Automatic Re-Organization of Group-Wised Web Courseware

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ABSTRACT

With the increasing popularity of the Internet, there is a growing demand for web-based education, which allows students to study and learn at their own pace over the Internet. However, in order to improve the teaching quality, such systems should be able to adapt the teaching in accordance with individual students' ability and progress. Focusing on this objective, this paper proposes a new method to construct group-wised courseware by mining both context and structure of the courseware to build personalized Web tutor trees. To this end, the concept of Web tutor units and the notion of similarity are presented. Five algorithms, including the Naive Algorithm for tutor concept tree and the Level-generate Algorithm to generate Web tutor units of $K+1$ levels, are proposed. Experimental results are presented to demonstrate the effectiveness of the new method.

Keywords: distance learning, student profiling, web tutor unit, group-wised tutor tree.

INTRODUCTION

With the rapid advancement in multimedia technologies and the availability of Web infrastructure, distance learning is now widely adopted in the higher education in China. The e-Teacher system, an experimental software for distance learning, has been jointly developed by the City University of Hong Kong and Sichuan University. It runs on the software platform with Windows NT plus IIS (Internet Information Server) and ASP (Active Server Page). The main idea of the e-Teacher is its capability in adapting the teaching in accordance with the progress of individual students. Its key mechanisms are as follows:

1) Clustering students into different groups according to their abilities. For example, group11 = (Theory, Excellent),
group12 = (Theory, Medium), group13 = (Theory, Not good), group21 = (Practice, Excellent), group22 = (Practice, Medium), group23 = (Practice, Not good), etc. Thus, the teaching style is called “group-wised teaching.” In the extreme situation when each group has only one student, it becomes a “personalized teaching.” In the e-Teacher system, this function is implemented in a data warehouse called ETDW.

2) **Constructing a group-wised courseware that can be accessed through common web browsers, such as Microsoft IE and Netscape Navigator.** It is implemented based on our experience in the course “Reading Selected Articles on Web” (RSAW). RSAW is one of the core courses of the distant learning M.Sc. and Ph.D. degree programs. One of the authors is currently teaching this course to students across several provinces in China. To organize the course RSAW in group-wised style, the distance-teacher needs to have the following:

- **A set of profiles:** To store the profile information of each student, such as name, age, class, interests, background, academic records, etc.
- **A tutor tree:** This is a learning schema designed for each cluster of students in accordance with their abilities. Each tree node is a 2-tuple <WTUnit, Weight>, where WTUnit is a Web tutor unit (an article or a sub tutor tree) organized in a multi-resolution form, and Weight is an array of integers (containing the cluster number, course importance, teaching hours).

- **A set of evaluation and upgrading facilities:** To automatically evaluate the answer sheets and exercise forms for each student, dynamically upgrade the student profiles (as a feedback of evaluation), and reorganize student grouping based on the evaluation results.

In this paper we focus on the design of a good tutor tree. A group-wised tutor tree allows students to find the articles satisfying personal demands in a short time. The basic idea and main steps to construct the tutor tree are as follows:

1) Use an existing (usually naive) URL tree as the initial tutor tree.
2) Configure the model to calculate the similarity by adjusting the weights of the Web tutor units, and to evaluate the similarity of Web tutor units.
3) Reorganize the tutor tree by similarity and group-wised keywords.
4) Establish the new tutor tree.

In current practice, distance-teachers use an existing collection of URLs in a way that the collection may be considered as a naive form of the tutor tree. As shown in Table 1, it works in an “eagerly collecting style” by collecting everything available with low efficiency. Our interest in this study is on how to build efficient and group-wised tutor trees for effective distance learning.

<table>
<thead>
<tr>
<th>Topic of selected articles</th>
<th>The root of tutor tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Discovery</td>
<td><a href="http://www.kdnuggets.com/">http://www.kdnuggets.com/</a></td>
</tr>
<tr>
<td>Repositories</td>
<td></td>
</tr>
</tbody>
</table>

*Table 1: Sample of naive tutor tree of RSAW*
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