Guide Teaching System Based on Artificial Intelligence

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Abstract—To improve the development and deployment efficiency of the system, this paper combined the software system with Java and AI language Prolog to achieve the guide teaching system based on artificial intelligence (AI). The system creatively adopted the theory of artificial intelligence expert system, at the same time, built a Struts+Spring+Hibernate lightweight JavaEE framework. The coupling degree of each module in the system was greatly reduced to facilitate the expansion of future functions. Based on the development principle of the artificial intelligence expert system, the system diagnosed the learner's mastery of each point of knowledge. It classified students' learning effect and evaluated the knowledge points. Making full use of the learning state of students and combining it with artificial intelligence expert system theory, the system developed a suitable learning strategy to help students improve their learning with less efforts. In addition, the system took the forgetting rule of human brain into account, which periodically presented trainees' knowledge points assessment and avoided students wasting time. The purpose was to help students improve their learning effect. Finally, the system was tested. The test results showed that the system is applicable and useful. It is concluded that the artificial intelligence system provides an example for the same method and has certain reference significance.

Keywords—intelligence, SSH, intelligence learning, JavaEE

1 Introduction

AI is an emerging cutting-edge discipline developed on the basis of interdisciplines such as computer science, cybernetics, information theory, neurophysiology, psychology, philosophy and linguistics. It mainly studies how to use machines (computers) to mimic human intelligence behavior.

AI theory studies how to use artificial methods to simulate and extend intelligence. This work is mainly done by science and engineering researchers. Based on the theory of natural intelligence, the working mechanism of natural intelligence and the structure of various functional components are clarified. Then, AI can be achieved by simulating and expanding similar structures in highly developed electronic, optical and biological devices. Through decades of development, a more systematic theory has formed. It contains very rich content and has been widely used in practice.

2 Literature review

2.1 An overview of the development of artificial intelligence

Artificial intelligence is a new subject. In 2017, Pantic and others as stated in [1] proposed the teaching introductory artificial intelligence using a simple agent framework. There is no unified definition yet. There are different understandings and definitions for artificial intelligence in different fields. In terms of artificial intelligence, Hendrawan as stated in [2] believes that an intelligent machine should have the following six kinds of typical ability: the ability to categorize all kinds of patterns; the ability to change one's own behavior, that is, learning ability, inductive reasoning ability, that is, generalization ability, deductive reasoning ability, the ability to form conceptual models and the ability to use this model, and the ability to understand. Therefore, the narrow sense of artificial intelligence can be defined as follows: It is used to study how the computer can do the intelligent work that only the talents can do. Its core goal is to make computer performance more impressive and develop in an all-round way. As a result, an ordinary computer is not a smart machine. Only when an electronic computer can be used to control and process information, the simulation for human thinking can be called artificial intelligence. Hilles and others as stated in [3] proposed the knowledge-based intelligent tutoring system for teaching mongo database. Hooshyar and others as stated in [4] used a flowchart-based intelligent tutoring system for improving problem-solving skills of novice programmers. In addition, Sullins and others as stated in [5] explored the effectiveness of a novel feedback mechanism within an intelligent tutoring system

In the 1950s, after the concept of AI was first put forward, a lot of notable achievements were made, such as machine theorem proving, checkers, solving program, USP table processing language and so on. In 2014, Bridge and others used as stated in [6] the machine learning for first-order theorem proving. At this stage, AI experts pay attention to the problem-solving method, ignoring the importance of knowledge, which causes failure in machine translation as well as in other aspects and makes artificial intelligence development at a low ebb. Moreover, Sanjika and Stephan as stated in [7] extracted the parallel phrases from comparable data for machine translation. From late 1960s to the 1970s, the emergence of the expert system has brought the research of artificial intelligence to a new climax. With the development of the fifth generation of computers, artificial intelligence has been greatly developed, and the focus of artificial intelligence during this period is to make intelligent robots. In late 1980s, the theory and technology of neural network developed rapidly. By the 1990s, due to the development of Internet technology, AI began to turn from the research of single intelligent agent to the research of distributed artificial intelligence based on network environment. Melo and Silveira as stated in [8] believed the blind can see tourist destinations on the internet. On the other hand, because of the improvement of computer speed and the expansion of storage capacity, the hardware of the computer has developed rapidly. A lot of work that couldn't be done can be carried out now. Therefore, artificial intelligence has a new climax. Some of these tech-

nologies have been applied, and artificial intelligence has penetrated into every field of social life.

2.2 Research hot spots of artificial intelligence

Through 50 years' development, artificial intelligence has made many remarkable achievements. From the expert system to the rise of artificial neural networks and genetic algorithms since 1990s, remarkable achievements have been achieved. AI has been successfully applied in many other fields, such as medicine, philosophy, biology, astronomy, geography and etc. At present, three hot spots in the research of artificial intelligence are respectively intelligent interface, data mining, and main body system.

In 2014, Neviarouskaya and others as stated in [9] used the intelligent interface technology for textual attitude analysis. In general, intelligent interface technology studies how to make it easier for people to use a computer. To achieve this goal, the computer is required to understand the text and the language, have the ability to talk and express, and even be able to translate between different languages. However, the implementation of these functions depends on the study of knowledge representation. Therefore, the research of intelligent interface technology not only has great practical value, but also has great theoretical significance.

Data mining is the process of extracting the unknown and useful information hidden in a large number of incomplete, noisy, fuzzy, and random practical application data. At present, the research of data mining and knowledge discovery has formed three powerful technical pillars: database, AI and mathematical statistics.

The main body system is a mental state with belief, desire, intention, ability, choice, commitment and so on. The system is more powerful and intelligent than the object, and has autonomy. The main body tries to accomplish the task autonomously and independently. Moreover, it can interact with the environment, communicate with other subjects, and achieve the goal in a planned way. The multi-agent system mainly studies the coordinated intelligent behavior between the multiple entities separated logically or physically, and finally solves the problem.

2.3 Practical use of artificial intelligence

At present, the main research and application fields of artificial intelligence include pattern recognition, natural language understanding, automatic theorem proving, program automation, intelligent database system, robot, expert system, artificial neural network and intelligent tutoring system (ITS). Roll and others as stated in [10] proposed to improve students' help-seeking skills by using metacognitive feedback in an intelligent tutoring system.

Automatic theorem proving: When people prove the theorem, methods of induction and deduction are generally used. From some of the most basic axioms, the correctness of the theorem is proved by strict reasoning. Now, people have successfully proved all the geometric theorems with computers. The most outstanding thing is to use the computer to prove the world-famous mathematical problem- The four-color problem.

Intelligent database system: Database system, or knowledge base system, is a computer software system that stores a lot of facts in a discipline. They can answer all kinds of science questions raised by users. In order to effectively represent, store and retrieve facts, and satisfy people's need for data processing, many technologies, especially including information retrieval system, have been developed.

Intelligent teaching system: It is a comprehensive subject involving artificial intelligence, computer science, cognitive science, education, psychology and behavioral science. The ultimate goal of its research is to bear the primary responsibility of human education by computers, that is, to give computer system intelligence. To a certain extent, the computer system can replace human teachers to achieve a better teaching effect. In recent years, with the popularization of computers and the increasing demand for educational software, the development of ITS is faster.

In summary, the existing research has not yet met the social demand for the management of the guide teaching system. Therefore, to improve the performance of guide teaching system, the idea of artificial intelligence is introduced in this paper. In view of the problem of classroom teaching and after-class practice, this method combines traditional classroom teaching with modern information technology and makes use of the complementary advantages of network courses and traditional classes.

3 Design and analysis of guide teaching system based on AI

3.1 Design and analysis of guide teaching system

With the opening of university tour guides and the improvement of students' professional courses, the Ministry of Education has formulated new regulations on the University syllabus, and has new requirements for university guide teaching. In this case, the teaching of computer-aided University guides, supported by multimedia technology and network technology, has developed rapidly. This teaching method aims to combine traditional classroom teaching with modern information technology and makes use of the complementary advantages of network courses and traditional classes. However, there are various problems in the current computer aided teaching guide, which mainly include the following aspects:

First, there is a shortage of professional teachers. The increase of students and the small class teaching model have caused the shortage of teachers. At the same time, the number of professional teachers is too small to take care of each student. To solve this problem fundamentally, we should improve the teaching quality and carry out targeted teaching method with the limited teachers. Secondly, the students have a weak foundation in the basic knowledge. As for the university teaching reform, the emphasis of tour related professional courses has changed. Teachers don't have spare time and energy to consolidate basic knowledge for students, which has hindered the improvement of the students' level to a certain extent. Therefore, teachers should help students to consolidate the basic knowledge in an efficient way and further improve the teaching quality. Thirdly, the awareness of students' self-teaching is obviously inadequate. Self-teaching includes three processes: self - monitoring, self - guidance

and self - strengthening. We should adopt a planned or skilled way to achieve this, urge students to make a schedule for learning in a regular way and enable students to achieve their learning goals through self-monitoring, feedback and adjustment.

In order to improve the development efficiency and deployment efficiency of the system, the software system developed in this paper combines Java and AI language Prolog to achieve a guide teaching system based on AI. The system creatively applies the theory of artificial intelligence expert system. At the same time, the Struts+Spring+Hibernate lightweight JavaEE framework is used. The coupling degree of each module in the system is greatly reduced to facilitate the expansion of future functions. Then, based on the development principle of the artificial intelligence expert system, the system sets the diagnostic checkpoint before the user uses the software to learn. This checkpoint can help learners to grasp knowledge by means of learning record information retained by students in the system, and classify students' learning effects and knowledge. Making full use of the learning state of students and combining the theory of artificial intelligence expert system, we can come up with suitable learning strategies to help students achieve better result with fewer efforts. Finally, the system takes into account the forgetting curve of the human brain. In order to help students to improve their learning effect, students should be evaluated periodically to avoid a large amount of time spent in doing too many exercises.

3.2 System architecture design

Using JavaEE technology and database technology, a guide teaching intelligent learning system is developed. This system needs to browse selectively according to users' needs and carries out some tests and interactive contents. Therefore, the website contains many contents, including several learning modules such as knowledge point information management, knowledge point testing, knowledge point management, and learning navigation providing suggestion for user. Each module is a different learning model for the learners. The learners have a new understanding and learning of computer English, and develop their interest slowly. After learning, the new knowledge is consolidated to achieve the ultimate learning effect.

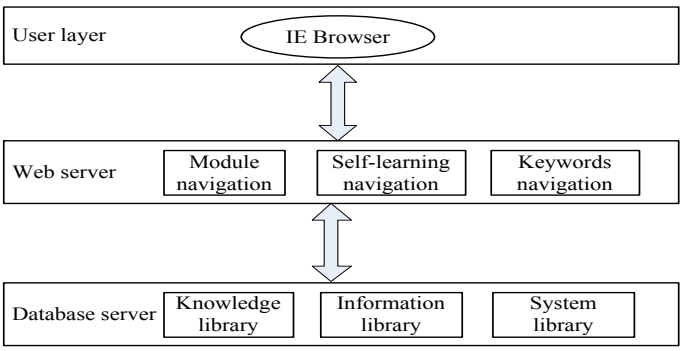

Fig. 1. The overall framework of guide teaching system

Figure 1 is the framework of the overall guide teaching system. The structure adopts the online teaching system based on the Internet-assisted, and uses the browser / server (B/S mode) architecture. The system is composed of the students' autonomous learning system and the assistant expert system of the university tour guide course. There are four users, such as system administrators, students, teachers, and domain experts. When the user login system, the system will automatically put forward different privileges according to the identity of different users. Among them, the system administrator carries out daily maintenance to the system.

The work of domain experts is mainly about maintenance of query, deletion, modification and addition of neural network, as well as maintenance of operations such as query, modification, addition and deletion of dynamic and static knowledge base. In addition, students can log into the system via the user password provided by the system administrator. After entering the system, students can carry out self - training, self - testing, and intensive practice relevant to knowledge points. Intensive exercises are conducted on the basis of results of self-testing and testing and combined with the principles of memory. As shown in figure 2, it is the network topology of the guide teaching system. It is known from the following diagram that the network structure consists of three parts: internal network, server side and remote client.

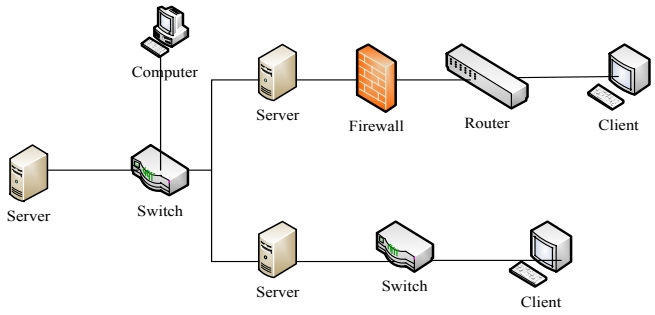

Fig. 2. Network topology diagram of guide teaching system

In addition, the system selects the intelligent learning process, which is mainly composed of diagnostic models. The diagnostic model consists of two parts: diagnosis and evaluation. It is used to diagnose the mistakes and defects of students in their study. In view of the errors and defects, the teaching of the error correction is made, so that the system carries out individualized teaching methods of teaching students in accordance with their aptitude. The evaluation is based on the results of the diagnosis to identify whether the students reach the teaching goals, and to achieve the basic standards. In a variety of ways, the feedback of evaluation results will be given to the students in time so that they can understand their academic achievements and defects. At the same time, the results of diagnosis and evaluation need to be sent to the knowledge base. As shown in figure 3, the results of the students and the types of statistical errors were calculated and the reasons for the error were explained. The teaching strategy reference is provided, and the teaching navigation system is corrected.

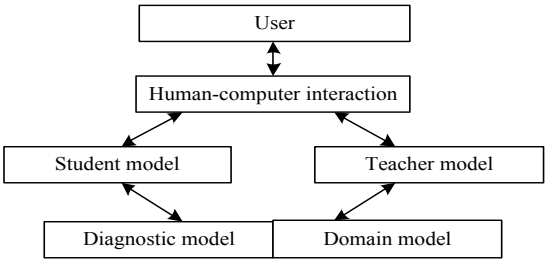

Fig. 3. Intelligent learning model

3.3 Design of the main module of the system

The teaching system is divided into two parts: front desk display and backstage management. The entity on the front desk is the user. Whether users are registered or not, they can search for professional knowledge. It provides a good platform for user to learn professional knowledge. Figure 4 is the flow chart of the login verification module program in the system. Figure 5 is a flow chart of the user query knowledge point algorithm in the knowledge point display function. The neural network expert system can calculate what knowledge points need to be mastered, memorized and strengthened according to the performance of these students.

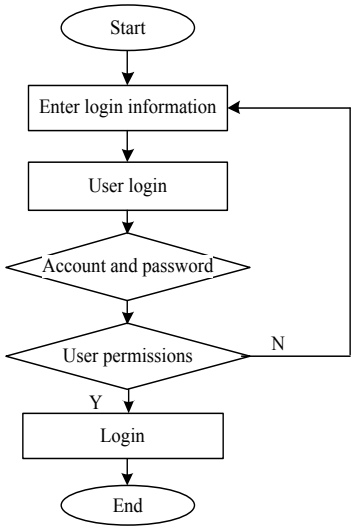

Fig. 4. Logon validation module program flow chart

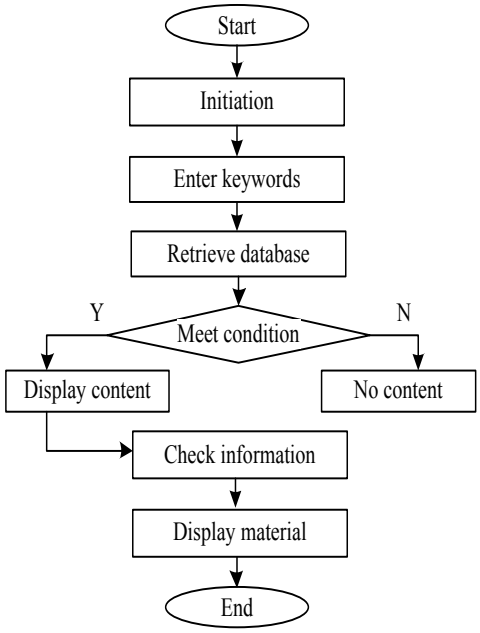

Fig. 5. User query knowledge point algorithm flow chart

4 The implementation and test of the system

4.1 System development and running environment

The guided teaching system based on AI adopts the B/S model and the database adopts the relevant database. In addition, the most significant feature of the B/S model is that the client can access the system anywhere via the browser. In a simple way, users access the system in the form of a web browser on the browser. The client's back-end server is Tomcats and the database is MySQL. They are on different hardware servers, respectively. The client browser can access the system and send out data and page requests. The server handles page request and sometimes involves data information in the database. The Web server needs to further access the database server where the system database system is located. The Web server returns the processed data information to the client and sends the data results with static pages to the browser to interpret and execute, and complete the operation of a business access logic. This structure is suitable for information query. The interface is user-friendly, and the overall requirement is simple. The difficulty of developing software using JavaEE technology is moderate. Besides, the cost of maintenance and extension is low, and the cross-platform operation is good. The software environment of the system development is shown in table 1.

Table 1. The software environment of the system development

Item	Item2	Item3
Operating system	Windows 7	Ultimate
Development language	Java	Up-to-date
Integrated environment for project development	My Eclipse	8.0
The development environment of static page	Dreamweaver	8.0
Database core server	MySQL	5.5
Database interface management tool	MySQL Tool Kit	5.1
The server	Apache Tomcat	6.0
Struts structure	Struts	21.6
Spring structure	Spring	3.0
Hibernate structure	Hibernate	3.13

4.2 System function realization

After the system requirements analysis and database structure design are completed, the system is designed in detail. According to the previous needs analysis, it is known that the teaching system is composed of many functional modules. Among them, the more important functions include login and verification module, online chat room module, network forum module, online job system, and backstage management module. With the increasing popularity of network teaching, more and more schools have begun to use the new and modern network teaching method. Therefore, a teaching system must have the above functions. These functions reflect the convenience and rapidity of the network teaching.

In the above subsystem, each system has its own unique system interface, and the operation is more user-friendly. Each system has its own unique functions. Therefore, they do not affect each other, but at the same time they are closely related to the concept of network teaching. The next part of this section is a detailed description of the design of these functional modules.

Login and validation module: User login is used to verify user's username, password, and user rights. Then, it determines the user's operation to the system resources, such as doing online operation. In fact, for network teaching, users can browse the course profile and the news bulletin without login. Users only need to log in if they are learning, teaching, arranging, doing online work, or when administrators need to manage website and user information through the system.

Learning navigation module: For keyword navigation, the user should first establish a database connection. User needs to open and read the database, use the SQL database query statement to do the relevant conditions and restrict query until the error prompt page does not appear. Multi-layer information classification supports multiple retrieval methods. The retrieval method is fast and effective and supports a variety of syntax search. For logic and fuzzy search, different search ranges can be limited, and the contents, categories and levels can be queried in different ways.

Backstage management module: The administrator entered the backstage management page after the successful login. The backstage mainly includes four management

modules, respectively knowledge point management, professional terminology management, material management and directory management.

4.3 System test

System analysis process: When developing the system, the software lifecycle, the whole system and each sub module function will have an error, and there will also be many other problems, such as the complexity problem that the code is written by many members. In general, the more errors there are in the system, the more errors will be found in the software. On the premise of ensuring the reliability of the software, a full analysis of the system is carried out, including how to find and correct the problems through technical review. Software testing should be carried out in strict accordance with the steps shown in figure 6. The general subsystem is composed of different modules, and then multiple subsystems are made up of software. Each step in the test is a continuation of the previous step. One step can also be tested in multiple jobs at the same time. The following is an introduction to the related tests.

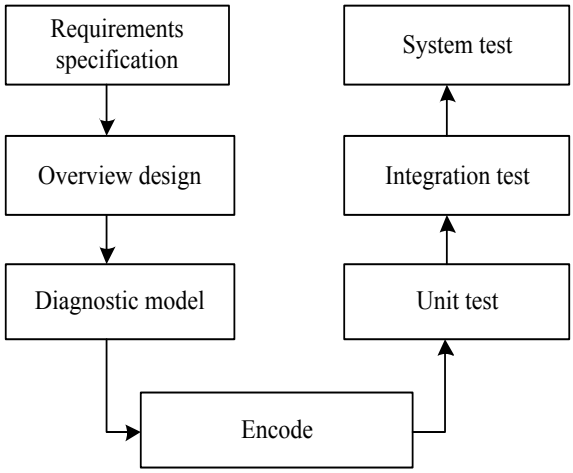

Fig. 6. Basic step diagram of software test

Test result: In the process of software development, the first step is to make requirement analysis, detailed and outline design, testing, maintenance, and coding. If the customer has a clear requirement, a detailed and summary design is carried out, and then the code is encoded. Secondly, the system tests such as security, compatibility, feasibility and client pressure tolerance are carried out. If the test is unmistakable, it will be delivered to the user. Finally, in order to facilitate the later maintenance of the system, the test results are recorded after the system is tested. The relevant material is filled out, and handed over to the programmer. The programmer puts forward relevant and effective suggestions.

When the system is tested, the pressure testing software WebCT is selected. The software can test the pressure of the system to ensure the server's load limit and the

customer's related requirements. Such a test ensures the normal work of the server and the client. The data effect of the client page shows that the system can meet the customer's requirements at the beginning of the design. A large number of data and students test show that the system has strong robustness and stability, and can realize the function of local artificial intelligence in guide teaching.

4.4 Teaching effect

In order to verify the feasibility and effectiveness of the guide teaching system proposed in this paper, we design the teaching system based on artificial intelligence and traditional teaching system for two classes respectively in class 1 and class 2. After the class is over, the students are investigated. The results of the investigation are shown in figure 7.

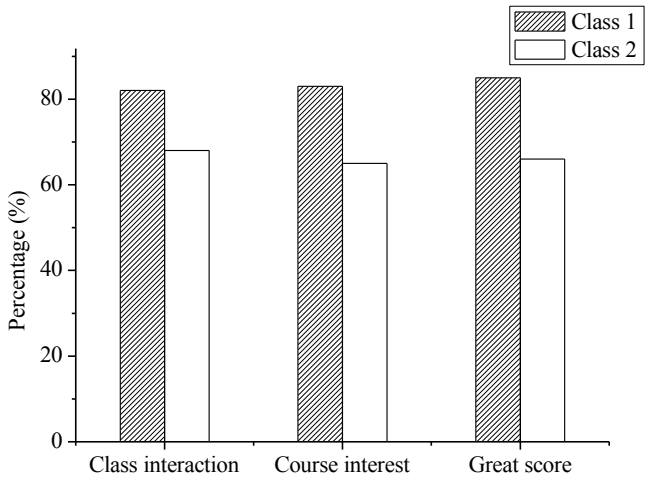

Fig. 7. Comparison diagram of teaching effect

As shown in figure 7, the class 1 that adopts the AI teaching system proposed in this paper is better than the class 2 that adopts the traditional teaching system. Students are more interested in the guide courses. They have more interaction with the teachers, and the results are more beneficial. As a result, the guided teaching system based on AI in this study is feasible and has good teaching effect.

5 Conclusions

The software system combined Java and AI language Prolog is used to achieve the guide teaching system based on artificial intelligence (AI). At the same time, the

Struts+Spring+Hibernate lightweight JavaEE framework was built. The purpose was to help students improve their learning effect. Finally, the system was tested. According to the test result, the following conclusions are drawn:

First, AI is a science that studies the laws of human intelligence. The principle, characteristics and application fields of artificial intelligence are introduced.

Second, the problems faced by the present guide teaching are analyzed and the realization scheme of guide teaching system based on artificial intelligence technology is put forward. The system uses the NET three-layer structure system based on the B/S model and has good reliability and maintenance extensibility.

Third, combined with the teaching of tour guide course, the function of guide teaching system is more sound and user-friendly. In addition, this paper mainly studies and realizes the teaching system of tour guide, which is a structure based on SSH. The related technologies, system function design, system requirements and database design of the system are carefully analyzed, and the specific implementation methods of each sub module are studied.

Fourth, the guide teaching system in campus network is expounded, and a concrete method is adopted. It has the characteristics that the traditional learning system fails to, including the pertinent learning strategies, take the forgetting curve of the human brain into consideration, and review the knowledge periodically. In addition, combined with the commonly used methods and basic steps in software testing, the existing hardware and software systems are tested until the tested system meets the overall goals.

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