The Application of Data Mining Technology in the Education Management System

Xin Zeng[1], Shijin Li[2,*], Ting Shi[3]

[1]School of Mathematics & Computer Science, Dali University, Dali, China

[2]Yunnan University of Finance and Economics, Kunming, China

[3]Yunnan Business Information Engineering School, Kunming, China

*Corresponding author: Shijin Li

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Abstract: Teaching quality is the core of higher education, and teaching quality is directly related to teaching management methods. How to implement scientific and reasonable teaching management methods in the teaching process is very important to improve the teaching effect, and scientific and reasonable teaching management methods must be based on the objective phenomenon of teaching and learning process. Using the data generated in the teaching process, through the data mining technology to discover the teaching rules hidden in it, establish reasonable evaluation methods and means according to the law, so as to achieve the purpose of ensuring the teaching effect and improving the teaching quality.

1. Introduction

With the application of information technology in the management of colleges and universities, the daily use of the teaching management system will leave a huge amount of data, which has formed a database of teaching information [1]. Under the conditions of modernization, if these massive data are analyzed and mined, information that is regular and instructive in educational management and student management can be found.

As a tool, data mining can be applied to the teaching management of colleges and universities. It can help managers find hidden rules or patterns from past data, provide information support for decision-making, and continuously improve the quality of teaching management and promote education management [1]. Further reform, improvement and development to improve the scientific, targeted and efficient management. Whether domestic or foreign, more and more colleges use data mining and other technologies to build decision-making systems, providing a data foundation for higher decision-making.

2. Data mining function

In addition to the ability to query data, data mining can discover patterns that have not been previously discovered and predict future trends and behaviors. To sum up, data mining mainly has the following functions: concept description, classification and prediction, correlation analysis, cluster analysis, and isolated point analysis.

Concept description. It refers to describing the connotation of a class of objects and summarizing the relevant features of such objects. The two ways of conceptual description are data characterization and data differentiation. Data characterization is a common feature that describes a class of objects, while data differentiation is a description of the differences between different classes of objects [1].

Classification and prediction. First, the classification establishes a model that can describe and distinguish data classes, and then use this model to predict object classes whose class tags are unknown. There are various forms of inductive classification, such as classification rules, decision trees, and neural networks [2]. When the predicted value is a value rather than a class tag, it is often referred to as a prediction.

Association analysis. The purpose of association analysis is to discover association rules that show the conditions under which two or more data items frequently appear together in a given data set. If these data items appear together in a certain law, there may be some association between these data items [2]. This law is called an association rule. Its association types mainly include simple association, time series association, and causal association. Credibility becomes an important measure of the rules generated by correlation analysis.

Cluster analysis. Clustering refers to dividing the data to be mined into multiple classes or clusters. Data with higher similarity will be divided into the same cluster, and data with larger gaps will be in different clusters. Cluster analysis is an important human behavior, which enhances people's understanding of objective reality and is a prerequisite for concept description and deviation analysis [2]. Traditional pattern recognition methods and mathematical statistics are the main techniques of cluster analysis.

Analysis of isolated points. An isolated point refers to some abnormal records that exist in the database, which are inconsistent with the general behavior or model of the data. Isolated points may include a lot of potential knowledge, such as exceptions that do not satisfy the rules, and anomalous instances in the classification [3]. These rare events may be more interesting than normal. Outlier analysis is also known as outlier mining.

3. The status quo of Chinese teaching management

The current teaching management methods are mainly supervision type and punishment type [1]. Regulatory means mainly include the supervision activities of various leaders and retired teachers, as well as the students' monitoring and reflection of the teaching process, as well as various measures that are continuously introduced to constrain the behavior of teachers. Punitive means mainly include disciplining the mistakes or negligence that may occur during the teaching process. The main purpose of these measures is to "teach" the teaching process [4]. In terms of actual results, these measures have limited effects, resulting in the following phenomena:

1) Teachers' enthusiasm is not high. Excessive ineffective management measures limit the subjective initiative of teachers. Excessive regulatory measures lead teachers to cope. Teachers only implement measures based on measures. These measures can effectively promote teaching. Not necessarily willing to implement.

2) Teaching management methods are not targeted and the objectives are not clear enough. Although the measures are increasing, they have not really solved the problem.

3) Lack of tools and methods for discovering teaching and learning. At present, problems are mainly discovered through communication with students, and problems cannot be found through data.

4. Design of education management data mining system

In the current education management system, a data mining technology that is more suitable for contemporary education management should be applied. The data mining system is created on the teaching management data warehouse, and the records taken from the record set are uniformly taken out and stored in the system workstation, and then the records are preprocessed, and then the preprocessed records are statistically analyzed and analyzed. The results of the statistics are displayed in various graphs and tables, and finally the results are modeled using appropriate models, and finally meaningful records are mined and interpreted. The mining system in the teaching management system has four modules, namely: data warehouse function, data preprocessing function module, data analysis function module and mathematical modeling and result analysis function module [3].

The establishment of the model. Most of the schools use the credit system education system to measure the students' learning by means of sub-disciplinary and part-time teaching. In the complicated education system, the scores of the unified examination courses are used as the basic data of the data warehouse. Data mining methods are used to analyze and classify students' performance, and to predict the choice of courses, so as to provide basic data and forecast data for the

school to develop talent training programs. Further provide decision support for school administrators to better and more accurately formulate school development programs [4]. At the same time, it can also provide a reliable data basis for schools to improve teaching quality and optimize teaching resources.

First, in a three-layer architecture based on B/S, the presentation layer, the intermediate layer, and the data layer are divided into three relatively independent units, such as below Fig.1. Using the three-tier architecture of the data warehouse, a system of application models belonging to the data warehouse of the college entrance examination course is built [5].
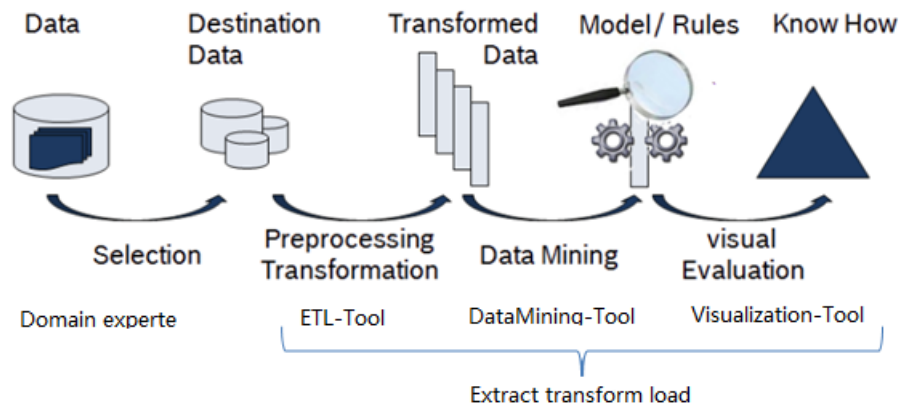

Fig.1 Data mining system process

In data mining methods there five parts are:

1) The data source contains all the basic data needed for future analysis. For example, basic information of students, test paper information, question type information, course information, teacher information, etc.

2) The ETL phase, that is, the extraction, conversion, loading and refreshing of data, the data comes from unused data sources, and the information representation in different data sources is also different. These data need to be filtered during the extraction process. , get high-quality information, and convert the data of different expressions into the same format, which is convenient for the subsequent data to be refreshed and loaded into another layer of data warehouse.

3) Central data warehouse, which is the data warehouse of the college entrance examination course. The central data warehouse stores the data after cleaning and conversion. After further processing, it is stored in the multi-dimensional database. Students can use the analysis of the data to select the course to achieve the decision support effect.

4) OLAP service layer, using OLAP technology or DM technology to query and access the data in the data warehouse of the test results, and obtain the auxiliary decision information.

5) Information display layer, the knowledge obtained by using the data analysis tool can display the analysis result more intuitively and comprehensively to the user through various visual information display technologies, such as icons, texts, videos, sounds and the like.

Data warehouse module. The main reason in the data warehouse module is to form a fact table. In this function module, it is a simple tool to select and load records. The selected records are converted and purified into the next module to form a relation table with various dimensions [4]. This module is data preprocessing.

Data preprocessing function module. The main function of this module is to discover knowledge. Because the data in the real world is transmitted to the computer, the main features are incomplete, redundant, etc., and the data processing technology is used to clean and denoise the data to improve the quality of the data [5].

Data analysis function module. After the pre-processed data is complete, noise-free, and non-redundant, the data can be modeled. The data analysis function module can use the table or graph mode to view these data sets, and finally generate some guidance.

Mathematical modeling and analysis effects module. This module is the focus of data mining technology. Its main function is to mine the records after data analysis. The mining results obtained

by different algorithms are different. For example, the classification method and clustering method are used to mine the data in the data mining library. Get different mining results, you can also evaluate the final result to see if it is credible.

5. The application of data mining in education management

The application of data mining in education management mainly includes the following items: student information management, teaching evaluation, performance analysis, distance education, intelligent teaching, and individualized training. Among them, teaching evaluation, performance analysis and personalized learning programs are all important for education management [6]. Link. There are a large amount of data to be processed in education management, such as teacher information, student information, school curriculum information, teaching plan information, management department information, etc. The use of data mining technology can effectively improve the efficiency of education management.

Classification and prediction. The application of classification and prediction in education management is generally used to develop a personalized talent development program for students. Respecting the individuality development of students is an important concept of modern higher education. This requires that colleges and universities will reflect the individualized characteristics of students as the focus of talent training, and develop different training methods to adapt to the individual development of different students [6]. Based on the commonality, the classification and classification are carried out according to the classification model, and thus a plurality of training programs with individualized characteristics are formulated. Then divide students in a given range and use some kind of personalized training program. Applying classification and forecasting to the process of formulating talent training programs not only provides constructive opinions on the subject curriculum of the school, but also provides more scientific and effective guidance for students' independent learning and personalized learning, which is conducive to the realization of talent training. The goal of cultivating diverse, individualized, and innovative talents.

Association analysis. Association rules are to discover the associations or interrelationships between data by analyzing the occurrence rules of certain items in a transaction [5]. At present, the most researched in the application of education management is the mining of association rules, such as the application of association rules in the course selection system and the application of association rules in college degree warning. The two articles are all researched on a large number of articles. The student's grade data is analyzed. The former is to find out the influence of different course setting sequences on the student's grades, so that the course order can be arranged more reasonably [7]. The latter is to dig the grade data of senior students, and get the law of failing grades that can't be awarded to degree students, so as to achieve the purpose of degree warning.

Cluster analysis. In education management, cluster analysis is mainly used to analyze the quality of test papers. First, by measuring the distribution of student test scores, a general evaluation of the quality of the test paper is obtained. Generally speaking, when the test papers are compiled successfully and the test questions are of good quality, the test scores will be normally distributed, and the measurement results are in line with the natural distribution law [7].

Bimodal type is bimodal, it means that the difficulty of the test is not very different, there is a polarization phenomenon that is difficult or partial, and the problem of moderate difficulty is too small. The difficulty distribution of such questions lacks distinction, and students who have excellent grades cannot be distinguished from those with poor grades, and only moderate students can be distinguished.

Isolated point detection. An isolated point refers to a data object whose data set is inconsistent with most data models. Outlier detection, also known as anomaly detection, aims to identify observations that are significantly different from other data features. The goal of the outlier detection algorithm is to find outliers and avoid marking normal objects as isolated points. The two criteria for the outlier detection algorithm are high detection rate and low false alarm rate [3]. Data mining in education management systems mostly uses association analysis or classification analysis.

6. Summary

With the rapid growth of data information in the education management system, the rational and effective use of data mining technology is of great significance to the reform, improvement and development of the education management model. Data mining tools can objectively discover hidden information in the education system, thus providing an important basis for educational managers to make relevant decisions and improve management efficiency.

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