

The series "Advances in Intelligent Systems and Computing" contains publications on theory, applications, and design methods of Intelligent Systems and Intelligent Computing. Virtually all disciplines such as engineering, natural sciences, computer and information science, ICT, economics, business, e-commerce, environment, healthcare, life science are covered. The list of topics spans all the areas of modern intelligent systems and computing.

The publications within "Advances in Intelligent Systems and Computing" are primarily textbooks and proceedings of important conferences, symposia and congresses. They cover significant recent developments in the field, both of a foundational and applicable character. An important characteristic feature of the series is the short publication time and world-wide distribution. This permits a rapid and broad dissemination of research results.

Sigeru Omatsu · José Neves · Juan M. Corchado Rodríguez · Juan F. De Paz Santana  
Sara Rodríguez González (Eds.)

#### Distributed Computing and Artificial Intelligence

The International Symposium on Distributed Computing and Artificial Intelligence 2013 (DCAI 2013) is a forum in which applications of innovative techniques for solving complex problems are presented. Artificial intelligence is changing our society. Its application in distributed environments, such as the internet, electronic commerce, environment monitoring, mobile communications, wireless devices, distributed computing, to mention only a few, is continuously increasing, becoming an element of high added value with social and economic potential, in industry, quality of life, and research. This conference is a stimulating and productive forum where the scientific community can work towards future cooperation in Distributed Computing and Artificial Intelligence areas. These technologies are changing constantly as a result of the large research and technical effort being undertaken in both universities and businesses. The exchange of ideas between scientists and technicians from both the academic and industry sector is essential to facilitate the development of systems that can meet the ever increasing demands of today's society. This edition of DCAI brings together past experience, current work, and promising future trends associated with distributed computing, artificial intelligence and their application in order to provide efficient solutions to real problems. This symposium is organized by the Bioinformatics, Intelligent System and Educational Technology Research Group (<http://bisite.usal.es/>) of the University of Salamanca. The present edition was held in Salamanca, Spain, from 22nd to 24th May 2013.

Omatu et al. (Eds.)



## Distributed Computing and Artificial Intelligence

Sigeru Omatsu  
José Neves  
Juan M. Corchado Rodríguez  
Juan F. De Paz Santana  
Sara Rodríguez González (Eds.)

# Distributed Computing and Artificial Intelligence

10th International Conference

Springer

ISSN 2194-5357



Available  
online  
[springerlink.com](http://springerlink.com)

[springer.com](http://springer.com)

# Advances in Intelligent Systems and Computing

Volume 217

*Series Editor*

J. Kacprzyk, Warsaw, Poland

For further volumes:  
<http://www.springer.com/series/11156>



Sigeru Omatsu · José Neves  
Juan M. Corchado Rodríguez  
Juan F. De Paz Santana  
Sara Rodríguez González  
Editors

# Distributed Computing and Artificial Intelligence

10th International Conference



*Editors*

Sigeru Omatsu  
Graduate School of Engineering  
Osaka Prefecture University  
Osaka  
Japan

José Neves  
Department of Computing Science  
University of Minho  
Braga Codex  
Portugal

Juan M. Corchado Rodríguez  
Department of Computing Science and  
Control  
Faculty of Science  
University of Salamanca  
Salamanca  
Spain

Juan F. De Paz Santana  
Department of Computing Science and  
Control  
Faculty of Science  
University of Salamanca  
Salamanca  
Spain

Sara Rodríguez González  
Department of Computing Science and  
Control  
Faculty of Science  
University of Salamanca  
Salamanca  
Spain

ISSN 2194-5357  
ISBN 978-3-319-00550-8  
DOI 10.1007/978-3-319-00551-5  
Springer Cham Heidelberg New York Dordrecht London

ISSN 2194-5365 (electronic)  
ISBN 978-3-319-00551-5 (eBook)

Library of Congress Control Number: 2013937503

© Springer International Publishing Switzerland 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

## Preface

The International Symposium on Distributed Computing and Artificial Intelligence 2013 (DCAI 2013) is a forum to present applications of innovative techniques for solving complex problems. Artificial intelligence is changing our society. Its application in distributed environments, such as the internet, electronic commerce, environment monitoring, mobile communications, wireless devices, distributed computing, to mention only a few, is continuously increasing, becoming an element of high added value with social and economic potential, in industry, quality of life and research. These technologies are changing constantly as a result of the large research and technical effort being undertaken in both universities and businesses. The exchange of ideas between scientists and technicians from both the academic and industry sector is essential to facilitate the development of systems that can meet the ever-increasing demands of today's society. The present edition brings together past experience, current work and promising future trends associated with distributed computing, artificial intelligence and their application in order to provide efficient solutions to real problems.

This conference is a stimulating and productive forum where the scientific community can work towards future cooperation in Distributed Computing and Artificial Intelligence areas. Nowadays it is continuing to grow and prosper in its role as one of the premier conferences devoted to the quickly changing landscape of distributed computing, artificial intelligence and the application of AI to distributed systems. This year's technical program will present both high quality and diversity, with contributions in well-established and evolving areas of research. Specifically, 101 papers were submitted from over 19 different countries (Colombia, Czech Republic, Finland, France, Germany, Greece, Italy, Japan, Libya, Mauritius, Mexico, Morocco, Poland, Portugal, Romania, Slovakia, Spain, Thailand, Tunisia), representing a truly "wide area network" of research activity. The DCAI'13 technical program has selected 75 papers. As in past editions, it will be special issues in journals such as Journal of Artificial Intelligence (IJAI), the International Journal of Imaging and Robotics (IJIR) and the International Journal of Interactive Multimedia and Artificial Intelligence (IJIMAI). These special issues will cover extended versions of the most highly regarded works.

This symposium is organized by the Bioinformatics, Intelligent System and Educational Technology Research Group (<http://bisite.usal.es/>) of the University of Salamanca. The present edition was held in Salamanca, Spain, from 22nd to 24th May 2013.

We thank the sponsors (Telefónica Digital, Indra, INSA, Ingeniería de Software Avanzado S.A., IBM, JCyL, IEEE Systems Man and Cybernetics Society Spain, AEPIA Asociación Española para la Inteligencia Artificial, APPIA Associação Portuguesa Para a Inteligência Artificial, CNRS Centre national de la recherche scientifique), the Local Organization members and the Program Committee members for their hard work, which was essential for the success of DCAI'13.

Salamanca  
May 2013

Sigeru Omatsu  
José Neves  
Juan M. Corchado Rodríguez  
Juan F. De Paz Santana  
Sara Rodríguez González (Eds.)

# **Organization**

## **General Chairs**

Ajith Abraham	Norwegian University of Science and Technology
Juan M. Corchado	University of Salamanca (Spain)
James Llinas	State University of New York (USA)
José M. Molina	Universidad Carlos III de Madrid (Spain)
Andre Ponce de Leon	University of Sao Paulo at Sao Carlos (Brazil)

## **Scientific Chair**

Sigeru Omatsu (Chairman)	Osaka Institute of Technology (Japan)
José Neves (Chairman)	Universidade do Minho, Braga (Portugal)

## **Organizing Committee**

Jesús García Herrero	University Carlos III of Madrid (Spain)
Juan M. Corchado (Chairman)	University of Salamanca(Spain)
Sara Rodríguez (Co-Chairman)	University of Salamanca (Spain)
Juan F. De Paz (Co-Chairman)	University of Salamanca (Spain)
Javier Bajo	Polytechnic University of Madrid (Spain)
Dante I. Tapia	University of Salamanca (Spain)
Fernando de la Prieta Pintado	University of Salamanca (Spain)
Davinia Carolina	University of Salamanca (Spain)
Zato Domínguez	University of Salamanca (Spain)
Gabriel Villarrubia González	University of Salamanca (Spain)
Alejandro Sánchez Yuste	University of Salamanca (Spain)
Antonio Juan Sánchez Martín	University of Salamanca (Spain)
Cristian I. Pinzón	University of Salamanca (Spain)
Rosa Cano	University of Salamanca (Spain)
Emilio S. Corchado	University of Salamanca (Spain)

Eugenio Aguirre	University of Granada (Spain)
Manuel P. Rubio	University of Salamanca (Spain)
Belén Pérez Lancho	University of Salamanca (Spain)
Angélica González Arrieta	University of Salamanca (Spain)
Vivian F. López	University of Salamanca (Spain)
Ana de Luís	University of Salamanca (Spain)
Ana B. Gil	University of Salamanca (Spain)
M <sup>a</sup> Dolores Muñoz Vicente	University of Salamanca (Spain)

### Scientific Committee

Zbigniew Pasek	IMSE/University of Windsor (Canada)
Adriana Giret	Politechnich University of Valencia (Spain)
Alberto Fernández	University Rey Juan Carlos (Spain)
Álvaro Herrero	University of Burgos (Spain)
Ana Carolina Lorena	Federal University of ABC (Brazil)
Andre Coelho	University of Fortaliza (Brazil)
Ângelo Costa	University of Minho (Portugal)
Antonio Moreno	University Rovira y Virgili(Spain)
Antonio Pereira	Instituto Politécnico de Leiria (Portugal)
Araceli Sanchís	University Carlos III of Madrid (Spain)
Ayako HIRAMATSU	Osaka Sangyo University (JAPAN)
B. Cristina Pelayo García-Bustelo	University of Oviedo (Spain)
Bianca Innocenti	University of Girona (Spain)
Bogdan Gabrys	Bournemouth University (UK)
Bruno Baroque	University of Burgos (Spain)
Carina González	University of La Laguna (Spain)
Carlos Carrascosa	Politechnich University of Valencia (Spain)
Carmen Benavides	University of Leon (Spain)
Daniel Glez-Peña	University of Vigo (Spain)
David Griol Barres	University Carlos III of Madrid (Spain)
Davide Carneiro	University of Minho (Portugal)
Dídac Busquets	University of Girona (Spain)
Dongshik KANG	Ryukyu University (JAPAN)
Eladio Sanz	University of Salamanca (Spain)
Eleni Mangina	University College Dublin (Ireland)
Emilio Corchado	University of Burgos (Spain)
Eugenio Aguirre	University of Granada (Spain)
Eugénio Oliveira	University of Porto (Portugal)
Evelio J. González	University of La Laguna (Spain)
Faraón Llorens Largo	University of Alicante (Spain)
Fernando Díaz	Univesity of Valladolid (Spain)
Fidel Aznar Gregori	University of Alicante (Spain)
Florentino Fdez-Riverola	University of de Vigo (Spain)

Organization	IX
--------------	----

Francisco Pujol López	Polytechnic University of Alicante (Spain)
Grzegorz Bocewicz -Koszalin	University of technology (Poland)
Helder Coelho	University of Lisbon (Portugal)
Ichiro Satoh	Thammasat University (Japan)
Ivan López Arévalo	Lab. of Information Technology Cinvestav-(Mexico)
Jamal Dargham	University of Malaysia, Saba, (Malaysia)
Javier Carbó	University Carlos III of Madrid (Spain)
Javier Martínez Elicegui	Telefónica I+D (Spain)
Jesús García Herrero	University Carlos III of Madrid (Spain)
Joao Gama	University of Porto (Portugal)
Johan Lilius	Åbo Akademi University (Finland)
José R. Villar	University of Oviedo (Spain)
Juan A. Botia	University of Murcia (Spain)
Juan Pavón	Complutense University of Madrid (Spain)
José M. Molina	University Carlos III of Madrid (Spain)
José R. Méndez	University of Vigo (Spain)
José V. Álvarez-Bravo	University of Valladolid (Spain)
Joseph Giampapa	Carnegie Mellon (USA)
Juan Manuel Cueva Lovelle	University of Oviedo (Spain)
Juan Gómez Romero	University Carlos III of Madrid (Spain)
Kazutoshi Fujikawa	Nara Institute of Science and Technology (Japan)
Lourdes Borrajo	University of Vigo (Spain)
Luis Alonso	University of Salamanca (Spain)
Luis Correia	University of Libon(Portugal)
Luis F. Castillo	Autonomous University of Manizales (Colombia)
Luís Lima	Polytechnic of Porto, (Portugal)
Manuel González-Bedia	University of Zaragoza (Spain)
Manuel Pegalajar Cuéllar	University of Granada (Spain)
Manuel Resinas	University of Sevilla (Spain)
Marcilio Souto	Federal University of Rio Grande do Norte (Brazil)
Margarida Cardoso	ISCTE (Portugal)
Maria del Mar Pujol López	University of Alicante (Spain)
Michael Zaki	University Rostok (Germany)
Michifumi Yoshioka	Osaka Prefecture University, (JAPAN)
Masanori Akiyoshi	Osaka University (JAPAN)
Masaru Teranishi	Hiroshima Institute of Technology (Japan)
Masatake Akutagawa	University of Tokushima (JAPAN)
Michifumi Yoshioka	Osaka Prefecture University, (JAPAN)
Miguel Ángel Patricio	University Carlos III of Madrid (Spain)
Miguel Delgado	University of Granada(Spain)
Miguel Molina	University of Granada(Spain)
Miguel Rebollo	University of Vigo (Spain)
Mohd Saberi Mohamad	University of Technology Malaysia (MALAYSIA)
Noki Mori	Osaka Prefecture University (Japan)

Nora Muda	National University of Malaysia (Malaysia)
Norihisa Komoda	Osaka University (Japan)
Paulo Novais	Polytechnic University of Minho (Portugal)
Pawel Pawlewski	Poznan University of Technology (Poland)
Peter Fobrig	University Rostok (Germany)
Ichiro Satoh	Thammasat University (Japan)
Rafael Corchuelo	Catholic University of Sevilla (Spain)
Ramón Rizo	University of Alicante (Spain)
René Leistikow	University Rostok (Germany)
Rodrigo Mello	University of Sao Paulo (Brazil)
Rubén Fuentes	Complutense University of Madrid (Spain)
Rui Camacho	University of Porto (Portugal)
Sebastian Bader	University of Rostock (Germany)
Seiichi Ozawa	Kobe University, JAPAN
Seiji Ito	Hiroshima Institute of Technology (Japan)
Seyedsaeid Mirkamali	University of Mysore (India)
Shanmugasundaram Hariharan	B.S.A. Rahman University Vandalur (India)
Silvana Aciar	University of Girona (Spain)
Shiro Tamaki	University of the Ryukyus (Japan)
Sofya V. Zhukova	St. Petersburg State University (Russia)
Toru Yamamoto	Hiroshima University (JAPAN)
Takuya Maekawa	Osaka University (JAPAN)
Vicente Botti	Politechnich University of Valencia (Spain)
Vicente Julián	Politechnich University of Valencia (Spain)
Victor J. Sosa-Sosa	Laboratory of Inf. Technology (LTI) (México)
Viet-Hoang VU	Hanoi University of Technology (Vietnam)
Waldo Fajardo	University of Granada(Spain)
Worawan Diaz Carballo	National Institute of Informatics (Thailand)
Yi Fang	Purdue University (USA)
Yusuke NOJIMA	Osaka Prefecture University (JAPAN)
Yutaka MAEDA	Kansai University (JAPAN)
Zbigniew Banaszak	University of Koszalin (Poland)

## Preface

The International Symposium on Distributed Computing and Artificial Intelligence 2013 (DCAI 2013) is a forum to present applications of innovative techniques for solving complex problems. Artificial intelligence is changing our society. Its application in distributed environments, such as the internet, electronic commerce, environment monitoring, mobile communications, wireless devices, distributed computing, to mention only a few, is continuously increasing, becoming an element of high added value with social and economic potential, in industry, quality of life and research. These technologies are changing constantly as a result of the large research and technical effort being undertaken in both universities and businesses. The exchange of ideas between scientists and technicians from both the academic and industry sector is essential to facilitate the development of systems that can meet the ever-increasing demands of today's society. The present edition brings together past experience, current work and promising future trends associated with distributed computing, artificial intelligence and their application in order to provide efficient solutions to real problems.

This conference is a stimulating and productive forum where the scientific community can work towards future cooperation in Distributed Computing and Artificial Intelligence areas. Nowadays it is continuing to grow and prosper in its role as one of the premier conferences devoted to the quickly changing landscape of distributed computing, artificial intelligence and the application of AI to distributed systems. This year's technical program will present both high quality and diversity, with contributions in well-established and evolving areas of research. Specifically, 101 papers were submitted from over 19 different countries (Colombia, Czech Republic, Finland, France, Germany, Greece, Italy, Japan, Libya, Mauritius, Mexico, Morocco, Poland, Portugal, Romania, Slovakia, Spain, Thailand, Tunisia), representing a truly "wide area network" of research activity. The DCAI'13 technical program has selected 75 papers. As in past editions, it will be special issues in journals such as Journal of Artificial Intelligence (IJAI), the International Journal of Imaging and Robotics (IJIR) and the International Journal of Interactive Multimedia and Artificial Intelligence (IJIMAI). These special issues will cover extended versions of the most highly regarded works.

This symposium is organized by the Bioinformatics, Intelligent System and Educational Technology Research Group (<http://bisite.usal.es/>) of the University of Salamanca. The present edition was held in Salamanca, Spain, from 22nd to 24th May 2013.

We thank the sponsors (Telefónica Digital, Indra, INSA, Ingeniería de Software Avanzado S.A., IBM, JCyL, IEEE Systems Man and Cybernetics Society Spain, AEPIA Asociación Española para la Inteligencia Artificial, APPIA Associação Portuguesa Para a Inteligência Artificial, CNRS Centre national de la recherche scientifique), the Local Organization members and the Program Committee members for their hard work, which was essential for the success of DCAI'13.

Salamanca  
May 2013

Sigeru Omatsu  
José Neves  
Juan M. Corchado Rodríguez  
Juan F. De Paz Santana  
Sara Rodríguez González (Eds.)

# **Organization**

## **General Chairs**

Ajith Abraham	Norwegian University of Science and Technology
Juan M. Corchado	University of Salamanca (Spain)
James Llinas	State University of New York (USA)
José M. Molina	Universidad Carlos III de Madrid (Spain)
Andre Ponce de Leon	University of Sao Paulo at Sao Carlos (Brazil)

## **Scientific Chair**

Sigeru Omatsu (Chairman)	Osaka Institute of Technology (Japan)
José Neves (Chairman)	Universidade do Minho, Braga (Portugal)

## **Organizing Committee**

Jesús García Herrero	University Carlos III of Madrid (Spain)
Juan M. Corchado (Chairman)	University of Salamanca(Spain)
Sara Rodríguez (Co-Chairman)	University of Salamanca (Spain)
Juan F. De Paz (Co-Chairman)	University of Salamanca (Spain)
Javier Bajo	Polytechnic University of Madrid (Spain)
Dante I. Tapia	University of Salamanca (Spain)
Fernando de la Prieta Pintado	University of Salamanca (Spain)
Davinia Carolina	University of Salamanca (Spain)
Zato Domínguez	University of Salamanca (Spain)
Gabriel Villarrubia González	University of Salamanca (Spain)
Alejandro Sánchez Yuste	University of Salamanca (Spain)
Antonio Juan Sánchez Martín	University of Salamanca (Spain)
Cristian I. Pinzón	University of Salamanca (Spain)
Rosa Cano	University of Salamanca (Spain)
Emilio S. Corchado	University of Salamanca (Spain)

Eugenio Aguirre	University of Granada (Spain)
Manuel P. Rubio	University of Salamanca (Spain)
Belén Pérez Lancho	University of Salamanca (Spain)
Angélica González Arrieta	University of Salamanca (Spain)
Vivian F. López	University of Salamanca (Spain)
Ana de Luís	University of Salamanca (Spain)
Ana B. Gil	University of Salamanca (Spain)
M <sup>a</sup> Dolores Muñoz Vicente	University of Salamanca (Spain)

### Scientific Committee

Zbigniew Pasek	IMSE/University of Windsor (Canada)
Adriana Giret	Politechnich University of Valencia (Spain)
Alberto Fernández	University Rey Juan Carlos (Spain)
Álvaro Herrero	University of Burgos (Spain)
Ana Carolina Lorena	Federal University of ABC (Brazil)
Andre Coelho	University of Fortaliza (Brazil)
Ângelo Costa	University of Minho (Portugal)
Antonio Moreno	University Rovira y Virgili(Spain)
Antonio Pereira	Instituto Politécnico de Leiria (Portugal)
Araceli Sanchís	University Carlos III of Madrid (Spain)
Ayako HIRAMATSU	Osaka Sangyo University (JAPAN)
B. Cristina Pelayo García-Bustelo	University of Oviedo (Spain)
Bianca Innocenti	University of Girona (Spain)
Bogdan Gabrys	Bournemouth University (UK)
Bruno Baroque	University of Burgos (Spain)
Carina González	University of La Laguna (Spain)
Carlos Carrascosa	Politechnich University of Valencia (Spain)
Carmen Benavides	University of Leon (Spain)
Daniel Glez-Peña	University of Vigo (Spain)
David Griol Barres	University Carlos III of Madrid (Spain)
Davide Carneiro	University of Minho (Portugal)
Dídac Busquets	University of Girona (Spain)
Dongshik KANG	Ryukyu University (JAPAN)
Eladio Sanz	University of Salamanca (Spain)
Eleni Mangina	University College Dublin (Ireland)
Emilio Corchado	University of Burgos (Spain)
Eugenio Aguirre	University of Granada (Spain)
Eugénio Oliveira	University of Porto (Portugal)
Evelio J. González	University of La Laguna (Spain)
Faraón Llorens Largo	University of Alicante (Spain)
Fernando Díaz	Univesity of Valladolid (Spain)
Fidel Aznar Gregori	University of Alicante (Spain)
Florentino Fdez-Riverola	University of de Vigo (Spain)

Organization	IX
--------------	----

Francisco Pujol López	Polytechnic University of Alicante (Spain)
Grzegorz Bocewicz -Koszalin	University of technology (Poland)
Helder Coelho	University of Lisbon (Portugal)
Ichiro Satoh	Thammasat University (Japan)
Ivan López Arévalo	Lab. of Information Technology Cinvestav-(Mexico)
Jamal Dargham	University of Malaysia, Saba, (Malaysia)
Javier Carbó	University Carlos III of Madrid (Spain)
Javier Martínez Elicegui	Telefónica I+D (Spain)
Jesús García Herrero	University Carlos III of Madrid (Spain)
Joao Gama	University of Porto (Portugal)
Johan Lilius	Åbo Akademi University (Finland)
José R. Villar	University of Oviedo (Spain)
Juan A. Botia	University of Murcia (Spain)
Juan Pavón	Complutense University of Madrid (Spain)
José M. Molina	University Carlos III of Madrid (Spain)
José R. Méndez	University of Vigo (Spain)
José V. Álvarez-Bravo	University of Valladolid (Spain)
Joseph Giampapa	Carnegie Mellon (USA)
Juan Manuel Cueva Lovelle	University of Oviedo (Spain)
Juan Gómez Romero	University Carlos III of Madrid (Spain)
Kazutoshi Fujikawa	Nara Institute of Science and Technology (Japan)
Lourdes Borrajo	University of Vigo (Spain)
Luis Alonso	University of Salamanca (Spain)
Luis Correia	University of Libon(Portugal)
Luis F. Castillo	Autonomous University of Manizales (Colombia)
Luís Lima	Polytechnic of Porto, (Portugal)
Manuel González-Bedia	University of Zaragoza (Spain)
Manuel Pegalajar Cuéllar	University of Granada (Spain)
Manuel Resinas	University of Sevilla (Spain)
Marcilio Souto	Federal University of Rio Grande do Norte (Brazil)
Margarida Cardoso	ISCTE (Portugal)
Maria del Mar Pujol López	University of Alicante (Spain)
Michael Zaki	University Rostok (Germany)
Michifumi Yoshioka	Osaka Prefecture University, (JAPAN)
Masanori Akiyoshi	Osaka University (JAPAN)
Masaru Teranishi	Hiroshima Institute of Technology (Japan)
Masatake Akutagawa	University of Tokushima (JAPAN)
Michifumi Yoshioka	Osaka Prefecture University, (JAPAN)
Miguel Ángel Patricio	University Carlos III of Madrid (Spain)
Miguel Delgado	University of Granada(Spain)
Miguel Molina	University of Granada(Spain)
Miguel Rebollo	University of Vigo (Spain)
Mohd Saberi Mohamad	University of Technology Malaysia (MALAYSIA)
Noki Mori	Osaka Prefecture University (Japan)

Nora Muda	National University of Malaysia (Malaysia)
Norihisa Komoda	Osaka University (Japan)
Paulo Novais	Polytechnic University of Minho (Portugal)
Pawel Pawlewski	Poznan University of Technology (Poland)
Peter Fobrig	University Rostok (Germany)
Ichiro Satoh	Thammasat University (Japan)
Rafael Corchuelo	Catholic University of Sevilla (Spain)
Ramón Rizo	University of Alicante (Spain)
René Leistikow	University Rostok (Germany)
Rodrigo Mello	University of Sao Paulo (Brazil)
Rubén Fuentes	Complutense University of Madrid (Spain)
Rui Camacho	University of Porto (Portugal)
Sebastian Bader	University of Rostock (Germany)
Seiichi Ozawa	Kobe University, JAPAN
Seiji Ito	Hiroshima Institute of Technology (Japan)
Seyedsaeid Mirkamali	University of Mysore (India)
Shanmugasundaram Hariharan	B.S.A. Rahman University Vandalur (India)
Silvana Aciar	University of Girona (Spain)
Shiro Tamaki	University of the Ryukyus (Japan)
Sofya V. Zhukova	St. Petersburg State University (Russia)
Toru Yamamoto	Hiroshima University (JAPAN)
Takuya Maekawa	Osaka University (JAPAN)
Vicente Botti	Politechnich University of Valencia (Spain)
Vicente Julián	Politechnich University of Valencia (Spain)
Victor J. Sosa-Sosa	Laboratory of Inf. Technology (LTI) (México)
Viet-Hoang VU	Hanoi University of Technology (Vietnam)
Waldo Fajardo	University of Granada(Spain)
Worawan Diaz Carballo	National Institute of Informatics (Thailand)
Yi Fang	Purdue University (USA)
Yusuke NOJIMA	Osaka Prefecture University (JAPAN)
Yutaka MAEDA	Kansai University (JAPAN)
Zbigniew Banaszak	University of Koszalin (Poland)

# Contents

## **Image Processing, Tracking, Robotic, Control and Industrial Systems**

<b>Improving the Performance of NEAT Related Algorithm via Complexity Reduction in Search Space .....</b>	<b>1</b>
<i>Heman Mohabeer, K.M.S. Soyjaudah</i>	
<b>Intelligent Application to Reduce Transit Accidents in a City Using Cultural Algorithms .....</b>	<b>9</b>
<i>Fernando Maldonado, Alberto Ochoa, Julio Arreola, Daniel Azpeitia, Ariel De la Torre, Diego Canales, Saúl González</i>	
<b>Synchronization Policies Impact in Distributed Agent-Based Simulation .....</b>	<b>19</b>
<i>Omar Rihawi, Yann Secq, Philippe Mathieu</i>	
<b>Parallel Hoeffding Decision Tree for Streaming Data .....</b>	<b>27</b>
<i>Piotr Cal, Michał Woźniak</i>	
<b>Stochastic Decentralized Routing of Unsplittable Vehicle Flows Using Constraint Optimization .....</b>	<b>37</b>
<i>Maksims Fiosins</i>	
<b>Extending Semantic Web Tools for Improving Smart Spaces Interoperability and Usability .....</b>	<b>45</b>
<i>Natalia Díaz Rodríguez, Johan Lilius, Manuel Pegalajar Cuéllar, Miguel Delgado Calvo-Flores</i>	
<b>OPTICS-Based Clustering of Emails Represented by Quantitative Profiles .....</b>	<b>53</b>
<i>Vladimír Špitálský and Marian Grendár</i>	

<b>Optimal Saving and Prudence in a Possibilistic Framework</b> .....	61
<i>Ana Maria Lucia Casademunt, Irina Georgescu</i>	
<b>Semantic Annotation and Retrieval of Services in the Cloud</b> .....	69
<i>Miguel Ángel Rodríguez-García, Rafael Valencia-García, Francisco García-Sánchez, Jose Javier Samper-Zapater, Isidoro Gil-Leiva</i>	
<b>Simulating a Team Behaviour of Affective Agents Using Robocode</b> .....	79
<i>António Rebelo, Fábio Catalão, João Alves, Goreti Marreiros, Cesar Analide, Paulo Novais, José Neves</i>	
<b>New Algorithms</b>	
<b>Qualitative Acceleration Model: Representation, Reasoning and Application</b> .....	87
<i>Ester Martínez-Martín, María Teresa Escrig, Angel P. del Pobil</i>	
<b>Framework of Optimization Methodology with Use of an Intelligent Hybrid Transport Management System Based on Hopfield Network and Travelling Salesman Problem</b> .....	95
<i>Natalia Kubiak, Agnieszka Stachowiak</i>	
<b>Selecting the Shortest Itinerary in a Cloud-Based Distributed Mobility Network</b> .....	103
<i>Jelena Fiosina, Maksims Fiosins</i>	
<b>Application of Genetic Algorithms to Determine Closest Targets in Data Envelopment Analysis</b> .....	111
<i>Raul Martínez-Moreno, Jose J. Lopez-Espin, Juan Aparicio, Jesus T. Pastor</i>	
<b>Odor Classification Based on Weakly Responding Sensors</b> .....	121
<i>Sigeru Omatsu, Mitsuaki Yano, Toru Fujinaka</i>	
<b>A Model to Visualize Information in a Complex Streets' Network</b> .....	129
<i>Taras Agryzkov, José L. Oliver, Leandro Tortosa, José F. Vicent</i>	
<b>Case-Based Reasoning Applied to Medical Diagnosis and Treatment</b> .....	137
<i>Xiomara Blanco, Sara Rodríguez, Juan M. Corchado, Carolina Zato</i>	
<b>Multiple Agents for Data Processing</b> .....	147
<i>Ichiro Satoh</i>	
<b>Migrants Selection and Replacement in Distributed Evolutionary Algorithms for Dynamic Optimization</b> .....	155
<i>Yesnier Bravo, Gabriel Luque, Enrique Alba</i>	

**Multi-agent Systems**

<b>Ubiquitous Computing to Lower Domestic Violence Rate Based on Emotional Support Social Network (Redsiam)</b> . . . . .	163
<i>Lourdes Margain, Guadalupe Gutiérrez, Begoña García, Amaia Méndez, Alberto Ochoa, Alejandro de Luna, Gabriela Hernández</i>	
<b>Multiobjective Local Search Techniques for Evolutionary Polygonal Approximation</b> . . . . .	171
<i>José L. Guerrero, Antonio Berlanga, José M. Molina</i>	
<b>GSched: An Efficient Scheduler for Hybrid CPU-GPU HPC Systems</b> . . . . .	179
<i>Mariano Raboso Mateos, Juan Antonio Cotobal Robles</i>	
<b>Comparison of K-Means and Fuzzy C-Means Data Mining Algorithms for Analysis of Management Information: An Open Source Case</b> . . . . .	187
<i>Angélica Urrutia, Hector Valdes, José Galindo</i>	
<b>Mobile-Based Distributed System for Managing Abandoned or Lost Pets</b> . . . . .	197
<i>Daniel Garrote-Hildebrand, José-Luis Poza-Luján, Juan-Luis Posadas-Yagüe, José-Enrique Simó-Ten</i>	
<b>Robust Optimization of Intradomain Routing Using Evolutionary Algorithms</b> . . . . .	201
<i>Vitor Pereira, Pedro Sousa, Paulo Cortez, Miguel Rio, Miguel Rocha</i>	
<b>A MAS for Teaching Computational Logic</b> . . . . .	209
<i>Jose Alberto Maestro-Prieto, M<sup>a</sup> Aránzazu Simón-Hurtado, Juan F. de-Paz-Santana, Gabriel Villarrubia-González</i>	
<b>Fast Post-Disaster Emergency Vehicle Scheduling</b> . . . . .	219
<i>Roberto Amadini, Imane Sefrioui, Jacopo Mauro, Maurizio Gabbielli</i>	
<b>Creating GPU-Enabled Agent-Based Simulations Using a PDES Tool</b> . . . . .	227
<i>Worawan Marurngsith, Yanyong Mongkolsin</i>	
<b>Agent and Knowledge Models for a Distributed Imaging System</b> . . . . .	235
<i>Naoufel Khayati, Wided Lejouad-Chaari</i>	
<b>DPS: Overview of Design Pattern Selection Based on MAS Technology</b> . . . . .	243
<i>Eiman M. Salah, Maha T. Zabata, Omar M. Sallabi</i>	

<b>Representing Motion Patterns with the Qualitative Rectilinear Projection Calculus .....</b>	251
<i>Francisco Jose Glez-Cabrera, Jose Vicente Álvarez-Bravo, Fernando Díaz</i>	
<b>Event Management Proposal for Distribution Data Service Standard .....</b>	259
<i>José-Luis Poza-Luján, Juan-Luis Posadas-Yagüe, José-Enrique Simó-Ten</i>	
<b>Trajectory Optimization under Changing Conditions through Evolutionary Approach and Black-Box Models with Refining .....</b>	267
<i>Karel Macek, Jiří Rojíček, Vladimír Bičík</i>	
<b>Modelling Agents' Risk Perception .....</b>	275
<i>Nuno Trindade Magessi, Luis Antunes</i>	
<b>On the Use of PSO with Weights Adaptation in Concurrent Multi-Issue Negotiations .....</b>	283
<i>Kakia Panagidi, Kostas Kolomvatsos, Stathes Hadjiefthymiades</i>	
<b>Monitoring Weight and Physical Activity Using an AmI Setting .....</b>	291
<i>João Ferreira, Rafaela Rosário, Ângelo Costa, Paulo Novais</i>	
<b>Distributed Computing, Grid Computing, Cloud Computing</b>	
<b>An Emotional Aware Architecture to Support Facilitator in Group Idea Generation Process .....</b>	299
<i>João Laranjeira, Goreti Marreiros, João Carneiroa, Paulo Novais</i>	
<b>Social Networks Gamification for Sustainability Recommendation Systems .....</b>	307
<i>Fábio Silva, Cesar Analide, Luís Rosa, Gilberto Felgueiras, Cedric Pimenta</i>	
<b>Web-Based Solution for Acquisition, Processing, Archiving and Diffusion of Endoscopy Studies .....</b>	317
<i>Isabel Laranjo, Joel Braga, Domingos Assunção, Andreia Silva, Carla Rolanda, Luís Lopes, Jorge Correia-Pinto, Victor Alves</i>	
<b>Texture Classification with Neural Networks .....</b>	325
<i>William Raveane, María Angélica González Arrieta</i>	
<b>A Context Aware Architecture to Support People with Partial Visual Impairments .....</b>	333
<i>João Fernandes, João Laranjeira, Paulo Novais, Goreti Marreiros, José Neves</i>	

Contents	XV
<b>Automatic Prediction of Poisonous Mushrooms by Connectionist Systems .....</b>	341
<i>María Navarro Cáceres, María Angélica González Arrieta</i>	
<b>Adaptive Learning in Games: Defining Profiles of Competitor Players .....</b>	351
<i>Tiago Pinto, Zita Vale</i>	
<b>Bioinformatics, Biomedical Systems, e-health, Ambient Assisting Living</b>	
<b>Associative Learning for Enhancing Autonomous Bots in Videogame Design .....</b>	361
<i>Sergio Moreno, Manuel G. Bedia, Francisco J. Serón, Luis Fernando Castillo, Gustavo Isaza</i>	
<b>An Integral System Based on Open Organization of Agents for Improving the Labour Inclusion of Disabled People .....</b>	369
<i>Alejandro Sánchez, Carolina Zato, Gabriel Villarrubia-González, Javier Bajo, Juan Francisco De Paz</i>	
<b>+Cloud: An Agent-Based Cloud Computing Platform .....</b>	377
<i>Roberto González, Daniel Hernández, Fernando De la Prieta, Ana Belén Gil</i>	
<b>Representation of Propositional Data for Collaborative Filtering .....</b>	385
<i>Andrzej Szwabe, Paweł Misiorek, Michał Ciesielczyk</i>	
<b>Face Identification by Real-Time Connectionist System .....</b>	393
<i>Pedro Galdámez, Angélica González</i>	
<b>QoS Synchronization of Web Services: A Multi Agent-Based Model .....</b>	401
<i>Jaber Kouki, Walid Chainbi, Khaled Ghedira</i>	
<b>Data mining, Information Extraction, Semantic, Knowledge Representation</b>	
<b>Comparing Basic Design Options for Management Accounting Systems with an Agent-Based Simulation .....</b>	409
<i>Friederike Wall</i>	
<b>Potential Norms Detection in Social Agent Societies .....</b>	419
<i>Moamin A. Mahmoud, Aida Mustapha, Mohd Sharifuddin Ahmad, Azhana Ahmad, Mohd Zaliman M. Yusoff, Nurzeatul Hamimah Abdul Hamid</i>	

<b>Collision Avoidance of Mobile Robots Using Multi-Agent Systems . . . . .</b>	429
<i>Angel Soriano, Enrique J. Bernabeu, Angel Valera, Marina Vallés</i>	
<b>Multi-Agent Architecture for Intelligent Insurance Systems . . . . .</b>	439
<i>Egona Lavendelis</i>	
<b>Evaluation Framework for Statistical User Models . . . . .</b>	449
<i>Javier Calle, Leonardo Castaño, Elena Castro, Dolores Cuadra</i>	
<b>Agent Mediated Electronic Market Enhanced with Ontology Matching Services and Emergent Social Networks . . . . .</b>	457
<i>Virgínia Nascimento, Maria João Viamonte, Alda Canito, Nuno Silva</i>	
<b>Artificial Intelligence Applications</b>	
<b>Semantic Multi-Agent Architecture to Road Traffic Information Retrieval on the Web of Data . . . . .</b>	465
<i>J. Javier Samper, Dolores M. Llidó, Juan José Martínez, Ramon V. Cirilo</i>	
<b>Personalised Advertising Supported by Agents . . . . .</b>	473
<i>Bruno Veloso, Luís Sousa, Benedita Malheiro</i>	
<b>Two Approaches to Bounded Model Checking for a Soft Real-Time Epistemic Computation Tree Logic . . . . .</b>	483
<i>Artur Meski, Bożena Woźna-Szczęśniak, Agnieszka M. Zbrzezny, Andrzej Zbrzezny</i>	
<b>Towards an AOSE: Game Development Methodology . . . . .</b>	493
<i>Rula Al-Azawi, Aladdin Ayesh, Ian Kenny, Khalfan Abdullah AL-Masruri</i>	
<b>Periodic Chemotherapy Dose Schedule Optimization Using Genetic Algorithm . . . . .</b>	503
<i>Nadia Alam, Munira Sultana, M.S. Alam, M.A. Al-Mamun, M.A. Hossain</i>	
<b>Mobile-Agent Based Delay-Tolerant Network Architecture for Non-Critical Aeronautical Data Communications . . . . .</b>	513
<i>Rubén Martínez-Vidal, Sergio Castillo-Pérez, Sergi Robles, Miguel Cordero, Antidio Viguria, Nicolás Giuditta</i>	
<b>A Preliminary Study on Early Diagnosis of Illnesses Based on Activity Disturbances . . . . .</b>	521
<i>Silvia González, José R. Villar, Javier Sedano, Camelia Chira</i>	

Contents	XVII
<b>Towards an Adaptable Mobile Agents' Management System</b> .....	529
<i>Mohammad Bashir Uddin Khan, Ghada Abaza, Peter Göhner</i>	
<b>Glove-based Input for Reusing Everyday Objects as Interfaces in Smart Environments</b> .....	537
<i>Ionuț-Alexandru Zaiți, Ștefan-Gheorghe Pentiuc</i>	
<b>Suboptimal Restraint Use as an Emergent Norm via Social Influence</b> ...	545
<i>Felicitas Mokom, Ziad Kobi</i>	
<b>Implementing MAS Agreement Processes Based on Consensus Networks</b> .....	553
<i>Alberto Palomares, Carlos Carrascosa, Miguel Rebollo, Yolanda Gómez</i>	
<b>Agent-Based Interoperability for e-Government</b> .....	561
<i>Fábio Marques, Gonçalo Paiva Dias, André Zúquete</i>	
<b>Context- and Social-Aware User Profiling for Audiovisual Recommender Systems</b> .....	569
<i>César A. Mantilla, Víctor Torres-Padrosa, Ramón Fabregat</i>	
<b>Current Trends in Bio-Ontologies and Data Integration</b> .....	579
<i>Rafael Pereira, Rui Mendes</i>	
<b>Challenges in Development of Real Time Multi-Robot System Using Behaviour Based Agents</b> .....	587
<i>Aleksis Liekna, Egons Lavendelis, Agris Nikitenko</i>	
<b>Application of Hybrid Agents to Smart Energy Management of a Prosumer Node</b> .....	597
<i>Pasquale Caianiello, Stefania Costantini, Giovanni De Gasperis, Niva Florio, Federico Gobbo</i>	
<b>Structuring and Exploring the Biomedical Literature Using Latent Semantics</b> .....	609
<i>Sérgio Matos, Hugo Araújo, José Luís Oliveira</i>	
<b>Upper Ontology for Multi-Agent Energy Systems' Applications</b> .....	617
<i>Gabriel Santos, Tiago Pinto, Zita Vale, Hugo Morais, Isabel Praça</i>	
<b>A Practical Mobile Robot Agent Implementation Based on a Google Android Smartphone</b> .....	625
<i>Dani Martínez, Javier Moreno, Davinia Font, Marcel Tresanchez, Tomàs Pallejà, Mercè Teixidó, Jordi Palacín</i>	

<b>Cloud-Based Platform to Labor Integration of Deaf People .....</b>	633
<i>Amparo Jiménez, Amparo Casado, Javier Bajo, Fernando De la Prieta, Juan Francisco De Paz</i>	
<b>Author Index .....</b>	641