Learning environments supported by Software Agents and Chat-bot

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ABSTRACT

Intelligent Agents are widly used in the literature in education environments connected to a specific subject matter. This paper investigate the use of IA to build LMS which are not connected to a specific subject matter.
The aim is to use Intellegent Agents to simplify online teachers and tutors activities by eliminating repetitive and recurring tasks.

The research is structured in two phases: firstly, the analysis of the messages exchanged between teachers, tutors and students in a online learning environment is provided. In the second phase, rules to implement a Chat-bot are explored: this instrument provide support to the tutors and theachers, rather than aiming to replace their activities. The next step is to integrate Chat-bot with information produced by Intelligent Agents, in order to obtain a *enactive* model that takes advantage of the interactions between teachers, tutors and students.

Keywords: Intelligent Tutoring System, Multi Agent System, Tracking Date, Chat-bot and User Profiles.

1. INTRODUCTION

The Intelligent Agents technology has been mainly used in the Intelligent Tutoring System, i.e. systems specifically related to subject matters, disciplinary determined. Examples can be Baghera [17], MyClass, Andes [13] [14], Gramy [15], Advanced Geometry Tutor [16].

The paper focus on the use of Intelligent Agents to build Learning Management Systems, which are not matter-oriented, i.e. the system is not based on a specific Knowledge Based. Intelligent Agents technology aims to support online teachers and tutors' work at two different levels: eliminating repetitive tasks, and building personalized learning paths for the students.

The research started by analyzing the use of Intelligent Agents to build a monitoring system that tracks individual or group students'activity. As a result of the study of messages exchanged between teachers/tutors and students in an online environment, we have identified the students'most common questions, showing how some of the questions could be delegated to an Intelligent Agent. The online environment takes place as part of an online course running at the University of Macerata by the Faculty of Education. The classification used and the keywords identified provide valid rules for the implementation of an Open Source Chat-bot system (software that simulates a conversation in natural language). The system is based on structured information already coded in the learning environment and inserted during the course, thus it is suitable to help teachers and tutors who work in the online learning environments.

Furthermore its flexibility guarantees to meet peculiar user's requirements.

2. RESEARCH OBJECTIVES

The technologies of semantic web and software agents have become mature and the use of semantic web in education is nowadays widespread (Koper) [6], making central the concepts of self-organized learning networks.

The organization of the learning environment is understood as the result of an evolving process restructures itself following the interactions among users. Hence, the role of online teachers and tutors becomes crucial.

This is the direction undertaken by the research team from the University of Macerata CELFI-CIRDIFOR, which focused on the following objectives:
- To *support* teachers and tutors in order to make online tuition sustainable and effective;
- To *develop* and experiment learning paths leveraging different approaches (e.g: cognitivist, socio-constructivist) through significant online interaction;
- To *design* learning environments able to support ever changing learning paths and processes that teachers and tutors can adapt to arising needs.

This work uses the theoretical background from Teachers' thinking (Shulman) [11], from the "New Didactic Research" (Damiano) [2] and from complex, situated design models already introduced by Gero [3], Koper [6], Cantoni et al. [1], Rossi [9], Rossi and Toppano [10].

The aim proposed in this article is the simplification of online teachers and tutors activities by eliminating repetitive and recurring tasks. We thus seek a twofold objective: on one hand, to shift the workload of teachers / tutors, from time wasting task to activities that require a more contextual targeted intervention, on the other hand, an automatic answering service is offered to meet students' needs. Therefore, the agents encourage self-regulated behavior in students, which take control of their own learning process (Prensky [8], Graesser et al.[18]).

3. ANALYSIS

3.1. Categorization of messages.

The first task of this research was the analysis of the messages exchanged between teachers, tutors and students of an online learning environment in a course held during 2009-2010 by the Faculty of Education. The course was chosen based on the high skills of the tutors, the significant number of students and the high number of online interactions made through web 2.0 tools (forum,

chat, wiki) in the learning environment. The course was structured in different activities and types of discussion forums, which required different types of participation and produced different relational and linguistic styles.

Specifically, the pilot study was performed on the *" Help Forum"* in a course running for a nine-week period, presented 145 messages divided into 52 threads, 18 participants with an average of eight messages per user; students posted a minimum of one message to a maximum of 11, while the assigned tutor posted 62 messages. considering only this forum, it has been estimated that moderation by the tutor required between 20 and 30 minutes per day..

The analysis consists of reading and classifying each message and assigning tags to them. There are three main categories of messages:

- *Information already coded within course/activities/study material*: messages catalogued in this category include questions concerning deadlines, test modality, features of assignments and study resources;
- *Acknowledgement/appreciation*: messages in this category usually conclude a thread by thanking tutors for given answers. Although this kind of messages do not usually require a reply, it may be useful to have them marked as Non-urgent by an automated cataloguing system so that tutors can keep trace of them without having to read them during pressuring times;
- *Assessment request*: these messages are usually sent from students to solicit tests scores and qualitative-quantitative assessment motivation. These information can be easily examined from a dedicated page within the LMS; replies to this family of messages could be processed by a software agent having access to platform and students' tracking data.

Moreover, we have identified relevant keywords in students' questions. The same analysis has been performed by two researchers who have read notes and than negotiated meanings (Miles and Huberman [7]).

As a result of the analysis, the overall collected data in help forum indicates that only 30% of messages required an in-depth analysis by tutors and 70% of learning support activities and moderation work could be carried out or partially facilitated by software agents.

The results also show that 42% of all questions posted in the help forum concerned information already coded in the materials on the course (e.g. deadline for projects). The answers to these questions can be delegated to software agents, counterbalancing the lack of deep reading of the materials by students. Therefore, the general questions are answered by software agents, leaving teachers and tutors with the task to investigate

and respond to questions that need personalized and context-specific interventions.

3. 2. Construction of rules.

In the second phase, the construction of rules concerning the implementation of a Chat-bot is addressed. To this aim it is critical to identify the proper tag for each student's question. Experimentally, we conducted an analysis of the semantic structure of the questions in the Help Forum. In detail, we have analyzed the questions concerning the topic "examination", which occurs 63 times in help forums. We have identified the following possible structures:

- *Indirect questions* ("I would ask you information about how the examination will take place") vs. *direct questions* ("Where the examination will take place?").
- *Questions related to thematic areas*:
  -content exams: ("I wonder if the review will focus on materials made in the master group or all materials");
  -location and hours: ("I would like to know the location and the time of the exam");
  -certificate and documents: ("I would like to receive news about the issue of the certificate/ I want to know when I have to send the documents relating to the application for admission to the examination").
  -situations / possibilities: (" Can I change the date of the examination?").

After this analysis, we identified the positions which contain the information required by the students (in this case, times, locations, structure of the exam assessment) within the environment of the course. The identification of the positions allows the teachers/ tutors to give clear instructions and informations and it allows the Information Retrieval Agent to find the necessary data needed by the Chat-Bot to promptly respond to students' requests.

3. 3. Implementing Chat-bot

This analysis was useful to analyze the Chat-bot agent as an information inquire and retrieval interface; the chat agent interacts with users through the LMS internal messaging system enabling a synchronous, on-demand, first-level help desk service. The previous steps require an extensive exploitation of users' tracking data (e.g.: single actions/clicks performed within the LMS) and a multi-agent system (MAS) based architecture in order to carry out scheduled, as well as on demand, complex calculations.

The system is being implemented on a OLAT ver 6.3 LMS loosely coupled to a JADE-based Multi Agent System in charge of processing user tracking data and running the ALICE [12] Chat-bot integrated with the platform messaging system. ALICE is the Chat-Bot based

on Artificial Intelligence Markup Language (AIML), a language introduced in 2000 by Wallace.

The aim is to use Intellegent Agents and Chat-bot to simplify online teachers and tutors activities by eliminating repetitive and recurring tasks. The Chat-bot refers to a series of structured information in the online environment and have the advantages to possess the synchronous mode: "The control of a synchronous system is simple to design and relatively easy to implement, debug and test. Unlike the uncertainty and unpredicability in asynchronous systems, synchronous systems are regular, easy to comprehend, and predicatable; they are therefore preferred by hyman beings" (Ghosh, 2009).

There is an issue associated with the construction of materials. The construction of well structured materials for the Chat-bot allows teachers to build effective and well understandable information for the students. In fact, Garson stated [5] speaking about resources: "Computerized applications may be able to provide all sorts of new and valutable information to decion makers. However, the information is only useful if the organization has the resources to take full advantage of the new information". Hence, it becomes important to tailor the construction of the material to the proper environment. This leads to an interactive model: the environment is able to receive as input the student's questions, and to process it to determinate decisions.

4. FUTURE RESEARCH:

4.1. Enactive model and dynamic interactions

Ongoing research aims to integrate Chat-bot whit monitoring information produced by Intelligent Agents. The goal is to present an enactive model in which a range of directions, determined by the student's profile and by the delivery of the course, will be offered at the student (e.g. advice to participate in an activity or in a specific forum). For this reason, it becomes important to identify and analyze the possible user profiles in an online course.

These profiles can be designed by the tracking data and by the online students activities. For instance, it may be useful to investigate the level of partecipation sustained by the student, the main type of work performed, the preference in the choice of materials. These informations allow us to obtain a dynamic profile of each users within the online environment. Finally, the next step will be to constitute an interactive model between the students' dynamic profile and the dynamic profile of the course. This model is not static and stable, but possess the advantage of constantly updating itself via interactions between teachers, tutors and students.

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