Research Article
A Cognitive Behavioral Computing Model Combined with DM’s Teaching Quality Improvement

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There are more and more ideas of applying data research science to replace theoretical research science, including monitoring and evaluation of school teaching quality. In order to distinguish different types of learners through knowledge and behavior performance, so as to better improve the teaching quality of teachers, a data mining model based on knowledge expression and calculation mode is provided. According to all the key cognitive and behavioral input parameters and cognitive and behavioral index factors, through the collection of artificial neural networks, sensitivity analysis, data mining, and classification regression trees, they are divided into three types of differences, so as to better adopt differentiation strategies for learners with different types. The experimental results also show that the behavior parameters are far more critical than the knowledge parameters. The research results show that the model is effective in supporting teachers’ work in the education system.

1. Introduction

“Big data is triggering a profound revolution in the field of Earth science”, “Starting from data, letting data speak”, with the advancement of the wave of big data, the application of data research science replaces the big data idea of theoretical research science by identifying numbers. The correlation relationship between the two has replaced the geoscience research method of finding out the causal relationship between things, which has been accepted and applied by more and more geologists. With the continuous development of education, a large amount of data has been accumulated in teaching and management work, but this data has not been effectively used. If this data can be fully utilized, the quality of teaching can be effectively improved. Academician Zhao Pengda pointed out that “big data improves the accuracy on a larger scale and improves the accuracy of prediction [1]. At the same time, big data analysis has shifted from causal analysis to correlation analysis, realizing the practicability of data analysis.” Academician Guo Huadong pointed out that “using the correlation of a large amount of data can replace the causal relationship and theories and models, and new knowledge and new discoveries can be obtained based on the correlation between the data”. If these data can be fully utilized, the quality of teaching can be effectively improved [2]. For existing problems, it can be understood as how to effectively carry out data mining, correspondingly. Data mining refers to the process of mining effective, novel, and potentially useful information from big data, and discovering potential relationships and rules existing in the database. Data mining is a professional, nonteaching, and objective research tool, which can be used for the application research of knowledge-based training system [3]. According to their abilities, they have a main goal to save their time and energy. Therefore, how to apply data mining skills to the curriculum is the key to improve teaching quality [4]. The main purpose of data mining process is to find fresh, interesting, and practical things in large-scale data sets through different technical means, including prediction, analysis, clustering, combination rule mining, and sequence model. At present, with the expansion of my country’s power grid and the popularization of smart products in the power grid industry, the amount of data in the power system has increased year by year, and big data has brought great challenges to computer application and development [5]. It means mining is effective, novel for potentially big data for
discovering potential relationships and rules in the database [6]. Such widely used data mining of K-means clustering algorithm, which can mine the electricity consumption data of customers and classify them by identifying the electricity consumption patterns of different users. The traditional K-means clustering algorithm is easily affected by a large amount of redundant information in the data, which makes its computational efficiency and accuracy low [7]. Today is an era of informationization and also an era of knowledge economy. As one of the most active and important factors, talents should be highly valued [8]. As a training base for cultivating high-level talents, quality of personnel training provide high-quality talents for various constructions of our society and realize it. In addition, the competition between countries is becoming more and more fierce. The essence of the competition is the competition of talents. If my country wants to occupy a more favorable position in the world, it needs to strengthen the training of talents [9]. The cultivation of talents is also inseparable from education, and the quality of teaching is of crucial significance to the quality of training. Colleges and universities should fully recognize the importance of quality, not only take corresponding measures to improve quality, but also take corresponding measures to monitor and evaluate quality, so as to ensure that the quality of colleges and universities meets the needs of the development of colleges and universities [10]. There are many methods for monitoring and evaluating the teaching quality, among which it is a more effective method and has strong practical value [11]. Relevant personnel should conduct in-depth research on it, so that it can play a greater role in the monitoring and evaluation system, so that people of China can cultivate higher-quality talents [12].

This paper mainly combines the cognitive behavior statistical model used by DM. Students are divided into three different types, so as to effectively carry out different teaching strategies for different types of students. This chapter focuses on the relationship between learning strategies and academic performance, and better help teachers’ classroom assignments through information mining methods. The main work flow is shown in Figure 1. This phenomenon can be defined by the accepted six basic action parameters. As input, three basic action parameters are key. The technology (DM) helps to obtain and study parameters, and proposes the one according to 307 markers. According to the experiment applied to C & RT, there are two classification rules (upper, middle, and lower), mainly for it, and the average method will be 100% [13].

2. State of the Art

2.1. Overview of Data Mining Technology. Information will be hot issue in the research and development of computer and database systems. Traditional mining refers to the unusual activities of discovering hidden, previously unknown, and potentially valuable information in a large amount of information in the database system. Data mining is an important tool for business decision-making. Generally, artificial intelligence, machine learning, pattern recognition, statistics, database, and information visualization methods are used to analyze business information through highly intelligent methods, conduct induction and reasoning, and find potential enterprises, so as to assist managers in market strategies to reduce errors and make reasonable decisions. This theory appeared in the 1980s, mainly by analyzing a large amount of data to obtain useful data. These data are of great value to the relevant decision makers, and invaluable benefits can be generated by utilizing these data [14]. In the early stage of the development of data mining methods, it is mainly used in business, and it is mainly used for all-round data collection and analysis, so as to provide investment directions for business decision makers and avoid business risks to the greatest extent [15]. University administrators use data mining technology to fully mine various data related to teaching quality, and then extract valuable information on the basis of in-depth analysis of these data. In short, the mining method is to fully explore the hidden information, including trends, characteristics, and correlations [16]. With the rapid development of current computer technology, information mining is also a digital science and technology to obtain hidden information from a large number of incomplete and random application information without its meaning in advance. From the basic concepts of data mining, it is not difficult to see that there are great similarities between data mining and knowledge mining in database systems, mainly because data mining inherits the achievements of information mining in terms of ideas and skills, and assigns this idea and method to the basic meaning of data mining [17]. For such statistical data, although the research results of data mining technology in the field of commercial application are relatively large, China is still at an early stage of development in the field of education data mining technology. In particular, the actual use level of education data mining technology in China’s education sector is still very different from that of developed countries. According to these conditions, relevant technical personnel of China have been organically combined with such teaching evaluation system of Chinese universities, so as to accurately evaluate the teaching quality of Chinese universities and improve the teaching quality [18].

2.2. Data Mining Methods. Data mining is an intersectional emerging discipline that integrates theories and technologies in multiple fields such as data visualization, database technology, high-performance computers, statistics, machine learning, pattern recognition, and artificial intelligence. The main methods of data mining are summarized as follows: predictive model method, data segmentation method, correlation analysis method, and deviation analysis method. The data mining method is a data-driven application method, that is, it does not require that one needs to fully understand in advance all the context and various properties of the problem to be solved, such as gasoline cleaning, sulfur reduction, all chemical properties of octane, and Change laws, but only a certain amount of background knowledge is required; then solve practical problems [19]. Reducing the loss of octane number in gasoline cleaning, that is, performing a more accurate quantitative calculation
of the loss of octane number that corresponds to the prediction and regression tasks of data mining methods [20]. To push efficiency for mining methods in solving problems, application process of the following data mining methods is designed, as shown in Figure 2.

Experts have provided many different data mining methods. Therefore, according to the shortcomings of the above score calculation formula, a score clustering analysis method using k-means method is provided. The results showed that it was the most effective for the results of fimbriae. Because this method is more reasonable and scientific than the previous total score method, and the results of fimbriae also contain more useful data, the new fimbriae method also reduces the uncertainty of the results formed after the random initial clustering. In view of the incomplete professional knowledge system of undergraduates, this paper provides targeted teaching contents of the “data mining” project for undergraduates majoring in economic management. From the actual effect, it is good in promoting. Applying data mining technology to education evaluation, through the analysis of the above financial data, we can reveal the correlation between the teaching effect of college teachers and the grade, title, and education level of teachers. In the investigation of the current education evaluation system, some technologies of the intelligent decision support system for education evaluation based on data mining technology are studied, which shows that this system can intelligently improve teaching. This kind of mining technology mainly focuses on self-adaptive learning, studies knowledge solutions, and then finds optimal ways from online knowledge. Learners’ cognitive activities and the process of students’ satisfaction are particularly important in participating and evaluating these projects. Influenced by various materials, in order to effectively improve teaching, we have provided a data mining mode based on statistical modeling of knowledge and behavior, and defined the basic tasks of learning, more detailed interaction information and learner activities through this information. The change caused by the model is verified by the student category selection experiment.

3. Method

3.1. Cognitive Computing Model. Many experts have explored the cognitive task model. However, considering that mental ability, mental data and consciousness parameters will be reflected in general goals, the theory of belief, desire, and intention) will also be applied as a cognitive model. The BDI mode used by the current agent is mainly designed according to the intention mode of Cohen and Leveque’s normal modal logic and the logic mode calculated by Rao and Georgeff’s BDI, that is, focusing on the formal description of beliefs, wishes, and intentions, or BDI. As is shown in Figure 3, the factors that affect the results of cognitive computing mainly include 8 main factors.

3.1.1. Performance Score. Based on the number of excellent classes, the number of relatively good classes, and the number of nondefective classes, the student’s performance score is calculated according to the student’s answer to the question.
performance score (with difficulty weight) is defined as follows:

\[ P_{ist}^{jx} = \frac{Q_{ist}^{x,g} \cdot W_g + Q_{ist}^{x,avg} \cdot W_{avg} - Q_{ist}^{x,b} \cdot W_b}{W_g + W_{avg} + W_b}. \]  \hspace{1cm} (1)

In the above formula, \( P_{ist}^{jx} \) is for such unweighted in the j-th subject, \( Q_{ist}^{x,g} \) is the one who provides excellent answers to the j subject questions, \( Q_{ist}^{x,avg} \) will be the one who provides general answers to j-type subject questions, and \( Q_{ist}^{x,b} \) will be the one who provides poor answers to j-type subject questions, and \( w_g \) is the weight of students who provide excellent answers value, \( w_{avg} \) is the weight value of students who provide average answers, and \( w_b \) is the weight value of students who provide poor answers.

In this problem, it is assumed that \( w_g = 0.4 \), \( w_{avg} = 0.15 \), and \( w_b = 0.45 \). When \( w_b \) takes a higher value, the formula plays a negative role.

3.1.2. Performance (with Difficulty Weight). Multiply \( P_{ist}^{jx} \) by \( w_{db} \), which is related to the difficulty of the question, and the performance score (with difficulty weight) is defined as follows:

\[ P_{ist,u}^{jx} = P_{ist}^{jx} \cdot W_d. \]  \hspace{1cm} (2)

In the above formula, \( P_{ist,u}^{jx} \) is the performance score with difficulty weight and \( w_d \) is determined according to the difficulty weight value of the difficulty level.

3.1.3. Capability. The ability value reflects how many questions one can answer. It is shown by the following formula:

\[ \text{(Capability)}_{ist} = \frac{\sum P_{ist,u}^{jx}}{\text{Total num of Question} \cdot \sum W_d}, \]

\[ X_{ist}^{x} = \frac{Q_{ist}^{x,g} \cdot W_{x,g} + Q_{ist}^{x,avg} \cdot W_{x,avg} - Q_{ist}^{x,b} \cdot W_{x,b}}{W_{x,g} + W_{x,avg} + W_{x,b}}. \]  \hspace{1cm} (3)

In the above formula, \( X_{ist}^{x} \) is a parameter used to calculate the degree of willingness, \( W_{x,g} \) is the selective weight value for students who provide excellent answers, \( W_{x,avg} \) is for students who provide general answers, and \( W_{x,b} \) is the selectivity weight value for students who provide poor answers.

In this problem, it is assumed that \( w_g = 0.4 \), \( w_{avg} = 0.15 \), and \( w_b = 0.4 \). When \( w_{x,b} \) takes a higher value, it plays a negative role in the formula.

3.1.4. Willingness. It characterizes the willingness of students to answer questions. Willingness is defined by the following formula:

\[ \text{(Desire)}_{ist} = \frac{\sum X_{ist}^{x} \cdot W_d}{\text{Total num of Question} \cdot \sum W_d}. \]  \hspace{1cm} (4)

3.1.5. Orientation. A student’s orientation plays an important role by choosing a problem and going about it with determination. Orientation is defined by the following formula:

\[ \text{(Preference)}_{ist} = \frac{\sum W_d \left( Q_{ist}^{x,g} \cdot W_{p,g} + Q_{ist}^{x,avg} \cdot W_{p,avg} - Q_{ist}^{x,b} \cdot W_{p,b} \right)}{\text{Total num of Question} \cdot \sum W_d}. \]  \hspace{1cm} (5)

3.1.7. Commitment. It means binding yourself to some kind of action. Commitment will be as follows:

\[ \text{(Commitment)}_{ist} = \text{(Desire)}_{ist} \cdot \text{(Capability)}_{ist}. \]  \hspace{1cm} (7)

3.1.8. Cognize Index Factor (CIF). The cognitive index factor is calculated based on students’ commitment and ability. The perception index factor is defined as follows:
3.2. Behavioral Computational Model. Human behavior computing model mainly refers to the multidimensional understanding and data of everyone’s work and social relations over a period of time and the statistical model of daily behavior characteristics, so as to accurately predict the trajectory of its spatiotemporal benchmark position activities.

3.2.1. Happy. Generally speaking, the word “happiness” represents a happy life state and feelings of self-enjoyment. In this state, it refers to a strong interest in a cultural activity.

3.2.2. Fatigue. Fatigue is a very tired condition, which can be observed by observing their facial movements. When asked repeatedly, they generally cannot answer all of them.

3.2.3. Distortion. Means by pull or twist, the shape changes. This is used to define a behavior parameter.

3.2.4. Behavior Expression Index Factor (BEIF). Students can be selected for specific problems with the help of the behavioral expression index factor, which is calculated based on pleasure, fatigue, and distortion, and is defined by the following formula:

\[
(C.I.F)_{ist} = (\text{Commitment})_{ist} \cdot (\text{Capability})_{ist}.
\]  

(8)

3.3. Data Storage Model. In order to realize the target feature data mining of the information intelligent recommendation system, the distributed storage model of the target feature data of the information intelligent recommendation system is designed according to the principle of distributed link fusion. The distributed storage mainly addresses how to store data on multiple machines, and addresses the issues of providing availability, reliability, and consistency. The data association distribution set of the information storage space is obtained as \( x(t) \). The number of common neighbors is as follows: \( xi = f(a) \times x(t) \). In the formula, \( f(a) \) is a neighbor activity parameter identification model. The activity feature analysis method of neighbor nodes is used to obtain the semantically related information components of the target data of the information intelligent recommendation system, and the ambiguity point set between the computing nodes is given. In the multisource information dissemination model, the cluster intersection items of the target features of the information intelligent recommendation system are obtained. According to the strength of the interaction between the two pieces of information, the path variability fusion and content evolution clustering methods are used to construct the target feature data storage structure model of the information intelligent recommendation system, as shown in Figure 4. Combined with the data structure analysis, the data mining algorithm is designed.

In Figure 4, N0 to N10, respectively, represent 10 nodes of the target feature data storage model and the 10 nodes form a data storage network.

3.4. Student Index Factor. Student index factor (SIF): with the help of the student index factor, different categories of students can be selected for specific problems. It is calculated based on the perception, and SIF can be controlled by \( a \), generally \( 0 < a < 1 \).

\[
(SIF)_{ist} = \alpha \cdot (\text{CIF})_{ist} + (1 - \alpha) (\text{BEIF})_{ist}.
\]

(10)

3.5. Data Mining Model Construction. According to the above research, considering the need for more comprehensive research methods and easy implementation, a brand-new student model is established on the basis of the knowledge statistical model and the behavior statistical model. In this model, the components of cognitive model are introduced. After completing the exercises and tests for each unit, make statistics on the knowledge ability value to judge the difficulty of the subsequent learning content and adjust the order of mastering the knowledge points. At the same time, the behavioral psychological factors (such as emotion) were also investigated. Based on the classification of psychological factors affecting learning, there is only a brief qualitative understanding of the impact of psychological factors on learners. Only learning enthusiasm, facial expression, and behavior parameters when solving problems are considered. According to the knowledge statistical model and the behavior statistical model, the data mining model presented in this paper can be used to count the ability index factors, knowledge index factors, and behavior index factors that affect students’ performance, and judge the degree of influence of the index factors that affect students on the knowledge parameters and behavior parameters. In Chinese traditional education, if each type of school adopts the same education strategy, it will only be beneficial to some schools. After adopting the data mining model given in this paper, schools can be divided into different types according to the learning influencing factors. Teachers can also let students choose different teaching strategies with strong pertinence. The data structure described above illustrates the static
The dynamic structure reveals such relationship for four ones that affect students' modeling in the whole teaching process, and its impact on the whole educational decision-making. We can find that student modeling is a dynamic structure. Through the analysis of students’ learning activities, we can track students’ learning activities, record, and adjust their knowledge, ability, and behavior, and describe the process information of their personalized characteristics. This paper puts forward a new teaching strategy, which takes data mining method as the core and involves the management of database system, the generation of information, and the management of decision-making questions.

It can be seen from Figure 5 that in the overall modeling, large-scale data resource mining, and calculation (such as decision tree and artificial neural network) are the key technologies. The overall process includes the following:

3.6. Decision Tree Method. Decision tree is a decision analysis method, especially in the case of potential challenges or value. We try to consider the value of specific attributes of negotiation through data mining. The decision tree algorithm is also a simple and easy to grasp alternative to other decision analysis methods such as numerical charts or statistical probabilities. Because the decision tree is adaptive, it means that it can be changed into more effective information to express itself, and even can be changed into more effective new methods to change the original scheme.

3.7. Artificial Neural Network Method. In the artificial neural network (ANN) model, the fast method, dynamic method, and radial basis function network (RBFN) are used. The speed method produces smaller hidden layer, faster training speed, and better generation effect. The dynamic method generates the initial topology, and the topology can be adjusted by adding or removing hidden cells in the practice phase. RBFN also uses a similar K-means clustering method to analyze information according to the target value. Compared with the above three methods, the dynamic method gives a more accurate state description, and is higher than the other two methods in terms of training accuracy. The algorithm produces smaller hidden layers, faster training speed, and better generation effect. In the speed method, there are six input parameters, and each parameter

<table>
<thead>
<tr>
<th>Composition</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasure</td>
<td>A state of happiness and a feeling of self-enjoyment, here refers to the positivity of student behavior.</td>
</tr>
<tr>
<td>Fatigue</td>
<td>A state of extreme fatigue, which can be found by observing students’ facial expressions, and when asked repeatedly, they generally cannot answer all of them.</td>
</tr>
<tr>
<td>Twisting</td>
<td>By pulling or twisting, the shape changes. This is used to define a behavior parameter.</td>
</tr>
<tr>
<td>Behavioral expression index</td>
<td>The behavioral expression index factor allows students to be selected for specific problems and is calculated based on pleasure, fatigue, and distortion.</td>
</tr>
</tbody>
</table>

Figure 4: Target feature data storage model.

Table 1: Behavioral calculation model.
has a certain value. Among the six methods, each method is divided into three stages. Thus, for each absolute value with three stages, there are three types of neurons. Thus, the number of neurons in the input layer of the whole neural network is \((3 \times 6 = 18)\). The artificial neural network models of all combinations are shown in Table 2.

4. Results and Analysis

4.1. Sensitivity Analysis. Sensitivity analysis method (SA) is a sensitivity algorithm used to analyze and describe the distribution of model data under various conditions. By removing several variables that have little or no effect on the network training, the sensitivity analysis method can reduce the complexity of the network structure and understand how each variable uses the network capability. The higher the sensitivity, the greater its effect on the output of the artificial neural network. For accuracy analysis, the detection result node can identify the most critical areas in some outputs. This can obtain faster and more effective algorithms, require less prediction, achieve better, and be easier to master. For sensitivity analysis, the detection result nodes can be identified in the domain, which is particularly critical in specific calculation. The ANN method mainly includes three kinds: fast one, which have certain characteristics for the relative importance of input. This is the one in Table 3.

4.2. Feature Selection of DM. Under this model, the feature selection node of Clementine 11.1 software can be used to determine each domain. For hundreds or even thousands of predictions, it is probably the most critical to select, arrange, and determine these predictions. Finally, it will be completed in a faster and more effective way, requiring less time to predict, faster operation, and easier to master. Main parameters of test results are shown in Table 4.

4.3. Execution Results. In this study, we also studied a machine learning system that can use web pages to perform the above calculations. The execution results are shown in Table 5.

It can be found from Table 5 that the factor SIF of the best student index is 49.375. Like belief, the average CIF per child is very low. Through formula (10), we can conclude that SIF is the indicator factor belief of students’ behavior, while the cognitive indicator factor CIF can be omitted. Therefore, through the explanation of the above conclusions, we can see that the action parameter is far more important than the cognition parameter in the performance classification. Therefore, teachers should improve the performance of various students and improve the teaching quality through the behavior performance of various types of students such as pleasure, fatigue, and distortion.

4.4. Strategies and Recommendations

4.4.1. Further Revise the Evaluation Methods and Evaluation Indicators for Teachers’ Teaching Work Performance. In the revised measures for the evaluation of teachers’ teaching work performance, the assessment institutions, and job responsibilities are further clarified, and all full-time class teachers in the whole hospital are included in the scope of assessment, and unified standards are evaluated. In terms of the education performance evaluation index system, it should highlight the scientificity and comprehensiveness, and should cover the characteristics of various stages and categories of education work. In addition to specifying the scope of education tasks, it should also strengthen the education content, methods, management means, curriculum construction, teaching results, teaching research ability. In terms of teaching reform, discipline construction, etc., it has specific and detailed provisions and requirements, which are highly operable. The assessment emphasizes the performance of activities and the reflection of information, and
takes communication as the main purpose of the assessment, so as to promote teachers’ discipline growth and quality training and achieve quality improvement, and achieve the ultimate purpose of carrying out the performance appraisal of teachers’ teaching work.

4.4.2. Establish a Teaching Quality Management Platform to Provide a Platform and Data Support for Teaching Diagnosis. On the one hand, change the traditional teaching quality management system, let the data and information “run” online, realize the timely feedback of information through the platform, transform the resulting indicators into process management and evaluation, monitor the teaching status in real time through the platform from the school level and department level, and transform the assessment from a single offline to a combination of online and offline, so that the teaching management work is more convenient and diverse, and the assessment is more scientific and effective; on the other hand, all kinds of data are collected through the platform to form an information weekly report, The monthly information report is fed back to all teachers, so that teachers can understand the specific situation of their teaching work, promote teachers to improve teaching, improve themselves, and promote teaching diagnosis and reform through big data analysis.

4.4.3. Strengthen Process Management, Pay Attention to the Actual Results of Assessment, And Promote the Improvement of Teaching Quality. For the school level, standardize various indicators and evaluation systems, strengthen teaching supervision, pay attention to extended feedback, and implement it with high standards and strict requirements at the level of departments and teaching and research departments. It will be applied to various types of evaluation and promotion, such as professional title evaluation and recommendation, which will play a good role in affirming and encouraging, and achieve the good effect of “promoting construction with evaluation and promoting reform with evaluation”, and truly improving the quality of teaching.

5. Conclusion

In order to correctly group and classify each student, the school applies the data mining technology to each student’s data analysis set based on the important knowledge and behavior input parameters of the students. Through artificial neural network, sensitivity analysis, statistical discovery, and classification and regression tree calculation, the importance of input problem classification is defined according to the neural network mode (high-speed, dynamic, and RBFN), and each student is divided into three different categories. The experimental results show that the student’s index factor
mainly depends on the behavior expression index factor, while the perception index factor is negligible. We should think that the action parameters are far more important than the cognitive data in questioning the types of students. They take different teaching strategies to improve the performance of different classes and improve the quality due to their happiness, fatigue, and distortion. In the future, the data mining method based on artificial neural network will be applied to other information collection, modify the original settings of data, carry out a large number of experiments, and find more meaningful data, so as to effectively help teachers in the research of the education system.

Data Availability

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflicts of interest.

References


