

# Lecture Notes in Artificial Intelligence 1544

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

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Barcelona*

*Hong Kong*

*London*

*Milan*

*Paris*

*Singapore*

*Tokyo*

Chenqi Zhang Dickson Lukose (Eds.)

# Multi-Agent Systems

Theories, Languages, and Applications

4th Australian Workshop  
on Distributed Artificial Intelligence  
Brisbane, QLD, Australia, July 13, 1998  
Selected Papers



Springer

## Series Editors

Jaime G. Carbonell, Carnegie Mellon University, Pittsburgh, PA, USA  
Jörg Siekmann, University of Saarland, Saarbrücken, Germany

## Volume Editors

Chenqi Zhang  
Dickson Lukose  
School of Mathematical and Computer Sciences  
The University of New England  
Armidale, N.S.W., 2351 Australia  
E-mail: {chengqi,lukose}@cs.une.edu.au

## Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

**Multi-agent systems** : theories, languages, and applications ; proceedings / 4th Australian Workshop on Distributed Artificial Intelligence, Brisbane, QLD, Australia, July 13, 1998. Chenqi Zhang ; Dickson Lukose (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo : Springer, 1998  
(Lecture notes in computer science ; Vol. 1544 : Lecture notes in artificial intelligence)  
ISBN 3-540-65477-1

CR Subject Classification (1998): I.2.11

ISBN 3-540-65477-1 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1998  
Printed in Germany

Typesetting: Camera-ready by author  
SPIN 10693067 06/3142 - 5 4 3 2 1 0 Printed on acid-free paper

# Preface

This volume contains revised versions of selected papers presented at the Fourth Australian Workshop on Distributed Artificial Intelligence (DAK'91), together with a set of invited papers. Each paper has been reviewed by at least two program committee members. The workshop was held in Brisbane, Queensland, Australia on July 17, 1992. The goal of the workshop was to promote research in distributed artificial intelligence and multi-agent systems, both nationally and internationally. The papers cover a wide range of issues in the field of distributed artificial intelligence and multi-agent systems, such as theories, languages, and applications.

Many people contributed to the success of this workshop. We would like to thank all the authors who submitted papers to the workshop. Many thanks also to the members of the programme committee who diligently reviewed all the papers submitted. Finally, we thank the editorial staff of Springer-Verlag for publishing this contribution to the Lecture Notes in Artificial Intelligence series.

October 1998

Chengqi Zhang and Dickson Lukose

## Programme Committee

Chengqi Zhang (Co-Chair)	University of New England, Australia
Dickson Lukose (Co-Chair)	Brightware Inc., USA
Victor Lesser	University of Massachusetts, USA
Jeffrey S. Rosenschein	Hebrew University, Israel
Toshiharu Sugawara	NTT Basic Research Labs, Japan
Rose Dieng	ACACIA Project, INRIA, France
Norbert Glaser	CRIN-INRIA Lorraine, France
Sascha Ossowski	Rey Juan Carlos Univ, Spain
Michael Luck	University of Warwick, UK
Mark d’Inverno	University of Westminster, UK
Tim Norman	University of London, UK
Douglas Norrie	University of Calgary, Canada
Bernard Moulin	Laval University, Canada
Zhisheng Huang	University of London, UK
Minjie Zhang	Edith Cowan University, Australia
Brahim Chaib-draa	Laval University, Canada

# Table of Contents

Team Formation by Self-Interested Mobile Agents .....	1
<i>Stanisław Ambroszkiewicz, Olaf Matyja, and Wojciech Penczek, Poland</i>	
Conception, Behavioral Semantics and Formal Specification of Multi-Agent Systems .....	16
<i>Walid Chainbi, Mohamed Jmaiel, and Ben Hamadou Abdelmajid, Tunisia</i>	
Learning Message-Related Coordination Control in Multiagent Systems ...	29
<i>Toshiharu Sugawara and Satoshi Kurihara, Japan</i>	
Multi-Agent Reinforcement Learning System Integrating Exploitation and Exploration-Oriented Learning .....	45
<i>Satoshi Kurihara, Rikio Onai, and Toshiharu Sugawara, Japan</i>	
Motivated Behavior for Goal Adoption .....	58
<i>Michael Luck and Mark d'Inverno, U.K.</i>	
Physically Based, Self-Organizing Cellular Automata .....	74
<i>Alan Dorin, Australia</i>	
Service Contract Negotiation - Agent-Based Support for Open Service Environments .....	88
<i>Annika Waern, Sweden</i>	
An Awareness-Based Model for Agents Involved in Reporting Activities ..	105
<i>Bernard Moulin, Canada</i>	
GTSM: A Language for Modelling and Developing Agent-Based Intelligent Systems .....	122
<i>Hongxue Wang and John Slaney, Australia</i>	
Programming Internet Based DAI Applications in Qu-Prolog .....	137
<i>Keith Clark, Peter J. Robinson, and Richard Hagen, Australia</i>	
Design of an Agent-Based, Multi-user Scheduling Implementation .....	152
<i>Andrew Scott, Karen Jenkin, and Rye Senjen, Australia</i>	
A Team of Agents Cooperating for Intelligent Tutoring .....	166
<i>Ruddy Lelouche, Canada</i>	
Secure Information Gathering Agent for Internet Trading .....	183
<i>X.F. Wang, X. Yi, K.Y. Lam, and E. Okamoto, Singapore and Japan</i>	
<b>Author Index</b> .....	195