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Gerhard Goos, Karlsruhe University, Germany
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Volume Editors

José Mira
Universidad Nacional de Educación a Distancia
Departamento de Inteligencia Artificial
Senda del Rey, s/n, E-28040 Madrid, Spain
E-mail: jmira@dia.uned.es

Juan V. Sánchez-Andrés
Universidad Miguel Hernández, Departamento Fisiología
Centro de Bioingeniería, Campus de San Juan, Apdo. 18
Ctra. Valencia, s/n, E-03550 San Juan de Alicante, Spain
E-mail: juanvi@umh.es

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Preface

Fifty years after the publication of Norbert Wiener's book on Cybernetics and a hundred years after the birth of Warren S. McCulloch (1898), we still have a deeply-held conviction of the value of the interdisciplinary approach in the understanding of the nervous system and in the engineering use of the results of this understanding. In the words of N. Wiener, "*The mathematician (nowadays also the physicist, the computer scientist, or the electronic engineer) need not have the skill to conduct a physiological experiment, but he must have the skill to understand one, to criticize one, and to suggest one. The physiologist need not be able to prove a certain mathematical theorem (or to program a model of a neuron or to formulate a signaling code...) but he must be able to grasp its physiological significance and to tell the mathematician for what he should look*". We, as Wiener did, had dreamed for years of a team of interdisciplinary scientists working together to understand the interplay between Neuroscience and Computation, and "*to lend one another the strength of that understanding*".

The basic idea during the initial Neurocybernetics stage of Artificial Intelligence and Neural Computation was that both the living beings and the man-made machines could be understood using the same organizational and structural principles, the same experimental methodology, and the same theoretical and formal tools (logic, mathematics, knowledge modeling, and computation languages).

This **interdisciplinary** approach has been the basis of the organization of all the IWANN biennial conferences, with the aim of promoting the interplay between Neuroscience and Computation, without disciplinary boundaries.

IWANN'99, the fifth International Work-Conference on Artificial and Natural Neural Networks, that took place in Alicante (Spain) June 2-4, 1999, focused on the following goals:

- I. Developments on Foundations and Methodology.
- II. From Artificial to Natural: How can Systems Theory, Electronics, and Computation (including AI) aid in the understanding of the nervous system?
- III. From Natural to Artificial: How can understanding the nervous system help in the obtaining of bio-inspired models of artificial neurons, evolutionary architectures, and learning algorithms of value in Computation and Engineering?
- IV. Bio-inspired Technology and Engineering Applications: How can we obtain bio-inspired formulations for sensory coding, perception, memory, decision making, planning, and control?

IWANN'99 was organized by the Asociación Española de Redes Neuronales, the Universidad Nacional de Educación a Distancia, UNED, (Madrid), and the Instituto de Bioingeniería of the University Miguel Hernández, UHM, (Alicante) also in cooperation with IFIP (Working Group in Neural Computer Systems, WG10.6), and the Spanish RIG IEEE Neural Networks Council.

Sponsorship was obtained from the Spanish CICYT and DGICYT (MEC), the organizing universities (UNED and UHM), and the Fundación Obra Social of the CAM.

The papers presented here correspond to talks delivered at the conference. After the evaluation process, 181 papers were accepted for oral or poster presentation, according to the recommendations of reviewers and the author's preferences. We have organized these papers in two volumes arranged basically following the topics list included in the call for papers. The first volume, entitled "Foundations and Tools in Neural Modeling" is divided into three main parts and includes the contributions on:

1. Neural Modeling (Biophysical and Structural Models).
2. Plasticity Phenomena (Maturing, Learning and Memory).
3. Artificial Intelligence and Cognitive Neuroscience.

In the second volume, with the title, "Engineering Applications of Bioinspired Artificial Neural Nets", we have included the contributions dealing with applications. These contributions are grouped into four parts:

1. Artificial Neural Nets Simulation and Implementation.
2. Bio-inspired Systems.
3. Images.
4. Engineering Applications (including Data Analysis and Robotics).

We would like to express our sincere gratitude to the members of the organizing and program committees, in particular to F. de la Paz and J.R. Álvarez, to the reviewers, and to the organizers of invited sessions (Bahamonde, Barro, Benjamins, Cabestany, Dorronsoro, Fukushima, González-Cristóbal, Jutten, Milán, Moreno-Arostegui, Taddei-Ferretti, and Vellasco) for their invaluable effort in helping with the preparation of this conference. Thanks also to the invited speakers (Abeles, Gordon, Marder, Poggio, and Schiff) for their effort in preparing the plenary lectures.

Last, but not least, the editors would like to thank Springer-Verlag, in particular Alfred Hofmann, for the continuous and excellent cooperative collaboration from the first IWANN in Granada (1991, LNCS 540), the successive meetings in Sitges, (1993, LNCS 686), Torremolinos, (1995, LNCS 930), and Lanzarote, (1997, LNCS 1240), and now in Alicante

The theme for the 1999 conference (from artificial to natural and back again), focused on the interdisciplinary spirit of the pioneers in Neurocybernetics (N. Wiener, A. Rosenblueth, J. Bigelow, W.S. McCulloch, W. Pitts, H. von Foerster, J.Y. Lettvin, J. von Neumann, ...) and the thought-provoking meetings of the Macy Foundation. We hope that these two volumes will contribute to a better understanding of the nervous system and, equally, to an expansion of the field of bio-inspired technologies. For that, we rely on the future work of the authors of these volumes and on our potential readers.

Invited Speakers

Prof. Moshe Abeles (Hebrew Univ. Jerusalem. Israel)

Prof. Mirta Gordon (CEA-Dept. Rech. Fond. Mat. Cond. SPSMS. France)

Prof. Eve Marder (Brandeis Univ., Waltham, MA. USA)

Prof. Tomaso Poggio (Brain Sci. Dept. AI Lab. MIT, Cambridge, MA. USA)

Prof. Steven Schiff (Krasnow Inst. Adv. Stud. George Mason Univ., VA. USA)

Field Editors

Prof. A. Bahamonde (Univ. de Oviedo en Gijón. Spain)

Prof. S. Barro (Univ. de Santiago de Compostela. Spain)

Prof. R. Benjamins (University of Amsterdam. Netherlands)

Prof. J. Cabestany (Universidad Politécnica de Cataluña. Spain)

Prof. J.R. Dorronsoro (Universidad Autónoma de Madrid, Spain)

Prof. K. Fukushima (Osaka Univ. Japan)

Prof. J.C. González-Cristóbal (Univ. Politécnica de Madrid. Spain)

Prof. C. Jutten (LIS-INPG. France)

Prof. J. del R. Millán (Joint Research Center - European Commission, Ispra. Italy)

Prof. J.M. Moreno-Arostegui (Univ. Politécnica de Cataluña. Spain)

Prof. C. Taddei-Ferretti (Istituto di Cibernetica, CNR. Italy)

Prof. M. Vellasco (Pontificia Univ. Católica, Rio do Janeiro. Brazil)

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