Proposal to organise a Special Session on

Nature Inspired Machine Learning Models

at International Conference of Computational Methods in Sciences and Engineering ICCMSE 2007, Corfu, Greece, 25-30 September 2007

Title

Nature Inspired Machine Learning Models

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Description

The natural world ruled by the laws of physics and the knowledge world ruled by the laws of information theory share very deep similarities and analogies arising from the equivalence and convergence between the elementary units of their worlds and statistical mechanisms of their interaction at different levels of course graining.

Already in the quantum world where quants and bits become the same entities a new discipline of quantum computing emerges trying to exploit the natural parallelism to ultra fast search algorithms and simulations of quantum processes. At the micro scale particles and data share similar statistical properties of entropy and uncertainty and physical processes at this level guide variety of optimisation techniques like particle filters, simulated annealing, stochastic diffusion search, and learning methods like mutual information maximisation, stochastic Boltzman learning or particle dynamics-based learning. Finally in the natural macro world, interacting living organisms with their brains, complex multimodal sensing mechanisms and social organisations continue to guide and inspire large scale simulatory optimisation techniques and are at the core of genetic algorithms, evolutionary computation, particle swarm and ant colony optimisations.

The goal of this Special Session is to gather together all different interfaces between information theory and natural sciences physics, biology, chemistry to properly identify, describe and propose new mechanisms of artificial learning directly guided by the natural physical or social processes/phenomena. The research topics covered by this session include but are not limited to:

- Analogies between natural sciences and information theory
- Physical limits of information acquisition, processing and transmitting
- Quantum information processing and learning
- Simulated Annealing (SA)
- Stochastic Diffusion Search (SDS)
- Stochastic Boltzman Learning (SBL)
- Particle Swarm and Ant Colony Optimisation (PSO, ACO)
- Genetic Algorithms (GA) and Evolutionary Computation (EC)
- Particle Filters (PF)
- Particle Dynamics-based Learning (PDL)
- Information Theoretic Learning (ITL), Maximisation of Mutual Information (MMI)
- Algorithmic Kolmogorov Complexity (AKC)
- Neural Networks (NN)
- Social Networks (SN)