



Assistant Teaching System of Human Resource Management Course Based on Data Mining

Ying Ye^(✉)

College of Labor Relations and Human Resources, China Institute of Labor Relations,
Beijing 10048, China
yying5113@sina.com

Abstract. The traditional assistant teaching system of human resource management course has some problems, such as small data transmission capacity, long system response time and so on. For this reason, this paper proposes an assistant teaching system of human resource management course based on data mining. Establish the snort plug-in mechanism, improve the connection behavior of the course detection engine according to the data mining principle, and then store the teaching information in the database host with the help of the transmission channel organization, so as to build the software execution environment of the teaching system, and complete the design of the auxiliary teaching system of human resource management course based on data mining in combination with the structure of relevant hardware equipment. The experimental results show that, compared with the traditional teaching system, under the action of the data mining assisted teaching system, the response speed of the teacher host and the student host has been effectively improved, which can better solve the problem of obvious accumulation of human resource management course data, and meet the actual application needs.

Keywords: Data mining · Human resource management · Course assistant teaching · Student users · Snort plug-in · Course detection engine

1 Introduction

Data mining is a hot issue in the field of artificial intelligence and database. The so-called data mining refers to a non trivial process of revealing implicit, previously unknown and potentially valuable information from a large amount of data in the database. Data mining is a decision support process. It is mainly based on artificial intelligence, machine learning, pattern recognition, statistics, database, visualization technology, etc. it highly automatically analyzes enterprise data, makes inductive reasoning, excavates potential patterns, and helps decision makers adjust market strategies, reduce risks and make correct decisions [1]. The process of knowledge discovery consists of the following three stages: ① data preparation; ② Data mining; ③ Expression and interpretation of results. Data mining can interact with users or knowledge bases. Data mining is a technology to find the law from a large amount of data by analyzing each data. It mainly includes three

steps: data preparation, law search and law representation. Data preparation is to select the required data from relevant data sources and integrate them into a data set for data mining; Law search is to find out the laws contained in the data set by some method; The tasks of data mining include association analysis, cluster analysis, classification analysis, anomaly analysis, special group analysis and evolution analysis.

With the development of computer technology, computer has become a part of people's life, and the Internet has connected the networks all over the world as a whole. Computer technology is changing people's study, life and work. The organic combination of network and education has a great impact on people's traditional educational mode, thinking, content Methods and talent training programs have a significant impact. The development of teaching means from tradition to computer technology has made a new development and leap in educational technology. For human resource management courses, the establishment of computer-aided teaching system and the use of the system for teaching services can not only save teachers' after-school counseling time, but also help students solve difficult problems in the learning process of computer courses. The test of basic theoretical knowledge in the auxiliary teaching system can help students consolidate the learning effect of the classroom [2, 3]. The use of interactive computer-aided instruction system can provide an interactive communication platform for teachers and students, facilitate teachers' curriculum guidance and improve the efficiency of solving problems. The design and implementation of CAI system can change the existing traditional teacher centered teaching mode and form a new student-centered action oriented teaching mode.

Literature [4] puts forward an auxiliary teaching system of human resource management course based on fuzzy logic [4], extracts the auxiliary teaching system data of human resource management course through data mining method, realizes the classification of teaching system through analytic hierarchy process, and realizes the auxiliary teaching system design of human resource management course according to fuzzy logic. This method can improve the data transmission capacity, but the system response time is too long. Literature [5] proposes an augmented reality based assisted instruction system for human resource management courses [5]. The teaching resources of human resource management courses are obtained through big data analysis method, and the augmented reality method is used to realize assisted instruction of human resource management courses. This method can shorten the response time, but the data transmission capacity is small.

In view of the above problems, this paper proposes an assistant teaching system of human resource management course based on data mining. According to the principle of data mining, improve the connection behavior of the course detection engine, and then store the teaching information in the database host with the help of the transmission channel organization, so as to build the software execution environment of the teaching system, and complete the design of the human resource management course auxiliary teaching system based on data mining. This method can better solve the problem of obvious accumulation of human resource management course data, and meet the needs of practical application.

2 Hardware Design of Auxiliary Teaching System for Human Resource Management Courses

2.1 Student User Registration

Student user registration is an important part of the auxiliary teaching system of human resource management course. Student users can log in to the system only after user registration through student number. After the student user enters the login page, click the “registered account” button on the page to register the user. The student ID is the only identification that distinguishes students. After entering the registration page, student users need to use the student ID as the user name for registration. When submitting information, the system will detect whether the user name has been registered. If the user name is registered, it will prompt that the registration fails and need to be re registered [3]. If the input information is wrong, such as the email address is wrong, a prompt will be given and you can continue to register after returning; If the registration is successful, you will be prompted on the registration success page. Click the login system connection to return to the system login page for user login.

In order to facilitate the use of the participants in the auxiliary teaching system, the data mining framework has established an object-oriented, hierarchical, unified model, and related collection of class libraries with good scalability, which is called API here. The function of this class library is the same as the MFC base class library provided in C++ and the Java class library in Java. It reduces the developer’s writing of student user registration code and improves work efficiency. These class libraries encapsulate a lot of powerful and practical program codes for the auxiliary teaching system. In the data mining framework, all the class libraries established by the human resource management course are integrated and applied to the framework. At the same time, the data mining class library itself has strong compatibility with the development language, has its own debugging function, and has a lot of Good error handling function. The specific module diagram is as follows (Fig. 1).

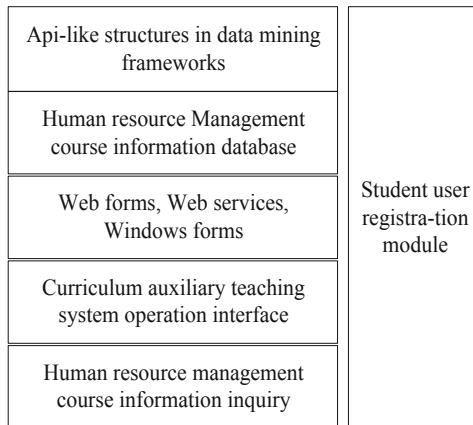


Fig. 1. Schematic diagram of student user registration module

In the entire student user registration module, the top layer is various types of programming languages. The data mining framework supports the development of multiple languages, such as C#, C++, VB, etc. A language specification process is designed for the programming language in the framework, as long as you follow this The programming language can be used at will according to the relevant requirements of the common language specification.

2.2 Question Answering Module

The question answering module provides a platform for student users to communicate with teachers and students. When student users have questions in the process of learning human resource management courses, they can ask questions through this module and consult the teacher’s reply. At the same time, they can consult the questions raised by other students and the teacher’s answers in this module. After the student user submits relevant question information through the question page, the information will be submitted to the teacher background question answering management module. The teacher user can conduct corresponding management operations on the questions and review the questions raised by the student user. After passing the review and replying, the students will be able to see the corresponding information in the question answering module.

Different from the student user registration module, the question answering module is mainly the object of processing human resource management course data, and it is also the core of data mining technology. The database can obtain the data through the above-mentioned data-related providers, and then temporarily store the data in the memory through the DataSet. It is a collection of many tables, not only to obtain data, but also to associate and constrain the various tables of the database through metadata. The DataSet object mainly contains two objects, namely DataTable and DataRelation. These two objects can obtain the relevant properties and methods of the DataSet, and

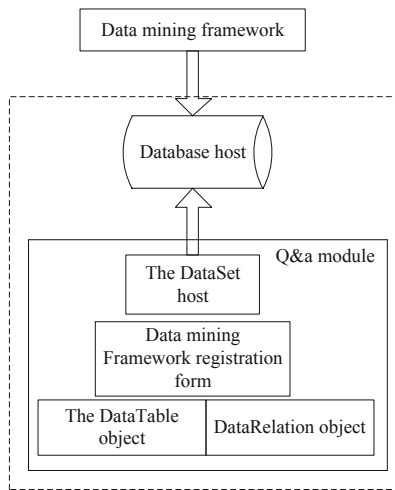


Fig. 2. Connection principle of the question answering module

then manipulate the data [4]. The description of the data is realized through XML. The DataSet completes the reading and writing of the data in the form of an XML document, and then transmits the data through HTTP and provides it to other applications for related operations. For some distributed applications, the DataSet object can enhance the interactivity of the program. The complete module connection structure is as follows (Fig. 2).

The question answering module mainly provides students with the ability to look up question information. The assigned questions are mainly updated and released by the teacher in the background. The completed question information is the upload folder under the homework directory. The type of information submitted by the students is set to RAR or ZIP format, and the question information submitted by the students is established The data folder with the current date as the folder name.

2.3 Data Statistics Module

The data statistics module belongs to a kind of hardware application server structure, which can publish some small human resource management course sites, and can also provide services for auxiliary teaching hosts. The operation of this module must rely on Microsoft Windows NT and Windows 2000 servers. On these application servers, an integrated search engine is implemented, which allows student users to create required search tables through multiple data mining techniques, such as ASP and SQL query statements. At the same time, the browser used by the remote node can also manage the existing server host, thereby establishing multiple different virtual hosts. With the support of data mining technology, the data statistics module can also use ASP technology to build dynamic web pages [5]. At present, the combined architecture of Windows 2000 and Windows NT can make the Web-side server closer to the actual application needs of students. The corresponding configuration of IIS is relatively simple and convenient. For the auxiliary teaching system of human resource management courses, the existence of this module can Realize the query and arrangement processing of related teaching information.

This module mainly includes three main subsystems, one is the real-time virtual teacher system, the second is the learning management system, and the third is the subsystem of learning content management. All subsystems are also implemented in a three-tier architecture. The development technology is based on the component model, and the system's development back-end database can support multiple database designs. In the module design process, it is necessary to define nodes such as.NET and.ASP. The specific node definitions and naming methods are shown in Tables 1 and 2.

To sum up, the development of data statistics module is suitable for human resource management courses, which has certain practical significance and advantages. The independent research and development of teaching assistance system is convenient for teachers to make appropriate adjustments to the teaching plan at any time, and can save a lot of course adjustment time. At the same time, with the emergence of new requirements, teachers can carry out secondary development of the system, so as to avoid the disconnection of the courses taught.

Table 1. Node naming method of data statistics module

The name of the node	Named form
.NET	Translation of human resource management course data in the form of decoding
.ASP	Encode human resource management course data
.XML	Identify the ability to transmit human resource management course data
.VS	Human Resource Management course data transmission direction
.SQL	Human resource management course data link form
.CLR	Human Resource Management course data storage location

Table 2. Ideal connection time

Course data transmission amount /(Gb)	Connection Duration /(ms)
1.0	0.15
2.0	0.34
3.0	0.47
4.0	0.56
5.0	0.62
6.0	0.70
7.0	0.71
8.0	0.71

3 Software Design of Auxiliary Teaching System for Human Resource Management Courses

With the support of the data mining framework, in accordance with the processing flow of SNORT plug-in mechanism settings, course detection engine connection, teaching information storage database construction, the software execution environment of the auxiliary teaching system is completed, and the relevant hardware application structure is combined to realize data mining-based The smooth application of the teaching system assisted by human resource management courses.

3.1 SNORT Plug-In Mechanism

As an open source application, SNORT is a prerequisite for designing a data mining framework, allowing users to implement specific application-specific detection modules on their platform in the form of plug-in modules. For the auxiliary teaching system of

human resource management courses, the plug-in mechanism of SNORT is implemented in C language, which mainly includes the following two parts:

- (1) Plug-in management program: Mainly responsible for the installation, registration, exit, restart and other operations of the teaching plug-in.
- (2) Various teaching plug-in function realization programs: mainly realize the function of course detection, and at the same time call auxiliary plug-ins to realize teaching logs or other execution actions.

The plug-in management program corresponding to each SNORT node is Plugbase. C. It is also the basic file of the data mining framework. It completes all plug-in management and service functions, provides installation functions for all plug-ins and some common functions used by plug-ins [6]. It provides 4 identical plug-in management interfaces for detection plug-ins, output plug-ins, and pre-processing plug-ins.

With the complexity and large-scale structure of the auxiliary teaching system of human resource management courses, network detection methods tend to be diversified, and data transmission behavior is no longer a single behavior, but a situation of mutual cooperation and influence, but based on data control behavior The teaching system cannot meet the real-time connection requirements of the client host and the teacher host. Under the effect of the SNORT plug-in mechanism, the data mining framework will continue to be more detailed, which will not only make the teacher host and the student host Presenting a stable connection state will also greatly reduce the pressure of course information storage faced by the database host [7].

Let χ_0 represent the initial coding coefficient of the SNORT node, χ_n represent the actual coding coefficient of the SNORT node, n represent the actual number of SNORT nodes in the data mining framework, and \bar{E} represent the average output of human resource management course data per unit time, \hat{r} represents the mining feature value of human resource management course data, and f represents the real-time mining coefficient. Combining the above physical quantities, the function capability of the SNORT plug-in mechanism based on data mining can be expressed as:

$$W = \frac{\sqrt{(\chi_n - \chi_0)|\hat{r} \cdot f|}}{n\bar{E}^2} \quad (1)$$

Since the components in the auxiliary teaching system should be composed of multiple modules that can work independently, the data mining framework must have strong adaptability. It needs to process relevant human resource management course data with the support of the SNORT plug-in mechanism. As a result, the information transmission capacity in the system environment gradually stabilizes.

3.2 Course Detection Engine

The function of the course detection engine is to use the network normal behavior class to detect the human resource management course data packets and filter those network normal data packets, so as to improve the real-time connection speed of the auxiliary

teaching system [8]. With the support of data mining framework, the setting of course detection engine must follow the following principles:

- (1) Standardize the application network of auxiliary teaching system.
- (2) Calculate the similarity level between the data package of human resource management course to be mined and each auxiliary teaching information.
- (3) If the similarity between the human resource management course data package and all auxiliary teaching information is greater than the mining radius, it indicates that it is an abnormal network data package, and it is fed back to the SNORT plug-in machine for further inspection.
- (4) If the similarity between the human resource management course packet and some kind of auxiliary teaching information is less than the mining radius, it indicates that it is a normal network packet and can be discarded.

The course detection engine must be supported by a complete human resource management course database. While judging the accuracy level of teaching information, it determines the real-time connection relationship between the teacher host and the student host. On the one hand, it can meet the storage requirements of the database host for teaching information, on the other hand, it can also avoid excessive occupation of system application space by the information to be stored.

Suppose i_{\min} represents the minimum execution authority value of data mining instructions, i_{\max} represents the maximum execution authority value of data mining instructions, g' represents the screening coefficient of human resource management course data, β represents the detection execution coefficient of auxiliary teaching instructions, and \bar{h} represents auxiliary teaching instructions. The average value of transmission in unit time, ΔD represents the storage value of human resource management course data in unit time. With the support of the above physical quantities, the simultaneous formula (1) can define the application requirements of the course detection engine as:

$$\delta = \left| \int_{i_{\min}}^{i_{\max}} (g' - \beta \bar{h})^2 d\bar{h} \right| / W \times |\Delta D|^2 \quad (2)$$

Through the idea of data mining to divide the human resource management course data, we can analyze the specific location of class nodes in the course detection engine, which is the key application problem of clustering mining framework.

3.3 Teaching Information Storage Database

The analysis of the detection engine based on data mining shows that the application of human resource management course assisted teaching system also needs to design the necessary storage database structure. The purpose of database design is to organize the data according to a certain model according to the existing application environment, realize the functions of storage, maintenance and retrieval, so as to construct an optimal database system, so that the information system can easily, timely and accurately obtain the required information from the database and meet the needs of users. Database is the

foundation and core of information resource management [9]. It generally includes the following design links:

- (1) Demand analysis stage: to design the database, we must first understand the customer's demand. Even if the demand will change dynamically in the future, it can still ensure that the demand is within the scope of development purpose. The focus of demand analysis is to investigate and analyze the user's information requirements in data management to ensure its integrity requirements.
- (2) Logical structure design stage: In this stage, it is necessary to find the data model that is most consistent with the corresponding conceptual structure, construct the DBMS, and make storage arrangements according to the requirements of the DBMS to form an internal database model [10, 11].
- (3) Conceptual structure design stage: According to user needs, comprehensive and generalize, abstract the conceptual model of DBMS, and express it with E-R diagram.
- (4) Database implementation and maintenance stage: In this stage, the database is established, application programs are compiled and debugged, operation tests are performed, and the database is continuously adjusted and modified.

Suppose j represents the real-time storage authority of teaching information, \tilde{Q} represents the characteristic value of the human resource management course data to be stored, ϕ represents the connection coefficient of the teaching information storage database, and h represents the necessary auxiliary teaching application indication. With the support of the above physical quantities, the simultaneous formula (2) can express the connection capacity of the teaching information storage database as:

$$S = \frac{\delta^2 \times j\tilde{Q}}{\sqrt{2\left[\frac{\phi}{h^2}\right] + 1}} \quad (3)$$

Teaching information database is responsible for storing information parameters related to human resource management courses, and can query the feasibility of existing stored information under the action of data mining instructions.

4 Case Analysis

In order to highlight the applicability difference between the auxiliary teaching system of human resource management course based on data mining and the traditional teaching system, the following comparative experiment is designed. A campus host with relatively stable operation ability is selected as the experimental object. Firstly, the data mining program is input into the host element. After running for a period of time, the connection time between the teacher host and the student host is recorded, and the obtained information is taken as the variable of the experimental group; Then disconnect the experimental group, input the routine execution program into the host element, after running for a period of time, record the connection time between the teacher host and

the student host again, and take the obtained information as the variable of the control group; Finally, the variable indexes of the experimental group and the control group were compared.

The connection time between teacher host and student host can reflect the accumulation ability of human resource management course data in the process of operation. In general, the shorter the connection time between the teacher host and the student host, the weaker the accumulation capacity of human resource management course data in the operation process, and vice versa.

The following table records the change of the ideal value of the connection time between the teacher host and the student host (Tables 2).

Analyzing Table 1 shows that, under ideal conditions, the connection time between the teacher-side host and the student-side host presents a continuous increase and then a continuous and stable value change state. The global maximum value reaches 0.71 ms, which is compared with the initial value of 0.15 ms. A rise of 0.56 ms.

The following figure reflects the experimental numerical record results of the response time between the teacher host and the student host.

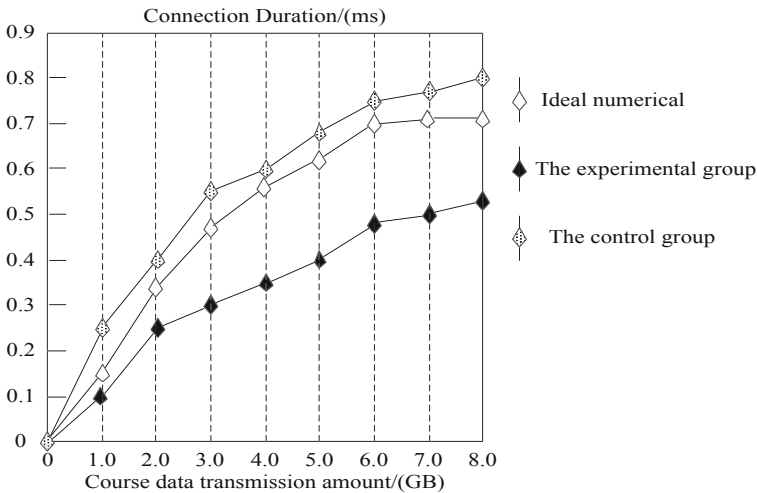


Fig. 3. Experimental results of connection duration (the first group)

It can be seen from the analysis of Fig. 3 that with the increase of the course data transmission volume, the connection duration of the experimental group and the control group showed an increasing numerical change trend, but it was obvious that the average level of the response duration of the experimental group was lower. During the whole experiment, the maximum connection duration of the experimental group was 0.52 MS, which decreased by 0.19 MS compared with the ideal maximum of 0.71 MS; The maximum response time of the control group was 0.80 MS, which increased by 0.09 MS compared with the ideal maximum of 0.71 MS, much higher than that of the experimental group.

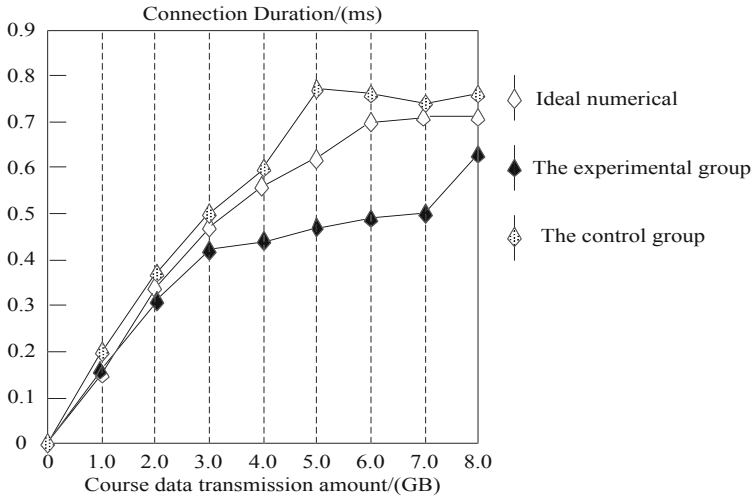


Fig. 4. Response time test results (the second group)

It can be seen from the analysis of Fig. 4 that with the increase of the course data transmission volume, the response time of the experimental group still keeps increasing. During the whole experiment, the maximum numerical result reaches 0.64 MS, which is 0.07 MS lower than the ideal maximum value of 0.71 Ms; The response duration of the control group kept the numerical trend of first rising, then falling, and finally rising again. Throughout the experiment, the maximum numerical result reached 0.78 MS, which increased by 0.07 MS compared with the ideal maximum value of 0.71 MS, much higher than the numerical level of the experimental group.

To sum up, under the action of the auxiliary teaching system based on data mining, with the increase of the data transmission volume of human resource management course, the connection time between the teacher host and the student host has been well controlled, which can solve the problem of obvious accumulation of human resource management course data.

5 Conclusion

Compared with the traditional teaching system, the new auxiliary teaching system, under the function of data mining technology, re plans the actual connection ability of student user registration module, question answering module and data statistics module, and combines the snort plug-in mechanism to restrict the application ability of the course detection engine, so as to stimulate the rapid storage of course data information in the teaching information database. The experimental results show that this new assistant teaching system can avoid the accumulation of human resource management course data, and has strong practical value.

Although this method has achieved high data response efficiency, it costs a high cost. Therefore, how to reduce the system cost needs further research.

References

1. Cuihong, L.: Research on the integration of online teaching platform and accounting information system course teaching practice. *Finance Acc. Learn.* **19**(03), 208–209 (2020)
2. Gen, L., Jie, J., Yan, Z., Zexun, Z.: Private cloud based multi course sharing assisted instruction system. *J. Electr. Electron. Educ.* **42**(01), 10–13+51 (2020)
3. Rui, X.: Design of computer aided instruction system for oncology course based on data mining. *Microcomput. Appl.* **38**(04), 22–25 (2022)
4. Jafari, M., Malekjamshidi, Z., Lu, D.C., et al.: Development of a fuzzy-logic-based energy management system for a multiport multioperation mode residential smart microgrid. *IEEE Trans. Power Electron.* **34**(4), 3283–3301 (2019)
5. Nan, X., Wenhui, F.: Research on interactive numerical optimization augmented reality teaching system. *Comput. Simul.* **37**(11), 203–206+298 (2020)
6. Nieto, R.M., Garcia-Martin, A., Hauptmann, A.G., et al.: Automatic vacant parking places management system using multicamera vehicle detection. *IEEE Trans. Intell. Transp. Syst.* **20**(3), 1069–1080 (2019)
7. Wang, Y., Moura, S.J., Advani, S.G., et al.: Power management system for a fuel cell/battery hybrid vehicle incorporating fuel cell and battery degradation. *Int. J. Hydrogen Energy* **44**(16), 8479–8492 (2019)
8. Dutta, S.K., Laing, A.M., Kumar, S., et al.: Improved water management practices improve cropping system profitability and smallholder farmers' incomes. *Agric. Water Manag.* **242**(03), 106411–106419 (2020)
9. Verdegay J.L., Rodriguez Z.: A new decision support system for knowledge management in archaeological activities. *Knowl. Based Syst.* **187**(7), 104843.1–104843.10 (2020)
10. Ebrahimi, J., Niknam, T., Firouzi, B.B.: Electrical and thermal power management in an energy hub system considering hybrid renewables. *Electr. Eng.* **103**(4), 1965–1976 (2021)