Using a User-Interactive QA System for Personalized E-Learning

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ABSTRACT

A personalized e-learning framework based on a user-interactive question-answering (QA) system is proposed, in which a user-modeling approach is used to capture personal information of students and a personalized answer extraction algorithm is proposed for personalized automatic answering. In our approach, a topic ontology (or concept hierarchy) of course content defined by an instructor is used for the system to generate the corresponding structure of boards for holding relevant questions. Students can interactively post questions, and also browse, select, and answer others' questions in their interested boards. A knowledge base is accumulated using historical question/answer (Q/A) pairs for knowledge reuse. The students' log data are used to build an association space to compute the interest and authority of the students for each board and each topic. The personal information of students can help instructors design suitable teaching materials to enhance instruction efficiency, be used to implement the personalized automatic answering and distribute unsolved questions to relevant students to enhance the learning efficiency. The experiment results show the efficacy of our user-modeling approach.

Keywords: question answering; Web-based applications; Web-based learning

INTRODUCTION

Traditional educational approaches are usually teacher-centric, not student-centric, since they do not sufficiently take into account the differences of characteristics among different students (Angehrn et al., 2001). In order to enhance student-centric learning and instruction efficiency, instructors should know the implicit requirements of students so as to prepare and design their

teaching materials. As a result, personalized support for learners becomes more and more important and, consequently, many researchers start to focus on this topic to increase the performance of the learning systems (Henze et al., 2004; Dolog et al., 2004). Moreover, knowledge accumulation and knowledge reuse are also important in collaborative e-learning (Millard et al., 2006), because they can be used to reduce the workload of the instructors and to enhance the learning efficiency. Up to now, Web-based learning has been regarded as an appropriate auxiliary method of traditional teaching methods to achieve higher learning quality, especially when e-learning takes place in open and dynamic learning and information networks. The advantage of Web-based learning is that the historical knowledge and the behavior and habit of the learners in different courses can be easily recorded for analysis. However, it is usually difficult to implement such an e-learning system, which can efficiently capture the students' model about the course content, such as knowledge background, interest, authority, and so on.

In this article, we propose a personalized e-learning framework using the *Buy-Ans* (BuyAns, 2005-2007; Wenyin, 2006) environment, which is a Web-based user-interactive question-answering (QA) system for users (or students) to interactively post and browse questions and answers. In *BuyAns*, users exchange their knowledge by posting their questions on related boards and browsing finding interesting/favorite questions to answer. The system records all the Q/A pairs and the historical activities all users, including browsing records, questions and answers.

The main processes of our framework are as follows: when a new question comes, the system first tries to automatically find the suitable answer from the knowledge base. If the answer is found, the question is then distributed to suitable users. With the help of *BuyAns*, two main improvements can be done in our e-learning framework. Firstly, all of those historical data contain a tremendous amount of information about users' personal information, such as interests, authorities, and so on. If the students' interests and authorities about the course content are known, *BuyAns* can automatically and properly distribute relevant questions and answers to relevant students. Students' interests and authorities can also be used to help instructors organize and design their teaching materials (Huang & Wenyin, 2005). Consequently, collaborative learning between students and instructors can be enhanced. Secondly, all the historical Q/A pairs can be accumulated to answer new questions automatically. Hence, the echo speed for answering new questions can be increased. Additionally, the personal information of the asker can be used to estimate whether the answer can meet his requirement.

In order to obtain the personal information of the users, we propose a method to calculate users' interest and authority about the course content. The capturing process is easy to implement, since only a topic ontology (or concept hierarchy) for the course content needs to be defined by the instructor. After the topic ontology is defined, the corresponding board structure can be generated to allow students to interactively post questions and answer others' questions. The topic ontology consists of topics, which belong to categories, and categories. With the accumulation of the historical data, we can build the association relations between Q/A pairs and the topic ontology. Based on the association relations the students' interest and author-

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