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# A MULTI-AGENT SYSTEM FOR STUDENT-CENTRED LEARNING

Shanghua Sun, Mike Joy  
*Department of Computer Science*  
*University of Warwick*  
*Coventry CV4 7AL*  
*{S.Sun,M.S.Joy}@warwick.ac.uk*

## ABSTRACT

In this paper, we present a novel integrated web-based multi-agent system architecture to facilitate student-centred learning. Learning materials are designed and organized in Learning Objects to satisfy different learning requirements. Each agent controls a specific part of the system in order to make adaptive and individual decisions for students. Students' interactions with the environment and agents, and the dialogues between the agents, take into consideration individual learning styles. This adaptive pedagogical agent system operates in a distributed environment, and is customized for individual students.

## KEYWORDS

Multi-agent system, learning objects, student-centred learning

## 1. INTRODUCTION

Advanced information technologies are increasingly used in higher education to facilitate learning and teaching, but inadequacies exist in current systems, materials and pedagogy. Students often tend to treat a course as a series of mechanical exercises rather than systemic concepts (Shi, et al, 2000), and a specific framework to support the change process is often lacking (Nunes and McPherson, 2002). Currently, most of the courseware and software in Computer Science education are unstructured and isolated from each other.

People learn in different ways, and the importance of being aware of learner differences is especially relevant during the current expansion of tertiary education to a greater proportion of the population. New delivery mechanisms are required, including online, open and distance learning, continuing education, and work-based learning (Beetham, 2002), accompanied by course flexibility to support different student learning styles (Jenkins, 2002). These issues can be partially resolved by providing student-centred, self-paced, highly interactive teaching materials and introducing automatic and asynchronous teaching methods.

Agent technology is a new paradigm for developing software systems, and it can provide a dynamic adaptation not only of domain knowledge but also of the behaviour of individual learners during a learning session (Aroyo and Kommers, 1999). Learning objects may be tagged with meta-data so that their identity and content are available to software systems which use them. In this paper, we outline an architecture being developed for an adaptive student-centred learning architecture using agent technology and supporting the use of learning objects.

## 2. SYSTEM ARCHITECTURE

The multi-agent system we propose (figure 1) is composed of five agents: *Student Agent*, *Record Agent*, *Modelling Agent*, *Learning Object Agent*, and *Evaluation Agent*. The Student Agent takes charge of communicating with student; the Record Agent keeps all of the information about each student; the Modelling Agent generates a representation of each student based on their academic progress and learning

desires, returning its results to the Learning Object Agent; the Learning Object Agent manages the learning objects, which are organized in different levels of difficulty; and the Evaluation Agent ensures learning objects are presented in an individual and adaptive learning path to each student.

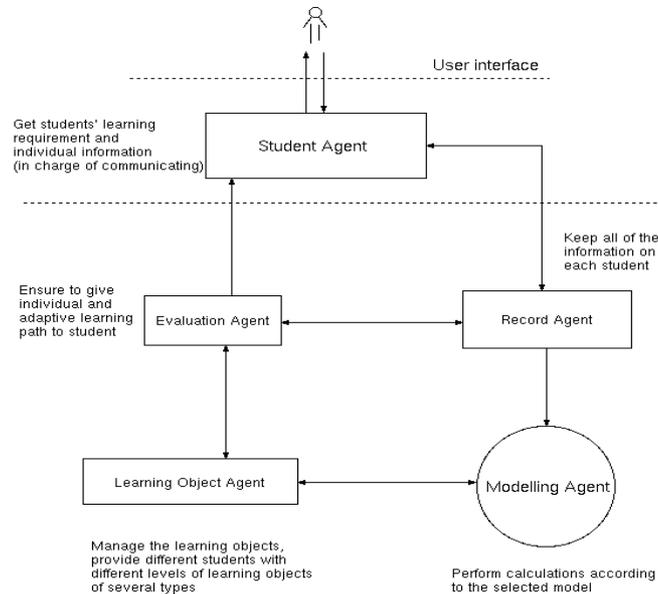


Figure 1. System Architecture

### 3. CONCLUSIONS AND FUTURE WORK

This paper has described a novel multi-agent system for student-centred learning. Using learning objects, students' interactions with the environment and agents, and the dialogues between the agents, take into consideration learning styles, and the system then makes adaptive and individual decisions for students. The pedagogical agent system architecture is still a prototype, but preliminary evaluation using a number of case studies has been successful, and implementation of a full version is envisaged.

Current work includes application and analysis of further types of learning scenarios, and identification of the most appropriate implementation approach, including suitable methods of categorizing learning styles and learning paths, and the organization and management of the learning objects. Future work is to complete the implementation of the system, and evaluate the effectiveness and efficiency.

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