

Book Reviews: When Humans and Agents Collide

Maria Ganzha, *Elblag University of Humanities and Economy*

Design of Intelligent Multi-Agent Systems: Human-Centredness, Architectures, Learning and Adaptation

Rajiv Khosla, Nikhil Ichalkaranje, and Lakhmi Jain, eds.

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Design of Intelligent Multi-Agent Systems: Human-Centredness, Architectures, Learning and Adaptation is a collection of papers whose content is grounded in two trends. First, soft-computing technologies have moved out of the laboratory and onto the Internet. Second, agent systems are being applied in areas such as engineering, process control, data mining, and e-business. In this context, three main problems arise: applying soft-computing agents in distributed environments, humanizing their interfaces, and optimizing the solutions they provide. Although the editors attempted to dedicate separate chapters to each problem, most chapters discuss each problem to some extent.

Chapter 1 presents the book's most complete discussion of humanizing an agent system's interface. For modeling agent systems, Rajiv Khosla, Quibang Li, and Chris Lai propose a five-layer architecture—an object layer, a distributed-processing layer, a tool or technology agent layer, an optimization layer, and a problem-solving ontology layer. They then describe the problem-solving, optimization, and tool or technology agent layers. Several interesting examples of human-centered modeling using soft-computing multiagent architectures (including models of Internet banking, unstained cell image

processing, and shirt-design processing) complete this chapter. This chapter, as well as chapters 5 and 7, would be of interest not only to computer scientists but also to computer ethics specialists. These chapters discuss the interaction between people and multiagent systems, including MASs' behavior, their communication and interactions with humans, and how MAS design and behavior influence human society and vice versa.

Chapter 2 discusses software agents' role in ubiquitous computing, addressing it as a humanization problem. Software agent technology is a good candidate for ubiquitous computing because agents by definition are designed for decentralized, heterogeneous, and dynamic environments. Sasu Tarkoma, Mikko Laukkanen, and Kimmo Raatikainen summarize different approaches and give a short overview of relevant technologies and specifications (such as Java and Corba) and agent platforms (for example, JADE and JADE-LEAP, FIPA-S, Grasshopper, and ZEUS).

Decision making in a wide range of e-applications requires using open information environments, making knowledge storage and sharing increasingly important. In this context, a new direction in knowledge management called *knowledge logistics* has appeared. KL deals with acquiring knowledge from distributed sources, integrating it, and transferring it to the right person, in the right context, at the right time, for the right purpose. Chapter 3 discusses KL research. Multiagent architectures are widely used in knowledge management systems because knowledge is located in distributed sources and presented in different formats. Alexander Smirnov, Mikhail Pashkin, Nikolai Chilov, and Tatiana Levashova's agent-based solution approaches KL as a network configuration problem whose nodes represent elements of a global information environment. These elements include end users or customers, loosely coupled knowledge sources (such as experts, knowledge bases, repositories, and documents), and information or knowledge management tools. The authors call this the Knowledge Source Net. Case studies of mobile hospital configuration and automotive supply network configuration illustrate the KSNet approach's application.

Chapter 4 considers architectural styles and design patterns for multiagent systems that adopt concepts from social theories. These styles represent MASs' macrolevel architecture in terms of actors, goals, and actor dependency.

Chapter 8 provides an interesting discussion of such architecture components as assistant agents. These provide an application's users with help services, such as organizing user data or suggesting suitable information. In this situation, the key architecture component is the coordinator, which is designed to be general and independent of particular groups of agents. Moreover, the coordinator is easily reusable to assist a large class of

applications, essentially by replacing the component responsible for interacting with a particular application. An interesting example of assistant agents that extend Web browsers with new functionalities—a user-profiler assistant, a data-extraction assistant, and a cart-manager assistant—finish the chapter.

For those interested in using MASs in e-learning, chapter 9 discusses, among other things, cooperation between learning agents, the mixed use of different learning paradigms at several levels, and learning trust relationships between agents.

Chapters 10 and 12 present interesting viewpoints on MASs and their implementation and on optimizing the solutions soft-computing agents provide. Chapter 10 covers problems involved in adaptation and mutation in MASs. Reconfigurable and mutable agents are especially important in highly heterogeneous systems. The authors review various approaches and present their research.

Chapter 12 considers implementing MASs in a distributed environment. Samuel Pierre focuses on the problems involved in seeking information and proposes using MASs and mobile agents. He begins by defining basic concepts: agent, MAS, communication among agents (including ACL (Agent Communication Language), KQML (Knowledge Query and Manipulation Language), and blackboard-based communication), cooperation among agents (including conflict resolution through arbitration or negotiation), differences between mobile agents and mobile code, and weak and strong mobility. Then, the author discusses in considerable detail a multiagent architecture for information retrieval. He implemented the system using the Grasshopper agent platform and finishes by presenting and analyzing test results.

Chapter 11 presents an unusual, interesting application of MASs—the creation of systems that generate animated figures. Existing systems allow for partially automatic generation of scenes involving few interacting characters, but expensive manual labor is still necessary to enrich the characters' behavior repertoires. Adam Swarowicz, Marek Mittmann, and Jaroslaw Francik explore the application of reinforced learning to acquire new high-level actions for animated characters. The proposed algorithm is the deterministic version of Q-learning, and experimental implementation illustrates their proposed solutions.

Conclusion

For beginners to agent systems, I recommend chapter 6, which contains basic information about agent platforms, specifically JADE and JADE-LEAP. Chapter 8 would be useful for readers interested in gaining basic knowledge about agent communication. For those interested in intelligent agents, chapters 3, 9, and 11 will be useful. Readers will find some details of MASs' design and implementation in chapters 3, 4, 10, and 12, but these chapters require some preliminary knowledge. The book—especially chapters 1,2, 5, and 7—will also be of interest to computer ethics specialists and researchers who would like to know about the state of the art in this field.

Maria Ganzha is an associate professor at Elblag University of Humanities and Economy. Contact her at ganzha@euh-e.edu.pl.

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