Information Processing and Self-Organization in Adaptive Biological and Artificial Systems

PhD studentships are available in the Adaptive Systems Research Group at the University of Hertfordshire in the topics of Artificial Life, especially for the study of principles behind information processing in adaptive, complex and self-organizing systems and the emergence and growth of complexity, a research area which has witnessed a dramatic increase of interest in the last years.

We use mathematical methods, with particular emphasis on an arsenal of recent techniques based on Shannon’s information theory, to describe, understand or construct such systems in the context of AI/robotics and biology. Questions of interest and possible research directions include, but are not limited to:

- information-theoretic approaches towards a mathematically founded understanding of information processing and the perception-action loop in agents; fundamental quantitative constraints governing the interaction between an agent and its environment

- theoretically grounded pathways towards a systematic way to generate self-organization in complex systems and autonomous increase in complexity

- biologically plausible methods based on information theory for creating Artificial Intelligence systems from first principles

- generic models for intrinsic motivation generation and artificial creativity based on such principles

- fundamental principles underlying biological (e.g. neural) computation (with opportunities to collaborate with the Biocomputation Research Group)

The prospective candidates should have a keen interest in contributing to a highly dynamic and quickly expanding research area and should have a strong background in Computer Science, Physics, Mathematics, Statistics or another relevant computational discipline. In particular, they should demonstrate excellent programming skills in one or more major computer languages. A mathematical/numerical background would be desirable, knowledge in at least one of the following fields would be a plus: probability theory, information theory, differential geometry, control, data modelling/neural network techniques.

The envisaged research will take place in the vibrant and enthusiastic research environment of the Adaptive Systems Research Group in the School of Computer Science at the University of Hertfordshire which offers a large number of specialized and interdisciplinary seminars as well as general training opportunities. Research in Computer Science at the University of Hertfordshire has been recognized as excellent by
the latest Research Assessment Exercise, with 55% of the research submitted being rated as world leading or internationally excellent.

Contact for informal inquiries on the research topic: Dr. Daniel Polani (E-mail: d.polani@herts.ac.uk)