

Personalized Learning System Based on Data Mining for Experimental Platforms

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Abstract—On the basis of adaptive learning and the results of data mining, a personalized learning system was designed and implemented. The system on this algorithm has implemented the educative conception of teaching students in accordance with their aptitudes. Experimental platform in the traditional learning modules is joined into a personalized recommendation and the more modern individualized educational philosophy. This system can meet the learning demands of different students in any time.

Keywords- personalized learning system, data mining, experimental platform of economics and management, data source, web log

I. INTRODUCTION

With the development of economics and management labs, there have emerged many Web-based experimental learning software, which have specific majors and functions, and cultivate students' hands-on ability by simulating real business (such as accounting and manufacture management). However, the functional singleness of software for economics and management cannot reflect the learners' comprehensive abilities well. The differences of knowledge background, learning objectives and abilities will result in different progress and demands for materials.

Based on existing knowledge, experiences and personalities, and with the core of internal needs, personalized learning is the education activity performed to freely, fully and harmoniously develop each student's ability and personality^[1]. It theoretically believes that learning is a process where students' existing knowledge and experience interact with the learning system to acquire knowledge and abilities. When learning, students can organize freely, formulate and perform learning plans, choose strategies they want, control and evaluate their process. It breaks down the traditional structure of group learning, considers the individualization of educational and learning behaviors, and by treating students as individuals, puts them in a more personalized setting^{[2] [3]}. Moreover, modern Web learning theories emphasize that learners should explore and discover initiatively. They are agents to process information, but not passive receivers^[4]. In network education, the four factors of learners are affected by personality, including attitudes, methods, online duration and learning evaluation. Psychological studies have indicated that individual differences have serious impact on learning^[5].

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This system performs data mining and analysis by collecting background information, and by using the data and web logs from various experimental software. Based on the rules it has mined out, it provides personalized learning route for learners, and recommends methods for teachers to evaluate the teaching effects and process.

II. SYSTEM STRUCTURE

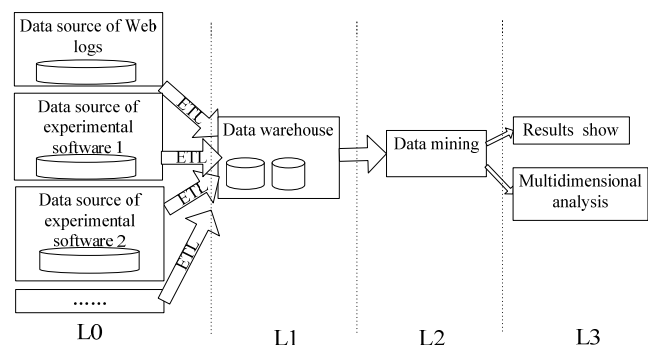


Fig.1 System Structure

Figure 1 shows the structure of the system. Layer 0 (L0) stores original records, including data sources in the database of each experimental software, and the web logs written by learners when they login to learn experimental software. Layer 1 (L1) performs data ETL for the database of economics and management experiments, then abstracts, cleans and merges data, filters noisy data, transforms and merges data in different formats to the same one and generates a data warehouse. Layer 2 (L2) mines and multidimensionally analyzes data sources in the data warehouse, using certain algorithms and based on requirements. Layer 3 (L3), designed for customer service, feeds back the mined results to teachers and learners, and proposes plans and knowledge for personalized learning.

III. DESIGN OF THE SYSTEM FUNCTIONS

The system has three groups of users: system managers, teachers and learners. Here are the functions for each group of users.

A. For managers:

- 1) Manage data sources: all data sources and web logs

of experimental software in servers, including Abstract, Clean, Transform, Load and Merge.

2) Manage learner information: personal information of learners, including major, grade, gender and speciality.

B. For teachers:

1) Mine and analyze learner information, including such attributes as grade, gender and major. For instance, one teacher finds out that sophomore male learners majoring in logistics have mastered balance sheets better than junior learners from marketing.

2) Mine and analyze knowledge of experimental learning software, including such attributes as time and master level at each learning stage. For instance, one teacher finds out that learners spend more time on finance than on ERP experiment.

3) Analyze by the dimension, including analysis and statistics by the class or the course.

C. For learners:

1) Fill in background information. For whatever experiment, learners first fill in background information, including student number, grade, gender, major, speciality and hobbies.

2) Individualized methods are recommended according to learning process. Based on learning process and the learning system of economics and management experiments, learners are guided from the easy level to the difficult level of knowledge. For instance, banking experiments should be learnt after finance and management experiments.

3) Individualized methods are recommended according to background. Knowledge is recommended to be learnt according to learners' grade, gender and speciality. For instance, sophomore female students from management who do not master data statements well, are recommended to strengthen financial statements.

4) Individualized methods are recommended according to learners' hobbies: if learners stay longer at certain learning points, recommend some similar knowledge. For instance, one learner who spends more time on financial experiments is recommended with other experiments in relation to finance.

IV. KEY TECHNIQUES AND THEORIES

Data mining means to extract contained, unknown but potentially usable information and knowledge from massive, incomplete, noisy, fuzzy and random applied data. This important computer application field will greatly improve the effects of information on social development, and produce enormous economic and social benefits^[6].

When this system mines association rules by the attribute, it uses FP-Growth^[7, 8]. This algorithm brings large aggregates, and is efficient both temporally and spatially. It uses divide-and-conquer strategy: compress the database which produces frequent itemsets into an FP-tree, so the relationship information between itemsets can be maintained; then mine FP-tree by creating model basis, and get frequent itemsets.

This algorithm only traverses data twice, does not generate candidate items, and only constructs FP-tree and conditional FP-tree.

When this system mines data by the time sequence, it uses Prefixspan^[9, 10]. This algorithm examines prefix subsequences of one schema, and then only projects the corresponding suffix subsequences onto the database. In each projected database, the growth of sequence pattern only relates to frequent local patterns. The mining steps are: first, scan the database, find out frequent event which can be compounded with the last element, or added to the end of the prefix to form a sequence pattern. Then, output every such pattern. A new independent prefix projected database is constructed, and mine next one. The algorithm finishes if no new frequent sequence is generated.

V. CONCLUSIONS

A personalized learning system based on data mining was designed for economics and management experimental platforms. By mining the data sources and web logs on each experimental platform, this system could help learners visit economics and management experimental platforms, then mine and analyze by using learning resources, and know the learning demands, knowledge background, process and interests of learners. Based on the mined results, each learner is recommended with an individualized experimental learning pattern and a personalized experimental web learning system for economics and management is constructed.

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