Study on Agent-based Intelligent Feedback System in Online Teaching and Interactive Learning

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Abstract: As a new education pattern, online teaching and interactive learning teaching breaks the constraints of time and space of the traditional teaching mode, but it has an obvious deficiency in personalized teaching which advocates teaching students in according to their aptitude. In order to solve this problem, on the base of the traditional network teaching system, it is necessary to increase an intelligence feedback system which is responsible for the task of such as adaptively pushing and updating the learning content, presenting the personalized home page, intelligently answering questions from the learner and so on. In online teaching and interactive learning practice, using this agent-based intelligent feedback system greatly enhanced the effect of personalized teaching and also promoted the development of the online teaching and interactive learning system.

Key words: Online teaching, interactive learning, agent technology, intelligent feedback, eigenvalue extraction, data mining, Apriori algorithm

INTRODUCTION

With the rapid development of network and database technology, the online teaching and interactive learning has grown up in worldwide; it mainly uses web technology and database technology to realize its real-time, interactive and dynamic features (Allen and Seaman, 2007). Networking teaching can realize resources sharing; break the traditional constraints of time and space; use multimedia technology to create rich and vivid environment to stimulate the students’ interest; realize the independent and active learning (Lee and Deng, 2008). Although online teaching and interactive learning has made great achievements, but there still exists many problems (Xue and Cui, 2006), especially personalized teaching which advocates teaching students in accord to their aptitude (Kone et al., 2000). In order to solve this problem, it is necessary to increase an intelligence feedback system which is responsible for the task of such as adaptively pushing and updating the learning content, presenting the personalized home page, intelligently answering questions from the learner and so on (Chen and Li, 2012).

This study proposes an agent-based intelligent feedback system in online teaching and interactive learning, designs the online teaching and interactive learning system and the intelligent feedback system, studies the key technical including eigenvalue extraction (Wang and Peng, 2007) and data mining technology and realizes the system and presents the main interface. In this way, the system can overcome the personalization defects of traditional online teaching and interactive learning (Shen et al., 2008).

INTELLIGENT FEEDBACK IN ONLINE TEACHING AND INTERACTIVE LEARNING

Online teaching and interactive learning system realized the interactive teaching activities with the aid of computers and artificial intelligence technology. The biggest difference of online teaching and interactive learning system and the ordinary teaching system lies in the different teaching way, the former realized not face-to-face exchanges of the teacher and the learner through the online communication technology and the latter is mainly face-to-face teaching which was composed of the teacher module, the learner module and the knowledge base module. In online teaching and interactive learning system, the intelligent feedback is to adapt to the learner’s learning requirements constantly according to the change of the learner’s module state with the use of the adaptive engine technology and the data mining technology (He et al., 2011). With the aid of intelligent feedback, the online teaching and interactive learning system can achieve the learner’s perfect experience according to their different learning interest and preference. In the learner’s view, the system just like tailored for him. The main function of the intelligent feedback system embodied in the following three points:

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The intelligent feedback system can constantly revise the learning database's visual display according to the change of the learner module, such as placing the frequently-used learning module on the top position, recording the learning content intelligently, displaying the teacher's evaluation in home page, etc. So the online teaching and interactive learning system with intelligent feedback can guide the learner's learning process, the learner also can better adjust their learning state and methods.

According to summarizing and analyzing of the learner's learning habits, needs and preference, the intelligent feedback system realize automatically the knowledge field's adaptable push and release suitable for the learner, create personalized learning space for each learner and this kind of intelligent guide can enhance user experience in the online teaching and interactive learning system to a great extent.

The intelligent feedback system can realize question-answering intelligently which search the common problems from the learner in database and provide basic answer feedback, just like the teacher answer question timely in face-to-face teaching environment.

**AGENT TECHNOLOGY**

Since released by Massachusetts Institute of Technology, the agent technology was applied to many fields relying on its own good interaction and intelligent characteristics, especially in the artificial intelligence field. It's internal structure is shown in Fig. 1.

The agent contains eight aspects, namely properties, methods, language, knowledge, reasoning mechanism, global knowledge, inheritance mechanism, system services, these eight aspects work together, to realize the function of the agent.

Choosing agent technology as the main technology of the online teaching and interactive learning, depended on its characteristics. The realization of online teaching and interactive learning system need the help of its characteristics, especially targeted, intelligent and collaborative characteristics (Liu, 2006), in which objectives and intelligent characteristics help us to establish online teaching and interactive learning feedback system, collaborative characteristic better meet the more users and more demand features of the online teaching and interactive learning system. This study uses Agent technology as the main way to communicate in the intelligent feedback system.

**DESIGN OF THE ONLINE TEACHING AND INTERACTIVE LEARNING INTELLIGENT FEEDBACK SYSTEM**

The overall design of the online teaching and interactive learning system: Online teaching and interactive learning adopts the client-agency-server model, communication between the client and the server does not communicate directly through HTTP to server, but through the middle layer agency which is responsible for transmitting request and response, so this mode is different from ordinary C/S model. There are some online teaching and interactive learning systems currently who use the browser landing program, but are often not as good as the client mode in functional aspects, because the client of online teaching and interactive learning system should be practical and easy to operate etc.

In addition to receive the date from server-side, the client in local client program can also realize part of the functions, such as storing the learning information, setting permission, etc.; agent is mainly responsible for the communication between the client and the server, completing the real-time communication; the server make different response for different client needs through HTTP protocol according to data information provided by different database. The structure of the online teaching and interactive learning system model is shown in Fig. 2.

The design of the intelligent feedback system: Online teaching and interactive learning system breaks the timeliness and region restriction of the traditional teaching, but the teacher and the learner can't communicate face-to-face, so the communication between them forward a higher request for online teaching and interactive learning, otherwise they can't communicate fluently in online teaching and interactive learning environment (Abu-Naser, 2008). At the same time, there are a lot of registered participants and everyone's learning time may be different, in the online teaching and interactive learning system, the teacher may not teach or correct paper online at any time. Therefore, the research on agent-based intelligent feedback system in online teaching and interactive learning is very meaningful.
In online teaching and interactive learning system, the intelligent feedback should not only help the student know their learning progress and learning effect timely, but take the appropriate strategy to improve the learning method according to the teacher's feedback information and promote the advantages of online learning. On the other hand, the online learning system can help the student choose their related courses adaptively based on the students' study habits and learning state, the learning course and content will be displayed in home page so as to emphasize it. How to implement these functions, in addition to the input information of student model, the system should combine a large number of data analysis in order to get the base of the intelligent feedback. The intelligent feedback model is shown in Fig. 3.

The online intelligence feedback system generally consists of three modules: data input module of a student model, database module, feedback module. As the data input of the feedback system, student model is the important part of the feedback system’s realization, it is to synthesize all operation records after the student login online teaching and interactive learning system, it is to summarize up the student’s learning behavior and it is necessary to quantify standard of the student's learning behavior before using these date. The date input of the feedback system mainly includes three contents: One is the online system's log files, the student had the user name and the password to login system after registration, the student’s every operation in the online system will be recorded, including carrying out what interface operation, launching what questions and return card, etc.; The second is the student’s study situation in the knowledge database, such as learn which course which notes and self-test, etc. (Yang, 2010). The three step is to build adaptive-question-answering system according to the student’s common questions and their learning fields.

The intelligent feedback system of online teaching and interactive learning use five databases, that are learning record library, strategy database, teaching content library, Q and A library, student information base. The student information base mainly record the student’s user name and password, the landing time and online learning time. Strategy database mainly storage the students using condition in the teaching system, such as the extraction of eigenvalue data.

Feedback module mainly included presenting personalized navigation, dynamically updating learning content, intelligent question and answering, test feedback and the teacher's suggestions. Personalized navigation is to present different interface according to different students' different learning situation; updating learning content dynamically is to adjust students learning content timely according to the students’ current learning condition and learning state; Intelligent question and answering accomplish its intelligent function through the keyword search according to the students’ basic question; test feedback and the teacher’s suggestions is to give feedback and advice according to the information of the students’ online testing system.
Fig. 4: MVC communication diagram

The design of the whole system adopts MVC (model-view-controller, MVC) design pattern, this MVC design mode separate representation logic and business logic, three parts each has its own job and realize together the function of online teaching and interactive learning system. Model is the core of the whole system and is the main frame of application's program, most of the business was completed in the model; view is the intuitive present of online teaching and interactive learning system and mainly manage user interface; controller deliver the information submitted by view to model to update, controller is responsible for the communication between model and view, the model change it and notice view page to update through the controller, the relation among the three parts is shown in Fig. 4.

MVC use layered structure, structure is very clear and the component can be flexible and reused. Using the MVC design pattern to develop online teaching and interactive learning management system is easy to maintain and extend. The view layer is composed mainly by all sorts of HTML and JSP page and is responsible for presenting the content of the online teaching and interactive learning system directly. Controller module plays an irreplaceable role as the bridge between view and model between which is responsible for processing the students' HTTP request, executing action through the model and then transmitting the response to view interface; Model layer mainly completes the system's business part, analyzes and finishes all business (Gong, 2012).

KEY TECHNICAL ANALYSIS OF INTELLIGENT ONLINE TEACHING AND INTERACTIVE LEARNING FEEDBACK SYSTEM

Eigenvalue extraction: The main task of the eigenvalue extraction is to form strategy database through the processing log or log agent generated by the students accessing to online teaching and interactive learning, including data sifting, data specification and data fusion. Its purpose is store the students' behavior in system to log for the preparation of data mining. The eigenvalue extraction process is very important, because of the quality of the extracted eigenvalue is related to the quality of the data mining.

The collection of students' behavior have different channels, but still basically comes from log files of the online teaching and interactive learning system server, log files main record the student's operation behavior in the teaching system. For example, the students' user name and password, specific web address ever visited by the students, as well as other operation in the teaching system. In many operations, how to extract feature value is a key problem, the process to extract characteristic value should not only be easy to implement, but also the characteristic value extracted should have certain practical significance for us to further analysis and study. The strategy database storage the students' useful behavior data and is responsible for the process strategy of eigenvalue extraction. The concrete realization is to recognize the user's identity according his user name and to extract specified user's operation behavior records through the log files in the system, then to storage the valuable operation behavior data to strategy database. The process of eigenvalue extraction mainly includes four parts: identity recognition, data screening, session identification and sequence identification:

- Identity recognition is to classify different the students' behavior separately, mainly according to the students' username and password and at the same time according to the IP address to distinguish different students
- Data screening is to integrate the students' log content, delete noise date, save relevant useful data of the follow-up data mining algorithm and at the same time, transform and process these useful data, provide an operational date for data mining
- Session identification is to recognize the user's operation, to distinguish this user's different session. The user's session is refers to of a series of operation after he login to online teaching and interactive learning system which must have a certain interaction between the user and the server, if the user just click blank, this doesn't belong to the category of conversation. Session identification is mainly to break a user's all operation records into a single session.
Data mining technology: Use data mining technology to analyze effective data after sequence identification, the system can get the students’ habitual operation process which reflect broadside the students’ learning style and learning habits (Wang et al., 2002). In view of these learning preferences and learning rules, the system can recommend suitable learning content as intelligent feedback.

There are many methods of data mining, such as use artificial neural online algorithm, decision tree algorithm or genetic algorithm, path analysis, the association rules analysis, clustering and statistical classification methods. By one of these method, the system can get statistics data of the students’ residence time in a learning module, these data can save to the students’ model library, to some extent, these data can reflect this student’s interest level of the module knowledge. Combined with the module test, the system can analyze the difficulty degree and master degree of the module knowledge. If student visited a learning video many times and the visits have certain regularity, the online system using data mining technology can analyze this learner’s learning style, so that to recommend related study content to this learner (Zhou et al., 2010). The process of data mining is shown in Fig. 5.

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<thead>
<tr>
<th>Data of pretreatment</th>
<th>Convert</th>
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<tr>
<td>Data of conversion</td>
<td>Mining</td>
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<td>Information of extraction</td>
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Fig. 5: The process of data mining

- Sequence identification is mainly for find suitable session for data mining from a user’s all sessions set. The session after sequence identification will become the direct data source of data mining.

The system’s function is rich, it covers all modules of the general online teaching and interactive learning system and increases the function of intelligence feedback. The first page’s adaptive feedback learning content, the first time feedback of the teacher’s suggestion, etc., compared with the general online teaching and interactive learning system, the
Fig. 6: Main interface of online teaching system

system with intelligent feedback increases the
individuation and improves the interactivity and
intelligent.

CONCLUSION

Because of its convenience, online teaching and
interactive learning system has been widely applied,
intelligent feedback system can not only recommend
learning resources according to the students’ learning
habits, but also can present personalized ho me page and
realize intelligent question-answering, the study on it has
certain practical significance. In this study, the author
designed agent-based intelligent feedback system and
explained the key technology aiming to further perfect the
of online teaching and interactive learning system. We
have used it in photography course and obtained good
teaching effect.

Although, this system can realize intelligent
feedback, but it needs to do more research to improve
real-time and accuracy function and it puts forward more
severe challenges to the system’s data extraction and
analysis. First is to optimize the data extraction mode to
improve the speed of data analysis so as to meet real-time
requirement. The second is to improve the existing data
mining algorithm to realize more accurate feedback. Last
is to improve the interaction and interface more friendly.

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REFERENCES

system for students learning to program in C++. Inform.
publications/survey/pdf/online_nation.pdf
Chen, N. and X. Li, 2012. Adaptive-resonance-theory
algorithm for image based on single training example.
support system dynamic feedback mechanism study.
He, C., F. Lang, H. Li and H. Wang, 2011. Simplified PCNN
based MR images grayscale inhomogeneity real-time
Kone, M.T., A. Shimizu and T. Nakajima, 2000. State of
the art in agent communication languages.


