Construction of University Education Teaching and Evaluation System Based on Data Mining Algorithm

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Abstract. This paper discusses the selection of teaching evaluation index, establishes and solves the decision tree model of teaching evaluation, and carries out the concrete application of mining conclusions. The evaluation of teachers' teaching quality is an effective measure to improve teaching quality and regulate teaching behavior. In this paper, we set up a data mining system for teaching evaluation, hoping to find out the information and knowledge that is helpful to improve teaching quality from a large number of teaching data, and apply it to practice. The construction of index system is the basis and basis of teaching evaluation. This paper uses AHP method to analyze the model of teaching evaluation system, and finally defines the evaluation indicators: teaching attitude, teaching content and teaching method as the basis for selecting and mining the teaching information attributes in the database, so as to reduce the mining library attributes; on the one hand, it improves the mining efficiency, On the other hand, it can avoid the phenomenon that the decision tree is too large because of too many mining fields, which leads to the phenomenon of over fitting mining objects.

Keywords: Data mining · Teaching evaluation · Decision tree algorithm · Analytic hierarchy process

1 Introduction

In recent years, with the expansion of enrollment in Colleges and universities, the quality of students declines, which puts forward higher requirements for teachers' teaching quality. Therefore, it is very important to strengthen the construction of teaching staff and the evaluation of teaching quality [1]. The current teaching evaluation methods are almost used to evaluate whether a teacher's teaching quality is "good" or "bad", but it is difficult to explain what factors are related to the level of teaching level, that is, it is difficult to find out the law of teaching quality from the original data collected. This paper adopts the research idea of interdisciplinary integration. Through the comprehensive application of teaching, management science, information theory, computer science and other basic theories, this paper gives the teaching evaluation model based on data mining, and realizes the model solution through programming, and reaches the mining conclusion. These conclusions can reveal the key factors affecting the teaching quality, And the

characteristics of teachers with high teaching level should have, so as to effectively help teachers improve the quality of teaching.

2   Common Algorithms in Data Mining

2.1   Decision Tree Algorithm

Classification analysis method is to analyze the data in the training set, make accurate description for each category or establish analysis model or dig out classification rules, so as to use the classification rules to classify the records in other databases in the future.

Decision tree is an algorithm commonly used in classification and prediction model. It can find some valuable and potential information by classifying a large number of data purposefully. Its main advantages are simple description, fast classification speed, especially suitable for large-scale data processing. The most influential and earliest decision tree method is the famous ID3 algorithm based on information entropy proposed by Quinlan. Its main problems are: ID3 is a non incremental learning algorithm; ID3 decision tree is a single variable decision tree, it is difficult to express complex concepts; the relationship between the same sex is not emphasized enough; the anti noise ability is poor. In view of the above problems, there are many better improved algorithms CA.5 (the successor version of 1d3 algorithm) to make the training samples estimate the accuracy of each rule. Since this will lead to an optimistic estimate of the accuracy of the rule, C5 uses a pessimistic estimate to compensate for the bias. As an alternative, a set of test samples independent of the training samples can also be used to assess accuracy.

2.2   Clustering Algorithm

Clustering analysis is different from classification. The class of data objects processed by cluster analysis is unknown. Clustering analysis is the process of grouping objects into clusters composed of similar objects.

Given a database of n objects or tuples, one partition method constructs K partitions of data, each partition represents a cluster, and kqn specifies. The classical algorithms include K-mean and k-medoids, and these algorithms have been added to many statistical analysis software packages or systems, such as SAS and SPSS.

Partition algorithms generally require all data to be loaded into memory, which limits their application on large-scale data; they also require users to specify the number of clusters in advance, but in most practical applications, the final number of clusters is unknown [2]. In addition, the partition algorithm only uses a certain fixed principle to determine the clustering, which makes the clustering results unsatisfactory when the shape of the clustering is irregular or the size of the cluster is very different.

All grid clustering algorithms have the problem of quantization scale. Generally speaking, the possibility of different clustering objects being divided into the same unit is increased due to too rough partition (insufficient quantization); on the contrary, if the partition is too detailed, many small clusters will be obtained.

3 Teaching Evaluation Data Mining System Model

3.1 Overview of dmote Model

Dote (data mining on teaching evaluation) model is a model that applies data mining technology to teaching evaluation. This model combines with the actual teaching evaluation work and builds a decision tree about teaching evaluation information by using decision tree algorithm of mining technology, The non leaf node in the tree represents the key attribute of teaching evaluation, the leaf node represents the judgment of the attribute value of teaching evaluation, its branch represents a partition of tree node attribute value or region, and a path from root node to leaf node represents a rule [3].

The purpose of dhote model is to classify teachers by using decision tree method in data mining, that is, the characteristics of teachers with good or poor teaching quality are mined out and divided into one class; each classification has n rules, which indicates that teachers with good or poor teaching quality have n different types of characteristics; Each rule also shows several key attributes that affect the teaching quality of teachers.

3.2 Theoretical Basis of dmote Model Information Theory

Information theory is a theory established by C.E. Shannon to solve the problem of information transmission (Communication), also known as statistical communication theory. A system for transmitting information is composed of sender (source) and receiver (sink) and the channel (channel) connecting them. Information theory regards communication process as a process of transmitting information in random interference environment. In this communication model, information source and interference (noise) are understood as some kind of random process or random sequence. Therefore, before the actual communication, it is impossible for the receiver (sink) to know exactly what kind of specific information the source will send out, and it is impossible to judge what kind of state the source will be in. In this case, the source state of the destination has uncertainty, and this uncertainty exists before communication, so it is also called prior uncertainty.

(1) Channel model

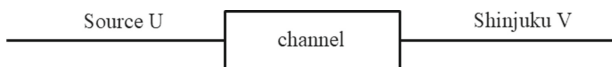The channel model of information theory is shown in Fig. 1.

Fig. 1. Channel pattern

The following mathematical formula is obtained:

$$\sum P(v_j \backslash u_l) = 1, \ i = 1, \ 2, \cdots, \ r \tag{1}$$

$P(v_j \backslash u_l)$ is the transition probability of input and output signal letters, that is, when the input signal letter is u_i, the output signal letter is v_j.

(2) Information entropy

The probability of occurrence $P(u_i)$ of message (symbol) u_i constitutes the source mathematical model.

$$\begin{bmatrix} U \\ P \end{bmatrix} = \begin{bmatrix} u_1\ u_2\ \cdots\ u_r \\ P(u_1)\ P(u_2)\ \cdots\ P(u_r) \end{bmatrix} \tag{2}$$

3.3   Simulation for ID3 Algorithm with Evaluation System

At present, the most influential example learning method in the world is i03 of J.R. Quinlan. Its predecessor is CS (concept learning system). The working process of CLS is to find out the most discriminating factors first, then divide the data into several subsets, and each subset selects the most discriminative factor to divide until all subsets contain only the same type of data. Finally, a decision tree is obtained, which can be used to classify the new samples.

In the entity world, each entity is described by multiple features. Each feature is limited to take mutually exclusive values in a high scatter set. Each entity belongs to a different category in the world. For simplicity, suppose there are only two categories, P and n. In these two kinds of inductive tasks, the entities of class P and class n are called the positive and negative examples of concepts respectively. Some known positive and negative examples are put together to get the training set.

The leaf of decision tree is a class name, i.e. P or n. Each feature is composed of a different feature. If we want to classify an entity, we test it from the root of the tree. According to the value branch of the feature, we enter the lower level node and test the node [4]. The process goes on to the leaf node, and the entity is judged to belong to the category marked by the leaf node (see Fig. 2).
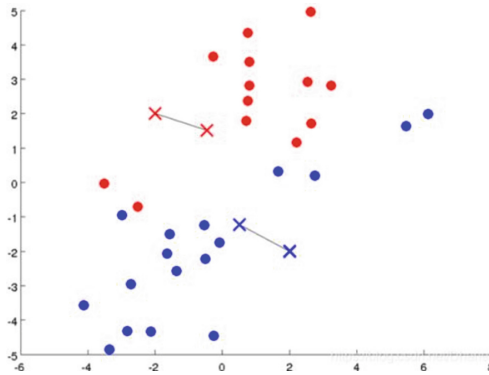

Fig. 2. Simulation for ID3 algorithm with evaluation system

The research of this system is to dig the data of teaching evaluation content. Every school has to evaluate the teaching situation of teachers every half a year [5]. Because of the large number of teachers, and each teacher teaches several courses, the data generated

is very amazing. If the school department wants to extract some useful information from it, its workload can be imagined. The development goal of the system is to extract some useful information from the large amount of data, so that the school leaders can be free from the task of studying a large number of data, improve the work efficiency of the school, so as to achieve the purpose of improving the teaching level (see Fig. 3) [6].

The mining system prunes a complete decision tree and adopts post pruning strategy. In the post pruning process, the sub tree replacement operation should be considered. This operation is processed from the leaf node to the tree root. First, access and calculate the error rate of all leaf nodes of a certain subtree, and then calculate the error rate of the subtree by combining the weight of each leaf node (i.e. the number of samples covered); then calculate the error rate after replacing the subtree with a leaf node of the subtree; if the error rate decreases after replacement, the subtree is replaced with this leaf node, otherwise the subtree is retained [7]. Then, consider whether the remaining subtree can be replaced, if so, replace it, otherwise keep it; finally, prune the previously generated decision tree into the simplest decision tree, so as to improve the correctness of the decision tree.
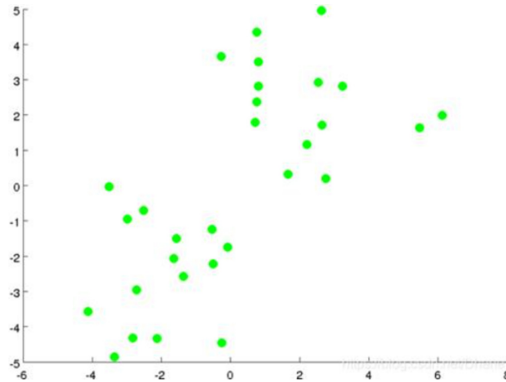

Fig. 3. Simulation for ID3 algorithm with teaching level

4 Demand Analysis of Teaching Evaluation Management System

Before the design and development of the system, we need to analyze the task and function of the system, understand the problems to be solved, the tasks to be completed, and the performance to be achieved. Therefore, the requirement analysis of the system is the basis to ensure the smooth completion of the system and achieve the desired goal. This chapter will analyze the requirements of the teaching quality evaluation system, and provide the basis for the design and implementation of the system [8].

4.1 The Overall Task of Teaching Evaluation System

The teaching evaluation system designed in this paper is to solve the problems of low efficiency of manual operation and poor timeliness in the current school teaching evaluation, ensure the openness and fairness of teaching evaluation, and make teachers and students more convenient to participate in the process of teaching evaluation. Therefore, according to the requirements of school teaching evaluation, there are mainly three links: teacher evaluation, expert evaluation and student evaluation, and the evaluation results should be analyzed and counted to form the final evaluation results. Therefore, combined with all aspects of the evaluation, the system should first be able to manage the basic information of each role. In addition, the most important thing is the evaluation results, that is, the evaluation project, the evaluation algorithm and the evaluation results, which is also the core task of the system. Therefore, around the above tasks, we should first make clear the whole business process of the evaluation, and then complete the demand analysis of the system [9].

4.2 Business Process Analysis

Through in-depth school investigation and discussion, understanding the overall business process of teaching evaluation is the premise of developing this system [10]. Through the interview, we know that the school's teaching quality evaluation is mainly composed of three parts: teacher mutual evaluation, expert evaluation and student evaluation. The specific evaluation process needs to run through the whole semester [11]. The specific business process is that at the beginning of the semester, the school will organize all teachers to give lectures and evaluation activities, that is, all teachers will give Demonstration Courses in their departments, and then the teachers of the same teaching and research department will give their evaluation on the demonstration courses, and this part of the score is the score of teacher evaluation. In the middle of the semester, the school will regularly invite experts from other schools to the school to check the teaching work. In the process of checking, the school will carry out the activities of pushing the door to listen to the class. According to the requirements, every teacher should be attended. If there is no class during the expert inspection, the secondary college will organize the activities to ensure that every teacher should be attended at least once a semester. At the end of the semester, after the students complete the course, the teacher of the course will be evaluated before the final exam, and the evaluation score is the teacher's student evaluation score [12].

5 Analysis of Non Functional Requirements of Teaching Evaluation System

The non functional requirements of the system mainly consider the system function and business, so the following analysis and requirements are from the perspective of performance, database portability and operation [13].

(1) Whether high performance can meet the needs of current teaching quality evaluation is the primary consideration of system performance analysis. First of all, it is

necessary to ensure that a large number of users log in and operate at the same time. It is necessary for the system to investigate the scale of existing teachers and students in Colleges and universities on the spot, reserve space for the above personnel to control the evaluation period and other factors by distinguishing departments and administrators, so as to meet the processing ability of at least 500 people accessing data at the same time. When concurrent access occurs, the system data query is busy, and 3 s is the longest response time or less [14].

(2) There are many drawbacks or defects in database migration ability software system. All kinds of reasons may cause the database used by the software to migrate. Therefore, the migration ability of the system database should be improved, so that it has a variety of database compatibility.

(3) Easy to use, the ease of use of the system should enable users to have a high degree of ease of operation, system design should be based on reference, respect and analysis of customer's operating habits [15].

6 Design and Implementation of Teaching Evaluation Management System

6.1 Design of System Logic Architecture

As the enrollment scale of the school is gradually expanding, the number of students in the school is increasing, the amount of information of students is very huge, and the evaluation mode and emphasis are constantly adjusting, so the system should be well designed for scalability at the beginning of development. As far as the actual situation is concerned, the client of the system mainly includes two parts of the campus LAN and the off campus Internet. In the actual design, due to the huge amount of information of students and teachers, and the student evaluation is the largest data group in the role of using the system, it is mainly for teaching evaluation after logging into the system, so it is necessary to configure a special data server to store the corresponding data, and then realize the operation of reading and writing data through the interface between the functional logic layer and the database, The interaction between system and user is realized through browser. To sum up, the overall architecture design of the system is mainly divided into three layers, namely the presentation layer, business layer and data layer. The performance layer is the front end of the system, which mainly completes the interaction between users and the system; the business layer is the logic layer of the system, which is mainly to realize the function logic of the system: the last layer is the data layer, which is used to store all the data of the system [16].

6.2 System Functional Architecture Design

In the process of comprehensive teaching evaluation, it is found that in the whole evaluation process, users such as teachers, students and experts mainly participate in the evaluation process [17, 18]. Therefore, first of all, it is necessary to manage the basic information data of these users. Secondly, it is the evaluation function of each user role, that is, teacher evaluation, expert evaluation and student evaluation. Finally, it is necessary to conduct comprehensive statistics on the evaluation results [19]. The system

is mainly divided into five main functions: basic data management, teacher evaluation, expert evaluation, student evaluation and comprehensive statistical analysis. In addition, in order to ensure the security of the system, the login module should be designed to prevent illegal users from logging in and ensure the security of the system. In addition, in order to ensure that the evaluation among teachers, experts and students is independent of each other in the whole evaluation process, it is necessary to set corresponding authority to evaluate within the scope of its own authority, and it is not allowed to interfere and check the evaluation results of other roles. In addition, the user's password and organizational structure should also be managed, so the corresponding system management module should be designed for the management of basic data such as data, organization, password, etc. in addition to the management of the above basic parameters, the evaluation index can also be managed in the system management, which mainly involves the setting of evaluation index and weight [20].

7   Testing of Teaching Evaluation System

System testing is to find the existing problems and hidden dangers in the operation of the software, and modify and correct them in time to ensure that the computer software is consistent with the initial goal. The main task of this system is to complete the test of the system function. In the process of testing, we don't need to investigate the program structure and algorithm in the system, just need to regard the system as a closed black box, and ignore its internal structure, Only the corresponding output result after the input instruction is tested. Therefore, the black box test is relatively simple, which is often used in the current software testing. Through the design of functional test cases, the various functions of the system are tested by enumeration method.

8   Conclusion

The evaluation of teachers' teaching quality is an effective measure taken by the school to comprehensively improve the teaching quality, effectively regulate the teaching behavior, optimize the structure of the teaching staff, promote the improvement of the teaching level of the teachers, and make the management of the teaching staff systematic and scientific. Especially in recent years, with the expansion of enrollment in Colleges and universities, the quality of students declines, which puts forward higher requirements for teachers' teaching quality. Therefore, it is very important to strengthen the construction of teaching staff and the evaluation of teaching quality. Teachers' teaching quality evaluation is a practical work, which needs a certain scientific theoretical basis and method as the basis. The index system is the basis and basis of evaluation, and the selection of teaching methods directly affects the scientificity of evaluation results. This paper points out the disadvantages of traditional teaching evaluation methods, which are almost used to evaluate a teacher's teaching quality. However, it is difficult to explain what factors are related to the level of teaching level, It is more difficult to tell us what characteristics of teachers' teaching factors, the teaching quality and teaching level will be higher. However, with today's cutting-edge technology data mining, we can break through the limitations of the original method, so as to solve the problem. Based on the B/S structure,

this paper develops a teacher teaching evaluation management system, which solves the problems of low efficiency and long time in the traditional manual evaluation operation. Different from the previous way, it adds the functions of fast browsing, statistics and analysis, which has high technical content. At the same time, we should pay attention to solve some problems in the process of system development. In order to achieve the maximum efficiency of the system and the smooth progress of the evaluation work, we have to consider the network speed and the response sensitivity of the website. If we can't solve the problem of user access caused by busy web pages, the best system, the most beautiful interface and the best user experience design will be greatly reduced. Therefore, the powerful, rapid and large capacity of the system must be considered.

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