Application of association rule mining algorithm in the design of information-based teaching management system

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Abstract. On this basis, combined with the characteristics of computer-aided instruction, a data-based computer-aided instruction management system is designed and implemented. On this basis, a data-based education management system is proposed, which is combined with the rule mining algorithm. On this basis, a data mining management system based on association rules is proposed. Association rule discovery algorithm can extract required information from massive association rules. The data obtained in this way can effectively manage the information resources of the university. This paper applies this method to my data requirements for implementing Kwalliso teaching from database to realize data-based teaching management, and analyzes the effectiveness of this system in the context of classroom questionnaires, customer interaction. Taking an information platform of a university as an example to test the performance of the system, the results show that the system can realize the course query function, has good client compatibility, can be applied to various browsers and operating systems, and has strong application and good data mining performance.

Keywords: teaching management; Association rules; Mining algorithm; Data mining; Database management

1 Introduction

Since the 21st century, information technology has developed at a high speed, and its development speed, scope and scale are constantly expanding. Using traditional information system for large-scale query, the feedback information is not timely, and its accuracy can not be guaranteed. The query effect of historical knowledge base by using database is remarkable [1]. However, due to the continuous expansion of the university, the total number of libraries has increased sharply, which makes it difficult to meet the needs of traditional database management and inquiry. The application of data mining technology provides a new way to solve the current technical difficulties. In the construction of college information, applying it to the construction of college information can effectively improve the level of college information construction and promote the smooth progress of college information construction. There are a large number of files

and files stored in the database. MIS can integrate and process all kinds of information and data effectively, so as to meet all kinds of information needs. Data mining technology can greatly improve the pertinence of information processing, promote data analysis based on specific needs, and obtain objective research results through further mining related data. Data mining technology is a systematic technology, including visualization technology, artificial intelligence technology and mathematical technology, which can not only complete the processing and analysis of information in a short time, but also provide scientific feedback and provide a basis for the follow-up work. Database data is not only large in cardinality, but also complex in specific types, which invisibly increases the difficulty of data processing. Different types of data need different processing and analysis methods. After integrating multiple information and data, it is necessary to build relevant models. To make data mining more effective, it is necessary to use a large number of calculation methods, such as statistics, mathematics and so on. Let's wait. There is a close relationship between college students' employment and daily work teaching, which can reflect many problems in the teaching process and provide good suggestions for teaching plan reform. How to apply information flow technology to the job hunting of college graduates is not only a reflection of the adaptability of China's education industry to The Times and social development, but also an important aspect of China's information construction. College teachers should strengthen the analysis and application of information technology in daily teaching activitiest [2-3].

Information management technology is widely used in education, such as student achievement information management system and personnel information management system, which is beneficial to the collection and centralized management of decentralized information in colleges and universities. Although these systems have a series of functions such as adding, deleting, modifying and searching data, it is impossible to find the relationship and rules between them and predict the future development trend of these data. Therefore, it has become a problem that decision makers in colleges and universities must face directly to help managers deeply analyze data and dig out some hidden connections between data [4-5].

At the same time, with the implementation of the policy of enlarging enrollment in universities, the teaching process has become more diversified, and the advantageous effect of low cost has become a new direction for university leaders to explore. That is to say, college leaders should understand this paper from a macro perspective, optimize the allocation of teaching resources, and improve the utilization of teaching resources. In this context, using data mining technology to analyse and analyse data sources can provide decision-makers in schools with changes in teaching methods, development, and historical data, and facilitate decision-making management. At present, colleges and universities continue to expand enrollment and students' employment pressure is increasing day by day. Colleges and universities must conform to the trend of the times and rationally allocate teaching resources, which is conducive to their rapid development. Therefore, it is the general trend to establish a suitable data warehouse for colleges and universities, mine existing data and obtain useful information from it. In the information society, the improvement of teaching quality in colleges and universities has become the goal of teaching workers, among which the accuracy of data analysis is

the key factor. Therefore, extracting effective information from massive data is the first condition to improve teaching quality. Data mining technology appeared in 1930s and developed rapidly. The so-called data mining technology is the process of extracting hidden, invisible, and valuable information from the massive amount of non-data. It is a set of methods that can test data quantity and structure relationship of data.   The goal of data mining is to convert more data into useful data. Data mining technology is related to many scientific technologies, which is called technology integration. There are many useless attributes that affect the reading speed and efficiency of computers in massive data. Through the optimization of the algorithm between data, the unnecessary attributes are eliminated and the algorithm is more suitable for the needs of modern society. At present, many companies are applying data mining technology to data management. On the one hand, it can improve the efficiency of data processing and enhance the competitiveness of enterprises, and on the other hand, it further promotes the development of data mining technology[6].

At present, most colleges and universities have their own systems in teaching management, such as the information system for managing students' employment, the information system for managing school personnel, and the related systems for managing students' basic information. Using these systems, colleges and universities can improve the efficiency of information processing. However, with the passage of time, the original data of colleges and universities will accumulate more and more, which makes these isolated systems unable to be centralized, and makes it impossible for managers to systematically analyze the data and extract effective information from them. Therefore, using data mining technology to quickly mine data and provide it to the leadership for decision-making has become one of the urgent problems to be solved.

The premise of data mining is to establish a data warehouse and store the original data. University decision-making system can delete, modify, add and search school data information, and can also realize the ideal of finding a needle in a haystack, select valuable information from a large number of disorderly data oceans, and predict the selected data, which is convenient for the leadership to see the development trend of the situation clearly and is conducive to improving the quality of running schools and the level of teaching management [7-8].

2   Methods: An information-based teaching management system integrating association rule mining algorithm

2.1   System design

(1) The overall structure design of the system

This article introduces a design method for data warehouse based on data warehouse management system. The main task of the client is to provide the display and interaction for the client, and to accomplish various tasks of the application through the main tasks of the server. On this basis, a mobile intelligent terminal application system based on C/S architecture is proposed. The system has two operating modes: B / S and C/S, and has communication functions such as HTTP and Socket. Through the analysis in

Figure 1, we can see that when designing the hierarchical data-oriented management system, the modeling process uses ROLAP technology to retrieve the whole data and applies fusion association rule mining algorithms to mine the data. On this basis, through the analysis of students' parents, the activities[9].
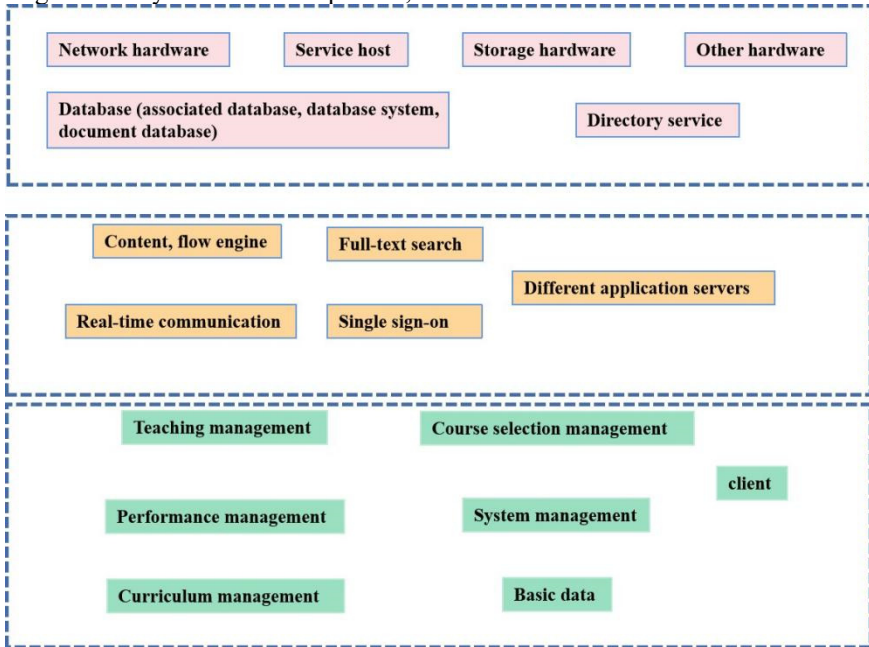

Fig. 1. Information-based teaching management system

(2) Design of system database

Using SQL Server 2009 software to design the system database. The database contains student table, teacher table, study questionnaire, curriculum, etc., which completely covers different aspects of data in teaching management.

On this basis, through the analysis of data structure, a system architecture based on data structure is proposed, and it is analyzed in detail. It goes something like this: embedding the data into the data source by data extraction, transformation, loading, etc., merging the data to generate the data, and using the ROLAP technique to store the data; After entering the system, users can access the database through tools such as data mining and querying, while maintaining and maintaining the database information. Knowledge gained from data mining is presented to the user through the Home screen of the user[10-11].

2.2   Application of Association Rule Mining Algorithm

(1) Design of data mining process

The method includes the following steps: determine the data type to be mined, transform, clear, and prepare. On this basis, a new mine information mining method is

proposed. When the mining ends, the results of the mining are identified and evaluated and reported to the user[12].

(2) Design of association rule mining algorithm.

In general, the basic concept of association rule mining algorithm Apriori can be divided into two problems: active object detection. According to the minimum support provided by the user, searching for all frequency components with the lowest support level, and the frequency components realized will have a close relationship with. In general, only when there are no other frequency components can the active components be found as the basis for the construction of association rules. The association rules are generated according to the lowest confidence given by the user, and the association rules are found in each active object with higher confidence or the same confidence[13].

Improvements to prior algorithms: In order to improve prior algorithms and improve their performance, pruning techniques have been added to the algorithm to reduce the size of candidates. Al. Pruning technique is based on the feature item, set a frequency set, and the frequency set of all subsets.If there is a subset (l-1) of a candidate itemset in A_l that does not belong to the frequency set (Kl-1), the candidate itemset can be pruned. This method can reduce the cost of supporting all the candidate itemsets.

(3) The application of the improved Apriori algorithm in the system.

According to the improved Apriori algorithm, the association rules based on constraints are obtained [14].

Definition 1: Let the set of n different projects be $J = \{j_1, j_2, ..., j_n\}$, the management set for J be B, and each management includes several projects $j_1, j_2, ..., j_n$. The association rules can be expressed as follows:

$$E \cap Q_e \Rightarrow F \cap Q_f \tag{1}$$

Where: Q_e and Q_f both represent constraints; E and F represent itemsets, $E \subset J, F \subset J$, and $E \cap F = \mu, \mu$ represents that when managing, it includes both E itemsets that meet the Q_e constraint and F itemsets that meet the Q_f constraint, so there is a constraint relationship between E and F.

Definition 2: Assuming that the management set B contains the above constraint association rules, the Support (E) of the e-itemset under the constraint condition Q_e is:

$$Support(E) = \frac{Support\_count(E)}{m} \tag{2}$$

Where: m and Support_ count (E) respectively represent the number of data (the total number of events) and the number of times that e itemsets appear in management.

B% of the management in management set B includes both E with Q_e constraint and F with Q_f constraint [15].

In terms of credibility, if $E \subset J, F \subset J$ and $E \cap F = \mu$ at the same time, the credibility of (E $\Rightarrow$ F) can be defined as:

$$connfidence(E \Rightarrow F) = \frac{Support\_count(E \cup F)}{Support\_count(E)} \tag{3}$$

Where: Support_ count(E∪F) indicates the number of times that e and f itemsets appear together in management. In the management set B, there are a% F itemsets with Q_f constraints in the E itemsets with Q_e constraints[16].

2.3   Query course implementation

Course query mainly includes course selection information query and course score query. For the courses set up by teaching administrators, students can choose courses online. Teachers can check the list of students who choose different courses at any time, and enter the course scores into the system after the course ends. Students can check their course scores through the system at any time. During this period, the teaching management personnel can not only check the teachers' information, but also check and count the students' achievement information. The teaching management personnel can manage the courses offered through the system. After the user enters the keyword "Course Query", click Start Query to enter the course query selection page, select course selection information or grade query, and click Start. If there is relevant information in the system, you can exit after querying the results. If the user wants to continue to query other information, you can click Return Query to return to the input page. If there is no relevant information, it will automatically jump to the initial input page [17].

3   Results and analysis

Taking a university as an example, this system is applied to the information platform of this university, and the overall performance of this system is tested by testing the course query function, compatibility and data mining performance of this system when it runs on this platform. The running environment of this system is: Core i5 CPU, 1 TB hard disk capacity of 8GB memory, Huawei USG6330 firewall, Windows8 operating system and Google browser.

3.1   System function test

A student is randomly selected from a class in an experimental university, and this system is used to query his course scores, so as to test the course query function of this system. This system can realize the course query function, and the interface is clear.

3.2   System Compatibility Test

In this paper, the system client is tested for compatibility, and whether the programs can run normally under various browsers and operating systems is tested. In the test, the commonly used Google browser, IE browser, 360 browser and Firefox browser are mainly tested, and the operating systems are Windows8 and WindowsXP. The compatibility test of this system is carried out by installing two operating systems and two browsers on two computers respectively. A student and a teacher are randomly selected from a class in an experimental university to operate two computers respectively. The operation contents are as follows: after entering personal verification information and logging into this system, they enter their respective information inquiry pages to inquire about their personal scores and course selection lists, and then quit logging in. Whether the system can run normally according to different users' needs during the whole operation is recorded, and the record results are shown in Table 1 [18].

Table 1. Compatibility Test Results

operating system	Google Chrome		IE explorer		360 browser		Firefox browser	
	format	data	format	data	format	data	format	data
Windows8	normal	accurate	Some fields have large fonts and slightly wide line spacing.	accurate	normal	accurate	normal	accurate
Windows XP	normal	accurate	Some fields have large fonts and slightly wide line spacing.	accurate	normal	accurate	normal	accurate

As can be seen from Table 1, the system in this paper only has a slight error in the text display format of query information when using IE browser, but the data is accurate and normal, which does not affect daily use. The applications in other browsers are normal and the data is accurate. This shows that the system in this paper can run normally in different browsers, and the system client has good compatibility, which can be applied to all kinds of browsers and operating systems and has strong applicability [19].

### 3.3	System Data Mining Performance Analysis

On this basis, 21,000 pieces of data were selected for verification. In this system, we can choose class information, teacher information, data information, grade information and other information to carry out association rules mining of these information, and also test other data mining functions of this system. The test results are shown in Table 2.

Table 2. Results of system data mining

Data volume/strip	Missed detection rate/%	False detection rate/%
3000	0	0
6000	0	0
9000	0	0
12000	0	0.03
15000	0.04	0.06
18000	0.07	0.09
21000	0.11	0.12

By analyzing the data in Table 2, it can be found that the mining right organization with less than 12000 data in the test process has higher accuracy, and there is no condition of invisibility or invalidity. As the total amount of data increases, the invisible errors and the measuring errors increase slightly, but the technique increases obviously, indicating that the whole data mining work of the system is good and can achieve good results of association rules[20].

## 4	Conclusion

This paper presents a data mining method based on association rules. Association rule exploration algorithm can achieve the goal of extracting massive data from specific association rules. Among them, the client, server and database are the most important components of the system, and the most important components of the system. By establishing a database system that includes various kinds of teaching management information and using the improved association rule mining algorithm, the information related to academic information that users need can be mined from the information system, and the choice of teaching and courses can be provided to users. Categories and other services provided by customers at home. On this basis, this paper will further test the performance and other functions of this system to verify its applicability and further expand its application scope.

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