EuCognition Network Action Proposal

Title:	**Non-Linear Dynamics and Robots:** **From Neurons to Cognition**
Membership number(s)	N°.73
Member name(s)	Paolo Arena
Member institute/company name(s)	DIEES – University of Catania
Goals of the action	The course builds upon the activities performed in the FP6 EU-SPARK Project, just concluded, and the ongoing research within the FP7 SPARK II Project. Therefore some of the main goals are to introduce students to the fields of action-oriented perception based on: • nonlinear dynamics in spatially extended systems; • the capability of planning ahead based on recurrent neural networks; • neurobiological/neurogenetic research results. Moreover, it is believed that a real breakthrough for this activity will be reached by inviting leading scientists in the feld of cognition, not belonging to the SPARK/SPARK II consortium, (like Prof. G. Rizzolatti (ITALY), Prof. A. Ferrus (SPAIN), Prof. M. I. Rabinovich (USA)). Therefore the goals will be extended to create a bridge among the cognitive capabilities in insects, what is known from the biology of neurons and their models, and the birth of higher functions, like learning by imitation. For this last reason a special support from the EuCognition Network is needed. The school targets reaching real impact, from educational, scientific and wide dissemination points of view. In fact, as reported in the temptative outline of the course (see annex), one part of the course (morning sessions depending on day) will be configured as a workshop, where lecturers will present the latest results abut their specific research on different aspects related to cognition. The other part (afternoon sessions) will be mostly devoted to tutorials hence going deeply on each topic by offering details on topics treated in morning sessions, in order to allow students to fully understand problems and methodologies. This is the way we shall approach the educational character of the action. Moreover, two wide and general audience open events will be organized: one dealing with "Intelligence and Robotics", coordinated by Prof. L. Fortuna, the other one held by Prof. G. Rizzolatti. These events are thought to arise interest also within lay audience and students and citizen at large on the significance of the research on various aspects of cognition and robot design.

Principal activity to which it contributes
   o   Community Outreach
   o   Scientific Outlook
   o   Education & Training
	From what has been stated above, the network action aims to contribute to all of these activities. Being a course, the main aim is education on the emerging field of complex dynamics, perception and cognition from different perspectives. By involving lecturers and students not usually involved in the EuCognition meetings, the other focus will be to enlarge the community of potentially interested people. Finally, the possibility to host together leading persons, also from overseas, expert in neuron biology and higher brain functions, will undoubtedly lead to a potential large scientific outlook.

Concrete outcomes of the action (at least one of which should be material suitable for publication on the euCognition website)	An outcome of the course will be a book with all lecture notes, to be edited by Prof. Paolo Arena (Coordinator of the SPARK Consortium), and to be published by a scientific international Publisher. An extended abstract of the book will be linked to the EuCognition website.
Effort in person-days that will be charged to the Network Action (if any)	None
Expected start and duration in months	The Course is scheduled to take place in Aug. 4-8, 2008.

The requested funding, under the following headings:
 	
   o   Travel Costs
 	
   o   Other Costs (check with the Network Coordinator if you aren't sure about eligibility of these costs)
 	
   o   Labour Costs (identify the number of person-days and the rate per day).
	The course will be held at Euroforum-UCM Summer resort located at EL ESCORIAL near Madrid (about fifty km from Barajas airport). A significant share of costs will be supported by the Universidad Complutense de Madrid. Another share will derive from SPARKII funds (travel and room and board costs for SPARK II lecturers).
	A particular support is asked for additional expenses:
	1. **2000€** to help defraying travel, room and board costs for two non-SPARK invited lecturers (Prof. G. Rizzolati –from Italy- and Prof. M. I. Rabinovich-from the USA)
	2. **1500 €** to help defraying travel, room and board costs for two EU SPARK-related invited speakers (Dr. M. Schilling and Prof. J. Schmitz, from the SPARK I project, already concluded);
	3. **1800 €** to offer a minimum of three fellowships for students not belonging to the EuCognition Network;
	
	Total funds requested:
	2000+1500+1800=**5300 €**
	
	In addition to that, since the morning sessions of the course are structured as a workshop-like, we are asking for this course for being eligible as an EUCognition official Event.
	In particular, it is foreseen that besides the lecturers and seminar speakers about 30 more participants will be allowed to attend the workshop-course event. This would permit optimizing discussions and exchange among speakers and participants (including typical "students")
	
	Therefore a reimbursement is asked for EuCognition members participating to the proposed action.

Please identify any other sources of funding that contribute to this Action (actions to support events such as workshop and conferences should include an outline budget identifying the total cost)	The Action will be sponsored by the Universidad Complutense de Madrid - Summer Programme by offering facilities and fellowships to a limited yet to be defined number of participants. Moreover, the EU project SPARK II will support the costs for the **SPARK II** lecturers.
Workshops: *official euCognition event* (yes/no & maximum number of members that can be accommodated)	Yes, a maximum of 25 members will be accommodated

COURSE OUTLINE (DRAFT)

Dates: **August 4-8, 2008**

Title: **NON-LINEAR DYNAMICS AND ROBOTS: FROM NEURONS TO COGNITION**

Place: Euroforum-UCM Summer Programme Resort, El Escorial, Madrid (Spain)

Director: **Manuel G. VELARDE, Instituto Pluridisciplinar, UCM**
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Co-director: **Paolo ARENA,** Coordinator SPARK II
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Editor Lecture Notes: **Paolo ARENA**

Lecturers/Workshop Speakers:
1. **Manuel G. Velarde** (Universidad Complutense de Madrid, Instituto Pluridisciplinar)
Introduction: From dynamical systems to lattices and reaction-diffusion models. From neurons and brains to robots. What is intelligence about? (Analog *versus* digital computers)
2. **Paolo Arena** (University of Catania, Italy)
Spatial-temporal patterns and perception in Bio-inspired-robots
3. **Alberto Ferrus** (Cajal Institute, CSIC, Madrid)
Inhibition in sensory inputs
4. **Holk Cruse** (University of Bielefeld, Germany)
Getting cognitive: from 1st order embodiment to 2nd order embodiment (and beyond)
5. **Pablo Gonzalez de Santos** (Instituto de Automatica, CSIC, Arganda, Madrid)
Engineering-inspired robots
6. **Mijail I. Rabinovich** (University of California, San Diego, USA)
Transient cognitive dynamics: metastability and decision making
7. **Giacomo Rizzolatti** (University of Parma, Italia)
Cognition and motor system
8. **Roland Strauss** (University of Mainz, Germany)
Neurogenetics and cognitive capabilities in Drosophyla Melanogaster

Tutorial sessions:
Ezequiel del Rio (IP-UCM and UPM, Madrid)
A prototype six-legged (insect-lkle) robot
Ramon Huerta (UCS, USA and UAM, Madrid)
Computational design of the olfactory system
Valeri A. Makarov (IP-UCM, Madrid)
i. Processing neurodata (alternative methodologies), ii. Recurrent neural networks (RNN), memory and learning
Luca Patanè
Rovers and legged robots: architectures and bio-inspired control algorithms
Malte Schilling
TBA

Joseph Schmitz (University of Bielefeld, Germany)
Neurobiological foundations of hexapod locomotion in insects and robots
Pablo Varona (UAM, Madrid)
TBA

General audience open session with demonstrations and exhibit of videos followed by general discussion on neurodynamics, neural networks, cognition, intelligence and robotics.
Coordinator and key-note speaker: **Luigi Fortuna** (University of Catania, Italy)

Dissemination: general audience public lecture
Speaker: **Giacomo Rizzolatti** (University of Parma, Italia)
TBA