Evaluation of Symbolic and Connectionist approaches in a Multi-agent System

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Abstract

The aim of this project is to design a multi-agent system for resource allocation. The problem addressed in this work is that of allocating the most appropriate academic member of staff to supervise an undergraduate or postgraduate project. The system employs case based reasoning and neural networks agents. The system design is influenced by the agent architecture proposed by the Knowledge Sharing Effort, using the Knowledge, Query and Manipulation Language for agent communication; this is an Internet agent based system, designed using HTML, Perl and Visual C++, that requires a WWW server and the help of web browsers.

Introduction

Identifying an adequate supervisor for a student is a very difficult and time-consuming task. The Project Monitoring Intelligent Agent (PMIA) architecture makes it possible to combine the advantages of both symbolic and connectionist approaches to artificial intelligence problem solving. The aims of this research are to test the theory that neither a completely deliberative nor completely reactive approach is suitable for building agents, to show how Neural Networks and Case Based Reasoning (CBR) Systems can be used to improve the learning processes of semi-autonomous agents and to show how well the process of matching projects to supervisors and subsequent project administration can be automated with the help of a Multi-agent based system.

The System Architecture

The PMIA system architecture (Figure 1) is composed of a set of heterogeneous agents: Teaching agents, Students agents, Teaching agent generator, Student agent generator, Contact agents, NN agents and CBR agents.

Teachers and Students have their own *agents*. These *agents* interact with their owners (teacher or student) through a web browser and by the e-mail system. Each *agent* learns about the areas of interest and aims of its owner by accessing to his/her emails and by interacting directly with him/her *Teacher and Student Agents* are created by *Teacher/Student agents Generators*. *Contact Agents* help other *Agents* to establish contact between

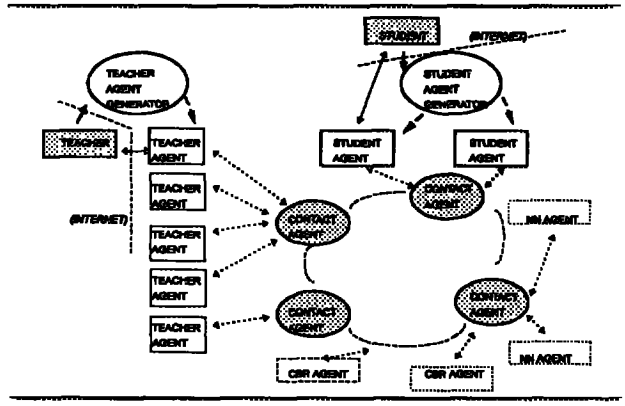

Figure 1: System Architecture

them, and the *Advisory Agents* identify the most appropriate teacher to supervise a particular student using the knowledge of a CBR or a NN. The communication between agents occurs through the Internet, a TCP/IP socket system has been implemented following the KQML protocols. *Agents* are Visual C++ executable programs running on PCs.

CBR and NNs Agents

Several CBR approaches have been tested on the system to determine how well they can be used by Autonomous Agents, and how they can improve their own Autonomy. In that respect CBRs have been proved to be very efficient and reliable. After doing a theoretical study of the Adaptative Resonance Theory NNs and practical tests on them, it has been seen that they can be incorporated in Autonomous Agents; also Fuzzy Sets and Neurofuzzy Algorithms have certain characteristics that can help an Autonomous Agent to be more Autonomous.

CBR systems performance was between 50 to 60% better than the performance of any NN tested over the experiment. This fact together with the ability of CBR Systems to learn over time by gradually acquiring their competence from observing and imitating passed cases and receiving explicit instructions from the users makes them an excellent learning engine for developing Semi-autonomous Agents.