Chapter X
Social and Affective Agents to Motivate Collaboration on Agent–Based Intelligent Tutoring Systems

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ABSTRACT

This chapter presents a social and affective agent, named social agent, that has been modeled using probabilistic networks in order to support and motivate collaboration in an intelligent tutoring system (ITS). The social agent suggests to students a workgroup to join in. Our testbed ITS is called AMPLIA, a probabilistic multiagent environment to support the diagnostic reasoning development and the diagnostic hypotheses modeling of domains with complex and uncertain knowledge, as the medical area. The AMPLIA environment is one of the educational systems, integrated in Portedu, which is a Web portal that provides access to educational contents and systems. The social agent belongs to Portedu platform and it is used by AMPLIA. The social agent reasoning is based on individual aspects, such as learning style, performance, affective state, personality traits, and group aspects, as acceptance and social skills. The chapter also presents some experiments using AMPLIA, and results obtained by the social agent.

INTRODUCTION

Social relations among human beings can be considered a complex and uncertain domain. We can use the help of computers to model those complex relationships. The model can consider various aspects of the individual, such as affective state, psychological issues, and cognition. The model can also consider how people relate to
each other, and to what group they belong. Those are the social aspects.

This chapter presents a proposal for using probabilistic networks to model the aspects of individuals, and to promote collaboration between individuals using intelligent tutoring systems. When systems store and reason about a user's actions, they can take appropriate decisions in order to help and motivate users in their collaborative tasks.

This chapter also presents, in details AMPLIA, a probabilistic multiagent environment that supports diagnostic reasoning development, and diagnostic hypotheses modeling of domains with complex and uncertain knowledge, as in the medical area. This multiagent environment is composed of three cognitive agents: Learner agent, domain agent, and mediator agent. A negotiation process will treat the differences of topology and probability distribution between the model that the learner built and the model that is built in the system. That negotiation is managed by the mediator agent. The negotiation process occurs between the agent that represents the expert knowledge domain (domain agent), and the agent that represents the learner knowledge (learner agent). Another agent was introduced to improve AMPLIA's features, the social agent (section social agent), aiming to support and to motivate group formation in the perspective of promoting collaborative work.

In this chapter, the reader will find a Background section providing an overview of related topics, such as social interaction, medical intelligent systems, and collaborative systems. The following section presents our Intelligent Probabilistic Multiagent Environment (AMPLIA), its goals, and its multiagent architecture. Following, the social agent section focuses on the model and reasoning of the agent, taking into account student's individual and group aspects. Finally, this chapter presents some experiments and results obtained so far.

**BACKGROUND**

The current intelligent tutoring systems (ITS) research have produced learning environments that take into account the social and affective skills of students.

Social issues are the focus of works related to coordination in multiagent societies. Examples of such works are Castelfranchi (Castelfranchi, Rosis, de. & Falcone, 1997; Castelfranchi & Falcone, 1998; Castelfranchi & Tan, 2001), and Prada (Prada & Paiva, 2005). The student's affective states had inspired the pedagogical agent model of Jaques (Jaques & Viccari, 2007) and also an important research of MIT Affective Computing Group (Picard, 1995). Conati's research (2002) is related to educational games and Cheng's research (Cheng & Vassileva, 2005a, 2005b) aims at motivating collaboration in virtual learning communities.

This research extends Conati's (2002) probabilistic assessment model of user's emotions, and employs it in AMPLIA's collaborative context.

The following subsections present the theoretical basis used to model PortEdu's social agent and to define the AMPLIA's study case.

**Collaborative Systems**

The importance of social interactions in the learning process is already known by educational theoreticians. Some studies in this field are the SocioCultural approach of Vygostky (1999), some works of Piaget (1995), theories of collaborative learning (Dillenbourg, Baker, Blaye, & O'Malley, 1995) and others.

The human being must adapt to a social environment as much as he/she does to a physical environment. However, it is the social environment that most stimulates cognitive evolution. Human beings are considered intelligent because they can acquire knowledge through their introduction into a social community. Therefore, we can consider, as a main function of creativity, the adaptation
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