

Using Pedagogical Agents to Support Collaborative Distance Learning

Patrícia Jaques* Adja Andrade** João Jung* Rafael Bordini* Rosa Vicari*

* PPGC, ** PGIE – Federal University of Rio Grande do Sul
{pjaques, jjung, bordini, rosa}@inf.ufrgs.br, adja@inf.pucrs.br

ABSTRACT

In this paper, we describe an animated pedagogical agent which assists the interaction among students in a virtual class within a collaborative communication tool, either on-line or not, motivating them, correcting wrong concepts and providing new knowledge. This guiding agent we call Collaboration Agent will consider not only cognitive capabilities of students, but also social and affective characteristics, which becomes a more qualitative mechanism for collaboration among students and learning. The considered agent is being modelled as part of the multi-agent architecture of the project “A Computational Model of Distance Learning Based on Socio-Cultural Pedagogical Approaches”.

Keywords

Pedagogical Agents, Dialogue Analysis, Communication Tools

INTRODUCTION

To support the interaction among students, collaborative systems provide tools that facilitate online interaction, such as chat, bulletin board and discussion lists. These software are good mechanisms for conversation among students, but they do not provide any guidance or direction for the student during or after the dialogue sessions (Soller, 2001).

The agent considered in this work, called Collaboration Agent, is being modelled as part of the multi-agent architecture of the project “A Computational Model of Distance Learning Based on Socio-Cultural Pedagogical Approaches” (Andrade et al., 2001).

DESCRIPTION OF THE ENVIRONMENT

The architecture of the system consists of four types of artificial agents – Diagnostic Agent, Mediating Agent, Collaboration Agent and Semiotic Agent – and human agents (students and tutors). Further details about the system can be found in (Andrade et al., 2001). The tutoring system may function as an individual tutor, where the Mediating Agent presents pedagogical contents to the student in accordance to his/her profile and cognitive style, or as a facilitating system of collaboration, where the Collaboration Agent monitor and mediate the interaction among the students with collaborative tools.

In this article, we will focus on the system as a collaborative tool. In this case, the Collaboration Agent has an important role. Its function is to promote and to mediate the interaction between groups of students using collaborative tools (e.g., chat, discussion list, and bulletin board). In that way, it supports the students during the interactions, stimulating them when they appear unmotivated, presenting new concepts and correcting wrong conceptions. In the next section, we describe the functionalities of the system as a collaborative tool.

We can better understand the implementation of this environment through a scenario. Let us imagine a student, using his/her computer (at home or at work), connected to this system through the Internet. A Mediating Agent will be sent to the user's machine and it will monitor his/her activities. The Diagnostic Agent will suggest to the Mediating Agent a pedagogical tactic and the contents to be presented based on the inferences on the student model. The Mediating Agent will request the contents to the Semiotic Agent, which will show it to the student.

When a Diagnostic Agent verify that there is a gap between a student's actual and potential learning, so that it is necessary the intervention of some facilitators (i.e., other more capable colleagues and/or tutors), it will make a request to the Social Agent. Then, the Social Agent creates a Collaboration Agent that will invite the students to participate on an interactive session through a collaborative tool. The Collaboration Agent will monitor the discussions among the students intervening, when necessary, as mentioned above. It will connect itself to the chosen collaborative tool, as if it were a normal user of the tool, which gives the Collaboration Agent greater realism.

COLLABORATION AGENT IMPLEMENTATION

Due to its social function – to communicate with students, to promote and monitor the interaction among students – it would be interesting for the Collaboration Agent to have an interface that would allow it to exploit students' social nature. In fact, one of our main concerns is to better exploit the social potential of the students to improve their learning, and studies demonstrate that people interacting with animated characters learn to interact with other humans (Huard, 1998).

Therefore, we chose to represent it as an animated character who has a personality and which interacts with the student through messages in natural language.

Thus, as in human social interactions, the Collaboration Agent must be able to and show and perceive emotional responses. Learning is a comprehensive process which does not simply consist of the transmission and learning of contents. A tutor (in this case, the Collaboration Agent) must promote the student's emotional and affective development, enhancing his/her self-confidence and a positive mood, ideal to learning. The way in which emotional disturbances affect mental life has been discussed in the literature (Goleman, 1995). He recalls the well-known idea that depressed, bad-humoured and anxious students find greater difficulty in learning.

In order to interact with the student in an adequate way, the agent has to correctly interpret his/her emotions. Therefore, it is necessary for Collaboration Agent to have not only a student cognitive model, but also an affective one. We are going to use the student model proposed by (Bercht et al., 1999), which considers the affective states such as effort, self-confidence and independence.

In collaborative learning, the group is an active entity; therefore, the system must contain information that refers to the group as a whole. This information generates a group model, which is built and maintained by the Collaboration Agent. The Collaboration Agent can build the group model from the individual student models, which are obtained from the interactions between the students and their Mediating Agents, and updated by the Diagnostic Agents. The group model can also be obtained from the observation of the group as a whole.

Still, it is necessary to have in mind the responsibility about the use of affective agent architecture for interaction with the user, especially in the education. Often we observe that agents have attitudes that are not suitable to students' mood (e.g., if an agent gets sad when the student could not carry out an exercise). This kind of attitude may generate a disturbed reaction in the student, making him/her more anxious and less self-confident. It is necessary to identify which behaviours are appropriate to promote a mood in the student that provides better learning conditions.

The Collaboration Agent will carry out the analysis of the student's dialogue based on statistical methods, such as pattern matching, message categorisation and information retrieval (Soller, 2001). The messages will be generated in natural language, using dialogue models and frames. We intend to base this analysis on the work in (Jaques & Oliveira, 1999) (Jaques et al., 2000).

CONCLUSIONS AND FUTURE WORK

This research is currently in the phase of implementation design and specification. The phase of study of the pedagogical architecture and computational modelling is concluded. This work is the result of a research project in the area of Artificial Intelligence applied to Education that intends to create a computational framework (in which the pedagogical agents are part of it) to support collaborative learning.

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