



IWINAC 2005

First INTERNATIONAL WORK-CONFERENCE
on the INTERPLAY between
NATURAL and ARTIFICIAL COMPUTATION

HOTEL MELIÁ LAS PALMAS

Las Palmas de Gran Canaria, Canary Islands (Spain)

June 15-18, 2005

Call for Papers

Organized by:

Univ. Nacional de Educación a Distancia (UNED)

In cooperation with:

Universidad de Las Palmas de Gran Canaria,
and Las Palmas UNED Associated Center

Official web site: <http://www.iwinac.uned.es/>

The first “International Work-conference on the Interplay between Natural and Artificial Computation” (IWINAC-2005) will take place in Las Palmas de Gran Canaria, Canary Islands (Spain), June, 15-18, 2005.

This meeting, with focus on the interplay between Neuroscience and Computation, inherits the general purpose, the scope and the more biologically oriented topics of the last IWANNs (Lanzarote, Alicante, Granada and Menorca) and expands this scope to the broad and more comprehensive fields of Computer Science, Artificial Intelligence (AI) and Knowledge Engineering (KE), including the different paradigms: Symbolic, Connectionist, “Situated” or Hybrid.

All accepted papers will be published in the proceedings by Springer-Verlag in Lecture Notes on Computer Science series.

Scope

Under the basic idea that living beings and machines can be understood using the same conceptual and formal tools, the same experimental methodology and the same organizative and structural principles, the IWINAC-2005 organizers, propose a forum for the discussion and exchange of ideas on the interplay between Bio-sciences (natural computation) and the Sciences of Computation (artificial computation), trying to contribute to the answer of two basic questions:

I: From Artificial to Natural Computation. What can Computation, Artificial Intelligence (AI) and Knowledge Engineering (KE) contribute to the understanding of Nervous System, Cognitive Processes and Social Behavior? This is the scope of Computational Neuroscience and Cognition, which uses computation to model and improve our understanding of natural science.

II: From sciences of Natural to Computation, AI&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.

Topics

To address these two questions, we will make 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, in-

troduced by Newell and Marr, situated above the symbol level and named by Newell “the Knowledge Level” (KL) and by Marr 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 Interplay at the Physical Level

From Artificial to Natural

1.1 Computational Neuroscience

1.1.1 Tools

Conceptual, formal, and computational tools and methods in the modeling of neuronal processes and neural nets: individual and collective dynamics.

1.1.2 Mechanisms

Computational modeling 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 library of neural circuitry.

1.1.3 Plasticity

Models of memory, adaptation, learning and other plasticity phenomena. Mechanisms of reinforcement, self-organization, anatomo-physiological coordination and structural coupling.

From Natural to Artificial

1.2 Bio-inspired Circuits and Mechanisms

1.2.1 Electronics

Bio-inspired electronics and computer architectures. Advanced models for ANN. Evolvable hardware (CPLDs, FPGAs, ...). Adaptive cellular automata. Redundancy, parallelism and fault-tolerant computation. Retinotopic organizations.

1.2.2 Non-conventional (Natural) Computation

Biomaterials for computational systems. DNA, cellular and membrane computing.

1.2.3 Sensory and motor prostheses

Signal processing, artificial cochlea, audio-tactile vision substitution. Artificial sensory and motor systems for handicapped people. Intersensory transfer and sensory plasticity.

2 Interplay at the Symbol Level

From Artificial to Natural

2.1 Neuro-informatics

2.1.1 Symbols

From neurons to neurophysiological symbols (regularities, synchronization, resonance, dynamics binding and other potential mechanisms underlying neural coding). Neural data structures and neural “algorithms”.

2.1.2 Brain databases

Neural data analysis, integration and sharing. Standardization, construction and use of databases in neuroscience and cognition.

2.1.3 Neurosimulators

Development and use of biologically oriented Neurosimulators. Contributions to the understanding of the relationships between structure and function in biology.

From Natural to Artificial

2.2 Bio-inspired Programming Strategies

2.2.1 Behavior based computational methods

Reactive mechanisms. Self-organizational optimization. Collective emergent behavior (ant colonies). Ethology and Artificial Life.

2.2.2 Evolutionary computation

Genetic algorithms, evolutionary strategies, evolutionary programming and genetic programming. Macroevolution and the interplay between evolution and learning.

2.2.3 Hybrid approaches

Neuro-symbolic integration. Knowledge-based ANN and connectionist KBS. Neuro-fuzzy systems. Hybrid adaptation and learning at the symbol level.

3 Interplay at the Knowledge Level

From Artificial to Natural

3.1 Computational approach to Cognition

3.1.1 AI&KE

Use of AI&KE concepts, tools, and methods in the modeling of mental processes and behavior. Contribution to the AI debate on paradigms for knowledge representation and use: symbolic (representational), connectionist, situated, and hybrid.

3.1.2 Controversies

Open questions and controversies in AI&Cognition (semantics versus syntax, knowledge as mechanisms that knows, cognition without computation, ...). Minsky, Simon, Newell, Marr, Searly, Maturana, Clancey, Brooks, Pylyshyn, Fodor, and more.

3.1.3 Knowledge Modeling

Reusability of components in knowledge modeling (libraries of tasks, methods, inferences and roles). Ontologies (generic, domain specific, object oriented, methods, and tasks). Knowledge representation Methodologies and Knowledge edition tools.

From Natural to Artificial

3.2 Cognitive Inspiration in AI&KE

3.2.1 Synthetic cognition

Bio-inspired modeling 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.

3.2.2 Applications

Bio-inspired solutions to engineering, computational and social problems in different application domain:

1. Medicine. Image understanding. KBS and ANN for diagnoses, therapy planning, and patient follow-up. Telemedicine.
2. Robotic paradigms. Dynamic vision. Path planning, map building, and behavior based navigation methods. Anthropomorphic robots.
3. Health biotechnology. Bio-inspired solutions for sustainable growth and development.
4. Other domains (surveillance and security systems, distance education, web, data mining and information retrieval, ...).

Call for pre-organized sessions

The Program Committee is requesting proposals for pre-organized sessions in one of the above areas or related to the global scope presented above. Also, new sessions in the interdisciplinary spirit of the interplay between natural and artificial computation are welcome. Prospective organizers should contact organization staff at iwinac@dia.uned.es as soon as possible. Information about current pre-organized sessions and further details for prospective organizers can be found at web: <http://www.iwinac.uned.es/>. The organizers of effective pre-organized sessions (with at least 4 accepted papers) will benefit of a discount on registration fees.

Invited Speakers

- JUAN VICENTE SÁNCHEZ ANDRÉS. University of La Laguna (Spain): "The Neurophysiology underlying Intelligence and Human Knowledge".
- DANA BALLARD. University of Rochester (USA): "Embodied Models of Natural Computation".
- JOOST. N. KOK. Leiden University (The Netherlands): "Evolutionary DNA Computing".

Paper Submission

The Program Committee request original papers on the above mentioned topics. Authors (no more than four for each paper) must submit the camera-ready final version of papers written in English (official language of the conference), of **up to 10 pages** (including figures, tables and references) in electronic format through either of the following two channels:

- Through a pre-organized session (refereed at least by session organizer and one external referee): Please, send 1 copy to the session organizer and then (after session organizer agrees) register the paper in the submission web form.
- Or directly to the general program (two external referees): Please, register the paper directly in the submission web form.

The contributions must use only the $\text{\LaTeX}2_{\epsilon}$ style file available in the Springer instructions web page: <http://www.springer.de/comp/lncs/authors.html> (follow "Information for LNCS Authors" link). Other formats or draft versions cannot be accepted at all (see hints for \LaTeX on MS-Windows in our web pages). Please, use gray scale (not color) for all the figures.

Authors must send their papers (\LaTeX sources plus camera ready in PDF/Postscript, see web page for details), **before February 15th** (23:59h. UTC), through the *submission web form* found in a link from the main web site: <http://www.iwinac.uned.es/>.

Please, do not send printed copies or email attachments (except when required by the organization staff). All authors must fill in (themselves or the contact author) the required data for the program database form as specified in the submission web form.

The proceedings will be published in the "Lecture Notes in Computer Science" series from Springer-Verlag.

All papers received will be refereed by the Program Committee. Accepted papers must be presented either orally (overhead, slide, data projectors and a PC with standard presentation software will be available) or as poster panels (size 90 cm. width \times 150 cm. height), however all accepted contributions will be published at full length using directly the camera ready electronic file sent by the authors. At least one author registration is required for each accepted paper.

Also, authors must fill in and sign the copyright form required by Springer. It can be found through a link in the Author's instructions web page. After paper acceptance send it in through postal (snail) mail or fax (+34-91-398-8895).

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Registration fees

The registration fee includes attending to the sessions, coffee breaks, lunches, social events, gala dinner and the Proceedings of the Work-Conference.

Type	Before April 30	After April 30
Standard	€ 450	€ 500
Session Organizer	€ 350	€ 400
Accompanying person (*)	€ 250	€ 290

(*) Accompanying person registration fee only includes lunches, social events and gala dinner.

Registration fees of at least one author for each accepted paper should be paid in full before submission to press (April 30, 2005).

Congress venue

HOTEL MELIÁ LAS PALMAS

Calle Gomera, 6

E-35006 Las Palmas de Gran Canaria (Spain)

<http://melialaspalmas.solmelia.com/>

Important dates

Final Date for Submission	February 15, 2005
Acceptance notification and start of registration	April 1, 2005
End of reduction fee for <i>early</i> registration	April 30, 2005
Congress date	June 15-18, 2005

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