The Information Grading Management System of College Students Based on Deep Learning

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Abstract. In view of the traditional student information management system can not maintain a certain system response speed under a large number of concurrent users, this paper designs a hierarchical management system of college student information based on deep learning. First of all, we use RFID technology to build the hardware module of student information collection, and design the software part of the management system. Then it constructs the structure of student information hierarchical management system, and determines the model of the system for student information hierarchical management. At last, we build the deep neural network model, and use the student information data set to train the neural network, realize the hierarchical management of university student information, and complete the design of the management system. By comparing with the traditional management system, it is proved that the management system based on deep learning can keep high response speed and superior system performance under a large number of concurrent users.

Keywords: Deep learning · Student information · Hierarchical management · System design

1 Introduction

Deep learning is a branch of machine learning, which aims at analyzing and interpreting data by establishing and simulating the operation process of human brain neurons. Neural network of deep learning is composed of multi-layer artificial neural network, through which the abstract knowledge expression can be learned automatically. Deep learning has the ability to automatically learn from the data to extract features, but also more scalable, by adjusting the training set data can identify more types. Using the method of deep learning, the training task and classification task can be separated when the application is realized, so as to achieve the effect of rapid classification of objectives [1].

Student information management is an important part of school office affairs management. Making full use of information technology, network technology and computer technology in student information management, the student information management system is constructed into an application system integrating information processing,

S. Liu et al. (Eds.): eLEOT 2020, LNICST 339, pp. 308–317, 2020.
https://doi.org/10.1007/978-3-030-63952-5_26

business process and knowledge management. Through the construction and use of student information management system, teachers and students can share information conveniently, communicate efficiently, change the traditional complex and inefficient way of work, achieve efficient, high-quality and all-round information processing, business process and knowledge management, and provide strong help for the modern college student information management, greatly improve work efficiency and management quality, and promote the college information construction [2, 3]. Through this system, the university teachers can use the network student information management, the curriculum information management and the student result management and so on; The student can carry on the result inquiry and the on-line choice and so on; The school administrator can carry on the batch student information management and the maintenance and the management and so on through this system. Student information management system through the network, space-time separation of the two sides can work together to achieve the information exchange between various departments, work coordination and cooperation, and this interaction and coordination can be completed almost instantaneously in the network environment, a great convenience to work. Therefore, this article will design the university student information grading management system based on the deep study.

2 Design of Hardware of College Student Information Grading Management System Based on Deep Learning

The hardware part of the student information hierarchical management system is composed of RFID data acquisition module and several servers. The following is a detailed description of RFID data collection module design.

Students' names, student numbers, majors, colleges, grades and other information are manually entered and stored in student cards. Students' school information, facial information and social information are collected by using radio frequency transceivers, high-definition cameras and ID card reading devices. The HD camera and ID card reader will input some information into the system software through the serial port, while the RF transceiver will read the relevant information from the student card and input it into the system software for processing.

The RF transceiver chip used in this paper is CC2540F256RHAR, the output power is 4 dBm, the maximum transmission rate is 1 Mbps, and the operating voltage is 2–3.6 V. Its flexible and efficient development tools, support KEILC, ISP download [4]. The appearance of the actual picture is shown in Fig. 1.

The programming environment of RF transceiver is KileC51, the programming language is C+, the information transceiver module is embedded with high-speed MCU and RF transceiver, its MCU is equipped with special SPI interface on chip, MCU operates and configures the register of RF transceiver through SPI interface, which can realize the control of RF transceiver working mode, and then control the data transmission and reception. Before sending data, initialization configuration and working mode configuration of RF transceiver need to be completed respectively.

The initialization and configuration of RF transceiver is mainly completed in rf init() function. Its main work is to configure channel, channel address, number of bytes sent each time, whether with CRC verification, power, etc. through RF = 1. Turn on the

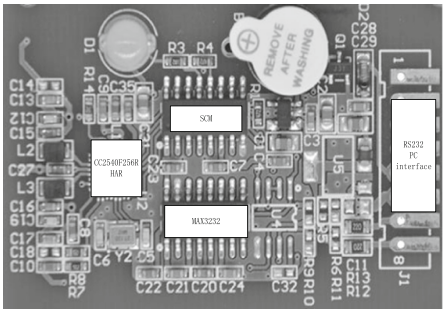

Fig. 1. Physical figure of RF transceiver

RF interrupt, set the transmission and reception address width of the RF transceiver through the SPI write buf() function, and initialize the RF transceiver by specifying the transmission power, transmission rate and received packet length. The transmission mode configuration of RF transceiver is completed in TX mode() function, and the data to be sent is written to transmission buffer through SPI Write buf() function, enabling CE to start transmission. For packet processing, ShockBurstTM mode is adopted. In shockbursttm mode, RF transceiver will use IRQ interrupt mode to inform MCU whether data transmission is completed, that is, when RF transceiver enters transmission state. MCU waits for the data to be sent out. When the data is sent out, IRQ interrupt will inform MCU that the data is sent out. When the data is sent out, the interrupt flag bit TX _DS of data transmission is changed to high level, which will interrupt IRQ pin and clear the status register, thus reducing the query time of MCU [5, 6]. The above is the hardware part of the system.

3 Software Design of College Student Information Grading Management System Based on Deep Learning

Based on the software part of the system, the software part of college student information grading management system based on deep learning is designed to realize the related functions of the management system.

3.1 Design the Architecture of Student Information Management System

The student information hierarchical management system established in this paper is divided into two levels as a whole, the first level management is school level management, the second level management is hospital level management. In order to update the student information data in time, the courtyard level management is divided into two levels according to grade and specialty.

MEAN Stack is the program framework development mode of the hierarchical management system, which is divided into front-end component AngularJS and back-end component, including ExpressJS skeleton engine, Node.js service running environment

and database, in which the database design mode is nested by C/S and B/S. The front-end component is implemented by the AngularJS framework, which provides the front-end MVVM pattern, controller modularization, automated bi-directional data binding, semantic tags, and so on. Back-end components include the ExpressJS skeleton engine, the Node.js service runtime environment, and the MongoDB database [7]. The back-end server environment is provided by Node.js, and the ExpressJS provides the entire back-end framework by relying on different node template engines, including error controllers, caches, routing controls, and a database for data persistence. Through the mapping between database and component, it realizes the management of user's operation on system information and user's call on system information. After determining the hierarchical architecture of the management system, the database of the information management system is designed.

3.2 Information Management Database Design

Considering the system security, the foreground system software is installed at the node of the user with high operation authority. Only the operator with high operation authority has the right to access the operation, and the general user has no right to access it. The other type is installed on a specific server in the form of a backend, which stores the students' information that can be disclosed, and the relevant personnel can submit the modification within their own legal operation authority. The access architecture of student information management database designed in this paper is shown in Fig. 2.

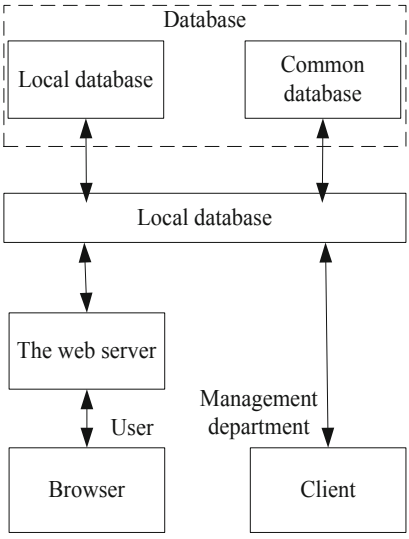

Fig. 2. Database access architecture

Table 1 below lists some of the data table's sub segment structure information.

Table 1. Sub segment structure information of some data tables

Field code	Project	Type (length)
BH	Serial number	CHAR(24)
XM	Name	CHAR(12)
XM2	Former name	CHAR(12)
XB	Gender	CHAR(2)
NL	Age	CHAR(4)
XH	Student id	CHAR(12)
BJ	Class	CHAR(12)
ZY	Major	CHAR(24)
YXDM	Department code	CHAR(6)
YXMC	Department name	CHAR(24)
CSRQ	Date of birth	CHAR(12)
JG_SSDM	Native city code	CHAR(2)
JG_DQDM	Native code	CHAR(6)
JT_TXDZ	Home address	CHAR(64)
DM	Social relationship code	CHAR(6)
SHGXMC	Name of social relations	CHAR(24)
TX	Image symbol	CHAR(1)
PHOTO	Image	BLOB(4000)
KM	Course	CHAR(16)
KMDM	Course Code	CHAR(24)
CJ	Grade	CHAR(8)

According to Table 1 above, the system database structure designed in this paper adopts the mode of combining C/S mode and B/S mode, and uses the advantages to make up for the disadvantages and uses them in a cross way. During the development, the functions of C/S mode will be made into client application programs, and the functions of B/S mode will be developed according to the format of web service programs, then each user application program will be installed on the appropriate client, and then the web service program will be installed on the web server, and browser software will be installed for all clients [8]. When using, users can use different ways (start client application or run browser) to realize the interactive function with database according to their needs. After designing the database of the student information management system, we use the principle of deep learning to build a hierarchical model of deep neural network.

3.3 Establishment of a Depth Neural Network Model

Deep neural network is an important branch of deep learning. In this paper, deep neural network is used to improve the hierarchical management efficiency of management system. The GoogLeNet network structure model shown in Fig. 3 is needed.

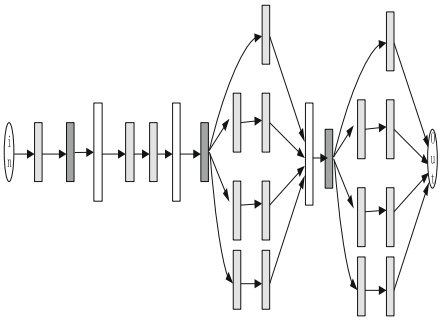

Fig. 3. GoogLeNet network structure model

GoogLeNet adopts a modular structure for easy addition and modification. Select a part of student information data set as the training set of neural network, through the training of neural network, get the specific parameters of neural network, realize the hierarchical management of student information.

The training process of neural network is described as follows: input sample data in the lowest layer of the network, through which the feature vectors are extracted and sampled to get some feature vectors. These eigenvectors are input into several join layers, and then the outputs are input into a classifier. Finally, the classification results of sample data, i.e. the probabilities of each classification, are obtained.

The computational expression of the entire neural network layer can be expressed as follows.

$$f(x) = s(b + Wx) \tag{1}$$

Where x represents the original input eigenvector. W represents the transformation mode of x, that is, the transformation matrix. b represents the offset adjusted after transformation, s is a nonlinear activation function, and the transformation is nonlinear [9]. As the output of the neural network layer, $f(x)$ represents the new eigenvector after transformation.

The training process is actually to input the sample data x, through a layer of calculation, get the final calculation result $f(x)$. Then, by adjusting the network parameters of each layer, that is, the transformation matrix W and the offset b, $f(x)$ is as close to the input x as possible, and finally the closest parameters of the neural network are obtained. The following formula is the updated gradient calculation formula of neural network parameter weight.

$$\frac{\partial c(\theta)}{\partial \theta} = -\frac{1}{m}\sum_{i=1}^{m}(y_i - h_\theta(x_i))x_j \tag{2}$$

In the above formula, y_i is the output of the middle layer of the deep neural network, θ represents each weight parameter, and $h_\theta(x_i)$ is the output value of the activation function of the last layer [10]. θ represents each weight parameter, and the partial derivative obtained is taken as the adjustment value of the weight parameter, i.e. offset b. The calculation formula of weight parameter θ is as follows.

$$\theta^{k+1} = \theta^k - \eta \frac{\partial c(\theta^k)}{\partial \theta^k} \tag{3}$$

In the above formula, η is the learning rate of the deep neural network, which represents the multiple of the adjusted deviation for each update. Its value generally decreases with the increase of training times. In this paper, it is set as 0.02. After training, the deep neural network is used to process the collected information data, and the processed data is stored in the system database, waiting for the user to send a call request to the database and call the data. So far, we have completed the design of the information grading management system of college students based on deep learning.

4 Experiment Results

This paper studies the students' information grading management system based on deep learning, in order to test the performance of the system, the following will be a comparative experiment. Through the analysis of experimental data, the relevant conclusions are drawn.

4.1 Experimental Content

In order to scientifically and effectively test the performance of the management system designed in this paper, this experiment adopts the form of comparative experiment. The contrast group of the experiment is the traditional student information management system, and the test group of the experiment is the college student information grading management system based on the deep learning. The contrast index of the experiment is the response time of the system under different user concurrency, and the response speed of the system is evaluated by comparing the response time.

4.2 Experimental Preparation

In the laboratory, build the test network environment with physical architecture as shown in Fig. 4.

The configuration parameters of each server in Fig. 4 are shown in Table 2.

Before the beginning of the experiment, the test group and the comparison group were tested to make sure that the relevant functions of the system could be realized. The detection software is used to monitor the response time of the two groups of systems to user requests under different user concurrency. Analysis of experimental data, evaluation of the test group and comparison group management system.

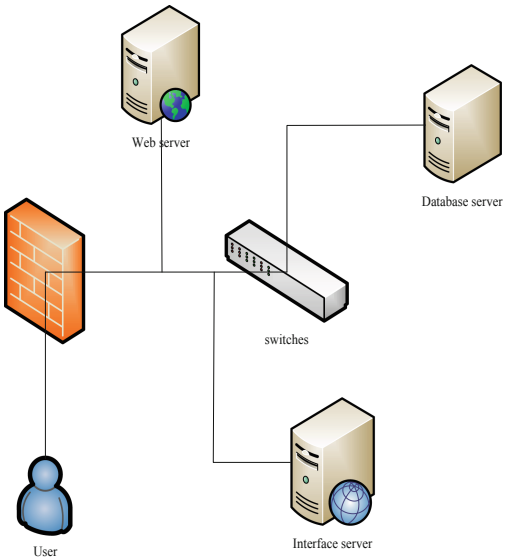

Fig. 4. Physical architecture of test environment

Table 2. Server configuration parameters

The serial number	Equipment	The hardware configuration	The software configuration
1	Client	CPU, Intel I5 9400F 2.4 GHz, memory, 8G, The hard disk, 500G, The network card: 100M	Windows 10 operating system, Office 2013, IE 10
2	Web server	CPU, Intel I9 9900K 3.6 GHz, memory, 16G, hard disk, 1 TB ordinary hard disk, 500 GB Solid state drives, Double gigabyte Ethernet card	Windows Server 2008 R2 operating system, Apache server
3	Database server	CPU, Intel i7-9700K 3.6 GHz 16 memory, 16G, hard disk: 1 TB ordinary hard disk, 500 GB Solid state drives, Double gigabyte Ethernet card, UPS power supply	Linux Cent OS 4.0 operating system, My SQL Database 5.6
4	Backup server	CPU, i7-9700K 3.6 GHz 16, memory, 8G, hard disk, 1 TB ordinary hard disk, Double gigabyte Ethernet card	Windows Server, 2008, R2 operating system

4.3 Experimental Results

The experimental results are shown in Table 3, and the data in the table are analyzed to draw the experimental conclusion.

According to Table 3, with the increasing number of concurrent users, the response time of both systems increases. When the number of concurrent users is less than 350, the difference between the two groups of systems is small, but when the number of concurrent users is more than 350, the increase rate of response time in the comparison group is much faster than that in the test group. The results showed that the response speed of the control group was significantly slower. In conclusion, under the large number of concurrent users, the management system designed in this paper can maintain better response rate and performance.

Table 3. System response time of different concurrent users/S

Serial number	User concurrency	Test group system	Contrast group system
1	50	0.1	0.7
2	100	0.1	1.1
3	150	0.2	1.4
4	200	0.5	1.9
5	250	0.7	2.2
6	300	0.9	2.7
7	350	1.1	3.0
8	400	1.4	3.6
9	450	1.5	4.2
10	500	1.5	5.0
11	550	1.7	5.7
12	600	1.8	6.4
13	650	1.9	7.1
14	700	1.9	8.0
15	750	2.1	8.9

5 Conclusion

Promoting information management is the focus of the current work of colleges and universities. In order to improve the efficiency of the management of College Students' information, this paper studies the hierarchical management system of College Students' information based on deep learning. Through the contrast experiment with the traditional student information management system, it is proved that the management

system designed in this paper can bear a large amount of user concurrency and keep normal operation under a large amount of user concurrency. That is to say, the performance of the information management system designed in this paper is better.

References

1. Chen, J., Wang, Z., Chen, J., et al.: Design and research on intelligent teaching system based on deep learning. Comput. Sci. **46**(1), 550–554+576 (2019)
2. Huang, Y., Wang, H., Cheng, F., et al.: Design and performance test of USV information management system based on time-series database. Chin. J. Ship Res. **14**(04), 161–166 (2019)
3. Cao, B., Chen, W., Wei, S.: Stereoscopic monitoring and management information system of riverbank dynamic changes. J. Yangtze River Sci. Res. Inst. **36**(10), 28–33 (2019)
4. Xiao, X.: Automatic classification of electronic documents based on deep learning: case study of electronic image documents. Inf. Res. (06), 78–82 (2019)
5. Wang, C., Xu, J.: Crew physioiogicai information management system based on Internet of Things. Electr. Autom. **41**(03), 7–9 (2019)
6. Zhang, Y.: Simulation of real-time management of orderly access information for urban traffic in big data. Comput. Simul. **35**(12), 139–142 (2018)
7. Qin, J., Qiu, L.: Design and development of a non-contact attendance system for College Students. Electron. Test (06), 58–59 (2019)
8. Zhu, J.: The design and implementation of the employment information system for students in higher vocational colleges. Autom. Instrum. (11), 141–143 (2018)
9. Zhang, W.: Research on data mining of the Internet of Things based on cloud computing platform. IOP Conf. Ser. Earth Environ. Sci. **113**(1), 49–53 (2018)
10. Wei, Y., Li, W., Zhou, L., et al.: Construction and application of geological information management system in karst hydrogeological environment. Carsologica Sinica **37**(01), 146–153 (2018)