

Lecture Notes in Artificial Intelligence 2782

Edited by J. G. Carbonell and J. Siekmann

Subseries of Lecture Notes in Computer Science

Springer

Berlin

Heidelberg

New York

Hong Kong

London

Milan

Paris

Tokyo

Matthias Klusch Andrea Omicini
Sascha Ossowski Heimo Laamanen (Eds.)

Cooperative Information Agents VII

7th International Workshop, CIA 2003
Helsinki, Finland, August 27-29, 2003
Proceedings



Springer

Series Editors

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

Volume Editors

Matthias Klusch

DFKI GmbH, German Research Center for Artificial Intelligence
Stuhlsatzenhausweg 3, 66123 Saarbrücken, Germany
E-mail: klusch@dfki.de

Andrea Omicini

University of Bologna, DEIS
Viale Risorgimento 2, 40136 Bologna, Italy
E-mail: andrea.omicini@ieee.org

Sascha Ossowski

University Rey Juan Carlos, School of Engineering (ESCET)
Campus de Mostoles, Calle Tulipan s/n, 28933 Madrid, Spain
E-mail: S.Ossowski@escet.urjc.es

Heimo Laamanen

TelioSonera Finland
P.O. Box 970, 00051 Sonera, Finland
E-mail: Heimo.Laamanen@teliasonera.com

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 <<http://dnb.ddb.de>>.

CR Subject Classification (1998): I.2.11, I.2, H.4, H.3.3, H.2, C.2.4, H.5

ISSN 0302-9743

ISBN 3-540-40798-7 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 Berlin Heidelberg New York
a member of BertelsmannSpringer Science+Business Media GmbH

<http://www.springer.de>

© Springer-Verlag Berlin Heidelberg 2003
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin GmbH
Printed on acid-free paper SPIN: 10931530 06/3142 5 4 3 2 1 0

Preface

These are the proceedings of the 7th International Workshop on Cooperative Information Agents (CIA 2003), held at the Sonera Conference Center in Helsinki, Finland, August 27–29, 2003. It was co-located with the 4th Agentcities Information Days.

One key challenge of developing advanced agent-based information systems is to balance the autonomy of networked data and knowledge sources with the potential payoff of leveraging them by the appropriate use of intelligent information agents on the Internet. An information agent is a computational software entity that has access to one or multiple, heterogeneous, and distributed data and information sources; proactively searches for and maintains relevant information on behalf of its human users or other agents, preferably just-in-time. In other words, it is managing and overcoming the difficulties associated with information overload in the open and exponentially growing Internet and Web. Depending on the application and tasks at hand information agents may collaborate in open, networked data and information environments to provide added value to a variety of applications in different domains. Thus, research and development of information agents is inherently interdisciplinary: It requires expertise in information retrieval, artificial intelligence, database systems, human-computer interaction, and Internet and Web technology.

Initiated in 1997, the purpose of the annual international workshop series on cooperative information agents (CIA) is to provide an interdisciplinary forum for researchers, software developers, and managers to get informed about, present, and discuss the latest high-quality results in advancements of theory and practice in information agent technology for the Internet and Web. Each event of this renowned series attempts to capture the intrinsic interdisciplinary nature of this research area by calling for contributions from different research communities, and by promoting open and informative discussions on all related topics. Since 2001, the series also issues a Best Paper Award, and a System Innovation Award, to acknowledge highly innovative research and development, respectively, in the domain of intelligent information agents.

In keeping with its tradition, this year's workshop featured a sequence of regular and invited talks of excellence given by leading experts in the field. These talks covered a broad area of topics of interest, such as pervasive information service provision; information agents and peer-to-peer computing; and information gathering and integration. Other topics were methods for negotiation and interaction; collaborative search and filtering; as well as issues of trust and engineering of information agent systems.

This year the *CIA System Innovation Award* and the *CIA Best Paper Award* were sponsored by Whitestein Technologies AG, Switzerland, and Elsevier Science, The Netherlands, respectively. The Spanish Association for Artificial Intelligence (AEPIA) provided limited financial support to its members who were co-authors of accepted papers so that they could give their presentations at CIA 2003.

CIA 2003 featured 2 invited, 17 regular (long), and 6 short papers selected from 60 submissions. The result of the peer-review of all contributions is included in this volume, rich in interesting, inspiring, and advanced work on research and development of intelligent information agents worldwide. All workshop proceedings have been published by Springer-Verlag as Lecture Notes in Artificial Intelligence volumes: 1202 (1997), 1435 (1998), 1652 (1999), 1860 (2000), 2182 (2001), and 2446 (2002).

The CIA 2003 workshop was organized in cooperation with the Association for Computing Machinery (ACM). In addition, we are very much indebted to our sponsors, whose financial support made this event possible and contributed to its success. The sponsors of CIA 2003 were:

TELIA SONERA, Finland
NOKIA, Finland
WHITESTEIN TECHNOLOGIES, Switzerland
ELSEVIER SCIENCE, The Netherlands
SPANISH ASSOCIATION FOR ARTIFICIAL INTELLIGENCE, Spain

We are also grateful to the authors and invited speakers for contributing to this workshop, as well as to all the members of the program committee and the external reviewers for their very careful, critical, and thoughtful reviews of all submissions. Finally, a deep thanks goes to each of the brave members of the local organization team at TeliaSonera in Helsinki for their hard work in providing CIA 2003 with a modern, comfortable location, and an exclusive social program. We hope you enjoyed CIA 2003, and were inspired!

August 2003

Matthias Klusch, Andrea Omicini,
Sascha Ossowski, Heimo Laamanen

Co-chairs

Matthias Klusch	DFKI, Germany, <i>General Chair</i>
Andrea Omicini	University of Bologna, Italy
Sascha Ossowski	University of Rey Juan Carlos in Madrid, Spain
Heimo Laamanen	TeliaSonera, Finland, <i>Local Chair</i>

Program Committee

Elisabeth Andre	University of Augsburg, Germany
Ricardo Baeza-Yates	University of Chile, Chile
Wolfgang Benn	TU Chemnitz, Germany
Sonia Bergamaschi	University of Modena, Italy
Brahim Chaib-draa	Laval University, Canada
Rose Dieng	INRIA, France
Frank Dignum	University of Utrecht, The Netherlands
Fausto Giunchiglia	University of Trento, Italy
Rune Gustavsson	Blekinge TH, Sweden
Heikki Helin	Sonera, Finland
Mike Huhns	University of South Carolina, USA
Toru Ishida	University of Kyoto, Japan
Manfred Jeusfeld	University of Tilburg, The Netherlands
Catholijn Jonker	Free University of Amsterdam, The Netherlands
Hillol Kargupta	UMBC, USA
Larry Kerschberg	George Mason University, USA
Sarit Kraus	University of Maryland, USA
Daniel Kudenko	University of York, UK
Victor Lesser	University of Massachusetts, USA
Mike Luck	University of Southampton, UK
Martti Mäntylä	Helsinki Institute for Information Technology, Finland
Dennis McLeod	University of Southern California, USA
Werner Nutt	Heriot-Watt University Edinburgh, UK
Eugenio Oliveira	University of Porto, Portugal
Terry Payne	University of Southampton, UK
Michal Pechoucek	TU Prague, Czech Republic
Paolo Petta	Austrian Research Institute for AI, Austria
Enric Plaza	CSIC AI Research Lab, Spain
Alun Preece	University of Aberdeen, UK
Kimmo Raatikainen	Nokia Research Center, Finland
Roope Raisamo	University of Tampere, Finland
Omer F. Rana	University of Wales, UK
Volker Roth	Fraunhofer IGD, Germany

Heiko Schuldt	ETH Zurich, Switzerland
Onn Shehory	IBM Research, Israel
Amit Sheth	University of Georgia, USA
Carles Sierra	CSIC AI Research Lab, Spain
Von-Wun Soo	National Tsing Hua University, Taiwan
Leon Stirling	University of Melbourne, Australia
Rudi Studer	University of Karlsruhe, Germany
Henry Tirri	University of Helsinki, Finland
Steven Willmott	UPC Barcelona, Spain
Mike Wooldridge	University of Liverpool, UK
Eric Yu	University of Toronto, Canada
Chengqi Zhang	University of Technology Sydney, Australia
Ning Zhong	Maebashi Institute of Technology, Japan

Local Organizing Committee

Heikki Helin	TeliaSonera, Finland
Heimo Laamanen	TeliaSonera, Finland
Mikko Laukkanen	TeliaSonera, Finland
Martti Mäntylä	Helsinki Institute of Information Technology, Finland
Kimmo Raatikainen	University of Helsinki, Finland
Roope Raisamo	University of Tampere, Finland
Henry Tirri	University of Helsinki, Finland

External Reviewers

Tibor Bosse	Ralf Neubert
Seokkyung Chung	Guilherme Pereira
Pilar Dellunde	Jan Peters
Otmar Görlitz	Enric Plaza
Mario Gomez	Avi Rosenfeld
Francesco Guerra	Luis Sarmento
Meirav Hadad	Teresa Solchaga
Aizhong Lin	Nenad Stojanovic
Maria-Victoria Belmonte Martinez	Maurizio Vincini
Rebecca Montanari	

Table of Contents

Pervasive Information Service Provision

ACCESS: An Agent Architecture for Ubiquitous Service Delivery	1
<i>Conor Muldoon, Gregory O'Hare, Donnacha Phelan, Robin Strahan, Rem Collier</i>	
Adaptive Agent-Based Service Composition for Wireless Terminals	16
<i>Sasu Tarkoma, Mikko Laukkanen</i>	
An Information Notification Model with VPC on KODAMA in an Ubiquitous Computing Environment, and Its Experiment	30
<i>Tadashi Iwao, Satoshi Amamiya, Kenichi Takahashi, Guoqiang Zhong, Tatsuya Kainuma, Lusheng Ji, Makoto Amamiya</i>	

Information Agents and Peer-to-Peer Computing

INVITED CONTRIBUTION

Multi-agent Systems and Peer-to-Peer Computing: Methods, Systems, and Challenges	46
<i>Manolis Koubarakis</i>	
A Peer-to-Peer Approach to Resource Discovery in Multi-agent Systems	62
<i>Vassilios V. Dimakopoulos, Evaggelia Pitoura</i>	
Ostensive Automatic Schema Mapping for Taxonomy-Based Peer-to-Peer Systems	78
<i>Yannis Tzitzikas, Carlo Meghini</i>	

Issues of Trading and Negotiation

Proposal-Based Negotiation in Convex Regions	93
<i>Marco Cadoli</i>	
A Conversational Component-Based Open Multi-agent Architecture for Flexible Information Trading	109
<i>Habin Lee, Patrik Mihailescu, John Shepherdson</i>	
The Search for Coalition Formation in Costly Environments	117
<i>David Sarne, Sarit Kraus</i>	

Information Gathering and Integration

GraniteNights – A Multi-agent Visit Scheduler Utilising Semantic Web Technology 137
Gunnar Aastrand Grimnes, Stuart Chalmers, Pete Edwards, Alun Preece

Send Fredo off to Do This, Send Fredo off to Do That 152
Luís Botelho, Hugo Mendes, Pedro Figueiredo, Rui Marinheiro

Database Integration Using Mobile Agents 160
Philip S. Medcraft, Ulrich Schiel, Cláudio S. Baptista

Collaborative Search and Filtering

Adaptive Web Search Based on a Colony of Cooperative Distributed Agents 168
Fabio Gasparetti, Alessandro Micarelli

Agents for Collaborative Filtering 184
Fabrcio Enembreck, Jean-Paul Barthès

Collaboration in Open Environments

INVITED CONTRIBUTION
 Emergence and Stability of Collaborations Among Rational Agents 192
Sandip Sen, Partha Sarathi Dutta, Sabyasachi Saha

A Framework for the Social Description of Resources in Open Environments 206
Matthias Nickles, Gerhard Weiß

A Coordination Framework for a Community of Over-Helping Agents 222
Franck Gaultier

Issues of Trust in Agent-Based Information Provision

Trust Networks on the Semantic Web 238
Jennifer Golbeck, Bijan Parsia, James Hendler

Exchanging Advice and Learning to Trust 250
Luís Nunes, Eugénio Oliveira

Information Agent Systems Engineering (1)

A Component-Based Approach for Interoperability across FIPA-Compliant Platforms 266
Mercedes Amor, Lidia Fuentes, José M^a. Troya

Logic Programming for Evolving Agents	281
<i>Jose J. Alferes, Antonio Brogi, Joao A. Leite, Luis M. Pereira</i>	
Temporal and Spatial Analysis to Personalise an Agent's Dynamic Belief, Desire, and Intention Profiles	298
<i>Catholijn M. Jonker, Vagan Terziyan, Jan Treur</i>	
Information Agent Systems Engineering (2)	
Meta-reasoning for Agents' Private Knowledge Detection	316
<i>Jan Tožička, Jaroslav Bárta, Michal Pěchouček</i>	
Formalizing Retrieval Goal Change by Prioritized Circumscription – Preliminary Report –	324
<i>Ken Satoh</i>	
Organisational Change: Deliberation and Modification	336
<i>Catholijn M. Jonker, Martijn C. Schut, Jan Treur</i>	
Author Index	345

Preface

These are the proceedings of the 7th International Workshop on Cooperative Information Agents (CIA 2003), held at the Sonera Conference Center in Helsinki, Finland, August 27–29, 2003. It was co-located with the 4th Agentcities Information Days.

One key challenge of developing advanced agent-based information systems is to balance the autonomy of networked data and knowledge sources with the potential payoff of leveraging them by the appropriate use of intelligent information agents on the Internet. An information agent is a computational software entity that has access to one or multiple, heterogeneous, and distributed data and information sources; proactively searches for and maintains relevant information on behalf of its human users or other agents, preferably just-in-time. In other words, it is managing and overcoming the difficulties associated with information overload in the open and exponentially growing Internet and Web. Depending on the application and tasks at hand information agents may collaborate in open, networked data and information environments to provide added value to a variety of applications in different domains. Thus, research and development of information agents is inherently interdisciplinary: It requires expertise in information retrieval, artificial intelligence, database systems, human-computer interaction, and Internet and Web technology.

Initiated in 1997, the purpose of the annual international workshop series on cooperative information agents (CIA) is to provide an interdisciplinary forum for researchers, software developers, and managers to get informed about, present, and discuss the latest high-quality results in advancements of theory and practice in information agent technology for the Internet and Web. Each event of this renowned series attempts to capture the intrinsic interdisciplinary nature of this research area by calling for contributions from different research communities, and by promoting open and informative discussions on all related topics. Since 2001, the series also issues a Best Paper Award, and a System Innovation Award, to acknowledge highly innovative research and development, respectively, in the domain of intelligent information agents.

In keeping with its tradition, this year's workshop featured a sequence of regular and invited talks of excellence given by leading experts in the field. These talks covered a broad area of topics of interest, such as pervasive information service provision; information agents and peer-to-peer computing; and information gathering and integration. Other topics were methods for negotiation and interaction; collaborative search and filtering; as well as issues of trust and engineering of information agent systems.

This year the *CIA System Innovation Award* and the *CIA Best Paper Award* were sponsored by Whitestein Technologies AG, Switzerland, and Elsevier Science, The Netherlands, respectively. The Spanish Association for Artificial Intelligence (AEPIA) provided limited financial support to its members who were co-authors of accepted papers so that they could give their presentations at CIA 2003.

CIA 2003 featured 2 invited, 17 regular (long), and 6 short papers selected from 60 submissions. The result of the peer-review of all contributions is included in this volume, rich in interesting, inspiring, and advanced work on research and development of intelligent information agents worldwide. All workshop proceedings have been published by Springer-Verlag as Lecture Notes in Artificial Intelligence volumes: 1202 (1997), 1435 (1998), 1652 (1999), 1860 (2000), 2182 (2001), and 2446 (2002).

The CIA 2003 workshop was organized in cooperation with the Association for Computing Machinery (ACM). In addition, we are very much indebted to our sponsors, whose financial support made this event possible and contributed to its success. The sponsors of CIA 2003 were:

TELIA SONERA, Finland
NOKIA, Finland
WHITESTEIN TECHNOLOGIES, Switzerland
ELSEVIER SCIENCE, The Netherlands
SPANISH ASSOCIATION FOR ARTIFICIAL INTELLIGENCE, Spain

We are also grateful to the authors and invited speakers for contributing to this workshop, as well as to all the members of the program committee and the external reviewers for their very careful, critical, and thoughtful reviews of all submissions. Finally, a deep thanks goes to each of the brave members of the local organization team at TeliaSonera in Helsinki for their hard work in providing CIA 2003 with a modern, comfortable location, and an exclusive social program. We hope you enjoyed CIA 2003, and were inspired!

August 2003

Matthias Klusch, Andrea Omicini,
Sascha Ossowski, Heimo Laamanen

Co-chairs

Matthias Klusch	DFKI, Germany, <i>General Chair</i>
Andrea Omicini	University of Bologna, Italy
Sascha Ossowski	University of Rey Juan Carlos in Madrid, Spain
Heimo Laamanen	TeliaSonera, Finland, <i>Local Chair</i>

Program Committee

Elisabeth Andre	University of Augsburg, Germany
Ricardo Baeza-Yates	University of Chile, Chile
Wolfgang Benn	TU Chemnitz, Germany
Sonia Bergamaschi	University of Modena, Italy
Brahim Chaib-draa	Laval University, Canada
Rose Dieng	INRIA, France
Frank Dignum	University of Utrecht, The Netherlands
Fausto Giunchiglia	University of Trento, Italy
Rune Gustavsson	Blekinge TH, Sweden
Heikki Helin	Sonera, Finland
Mike Huhns	University of South Carolina, USA
Toru Ishida	University of Kyoto, Japan
Manfred Jeusfeld	University of Tilburg, The Netherlands
Catholijn Jonker	Free University of Amsterdam, The Netherlands
Hillol Kargupta	UMBC, USA
Larry Kerschberg	George Mason University, USA
Sarit Kraus	University of Maryland, USA
Daniel Kudenko	University of York, UK
Victor Lesser	University of Massachusetts, USA
Mike Luck	University of Southampton, UK
Martti Mäntylä	Helsinki Institute for Information Technology, Finland
Dennis McLeod	University of Southern California, USA
Werner Nutt	Heriot-Watt University Edinburgh, UK
Eugenio Oliveira	University of Porto, Portugal
Terry Payne	University of Southampton, UK
Michal Pechoucek	TU Prague, Czech Republic
Paolo Petta	Austrian Research Institute for AI, Austria
Enric Plaza	CSIC AI Research Lab, Spain
Alun Preece	University of Aberdeen, UK
Kimmo Raatikainen	Nokia Research Center, Finland
Roope Raisamo	University of Tampere, Finland
Omer F. Rana	University of Wales, UK
Volker Roth	Fraunhofer IGD, Germany

Heiko Schuldt	ETH Zurich, Switzerland
Onn Shehory	IBM Research, Israel
Amit Sheth	University of Georgia, USA
Carles Sierra	CSIC AI Research Lab, Spain
Von-Wun Soo	National Tsing Hua University, Taiwan
Leon Stirling	University of Melbourne, Australia
Rudi Studer	University of Karlsruhe, Germany
Henry Tirri	University of Helsinki, Finland
Steven Willmott	UPC Barcelona, Spain
Mike Wooldridge	University of Liverpool, UK
Eric Yu	University of Toronto, Canada
Chengqi Zhang	University of Technology Sydney, Australia
Ning Zhong	Maebashi Institute of Technology, Japan

Local Organizing Committee

Heikki Helin	TeliaSonera, Finland
Heimo Laamanen	TeliaSonera, Finland
Mikko Laukkanen	TeliaSonera, Finland
Martti Mäntylä	Helsinki Institute of Information Technology, Finland
Kimmo Raatikainen	University of Helsinki, Finland
Roope Raisamo	University of Tampere, Finland
Henry Tirri	University of Helsinki, Finland

External Reviewers

Tibor Bosse	Ralf Neubert
Seokkyung Chung	Guilherme Pereira
Pilar Dellunde	Jan Peters
Otmar Görlitz	Enric Plaza
Mario Gomez	Avi Rosenfeld
Francesco Guerra	Luis Sarmento
Meirav Hadad	Teresa Solchaga
Aizhong Lin	Nenad Stojanovic
Maria-Victoria Belmonte Martinez	Maurizio Vincini
Rebecca Montanari	

Table of Contents

Pervasive Information Service Provision

ACCESS: An Agent Architecture for Ubiquitous Service Delivery	1
<i>Conor Muldoon, Gregory O'Hare, Donnacha Phelan, Robin Strahan, Rem Collier</i>	
Adaptive Agent-Based Service Composition for Wireless Terminals	16
<i>Sasu Tarkoma, Mikko Laukkanen</i>	
An Information Notification Model with VPC on KODAMA in an Ubiquitous Computing Environment, and Its Experiment	30
<i>Tadashi Iwao, Satoshi Amamiya, Kenichi Takahashi, Guoqiang Zhong, Tatsuya Kainuma, Lusheng Ji, Makoto Amamiya</i>	

Information Agents and Peer-to-Peer Computing

INVITED CONTRIBUTION

Multi-agent Systems and Peer-to-Peer Computing: Methods, Systems, and Challenges	46
<i>Manolis Koubarakis</i>	
A Peer-to-Peer Approach to Resource Discovery in Multi-agent Systems	62
<i>Vassilios V. Dimakopoulos, Evaggelia Pitoura</i>	
Ostensive Automatic Schema Mapping for Taxonomy-Based Peer-to-Peer Systems	78
<i>Yannis Tzitzikas, Carlo Meghini</i>	

Issues of Trading and Negotiation

Proposal-Based Negotiation in Convex Regions	93
<i>Marco Cadoli</i>	
A Conversational Component-Based Open Multi-agent Architecture for Flexible Information Trading	109
<i>Habin Lee, Patrik Mihailescu, John Shepherdson</i>	
The Search for Coalition Formation in Costly Environments	117
<i>David Sarne, Sarit Kraus</i>	

Information Gathering and Integration

GraniteNights – A Multi-agent Visit Scheduler Utilising Semantic Web Technology 137
Gunnar Aastrand Grimnes, Stuart Chalmers, Pete Edwards, Alun Preece

Send Fredo off to Do This, Send Fredo off to Do That 152
Luís Botelho, Hugo Mendes, Pedro Figueiredo, Rui Marinheiro

Database Integration Using Mobile Agents 160
Philip S. Medcraft, Ulrich Schiel, Cláudio S. Baptista

Collaborative Search and Filtering

Adaptive Web Search Based on a Colony of Cooperative Distributed Agents 168
Fabio Gasparetti, Alessandro Micarelli

Agents for Collaborative Filtering 184
Fabrcio Enembreck, Jean-Paul Barthès

Collaboration in Open Environments

INVITED CONTRIBUTION
 Emergence and Stability of Collaborations Among Rational Agents 192
Sandip Sen, Partha Sarathi Dutta, Sabyasachi Saha

A Framework for the Social Description of Resources in Open Environments 206
Matthias Nickles, Gerhard Weiß

A Coordination Framework for a Community of Over-Helping Agents 222
Franck Gaultier

Issues of Trust in Agent-Based Information Provision

Trust Networks on the Semantic Web 238
Jennifer Golbeck, Bijan Parsia, James Hendler

Exchanging Advice and Learning to Trust 250
Luís Nunes, Eugénio Oliveira

Information Agent Systems Engineering (1)

A Component-Based Approach for Interoperability across FIPA-Compliant Platforms 266
Mercedes Amor, Lidia Fuentes, José M^a. Troya

Logic Programming for Evolving Agents	281
<i>Jose J. Alferes, Antonio Brogi, Joao A. Leite, Luis M. Pereira</i>	
Temporal and Spatial Analysis to Personalise an Agent's Dynamic Belief, Desire, and Intention Profiles	298
<i>Catholijn M. Jonker, Vagan Terziyan, Jan Treur</i>	
Information Agent Systems Engineering (2)	
Meta-reasoning for Agents' Private Knowledge Detection	316
<i>Jan Tožička, Jaroslav Bárta, Michal Pěchouček</i>	
Formalizing Retrieval Goal Change by Prioritized Circumscription – Preliminary Report –	324
<i>Ken Satoh</i>	
Organisational Change: Deliberation and Modification	336
<i>Catholijn M. Jonker, Martijn C. Schut, Jan Treur</i>	
Author Index	345

Preface

These are the proceedings of the 7th International Workshop on Cooperative Information Agents (CIA 2003), held at the Sonera Conference Center in Helsinki, Finland, August 27–29, 2003. It was co-located with the 4th Agentcities Information Days.

One key challenge of developing advanced agent-based information systems is to balance the autonomy of networked data and knowledge sources with the potential payoff of leveraging them by the appropriate use of intelligent information agents on the Internet. An information agent is a computational software entity that has access to one or multiple, heterogeneous, and distributed data and information sources; proactively searches for and maintains relevant information on behalf of its human users or other agents, preferably just-in-time. In other words, it is managing and overcoming the difficulties associated with information overload in the open and exponentially growing Internet and Web. Depending on the application and tasks at hand information agents may collaborate in open, networked data and information environments to provide added value to a variety of applications in different domains. Thus, research and development of information agents is inherently interdisciplinary: It requires expertise in information retrieval, artificial intelligence, database systems, human-computer interaction, and Internet and Web technology.

Initiated in 1997, the purpose of the annual international workshop series on cooperative information agents (CIA) is to provide an interdisciplinary forum for researchers, software developers, and managers to get informed about, present, and discuss the latest high-quality results in advancements of theory and practice in information agent technology for the Internet and Web. Each event of this renowned series attempts to capture the intrinsic interdisciplinary nature of this research area by calling for contributions from different research communities, and by promoting open and informative discussions on all related topics. Since 2001, the series also issues a Best Paper Award, and a System Innovation Award, to acknowledge highly innovative research and development, respectively, in the domain of intelligent information agents.

In keeping with its tradition, this year's workshop featured a sequence of regular and invited talks of excellence given by leading experts in the field. These talks covered a broad area of topics of interest, such as pervasive information service provision; information agents and peer-to-peer computing; and information gathering and integration. Other topics were methods for negotiation and interaction; collaborative search and filtering; as well as issues of trust and engineering of information agent systems.

This year the *CIA System Innovation Award* and the *CIA Best Paper Award* were sponsored by Whitestein Technologies AG, Switzerland, and Elsevier Science, The Netherlands, respectively. The Spanish Association for Artificial Intelligence (AEPIA) provided limited financial support to its members who were co-authors of accepted papers so that they could give their presentations at CIA 2003.

CIA 2003 featured 2 invited, 17 regular (long), and 6 short papers selected from 60 submissions. The result of the peer-review of all contributions is included in this volume, rich in interesting, inspiring, and advanced work on research and development of intelligent information agents worldwide. All workshop proceedings have been published by Springer-Verlag as Lecture Notes in Artificial Intelligence volumes: 1202 (1997), 1435 (1998), 1652 (1999), 1860 (2000), 2182 (2001), and 2446 (2002).

The CIA 2003 workshop was organized in cooperation with the Association for Computing Machinery (ACM). In addition, we are very much indebted to our sponsors, whose financial support made this event possible and contributed to its success. The sponsors of CIA 2003 were:

TELIA SONERA, Finland
NOKIA, Finland
WHITESTEIN TECHNOLOGIES, Switzerland
ELSEVIER SCIENCE, The Netherlands
SPANISH ASSOCIATION FOR ARTIFICIAL INTELLIGENCE, Spain

We are also grateful to the authors and invited speakers for contributing to this workshop, as well as to all the members of the program committee and the external reviewers for their very careful, critical, and thoughtful reviews of all submissions. Finally, a deep thanks goes to each of the brave members of the local organization team at TeliaSonera in Helsinki for their hard work in providing CIA 2003 with a modern, comfortable location, and an exclusive social program. We hope you enjoyed CIA 2003, and were inspired!

August 2003

Matthias Klusch, Andrea Omicini,
Sascha Ossowski, Heimo Laamanen

Co-chairs

Matthias Klusch	DFKI, Germany, <i>General Chair</i>
Andrea Omicini	University of Bologna, Italy
Sascha Ossowski	University of Rey Juan Carlos in Madrid, Spain
Heimo Laamanen	TeliaSonera, Finland, <i>Local Chair</i>

Program Committee

Elisabeth Andre	University of Augsburg, Germany
Ricardo Baeza-Yates	University of Chile, Chile
Wolfgang Benn	TU Chemnitz, Germany
Sonia Bergamaschi	University of Modena, Italy
Brahim Chaib-draa	Laval University, Canada
Rose Dieng	INRIA, France
Frank Dignum	University of Utrecht, The Netherlands
Fausto Giunchiglia	University of Trento, Italy
Rune Gustavsson	Blekinge TH, Sweden
Heikki Helin	Sonera, Finland
Mike Huhns	University of South Carolina, USA
Toru Ishida	University of Kyoto, Japan
Manfred Jeusfeld	University of Tilburg, The Netherlands
Catholijn Jonker	Free University of Amsterdam, The Netherlands
Hillol Kargupta	UMBC, USA
Larry Kerschberg	George Mason University, USA
Sarit Kraus	University of Maryland, USA
Daniel Kudenko	University of York, UK
Victor Lesser	University of Massachusetts, USA
Mike Luck	University of Southampton, UK
Martti Mäntylä	Helsinki Institute for Information Technology, Finland
Dennis McLeod	University of Southern California, USA
Werner Nutt	Heriot-Watt University Edinburgh, UK
Eugenio Oliveira	University of Porto, Portugal
Terry Payne	University of Southampton, UK
Michal Pechoucek	TU Prague, Czech Republic
Paolo Petta	Austrian Research Institute for AI, Austria
Enric Plaza	CSIC AI Research Lab, Spain
Alun Preece	University of Aberdeen, UK
Kimmo Raatikainen	Nokia Research Center, Finland
Roope Raisamo	University of Tampere, Finland
Omer F. Rana	University of Wales, UK
Volker Roth	Fraunhofer IGD, Germany

Heiko Schuldt	ETH Zurich, Switzerland
Onn Shehory	IBM Research, Israel
Amit Sheth	University of Georgia, USA
Carles Sierra	CSIC AI Research Lab, Spain
Von-Wun Soo	National Tsing Hua University, Taiwan
Leon Stirling	University of Melbourne, Australia
Rudi Studer	University of Karlsruhe, Germany
Henry Tirri	University of Helsinki, Finland
Steven Willmott	UPC Barcelona, Spain
Mike Wooldridge	University of Liverpool, UK
Eric Yu	University of Toronto, Canada
Chengqi Zhang	University of Technology Sydney, Australia
Ning Zhong	Maebashi Institute of Technology, Japan

Local Organizing Committee

Heikki Helin	TeliaSonera, Finland
Heimo Laamanen	TeliaSonera, Finland
Mikko Laukkanen	TeliaSonera, Finland
Martti Mäntylä	Helsinki Institute of Information Technology, Finland
Kimmo Raatikainen	University of Helsinki, Finland
Roope Raisamo	University of Tampere, Finland
Henry Tirri	University of Helsinki, Finland

External Reviewers

Tibor Bosse	Ralf Neubert
Seokkyung Chung	Guilherme Pereira
Pilar Dellunde	Jan Peters
Otmar Görlitz	Enric Plaza
Mario Gomez	Avi Rosenfeld
Francesco Guerra	Luis Sarmento
Meirav Hadad	Teresa Solchaga
Aizhong Lin	Nenad Stojanovic
Maria-Victoria Belmonte Martinez	Maurizio Vincini
Rebecca Montanari	

Table of Contents

Pervasive Information Service Provision

ACCESS: An Agent Architecture for Ubiquitous Service Delivery	1
<i>Conor Muldoon, Gregory O'Hare, Donnacha Phelan, Robin Strahan, Rem Collier</i>	
Adaptive Agent-Based Service Composition for Wireless Terminals	16
<i>Sasu Tarkoma, Mikko Laukkanen</i>	
An Information Notification Model with VPC on KODAMA in an Ubiquitous Computing Environment, and Its Experiment	30
<i>Tadashi Iwao, Satoshi Amamiya, Kenichi Takahashi, Guoqiang Zhong, Tatsuya Kainuma, Lusheng Ji, Makoto Amamiya</i>	

Information Agents and Peer-to-Peer Computing

INVITED CONTRIBUTION

Multi-agent Systems and Peer-to-Peer Computing: Methods, Systems, and Challenges	46
<i>Manolis Koubarakis</i>	
A Peer-to-Peer Approach to Resource Discovery in Multi-agent Systems	62
<i>Vassilios V. Dimakopoulos, Evaggelia Pitoura</i>	
Ostensive Automatic Schema Mapping for Taxonomy-Based Peer-to-Peer Systems	78
<i>Yannis Tzitzikas, Carlo Meghini</i>	

Issues of Trading and Negotiation

Proposal-Based Negotiation in Convex Regions	93
<i>Marco Cadoli</i>	
A Conversational Component-Based Open Multi-agent Architecture for Flexible Information Trading	109
<i>Habin Lee, Patrik Mihailescu, John Shepherdson</i>	
The Search for Coalition Formation in Costly Environments	117
<i>David Sarne, Sarit Kraus</i>	

Information Gathering and Integration

GraniteNights – A Multi-agent Visit Scheduler Utilising Semantic Web Technology	137
<i>Gunnar Aastrand Grimnes, Stuart Chalmers, Pete Edwards, Alun Preece</i>	

Send Fredo off to Do This, Send Fredo off to Do That	152
<i>Luís Botelho, Hugo Mendes, Pedro Figueiredo, Rui Marinheiro</i>	

Database Integration Using Mobile Agents	160
<i>Philip S. Medcraft, Ulrich Schiel, Cláudio S. Baptista</i>	

Collaborative Search and Filtering

Adaptive Web Search Based on a Colony of Cooperative Distributed Agents	168
<i>Fabio Gasparetti, Alessandro Micarelli</i>	

Agents for Collaborative Filtering	184
<i>Fabrcio Enembreck, Jean-Paul Barthès</i>	

Collaboration in Open Environments

INVITED CONTRIBUTION	
Emergence and Stability of Collaborations Among Rational Agents	192
<i>Sandip Sen, Partha Sarathi Dutta, Sabyasachi Saha</i>	

A Framework for the Social Description of Resources in Open Environments	206
<i>Matthias Nickles, Gerhard Weiß</i>	

A Coordination Framework for a Community of Over-Helping Agents	222
<i>Franck Gaultier</i>	

Issues of Trust in Agent-Based Information Provision

Trust Networks on the Semantic Web	238
<i>Jennifer Golbeck, Bijan Parsia, James Hendler</i>	

Exchanging Advice and Learning to Trust	250
<i>Luís Nunes, Eugénio Oliveira</i>	

Information Agent Systems Engineering (1)

A Component-Based Approach for Interoperability across FIPA-Compliant Platforms	266
<i>Mercedes Amor, Lidia Fuentes, José M^a. Troya</i>	

Logic Programming for Evolving Agents	281
<i>Jose J. Alferes, Antonio Brogi, Joao A. Leite, Luis M. Pereira</i>	
Temporal and Spatial Analysis to Personalise an Agent's Dynamic Belief, Desire, and Intention Profiles	298
<i>Catholijn M. Jonker, Vagan Terziyan, Jan Treur</i>	
Information Agent Systems Engineering (2)	
Meta-reasoning for Agents' Private Knowledge Detection	316
<i>Jan Tožička, Jaroslav Bárta, Michal Pěchouček</i>	
Formalizing Retrieval Goal Change by Prioritized Circumscription – Preliminary Report –	324
<i>Ken Satoh</i>	
Organisational Change: Deliberation and Modification	336
<i>Catholijn M. Jonker, Martijn C. Schut, Jan Treur</i>	
Author Index	345

Preface

These are the proceedings of the 7th International Workshop on Cooperative Information Agents (CIA 2003), held at the Sonera Conference Center in Helsinki, Finland, August 27–29, 2003. It was co-located with the 4th Agentcities Information Days.

One key challenge of developing advanced agent-based information systems is to balance the autonomy of networked data and knowledge sources with the potential payoff of leveraging them by the appropriate use of intelligent information agents on the Internet. An information agent is a computational software entity that has access to one or multiple, heterogeneous, and distributed data and information sources; proactively searches for and maintains relevant information on behalf of its human users or other agents, preferably just-in-time. In other words, it is managing and overcoming the difficulties associated with information overload in the open and exponentially growing Internet and Web. Depending on the application and tasks at hand information agents may collaborate in open, networked data and information environments to provide added value to a variety of applications in different domains. Thus, research and development of information agents is inherently interdisciplinary: It requires expertise in information retrieval, artificial intelligence, database systems, human-computer interaction, and Internet and Web technology.

Initiated in 1997, the purpose of the annual international workshop series on cooperative information agents (CIA) is to provide an interdisciplinary forum for researchers, software developers, and managers to get informed about, present, and discuss the latest high-quality results in advancements of theory and practice in information agent technology for the Internet and Web. Each event of this renowned series attempts to capture the intrinsic interdisciplinary nature of this research area by calling for contributions from different research communities, and by promoting open and informative discussions on all related topics. Since 2001, the series also issues a Best Paper Award, and a System Innovation Award, to acknowledge highly innovative research and development, respectively, in the domain of intelligent information agents.

In keeping with its tradition, this year's workshop featured a sequence of regular and invited talks of excellence given by leading experts in the field. These talks covered a broad area of topics of interest, such as pervasive information service provision; information agents and peer-to-peer computing; and information gathering and integration. Other topics were methods for negotiation and interaction; collaborative search and filtering; as well as issues of trust and engineering of information agent systems.

This year the *CIA System Innovation Award* and the *CIA Best Paper Award* were sponsored by Whitestein Technologies AG, Switzerland, and Elsevier Science, The Netherlands, respectively. The Spanish Association for Artificial Intelligence (AEPIA) provided limited financial support to its members who were co-authors of accepted papers so that they could give their presentations at CIA 2003.

CIA 2003 featured 2 invited, 17 regular (long), and 6 short papers selected from 60 submissions. The result of the peer-review of all contributions is included in this volume, rich in interesting, inspiring, and advanced work on research and development of intelligent information agents worldwide. All workshop proceedings have been published by Springer-Verlag as Lecture Notes in Artificial Intelligence volumes: 1202 (1997), 1435 (1998), 1652 (1999), 1860 (2000), 2182 (2001), and 2446 (2002).

The CIA 2003 workshop was organized in cooperation with the Association for Computing Machinery (ACM). In addition, we are very much indebted to our sponsors, whose financial support made this event possible and contributed to its success. The sponsors of CIA 2003 were:

TELIA SONERA, Finland
NOKIA, Finland
WHITESTEIN TECHNOLOGIES, Switzerland
ELSEVIER SCIENCE, The Netherlands
SPANISH ASSOCIATION FOR ARTIFICIAL INTELLIGENCE, Spain

We are also grateful to the authors and invited speakers for contributing to this workshop, as well as to all the members of the program committee and the external reviewers for their very careful, critical, and thoughtful reviews of all submissions. Finally, a deep thanks goes to each of the brave members of the local organization team at TeliaSonera in Helsinki for their hard work in providing CIA 2003 with a modern, comfortable location, and an exclusive social program. We hope you enjoyed CIA 2003, and were inspired!

August 2003

Matthias Klusch, Andrea Omicini,
Sascha Ossowski, Heimo Laamanen

Co-chairs

Matthias Klusch	DFKI, Germany, <i>General Chair</i>
Andrea Omicini	University of Bologna, Italy
Sascha Ossowski	University of Rey Juan Carlos in Madrid, Spain
Heimo Laamanen	TeliaSonera, Finland, <i>Local Chair</i>

Program Committee

Elisabeth Andre	University of Augsburg, Germany
Ricardo Baeza-Yates	University of Chile, Chile
Wolfgang Benn	TU Chemnitz, Germany
Sonia Bergamaschi	University of Modena, Italy
Brahim Chaib-draa	Laval University, Canada
Rose Dieng	INRIA, France
Frank Dignum	University of Utrecht, The Netherlands
Fausto Giunchiglia	University of Trento, Italy
Rune Gustavsson	Blekinge TH, Sweden
Heikki Helin	Sonera, Finland
Mike Huhns	University of South Carolina, USA
Toru Ishida	University of Kyoto, Japan
Manfred Jeusfeld	University of Tilburg, The Netherlands
Catholijn Jonker	Free University of Amsterdam, The Netherlands
Hillol Kargupta	UMBC, USA
Larry Kerschberg	George Mason University, USA
Sarit Kraus	University of Maryland, USA
Daniel Kudenko	University of York, UK
Victor Lesser	University of Massachusetts, USA
Mike Luck	University of Southampton, UK
Martti Mäntylä	Helsinki Institute for Information Technology, Finland
Dennis McLeod	University of Southern California, USA
Werner Nutt	Heriot-Watt University Edinburgh, UK
Eugenio Oliveira	University of Porto, Portugal
Terry Payne	University of Southampton, UK
Michal Pechoucek	TU Prague, Czech Republic
Paolo Petta	Austrian Research Institute for AI, Austria
Enric Plaza	CSIC AI Research Lab, Spain
Alun Preece	University of Aberdeen, UK
Kimmo Raatikainen	Nokia Research Center, Finland
Roope Raisamo	University of Tampere, Finland
Omer F. Rana	University of Wales, UK
Volker Roth	Fraunhofer IGD, Germany

Heiko Schuldt	ETH Zurich, Switzerland
Onn Shehory	IBM Research, Israel
Amit Sheth	University of Georgia, USA
Carles Sierra	CSIC AI Research Lab, Spain
Von-Wun Soo	National Tsing Hua University, Taiwan
Leon Stirling	University of Melbourne, Australia
Rudi Studer	University of Karlsruhe, Germany
Henry Tirri	University of Helsinki, Finland
Steven Willmott	UPC Barcelona, Spain
Mike Wooldridge	University of Liverpool, UK
Eric Yu	University of Toronto, Canada
Chengqi Zhang	University of Technology Sydney, Australia
Ning Zhong	Maebashi Institute of Technology, Japan

Local Organizing Committee

Heikki Helin	TeliaSonera, Finland
Heimo Laamanen	TeliaSonera, Finland
Mikko Laukkanen	TeliaSonera, Finland
Martti Mäntylä	Helsinki Institute of Information Technology, Finland
Kimmo Raatikainen	University of Helsinki, Finland
Roope Raisamo	University of Tampere, Finland
Henry Tirri	University of Helsinki, Finland

External Reviewers

Tibor Bosse	Ralf Neubert
Seokkyung Chung	Guilherme Pereira
Pilar Dellunde	Jan Peters
Otmar Görlitz	Enric Plaza
Mario Gomez	Avi Rosenfeld
Francesco Guerra	Luis Sarmento
Meirav Hadad	Teresa Solchaga
Aizhong Lin	Nenad Stojanovic
Maria-Victoria Belmonte Martinez	Maurizio Vincini
Rebecca Montanari	

Table of Contents

Pervasive Information Service Provision

ACCESS: An Agent Architecture for Ubiquitous Service Delivery	1
<i>Conor Muldoon, Gregory O'Hare, Donnacha Phelan, Robin Strahan, Rem Collier</i>	
Adaptive Agent-Based Service Composition for Wireless Terminals	16
<i>Sasu Tarkoma, Mikko Laukkanen</i>	
An Information Notification Model with VPC on KODAMA in an Ubiquitous Computing Environment, and Its Experiment	30
<i>Tadashi Iwao, Satoshi Amamiya, Kenichi Takahashi, Guoqiang Zhong, Tatsuya Kainuma, Lusheng Ji, Makoto Amamiya</i>	

Information Agents and Peer-to-Peer Computing

INVITED CONTRIBUTION

Multi-agent Systems and Peer-to-Peer Computing: Methods, Systems, and Challenges	46
<i>Manolis Koubarakis</i>	
A Peer-to-Peer Approach to Resource Discovery in Multi-agent Systems	62
<i>Vassilios V. Dimakopoulos, Evaggelia Pitoura</i>	
Ostensive Automatic Schema Mapping for Taxonomy-Based Peer-to-Peer Systems	78
<i>Yannis Tzitzikas, Carlo Meghini</i>	

Issues of Trading and Negotiation

Proposal-Based Negotiation in Convex Regions	93
<i>Marco Cadoli</i>	
A Conversational Component-Based Open Multi-agent Architecture for Flexible Information Trading	109
<i>Habin Lee, Patrik Mihailescu, John Shepherdson</i>	
The Search for Coalition Formation in Costly Environments	117
<i>David Sarne, Sarit Kraus</i>	

Information Gathering and Integration

GraniteNights – A Multi-agent Visit Scheduler Utilising Semantic Web Technology 137
Gunnar Aastrand Grimnes, Stuart Chalmers, Pete Edwards, Alun Preece

Send Fredo off to Do This, Send Fredo off to Do That 152
Luís Botelho, Hugo Mendes, Pedro Figueiredo, Rui Marinheiro

Database Integration Using Mobile Agents 160
Philip S. Medcraft, Ulrich Schiel, Cláudio S. Baptista

Collaborative Search and Filtering

Adaptive Web Search Based on a Colony of Cooperative Distributed Agents 168
Fabio Gasparetti, Alessandro Micarelli

Agents for Collaborative Filtering 184
Fabrcio Enembreck, Jean-Paul Barthès

Collaboration in Open Environments

INVITED CONTRIBUTION
 Emergence and Stability of Collaborations Among Rational Agents 192
Sandip Sen, Partha Sarathi Dutta, Sabyasachi Saha

A Framework for the Social Description of Resources in Open Environments 206
Matthias Nickles, Gerhard Weiß

A Coordination Framework for a Community of Over-Helping Agents 222
Franck Gaultier

Issues of Trust in Agent-Based Information Provision

Trust Networks on the Semantic Web 238
Jennifer Golbeck, Bijan Parsia, James Hendler

Exchanging Advice and Learning to Trust 250
Luís Nunes, Eugénio Oliveira

Information Agent Systems Engineering (1)

A Component-Based Approach for Interoperability across FIPA-Compliant Platforms 266
Mercedes Amor, Lidia Fuentes, José M^a. Troya

Logic Programming for Evolving Agents	281
<i>Jose J. Alferes, Antonio Brogi, Joao A. Leite, Luis M. Pereira</i>	
Temporal and Spatial Analysis to Personalise an Agent's Dynamic Belief, Desire, and Intention Profiles	298
<i>Catholijn M. Jonker, Vagan Terziyan, Jan Treur</i>	
Information Agent Systems Engineering (2)	
Meta-reasoning for Agents' Private Knowledge Detection	316
<i>Jan Tožička, Jaroslav Bárta, Michal Pěchouček</i>	
Formalizing Retrieval Goal Change by Prioritized Circumscription – Preliminary Report –	324
<i>Ken Satoh</i>	
Organisational Change: Deliberation and Modification	336
<i>Catholijn M. Jonker, Martijn C. Schut, Jan Treur</i>	
Author Index	345