Lecture Notes in Artificial Intelligence 1042

Subseries of Lecture Notes in Computer Science
Edited by J. G. Carbonell and J. Siekmann

Lecture Notes in Computer Science
Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Gerhard Weiß Sandip Sen (Eds.)

Adaption and Learning in Multi-Agent Systems

IJCAI '95 Workshop
Montréal, Canada, August 21, 1995
Proceedings

Springer

Series Editors

Jaime G. Carbonell
School of Computer Science, Carnegie Mellon University
Pittsburgh, PA 15213-3891, USA

Jörg Siekmann
University of Saarland
German Research Center for Artificial Intelligence (DFKI)
Stuhlsatzenhausweg 3, D-66123 Saarbrücken, Germany

Volume Editors

Gerhard Weiß
Institut für Informatik, Technische Universität München
D-80290 München, Germany

Sandip Sen
Department of Mathematical and Computer Science, University of Tulsa
Tulsa, OK 74104-3189, USA

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Adaption and learning in multi-agent systems : proceedings / IJCAI '95 workshop, Montréal, Canada, August 1995. Gerhard Weiss ; Sandip Sen (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Budapest ; Hong Kong ; London ; Milan ; Paris ; Santa Clara ; Singapore ; Tokyo : Springer, 1996
(Lecture notes in computer science ; 1042 : Lecture notes in artificial intelligence)
ISBN 3-540-60923-7
NE: Weiss, Gerhard [Hrsg.]; IJCAI <14, 1995, Montréal>; GT

CR Subject Classification (1991): I.2, I.6, D.3.2

ISBN 3-540-60923-7 Springer-Verlag Berlin Heidelberg New York

Typesetting: Camera ready by author
SPIN 10512570 06/3142 - 5 4 3 2 1 0 Printed on acid-free paper

Preface

This volume contains the revised and extended versions of fourteen papers that were first presented at the workshop on "Adaptation and Learning in Multi-Agent Systems" held August 21, 1995 in Montréal, Canada, as part of the Fourteenth International Joint Conference on Artificial Intelligence (IJCAI-95). The goal of this workshop was to bring together researchers and practitioners with an active interest in adaptation and learning problems in environments co-habited and shared by multiple agents, and to provide a forum for discussing existing approaches and results, exchanging insights and expertise, and developing new ideas and perspectives. The workshop was international and attracted more than 35 participants from seven countries.

Adaptation and learning in multi-agent systems establishes a relatively new but significant topic in Artificial Intelligence (AI). Multi-agent systems typically are very complex and hard to specify in their behavior. It is therefore broadly agreed in both the Distributed AI and the Machine Learning community that there is the need to endow these systems with the ability to adapt and learn, that is, to self-improve their future performance. Despite this agreement, however, adaptation and learning in multi-agent systems has been widely neglected in AI until a few years ago. On the one hand, work in Distributed AI mainly concentrated on developing multi-agent systems whose activity repertoires and coordination mechanisms are more or less fixed and thus less robust and effective particularly in changing environments. On the other hand, work in Machine Learning mainly concentrated on learning techniques and methods in single-agent or isolated-system settings. Today this situation has changed considerably, and there is an increasing number of researchers focussing on this topic.

The papers contained in this volume, each reviewed by three experts, reflect both the broad spectrum of and the progress made in the available work on learning and adaptation in multi-agent systems. They address this topic from different points of view, and describe and experimentally and/or theoretically analyze new adaptation and learning approaches for situations in which several agents have to cooperate or to compete with each other in order to solve a given task or set of tasks.

Additionally, to assist the novice reader, an introductory and motivational article is included which provides a compact guide to this topic. This article takes a general look at multi-agent systems and at adaptation and learning therein, and offers an extensive and interdisciplinary list of pointers to relevant and related work.

This is the first available book on adaptation and learning in multi-agent systems. We hope that the reader will find it both useful and interesting, and that it will foster further investigations on this topic.

We would like to thank all the people who contributed to the success of this workshop. In particular, we are grateful to the authors and workshop partici-

pants for submitting papers and for the good atmosphere during and between the sessions, to the committee members for their organizational activities and for carefully reviewing the initial submissions, to the IJCAI-95 organizers for supporting this workshop, and to Springer-Verlag and Alfred Hofmann for the opportunity to publish this volume and for the unbureaucratic cooperation.

January 1996

Gerhard Weiß
Sandip Sen

Workshop Organization

Sandip Sen (Chair)	University of Tulsa, USA
Michael N. Huhns	University of South Carolina, USA
Maja J. Mataric	Brandeis University, USA
Michael J. Shaw	University of Illinois at Urbana-Champaign, USA
Devika Subramanian	Cornell University, USA
Ming Tan	GTE Laboratories Inc., USA
Moshe Tennenholtz	Technion - Israel Institute of Technology, Israel
Gerhard Weiß	Technische Universität München, Germany

Additional Reviewers

Thomas Haynes	University of Tulsa, USA
Tuomas Sandholm	University of Massachusetts at Amherst, USA

Contents