Sources and Processing

3.1 Source of Information

In this study, a total of 77 central monitoring stations from the Environmental Protection Administration of the Executive Yuan (EPA) were used. The hourly meteorological and air pollution indicators were recorded from 2014 to 2018. The meteorological indicators include rainfall, wind speed, and relative humidity15, while the air pollution indicators include $PM2.5$ (fine suspended particulates), $PM10$ (suspended particulates), CO (carbon monoxide), NO (nitric oxide), $NO2$ (nitrogen dioxide), $SO2$ (sulfur dioxide) and $O3$ (ozone).

The data collected in this study were obtained from the historical traffic accident data of the Police Department of the Ministry of the Interior, which includes traffic accident data since 2014. The Ministry of Transportation and Communications classifies traffic accidents into three categories, A1, A2, and A3, according to the casualty status of the parties involved in the accident, with category A1 being accidents resulting in death on the spot or within 24 h, category A2 being accidents resulting in injury or death over 24 h, and category A3 being accidents with only property damage.

According to the "Road Traffic Accident Handling Regulations", 18 the regulations on the filing of various types of traffic accidents, A3 cases can be filed or not at the discretion of the relevant police units, so there may be a large number of underreporting of A3 data. In addition, accidents with only property damage or accidents in which the parties involved settle privately may result in underreporting. Furthermore, accidents with only property damage may not be fully recorded due to private settlements between the parties involved, so only A1 and A2 traffic accidents in 2021 were used for analysis.

3.2 Data Processing

In this study, the data processing was divided into two stages and proceeded sequentially. In the first stage, the raw data were firstly integrated (e.g., categorization of township urban areas and vehicle types, examination of the reasonableness of the observations, etc.), and the meteorological and air quality data were additionally processed by the spatial interpolation method, which aimed to obtain the hourly incident data and the estimated values of each observation for each township urban area; in the second stage, based on the results of the first stage, calculations such as averaging and summation were performed according to the needs of this study, and this stage was used to obtain daily traffic accident statistics and estimates of each observation for each township.

In short, this study aims to convert the data of meteorological and air quality, and traffic accidents into daily data (including accident data and estimates of observations) for each township and urban area through two stages of data processing. Therefore, in the first stage of data processing, the incident time (or observation time) is divided into year, month, day, and hour, while the incident location is divided into county, city, and township urban areas, etc. This approach not only makes the data easier to process, but also facilitates the inclusion of time and area fixation.

4 Discussion and Conclusion

Climate change and air pollution are major issues of interest to governments and academics in recent years, and numerous studies have been conducted to investigate the effects of temperature and air quality on human psychological and physiological states. Since safe driving is a complex task that requires a stable state, temperature and air quality may affect the driver's state and lead to traffic accidents. The purpose of this study is to investigate the effects of air temperature and air quality on traffic accidents, with the number of accidents and the number of vehicles involved as the subjects. In this study, it was found that the number of accidents and the number of vehicles involved were not correlated when the daily high temperature was below 20 °C, but above 20 °C, the coefficients of each daily high-temperature range showed a positive significant correlation, indicating that the higher the daily high-temperature value, the higher the number of accidents and the number of vehicles involved.

This study also classified the vehicles involved into two types, namely, automobiles and motorcycles, and further discussed the effect of high temperatures on the drivers of these two types. The results showed that the effect of high temperature on motorcycle drivers were more significant, and it was assumed that motorcycle drivers were more affected by the temperature because they were less sheltered and protected by the body of the vehicle than automobile drivers.

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A Comparative Study on the Impact of Urban Hazards and the Reconstruction of Old Buildings on the Property Prices of Surrounding Residential Areas

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Abstract. We have conducted a study on the spatial clustering of old buildings and land use management, using Taipei city as the context of our research. The purpose of this study is to investigate the influence of land use policies on the spatial distribution of old buildings and to understand the relationship between urban development and the distribution of old buildings by evaluating spatial autocorrelation. To begin with, we utilized Moran's index for the analysis of spatial autocorrelation, where we discovered a significant spatial clustering phenomenon of old buildings in Taipei city. Based on the results mentioned above, we suggest that urban planning departments strengthen the formulation and modification of land use policies, with an emphasis on their impact on the spatial distribution of old buildings. At the same time, we also assert that future research should investigate further the correlation between land use policies and the spatial distribution of old buildings, to gain a more comprehensive understanding of urban development patterns and offer appropriate policy recommendations.

Keywords: Spatial Cluster · Moran's I · Spatial Autocorrelation

1 Introduction

As the largest metropolis and international gateway in Taiwan, Taipei City is a hub of politics, economy, and culture, boasting numerous historic and old buildings. These structures not only chronicle the evolution and development of the city, serving as vessels of urban memory, but also bear significant historical and cultural values. This situation has triggered discussions on urban environment, preservation of cultural heritage, and land use management.

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However, previous studies have focused on individual buildings or areas, lacking a comprehensive perspective and spatial analysis. Therefore, it is imperative to approach this issue from a new perspective, to enrich our understanding and provide a more comprehensive strategy and basis for decision-making. With the advancement of geographic information science, we are now equipped with analytical methods such as spatial autocorrelation and geographic weighted regression. These methods allow us to investigate deeper into the spatial distribution and clustering characteristics of old buildings and their relationship with land use. These tools provide fresh insights for our research and help unravel the complexities of spatial clustering of old buildings and their connection with land use management.

Essentially, this study focuses on analyzing the spatial clustering of old buildings in Taipei City and their correlation with land use. We aim to deepen the understanding of this relationship's influence on land use management and propose potential solutions. Our hope is that this research will provide empirical evidence to aid in the preservation of old buildings and land use management in Taipei City. Furthermore, our objective is to serve as a reference for future policy formulation and urban development planning.

2 Research Objectives

2.1 Study Area

Taipei City, nestled in the Taipei Basin in the northern part of Taiwan Island, is flanked by New Taipei City on all sides. It is the fourth most populous city among all cities and counties on the island, yet it possesses the highest population density. Along with the adjacent satellite towns, the total population of the Taipei Metropolitan Area's is 3,979,218 as of September 2022. The twelve districts under their jurisdiction display a population distribution that descends in the following order: Da'an, Neihu, Shilin, Wenshan, Beitou, Zhongshan, Xinyi, Songshan, Wanhua, Zhongzheng, Datong, and Nangang.

In 2022, Taipei City was home to 182,229 buildings. These structures are dispersed among its twelve districts in the following descending order: Shilin, Beitou, Neihu, Wenshan, Zhongshan, Da'an, Wanhua, Xinyi, Songshan, Datong, Zhongzheng, and Nangang, as depicted in Fig. 1. Of these buildings, 19,196 are over 50 years old, making up 10.5% of Taipei City's old buildings, as represented in Fig. 2.

2.2 Geographic Information System and Spatial Analysis

Maps serve as tools for representing spatial phenomena on the Earth's surface. With the advancements in technology, the speed of information exchange and transmission has significantly accelerated, enabling the visualization of human activities on the Earth's surface through maps. Traditional geography, which has traditionally focused primarily on natural landscapes, has evolved to include the study of human activities within natural environments, resulting in the development of various branches of study, such as human geography and social geography [1].

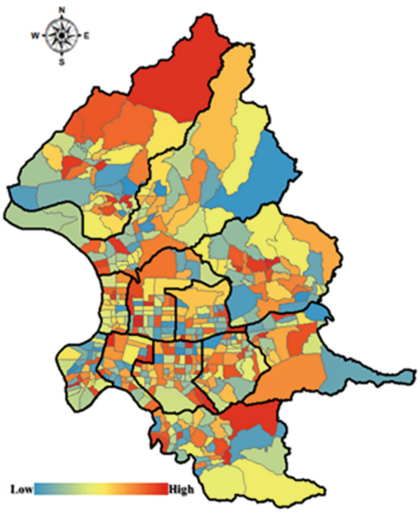

Fig. 1. Distribution map of buildings across districts in Taipei City.

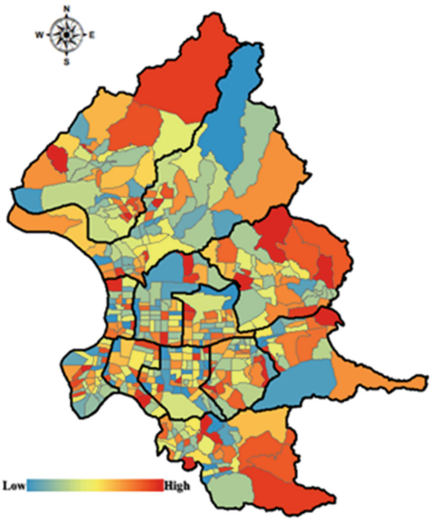

Fig. 2. Distribution map of buildings over 50 years old in Taipei City.

Technological advances have brought about new perspectives that have led to the gradual development of sophisticated and complex tools. The increasingly advanced Geographic Information System (GIS) has also become a crucial foundation for analysis and decision-making. The components of a GIS typically include computer software, computer hardware, geographic data, professionals, and operational procedures. Establishing a GIS aims to achieve efficient collection, storage, update, processing, analysis, and visualization of various geographically related information [2]. A Geographic Information System (GIS) is an integrated information technology and database system that allows the input, storage, and analysis of spatial data. By linking attribute data, it enables the exploration of the social characteristics of space and the impact of socio-economic conditions on spatial utilization. GIS is a graphical interface that can comprise a single layer or multiple layers stacked together. Ultimately, it presents geographic information in a visual format [3].

This study uses spatial analysis software to visualize the overall distribution of old buildings in Taipei City. The description of the analytical methods is as follows.

1. Thematic map.
The spatial analysis software is utilized to organize the analysis of old buildings into thematic maps. The data are then organized into gradient maps, which use gradient colors to visually represent changes in data values with the same attribute across administrative boundaries [4].
2. Graduated symbol map.
Spatial analysis software is utilized to organize the addresses of old buildings into point features. This allows the observation of the distribution pattern of point features on the spatial data, and the attribute data of point features can be visually represented by varying the size of the symbol area to indicate changes in the proportion of attribute values [5].

3. Density analysis.
The density analysis tool in spatial analysis software is used to analyze the density of old building addresses using kernel density methods. This analysis helps to observe the trend of concentrated distribution trend of point features [6].
4. Overlay analysis.
The thematic map that illustrates the characteristics of old buildings is overlaid with the distribution map of old building addresses. This overlay analysis combines spatial and attribute data to examine the alignment between the distribution of old buildings in Taipei City and the needs of the target population needs [7].

3 Results

3.1 Global Moran's I Analysis

Global Moran's I is the most commonly used indicator for calculating global spatial autocorrelation. Specifically, this indicator is based on the statistical concept of covariance and is calculated using a spatial matrix (Wij). The definition is shown in Fig. 3.

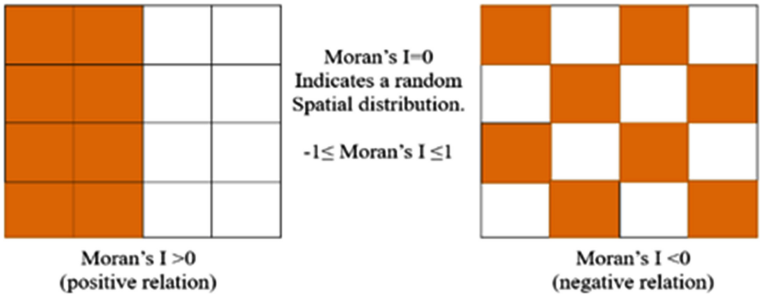

Fig. 3. Global Moran's I.

When analyzing the variable of the old buildings (represented by x), with n as the sample size of the old buildings, xi represents the total incidence rate of air pollution in the spatial unit i, and xj represents the rate of j. wij is an n × n symmetric matrix consisting of 0s and 1s, reflecting the neighboring relationship between the spatial units. If units i and j are neighbors, the corresponding value of wij is 1; otherwise, it is 0. The self-neighbors (wii and wjj) are also set to 0.

Moran's I value, calculated using the above formula, always ranges from -1 to 1. When the I value is greater than 0, it indicates that neighboring areas exhibit similar attribute values. In simple terms, it implies clustering phenomena in areas with high and low attribute values. Typically, the significance of the Moran's I statistic is evaluated using the Monte Carlo Significance Test, which transforms the statistic into a Z-score. At a significance level of 5% (i.e., $I > 1.96$), it indicates a significant positive spatial correlation, suggesting a notable association among the aggregated cases of spatial units within the study area.

3.2 Local Moran's I Analysis

Each matrix relationship corresponds to a Moran's I, which represents the degree of spatial autocorrelation of the support rates across locations under this matrix relationship. However, Moran's I captures the overall spatial distribution characteristics of the variable, whether it is clustered, dispersed, or randomly distributed. To understand the specific relationships between individual regions and their neighboring areas, further calculation of local Moran's I can be performed. All I_i values are components of the global spatial autocorrelation measure, Moran's I. The collective set of all I_i values represents the value of Moran's I.

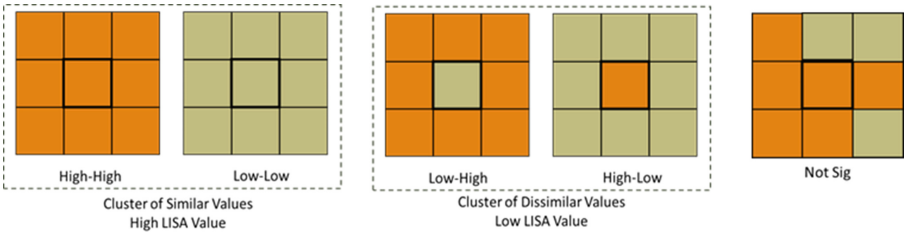

Fig. 4. Local Moran's I.

4 Discussion and Conclusion

The spatial clustering of old buildings (as shown in Fig. 4) is mainly concentrated in six areas, from south to north: Wenshan District, Zhongzheng District, Da'an District, Xinyi District, Nangang District, Neihu District, Songshan District, Zhongshan District, and Datong District. The calculated Moran's I value is 0.223755. For random distribution, the expected value of Moran's I is z-score = 25.873. The probability (p-value) of a Type I error, which indicates that our conclusion is incorrect, is less than 0.00. This means that the difference between the calculated value of Moran's I and the expected value is statistically significant. Therefore, we have obtained a positive spatial autocorrelation for the attribute. The spatial clustering of old buildings exhibits a clustered (grouped) distribution pattern.

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The Use of AI Technology and Embryo Imaging for the Diagnosis of Artificial Reproduction Techniques

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Abstract. Following the World Health Organization (WHO), it is estimated that approximately 80 million men and women with childbearing potential around the world need medical assistance due to fertility difficulties, with a rate of approximately 15%, more than three times the population of Taiwan. Similarly, approximately 15% of couples of maternal ages in Taiwan face infertility problems. In the clinical setting, artificial reproduction techniques include artificial insemination and in vitro fertilization (IVF), but the use of IVF is predominant. In vitro fertilization (IVF) is a method of fertilization in which sperm and eggs are extracted and combined through laboratory technology to grow fertilized eggs into embryos and reproduce the fertilized embryo for return to the mother. By establishing a reliable classification and prediction model through deep learning technology, we can assist physicians in embryo selection and systematically select high-quality embryos with high fertility rates, thus reducing manual visual classification errors and improving the success rate of pregnancy.

Keywords: Convolution Neural Networks · Deep Learning · Embryo

1 Introduction

According to an estimate by the World Health Organization (WHO), a fertility population of about 80 million men and women around the world face infertility difficulties and need medical help. The rate is about 15%, which is more than triple the population of Taiwan. Similarly, approximately 15% of couples at the age of childbirth face infertility problems in Taiwan. In light of this estimate of the ratio, there are about 300,000 pairs of men and women in Taiwan facing fertility problems or problems of varying degrees [1, 2], many factors can cause infertility or low pregnancy ability. According to the

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report on artificial reproduction results in 107 published by the Ministry of Health and Welfare of Taiwan [3], causes such as abnormal fallopian tubes (8.0%) and other uterine factors (5.2%), male factors (12.3%), ovarian factors (31.5%), endome-triosis (3.9%), other female factors (4.6%), multiple factors (30.9%) and unknown causes (3.7%), etc., the above-mentioned methods for infertility in clinical treatment can be controlled by the intervention of lower level to the time of ovulation, intrauterine insemination (IUI) and the intervention of even higher level in vitro fertilization (IVF).

The pregnancy rate of women usually decreases with age, especially when women over the age of 30. Both the conception rate and the birth rates of the fetus decreased significantly [4, 5]. With increasing female age, the chance of conception de-creases year by year and the risk of miscarriage increases year by year. The female pro-duces approximately one million oocytes during her lifetime. Among them, 40% of the causes of infertility are female, 40% are male, and the remaining 20%, due to the mutual influence of the two sides and for reasons that cannot be explained by science [6].

With the development of reproductive technology in recent years, treatment methods have made great progress. Under the collaborative efforts of British physiologist Dr. Robert Edwards and obstetrician and gynecologist Patrick Steptoe, the first test tube baby was born in 1978 [7]. Through statistics from the European Society of Human Reproduction and Embryology (ESHRE) in 2016, European countries had registered IVF treatments whose clinical pregnancy rate per embryo implantation was only 27.1% [8].

Due to the inefficiency of IVF treatment in the early period, more embryos must be transplanted to achieve the purpose of pregnancy. In addition to fetal death or the end of development, preeclampsia, eclampsia, placental abnormalities, and primary postpartum hemorrhage can occur, but also increase with it [9–11]. The development potential of each embryo can be con-firmed by prolonging the in vitro culture time, and the technological development of the embryo in frozen/vitrified can also maximize the preservation of embryos with developmental capacity [12–14], furthermore, related research compares the implantation and pregnancy ability of embryos with embryo morphology. The selection of a single form of the best embryo for transplantation is to achieve the goal of a single birth [15].

2 Materials and Methods

After stimulation of ovulation and IVF during assisted reproductive technology cycles, embryos are cultured in vitro for two to five days prior to implantation in the uterus. The desire of the patient for a successful pregnancy comparatively increases the patient's tolerance to multiple pregnancies, resulting in a much higher risk of subsequent high-risk pregnancies and preterm births, which consumes considerable medical resources [16].

2.1 Importance of Embryo Quality in IVF Treatment

The clinical guidelines of the American Society for Reproductive Medicine over the years have focused on different age groups and embryo types on the third or fifth day. The so-called selective single embryo implantation with embryos in this division period on the third day is not effective [17, 18], which means that currently there is no way to directly select the most implantable embryo for the implantation of a single embryo and achieve the best pregnancy rate.

Most artificial reproduction institutions use embryos on the third day of the division stage as the main axis of embryo implantation. This is due to the following factors: First, the embryo is cultured in vitro for five days, and the demand for manpower and incubator space has increased by more than 40%. Therefore, the cost of culture for five days will increase significantly. Second, embryos are cultured in vitro for five days. The main effect is to select better embryos through the culture process, which only increases the rate of embryo implantation.

2.2 Selection and Transfer in IVF Treatment

When embryos reach the two-cell stage, mitochondria are initially distributed mainly at the far end of the two nuclei and then distributed around them. In the four-cell stage of embryos, mitochondria were originally also distributed at the far end of the nucleus in most cells, but some cells may acquire more mitochondria and some may be assigned to fewer mitochondria [19]. Therefore, the in vitro culture used clinically is divided into two stages; The first stage is rich in pyruvate and suitable for embryo development in the first three days. The second stage is based on glucose, which is appropriate for the development of the fourth and fifth days.

In other words, embryos that have developed to the eight-cell stage in the first three days may have considerable amounts of free radicals and oxidative formation as a result of the effect of oxidative phosphorylation and are easily affected by oxidative stress. Therefore, the maintenance of mitochondrial membrane potential is related to embryonic development in the first three days, and the energy source at this stage is preferably pyruvate instead of glucose.

3 Results

When feature maps are fused on different scales, computational effort decreases by employing multiple $3 * 3$ convolutions to replace $5 * 5$ convolutions or $7 * 7$ convolutions.

3.1 Inception-ResNet Architecture

The feature extraction utilizes stride, padding, and max pooling in convolution to obtain the feature vectors of the face images, which are finally composed of average pooling, dropout, fully connected layer, and L2 normalization layer (as shown in Fig. 1).

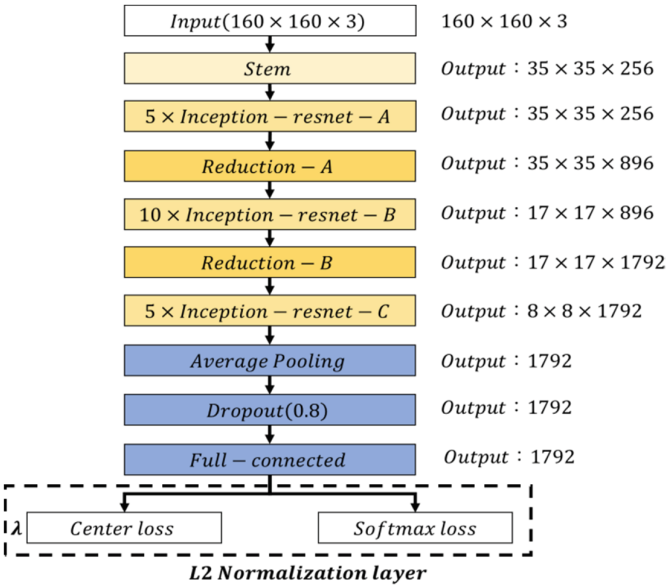

Fig. 1. Inception-ResNet-v1 architecture.

The difference between Inception-ResNet-v1 and Inception-ResNet-v1 is that there are more output dimensions than Inception-ResNet-v1 after the calculation of different stem structures, and the number of parameters corresponding to each module is also higher. The feature vector of the face image is also extracted using stride, padding, and max pooling in the convolution. Eventually, it is made up of using average pooling, dropout (to avoid overfitting), fully connect-ed layer, and L2 normalization layer.

Inception-ResNet blocks (residual inception blocks): In the Residual-Inception network, Inception blocks are used, which are less computationally intensive than the original Inception blocks. It can be seen that the so-called Inception-ResNet is the residual structure of ResNet added to Inception, that is, the output of each InceptionResNet layer adds its input value to deepen the depth of the network. The Inception-ResNet module is a well-designed convolution module that generates differentiated features and reduces the number of parameters. At the end of the Inception-ResNet layer, there is a 1×1 convolution kernel for dimensionality enhancement, while at the end of the Inception layer, there is no 1×1 convolution kernel.

We have also found that by scaling the residuals, if the number of filters exceeds 1000, the residual network becomes unstable in the early stages of the training process. In this situation, the learning rate is slowly adjusted to a stable level, while the residual scaling factor is set between 0.1 and 0.3 to achieve regular training (as shown in Fig. 2).

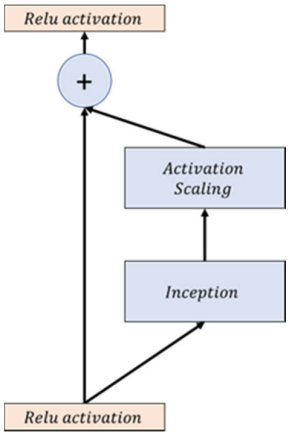

Fig. 2. Scaling of the Residuals.

The formulation of ResNet residual learning propagation discovers that the feedforward and feedback signals can be transmitted directly. Therefore, the non-linear initiation function (e.g., ReLU) of a shortcut connection is replaced by Identity Mappings. Meanwhile, Inception-ResNet-V2 uses Batch Norm in each layer. After normalization, it is easier to train and improve the adaptability of the learning model to uncertain data than before.

4 Conclusions

In this research, microscopic images of fertilized embryos were used as the basis for analysis using the Inception-ResNet-V2 algorithm. Inception-ResNet is a hybrid of the Inception network and the Residual network. Model accuracy validation is performed using K-Fold cross-validation and hierarchical analysis. By combining the image enhancement method with hyperparameter adjustments, such as adjustment of image size, dropout layer, and learning rate, we obtained a classification model with a maximum accuracy of 80%, which is better than the general conception rate of manual selection. However, there are few relevant studies with deep learning techniques to image fertilized embryos. The classification model developed in this research has the degree of reference values for clinical application with better recognition of fertilized embryos. Subsequently, if the classification model can be systematized, this will provide an effective aid in the manual selection of embryos during the IVF procedure, thus reducing the burden and errors of manual selection. Last but not least, this will improve the standardization and efficiency of the embryo selection process for the benefit of patients with infertility by increasing their chances of conception.

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Concept Drift Adaption for Online Game Chargeback Detection

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Abstract. The flourishing online game market, driven by the rapid development of the Internet and hardware performance, has attracted the attention of criminals. Online game service providers have become prime targets, facing significant losses due to malicious chargebacks. Unfortunately, the current approach is reactive, as providers can only block affected game accounts after they have been attacked. Although there is existing research on detecting malicious chargebacks using machine learning, these criminals intentionally evade detection, exacerbating the concept drift of game records. This research aims to address not only the enhancement of malicious chargeback detection in online games but also the detection and prevention mechanisms for concept drift. In this paper, we propose an adaptive learning model for concept drift in online game top-up fraud, with the goal of preventing malicious chargebacks in top-ups before any losses occur.

Keywords: Concept Drift · Machine Learning · Online Game

1 Introduction

Game data analysis company Newzoo predicted in its 2022 Global Cloud Gaming Report that by the end of 2022, there would be 31.7 million paying users for cloud gaming services, with a total spending of $2.4 billion on cloud gaming services and games transmitted through the cloud. In its 2022 Global Games Market Report, Newzoo also predicted that the game market would grow from $179.1 billion in 2020 to $211.2 billion in 2025, with a compound annual growth rate of +3.4%. The game industry can be roughly divided into developers, operators (publishers), and distributors based on their upstream and downstream relationships. Developers are responsible for game development and production, while operators acquire game publishing rights to handle marketing, daily operations, and after-sales services, generating revenue from distribution and operation commissions and player game top-ups. Distributors are platforms that sell products directly to customers, such as Apple Store and Google Play. Currently, the majority of Taiwan's game industry adopts a business model that focuses on operation with in-house development as a supplement. To comply with regulatory requirements and safeguard players' rights, game companies have established refund mechanisms to provide players with opportunities to retract or rectify mistaken purchases. However, this

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has also become a means for unscrupulous individuals to exploit for illicit gains. Several Korean game companies have reported instances of users abusing the refund system, and addressing this issue requires operators to analyze users' payment data and game logs to identify methods for blocking users who repeatedly engage in malicious refund practices. Taking the digital game platform STEAM as an example, STEAM allows game operators to release their developed games on the platform for users to play and purchase in-game items and services. The refund mechanism stipulates that players can request a refund if the gameplay time does not exceed 2 h within 14 days of purchase, and if the product itself has not been consumed, modified, or transferred. However, this mechanism has also been abused, with individuals writing malicious refund tutorials on the internet, providing detailed instructions on how to bypass system checks to enjoy online games for free. From the above, it can be understood that developers are only responsible for game production, while the actual operation of the game, distribution of in-game items, and player top-ups are handled by operators. Therefore, in cases of malicious refund incidents, the game operators bear the risk and losses of refunding payments and reclaiming items.

Malicious chargebacks are a common occurrence in platforms like Google Play and the App Store, often resulting from reasons such as purchasing the wrong products, incorrect top-ups of gaming credits, or accidental purchases made by children. In addition to these typical scenarios, unauthorized chargebacks are prevalent, particularly on Google Play. This situation arises when a user takes advantage of the chargeback process to prevent a chargeback initiated by their family or friends on their behalf, mistakenly or otherwise. Unfortunately, online gaming service providers are unable to intervene in the chargeback process, leaving them helpless in preventing further losses. While originally intended as a customer-friendly mechanism, fraudsters have identified new business opportunities in exploiting the chargeback system. They offer refund tutorial services to consumers and take a 20–50% cut from the chargeback amounts received by these consumers. This gray industry represents a significant risk to game providers, as the abuse of chargebacks can result in substantial financial losses.

To address this problem, this study will use machine learning to detect fraudulent refund behavior in online games and utilize real game data provided by gaming companies for research purposes. However, the actual game data will face the following challenges: data imbalance, as the number of normal transactions far exceeds that of abnormal transactions in real scenarios, and concept drift, as the data undergoes changes due to users' deposit and spending behaviors, leading to concept drift. Based on these two challenges, the research objective will focus on sampling techniques to handle imbalanced datasets and construct incremental learning models to adapt to concept drift, reducing the situation where the model's performance is compromised due to real-world transaction data. This study will train models using two types of game data to improve the general detection mechanism for malicious refund evaluations, aiming to better identify players engaging in fraudulent refund behavior and reduce losses for game developers.

2 Related Work

The definition of concept drift is the statistical properties of the target variable, which the model is trying to predict, change over time in unforeseen ways [1]. Online games generate large amounts of in-game logs based on their actions and purchases. Concept drift in fraud detection means that the detection system continues to import data and perform detection for a long time, but the behavior of legitimate or fraudsters gamer will change over time [1]. Take the credit card transactions as an example, the concept drift of credit card fraud detection is that the cardholder's transaction behavior will change due to external factors. Therefore, the cardholder's consumption behavior, income and lifestyle will cause changes in the transaction amount and frequency. As described above, it can be seen that when concept drift occurs, old data will be used to retrain the detection model, but when new data receives constantly, the model will be misled by old knowledge and result in wrong predictions [2]. Concept drift has other alternative names, for example the concept shift in [3, 4] or dataset shift [5]. Concept drift can be classified as sudden drift, gradual drift, incremental drift and reoccurring concepts as shown in Fig. 6. Sudden drift occurs when a new concept appears in a short time. Gradual drift occurs when a new concept replaces the old one within a period of time gradually. Incremental drift occurs when the old concept changes to a new concept within a period of time incrementally. Reoccurring concepts means the old concept may reoccur after some period of time.

In [7], the author reorganize and propose a clear framework for the papers on the past researches on concept drift, which mainly divides concept drift research into three categories: concept drift detection, understanding and adaptation, and we only discuss the definition and types of concept drift, as shown in Fig. 2, in this paper.

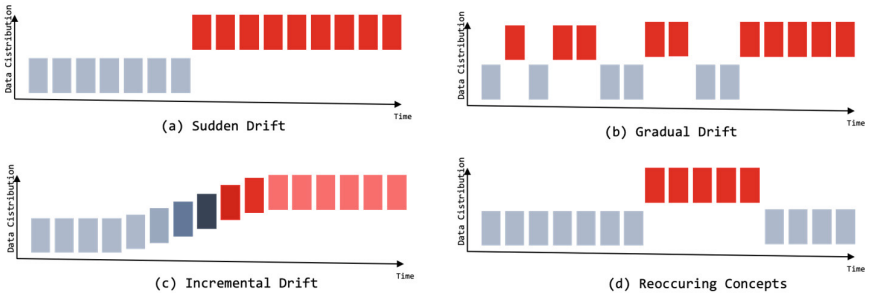

Fig. 1. The types of concept drift can be classified as sudden drift, gradual drift, incremental drift and reoccurring concepts.

2.1 Concept Drift Detection

Concept drift detection can be performed through error rate, data distribution, and multiple hypothesis validation. Error rate-based detection refers to triggering drift detection when the classification error rate significantly increases or decreases. Data distribution-based detection involves calculating the difference in data distributions to detect drift,

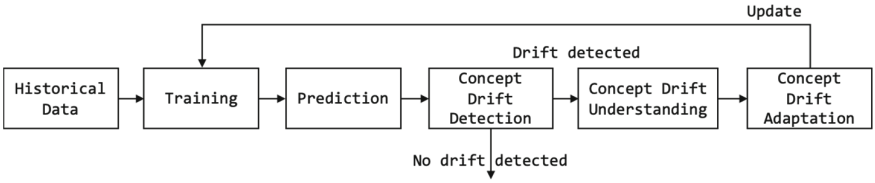

Fig. 2. In addition to conventional machine learning, for handling concept drift include concept drift detection, concept drift understanding and concept drift adaptation [7].

which can examine both temporal drift and concept differences within the dataset. Typically, two sliding windows are used to select data. Multiple hypothesis validation detection methods can be divided into two groups: parallel multiple hypothesis validation and hierarchical multiple hypothesis validation. However, in this study, we only discuss error rate-based detection methods.

The most famous and commonly used error rate-based detection method is DDM (Drift Detection Method) [8]. Based on the PAC (Probably Approximately Correct) learning model, this method assumes that the classifier's error rate decreases or remains unchanged as the number of instances increases; otherwise, drift occurs. EDDM (Early Drift Detection Method) [9] is effective for detecting gradual and abrupt changes. It primarily detects changes based on the distance between classification errors, rather than just considering the number of errors. This method assumes that drift may occur when the distance between errors gradually decreases. HDDM (Drift Detection Method based on the Hoeffding's inequality) [10] is divided into HDDM A-test and W-test. The former compares moving average lines to detect drift and is suitable for abrupt changes. The latter uses the EWMA (Exponentially Weighted Moving Average) forgetting method to weight the moving average line and then compares the weighted moving average values to detect drift. The Hoeffding's inequality is used to set the upper limit on the difference level between the means.

In addition to the methods mentioned above, another approach is to use sub-windows and main windows to detect changes in error rates. ADWIN (ADaptive WINdowing) [11] uses the window W to identify changes in the data distribution. It divides W into two self-adaptive sub-windows and compares the basic statistical information. The main window grows when no changes are detected. If a change is detected between the sub-window statistics, the main window shrinks. This change is handled by the Hoeffding Bound. KSWIN [12] is similar to ADWIN, but it uses the Kolmogorov-Smirnov (KS) statistical test to detect data distribution without assuming any specific distribution. KSWIN maintains a fixed window size and compares the cumulative distribution of the current window with the cumulative distribution of the previous window. If the KS test rejects the null hypothesis of the same distribution, it indicates a detected drift.

2.2 Concept Drift Adaption

J. Gama et al. [13] viewed the ability to adapt to concept drift as an extension of incremental learning systems, enabling them to adjust to data that changes over time. The authors proposed that predictive models should: quickly detect concept drift and adjust when necessary, differentiate between drift and noise, exhibit adaptability to changes while being robust to noise, operate within a timeframe shorter than the arrival of new instances, and store a fixed number of memories. Several strategies for handling concept drift in incremental learning exist, including instance selection or window-based methods, weight-based methods, and classifier ensembles. Sliding window methods are primarily used in online learning environments, where they retain a portion of the most recent data and update the current model with both retained and newly arrived training instances. Other methods explicitly define concept drift detection during the learning algorithm, updating the model with new data if drift is not detected. Otherwise, the current model, which could be a single learner or an ensemble, is discarded and a new model is constructed from scratch, without preserving previously acquired knowledge [14, 15]. In this study, we will first explore the concept of incremental learning and then investigate methods that focus on preserving historical models and utilizing them for incremental learning. Thus, we will discuss the relevant literature in this regard.

3 Research Methodology

3.1 Concept Drift Detection

ADWIN [11] is used to maintain the bit o real number level of the adjustable window size. When it detects that there is no significant change in the data, the algorithm will automatically increase the window, otherwise it will shrink when it changes. The window size can be adjusted to the best balance point between reaction time and small variance. In this section, we will describe how to dynamically adjust the size of the window. First, the input of the algorithm is divided into a confidence interval $\delta \in (0, 1)$ and a real-valued sequence $x_1, x_2, ..., x_t, x_t$ is only at time t.

ADWIN keep a sliding window w, where comprises the newly x_i read, $\widehat{\mu}_w$ is the average of the elements W. μ_w is μ_t the average value for $t \in W$. As long as two sufficiently large sub-windows of W can show sufficiently different average values, corresponding expected values and different conclusions can be drawn. According to the ADWIN algorithm in [11], compare W_0 and W_1 the average values to confirm that they correspond to the same distribution. If the distribution equation no longer holds, a concept drift is detected. When a drift is detected, a new W_1 will be initialized, and W_0 is replaced by W_1. The confidence interval is δ used to confirm whether the two sub-windows correspond to the same distribution.

DDM [8] is a concept change detection method based on the premise of the PAC learning model. As long as the data distribution is stable, the error rate of the learner will decrease as the number of analyzed samples increases. When the detection error rate increases and exceeds the critical point of the calculation, a change will be detected or a warning will be changed latter, which is called a warning zone. The critical value of detection is calculated based on two statistical values, when $(p_i + s_i)$ is the minimum

value, p_{min} refers to the minimum error rate of the, and s_{min} refers to the minimum standard deviation of the record. p_i refers to the error rate at i, and s_i refers to the standard deviation at i.

EDDM [9] is mainly to improve the detection rate of DDM in progressive drift, while maintaining a good performance against sudden conceptual drift. The principle of this method is to track the average distance between two errors, not just the error rate. Therefore, it is necessary to track and calculate the average distance, standard deviation, maximum distance, and maximum standard deviation. The algorithm of EDDM is similar to DDM, except that statistics are tracked and used to calculate the average distance $p_i\prime$, standard deviation $s_i\prime$, maximum distance $p_{max}\prime$ and maximum standard deviation $s_{max}\prime$, which are $(p_i\prime + 2 * s_i\prime)$ when the maximum value is reached $p_i\prime$ and $s_i\prime$.

In [10], the authors propose two methods for detecting drift. The first method is aimed at moving average, which is suitable for detecting sudden changes, called HDDM_A, which is based on Hoeffding bounding moving averages drift detection method, using average value as an estimator; the second one follows a wide range of intuitive ideas and uses a weighted moving average to process progressive changes, called HDDM_W, which is a drift detection method based on the Hoeffding bounding weighted moving averages, which is an online method using the McDiarmid [23] boundary. The drift detection method uses the exponentially weighted moving average EWMA statistic as the estimator. Both receive the actual data stream as input and return the evaluation status of the data stream: stable, warning, or drifting.

KSWIN [12] uses the Kolmogorov-Smirnov window method for concept drift detection, which is a concept change detection method based on KS-test. KS-test is a statistical test that does not assume the distribution of basic data. KSWIN can monitor data or performance distribution, and also maintain a sliding window of a fixed size n (the size of the sliding window) Ψ. The hypothetical Ψ last r samples represent regarded as R's the last concept; from Ψ the first $n - r$ samples, r samples are taken on average, which represents the approximate last concept Ψ. KS-test is executed on windows R and W of the same size, and with the cumulative experience data distribution $dist(R, W)$ distance is compared.

3.2 Concept Drift Adaption Model

In this paper, we propose a concept drift adaption learning model for online game chargeback fraud prevention. It is mainly divided into three stages, namely, pre-processing, basic classifier construction stage, and incremental learning stage. The following Fig. 3 shows the architecture of the proposed model. In the first stage, feature construction, feature selection, and imbalanced data set processing are carried out; in the second stage, machine learning and deep learning model construction are carried out, the trained model is evaluated by cross-validation, and the test set is used for final verification; The stage is to detect concept drift, and determine the subsequent processing conditions according to the detection results. It is divided into three results: no drift, warning zone and drift occurred. When there is no drift, continue to return to the second stage and use the trained model to predict the results; Enter the warning zone, collect and store the data during this period in the buffer for incremental learning, use small windows and small batches for incremental learning, and become a backup classifier until it returns to no

drift; when it happens When drifting, larger batches are used for incremental learning, and the second stage classifier is updated.

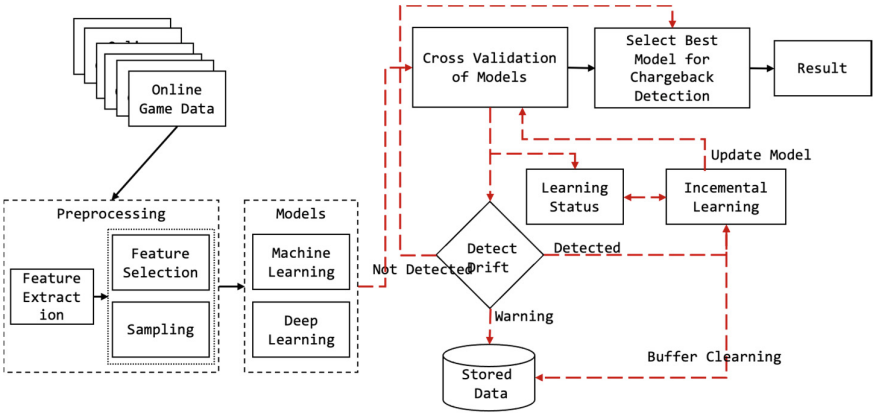

Fig. 3. The framework of concept drift adaption learning model.

4 Experiment Results

To compare and evaluate various concept drift detection algorithms, we utilized real game data obtained from a game provider in Taiwan. The game company has a substantial presence in Taiwan, having already released multiple games. For our research, the game company shared data from one of their games, which included information such as the number of game plays, top-ups, chargebacks, blacklists, delisting from blacklists, and registration dates of game accounts. The data spanned from April 1, 2019, to March 31, 2021. Throughout this period, more than 67,000 accounts were registered, resulting in over 260,000 valid top-ups and over 550,000,000 game plays. Although we received a large volume of records from the game company, the usable data specifically pertained to 54 users who were blacklisted out of 7,087 valid top-ups that were blocked during log-ins.

In terms of data preprocessing, our first step is to discuss the labeling of the data and the creation of features from the original datasets. Out of the 96 users, we labeled 88 as blacklist accounts. Among these, the game company has blocked 54 users from logging into their accounts as the most severe punishment for their malicious chargeback behaviors. However, the registration dates for three of these 54 users are missing, resulting in the omission of features for those three accounts. Consequently, the data from these three accounts is excluded from our research. Among the remaining 51 users, nine have applied for delisting from the blacklist and have returned the chargeback amounts. As a result, the transactions made by these nine users are considered legitimate/normal top-up transactions. The chargeback transactions of the remaining 42 users are classified as malicious chargebacks. After labeling the transactions of the 51 users, we have a total

of 1,699 transactions, consisting of 230 malicious chargeback transactions and 1,469 legitimate/normal transactions.

In Fig. 4, the red line represents the detection of concept drift. From Fig. 4, we can observe that the different concept drift detection algorithms have different outcomes. And from the outcome of Fig. 4, we can ensure that the proposed chargeback detection model with the dataset provided by the game provider in Taiwan may occur concept drift. In the future, we intend do advanced investigations and adopt better algorithm and propose an anti-concept drifting enhanced learning model.

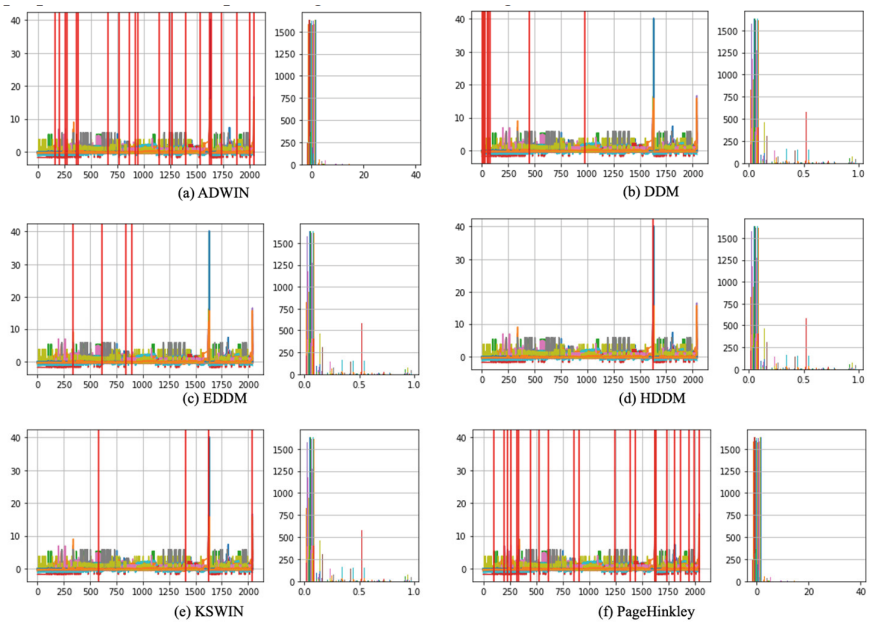

Fig. 4. The illustration of the concept drift detection algorithm, which red line represent the detection of concept drift. (Color figure online)

5 Conclusions and Future Work

In Taiwan, the game industry primarily follows an operation-focused business model with in-house development as a supplement. To comply with regulations and protect player rights, game companies have implemented refund mechanisms. However, some individuals exploit these mechanisms for illicit gains, necessitating the analysis of payment data and game logs to detect and block users engaging in malicious refund practices. Platforms like Google Play and the App Store frequently encounter malicious chargebacks, including unauthorized and fraudulent refund attempts. These incidents pose risks and financial losses for online gaming service providers, who are unable to intervene in the chargeback process. Fraudsters have taken advantage of the system by offering

refund tutorial services to consumers, receiving a cut from the chargeback amounts. This gray industry presents a significant risk to game providers, leading to substantial financial losses. To address this issue, the study proposes using machine learning to detect fraudulent refund behavior in online games. Real game data provided by gaming companies will be utilized, despite challenges such as data imbalance and concept drift. The research objective focuses on construct incremental learning models that adapt to concept drift. The goal is to improve the detection mechanism for malicious refund evaluations, identifying players engaged in fraudulent refund behavior and reducing losses for game developers.

The proposed model in this paper still requires further work. Currently, we have only implemented the concept drift detection method. In the future, we plan to implement the complete concept drift adaptation framework and conduct additional experiments and evaluations to demonstrate the contributions of the proposed framework and model.

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Improving Interoperability in Healthcare: A User-Friendly International Standard Data Conversion Framework

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Abstract. Standardization helps improve supplier compatibility, interoperability, repeatability, security, and quality. The SARS-CoV-2 pandemic has highlighted the need for global requirements regarding the interoperability of healthcare information. Currently, Taiwan still relies on the second edition of the Clinical Document Architecture (CDA) as the standard for exchanging medical data, which was formulated 17 years ago. There is currently no unified specification for medical data transformation or review mechanism in place. To address this issue, it is necessary to adopt the widely used international healthcare data exchange standard, Fast Healthcare Interoperability Resources (FHIR), established by Health Level Seven International (HL7). The aim of this research is to simplify the mapping of medical data and convert it into the international FHIR format, enabling rapid data transformation. Additionally, an interface will be designed to meet user habits and requirements. By utilizing common clinical data structures in Taiwan as an example, a mechanism for data conversion and verification will be developed to achieve fast health data exchange and enhance interoperability in the healthcare field.

Keywords: Medical information exchange · FHIR · User interface

1 Introduction

Hospital data formats and systems are determined by individual hospitals, resulting in challenges in interoperability of electronic healthcare data. In 2011, the Health Level Seven International (HL7) established the Fast Healthcare Interoperability Resources (FHIR) standard as an interoperability standard for rapid healthcare data exchange. In

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https://doi.org/10.1007/978-981-99-9416-8_52

2020, the US government mandated that healthcare institutions contracted with relevant health insurance plans adopt the international healthcare data exchange standard, FHIR, to enhance data interoperability [2]. Currently, there is a lack of user-friendly interfaces for operating FHIR open-source tools or software, making it difficult for non-programmers to use them. Therefore, there is a need for a visual interface for FHIR conversion. Additionally, due to the impact of COVID-19, the World Health Organization has adopted the FHIR format to develop the implementation guidelines for the WHO Digital Documentation of COVID-19 Certificates (DDCC) [3]. However, in Taiwan, the main data exchange structure used by healthcare institutions is based on the outdated CDAR2 standard. Therefore, this study aims to improve interoperability in the healthcare field by utilizing the Taiwan National Health Insurance data structure for conversion. The research establishes a FHIR visualization interface conversion system that simplifies the labor-intensive and complex steps required for FHIR mapping. By utilizing the developed tool, users can easily perform the conversion of clinical data to the FHIR format. The ultimate goal is to facilitate rapid exchange of health and medical data, promoting integration and increasing efficiency.

2 Literature Review

FHIR, developed by HL7 in 2011, is the latest generation of interoperability standards for data sharing [4]. The US government has mandated that healthcare institutions contracted with relevant health insurance plans adopt the international healthcare data exchange standard, FHIR, to enhance data interoperability [2]. There are also studies aiming to improve Taiwan's healthcare exchange specifications and move towards internationalization [5, 6]. Previous studies have utilized FHIR to establish personal health records (PHRs), but they have not utilized health insurance claim data for conversion [7]. Based on the literature collected in this study, it has been found that there is a lack of user-friendly interfaces and systems for operating FHIR open-source tools or software. Considering the above, there is a need to develop a system with a friendly interface and streamlined processes that can convert input clinical databases into international standards. The aim is to simplify the FHIR field mapping process and transform common clinical data structures in Taiwan into the internationally recognized FHIR format. This will facilitate rapid exchange of health data, accelerate integration, ensure accurate conversions, and improve interoperability.

3 Material and Methods

3.1 Material

In this study, we utilized test data from Taiwan's health insurance data structure for the conversion process. A few randomly selected data records were used to facilitate testing of our conversion system.

3.2 Methods

3.2.1 Mapping of FHIR

Data transformation can be divided into three main steps. In the first step, it is essential to understand the field definitions of the data. Only when all data field definitions are clear can the conversion process be carried out effectively. The second step involves mapping similar fields, and the third step is to generate a mapping table. Using the example of the Cancer Registry Long Form (CRLF), let's illustrate the process. During the data mapping and conversion process, we rely on field definitions and content. For instance, the field for identification number (e.g., ID card) is a straightforward field that can be directly included without requiring special handling of data content. The overall data types and definition content are generally similar, but adjustments may be needed for fields such as gender, date formats, and data fields that require conversion adjustments.

3.2.2 Calculate the Mapping Loss Rate

During the mapping and conversion process, it is possible to encounter cases where successful mapping cannot be achieved due to differences in the design of formats, variations in data content, and differences in data types. Therefore, in this study, the loss rate of mapping between the health insurance data structure and FHIR will be calculated separately. The following formula represents the mapping loss rate. (Eq. (1))

$$Mapping\ loss\ rate = \frac{The\ quantity\ of\ unmappable\ items.}{The\ total\ number\ of\ items\ to\ be\ mapped\ (total\ number\ of\ target\ fields).} \times 100\% \quad (1)$$

3.3 System Architecture and System Flow Design

3.3.1 System Architecture

In this study, the software architecture adopted is MVC (Model-View-Controller), and the development language used is C#. The system interface design is carried out by utilizing FHIR resource object fields and determining their priority sequence.

3.3.2 System Flow Design

Initially, users can utilize the developed tool in this study to upload their own data and complete the previous steps. The system will generate an Excel file containing the mapping results of FHIR and a JSON file in FHIR format. Users have the option to upload this JSON file to the FHIR Server (Fig. 1).

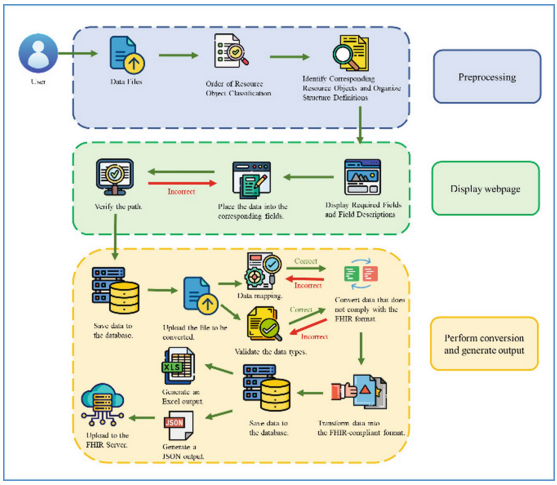

Fig. 1. Translation: System flowchart.

3.4 Translation: Data Validation Design

3.4.1 Translation: Validating Data Transformation

Data integrity: The data is transformed and checked for any tampering or errors. In this study, a comparison is made between the data in the health insurance data format and FHIR. For example, the transformed data is checked against the original data using unique identifiers to ensure there have been no alterations or errors. However, when dealing with converted data, a conditional comparison of the transformed content is necessary. For instance, in the health insurance declaration, "2" represents female, while in FHIR, the gender is represented as "female."

3.4.2 Data validation: Verifying the Data Conversion

Data accuracy: Ensuring the correctness and consistency of the converted data. This study will compare the number of records in the converted data with different mapping conditions from various forms. The original data's quantity will be compared to the quantity after conversion. The study will compile the conditions that require quantity comparison.

3.4.3 Data Validation

In this study, random selection criteria were used to compare the patient counts between the Taiwan National Health Insurance data structure and FHIR, in order to verify the accuracy of the data content.

4 Results

4.1 Conversion Platform

This research platform adopts the ASP.NET MVC framework and utilizes D3.js and backend programming to achieve the standardization of diverse clinical data. The platform enables various clinical data to be presented in the same format, while complying with the international FHIR standard, thus achieving the goal of fast data transformation.

4.1.1 Upload File and Convert to Path

(Fig. 2) In this study, user files are uploaded through the website, and by capturing the uploaded and newly added fields, they are transformed into paths. The dynamic visual diagram (Fig. 3) is used to understand the relationships between resource objects.

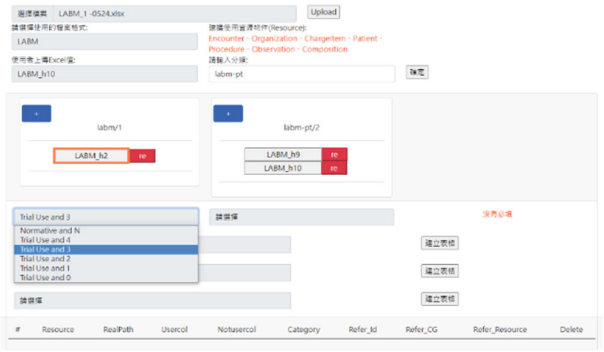

Fig. 2. Upload File and Convert to Path Screen

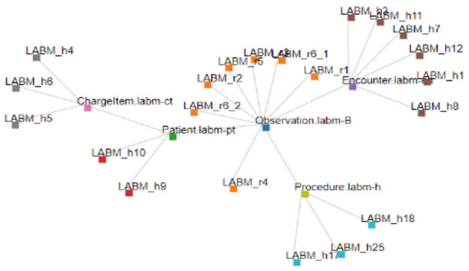

Fig. 3. Dynamic visual diagram.

4.1.2 Conversion of Paths to FHIR Format

Once the file upload is successfully converted to paths, they can be further transformed into a format that complies with the FHIR standard. Figure 4 depicts the conversion interface where the content is transformed into JSON format based on the data uploaded by the user and the specified path, as shown in Fig. 5.

Fig. 4. UI for converting to JSON file in FHIR format.

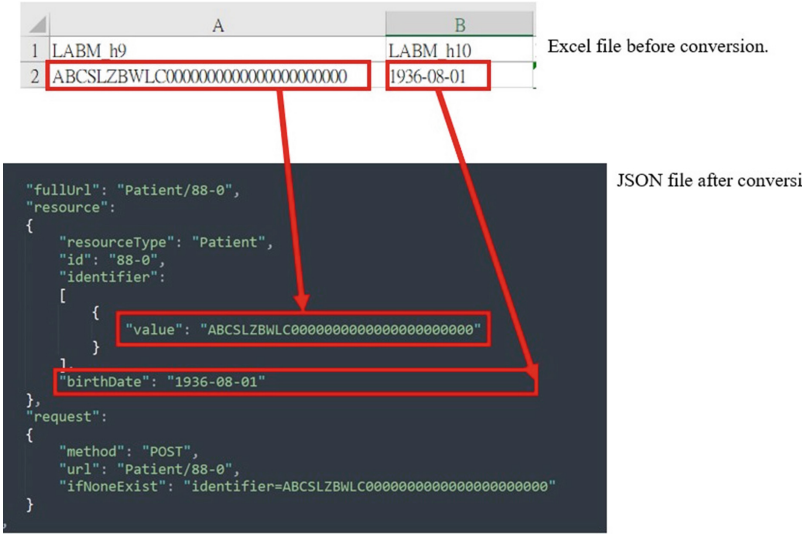

Fig. 5. Comparison Transformation Diagram

Data Mapping and Loss Rate.

4.1.3 Mapping Loss Rate

In this study, the loss rate of mapping between the National Health Insurance data structure format and FHIR was calculated for eight forms, as shown in Table 1.

We can observe that there are no missing fields during the mapping process to FHIR. This indicates that FHIR offers high flexibility in conversion, as long as the data type is appropriately handled, suitable corresponding fields can be found smoothly.

Table 1. Loss Rate of National Health Insurance Data Structure Format and FHIR Mapping

Form	Original Field Count	Missing FHIR Fields Count	FHIR Mapping Loss Rate
TOTFA	38	0	0%
TOTFB	36	0	0%
LABD	28	0	0%
LABM	29	0	0%
CRLF	112	0	0%
CRSF	41	0	0%
DEATH	7	0	0%
CASE	8	0	0%

4.1.4 Mapping and Transformation

The mapping and transformation results of this study are shown in Table 2 below. We have compiled the resources and forms required for eight forms, and the mapping process will be carried out based on the characteristics of each form.

Table 2. Mapping and Transformation Results in FHIR

Form Resource	TOTFA	TOTFB	LABD	LABM	CRLF	CRSF	DEATH	CASE
Patient	1	1	1	1	1	1	1	1
Organization	1	1	1	1	1	1	X	X
Observation	X	2	1	1	31	6	1	1
Condition	5	5	X	X	2	1	X	X
Procedure	7	5	5	1	11	8	X	X
Encounter	1	1	1	1	X	X	X	X
ChargeItem	1	1	X	1	X	X	X	X
CarePlan	X	X	X	X	1	1	X	X
MedicationRequest	X	X	X	X	X	X	X	X
MedicationRequest*	1	1	X	X	X	X	X	X
Procedure*	1	1	X	X	X	X	X	X
ChargeItem*	1	1	X	X	X	X	X	X
Observation*	1	1	X	X	1	X	X	X

X denotes unused *Used for special conditions encountered

4.2 Validating Data Transformation Results

4.2.1 Validating Data Transformation

Based on the transformation results of the LABM form presented in Table 3, it can be seen that the converted results were not modified or had incorrect quantities. This demonstrates the accuracy and success of this study in FHIR transformation.

Table 3. Conversion Result - LABM to FHIR

Resource	Number of Records	Count of Usage	Expected Conversion Quantity	Actual Converted Quantity	Percentage (%)
Organization	100	1	100	100	100
ChargeItem	100	1	100	100	100
Encounter	100	1	100	100	100
Procedure	100	1	100	100	100
Patient	100	1	100	100	100
Observation	100	1	100	100	100
Total	600	6	600	600	100

4.2.2 Validating the Content of the Data

In this study, the results of FHIR transformation were compared by querying with different filtering conditions using eight forms. Table 4 presents an example using the LABM form.

Based on the above, the developed visualized FHIR transformation system in this study is meaningful and feasible. We verified that the conversion quantities for both systems, under the mapping conditions, were approximately 100%. Comparing the quantities based on categories proved to be viable. Furthermore, by randomly applying different filtering conditions for queries, we validated whether the output quantities were modified, increased, or decreased. In terms of query results, the values also approached 100%. These results confirm the accuracy and integrity of the data and further substantiate the correctness of our research findings.

Table 4. Screening results of LABM.

Conditional statement	Original quantity	FHIR quantity	%
Patient is male	19	19	100
Patient is female	81	81	100
Medical category is outpatient Western medicine hospital	75	75	100
Medical category is inpatient Western medicine hospital	25	25	100
Case classification is Western medicine chronic disease	39	39	100
Case classification is Western medicine other projects	14	14	100
Patient's age is less than 60	48	48	100
Patient's age is greater than or equal to 70 and less than 90	44	44	100
Patient's age is greater than 90	8	8	100
Procedure code is blood and body fluid glucose	12	12	100
Procedure code is serum alanine aminotransferase	5	5	100
Procedure code is creatinine, blood	3	3	100
Procedure code is white blood cell differential count	1	1	100
Procedure code is prothrombin time (one-stage)	2	2	100
Procedure code is total cholesterol	7	7	100
Procedure code is high-density lipoprotein cholesterol	2	2	100
Procedure code is low-density lipoprotein cholesterol	2	2	100
Test item name is blood	12	12	100
Test item name is urine	2	2	100
Test item name is whole blood (1 set of blood bottles)	1	1	100

5 Discussion

5.1 Mapping Loss Rate and Accuracy

According to the results of this study, the loss rate of FHIR mappings is close to zero percent. We believe that FHIR was initially designed with high flexibility, making it more adaptable in practical usage. Furthermore, FHIR allows the utilization of extensions to extend the fields, enabling users to selectively adjust the desired fields. In this study,

mapping was conducted with reference to the TW Core IG [8]. However, it is hoped that future discussions with other experts can be conducted to further enhance the accuracy of mappings.

5.2 Data Type Conversion

In this study, it was observed that when referencing the definition and format of health insurance data, fields that were not included were filled with "99999", indicating missing or undocumented data. For date fields, this study converted them to the date format "0001-01-01" to align with the FHIR field specifications. There are a few limitations to this study. Firstly, real data was not used for testing; instead, the test data was created based on the field definitions of forms, which might lack the exceptional scenarios encountered in real data. It is hoped that future testing can be conducted using real data to establish a more comprehensive conversion system. Secondly, the complexity of filtering conditions was relatively low. This study employed simple random filtering conditions based on the test data, primarily focusing on field-level filtering. In the future, more complex and diverse conditions will be incorporated using real data to further validate and enhance the conversion system and validation mechanism. Lastly, this study is currently based on FHIR R4 version, and future considerations will include incorporating the R5 version.

6 Conclusion

According to the research results, the conversion system established in this study is feasible, and the results obtained from the designed validation process have achieved data transformation accuracy and completeness. The system provides users with a convenient tool for mapping and conversion, not only limited to Taiwan's health insurance declaration structure but also applicable to any structure that requires conversion to comply with the FHIR format. This improves interoperability in the healthcare field.

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Development of an Artificial Intelligence-Based Precise Nutrition and Dietary Management Model with Nutrient Intake Recommendation Framework

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Abstract. In order to improve people's understanding of healthy eating, various countries have issued numerous dietary guidelines to provide guidance for their populations. However, surveys have shown that the adherence to dietary guideline recommendations is generally low among the majority of individuals. Furthermore, without assistance, the motivation to adjust their diet based on these recommendations is reduced. Therefore, for a more convenient and accurate assistance in managing diet and nutritional intake, a system needs to be developed that can calculate the daily recommended calorie intake and servings of the six major food groups according to the dietary guidelines. This system can then generate a nutritionally balanced daily menu for users to reference, allowing them to easily fulfill their daily nutritional requirements by following the provided menu.

Keywords: Recommended Menu · Dietary advice · Self-dietary management

1 Introduction

According to the World Health Organization (WHO)'s Global Health Estimates for the year 2019, noncommunicable diseases (NCDs) including cardiovascular diseases, diabetes, hypertension-related conditions, and chronic lower respiratory diseases accounted for 44% of all global deaths, making them the top seven causes of death worldwide. There are multiple factors contributing to the development of NCDs, including unhealthy diet, lack of physical activity, smoking, and alcohol consumption. Therefore, it is evident that adopting a healthy diet is crucial for reducing the risk of chronic diseases [1].

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According to the latest Nutrition and Health Survey in Taiwan conducted between 2017 and 2020, it was found that the majority of the population in the country had insufficient intake in all six categories of food. Among them, dairy products, vegetables, and fruits were particularly below the recommended intake levels [2]. To promote a correct understanding of healthy eating among the population, countries have issued various dietary guidelines. In October 2018, Taiwan released the latest version of its Dietary Guideline of Taiwan, providing updated recommendations for daily nutritional intake that are more aligned with the needs of modern individuals [3].

To conveniently and accurately manage diet and nutritional intake, it is necessary to calculate the calories, three major nutrients, and portions of the six categories of food based on the consumed foods of the day. This calculation can be done by referring to the guidelines and standards of nutritional intake, such as the "Dietary Guideline of Taiwan "in our country. By calculating the individual's daily required calorie intake and portions of the six major food groups according to the specified guidelines, a nutritionally balanced daily menu can be generated for user reference.

2 Literature Review

In order to promote the nutritional health of the population, countries have issued dietary guidelines. Taiwan's "Dietary Guideline of Taiwan" categorizes food into six categories of food and provides recommendations. The groups are "whole grains" and "Fish, meat and eggs", "Legumes and their products", "Vegetables", "Fruits", and "Oils, fats, nuts and seeds". Specific recommended intake amounts are set for each of these six categories of food [3].

In a nutrition behavior study conducted by Doreen Gille et al. in Switzerland, the main research group consisted of individuals aged 50 and above. Online and paper questionnaires were distributed to gather information on their dietary habits and awareness of the national nutrition guidelines. The results showed that only 38% of the participants followed the dietary guidelines. This indicates a low level of compliance with the guidelines among the respondents, suggesting limited utilization and understanding of the nutritional guidelines. Therefore, exploring new tools to translate the recommendations into practical applications is crucial [4].

In 2018, Kristen DiFilippo et al. published a study on the feasibility of digital dietary records. After receiving instructions from the researchers, the participants used methods such as taking photos, providing textual descriptions, recording voice memos, and searching food databases to record their food intake. At the end of the study, several participants expressed that digital dietary records were feasible and acceptable. During the testing process, they eagerly anticipated receiving feedback on their dietary records, such as alerts for meeting or falling short of intake goals. They also found it motivating to adjust their diet according to dietary recommendations. These findings indicate that digital dietary records and management mechanisms are viable [5].

In 2021, Rachael Jinnette et al. published a systematic evaluation of a randomized controlled trial on whether personalized nutrition recommendations can improve dietary intake in healthy adults. They observed evidence indicating that participants who were randomly assigned to receive personalized nutrition recommendations showed improvements in their dietary intake compared to the control group. Therefore, designing a system that provides personalized, dynamically adjusted recommended menus based on user's body conditions, activity levels, and previous dietary information could help individuals better understand their nutritional intake and subsequently improve their nutritional health [6].

In light of this, healthy dietary management can help stabilize blood pressure, blood sugar, and blood lipid levels, as well as reduce the risk of overweight and obesity, thereby lowering the risk of chronic diseases. According to research, digital dietary records and management mechanisms are feasible, and there are currently various digital tools available for recording and managing dietary intake. These tools make it more convenient for users to control their calorie intake, reducing the risk of non-communicable diseases associated with obesity.

3 Materials and Methods

The aim of this study is to develop a system that provides a daily balanced menu design based on individual nutritional requirements for users to reference and assist in managing their dietary intake.

Firstly, we need to gather relevant information about various foods and design a method to calculate the nutritional composition of each food item. This will serve as the basis for recommending a balanced daily menu.

Next, we will refer to the "Dietary Guideline of Taiwan" for dietary intake recommendations. Based on an individual's age and activity level, we will obtain the suggested daily nutritional intake amounts.

Finally, we will design a process to formulate a daily balanced menu plan based on an individual's specific nutritional requirements for the day.

3.1 Food Data Collection

To calculate nutritional intake, this study collected three major types of food: ingredients, recipe dishes, and meals consumed outside the home. These three types of food were collected from different sources to enable the system to calculate nutritional intake and recommend a daily balanced menu (Table 1).

Table 1. Definition and source of the three major types of food.

Types	Definition
Ingredients	The ingredients required for food preparation, such as cucumber, Chinese cabbage, beef, etc Sources: Food composition tables for Taiwan
Recipe Dishes	The appearance of ingredients after processing and being made into specific food dishes Sources: Recipe websites
Meals Consumed Outside the Home	Pre-packaged or store-bought dishes that are not prepared for self-cooking, such as French fries purchased from McDonald's Sources: Official websites of various dining establishments

3.2 Nutrient Calculation

The database records the basic nutritional values of each food category, such as calories, moisture, crude protein, crude fat, saturated fat, total carbohydrates, dietary fiber, sodium, potassium, calcium, and various vitamin contents. In order to recommend a daily menu based on the "Dietary Guideline of Taiwan," it is necessary to calculate the portion sizes of each food item from the six major food categories.

In this study, ingredients are further classified into two categories: six categories of food ingredients and composite ingredients, which require different methods for nutrient calculation. The six categories of food refer to specific food items such as white rice and beef, which can be directly associated with a particular food category. On the other hand, composite ingredients are more complex in composition or are processed from multiple ingredients, such as pudding, cookies, or dumplings.

Recipe dishes will first retrieve the ingredients from the database, as shown in Fig. 1. Then, the nutritional values of each ingredient will be calculated separately.

For standardized foods, as the ingredients are unknown, they are all calculated as composite ingredients. Below, we will explain the calculation methods for six categories of food ingredients and composite ingredients.

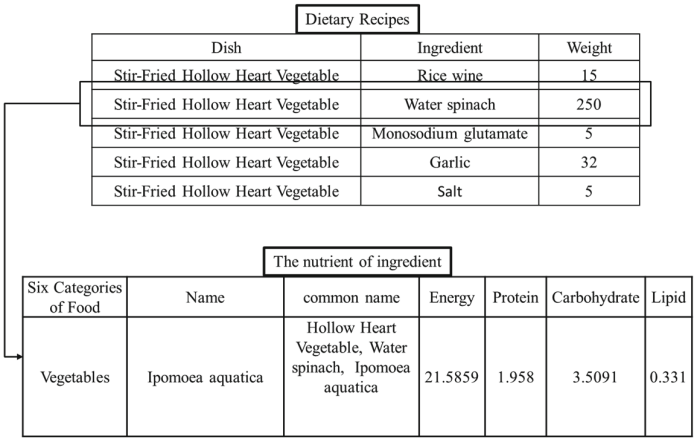

Fig. 1. Calculating Nutrients for Recipe Ingredients.

Six Categories of Food

First, determine whether the food item falls under the category of the six categories of food or composite food items, as the calculation methods differ. For the six categories of food, the portion size will be calculated based on the portion standards provided in the Health Promotion Administration's Dietary Guideline of Taiwan (Table 2).

Table 2. Conversion standards for six categories of food.

Six Categories of Food	Bases	Conversion Standards (g)
Whole grains	Carbohydrate	Per 15 g
Fish, meat and eggs	Protein	Per 7 g
Legumes and their products	Protein	Per 8 g
Vegetables	edible portion weight	Per 100 g
Fruits	edible portion weight	Per 100 g
Oils, fats, nuts and seeds	Lipid	Per 5 g
Sources of information: Dietary Guideline of Taiwan [3]		

Composite Food Items

The calculation of composite food items is based on the conversion method specified in the Dietary Guideline of Taiwan by the Health Promotion Administration. The following formula is used for the calculation:

- Whole grains = carbohydrate/15
- Fish, meat and eggs = [protein - (The portion size of Whole grains is in the above formula * 2)]/7
- Oils, fats, nuts and seeds = [Lipid – 5 * (The portion size of Fish, meat and eggs is in the above formula)]/5

3.3 The Dietary Recommendation Process

According to the health condition, the system queries the nutritional intake recommendation knowledge base to understand the required nutrient intake and recommended portion sizes for six categories of food. It then compares the previous nutrient intake with the recommendations and provides reminders on the recommended intake and the differences. Based on the individual's nutrient intake status, the system selects suitable menu options for the recommendation. Figure 2 illustrates the flowchart of the dietary recommendation process.

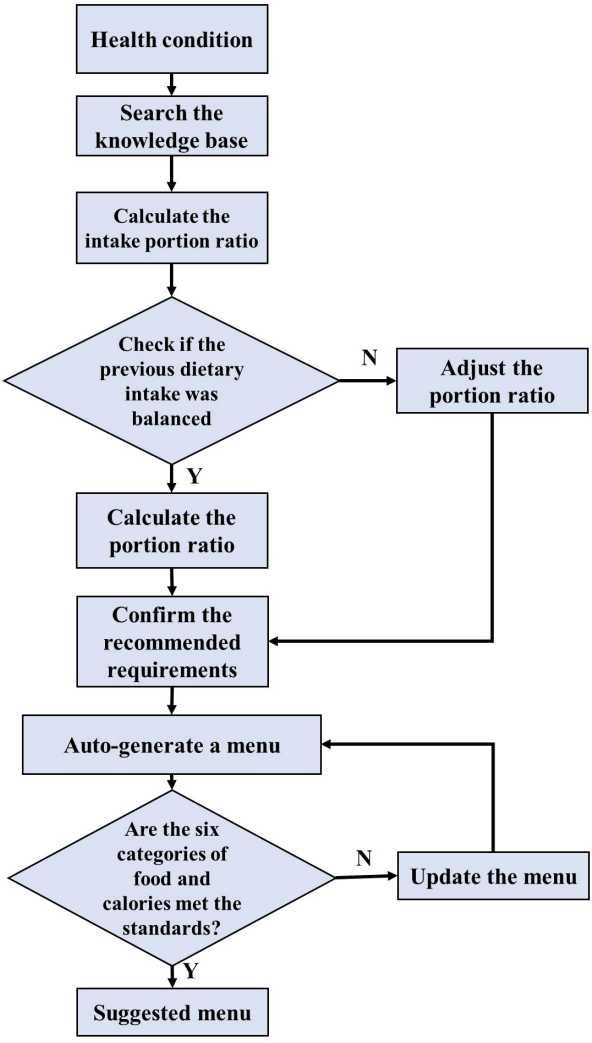

Fig. 2. Dietary recommendation process flowchart.

Table 3. Recommended menu example.

Basic information

Gender: Female		Age: 39 years old
Activity level: Slightly low		Health condition: None
Height: 162 cm	Weight: 66 kg	BMI：25.15

Recommended daily intake standards for the Six Categories of Food (Unit: servings)					
Whole grains	**Fish, meat and eggs**	**Legumes and their product**	**Vegetables**	**Fruits**	**Oils, fats, nuts and seeds**
11	**4.5**	**1.5**	**3**	**2**	**4.5**

Dietary situation in the previous week (average per day) (Unit: servings):

Whole grains	Fish, meat and eggs	Legumes and their product	Vegetables	Fruits	Oils, fats, nuts and seeds
4.05	7.85	0.45	0.85	0.65	3.43

***All dietary menus are in one serving of 200 grams each.**

Recommended menu for today (already consumed one serving of corn egg pancake for breakfast, and a cup of milk tea):

Intake of the six major food groups for breakfast (Unit: servings)					
Whole grains	**Fish, meat and eggs**	**Legumes and their product**	**Vegetables**	**Fruits**	**Oils, fats, nuts and seeds**
1.9	---	---	---	---	2.64

Recommended menu
• Grilled beef cubes
• Salmon rice
• Preserved meat with dried tofu rice
• Watermelon milk ice

Recommended intake of the six major food groups for the menu (including breakfast) (Unit: servings)					
Whole grains	**Fish, meat and eggs**	**Legumes and their product**	**Vegetables**	**Fruits**	**Oils, fats, nuts and seeds**
8.9	5.66	0.39	1.12	2.16	4.17

4 Results

The recommended menu is generated by the system based on the user's height, weight, age, activity level, and the previous week's dietary intake data. After screening the ingredients, the system randomly selects dishes that meet the nutritional requirements to compose the menu. Table 3 presents an example of the menu recommended by the system using a personalized nutritional recommendations knowledge base.

5 Discussion

This study successfully recommends a daily menu that meets the user's daily nutritional intake requirements based on their height, weight, age, and activity level. The recommended menu has been validated to comply with the standards set by the Dietary Guideline of Taiwan. It effectively assists users in managing and controlling their diet.

This study has some limitations that need to be acknowledged. Firstly, the reliance on self-reported dietary records provided by users as the basis for evaluation introduces uncertainties regarding users' knowledge about their diets and the accuracy of the dietary data. Future research could benefit from having professionals assist users in completing dietary records to ensure more accurate information for menu recommendations. Secondly, this study calculated the nutritional composition of dishes based on data from the FDA's Food composition tables for Taiwan, and dish information was obtained from publicly available sources online. As a result, the quantity and variety of dishes may be limited, and it may not represent all possible dishes. It is important to expand the dish database in the future to ensure greater diversity in the available options.

6 Conclusions

According to the research results, the recommended daily menu proposed in this study is feasible, and the nutritional composition of the recommended menu also meets the standards of what the user should consume. Therefore, the main contribution of this study is the design of a personalized nutritional intake recommendation system. It can incorporate the previously consumed nutrients to set up a reminder mechanism (nutrients, intake of six categories of food) and continuously adjust the diet based on the user's feedback. The aim is to increase the user's awareness of nutritional intake, improve their nutritional health status, and promote balanced dietary habits among people in Taiwan.

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The New Paradigm of Safe and Sustainable Transportation: Urban Air Mobility

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Abstract. Urban Air Mobility (UAM) is a revolutionary air transportation system that enables on-demand air travel. To enable successful air transportation, efficient management of large-scale aircraft is a critical factor to consider. In a dynamic environment, it is difficult to establish control rules due to uncertainty. To ensure the security and safety of both passengers and unmanned aerial vehicles, the UAM fleet needs a secure air traffic management system. However, regulations, infrastructural requirements, operation robustness, and communication still have problems to address. In this study, we summarize the challenges to deploying UAM widely. This overview discusses potential barriers to the UAM systems in terms of communication, control, and operations. Furthermore, we also provide open issues and research challenges in the paper.

Keywords: Urban Air Mobility (UAM) · flying vehicles · on-demand air mobility · Unmanned aircraft (UA) · Vertical Takeoff and Landing (VTOL)

1 Introduction

Urban aerial mobility (UAM) has attracted significant attention due to its potential to alleviate ground traffic congestion. Unmanned aerial systems (UAS), also known as unmanned air vehicles (UAV) or drones, have experienced a surge in usage in recent years, especially in civilian applications [1]. To reduce transportation times, avoid ground traffic, and enable point-to-point flights between cities, it is imperative to explore evolving mobility concepts and paradigms. UAM has the potential to revolutionize the aviation industry and disrupt mobility systems and urban planning. UAM refers to a safe, sustainable, environment-friendly, and cost-effective on-air transit system for passengers, commodities delivery, and on-demand access inside and beyond urban regions [2].

Recent technology developments in electrification, automation, and vertical takeoff and landing (VTOL) are creating opportunities for new aircraft designs, services, and business models. These factors are coming together to create new possibilities for on-demand UAM vehicles to transport goods and move people across cities. Compared to conventional aircraft designs, UAM vehicles have diverse and unique requirements and boundary conditions [3]. Several of the leading aviation companies are advancing VTOL technologies and prototyping and mass-producing the next generation of VTOL vehicles used by air taxi services.

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Due to VTOL capabilities, this demand differs significantly from commercial airlines. The aircraft will start from airports known as vertiports and will have to maintain specific rules and guidelines to avoid collision with other aircraft, avoid high-rise buildings, and abide by air traffic control (ATC) rules and restrictions. Since the altitudes will be similar and the aircraft will be closer to the ground, collision avoidance is significant. In addition, migrating birds, rain, winds, and clouds are also crucial factors to consider. Another key challenge to success in the UAM is maintaining safe flight in a highly dynamic environment.

In this paper, we will provide an overview of UAM and discuss key aspects of this technology. These aspects include UAM operational concepts and communication techniques such as data type, communion reliability, localization and navigation, network topology, and collision avoidance. We will also discuss the challenges and opportunities associated with UAM development and its potential impact on society.

In the next section, we discuss various aspects of UAM operation. Following that, we review communication techniques for UAM. Afterwards, we provide open research issues and challenges for UAM. We conclude this study in the next section.

2 Operational Concepts of UAM

The basic UAM design factors affecting the selection of a particular aircraft type and the subsequent design specification are shown in Fig. 1. Although the concept of UAM has been around for a while and is gradually taking shape in certain ways, its application to specific needs for aircraft varies greatly. This applies to various design ranges, capacities, and cruising speeds of top-level aircraft requirements [4].

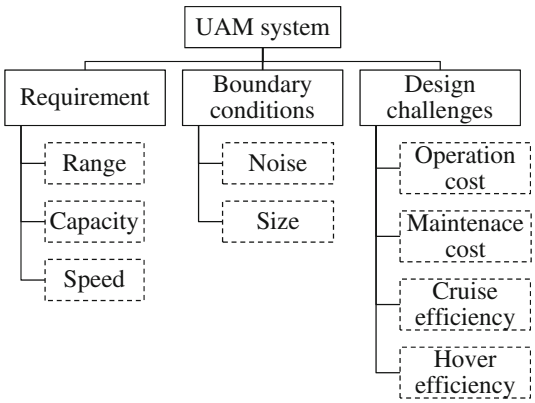

Fig. 1. Crucial factors for UAM systems development.

2.1 Power Source

Recently, there has been an increase in popularity of aerial vehicles (AVs) due to the emergence of innovative distributed electric propulsion (DEP) and advanced electric

technology [5]. These technologies have enabled us to combine strongly divergent and underlying operational needs to design different aircraft types. The development and possibilities of DEP have enabled researchers and companies to design aircraft with acceptable system complexity and weight for both rotary-wing and fixed-wing-based cruise vehicles. Rotary-wing vehicles create lifts with spinning wings during flight. They are often constrained by cruise speed during cruise flights, hence have range limitations. However, they possess excellent hover and VTOL capabilities.

2.2 Level of Autonomy

Drones can be operated in a variety of ways, including fully autonomous operation, human-piloted operation, or a combination of both. The degree of autonomy and the need for a human pilot will depend on the specific UAV system and the regulatory environment in which it operates. Fully autonomous UAVs are designed to operate without a human pilot, using sensors and navigation systems to make decisions independently [6].

2.3 Air Traffic Management (ATM)

UAM presents challenges that cannot be addressed by conventional ATM methods [7]. ATM services, including current and next generation systems, manage all types of flights of commercial and military aircraft. Commercial flights are supposed to provide secure passenger and container deportation between well-known airports whereas military aircraft serve and secure the country's airspace from enemy attacks and provide support to ground troops. As the number of autonomous aircraft increases, UAM will need separate ATM systems or an adapted one that can handle on-demand, high-volume, short-range flights in close proximity to urban airspace.

3 Communication Techniques in UAM

UAM system requirements must consider the difficulties and variations between different environments, such as waterbodies, rural locations, and urban areas. There will be sporadic obstructions on line-of-sight (LOS), non-line-of-sight, and blind-line-of-sight links, which pose greater threats than in current aviation environments. Navigation signaling accuracy and latency will also be emphasized.

3.1 Data Type

Command and Control (C&C) includes information related to flight controls, safety systems, navigation, and communication. This data type is dynamic and constantly changing, as real-time evaluation of flight operations for potential aborts will require a significant amount of data from flight system diagnostics. Aerial vehicle handling and operation may benefit from live visuals to facilitate remote operation, such as artificial intelligence applications across cloud services. All additional data, such as post-flight data or passenger information, will come under the non-C&C category [8].

3.2 Spectrum and Carrier Frequencies

Communication systems have congested bandwidth and transmission spectrum. To implement an UAM communication system, modern frequency bands can be used, including sub-6 GHz, 3rd generation partnership project, millimeter wave bands (24–86 GHz), and low earth orbit bands [9].

3.3 Communication Reliability

AVs and standard aviation systems (such as helicopters) differ significantly in terms of their proximity to terrestrial barriers and architectures due to their low altitude in urban and rural areas. This creates a communication challenge known as shadowing and obstruction or blockage. Such effects can cause enough attenuation to break a connection. Therefore, several links must be used to connect AV to C&C stations. Air-ground communication is typically preferred over satellite or high-altitude platform (HAP) system links for LOS links due to high power efficiency and less delay [10].

3.4 Network Topology

Multiple communication links can be established using multi-point receiver and transmitter schemes through central or decentralized fifth-generation technology standard techniques and systems for UAM networks. Mobile ad-hoc networks can also offer multiple links, which often require more sophisticated network-layer techniques, such as adaptive routing [11]. Several connectivity options are available through HAPs or satellite communications.

3.5 Navigation and Localization

A high-accuracy positioning system will be necessary as the number of UAM nodes increases for situational awareness and self-awareness [12]. The development of robust tracking algorithms and fusion sensors that are sufficiently complex to provide accurate information and positional awareness is crucial for UAM operations.

3.6 Collision Detect-And-Avoid (CDAA) Systems

The use of ground based CDAA for routing UAM terminal area activities is a crucial factor in integrating UAM into urban and nearby urban airspace. This may be achieved through both on the ground and with onboard assistance. The National Aeronautics and Space Administration (NASA) [13] performed 11 flights and 200 staged interactions with other aircraft using an Ikhana aircraft fitted with a prototype continuous descent approaches (CDA) system. The CDA sensor and radar, traffic warning, and collision avoidance system were all installed in the aircraft. Since UAM operations are intended to be autonomous, the CDA process cannot be detected only in defined UAM operating systems are all important considerations. This is because UAM systems with flight routes to the central management system, and cooperative data exchange via onboard sensor technology that tracks other UAM systems are equally necessary.

4 Open Research Issues and Challenges

Despite its aim of delivering safe, sustainable, economical, and accessible transportation, UAM faces obstacles, including public acceptability and public safety. Many lucrative operating criteria, such as flying limits over residential areas, nighttime operability, inclement weather, and development of green technologies, might make UAMs more manageable. Moreover, the development of VTOLs and UAMs will certainly need significant cooperation and investment from both the private and governmental sectors to build infrastructure and scale operations. On top of these, safety issues, and public perception of UAM have to be additionally concerned.

To balance economic interests, technological progress, and the public good in the future, more research, strategic planning and execution, and analysis of UAM implications are required. Ensuring the safety of the aircraft and people is of crucial importance. Since UAM comes with extensive benefits, there are also a number of limitations, such as maintaining safe flight at low altitudes, avoiding hazards such as bird collisions, and weather effects. Furthermore, in urban areas, high rise buildings are too frequent, and this makes the UAM flight trajectory significantly complicated. These issues make UAM implementation in urban areas very challenging [14]. Thus, collision avoidance in UAM can be a fascinating research topic for future studies.

In addition, UAM encounters various challenges such as safety, ATC regulation, noise, public acceptability, weather conditions, environmental implications, infrastructure, and security [15]. Furthermore, a UAM concepts success or failure will also be significantly influenced by the requirement for minimal noise emissions, which is a high concern for public acceptance. Despite aiming to provide safe, sustainable, inexpensive, and accessible mobility, UAM must deal with concerns including societal equality, public acceptability of noise, and safety.

5 Conclusion

Aeronautical communication is entering a new era thanks to UAM. To successfully deploy UAM technologies, some key requirements must be met. These include techniques to establish high-speed and high-accuracy data communication links and mid-air vehicle-to-vehicle communication. All these technologies must be reliable and robust. In this paper, we aim to discuss the on-demand UAM system and examine its operational and communicational aspects, as well as the challenges and opportunities it presents. There are several challenges associated with UAM system deployment, including infrastructure development, safe flight operations, and integration with existing transportation networks. Despite aiming to provide safe, sustainable, inexpensive, and accessible mobility, UAM must deal with issues including societal equality, public acceptability of noise, and safety.

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Fusion Self-attention Feature Clustering Mechanism Network for Person ReID

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Abstract. For the problem that pedestrian features cannot be sufficiently extracted in person re-identification, a person re-identification model based on attention mechanism is proposed. Firstly, pedestrian features are extracted using a hybrid network combining Transformer's core multi-headed self-attention module with the convolutional neural network ResNet50-IBN-a; Secondly, an self attention mechanism is embedded to make the model of this paper more focused on the key information in the pedestrian foreground; Finally, fusing the mid-level and high-level features in the model can avoid some discriminative features loss. The experimental results show that the provide model achieves 94.8% Rank-1 and 84.5% Rank-1 on the Market1501 dataset and the DukeMTMC-reID dataset, while mAP achieves 84.9% and 65.9%.The model in this paper compares well with some of the existing person re-identification models on all the three main datasets mentioned above.

Keywords: Self-Attention · Person ReID · Feature fusion · CNN · Pedestrian foreground

1 Introduction

Recently, because of society and the progress of artificial intelligence and the continuous increase in the flow of people in many public places, the safety hazards and crime investigation applications in public places are also becoming more and more widespread. Therefore, the popularization of intelligent monitoring equipment, which has resulted in a huge amount of surveillance video data. In order to use surveillance video data to keep people safe and improve people's quality of life, more efficient technologies is needed to process it. Person Re-identification is increasingly important in intelligent security surveillance systems, suspect tracking, intelligent people finding, etc., and is gradually becoming an important tool for maintaining public safety and social stability [1].

The rapid development of deep learning algorithms and convolutional neural networks and the improvement of computing hardware, especially the arithmetic power of graphics processing units (GPU), have enabled the use of deep learning methods for image-based person re-identification. Unlike traditional methods, deep learning-based

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person re-identification methods integrate the image feature extraction module and the metric learning comparison similarity module in a single model, which greatly increases the efficiency. There are still obstacles to be solved for the practical application of person re-identification, including large variations in light intensity under different cameras, inconsistent image resolution due to the distance of the captured pedestrians, and the fact that pedestrians may also be obscured by other objects such as vehicles and umbrellas.

Most current research works related to person re-identification combine global and local branches trained together to extract features from pedestrian images. However, local features often require additional models such as human pose estimation [2] or human semantic masks [3] to locate pedestrians in the images. The additional models not only increase the complexity of the model, but also the inaccurate localization will directly affect the later work. Therefore, this paper obtained effective results by only applying the global branch, including multiple attention mechanisms and feature fusion methods to extract features.

2 Method for Person ReID

2.1 Self-attention Mechanism

The attention mechanism is used to extract representation learning to solve image misalignment problems because of its property of enhancing important features and suppressing irrelevant features. Yang et al. [4] proposed a combination of spatial attention and channel attention is proposed to learn to capture features that distinguish between the overall pedestrian image and the pedestrian part image. In addition, an interactive attention module was designed to enable the network to learn optimal weights adaptively. Li et al. [5] found that the existing methods are insufficient for soft attention. So they combined hard and soft attention mechanisms to learn important features at the region level and pixel level to solve the problem of large disparity between different graph phases of the same pedestrian, and also proposed a cross- attention interaction learning mechanism to learn global features and local features efficiently and jointly.

In this paper, the Multi-Head Self-Attention (MHSA) module in Transformer is applied to person re-identification, which can improve the performance of person reidentification by applying Multi-Head Self-Attention to replace the 3×3 convolution in the residual blocks of the baseline model Conv4_x and Conv5_x for person reidentification.

2.2 Feature Fusion Module

Convolutional neural network in the extraction of features, it is carried out one by one according to the residual block, and the output feature of the last residual block as a discriminator, but the final extracted features are the high-level features of pedestrians, pedestrians have the recognition of intermediate features are ignored, which has a certain impact on the recognition rate of person re-identification carried out afterwards, so the fusion of mid-level features and high-level features can make up for the shortage between.

When extracting pedestrian features, the output features of Conv3_x are $32 \times 16 \times 512$, the output features of Conv4_x are $16 \times 8 \times 1024$, and the output features of

Conv5_x are $8 \times 4 \times 2048$,In order to make the feature maps output by Conv3_x to Conv5_x uniform and achieve the fusion of features from multiple scales, the feature maps output by Conv3_x and Conv4_x in Fig. 1 are downsampled using the maximum pooling operation.

2.3 Proposed Architecture

The general framework of person re-identification based on attention mechanism proposed in this paper is shown in Fig. 1. There are mainly baseline networks, multi-head self-attention module [6], efficient channel attention module [7], and feature fusion module. In the first step pedestrian images is extracted features through the ResNet50-IBN-a [8] baseline network, where the 3×3 convolutional modules in the Conv4_x and Conv5_x residual blocks are replaced with multi-head attention modules, while channel attention modules are accessed after each residual block from Conv1_x to Conv5_x. The feature fusion module fuses the features of the last three residual blocks, where the output features of the Conv3_x and Conv4_x residual blocks are downsampled by maximum pooling so that they can be better fused with the output features of the Conv5_x residual block. The second step combines multiple losses such as triplet loss and cross-entropy loss for loss optimization.

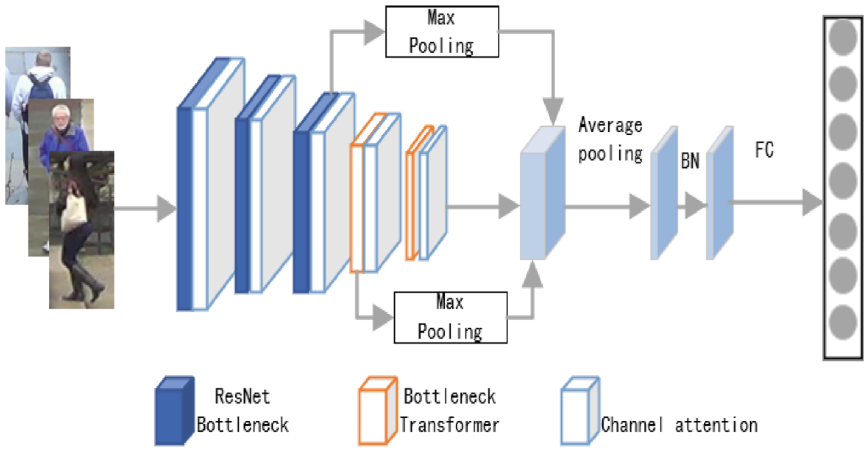

Fig. 1. General framework of Self-Attention and Feature Fusion Mechanism Network.

3 Experimental Results

To evaluate the validity of the experimental model, it was evaluated on top of three publicly available datasets, including two full-body pedestrian datasets Market-1501 [9] and DukeMTMC-reID [10].

In this paper, we use the two most commonly used evaluation metrics for person re-identification, Rank-n accuracy and Mean Average Precision (mAP). Rank-n reflects

the probability that the top n images with matching values among the pedestrian images to be selected are the pedestrians to be queried, and mAP integrates accuracy and recall, which can reflect the degree to which the query images are at the top of the image The mAP reflects the degree to which all correct images in the library are at the top of the retrieved list.

Table 1. Table captions should be placed above the tables.

Models	Market1501		DukeMTMC-ReID	
	mAP(%)	Rank-l(%)	mAP(%)	Rank-l(%)
SCPNet [11]	75.2	91.2	62.6	80.3
DCNN [12]	82.7	90.2	78.0	81.0
CGEA [13]	84.9	94.2	75.6	86.9
AlignedReID++ [14]	79.1	91.8	69.7	82.1
Our Method	82.4	94.8	65.9	84.5

Fig. 2. The test results using our proposed method.

In Table 1, the CGEA model using graph neural network and cross-plot embedding alignment layer to jointly learn each person key point region and embed topological information achieves good results on both Market1501 dataset and DukeMTMC-reID dataset, but our model has low computational complexity and a simple structure. In the Market1501 dataset, our model improves 7.2% and 3.6%, respectively, compared to the SCPNet model Rank-1 and mAP. In the DukeMTMC-ReID dataset, the algorithm of this paper improves 3.3% and 4.2%, respectively, compared with the SCPNet model Rank-1 and mAP. The results show that the model in our paper can extract pedestrian features relatively well. Figure 2 shows a rendering of the retrieval results on the dataset using the method proposed in this article. The first image of each row in the figure is the image that needs to be queried in the query set. The following ten pedestrian images are the sorting results obtained from the candidate set. The pedestrians marked with red borders in the figure represent those who match incorrectly. Due to explain the validity of each module

added, ablation experiments were done for this purpose, and all the ablation experiments in this paper were tested with the Market1501 dataset as an example. In Table 2, Baseline is the ResNet50-IBN-a network, and SAM is the Self-Attention Mechanism. Combining self attention mechanism and feature fusion for re-identification, both Rank-1 and mAP values gradually increase based on the baseline network.

Table 2. Experimental results of different block.

Models	Market1501	DukeMTMC-ReID
	mAP (%)	Rank-l (%)
Baseline	71.7	82.4
Baseline + SAM	76.3	89.6
Baseline + SAM + Feature Fusion	81.5	92.7

4 Conclusions

We provide this person re-identification model based on the attention mechanism, firstly, we consider that the visual Transformer has better results in the field of image processing compared with the traditional convolutional neural network, but using pure Transformer will add a large number of parameters and lead to a significant increase in computation, thus we use the core multi-head self-attention mechanism in Transformer and convolutional neural network. Secondly, a simple and effective channel attention mechanism is added to focus the model of this paper more on the important parts of the pedestrian's foreground. Finally, fusing the mid-level and highlevel features in the model avoids the loss of some distinguishing features. Experimental results on three major datasets, Market-1501 and DukeMTMC-reID, show that the performance of the proposed method is improved, and the performance metrics exceed many existing person re-identification models.

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A Study on How to Generate Fire Data from Video/Image Using the F-guess and ROI Method

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Abstract. This paper presents the best method for generating fire data and improving the fire recognition rate. At the same time, shorten the labelling time by using fire videos and images when there is a limit to collecting the data and hard to improve the recognition rate with a small label such as a fire. In order to improve the recognition rate and shorten the labelling time, the F-guessed method and the region of interest (ROI) expression method were used to process the data so that the predicted result labelling value and the correct answer value is similar. As a result, data generation increased by about 5.4 times from 5,565 data to 35,633 data compared to the initial labelling task, and mAP@0.5 improved by about 17.6% from 65.9% to 83.5%.

Keywords: semi-supervised learning · deep learning · fine-tuning · pseudo labeling

1 Introduction

In the field of computer vision, semi-supervised learning methods have developed rapidly over the past few years. Current state-of-the-art methods introduce hybrid methods by simplifying previous work in terms of architecture and loss function or by mixing different formulations [1]. However, the most representative methodology of deep learning is supervised learning. Supervised learning is a learning method that memorizes patterns in training data. Therefore, it is not easy to recognize data that has never been learned. For good generalization, more labeled data is required [2].

In cases where labelled data is limited, such as fire, applying the existing method is difficult. In other words, collected fire result labels cannot handle whole. When new test data not included in the training data came in, Mis-recognition was made often. Therefore, in this paper, the existing Pseudo-label method with fine-tune learning and classify to data with no correct answers. The study focuses on the shape and size of fires, particularly their small and similar shapes in the initial stages [3].

This paper proposes that set an ROI on a fire scene of fire ignition video and comparing it with ROI data that the initial learning model predicts. If differences are less

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than 50%, use Guessed Label method to increase the fire recognition rate and reduce labelling time. Figure 1 is a conceptual diagram of initial fire data generation using the ROI comparison method of the proposed algorithm.

2 Understanding Semi-supervised Learning

Semi-supervised learning can be considered if there is a small amount of correct label data (Labeled) and a lot of uncorrected label data (Unlabeled) which can be used. Semi-supervised learning aims to improve performance by applying supervised learning to a small number of correct labels and unsupervised learning to many uncorrected labels. Various semi-supervised learning methodologies have appeared regarding how to use labels without correct answers for learning. Among the methodologies similar to the currently proposed are pseudo-labelling methods and MixMatch also FixMatch.

Pseudo labeling [4] uses a model primarily trained through supervised learning to make predictions on unlabeled data. Label it as Pseudo using the performed prediction result. Therefore, to perform Pseudo labelling, there must be a trained model and label data without correct answers. For labels without correct answers, performing secondary learning using extended data set after Pseudo labelling.

MixMatch [5, 6] method generates processed correct label samples (X') and predicted labeled (U') when given correct label data (X) and uncorrected label data (U). This method applies entropy minimization, label consistency regularization, and mixup.

FixMatch [7] method uses cross-entropy loss to train a supervised learning model from correct label images. Two images are obtained by applying weak and strong enhancement methods to each image of the unanswered label. The weakly augmented image is passed to the model and the prediction for the class is obtained and the probability of the most confident class is compared against a threshold. The corresponding class uses a pseudo-label as the default label if it exceeds the threshold value.

The enormously augmented image passes through the model to make predictions for the class. This prediction is used as the cross-entropy loss compared to the correct pseudo-label. At this point, the two losses are combined, and the model is optimized.

3 Proposal Method

"A Study on Fire Data Generation and Recognition Rate Improvement using F-guessed and Semi-supervised Learning"[8] by the author proposed the Semi-supervised learning method that uses a Pseudo labelling method that extracts images per frame from a fire video and using a fire answer label. In this study, we changed the method to a method that can extract guessed label from a video without changing the video to images. In addition, for the pseudo-labelled guessed from image/video files, the guessed labels were determined by increasing the value approximately twice every step from 2000 files. Figure 1 indicates the whole system fire data generating diagram that is proposed.

Also, when the fire ignites, it gradually increases over a specific time, as in Fig. 2. The fires have different shapes, but the sizes are similar before the fires increase as long as the camera is not moving. Focusing on this, once an ROI is set in a fire video which extracts pseudo labelling from a fire starting point in the video, the shape and size of

Fig. 1. Conceptual diagram of fire data generation using region of interest (ROI) comparison method.

the fire keep changing in the area of the ROI so that can collect good quality fire data without additional labelling.

Fig. 2. The shape and size of fire in the region of interest (ROI) in the video

The principle of operation is simple. Comparing fire data in ROI with fire B/B(Bounding Box) of ROIs recognized as the learning model of Labeled data. If there is no difference of more than 50%, Using Pseudo labelling of the B/B as Guessed labelled. As a result, in this study, the recognition rate was improved by using Pseudo labelling methods to minimize misrecognition when predicting fire image data by estimating the Guessed Labelled data, which can occur when there is little initial labelled data close to the correct label.

The reason for applying Fine-tuning was to transform the architecture for image data of new purpose based on previously learned models and to update the learned model before.

4 Experimental Results

The research experiment on the method of generating fire data using the F-guess approach was conducted on a computer system with the following specifications: CPU: AMD Ryzen 7 3700X 8-Core Processor 3.6 GHz, GPU: NVIDIA GeForce RTX 8000, RAM 32GB [8]. Darknet 53 was used for learning, and Yolov4 was used for fire object detection.

Table 1 displays the number of fire data generation in every step and the number of whole images by using F-guessed and Semi-supervised learning. The 5,565 Answer labels used in initial learning are manually labelled (Labeled data) by a person and result in Guessed answer labels (Pseudo labeled) which use videos and images of unlabeled data displayed as F-guessed quantity. The number of F-guessed continues to increase because it is designed to re-label with final Weight values by reaping the Pseudo Labelled Guessed Labelled every step.

Table 1. Pseudo labeled data set augmentation information.

Data	Labeled Q'ty	Unlabeled Q'ty	F-guessed Q'ty	Division
Basic labeled data	5,565	0	0	image
1st augmentation	5,565	2,587	2,587	video
2nd augmentation	5,565	2,778	5,365	image
3rd augmentation	5,565	6,940	12,305	video
4th augmentation	5,565	8,182	20,487	image
5th augmentation	5,565	9,581	30,068	image

As a result, Table 2 shows an experiment comparing the data of 37,259 F-guessed completed based on 35,633 correct answer labels manually labeled by humans and 5,565 initial correct answer labels. As a result of the experiment, Loss was improved by 0.98, mIOU by 8.9%, and mAP by 4.95% compared to manual labeling by humans.

Table 2. Labeled and guessed labeled data comparison experiment tables.

Data	Q'ty	Loss	mIOU	mAP
Basic labeled data	5,565	3.347	52.23	65.93
Manual labeled	36,749	2.38	69.42	78.34
Guessed labeled	35,633	1.40	78.33	83.29

5 Conclusions

The research in this paper has suggested a comparison of the F-guessed method and the ROI method that complements the existing Pseudo-labelling method of semi-supervised learning [8] to facilitate data collection and labelling in special cases where data collection is limited, such as in the field of fire and disaster. As a result, compared to the initial correct label data, Loss decreased by up to 1.95%, mIOU increased by 26.1%, and mAP@0.5 improved by 17.36%. In addition, the human resources and time to get the correct answer label took about a month, based on manual labelling. However, after the change, it was significantly reduced to 48 h.

And the number of secured data also secured 35,633 correct answer data, which increased by 5.4 times based on the initial correct answer label data of 5,565. In the future, additional research will be processed to get additional data so that the pseudo-labelling position automatically follows the camera movement in the fire video.

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