

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos

New York University, NY, USA

Doug Tygar

University of California, Berkeley, CA, USA

Moshe Y. Vardi

Rice University, Houston, TX, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

José Mira José R. Álvarez (Eds.)

Mechanisms, Symbols, and Models Underlying Cognition

First International Work-Conference on the Interplay
Between Natural and Artificial Computation, IWINAC 2005
Las Palmas, Canary Islands, Spain, June 15-18, 2005
Proceedings, Part I



Springer

Volume Editors

José Mira
José R. Álvarez
Universidad Nacional de Educación a Distancia
E.T.S. de Ingeniería Informática
Departamento de Inteligencia Artificial
Juan del Rosal, 16, 28040 Madrid, Spain
E-mail: {jmira, jras}@dia.uned.es

Library of Congress Control Number: 2005927486

CR Subject Classification (1998): F.1, F.2, I.2, G.2, I.4, I.5, J.3, J.4, J.1

ISSN	0302-9743
ISBN-10	3-540-26298-9 Springer Berlin Heidelberg New York
ISBN-13	978-3-540-26298-5 Springer Berlin Heidelberg New York

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

Springer is a part of Springer Science+Business Media

springeronline.com

© Springer-Verlag Berlin Heidelberg 2005

Printed in Germany

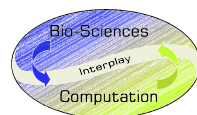
Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 11499220 06/3142 5 4 3 2 1 0

José Mira
José R. Álvarez (Eds.)

In Search of Mechanisms, Symbols, and Models underlying Cognition

**International Work-conference on the Interplay
between Natural and Artificial Computation, IWINAC2005
Las Palmas de Gran Canaria, Spain, June 2005
Proceedings, Part I**

Lecture Notes in Computer Science



[...]

Volume Editors

José Mira

José R. Álvarez

Universidad Nacional de Educación a Distancia

E.T.S. de Ingeniería Informática

Departamento de Inteligencia Artificial

Juan del Rosal, 16. E-28040 Madrid, Spain

E-mail: jmira,jras@dia.uned.es

[...]

Preface

The computational paradigm considered here is a conceptual, theoretical and formal framework situated above machines and living creatures (two instantiations), sufficiently solid, and still non-exclusive, that allows us:

1. to help neuroscientists to formulate intentions, questions, experiments, methods and explanation mechanisms assuming that neural circuits are the psychological support of calculus;
2. to help scientists and engineers from the fields of artificial intelligence (AI) and knowledge engineering (KE) to model, formalize and program the computable part of human knowledge;
3. to establish an interaction framework between natural system computation (NSC) and artificial system computation (ASC) in both directions, from ASC to NSC (in computational neuroscience), and from NSC to ASC (in bioinspired computation).

With these global purposes, we organized IWINAC 2005, the 1st International Work Conference on the Interplay Between Natural and Artificial Computation, which took place in Las Palmas de Gran Canaria, Canary Islands (Spain), during June 15–18, 2005, trying to contribute to both directions of the interplay:

- I:** From Artificial to Natural Computation. What can computation, artificial intelligence (AI) and knowledge engineering (KE) contribute to the understanding of the nervous system, cognitive processes and social behavior? This is the scope of computational neuroscience and cognition, which uses the computational paradigm to model and improve our understanding of natural science.
- II:** From Natural Sciences to Computation, AI and KE. How can computation, AI and KE find inspiration in the behavior and internal functioning of physical, biological and social systems to conceive, develop and build up new concepts, materials, mechanisms and algorithms of potential value in real-world applications? This is the scope of the new bionics, known as bioinspired engineering and computation, as well as of natural computing.

To address the two questions posed in the scope of IWINAC 2005, we made use of the “building of and for knowledge” concepts that distinguish three levels of description in each calculus: the physical level (PL), where the hardware lives, the symbol level (SL) where the programs live, and a third level, introduced by Newell and Marr, situated above the symbol level and named by Newell as “the knowledge level” (KL) and by Marr as the level of “the theory of calculus.” We seek the interplay between the natural and the artificial at each one of these three levels (PL, SL, KL).

1. For the interplay at the **physical level** we consider:

- **Computational Neuroscience.** *Tools:* Conceptual, formal and computational tools and methods in the modelling of neuronal processes and neural nets: individual and collective dynamics. *Mechanisms:* Computational modelling of neural mechanisms at the architectural level: oscillatory/regulatory feedback loops, lateral inhibition, reflex arches, connectivity and signal routing networks, distributed central-patterns generators. Contributions to the library of neural circuitry. *Plasticity:* Models of memory, adaptation, learning and other plasticity phenomena. Mechanisms of reinforcement, self-organization, anatomo-physiological coordination and structural coupling.
- **Bio-inspired Circuits and Mechanisms.** *Electronics:* Bio-inspired electronics and computer architectures. Advanced models for ANN. Evolvable hardware (CPLDs, FPGAs, etc.). Adaptive cellular automata. Redundancy, parallelism and fault-tolerant computation. Retinotopic organizations. *Non-conventional (Natural) Computation:* Biomaterials for computational systems. DNA, cellular and membrane computing. *Sensory and Motor Prostheses:* Signal processing, artificial cochlea, audio-tactile vision substitution. Artificial sensory and motor systems for hand-icapped people. Intersensory transfer and sensory plasticity.

2. For the interplay at the **symbol level** we consider:

- **Neuro-informatics.** *Symbols:* From neurons to neurophysiological symbols (regularities, synchronization, resonance, dynamics binding and other potential mechanisms underlying neural coding). Neural data structures and neural “algorithms.” *Brain Databases:* Neural data analysis, integration and sharing. Standardization, construction and use of databases in neuroscience and cognition. *Neurosimulators:* Development and use of biologically oriented neurosimulators. Contributions to the understanding of the relationships between structure and function in biology.
- **Bio-inspired Programming Strategies.** *Behavior-Based Computational Methods:* Reactive mechanisms. Self-organizing optimization. Collective emergent behavior (ant colonies). Ethology and artificial life. *Evolutionary Computation:* Genetic algorithms, evolutionary strategies, evolutionary programming and genetic programming. Macroevolution and the interplay between evolution and learning. *Hybrid Approaches:* Neuro-symbolic integration. Knowledge-based ANN and connectionist KBS. Neuro-fuzzy systems. Hybrid adaptation and learning at the symbol level.

3. For the Interplay at the **knowledge level** we consider:

- **Computational Approaches to Cognition.** *AI and KE:* Use of AI and KE concepts, tools and methods in the modelling of mental processes and behavior. Contribution to the AI debate on paradigms for knowledge representation and use: symbolic (representational), connectionist, situated, and hybrid. *Controversies:* Open questions and controversies in

AI and Cognition (semantics versus syntax, knowledge as mechanisms that know, cognition without computation, etc.). Minsky, Simon, Newell, Marr, Searle, Maturana, Clancey, Brooks, Pylyshyn, Fodor, and others. *Knowledge Modelling*: Reusability of components in knowledge modelling (libraries of tasks, methods, inferences and roles). Ontologies (generic, domain-specific, object-oriented, methods and tasks). Knowledge representation methodologies and knowledge edition tools.

- **Cognitive Inspiration in AI and KE.** *Synthetic Cognition*: Bio-inspired modelling of cognitive tasks. Perception, decision-making, planning and control. Biologically plausible (user-sensitive) man-machine interfaces. Natural language programming attempts. Social organizations, distributed AI, and multi-agent systems. *Bio-inspired Solutions to Engineering, Computational and Social Problems in Different Application Domains*: Medicine, image understanding, KBSs and ANNs for diagnoses, therapy planning, and patient follow-up. Telemedicine. Robotic paradigms. Dynamic vision. Path planning, map building, and behavior-based navigation methods. Anthropomorphic robots. Health biotechnology. Bio-inspired solutions for sustainable growth and development.

IWINAC 2005 was organized by the Universidad Nacional de Educación a Distancia (UNED) in cooperation with the Instituto Universitario de Ciencias y Tecnologías Cibernéticas de la Universidad de Las Palmas de Gran Canaria and the Las Palmas UNED Associated Center.

Sponsorship was obtained from the Spanish Ministerio de Ciencia y Tecnología and the organizing universities (UNED and Las Palmas de Gran Canaria).

The chapters of these two books of proceedings correspond to the talks delivered at the IWINAC 2005 conference. After the refereeing process, 117 papers were accepted for oral or poster presentation, according to the authors' preferences. We organized these papers into two volumes basically following the topics list previously mentioned. The first volume, entitled "*In Search of Mechanisms, Symbols, and Models Underlying Cognition*," includes all the contributions mainly related to the methodological, conceptual, formal, and experimental developments in the fields of neurophysiology and cognitive science.

In the second volume, "*Artificial Intelligence and Knowledge Engineering Applications: A Bioinspired Approach*," we have collected the papers related to bioinspired programming strategies and all the contributions related to the computational solutions to engineering problems in different application domains.

And now is the time for acknowledgements. A task like this, organizing a work conference with a well-defined scope, cannot be achieved without the active engagement of a broad set of colleagues who share with us the conference principles, foundations and objectives. First, let me express my sincere gratitude to all the scientific and organizing committees, in particular, the members of these committees who acted as effective and efficient referees and as promoters and managers of preorganized sessions on autonomous and relevant topics under the IWINAC global scope. Thanks also to the invited speakers, Joost N. Kok,

Dana Ballard and Juan Vicente Sánchez Andrés, for synthesizing the plenary lectures. Finally, thanks to all the authors for their interest in our call and their efforts in preparing the papers, condition sine qua non for these proceedings.

My debt of gratitude to José Ramón Alvarez and Félix de la Paz goes further the frontiers of a preface. Without their collaboration IWINAC 2005 would not have been possible, in the strictest sense. And the same is true concerning Springer and Alfred Hofmann, for being continuously receptive and for collaborating on all our editorial joint ventures on the interplay between neuroscience and computation, from the first IWANN in Granada (1991, LNCS 540), to the successive meetings in Sitges (1993, LNCS 686), Torremolinos (1995, LNCS 930), Lanzarote (1997, LNCS 1240), Alicante (1999, LNCS 1606 and 1607), again in Granada (2001, LNCS 2084 and 2085), then in Maó (Menorca) (2003, LNCS 2686 and 2687) and, now, the first IWINAC in Las Palmas.

June 2005

José Mira

Organization

General Chairman

José Mira, UNED (Spain)

Organizing Committee

José Ramón Álvarez Sánchez, UNED (Spain)

Félix de la Paz López, UNED (Spain)

Local Organizing Committee

Roberto Moreno-Díaz, Jr., Univ. Las Palmas de Gran Canaria (Spain)

Alexis Quesada, Univ. Las Palmas de Gran Canaria (Spain)

José Carlos Rodríguez, Univ. Las Palmas de Gran Canaria (Spain)

Cristobal García Blairsy, UNED (Spain)

José Antonio Muñoz, Univ. Las Palmas de Gran Canaria (Spain)

Invited Speakers

Joost N. Kok, Leiden University (The Netherlands)

Dana Ballard, University of Rochester (USA)

Juan Vicente Sánchez Andrés, University of La Laguna (Spain)

Field Editors

Eris Chinellato, Universitat Jaume I (Spain)

Carlos Cotta, University of Málaga (Spain)

Angel P. del Pobil, Universitat Jaume I (Spain)

Antonio Fernández-Caballero, Universidad de Castilla-La Mancha (Spain)

Oscar Herreras, Hospital Ramón y Cajal (Spain)

Heinz Hügli, University of Neuchâtel (Switzerland)

Roque Marín, Universidad de Murcia (Spain)

Carlos Martin-Vide, Rovira i Virgili University of Tarragona (Spain)

Victor Mitrana, Rovira i Virgili University of Tarragona (Spain)

José T. Palma Méndez, University of Murcia (Spain)

Miguel Angel Patricio Guisado, Universidad de Alcalá (Spain)

Eduardo Sánchez Vila, Universidad de Santiago de Compostela (Spain)

Ramiro Varela Arias, Universidad de Oviedo (Spain)

Scientific Committee (Referees)

Ajith Abraham, Chung Ang University (South Korea)
Igor Aleksander, Imperial College London (UK)
José Ramón Álvarez Sánchez, UNED (Spain)
Margarita Bachiller Mayoral, UNED (Spain)
Antonio Bahamonde, Universidad de Oviedo (Spain)
Emilia I. Barakova, RIKEN (Japan)
Alvaro Barreiro, Univ. A Coruña (Spain)
Senen Barro Ameneiro, University of Santiago de Compostela (Spain)
Luc Berthouze, AIST (Japan)
Joanna J. Bryson, University of Bath (UK)
Lola Cañamero, University of Hertfordshire (UK)
Joaquín Cerdá Boluda, Univ. Politécnica de Valencia (Spain)
Enric Cervera Mateu, Universitat Jaume I (Spain)
Eris Chinellato, Universitat Jaume I (Spain)
Carlos Cotta, University of Málaga (Spain)
Paul Cull, Oregon State University (USA)
Kerstin Dautenhahn, University of Hertfordshire (UK)
Félix de la Paz López, UNED (Spain)
Ana E. Delgado García, UNED (Spain)
Javier de Lope, Universidad Politécnica de Madrid (Spain)
Angel P. del Pobil, Universitat Jaume I (Spain)
Jose Dorronsoro, Universidad Autónoma de Madrid (Spain)
Richard Duro, Universidade da Coruña (Spain)
Juan Pedro Febles Rodriguez, Centro Nacional de Bioinformática (Cuba)
Antonio Fernández-Caballero, Universidad de Castilla-La Mancha (Spain)
Jose Manuel Ferrández, Universitöt Politécnica de Cartagena (Spain)
Nicolas Franceschini, Université de la Méditerranée (France)
Marian Gheorghe, University of Sheffield (UK)
Karl Goser, Universität Dortmund (Germany)
Carlos G. Puntonet, Universidad de Granada (Spain)
Manuel Graña Romay, Universidad Pais Vasco (Spain)
John Hallam, University of Southern Denmark (Denmark)
Denise Y.P. Henriques, York University (Canada)
Oscar Herreras, Hospital Ramón y Cajal (Spain)
Juan Carlos Herrero, (Spain)
Heinz Hügli, University of Neuchâtel (Switzerland)
Shahla Keyvan, University of Missouri, Columbia (USA)
Kostadin Koroutchev, Universidad Autónoma de Madrid (Spain)
Elka Korutcheva, UNED (Spain)
Max Lungarella, University of Tokyo (Japan)
Francisco Maciá Pérez, Universidad de Alicante (Spain)
george Maistros, University of Edinburgh (UK)
Dario Maravall, Universidad Politécnica de Madrid (Spain)
Roque Marín, Universidad de Murcia (Spain)

Rafael Martínez Tomás, UNED (Spain)
Jose del R. Millan, IDIAP (Switzerland)
José Mira, UNED (Spain)
Victor Mitrana, Rovira i Virgili University of Tarragona (Spain)
Roberto Moreno-Díaz, Universidad de Las Palmas de G.C. (Spain)
Lucas Paletta, Joanneum Research (Austria)
José T. Palma Méndez, University of Murcia (Spain)
Miguel Angel Patricio Guisado, Universidad de Alcalá (Spain)
Mario J. Pérez Jiménez, Universidad de Sevilla (Spain)
Franz Pichler, Johannes Kepler University (Austria)
Luigi M. Ricciardi, Università di Napoli Federico II (Italy)
Mariano Rincón Zamorano, UNED (Spain)
Camino Rodríguez Vela, Universidad de Oviedo (Spain)
Ulrich Rückert, Universität Paderborn (Germany)
Daniel Ruiz Fernández, Universidad de Alicante (Spain)
Ramón Ruiz Merino, Universidad Politécnica de Cartagena (Spain)
Eduardo Sánchez Vila, Universidad de Santiago de Compostela (Spain)
José Santos Reyes, Universidade da Coruña (Spain)
Juan A. Sigüenza, Universidad Autónoma de Madrid (Spain)
Wolf Singer, Max Planck Institute for Brain Research (Germany)
Mikhail M. Svinin, RIKEN (Japan)
Ma. Jesus Taboada, Universidad Santiago de Compostela (Spain)
Ramiro Varela Arias, Universidad de Oviedo (Spain)
Marley Vellasco, Pontifical Catholic University of Rio de Janeiro (Brazil)
Barbara Webb, University of Edinburgh (UK)
Stefan Wermter, University of Sunderland (UK)
Tom Ziemke, University of Skövde (Sweden)

Table of Contents - Part I

Computational Neuroscience

On the Use of the Computational Paradigm in Neurophysiology and Cognitive Science <i>José Mira</i>	1
Modules, Layers, Hierarchies, and Loops Where Artificial Intelligence Meets Ethology and Neuroscience – In Context of Action Selection <i>Pinar Öztürk</i>	16
A Unified Perspective on Explaining Dynamics by Anticipatory State Properties <i>Jan Treur</i>	27
A Novel Intrinsic Wave Phenomenon in Low Excitable Biological Media <i>Roustem Miftahof</i>	38
Conceptual Idea of Natural Mechanisms of Recognition, Purposeful Thinking and Potential of Its Technical Application <i>Zinoviy L. Rabinovich, Yuriy A. Belov</i>	48
Simulation of Orientation Contrast Sensitive Cell Behavior in TiViPE <i>Tino Lourens, Emilia Barakova</i>	58
Formulation and Validation of a Method for Classifying Neurons from Multielectrode Recordings <i>María Paula Bonomini, Jose Manuel Ferrandez, José Angel Bolea, Eduardo Fernandez</i>	68
Gap-Junctions Promote Synchrony in a Network of Inhibitory Interneurons in the Presence of Heterogeneities and Noise <i>Santi Chillemi, Alessandro Panarese, Michele Barbi, Angelo Di Garbo</i>	77
A Conceptual Model of Amphibian's Tectum Opticum with Probabilistic Coded Outputs <i>Arminda Moreno-Díaz, Gabriel de Blasio, Roberto Moreno-Díaz</i>	86

Realistic Stimulation Through Advanced Dynamic-Clamp Protocols <i>Carlos Muñiz, Sara Arganda, Francisco de Borja Rodríguez, Gonzalo G. de Polavieja</i>	95
Interacting Slow and Fast Dynamics in Precise Spiking-Bursting Neurons <i>Fabiano Baroni, Joaquín J. Torres, Pablo Varona</i>	106
An Integral Model of Spreading Depression: From Neuron Channels to Field Potentials <i>Ioulia Makarova, Iria R. Cepeda, Fivos Panetsos, Oscar Herreras</i>	116
Separation of Extracellular Spikes: When Wavelet Based Methods Outperform the Principle Component Analysis <i>Alexey Pavlov, Valeri A. Makarov, Ioulia Makarova, Fivos Panetsos</i> ..	123
Structural Statistical Properties of the Connectivity Could Underlie the Difference in Activity Propagation Velocities in Visual and Olfactory Cortices <i>Mavi Sanchez-Vives, Albert Compte</i>	133
Rules and Roles of Dendritic Spikes in CA1 Pyramidal Cells: A Computational Study <i>José M. Ibarz, Ioulia Makarova, Iria R. Cepeda, Oscar Herreras</i>	143
Slow Conductances Encode Stimulus History into Spike Shapes <i>Gonzalo G. de Polavieja, Annette Harsch, Hugh Robinson, Mikko Juusola</i>	150
Comparison of Plasticity of Self-optimizing Neural Networks and Natural Neural Networks <i>Adrian Horzyk, Ryszard Tadeusiewicz</i>	156
Evaluation of Neuronal Firing Densities via Simulation of a Jump-Diffusion Process <i>Antonio Di Crescenzo, Elvira Di Nardo, Luigi M. Ricciardi</i>	166
Gaussian Processes and Neuronal Modeling <i>Elvira Di Nardo, Amelia G. Nobile, Enrica Pirozzi, Luigi M. Ricciardi</i>	176
On the Moments of Firing Numbers in Diffusion Neuronal Models with Refractoriness <i>Virginia Giorno, Amelia G. Nobile, Luigi M. Ricciardi</i>	186

Fluctuation Dynamics in Electroencephalogram Time Series <i>In-Ho Song, Doo-Soo Lee</i>	195
Modelling of Dysfunctions in the Neuronal Control of the Lower Urinary Tract <i>Daniel Ruiz Fernández, Juan Manuel García Chamizo, Francisco Maciá Pérez, Antonio Soriano Payá</i>	203
Coding Strategies in Early Stages of the Somatosensory System <i>Juan Navarro, Eduardo Sánchez, Antonio Canedo</i>	213
Auditory Nerve Encoding of High-Frequency Spectral Information <i>Ana Alves-Pinto, Enrique A. Lopez-Poveda, Alan R. Palmer</i>	223
Multielectrode Analysis of Information Flow Through Cat Primary Visual Cortex <i>Luis M. Martinez, Jose-Manuel Alonso</i>	233
 Bioinspired Computation	
Towards Evolutionary DNA Computing <i>Christiaan V. Henkel, Joost N. Kok</i>	242
A Linear Solution of Subset Sum Problem by Using Membrane Creation <i>Miguel Angel Gutiérrez-Naranjo, Mario J. Pérez-Jiménez, Francisco José Romero-Campero</i>	258
A Study of the Robustness of the EGFR Signalling Cascade Using Continuous Membrane Systems <i>Mario J. Pérez-Jiménez, Francisco José Romero-Campero</i>	268
A Tool for Implementing and Exploring SBM Models: Universal 1D Invertible Cellular Automata <i>Joaquín Cerdá, Rafael Gadea, Jorge Daniel Martínez, Angel Sebastián</i>	279
Network of Evolutionary Processors with Splicing Rules <i>Ashish Choudhary, Kamala Krithivasan</i>	290
Network of Evolutionary Processors with Splicing Rules and Forbidding Context <i>Ashish Choudhary, Kamala Krithivasan</i>	300

A Multiplexed Current Source Portable Stimulator Architecture for a Visual Cortical Neuroprosthesis <i>Jose Manuel Ferrández, María Paula Bonomini, Eduardo Fernández</i>	310
An Augmented Reality Visual Prosthesis for People Affected by Tunneling Vision <i>Francisco Javier Toledo, José Javier Martínez, Francisco Javier Garrigós, Jose Manuel Ferrández</i>	319
Eye Tracking in Coloured Image Scenes Represented by Ambisonic Fields of Musical Instrument Sounds <i>Guido Bologna, Michel Vinckenbosch</i>	327
Tasks Modelling at the Knowledge Level	
Avoidance Behavior Controlled by a Model of Vertebrate Midbrain Mechanisms <i>David P.M. Northmore, Brett J. Graham</i>	338
Transition Cells and Neural Fields for Navigation and Planning <i>Nicolas Cuperlier, Mathias Quoy, Philippe Laroque, Philippe Gaussier</i>	346
Spatial Navigation Based on Novelty Mediated Autobiographical Memory <i>Emilia Barakova, Tino Lourens</i>	356
Vision and Grasping: Humans vs. Robots <i>Eris Chinellato, Angel P. del Pobil</i>	366
Evolved Neural Reflex-Oscillators for Walking Machines <i>Arndt von Twickel, Frank Pasemann</i>	376
A Haptic System for the Lucs Haptic Hand I <i>Magnus Johnsson, Robert Pallbo, Christian Balkenius</i>	386
Action-Based Cognition: How Robots with No Sensory System Orient Themselves in an Open Field Box <i>Michela Ponticorvo, Orazio Miglino</i>	396
A Robotics Inspired Method of Modeling Accessible Open Space to Help Blind People in the Orientation and Traveling Tasks <i>José Ramón Álvarez Sánchez, Félix de la Paz, José Mira</i>	405

A Scientific Point of View on Perceptions <i>Juan Carlos Herrero</i>	416
Reasoning by Assumption: Formalisation and Analysis of Human Reasoning Traces <i>Tibor Bosse, Catholijn M. Jonker, Jan Treur</i>	427
Aligning Reference Terminologies and Knowledge Bases in the Health Care Domain <i>María Taboada, Julio Des, Diego Martínez, José Mira</i>	437
Predicting Mortality in the Intensive Care Using Episodes <i>Tudor Toma, Ameen Abu-Hanna, Robert Bosman</i>	447
A Fuzzy Temporal Diagnosis Algorithm and a Hypothesis Discrimination Proposal <i>José Palma, Jose M. Juárez, Manuel Campos, Roque Marín</i>	459
Spatial Reasoning Based on Rules <i>Haibin Sun, Wenhui Li</i>	469
Key Aspects of the Diagen Conceptual Model for Medical Diagnosis <i>Rafael Martínez, José Ramón Álvarez Sánchez, José Mira</i>	481
Connectionist Contribution to Building Real-World Ontologies <i>Miłostaw L. Frey</i>	489
Self Assembling Graphs <i>Vincent Danos, Fabien Tarissan</i>	498
Knowledge Modeling for the Traffic Sign Recognition Task <i>Mariano Rincón, Sergio Lafuente-Arroyo, Saturnino Maldonado-Bascón</i>	508
Interval-Valued Neural Multi-adjoint Logic Programs <i>Jesus Medina, Enrique Mérida-Casermeiro, Manuel Ojeda-Aciego</i> ...	518
Author Index	529

Table of Contents - Part II

Evolutionary Computation

Cultural Operators for a Quantum-Inspired Evolutionary Algorithm Applied to Numerical Optimization Problems <i>André V. Abs da Cruz, Marco Aurélio C. Pacheco, Marley Vellasco, Carlos Roberto Hall Barbosa</i>	1
New Codification Schemas for Scheduling with Genetic Algorithms <i>Ramiro Varela, David Serrano, María Sierra</i>	11
Solving the Multidimensional Knapsack Problem Using an Evolutionary Algorithm Hybridized with Branch and Bound <i>José E. Gallardo, Carlos Cotta, Antonio J. Fernández</i>	21
Cryptanalysis of Substitution Ciphers Using Scatter Search <i>Mohamed Amine Garici, Habiba Drias</i>	31
Combining Metaheuristics and Exact Algorithms in Combinatorial Optimization: A Survey and Classification <i>Jakob Puchinger, Günther R. Raidl</i>	41
Convergence Analysis of a GA-ICA Algorithm <i>Juan Manuel Górriz, Carlos G. Puntonet, Fernando Rojas, E.G. Medialdea</i>	54
An Evolutionary Strategy for the Multidimensional 0-1 Knapsack Problem Based on Genetic Computation of Surrogate Multipliers <i>César L. Alonso, Fernando Caro, José Luis Montaña</i>	63
An Evolutionary Approach to Designing and Solving Fuzzy Job-Shop Problems <i>Inés González-Rodríguez, Camino Rodríguez Vela, Jorge Puente</i>	74
Memetic Algorithms with Partial Lamarckism for the Shortest Common Supersequence Problem <i>Carlos Cotta</i>	84

2D and 3D Pictural Networks of Evolutionary Processors <i>K.S. Dersanambika, K.G. Subramanian, Anthonath Roslin Sagaya Mary</i>	92
Analysing Sentences with Networks of Evolutionary Processors <i>Gemma Bel Enquix, María Dolores Jimenez Lopez</i>	102
Simulating Evolutionary Algorithms with Eco-grammar Systems <i>Adrian Horia Dediu, María Adela Grando</i>	112
Timed Accepting Hybrid Networks of Evolutionary Processors <i>Florin Manea</i>	122
A New Immunotronic Approach to Hardware Fault Detection Using Symbiotic Evolution <i>Sanghyung Lee, Euntai Kim, Eunjoo Song, Mignon Park</i>	133
A Basic Approach to Reduce the Complexity of a Self-generated Fuzzy Rule-Table for Function Approximation by Use of Symbolic Regression in 1D and 2D Cases <i>Gines Rubio, Hector Pomares, Ignacio Rojas, Alberto Guillén</i>	143
Parallel Evolutionary Computation: Application of an EA to Controller Design <i>Manuel Parrilla, Joaquín Aranda, Sebastián Dormido-Canto</i>	153
MEPIDS: Multi-Expression Programming for Intrusion Detection System <i>Crina Groşan, Ajith Abraham, San Yong Han</i>	163
A Study of Heuristic Techniques Inspired in Natural Process for the Solution of the Container Fill Problem <i>Miguel Delgado Pineda, José Manuel De Pedro Salinas, Joaquín Aranda</i>	173
Attribute Grammar Evolution <i>Marina de la Cruz Echeandía, Alfonso Ortega de la Puente, Manuel Alfonseca</i>	182
Evolution and Evaluation in Knowledge Fusion System <i>Jin Gou, Jiangang Yang, Qian Chen</i>	192
The Allele Meta-model – Developing a Common Language for Genetic Algorithms <i>Stefan Wagner, Michael Affenzeller</i>	202

Using Bees to Solve a Data-Mining Problem Expressed as a Max-Sat One <i>Karima Benatchba, Lotfi Admane, Mouloud Koudil</i>	212
A Comparison of GA and PSO for Excess Return Evaluation in Stock Markets <i>Ju-sang Lee, Sangook Lee, Seokcheol Chang, Byung-Ha Ahn</i>	221
Nonlinear Robust Identification Using Multiobjective Evolutionary Algorithms <i>Juan M. Herrero, Xavier Blasco, Manuel Martínez, César Ramos</i>	231
Genetic Algorithms for Multiobjective Controller Design <i>Manuel Martínez, Javier Sanchis, Xavier Blasco</i>	242
Grammar Based Crossover Operator in Genetic Programming <i>Daniel Manrique, Fernando Márquez, Juan Ríos, Alfonso Rodríguez-Patón</i>	252
GA-Selection Revisited from an ES-Driven Point of View <i>Michael Affenzeller, Stefan Wagner, Stephan Winkler</i>	262
Agent WiSARD in a 3D World <i>Ernesto Burattini, Paolo Coraggio, Massimo De Gregorio, Mariacarla Staffa</i>	272
One Generalization of the Naive Bayes to Fuzzy Sets and the Design of the Fuzzy Naive Bayes Classifier <i>Jiacheng Zheng, Yongchuan Tang</i>	281
Towards a Methodology to Search for Near-Optimal Representations in Classification Problems <i>Manuel del Valle, Beatriz Sánchez, Luis F. Lago-Fernández, Fernando J. Corbacho</i>	291
Playing a Toy-Grammar with GCS <i>Olgierd Unold</i>	300
A Genetic Approach to Data Dimensionality Reduction Using a Special Initial Population <i>M. Borahan Tümer, Mert C. Demir</i>	310
Engineering Optimizations via Nature-Inspired Virtual Bee Algorithms <i>Xin-She Yang</i>	317
Solving Partitioning Problem in Codesign with Ant Colonies <i>Mouloud Koudil, Karima Benatchba, Said Gharout, Nacer Hamani</i> . . .	324

Electronics and Robotics

A Neuromimetic Integrated Circuit for Interactive Real-Time Simulation <i>Sylvain Saïghi, Jean Tomas, Yannick Bornat, Sylvie Renaud</i>	338
A FPGA Architecture of Blind Source Separation and Real Time Implementation <i>Yong Kim, Hong Jeong</i>	347
Description and Simulation of Bio-inspired Systems Using VHDL-AMS <i>Ginés Doménech-Asensi, José A. López-Alcantud, Ramón Ruiz-Merino</i>	357
Transistor-Level Circuit Experiments Using Evolvable Hardware <i>Adrian Stoica, Ricardo Zebulum, Didier Keymeulen, Taher Daud</i>	366
An Electronic Reconfigurable Neural Architecture for Intrusion Detection <i>F. Ibarra Picó, A. Grediaga Olivo, F. García Crespi, A. Camara</i>	376
Construction and VHDL Implementation of a Fully Local Network with Good Reconstruction Properties of the Inputs <i>Joël Chavas, Demian Battaglia, Andres Cicuttin, Riccardo Zecchina</i>	385
Reconfigurable Hardware Implementation of Neural Networks for Humanoid Locomotion <i>Beatriz Prieto, Javier de Lope, Darío Maravall</i>	395
An Associative Cortical Model of Language Understanding and Action Planning <i>Andreas Knoblauch, Heiner Markert, Günther Palm</i>	405
Neural Clustering Analysis of Macroevoolutionary and Genetic Algorithms in the Evolution of Robot Controllers <i>Jose Antonio Becerra, José Santos</i>	415
Induced Behavior in a Real Agent Using the Multilevel Darwinist Brain <i>Francisco Bellas, Jose Antonio Becerra, Richard J. Duro</i>	425
Landscaping Model for Virtual Environment <i>Madjid Fathi, Ursula Wellen</i>	435

Other Applications

Sensitivity from Short-Term Memory vs. Stability from Long-Term Memory in Visual Attention Method <i>María Teresa López Bonal, Antonio Fernández-Caballero, Miguel A. Fernández, Ana E. Delgado</i>	448
Visual Attention, Visual Saliency, and Eye Movements During the Inspection of Natural Scenes <i>Geoffrey Underwood, Tom Foulsham, Editha van Loon, Jean Underwood</i>	459
Model Performance for Visual Attention in Real 3D Color Scenes <i>Heinz Hügli, Timothée Jost, Nabil Ouerhani</i>	469
On the Evolution of Formal Models and Artificial Neural Architectures for Visual Motion Detection <i>Roberto Moreno-Díaz jr., Alexis Quesada-Arencibia, Jose Carlos Rodríguez-Rodríguez</i>	479
Estimation of Fuel Moisture Content Using Neural Networks <i>David Riaño, Susan L. Ustin, Luis Usero, Miguel Angel Patricio</i>	489
Adjustment of Surveillance Video Systems by a Performance Evaluation Function <i>Óscar Pérez, Jesús García, Antonio Berlanga, José Manuel Molina</i> ..	499
Application of Machine Learning Techniques for Simplifying the Association Problem in a Video Surveillance System <i>Blanca Rodríguez, Óscar Pérez, Jesús García, José Manuel Molina</i>	509
A Neurocalibration Model for Autonomous Vehicle Navigation <i>Miguel Angel Patricio, Dario Maravall, Julio Rejón, Angel Arroyo</i>	519
Some Remarks on the Application of Artificial Neural Networks to Optical Character Recognition <i>Antonio Moratilla, Ignacio Olmeda</i>	529
Using Fuzzy Clustering Technique for Function Approximation to Approximate ECG Signals <i>Alberto Guillén, Ignacio Rojas, Eduardo Ros, Luis J. Herrera</i>	538

Information Retrieval and Classification with Wavelets and Support Vector Machines <i>Sebastián Dormido-Canto, Jesus Vega, José Sánchez, Gonzalo Farias</i>	548
A New Approach to Clustering and Object Detection with Independent Component Analysis <i>Ingo R. Keck, Salua Nassabay, Carlos G. Puntonet, Elmar W. Lang</i>	558
Bispectra Analysis-Based VAD for Robust Speech Recognition <i>Juan Manuel Górriz, Carlos G. Puntonet, Javier Ramírez, José Carlos Segura</i>	567
On-line Training of Neural Networks: A Sliding Window Approach for the Levenberg-Marquardt Algorithm <i>Fernando Morgado Dias, Ana Antunes, José Vieira, Alexandre Manuel Mota</i>	577
Boosting Parallel Perceptrons for Label Noise Reduction in Classification Problems <i>Iván Cantador, José R. Dorronsoro</i>	586
On the Connection Between the Human Visual System and Independent Component Analysis <i>Susana Hornillo-Mellado, Rubén Martín-Clemente, Carlos G. Puntonet, José I. Acha</i>	594
Image Classifier for the TJ-II Thomson Scattering Diagnostic: Evaluation with a Feed Forward Neural Network <i>Gonzalo Farias, Raquel Dormido, Matilde Santos, Natividad Duro</i>	604
Computerized Adaptive Tests and Item Response Theory on a Distance Education Platform <i>Pedro Salcedo, María Angélica Pinninghoff, Ricardo Contreras</i>	613
Stochastic Vs Deterministic Traffic Simulator. Comparative Study for Its Use Within a Traffic Light Cycles Optimization Architecture <i>Javier Sánchez Medina, Manuel Galán Moreno, Enrique Rubio Royo</i>	622
Author Index	633