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Research Article

Construction and Application Analysis of University Management System Based on Association Rule Mining Algorithm Apriori

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With the rapid development of data mining and dynamic data modeling, this technology has been applied in most groups. In recent years, with the continuous development of the data processing technology, society has entered the digital era. Big data technology is widely used in economics, medicine, computer, and other fields. Based on the development status of the big data technology, an association rule mining algorithm Apriori is proposed to study the characteristics of massive data in a university management system. Combined with the big data discrete dynamic modeling technology, the cloud storage problem in the management system is optimized and improved. Dynamic modeling technology is used to optimize the energy-saving and energy storage functions of the system. Secondly, the Apriori algorithm is used to mine the student achievement data, and the factors affecting the change of student achievement are analyzed. Finally, the running efficiency of the whole university management system is dynamically modeled and analyzed. The results show that the system performance of Apriori algorithm mining has high client compatibility. Association rule algorithm is mainly used in student personality analysis and personal information management, The algorithm used in this paper can optimize the overall performance of the university management system and has certain effectiveness and applicability. It can quickly query the required information under the background of big data and has strong applicability. Dynamic modeling and optimization of the storage system can also improve the utilization of the storage system.

1. Introduction

With the increasing development trend of China's education industry, the management demand of higher education is also gradually expanding [1]. In the management of college students, the management of students' personal information and the management of students' life are our key research contents [2]. Schools should change from traditional student management to information management. In today's university management, most schools can change traditional ideas and carry out various forms of digital information management [3]. With the application of computer technology, the function of management systems is gradually improving. The effect and efficiency of student management have been greatly improved. With the advent of the era of big data, the amount of student data information is also rising sharply [4]. In the face of dynamic and complex information changes, the design of traditional university management systems is relatively simple, which cannot meet the needs of a large number of students. In the process of mutual communication and communication between school management departments, too much data will also lead to information transmission failure [5]. When students' personal information needs to be changed, the traditional management system cannot find students' files quickly and accurately; this slow response management system has been gradually eliminated [6]. Facing the above situation, in order to ensure good efficiency and effect in the process of university work, many researchers propose the association rule mining algorithm Apriori to optimize the system function. Association rule is an important technology in data mining. It was first widely used in the business field and can meet the

individual needs of users [7, 8]. Under the background of big data, data mining technology can use the association rule algorithm to solve the problems of low efficiency and data redundancy caused by too much personal information data. According to the above research, in the establishment of university management systems, aiming at the characteristics of massive data, the system runs slowly [9]. Based on data mining technology, this paper proposes the Apriori algorithm to process student information. Because the storage function of the traditional management system still stay in the database model, this model will cause the database to jam and stop working with an increase in the amount of data. Using the big data discrete dynamic modeling technology to optimize the storage function [10],this paper proposes to use the Apriori association rule mining algorithm to obtain students' personal data and association data in the database. Its innovative contributions include: 1 Through the Apriori association rule algorithm, this paper analyzes the relevant reasons affecting the change of students' grades and improves the overall operation efficiency of the management system and reduces errors and defects in the use process. 2. The differences between the traditional modeling technology and the discrete dynamic modeling technology in system operation efficiency and error coefficient are compared. Experimental results show that the Apriori association rule algorithm can accurately obtain information data and optimize the performance of the management system. 3. The system realizes the functions of students' automatic course selection and personal information management. The optimized storage function of the discrete dynamic modeling technology can automatically remove historical traces and reduce the garbage data left by repeated dynamic data changes.

This paper is mainly divided into three parts. The first part briefly describes the functions of the university management system and analyzes the role of the dynamic modeling technology in university management systems. Finally, the development status of the dynamic modeling technology in various countries is analyzed, and the research content of this paper is put forward. In the second part, firstly, the Apriori algorithm is used to mine and analyze students' data, and a management system is established according to students' personalized needs. We then use the discrete dynamic modeling technology to optimize cloud storage functions. Finally, the Apriori algorithm is used to mine student achievement data, and the dynamic modeling technology is used in the overall efficiency analysis of the system. The third part mainly analyzes the research results of the university management system after Apriori algorithm mining, and finally analyzes the system efficiency of the big data dynamic modeling technology.

2. Related Works

With the increasing number of college students in China, it is necessary to store and manage students' personal information [11]. The operation efficiency and the construction of a school management system become extremely important. Using the university management system to sort out and store personal data can liberate the human capital of school work [12]. The traditional way of paper statistics in school management can no longer apply to the sharp increase in the number. Therefore, in order to facilitate the effective management of school workers, we can use dynamic modeling to build a university management system [13]. Teachers can realize student information management anywhere and improve office work efficiency [14]. When establishing the university management system, it should adopt the dynamic data processing method. Firstly, it should use the data mining technology to summarize and process the student information data. In data mining technology, this paper mainly studies the role of the Apriori algorithm [15]. Finally, facing the problem of dynamic changes in student information management, the big data dynamic modeling technology is proposed to study the dynamic modeling of the system [16]. The application of the dynamic modeling technology can improve the accuracy reduction caused by too much data in traditional system modeling, and improve the overall operation efficiency of the management system. This technology is also applied in many fields in various countries [17].

The high-tech industry in the United States has developed rapidly. In the process of enterprise recruitment, it often faces the problem of system jam caused by excessive resume information [18]. Therefore, they applied the big data discrete dynamic modeling technology to the application system of the high-tech industry, and used the discrete nonlinear implementation change model to flexibly control the recruiter. Finally, it ensures the operation efficiency of the system and improves the accuracy of talent expansion [19].

France is a country that pays attention to the level of spiritual development and has invested a lot of money in leisure and entertainment [20]. However, the infrastructure of many scenic spots is not developed enough, and the quality problems in the process of sightseeing cannot be guaranteed. Facing this situation, researchers combined smart tourism with the dynamic modeling technology. It realizes the intelligent system of personalized recommendation, navigation, and service for tourists. Through dynamic modeling, the user information is updated in real time to improve the tourism quality.

Urban planning in Britain is in a developing state [21, 22]. In urban planning and management, traffic congestion and path planning are inevitable problems. Many researchers have found that using the big data dynamic modeling technology to build urban models can analyze the number of vehicles and road congestion in real time. Through the dynamic model detection function, the urban traffic management is changed and the intelligent urban traffic planning system is realized [23].

China is in a relatively advanced position in the development of big data technology [24]. In view of the increasing bad environment such as global warming, researchers began to pay attention to reducing harmful gas emissions. Among them, the carbon emission of vehicles is at a very high pollution level [25]. Therefore, they use dynamic effects and discrete modeling to monitor and detect

carbon emissions and analyze air change trends in real time. Through the analysis of the above discrete dynamic modeling technology, this paper puts forward the dynamic modeling technology combined with the Apriori algorithm to study the university management system.

3. Research on Apriori Association Rule Mining Algorithm and Big Data Discrete Dynamic Modeling Technology in Efficient Management System

3.1. Research on Apriori Association Rule Mining Algorithm and Discrete Dynamic Modeling Cloud Storage Function in College Teaching Management System. In the management of colleges and universities, as the main component of the core of the system, data information needs to be processed by many means. As one of the important components of data mining technology, the Apriori algorithm for mining association rules has been widely used in many fields. Because the core content of the association rule mining algorithm is frequent data extraction, association information is obtained according to the generated dataset. Therefore, in system management, we use the Apriori algorithm to analyze big data, and finally optimize and improve the stored data combined with the discrete dynamic modeling technology. It can minimize the calculation error caused by the variability and diversity of dynamic data. Dynamic error is different from steady-state error. Dynamic error is a function of time, which can provide the law of control error changing with time when the system is in steady state. The amplitude and direction of the static error are constant or change slowly according to a certain law. In the management system of colleges and universities, due to the differences in the internal structure of colleges and universities, the data such as teachers' personal data, students' personal data, discipline information, and achievements are more cumbersome for the management work. We hope to reduce the management scale and improve the management efficiency by improving the characteristics of the management system for personalized and targeted classification. The main components of the whole system structure are the client, the application platform, the server, and data storage. The specific structure is shown in Figure 1.

As can be seen from Figure 1, the main function of the client is to ensure that the user interacts with the machine, and the server system can complete the logical operation of the program operation. The system model built is mainly aimed at the mobile platform, which can access work information and content anytime and anywhere. This paper classifies the management functions of colleges and universities in the form of structural stratification. After storing student data and other data, the Apriori algorithm is used to mine the data. Finally, the mining data are unified to establish a personalized model. The function of the personalized model is to solve the problems of students and teachers. Realizing the establishment of personalized education schemes in the university management system can analyze the needs of different students and their own situation of data mining. The specific structure of the personalization model is shown in Figure 2.

In Figure 2, the personalized model based on association rule mining is mainly divided into audience and data source. The targeted groups include students, teachers, and staff. It is mainly used to update the selection of teaching materials and formulate personalized teaching materials. For the data mining design of a personalized university management system, relevant rules need to be established, i.e., the causal relationship between the two events. Assuming that the set after event preprocessing has association rules, it is divided according to the support coefficient and trust degree. The calculation formula of the total event ratio is as follows:

$$S(X \longrightarrow Y) = P(X \cup Y). \tag{1}$$

Trust level refers to the number contained in the dataset and the ratio between events:

$$C(X \longrightarrow Y) = P(Y|X) = \frac{S(X \cup Y)}{S(X)}. \tag{2}$$

Assume that the minimum support coefficient and trust variables are correlation functions. In order to control the establishment of personalized schemes, it is necessary to classify the data as a whole. Set the distance between the two events in the database to:

$$D(I_1, I_2) = 1 - \frac{P(I_1 \cup I_2)}{p(X) + P(Y) - P(I_1 \cup I_2)}, \tag{3}$$

where $D(I_1, I_2)$ is the ratio of the number of events, and the value range is fixed. When two events are generated at the same time, the distance is 0. Define the distance of the event set as the average distance:

$$D(X, Y) = \frac{\sum_{i=1}^{m} \sum_{j=1}^{n} D(I_1, I_2)}{m \times n}. \tag{4}$$

The definitions of association rules are relatively standardized. It is assumed that the following rules exist in the database:

$$\begin{cases} X_1 \longrightarrow Y_1, R_1, \\ X_2 \longrightarrow Y_2, R_2. \end{cases} \tag{5}$$

Then, the distance between the total defined variables in the above formula can be expressed as:

$$\begin{aligned} D(R_1, R_2) = {} & \alpha\, D(X_1 \cup Y_1, X_2 \cup Y)_2 \\ & + \beta\, D(X_1, X_2) + \gamma\, D(Y_1, Y_2). \end{aligned} \tag{6}$$

Among them, α, β, and γ are the user-defined parameter coefficients, which can be transformed and adjusted according to the actual dynamic data. In order to realize the function of association mining, use the clustering algorithm for classification. According to the function of the frame coefficient evaluation algorithm, the coefficient is defined as

$$k(i) = \frac{b_i - a_i}{\max(a_i, b_i)}, \tag{7}$$

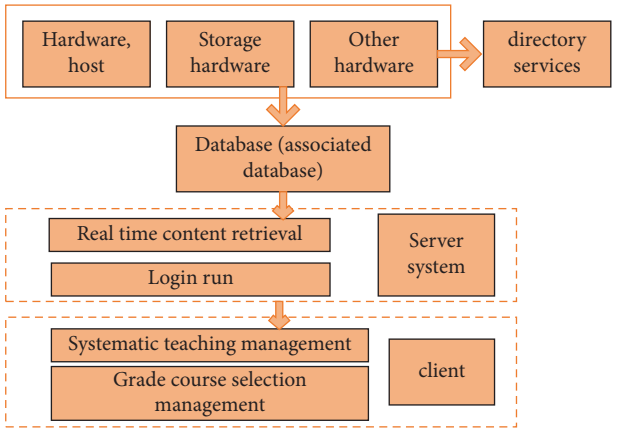

Figure 1: System-specific structure diagram.

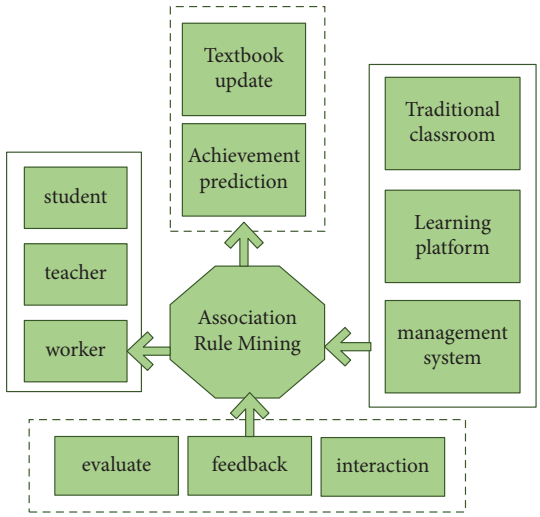

Figure 2: Specific structure diagram of the personalized model.

where a_i represents the average value of the sample parameters and other variables in each associated set. It can be rewritten as

$$k(i) = \begin{cases} 1 - \dfrac{a_i}{b_i}, & a_i < b_i, \\ 0, & a_i = b_i, \\ \dfrac{a_i}{b_i} - 1, & a_i > b_i. \end{cases} \tag{8}$$

The process of data mining needs to accurately classify and check the collected data. The information in the database is dynamically transformed, and the actual applicability of the mining algorithm is judged according to the accuracy coefficient. In the process of Apriori mining, find that most datasets will be searched according to the user's minimum support coefficient. It can analyze and rank data according to the minimum degree of trust. In order to improve the operation efficiency of the algorithm, add cutting technology to the operation. Set different datasets, and their association rules are expressed as

$$E \cap Q_e \longrightarrow F \cap Q_f, \tag{9}$$

In the formula, Q_e and Q_f represent constraint rules, and E represents item sets. After setting the data association rule, change the support coefficient to

$$\text{Support}(E) = \frac{\text{Support\_count}(E)}{m}. \tag{10}$$

In terms of trust degree, it is defined as

$$\text{confidence}(E \longrightarrow F) = \frac{\text{Support\_count}(E \cup F)}{\text{Support\_count}(E)}, \tag{11}$$

In the formula, $\text{Support\_count}(E \cup F)$ represents the number of times the dataset appears in the management system. Comparing the Apriori algorithm before and after optimization, the changes in the system mining efficiency are shown in Figure 3.

As can be seen from Figure 3, the optimized algorithm can improve the speed of data processing. Applying the above algorithm to the university management system can realize the mining of student information and personalized management and recommendation of data. With the efficiency of data mining, there is a need to improve the storage function. With the development of traditional database, there is a problem of high-energy consumption. We propose to optimize this using the dynamic modeling technology. The energy-saving effect is obtained by analyzing the state and storage information of the data storage node. The matrix of stored data is expressed as

$$DF_{n\times m} = \begin{bmatrix} b_{11}b_{12}\ldots b_{1m} \\ b_{21}b_{22}\ldots b_{2m} \\ b_{n1}b_{n2}\ldots b_{nm} \end{bmatrix}. \tag{12}$$

In order to solve the problem of inadaptability in the dynamic data model, add the management node of the discrete dynamic model to the original storage structure. Solve the system compatibility problem according to the adjustment of the fitness function. Due to the dynamic change of data, the node classification management adopted can effectively input and classify the data. It can avoid the risk problems caused by the management system and optimize the stability of the original system. Different storage areas and data access frequencies are compared, and the discrete dynamic configuration method is used to divide the data storage. The scatter diagram of the discrete and dynamically divided storage nodes is shown in Figure 4.

It can be seen from Figure 4 that the original scattered points are distributed in the centralized area, which is easy to cause data redundancy. With the deletion and change of dynamic data, it cannot react quickly. The data nodes after discrete dynamic modeling and planning can be automatically classified and divided into regions. This method can not only save energy, but also improve data parallelism and feedback efficiency. With the dynamic change of cloud storage data, the discrete dynamic modeling technology can effectively reduce the system computing cost, reconfigure the storage structure, and achieve the maximum utilization of resources.

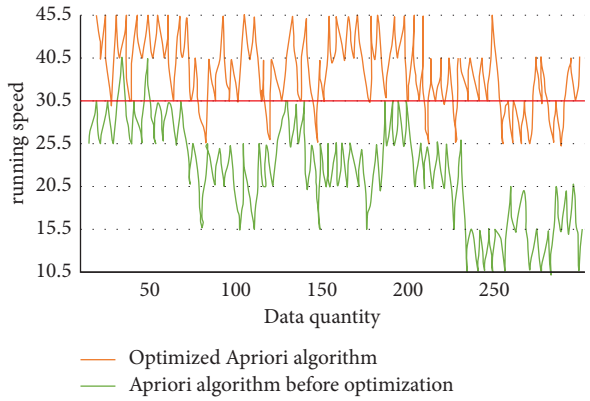

Figure 3: Efficiency change diagram of the Apriori algorithm before and after optimization.

3.2. Research on Discrete Dynamic Modeling of Efficiency Change of College Student Achievement Mining and Management System Based on Apriori Algorithm. In the university management system, with the growth of running time, a large number of duplicate data will be generated, E.g., students' basic information and historical traces of course selection and withdrawal. In the above, we have carried out data mining on students' personal information and teachers' information, and established a personalized management system. However, for the monitoring of student achievement changes, the Apriori algorithm needs to be used for further statistical research. In association rule calculation, in addition to defining the support coefficient and trust degree, relevant evaluation criteria should also be established:

$$\begin{aligned} \text{lift}(A,B) &= \frac{P(A\cup B)}{P(A)P(B)} \\ &= \frac{\text{confidence}(A \longrightarrow B)}{\text{Support}(B)}. \end{aligned} \tag{13}$$

The above calculation result is a correlation variable, and the calculation coefficient of 1 indicates that the two events are negatively correlated. If the calculation coefficient is greater than 1, it indicates that the two events are positively correlated. Therefore, through the judgment of correlation, the relationship between data can be analyzed. The resulting datasets are integrated using discrete dynamic modeling. The disk data matrix formula is as follows:

$$B\ DS_{n\times m} = \begin{bmatrix} b\ ds_{11} b\ ds_{12} \ldots b\ ds_{1m} \\ b\ ds_{21} b\ ds_{22} \ldots b\ ds_{2m} \\ b\ ds_{n1} b\ ds_{n2} \ldots b\ ds_{nm} \end{bmatrix}. \tag{14}$$

Frequently occurring data need to define association. For each set, there are relevant subsets:

$$s = \frac{\text{Support\_count}(I)}{\text{Support\_count}(s)} \geq \min\_conf, s \longrightarrow (l-s). \tag{15}$$

In order to analyze the reasons why students fail in the course, randomly select some students' performance data for correlation rule mining. The course score changes are shown in Figure 5.

As can be seen from Figure 5, in college courses, the overall scores of basic courses are higher and the overall scores of professional courses are lower. Through the discrete dynamic transformation of students' scores, the correlation between score data and data mining is linked. With the increase in the number of mining data, the performance change shows a nonlinear discrete change, as shown in Figure 6.

As can be seen from Figure 6, due to the dynamic changes of data, the performance curve presents a very uneven state. In order to explore the efficiency of the overall model of the university system, use the big data discrete dynamic modeling technology. Considering the dynamic data change factors in model building, optimize the system management process. It mainly simplifies the functions of data storage and data extraction. During the operation of the system, analyze the operation efficiency and accuracy of the model according to the speed of data feedback. In the actual test, in order to meet the expected amount of information, analyze the feasibility of dynamic modeling. The speed of system feedback, the maximum range of data acquisition, and the accuracy of management information are all independent variables to test the efficiency of the system. The main impact on the operation efficiency of the university system is reflected in the amount of information processed and the operation performance. If the dynamic data change at any time, the repeated historical traces will lead to the reduction of the operation accuracy of the whole system, which will affect the efficiency. Analyze the operation efficiency comparison results between the traditional university system model and the discrete dynamic modeling system, as shown in Figure 7.

It can be seen from Figure 7 that the running speed of the traditional system model decreases significantly with an increase in the amount of data. There is also a decline in the speed of feedback received by administrators. The discrete dynamic modeling technology used in this paper can ensure that the operation efficiency of the system is in the rising stage. Therefore, the discrete dynamic modeling technology can analyze the overall operation efficiency of the system. With the increase in the amount of data, the system performance coefficient can also be maintained in a stable range.

4. Analysis of Research Results of Apriori Algorithm and Discrete Dynamic Modeling Technology in Efficient Management System

4.1. Analysis of the Functional Research Results of Apriori Algorithm Combined with Discrete Dynamic Modeling Technology in College Teaching Management System. According to the requirements and functions of the university management system, this paper mainly adopts the two-way mode to establish the client and application platform when designing the system structure. Therefore, students and managers can query and manage personal information independently. Firstly, the Apriori algorithm is used to mine student data, and the relevant data are

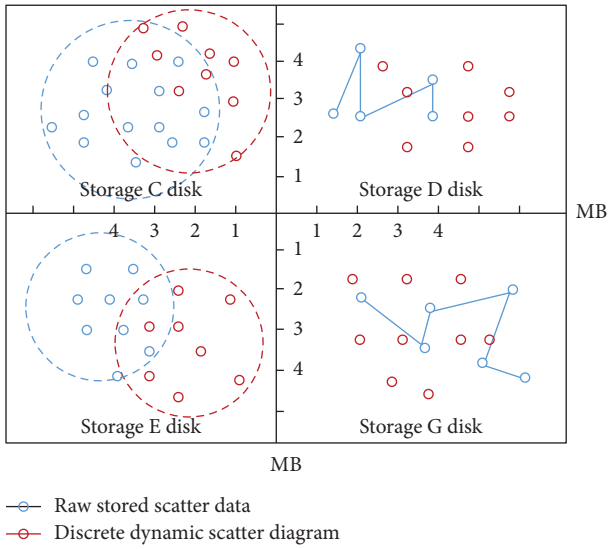

Figure 4: Storage node scatter graph with discrete dynamic partition.

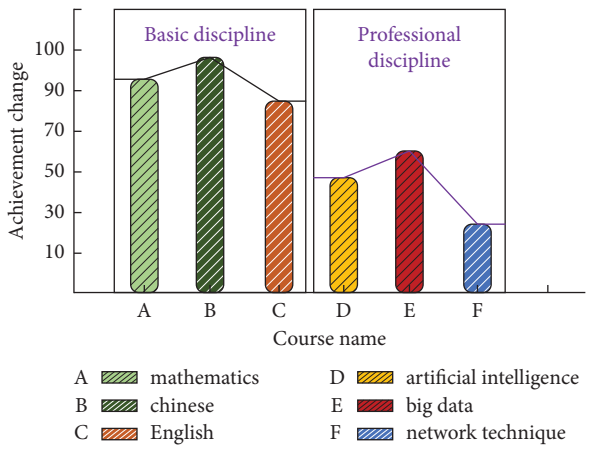

Figure 5: Student course score change chart.

classified. In order to verify that this system can realize personalized teaching management, compare the support coefficient and confidence of the traditional mining algorithm and the Apriori algorithm. A certain range of personalized data is randomly selected as the variation, as shown in Figure 8.

It can be seen from Figure 8 that the support coefficient and the confidence coefficient of traditional mining algorithms are low when data mining is carried out in different data volume ranges. The Apriori algorithm of association rules used in this paper has a high correlation coefficient. Therefore, it can be explained that the Apriori algorithm is effective for system establishment and can help researchers improve personalized data acquisition. Finally, use the discrete dynamic modeling technology to build the system model. Firstly, analyze the mined dynamic information. Automatically classify the information and realize the functions of the subject query, personal data query, course selection system, and so on. In order to verify the

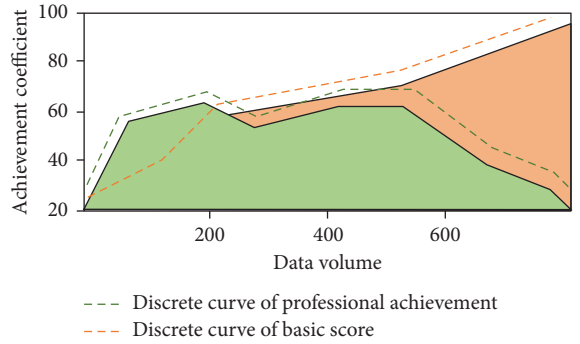

Figure 6: Discrete change diagram of the correlation between score data and data mining.

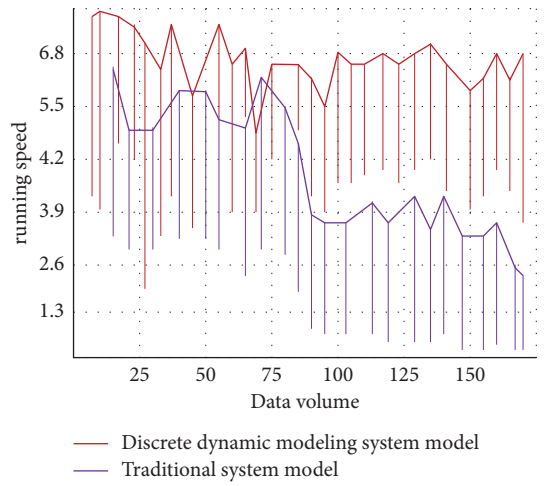

Figure 7: Comparison of system operation efficiency between the traditional university system model and the discrete dynamic model.

functionality of the teaching management system, take the data of a university as an example to test the compatibility and the data mining of the system. Randomly select the student information of a class as the test data, and query her personal information and academic performance, respectively, as shown in Figure 9.

As can be seen from Figure 9, the running interface can accurately find the student's personal information, including photos and class information. Specific subjects can also be found in the score query interface. Therefore, the system established by the discrete dynamic modeling technology has strong functionality and fast running speed.

4.2. Performance Mining Based on Apriori Algorithm and Discrete Dynamic Modeling of Efficiency Change of Management System. Because the query operation will produce a lot of duplicate data, it is more difficult to query with the continuous operation of the system in data mining. When using the Apriori algorithm to mine student data, there are occasional format errors, but the data information is more accurate and does not affect the usual work content. Therefore, the compatibility of the client is high. When

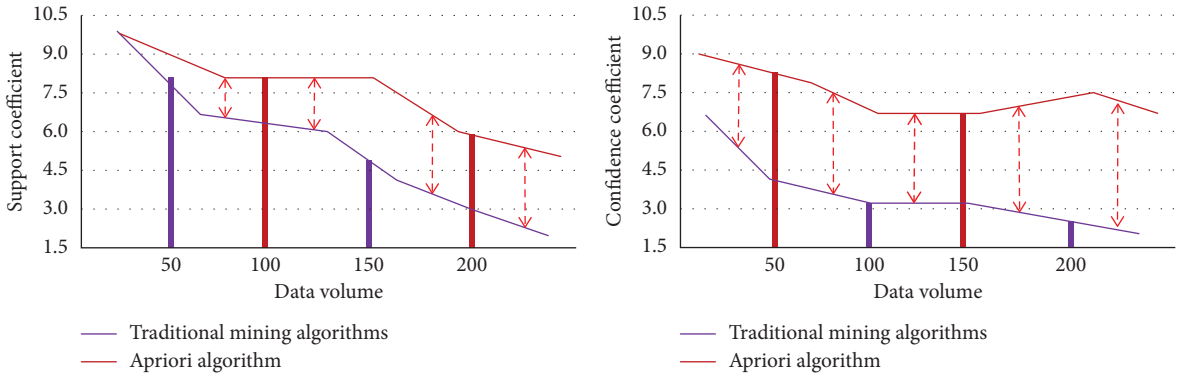

Figure 8: Comparison results of the support coefficient and the confidence coefficient between the traditional mining algorithm and the Apriori algorithm.

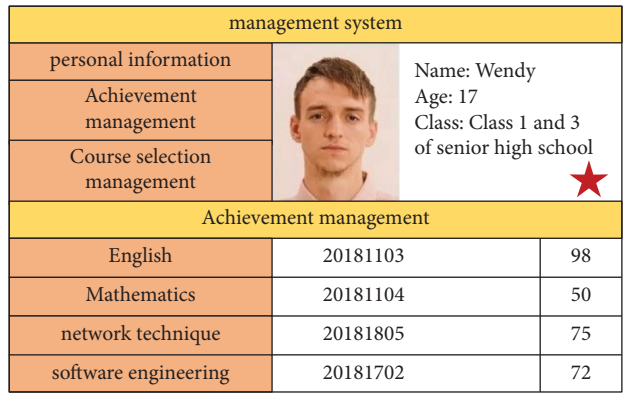

Figure 9: Application diagram of the management system.

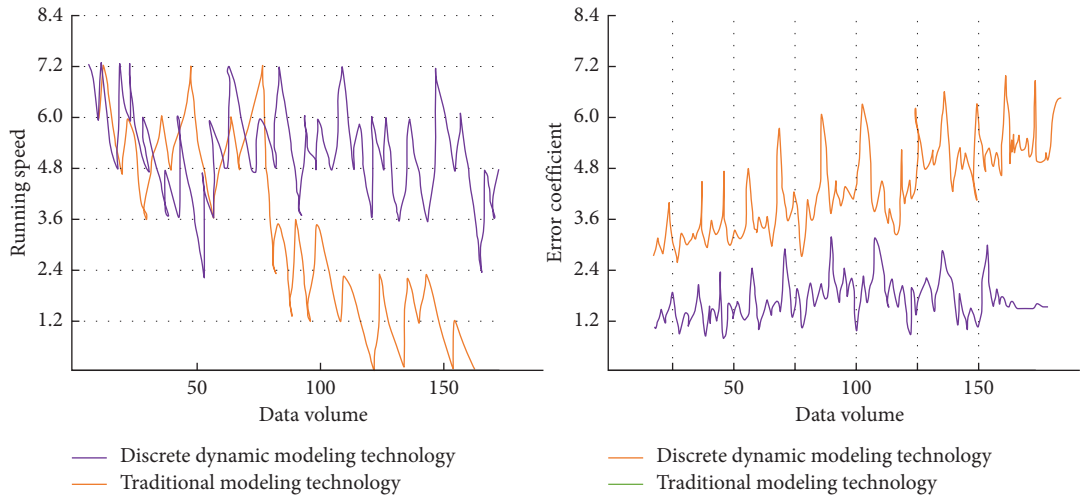

Figure 10: Comparison of differences between the traditional modeling technology and the discrete dynamic modeling technology.

mining association rules for personal achievements, the amount of data is very huge. In the above, analyze the overall situation of relevance through support coefficient and confidence coefficient so as to find out the specific factors affecting the change of the students' performance. From the relevance, the unqualified results are related to the professional courses. The change of professional course performance is related to the English and Mathematics subjects in the basic course. When using the discrete dynamic modeling technology to establish the management system, the research needs to consider the efficiency and performance of the system.

Firstly, the management efficiency of the platform is simulated, and the running speed is analyzed according to the actual situation of the data flow and system data. Compare the differences between the traditional modeling technology and the discrete dynamic modeling technology, as shown in Figure 10.

As can be seen from Figure 10, in the process of system simulation, the data information of students in a grade is randomly selected as variables. The discrete dynamic modeling technology can ensure that the running speed of the system is above the standard range in the dynamic data change. In this regard, the error coefficients of the two in data operation are also analyzed. The error rate element of the discrete dynamic modeling technology is much smaller than that of the traditional modeling technology.

5. Conclusion

With the continuous development of science and technology in China, schools and education industries began to use the big data technology to establish an information management system. Due to the continuous updating of student data, the pressure on management workers also increases. Facing this situation, this paper proposes to use the Apriori association rule mining algorithm to obtain students' personal data and association data in the database. The obtained data are personalized, classified, and divided into multiple subsets for storage. The traditional cloud storage function cannot meet our needs with an increase and change of data. In this paper, the big data discrete dynamic modeling technology is used to optimize the storage function, and the storage nodes are replanned using discrete data. Data mining mainly considers mining students' personal scores and analyzing the relevant factors of score changes. Through the Apriori association rule algorithm, this paper analyzes the correlation reasons affecting the change of students' grades. In the establishment of a system model, the discrete modeling technology is used for dynamic data management. The differences in system operation efficiency and error coefficient between the traditional modeling technology and the discrete dynamic modeling technology are compared. The experimental results show that the Apriori association rule algorithm can accurately obtain information data and optimize the performance of the management system. The system realizes the functions of students' automatic course selection and personal information management. The optimized storage function of the discrete dynamic modeling technology can automatically remove historical traces and reduce the garbage data left by repeated dynamic data changes. Therefore, the content of this paper can improve the overall operation efficiency of the management system and reduce the error defects in the process of use. Compared with the traditional school management system, with the change of big data, it has applicability and effectiveness.

Data Availability

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

Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgments

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