

Lecture Notes in Artificial Intelligence

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Emilio Corchado Marek Kurzyński  
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# Hybrid Artificial Intelligent Systems

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Proceedings, Part I

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# Preface

Hybrid intelligent systems are becoming more and more popular due to their capabilities in handling many real-world complex problems, involving imprecision, uncertainty, vagueness and high dimensionality. Intelligent systems are pervasive in our society and growing in size and complexity at an astonishing pace, and the response to the coming challenges will come; as always it has the modularity and the ability to decompose problems and find the best partial solution. In this paradigm, hybrid intelligent systems are the natural approach to the problems, rather than the exceptional case. They provide us with the opportunity to use both our knowledge and raw data to solve problems in a more interesting and promising way. This multidisciplinary research field is in a continuous expansion within the artificial intelligence research community.

The 6<sup>th</sup> International Conference on Hybrid Artificial Intelligence Systems (HAIS 2011) provided an interesting opportunity to present and discuss the latest theoretical advances and real-world applications in this multidisciplinary research field.

The volume of *Lecture Notes in Artificial Intelligence* (LNAI) includes accepted papers presented at HAIS 2011, which took place in Wroclaw University of Technology, Wroclaw, Poland, in May 2011.

Since the first edition held in Brazil in 2006, HAIS has become an important forum for researchers working on fundamental and theoretical aspects of hybrid artificial intelligence systems based on the use of agent and multi-agent systems, bioinformatics and bio-inspired models, fuzzy systems, artificial vision, artificial neural models, optimization models, compound and combined classification and alike.

HAIS 2011 received 241 technical submissions. After a rigorous peer-review process the International Program Committee selected 114 papers, which are published in these conference proceedings. In this edition emphasis was put to the organization of special sessions. Nine special sessions were organized on the following topics:

- Hybrid Intelligence System on Logistics and Intelligent Optimization
- Metaheuristics for Combinatorial Optimization and Modelling Complex Systems
- Hybrid Systems for Context-Based Information Fusion
- Methods of Classifier Fusion
- Intelligent Systems for Data Mining and Applications
- Systems, Man, and Cybernetics
- Hybrid Artificial Intelligence Systems in Management of Production Systems
- Hybrid Artificial Intelligent Systems for Medical Applications
- Hybrid Intelligent Approaches in Cooperative Multi-robot Systems

The editors would like to express their deep thanks to authors for their valuable submissions and all reviewers and special session organizers for their hard work. A thorough peer-review process is very important to maintain the high quality of a conference and the HAIS series of conferences would not exist without their help.

As a follow-up of the conference, we anticipate further publication of selected papers in special issues of the following journals:

- *Computational Intelligence*, Wiley-Blackwell
- *Expert Systems*, Wiley-Blackwell
- *Neurocomputing*, Elsevier
- *Journal of Applied Logic*, Elsevier

HAIS 2011 enjoyed outstanding keynote speeches by distinguished guest speakers:

- Ajith Abraham - Machine Intelligence Research Labs (USA)
- Francisco Herrera - University of Granada (Spain)
- Adam Krzyżak - Concordia University (Canada)
- Juliusz Lech Kulikowski - M. Nalecz Institute of Biocybernetics and Biomedical Engineering PAS (Poland)
- James Llinas - State University of New York at Buffalo (USA)
- B. John Oommen - Carleton University (Canada)
- Gerald Schaefer - Loughborough University (UK)

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We would like to thank Alfred Hofmann and Anna Kramer from Springer for their help and collaboration during the publication process.

Last but not least we would like to give special thanks to the local organizing team (Robert Burduk, Konrad Jackowski, Bartosz Krawczyk, Maciej Krysmann, Bartosz Kurlej, Piotr Sobolewski, Szymon Sztajer, Marcin Zmysłony, Andrzej Żołnierek) who did a great job.

May 2011

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## **Hybrid Intelligent Approaches in Cooperative Multi-robot Systems**

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# Hybrid Artificial Intelligent Systems for Medical Application

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