Design of Online Preschool Education Decision Support System Based on Data Mining

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Abstract. Online preschool education decision support system has the problem that large-scale data can not be calculated in parallel, which affects the efficiency of random data writing and reading. An online preschool education decision support system based on data mining is designed. In the hardware part, CS5368 chip is used to realize the storage function of the acquisition node, 64K static random access memory 23LCV512 is used as the buffer, and SRAM reads and writes in byte mode. In the software part, the overall system is based on B/S architecture and combined with web technology to make the whole system application run on the server side. Using data mining technology to establish a database, the decision-making process of online preschool education is regarded as a classification and prediction problem. Design the system function module to complete the management operations such as data addition, deletion, modification and query. The system performance test results show that the total time and rate of random data writing and reading of the system are obviously better than the decision support system based on GA-BP neural network and artificial intelligence, so it has higher data processing efficiency and load capacity.

Keywords: Data mining · Online education · Preschool education · Education data · Decision support · System design

1 Introduction

Modern information technology with multimedia technology, computer technology and network technology as the core is widely used in higher education, providing a new technical means for the management and reform of discipline construction in Colleges and universities [1]. To build the discipline of online preschool education into a modern, open and international first-class discipline, we must make decisions that conform to the discipline development law. The need for scientific decision-making in the discipline construction of online preschool education in Colleges and universities provides a demand background for the application of decision support system [2] in the discipline field of colleges and universities.

Zhang zhuoyou and others designed and implemented an intelligent decision system. On the basis of establishing a reasonable bid evaluation index system, they designed the

W. Fu and G. Sun (Eds.): eLEOT 2022, LNICST 453, pp. 185–196, 2022.
https://doi.org/10.1007/978-3-031-21161-4_15

fitness function with the network mean square error of BP neural network algorithm, and then established a computer automatic bid evaluation model based on GA-BP neural network by MATLAB programming [3]. Zhan Jinwu and others designed an adaptive evaluation decision support system based on artificial intelligence. In order to avoid the limitations of single index decision-making and the defects of subjective judgment, the system completes the quantitative selection of multi index intelligent decision-making by using the method of combining intelligent design theory and decision theory [4]. The system combines the evaluation model with knowledge acquisition to represent knowledge in the form of rules, and the evaluation results are consistent with the actual situation. Although the above research can integrate all kinds of data and realize the openness and convenience of decision support system, it is applied to online preschool education decision support. Because online preschool education involves many aspects of decision data, it has the problem that large-scale data cannot be calculated in parallel.

Decision making is a kind of behavior activity that people decide strategies or effective schemes to achieve a certain purpose. Any type of behavior activity is also a result of relevant decisions. Data mining is the process of knowledge discovery and application (prediction). In the field of education, knowledge or rules are embodied in the rules of teaching and learning, so educational data mining is the discovery and application of teaching and learning rules (prediction) process. The reason why data mining can play a role in the learning and teaching process. Firstly, data mining is used to analyze the past learning experience of learners or others, so as to predict the learning conditions for effective learning and the future learning behavior of learners. Then, according to the above data, in order to provide learners with targeted learning resources and learning processes, teachers can guide learners to learn, so as to solve the problem of large-scale data parallel computing. Therefore, this paper designs the online preschool education decision support system based on data mining, uses advanced tools and new technologies to assist in making more effective decisions, and explores the application of the decision support system based on data mining in the discipline construction of colleges and universities.

2 Hardware Design of Online Preschool Education Decision Support System

Online preschool education decision support system collects more education data, so it can not directly transmit the collected data to the host computer in real time. In order to ensure that the node has enough space to store the collected data, the measurement node must have its own storage function. Taking the sampling speed of 1 s interval as the standard, the node needs 17 bytes of space for one measurement, and 17 bytes include measurement results and time tags. The system uses CS5368 chip to realize this function. The chip is a 32 MB flash memory with SPI interface, and the flash is read and written in sectors, 4K bytes per sector. The schematic diagram of flash storage circuit is shown in Fig. 1.

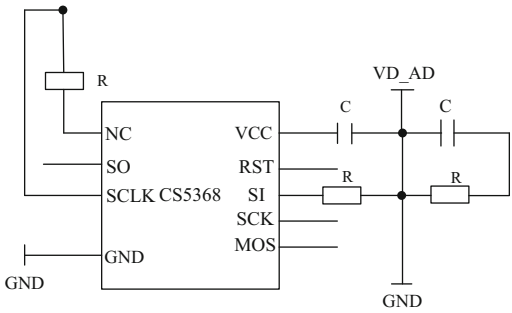

Fig. 1. Flash memory circuit

The reference voltage collected by CS5368 is generated by the chip itself, and its value is half of VA. it requires three clock sources during operation, namely MCLK (master clock signal), SCLK (shift clock signal) and lrck (acquisition clock signal). Most of the energy is exchanged between the device power supply on the circuit board and the pin connecting the ground wire. Each pin is directly connected to the ground and is independent of each other. The clock management module of CS5368 can be configured through hardware. You can choose to use an external controller to provide clock source to CS5368 or an external crystal oscillator to provide clock signal to CS5368. In this paper, the crystal oscillator clock pins XT0 and XT 1 in CS5368 are grounded, and the clock source signal is provided through external clock signal, that is, through FPGA, Then it is configured through FPGA to make its working mode as pin configuration mode. The power module is responsible for level conversion and supplying other modules. Therefore, MC79FC33HT 1 step-down DC-DC regulator of mc78fc00 series is selected to realize 1.5 V to 3.3 V voltage conversion. Flash has large storage capacity, but it takes a long time to read and write by page. SRAM writes by byte, and its single write is on the microsecond level. In order to meet the storage requirements and reduce the impact of data writing on measurement synchronization, SRAM and flash are used to realize the storage function. Divide the SRAM into two blocks. After one area is filled, switch to another area to continue writing. The data in the full block is written to flash. Let CS5368 generate SCLK clock and lrck clock internally. The analog signal at the current end enters the ADC. Firstly, it will be converted into digital signal through oversampling, filtering and other operations inside the ADC, and then output through sdout pin. CS5368 has four acquisition data output pins. In this subject, it is configured as 3.3 V level output, and the sdout of each channel is to multiplex the analog signals of two front ends. Because SPI communication is adopted, pull-up resistance is adopted to ensure the reliability of communication. Using 64K static random access memory 23LCV512 as buffer, SRAM can read and write in byte mode. The isolation band and a large number of vias in the circuit board will inevitably make the current distribution uneven, and this layout will cause voltage fluctuations. In this case, the voltage fluctuation will have a certain negative impact on the power supply pin and the device connected to the ground wire. In order to avoid this negative effect, a decoupling capacitor should be added next to the chip. On the one hand, the change of current in the circuit network can be reduced, so the instantaneous overshoot of voltage on the power supply will also be reduced. On the

other hand, the decoupling circuit can effectively suppress and eliminate the radiation of the power loop on the PCB and the burr on the power supply, and better suppress the parasitic coupling between circuits.

3 Software Design of Online Preschool Education Decision Support System

3.1 System Architecture Design

The structure of online preschool education decision support system designed in this subject is established on the basis of fully combining the characteristics of discipline management in Colleges and universities, the applicability of decision support system and the friendliness of users. Online preschool education decision support is actually a process of data and information exchange. All aspects involved in discipline management are usually quantified with certain data [5]. The design of the system fully considers the existing technical characteristics and future functional requirements, and uses a variety of integration technologies provided by Microsoft net platform to make the whole system not only realize the existing functions, but also adapt to the future needs and technical requirements. At the same time, in order to integrate with the third-party system, The system adopts service-oriented architecture to exchange information with the third-party system through standard data exchange interface to realize the integration between systems. The system combines web technology with B/S architecture to make the whole system application run on the server side, which can ensure a good running environment of the system. The system fully supports XML, soap, web service and other currently widely supported open standards, which ensures that the system can exchange data with application systems and databases of other platforms, and carry out application level interoperability and interconnection. More importantly, the B/S architecture has good scalability and communication ability, so that the system can easily communicate with other MIS systems and expert systems to achieve more intelligent decision-making ability. For example, the system can send the knowledge obtained from data mining to the expert system, so it can automatically add knowledge to the knowledge base of the expert system, In this way, the knowledge acquisition ability of the expert system is further improved, and the reasoning results can also be obtained from the expert system. Moreover, B/S architecture ensures good interactivity, strong page presentation ability and interaction ability, and displays decision-making knowledge and mode. The architecture of the online preschool education decision support system finally designed is shown in Fig. 2.

The system architecture uses a business relational database as the decision information base (knowledge base), which solves the coupling of training knowledge and using knowledge, because knowledge mining is a very time-consuming operation and requires a lot of reasoning and calculation. If the system needs a long operation process every time, it is difficult to ensure the real-time performance of the system [6]. The system supports the output display of data and information. The system shall provide rich and friendly output interface and display platform through the design of Multimedia Library and its management system, so as to facilitate users, decision makers and other

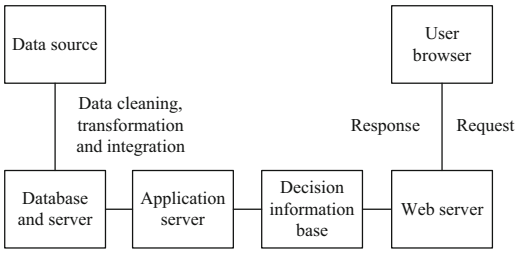

Fig. 2. Architecture of online preschool education decision support system

information demanders to query, browse and make decisions. The mining knowledge is stored through the business database. When users make decisions on decision-making problems, they can directly obtain the existing knowledge from the knowledge base, so as to improve the real-time performance of the system.

3.2 Establishment of Online Preschool Education Database Based on Data Mining

To make full use of the effective data resources in online preschool education decision-making, database is the best choice at present. The main function of database is to store, manage, provide and maintain data for decision support. The database stores various data information inside and outside the school required for online preschool education monitoring, analysis and evaluation. Using data mining technology, online preschool education decision-making process can be regarded as a classification prediction problem, and an education decision can be determined as a supported or unsupported problem [7]. Applying data mining to realize data classification is actually to construct a mathematical model or classifier to predict its class label, so as to realize parallel computing of large-scale data [8]. Support vector machine is proposed for binary classification, but many problems in preschool education decision-making are multi classification and need to be extended to multi classification. At present, there are two main ideas to realize multi classification support vector machine: the first is to optimize the objective function to construct a multi classification model, so as to realize the multi classification problem; the second is to reduce the multi classification to multiple two classification problems. Database technology is used to solve the problem that business data cannot solve - data analysis. By effectively organizing a large number of business data, the database can realize business intelligence and help managers get rid of the blindness of decision-making without data support. In order to improve the generalization ability of binary tree multi classification SVM, the key is to use reasonable strategies to generate binary tree. The distribution volume of various sample data is calculated according to the formula of the minimum class inclusion of hypercube or the minimum class inclusion of hypersphere. Assuming that a certain type of data P has s samples $p_1, p_2, \cdots, p_s$, the center of gravity of such sample set can be expressed as:

$$\overline{p} = \frac{1}{s} \sum_{a=1}^{s} p_a \tag{1}$$

In formula (1), $\overline{p}$ represents the center of gravity of such sample set; s represents the total number of samples; a represents the serial number of data samples. The volume of hypersphere is calculated as:

$$V = \pi r^m \tag{2}$$

In formula (2), V and r represent the volume and radius of the hypersphere respectively; m represents the dimension of the sphere. Because the purpose is to compare the relative size of the distribution range of each category, radius comparison can be used to replace the volume, and only the radius needs to be calculated. Then the minimum radius of the hypersphere containing these samples is:

$$r = \max\{\|\overline{p} - p_a\|\} \tag{3}$$

Sort the categories according to the distribution volume from large to small. The system puts data analysis and data mining in an important position in the design, regards the whole decision-making process as a data mining process or a data analysis process, and provides the interface of data mining algorithm. After the data set is divided into blocks, each block calls for parallel training processing to obtain the support vector of each data block. Database management system is a software for the establishment, use and maintenance of database. Users can access data, call and calculate model library and method library through database management system. The support vector obtained from the training data block is transmitted to the reduce end for processing. After the data is transferred to reduce, it will be sorted and merged, and finally the results will be output to the specified file. For the domain problems to be solved, the decision model or decision knowledge is trained by designing or selecting a reasonable data mining algorithm to act on the historical data. These decision-making knowledge is the reference for decision-makers to make scientific decisions.

3.3 Design System Function Module

To access the system, users need to be authenticated by the user login module. At present, the system provides three roles for users to access the system, which are divided into the heads of the competent departments of the Education Commission. The user selects the corresponding role and enters the user name, the password and verification code of the Department in charge of discipline construction in Colleges and universities and each student in Colleges and universities. Only after the system is verified can he log in to the system and enter the system home page. The ultimate purpose of the database is for the upper application, so it needs to have accessibility and presentation. The data application layer of online preschool education evaluation and decision support system adopts a two-tier structure, which is divided into access layer and display layer to meet different control needs. The database access layer is mainly used for comprehensive evaluation, early warning monitoring, operation analysis, coordination control and other online preschool education data query. The display layer is used for data access display of desktop operating system, large screen and other outdoor multimedia display systems. The data management function of the system is mainly completed by the data management module of key disciplines. They jointly realize the management operations

such as adding, deleting, modifying and querying the data used in the system. The addition of system data also realizes the functions of single data entry and batch data upload according to business requirements. Knowledge base management system is an important branch of artificial intelligence technology. Its intelligence is mainly manifested in that it can imitate human expert thinking to solve complex problems in a specific field. The basic principle of knowledge base management system is to transform the problem solving process into a search problem in state space. The known facts of solving the problem constitute the initial state, and the final solution of the problem constitutes the target state. There are different levels of sub target states between the initial state and the target state, The solution process is to use the inference engine to find a path from the initial state to the target state in the whole state space. The business logic layer reads the data in the cloud environment after ETL processing in the data layer, calls the mining algorithm library to perform data mining analysis, and finally returns the mining results to the presentation layer and interface service layer. Through the corresponding function buttons on the navigation bar, you can enter the data management interface, through which you can view all historical data in the system, or enter each specific record to modify all indicator attribute values of each discipline record. The business logic layer should undertake these functions: running the mining algorithm to calculate and analyze the data, executing the mining algorithm in the parallel computing environment, managing the mining process and results, and undertaking the development of business logic scalability. The business logic layer is mainly composed of these key components: mining algorithm computing module, cloud computing module, mining management module, policy design pattern module, etc. Multimedia library is a part of the decision support system designed separately in this paper. It is mainly used for the display interface in the human-computer interaction system. The display interface function design includes report display, process display, visual display, intelligent display, indicator display, event and early warning display, etc. Through the multimedia library management system, the report, analysis and evaluation model are displayed comprehensively and vividly to realize the generation and display of various graphics such as pie chart, histogram, broken line chart, two-dimensional table, honeycomb chart and dashboard, as well as the function of visual guide service. So far, the design of online preschool education decision support system based on data mining has been completed.

4 System Performance Test

4.1 Test Preparation

The online preschool education decision support system designed this time is built on a Hadoop cluster composed of six computers running HDFS distributed file system. The operating system of all node machines is Ubuntu 14.04. A computer with the same configuration acts as an application server for deploying the online preschool education decision support system. The system provides services for users through browser or intelligent terminal application. After referencing the DLLs related to Microsoft Sync Framework in.Net, first create a SQL sync scope provisioning synchronization object, then create local and cloud providers, and start the synchronization clientprovision by using the file provider provided by Sync Framework.

The experimental data comes from a kindergarten. The decision-making data generated during its online teaching is taken as the source and set up a database for testing.

4.2 Test Results and Analysis

Performance test is mainly responsible for testing the load capacity of online preschool education decision support system. In order to verify the superiority of the system designed in this paper, the test results of the system are compared with the decision support system based on GA-BP neural network and artificial intelligence. This experiment carries out stress test on the database of online preschool education decision support system, stores millions of test data on the resource memory, and tests the total time and rate of random writing and reading of data respectively. The comparison results of the total time length of data random writing and reading are shown in Table 1 and Table 2, and the rate comparison results are shown in Table 3 and Table 4.

Table 1. Comparison of total random write time of data (s)

Number of experiments	Decision support system based on data mining technology	Decision support system based on GA-BP neural network	Decision support system based on artificial intelligence
1	826	1125	1236
2	804	1208	1231
3	856	1147	1342
4	849	1354	1475
5	925	1168	1254
6	912	1239	1363
7	901	1226	1321
8	765	1312	1284
9	882	1125	1119
10	858	1150	1243

The experimental data writing and reading have a certain randomness, and its efficiency can characterize the operating pressure of the system. According to the results in Table 1, the average total time of data random writing in the online preschool education decision support system based on data mining technology is 858 s, which is 347 s and 429 s shorter than the system based on GA-BP neural network and artificial intelligence.

Table 2. Comparison of total time of random data reading (s)

Number of experiments	Decision support system based on data mining technology	Decision support system based on GA-BP neural network	Decision support system based on artificial intelligence
1	204	299	324
2	216	312	326
3	207	324	315
4	214	319	328
5	199	299	325
6	198	305	317
7	207	312	299
8	215	307	311
9	208	314	304
10	206	319	298

According to the results in Table 2, the average total time of random data reading of online preschool education decision support system based on data mining technology is 207 s, which is 104 s and 108 s shorter than the system based on GA-BP neural network and artificial intelligence.

Table 3. Comparison of data random write rates (rows/s)

Number of experiments	Decision support system based on data mining technology	Decision support system based on GA-BP neural network	Decision support system based on artificial intelligence
1	1658	1025	997
2	1614	1047	984
3	1707	1076	978
4	1628	1154	1195
5	1759	1068	1056
6	1836	1189	1265
7	1525	993	1124
8	1764	935	1041
9	1627	929	1082
10	1631	1014	994

According to the results in Table 3, the average rate of random data writing in the online preschool education decision support system based on data mining technology is 1675 rows/s, which is 632 rows/s and 603 rows/s higher than that based on GA-BP neural network and artificial intelligence.

Table 4. Comparison of data random reading rate (rows/s)

Number of experiments	Decision support system based on data mining technology	Decision support system based on GA-BP neural network	Decision support system based on artificial intelligence
1	4672	3181	3034
2	4504	3044	3064
3	4647	3287	3189
4	4888	3165	3296
5	4965	3452	3365
6	4826	3354	2938
7	5055	3218	3222
8	4994	3006	3243
9	4738	3054	3371
10	4822	3135	3054

According to the comparison results in Table 4, the average data random reading rate of the online preschool education decision support system based on data mining technology is 4811 rows/s, which is higher than that of the system based on GA-BP neural network and artificial intelligence by 1621 rows/s and 1633 rows/s. Based on the above results, the online preschool education decision support system designed based on data mining technology has strong load capacity, supports the writing and reading of large-capacity data, and provides users with an efficient data storage environment.

System response time is an important index to verify system performance. Compare the response times of the three systems, and the results are shown in Fig. 3.

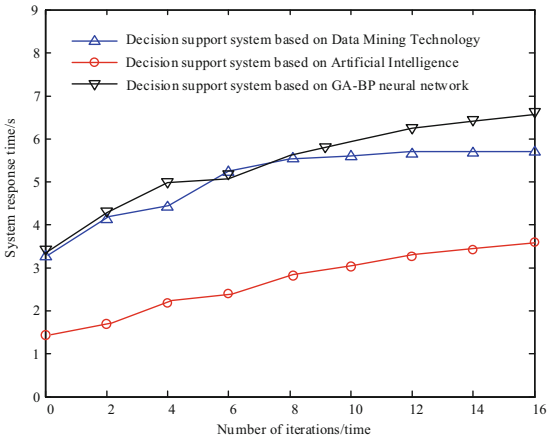

Fig. 3. Comparison of response time of three systems

According to the analysis of Fig. 3, the response time of the system in this paper shows an increasing trend under different iteration times. Although the decision support system based on data mining technology and the decision support system based on GA-BP neural network fluctuate to a certain extent, they also show an upward trend on the whole. By comparing the specific data results, it can be seen that the shortest response time of the system in this paper is only 1.4 s and the longest is only 3.6 s. After comparison, it is found that under the same number of iterations, the system in this paper has the shortest time and the highest efficiency. Although the decision support system based on data mining technology is stronger than the decision support system based on GA-BP neural network, its time is also much higher than the system in this paper.

5 Conclusion

The research on online preschool education decision support system is of great significance to improve the objectivity and scientificity of discipline construction and development decision-making. This paper designs the online preschool education decision support system based on data mining. Millions of test data are stored in the resource memory. The total time and rate of random writing and reading of data in the system are obviously better than the decision support system based on GA-BP neural network and artificial intelligence, which supports the writing and reading of large capacity data. After educational analysis and decision-making, educators need to improve and optimize teaching according to decision-making. The specific implementation of improving and optimizing teaching requires school management authority, long experimental cycle and data comparison during the experiment. It is expected to organize relevant teams to further carry out relevant research in the future.

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