# Lecture Notes in Artificial Intelligence 2891

Edited by J. G. Carbonell and J. Siekmann

Subseries of Lecture Notes in Computer Science

# Springer Berlin

Berlin Heidelberg New York Hong Kong London Milan Paris Tokyo Jaeho Lee Mike Barley (Eds.)

# Intelligent Agents and Multi-Agent Systems

6th Pacific Rim International Workshop on Multi-Agents, PRIMA 2003 Seoul, Korea, November 7-8, 2003 Proceedings



#### Series Editors

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

Volume Editors

Jaeho Lee University of Seoul Department of Electrical and Computer Engineering 90 Cheonnong-dong, Tongdaemun-gu, Seoul 130-743, Korea E-mail: jaeho@uos.ac.kr

Mike Barley University of Auckland Department of Computer Science Private Bag 92019, Auckland, New Zealand E-mail: barley@cs.auckland.ac.nz

Cataloging-in-Publication Data applied for

A catalog record for this book is available from the Library of Congress.

Bibliographic information published by Die Deutsche Bibliothek. Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data is available in the Internet at <a href="http://dnb.ddb.de">http://dnb.ddb.de</a>>.

CR Subject Classification (1998): I.2.11, I.2, C.2.4, D.2, F.3

ISSN 0302-9743 ISBN 3-540-20460-1 Springer-Verlag 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 is a member of Springer Science+Business Media GmbH

springeronline.com

© Springer-Verlag Berlin Heidelberg 2003 Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Protago-TeX-Production GmbH Printed on acid-free paper SPIN: 10969090 06/3142 5 4 3 2 1 0

#### **Preface**

Five years ago, with excitement and uncertainty, we witnessed the birth of PRIMA (Pacific Rim International Workshop on Multi-Agents). The first PRIMA in 1998 has now grown into PRIMA 2003, the 6th Pacific Rim International Workshop on Multi-Agents in Seoul, Korea. During a period of five years, the notion of agent research has grown so much that we hear the term agent on a daily basis. Various fields such as business, the Web, software engineering, on-line games and such are now using the term agent as a placeholder, just like the term object is used in the object-oriented paradigm. On the other hand, the research area has extended toward real applications, such as the Semantic Web and ubiquitous computing. The themes of PRIMA 2003 reflected the following trends:

- agent-based electronic commerce, auctions and markets
- agent architectures and their applications
- agent communication languages, dialog and interaction protocols
- agent ontologies
- agent programming languages, frameworks and toolkits
- agentcities
- agents and grid computing
- agents and peer computing
- agents and the Semantic Web
- agents and Web services
- artificial social systems
- conflict resolution and negotiation
- evaluation of multi-agent systems
- languages and techniques for describing (multi-)agent systems
- meta modeling and meta reasoning
- multi-agent planning and learning
- multi-agent systems and their applications
- social reasoning, agent modeling, and organization
- standards for agents and multi-agent systems
- teams and coalitions
- ubiquitous agents

PRIMA 2003 in Seoul, Korea hoped to build on the wonderful success of its predecessors, PRIMA 1998 in Singapore, PRIMA 1999 in Kyoto, Japan, PRIMA 2000 in Melbourne, Australia, PRIMA 2001 in Taipei, Taiwan, and PRIMA 2002 in Tokyo, Japan. We received 44 submissions to be considered. Each paper was carefully reviewed by three internationally renowned agent researchers chosen from the program committee (PC) members. There were 18 papers selected to be printed in this volume. We would like to thank all the authors for submitting their papers to PRIMA 2003 and the PC members for

#### VI Preface

their diligent efforts to review those papers. Also, we are so grateful to have had our invited speakers, Ronald Arkin (Georgia Institute of Technology), Edmund Durfee (University of Michigan), Nick Gibbins (University of Southampton), and Hiroshi Ishiguro (Osaka University). Last, but not least, we would like to express our thanks to the editorial staff of Springer-Verlag for publishing this volume in the Lecture Notes in Computer Science series and the Institute of Information Technology Assessment (IITA), Korea for their generous financial support for this workshop.

November 2003

Jaeho Lee Mike Barley

### Organization

PRIMA 2003 was organized by the Korea Intelligent Information Systems Society (KIISS) and the Electronics and Telecommunications Research Institute (ETRI).

#### General Chair

Jin Hyung Kim Computer Science Department KAIST (Korea Advanced Institute of Science and Technology), Korea jkim@cs.kaist.ac.kr

#### **Program Co-chairs**

Jaeho Lee Department of Electrical and Computer Engineering University of Seoul 90 Cheonnong-dong, Tongdaemun-gu, Seoul 130-743, Korea jaeho@uos.ac.kr

Mike Barley
Department of Computer Science
University of Auckland
Private Bag 92019, Auckland, New Zealand
barley@cs.auckland.ac.nz

#### Local Organization Co-chairs

Ho-Sang Ham Internet Computing Research Department Electronics and Telecommunications Research Institute (ETRI), Korea hsham@etri.re.kr

Jung-Jin Yang
Department of Computer Science and Engineering
Catholic University of Korea, Korea
jungjin@catholic.ac.kr

#### Local Organization Committee

Soowon Lee (Soongsil University)

Suhn Beom Kwon (Dankook University)

Hyun Kim (Electronics and Telecommunications Research Institute)

Seung Ik Baek (Hanyang University)

#### **Program Committee**

Cristiano Castelfranchi (Italy)

Brahim Chaib-draa (Canada)

Joongmin Choi (Korea)

John Debenham (Australia)

Klaus Fisher (Germany) Chun-Nan Hsu (Taiwan)

Michael Huhns (USA)

Toru Ishida (Japan)

Ilkon Kim (Korea)

In-Cheol Kim (Korea)

Minkoo Kim (Korea)

David Kinny (Australia)

Yasuhiko Kitamura (Japan)

Kazuhiro Kuwabara (Japan)

Jimmy H.M. Lee (China)

Ho-fung Leung (China)

Chao-Lin Liu (Taiwan)

Jiming Liu (China)

Jyi-shane Liu (Taiwan)

Rey-long Liu (Taiwan)

Jian Lu (China)

 ${\it Michael \ Luck\ (UK)}$ 

Xudong Luo (UK)

John Jules Meyer (The Netherlands)

Luc Moreau (UK)

Joerg Mueller (Germany)

Hideyuki Nakashima (Japan)

Ei-Ichi Osawa (Japan)

Ichiro Osawa (Japan)

Sascha Ossowski (Spain)

Young-Tack Park (Korea)

Van Parunak (USA)

Ramakoti Sadananda (Thailand)

Zhongzhi Shi (China)

Wookho Son (Korea)

Liz Sonenberg (Australia)

Von-Wun Soo (Taiwan)

Toshiharu Sugawara (Japan)

Ron Sun (USA)

Qijia Tian (China)

Jung-Jin Yang (Korea) Makoto Yokoo (Japan)

Xinghuo Yu (Australia)

Soe-Tsyr Yuan (Taiwan)

Chengqi Zhang (Australia)

## **Table of Contents**

A Multi-agent Approach to Business Processes Management in an Electronic Market	1
Modeling of a Multi-agent System for Coordination of Supply Chains with Complexity and Uncertainty	13
A Teamwork Protocol for Multi-agent System	25
Extraction of Implicit Resource Relationships in Multi-agent Systems  Toshiharu Sugawara, Satoshi Kurihara, Osamu Akashi	37
Evolutionary Learning of Multiagents Using Strategic Coalition in the IPD Game	50
Multi-agent Travel Planning through Coalition and Negotiation in an Auction	62
Agents for Intelligent Information Extraction by Using Domain Knowledge and Token-Based Morphological Patterns	74
Using Web Usage Mining and SVD to Improve E-commerce Recommendation Quality	86
Semantic Web Service Architecture Using Multi-agent Scenario Description	98
A Generic Model for Distributed Real-Time Scheduling Based on Dynamic Heterogeneous Data	110
SWEMAS: Toward a Practical Multi-agent Framework Utilizing the Semantic Web	122

#### X Table of Contents

Speculative Constraint Processing in Multi-agent Systems	133
Coordinated Collaboration of Multiagent Systems Based on Genetic Algorithms	145
Honesty, Trust, and Rational Communication in Multiagent Semi-competitive Environments	158
Ontology-Services to Facilitate Agents' Interoperability	170
An Ontology-Based Intelligent Agent System for Semantic Search in Medicine	182
Agent-Based Intelligent Clinical Information System for Persistent Lifelong Electronic Medical Record	194
Extended Hierarchical Task Network Planning for Interactive Comedy Ruck Thawonmas, Keisuke Tanaka, Hiroki Hassaku	205
Author Index	215