GENERATING COMPUTER-BASED ADVICE IN WEB-BASED DISTANCE EDUCATION ENVIRONMENTS

By

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The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

There is an increasing demand for distance education to be implemented nowadays by most educational organizations. The Internet has become the medium for course delivery, and Web Course Management Systems (WCMS) are widely used to deploy distance courses which need to provide appropriate support to both students and instructors. The instructors play a central role in managing the course, and their success in dealing with reported problems in distance learning, such as students’ isolation and disorientation in hyperspace, depends on the understanding the instructors have about what is happening in distance classes. Based on tracking data, most WCMS provide statistical information to help instructors monitor their students. However, there is a lack of automatic features to guide instructors by pointing at important situations and highlighting possible problems. Such features may help instructors, and reduce the workload and communication overhead needed for managing distance classes effectively.

In this thesis, an approach is proposed where an artificial advisor is built to inform course instructors and facilitators about possible problems and needs of individuals and groups of students, as well as to suggest appropriate actions, when possible. A framework named TADV (Teacher ADVisor) has been developed to build fuzzy student, group, and class models based on the tracking data generated by WCMS. A taxonomy containing three main categories of advice related to the performance of individual students, groups of students, and the whole class is proposed, and an advice generator mechanism is developed. Important situations are highlighted to instructors and, when appropriate, possible actions are recommended.

A prototype of TADV is implemented and integrated within an existing WCMS. An empirical evaluation of the prototype has been conducted in a Discrete Mathematics course at the Arab Academy for Science and Technology, Alexandria, Egypt. The evaluative study has shown that TADV provides practical and effective advice. It allows advice generation and informing of instructors, which, in turn, made it easy to send help and feedback to distance students. The instructors confirmed the appropriateness of the generated advice and appreciated the knowledge they gained about their students. The students appreciated the feedback received from the instructors, which was a result of TADV recommendations. The study showed better overall satisfaction and social aspects for the students who used TADV advising features.
To My Dear Wife
Acknowledgments

Without the encouragement and support of many people the progress on this thesis would have been severely impeded. I would like to extend my sincere appreciation to them, even though this gesture is inadequate to measure my appreciation.

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Dr. Khaled Mahar, the Discrete Mathematics domain expert, has had great influence on this thesis; he helped out with all tasks related to the course and metadata preparation, and the administration of the experimental study conducted. Many thanks.

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Last, but not the least, thanks to my wife and sons for their absolute support and encouragement with patience and love.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAST</td>
<td>Arab Academy for Science and Technology</td>
</tr>
<tr>
<td>AASTOLP</td>
<td>AAST On-line Learning Portal</td>
</tr>
<tr>
<td>AG</td>
<td>Advice Generator</td>
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<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>AIED</td>
<td>Artificial Intelligence in Education</td>
</tr>
<tr>
<td>CF</td>
<td>Certainty Factor</td>
</tr>
<tr>
<td>CM</td>
<td>Class Model</td>
</tr>
<tr>
<td>CSCL</td>
<td>Computer-Supported Collaborative Learning</td>
</tr>
<tr>
<td>DE</td>
<td>Distance Education</td>
</tr>
<tr>
<td>DKB</td>
<td>Domain Knowledge Base</td>
</tr>
<tr>
<td>DMK</td>
<td>Domain Meta Knowledge</td>
</tr>
<tr>
<td>GM</td>
<td>Group Model</td>
</tr>
<tr>
<td>GPA</td>
<td>General Point Average</td>
</tr>
<tr>
<td>HTML</td>
<td>Hyper Text Mark-up Language</td>
</tr>
<tr>
<td>IEEE LOM</td>
<td>Institute of Electrical and Electronics Engineer's Learning Object and Metadata</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Tutoring Systems</td>
</tr>
<tr>
<td>MB</td>
<td>Measure of Belief</td>
</tr>
<tr>
<td>MD</td>
<td>Measure of Disbelief</td>
</tr>
<tr>
<td>SDB</td>
<td>Student DataBase</td>
</tr>
<tr>
<td>SMB</td>
<td>Student Model Builder</td>
</tr>
<tr>
<td>TADV</td>
<td>Teacher Advisor</td>
</tr>
<tr>
<td>WBDE</td>
<td>Web-Based Distance Education</td>
</tr>
<tr>
<td>WBITS</td>
<td>Web-Based Intelligent Tutoring Systems</td>
</tr>
<tr>
<td>WCMS</td>
<td>Web Course Management Systems</td>
</tr>
<tr>
<td>WWW</td>
<td>World Wide Web</td>
</tr>
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</table>
Conventions

The meaning of learner and student in this thesis is assumed equal. They refer to a person studying with a computer-based educational system. In the same line of thought, we assume that both terms learner model and student model are identical. They can be used in the same context to name the model built inside a computer system to present aspects of the knowledge of a person working with the system.

The meaning of instructor, teacher, and facilitator is assumed equal. They refer to a person teaching students via distance.

Throughout this thesis we will use male gender for the learner or the teacher, which is purely for convenience. In the exposition, he shall be taken to mean he or she and his shall be taken to mean his or her.

Throughout the whole thesis, we refers to the author and our refers to author’s.
Publications

Some of the work in this thesis has been published prior to thesis submission.


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