Multi-Agent Systems for Education and Interactive Entertainment: Design, Use and Experience

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Detailed Table of Contents

Preface ............................................................................................................................................. xii
Acknowledgment.................................................................................................................................. xiv

Section 1
Teaching Agent-Based Systems within Computing

Agent-Based systems can be used effectively as teaching aids and this section provides examples of their use both within Computing and in other subjects. These four chapters present a number of approaches to introducing agent-based technology into the wider Computer-Science curriculum and show how they can be used to enhance the student learning experience.

Chapter 1
MAgICS: Toward a Multi-Agent Introduction to Computer Science................................................. 1
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This chapter introduces a new approach for revitalizing introductory undergraduate or high school Computer Science curricula through the deep integration of agent-based modeling and multi-agent systems (MAS) perspectives. The merits of using Multi-Agent systems are discussed as a means to facilitate conceptual understanding across disciplines, compare Multi-Agent approaches to traditional serial ones, and explore how this approach can bring together disparate topics in Computer Science through the common focus on emergent systems to promote a broader view of the field as a whole.

Chapter 2
An Intelligent Agents and Multi-Agent Systems Course Involving NetLogo........................................ 26
Ilias Sakellarious, University of Macedonia, Greece
Petros Kefalas, CITY College, Greece
Ioanna Stamatopoulou, CITY College, Greece

This chapter records the authors’ experience in teaching a MAS course, using NetLogo as the vehicle for practical coursework. In addition, two extra NetLogo libraries that were provided to students are described, one for BDI-like agents (Belief-Desire-Intention, i.e. goal-oriented agents) and one for ACL-
like (Agent Communication Language) communication, which were specifically developed for allowing students to implement more complex agent societies than the original NetLogo platform allowed.

Chapter 3
Adapting Rewards to Encourage Creativity

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Curriculum standards for CS education typically lack the emphasis and coverage to promote or encourage creative approaches to Software Engineering, focusing on technological solutions rather than innovative design. As a result, creativity is not directly rewarded. This chapter discusses the development of a Multi-Agent system to apportion rewards for creative contributions to collaborative and group problem solving among students in a software projects course. Encouraging creativity in a classroom team environment, especially for software development, needs a collaboration framework that combines idea management with a motivating reward system.

Chapter 4
A Multiagent Approach to Teaching Complex Systems Development

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The authors show how they have attempted to reduce the difficulties in teaching complex issues in Computer Science by targeting teaching towards undergraduate and postgraduate computing students from increasingly diverse educational backgrounds. They specify an adaptable multi-agent architecture and provide a set of general purpose agents to handle essential multi-modal tasks like speech input/output, fusion and semantic analysis. The authors outline the design of this system and describe how it provides a framework for students to assemble complex systems and experiment with agent-level design patterns.

Section 2
Teaching Agent-Based Systems beyond Computing

Not only Computer Science students can benefit from the use of agent-based technology. These two papers show how they can be deployed effectively to enhance the learning experience over a range of subject areas.

Chapter 5
Introducing AI and IA into a Non Computer Science Graduate Programme

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Maria Fasli University of Essex, UK
Petros Kefalas CITY College, Greece
This chapter shows how the authors introduce students to Artificial Intelligence and Intelligent Agents in ways that are different from "mainstream" practices as the programme is intended for students from varying, not necessarily Computer Science related, backgrounds. The authors report their approach and experience of the entire process - from designing the unit, taking into consideration some inherent restrictions such as coordination of teachers and short duration of the course, to delivering it to a diverse audience that requires different didactic methods to be employed.

Chapter 6
Introducing Multiagent Systems to Undergraduates through Games and Chocolate .......................... 101

Emma Bowring University of the Pacific, USA
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This chapter outlines three key issues that must be addressed in teaching students from a range of disciplines the basics of Multi-Agent systems. The first issue is facilitating students' intuitive understanding of fundamental concepts of Multi-Agent systems. The second is in selecting the right material - either science-fiction material or games - for providing students with the necessary motivation and intuition. The third issue is in educating students about the fundamental philosophical, ethical and social issues surrounding agents and Multi-Agent systems.

Section 3
Using Agent Systems in Educational and Training Contexts:
Educational Uses of Multi-User Virtual Environments

There are many other educational and training contexts in which agent-based systems can make a significant contribution. Agent technology provides the means for developing much more realistic training scenarios by adding intelligent interaction.

Chapter 7
Survey of Educational Multi-User Virtual Environments and Agents........................................... 116

Arda Tezcan, Macquarie University, Australia
Debbie Richards, Macquarie University, Australia

The potential value of Multi-User Virtual Environments (MUVEs) is increasing amongst educationalists. A key issue with MUVE for education is the need to provide system intelligence and believable characters so that the learning goals may be monitored and achieved. Agent-technology offers solutions towards achieving these needs. In this paper, the authors explore numerous existing educational MUVE and the use of agents for pedagogy in general, as they pave the way forward for delivering intelligent educational MUVE.

Chapter 8
A Comparative Study of Platforms for Multi-User Virtual Environments ........................................ 137

Arda Tezcan, Macquarie University, Australia
Debbie Richards, Macquarie University, Australia
This chapter provides a comparative study of prominent existing platforms for MUVEs that can be used to identify the right balance of functionality, flexibility, effort and cost for a given educational and technical context. A number of metrics are identified, described and used to enable the comparison. Platform assessment was done in four main metric groups: communication and interaction, characters, features and education.

Section 4
Using Agent Systems in Educational and Training Contexts: Specific Issues and Solutions

The final five chapters look at specific issues related to the use of agent-based educational applications.

Chapter 9
Agents with a Theory of Mind in Virtual Training ......................................................... 172
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Virtual training provides an effective means to train complex, dynamic tasks like social interaction, negotiation and crisis management. The virtual characters with whom the trainee interacts are often played by autonomous, intelligent agents. For effective training, it is required that the agents behave in a believable way. In order to display believable social behavior, the agents must be able to take others’ perspectives into account. This can be achieved by equipping them with a theory of mind, that is, the ability to attribute mental states such as beliefs and desires to others. In this chapter the authors describe an executable model for agents with a theory of mind, based on the BDI (belief desire intention) approach. The aim of the model is to develop agents that display believable social behavior and provide explanations about their behavior.

Chapter 10
Computers Can Feel Too: Intelligent Emotional Agents in E-Learning Systems.................. 188
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In this chapter the authors review existing systems that use emotional agents and analyze their specific characteristics, their advantages and disadvantages. Finally, based on this analysis they enumerate specific requirements for efficient communication between agents and users and use them to propose a general architecture model upon which the development of future Intelligent Emotional Agents could be based.
Chapter 11
Scenario Authoring by Domain Trainers ................................................................. 206

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Authoring is a bottleneck in the widespread uptake of technology for training and education as the time and skill needed for domain experts such as trainers and teachers to develop learning modules is prohibitive. The authors have created a simple approach involving synthetic agents within a Virtual Environment who can be changed along with their dialog and behaviour to create and modify scenarios as deemed appropriate by the domain expert in order to improve the learning experiences of the trainee.

Chapter 12
Crafting a Personalised Agent-Oriented Mobile E-Learning Platform for Adaptive Third Level Education .................................................................................................................. 233

Olapeju Latifat Ayoola, University College Dublin, Ireland
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This chapter presents the architecture of an agent-based m-Learning platform, which incorporates adaptive personalisation and collaborative learning for the development of enhanced e-learning. The main objective of this platform is to provide University College Dublin with a single supported intelligent mobile learning environment that will promote adaptive and collaborative learning, Human Computer Interaction (HCI) on mobile clients anywhere, any time and also provide useful recommendations about available educational resources.

Chapter 13
How to Build up Recommender Agents, Step by Step ............................................. 248

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Albert Trias, University of Girona, Spain
Nicolás Hormazábal, University of Girona and Easy Innova, Spain
Esteve del Acebo, University of Girona, Spain
Miquel Montaner, University of Girona and Strategic Attention Management, Spain

This chapter introduces the agency features necessary to construct a recommender agent: user profiling and recommender systems, trust, aggregation-consensus, and negotiation-auctions. The contents of this chapter were developed for a masters level course. This was less concerned with methodologies and more focused on mastering the agent features necessary to build up agents that autonomously work on behalf of users.

Compilation of References ............................................................................................ 273

About the Contributors .................................................................................................... 300

Index .................................................................................................................................... 308