Chapter 15
A Multi-Agent Model for Personalizing Learning Material for Collaborative Groups

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ABSTRACT

The use of computer-supported collaborative learning (CSCL) environments in teaching and learning processes has increased during the last decade. These environments have various collaboration, communication and coordination tools that students and teachers can use without depending on the time and place where they are. However, having software tools that support group learning does not guarantee successful collaboration because factors such as insufficient knowledge of study contents can impair learning. The analysis of group interactions should allow teachers to recognize obstacles in the learning process, but when there are a lot of interactions the manual analysis is unfeasible owing to time and effort required. This chapter presents a multi-agent model that personalizes the delivery of learning material when groups of collaborative students manifest lack of knowledge. In addition, this chapter describes results of experiments conducted to evaluate the feasibility of using Lucene for retrieving learning material written in English and Spanish.

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INTRODUCTION

With the rapid development of knowledge-based society the importance that is given to collaborative knowledge creation has increased. In this context, CSCL has become a new form of education where students learn through interaction with people who may be located in different temporal and spatial contexts (Suh & Lee, 2006). However, availability of software tools that support group learning does not guarantee that students collaborate, since factors such as insufficient knowledge in the content area, lack of access to appropriate resources, lack of knowledge on how to use resources, skills deficit, and problems with course materials, may obstruct the learning process of students (Costaguta, García, & Amandi, 2011; Olivares, 2007; Onrubia & Engel, 2012; O'Rourke, 2003; Orvis & Lassiter, 2006; Varvel, 2007). According to Varvel (2007) e-tutors (teachers) are responsible for identifying these obstacles in group learning so as to assist students at the right time and with the appropriate methods.

In CSCL environments a complete record of the activities and interactions of students is available. Further analysis of this set of activities and interactions should enable e-tutors recognize the presence of obstacles in the learning process mentioned above. But when there is a considerable amount of interactions manual analysis is virtually impossible due to the time and effort required (Chen, 2006; Rosé et al., 2008). Furthermore, coordination of discussions imposes to CSCL e-tutors a huge effort, both temporal and cognitive, especially when there are several groups working simultaneously (Schwarz & Asterhan, 2011). If we also take into account that the e-tutors may not log in the course site for a long time due to health problems, travel, connection problems, among others, it is clear that the group learning process would be slowed down if students were not able to solve the obstacles that arise during an activity or course (Souali, Afia, Faizi, & Chiheb, 2011).

Based on what we mentioned in the last paragraph, a multi-agent model to deal specifically with the problem of insufficient knowledge in the content area is proposed. In the proposed model, an agent will analyze group interactions to identify themes or content areas where students have doubts or difficulties. Once detected the failure of knowledge, another agent will suggest students study materials (power point presentations, books, monographs, web pages, videos, and so on) that can be consulted to resolve the problem or difficulty. In these cases the system will alert the teacher to assist students to achieve completeness of the task or activity.

With this multi-agent model it is intended to alleviate the workload of teachers, as well as to help students to be less dependent on the teacher. For students, having a system that recommends them to review the contents would help them better manage their own time, since often they are limited in this aspect and they do not have the possibility of reviewing all the study material. This situation is exacerbated when one considers that many college students combine their studies with part-time jobs.

Once gaps in knowledge have been recognized, the subsequent recommendation of learning materials is not easy especially when working with materials written in more than one language. The search and retrieval of information from materials written in multiple languages is precisely the main focus of this work. This chapter assesses the feasibility of using Lucene as multilingual search engine within the multi-agent model for recommending study material.

The rest of the chapter begins with a theoretical background section as it introduces the notion of software agent, describes the types of communication interfaces used in CSCL tools, refers to the techniques for analyzing interactions through communication interfaces based on natural language, explains the concept as well as a taxonomy of recommender systems, presents the methods commonly used to search