Chapter 3.8
MASACAD:
A Multi-Agent System for Academic Advising

Mohamed Salah Hamdi
University of Qatar, Qatar

ABSTRACT

The evolution of the Internet into the Global Information Infrastructure has led to an explosion in the amount of available information. Realizing the vision of distributed knowledge access in this scenario and its future evolution will need tools to customize the information space. In this article we present MASACAD, a multi-agent system that learns to advise students and discuss important problems in relationship to information customization systems and smooth the way for possible solutions. The main idea is to approach information customization using a multi-agent paradigm.

INTRODUCTION

In our previous work (Hamdi, 2005), we have presented an e-learning system that provides a service to a student that checks whether lecturers are offering information that matches the profile of the student and informs the student of the information found. The student is registered in many courses and seeks course materials from the sites of the different lecturers. These diverse resources can be physically distributed. They also are dynamic so that course materials can be added, updated, or deleted. The student profile, that includes the courses currently attended and possibly much more information, changes also over time because the student can leave a course or register in a new one. All of this means that the customized presentation of information for the student should be updated continuously as new information becomes available. This happens with no user intervention using an autonomous multi-agent system.

In this article, following the same long-term objective of providing a complete e-learning environment for students and aiming for the more general goal of information customization, we describe MASACAD (Multi-Agent System for

ACademic ADvising; "MASACAD" is also the Arabic word for "courses"), a multi-agent system that advises students by adopting a machine learning paradigm. The decision for employing the multi-agent approach combined with machine learning is supported by the following general arguments (more specific arguments are discussed in Section 3.5).

Humans often deal with problem complexity by organizing teams and cooperating in the search for solutions. Group problem solving techniques have evolved into powerful strategies in areas where any single individual would simply be overwhelmed. AI research has paralleled this approach by developing the distributed problem-solving paradigm. Problem-solving systems can distribute among them the processes needed to accomplish a given task.

Given the amount of problems that can be approached through distributed processing, AI has directed significant effort towards exploring possibilities to develop specialized problem-solving systems that can interact in their search for a solution. One way to embody this approach is represented by the multi-agent system paradigm.

An agent is a collection of knowledge and methods that are intended to embody a well defined functionality. Agents cooperate in solving a problem by contributing various parts of the problem-solving process. Agents can be modified independently and they are well focused on their tasks. Such subsystems are often easier to design, develop, and validate, than their counterparts that combine the equivalent functionality within one system.

Because it is not possible to account for all the aspects of multi-agent problem-solving at development time, a good problem-solver has to be able to compensate autonomously for the dynamic and unpredictable aspects of its execution environment through adaptation. Adaptation is reached by letting the system learn from experience.

In the following, we start with presenting some background material and then introduce the problem of academic advising and argue that a multi-agent system would be a good approach for addressing this problem. The paper then presents the architecture of the proposed system and discusses in detail its individual components. The following section discusses the student evaluation of the system and provides preliminary evidence that it is helpful. Benefits and limitations of MASACAD, future directions of work, and related research are discussed respectively in each of the next sections. The final section presents a short summary of the paper.

BACKGROUND

The MASACAD system makes use of a wide range of technologies. These are discussed briefly in the following paragraphs.

E-Learning: Several years ago, online education was considered as an experimental approach with more disadvantages than advantages. However, today it should be considered not only a complementary educational resource but also a serious alternative that competes with conventional and now classical methods. The adaptation to the new features and services of the e-learning environment is not immediate and requires experience, time, investment, pedagogical and technical resources, and government or campus administration support. At the UAE University there exists enormous interest in the area of online education. Rigorous steps are taken towards the creation of the technological infrastructure (hardware, software, and communications) and the academic infrastructure (course materials, teacher-student communication) for the improvement of teaching and learning. MASACAD, the academic advising system described in this article is to be understood as a tool that uses network technology to support learning and as part of the e-learning environment at the university. We use it to demonstrate the capability of exploiting the digital infrastructure, enabled by the online mode