Tutorial SBRN'08

Evolving and Self-learning Connectionist Systems: The Knowledge Engineering Approach

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Evolving Connectionist-based Systems (ECOS) are systems that develop their connectionist structure, their functionality and their internal knowledge representation through continuous learning from data and interaction with the environment. ECOS can also evolve through generations of populations using evolutionary computation, but the focus of the tutorial is on the adaptive self-learning and self-improvement of each individual connectionist system. The learning process can be: on-line, off-line, incremental, supervised, unsupervised, active, sleep/dream, multiple task, etc. These general principles can be applied to develop different models of ECOS, including:

- Simple evolving neural networks,
- Evolving spiking neural networks,
- Evolving neuro-fuzzy systems,
- Evolving quantum-inspired neural networks,
- Integrated hybrid models.

The emphasis here is on two knowledge engineering aspects of the evolving and self-learning systems:
(1) Structural and functional adaptation of the system to new data, possibly in an on-line or real time mode;
(2) Knowledge representation and knowledge extraction.

ECOS are demonstrated on challenging problems from:
- Bioinformatics and Neuroinformatics;
- Medical decision support;
- Autonomous robot control;
- Adaptive multimodal information processing;
- Environmental and ecological risk prognosis;
- Financial on-line prediction;

The tutorial targets computer, information and engineering graduate students, researchers and practitioners. Pre-requisite is a basic knowledge on neural networks and statistics.

Text book: N.Kasabov, Evolving connectionist systems: The Knowledge Engineering Approach, Springer, 2007.

Keywords: *Computational Intelligence, Knowledge-based neural networks, Evolving connectionist systems, Data Mining; Knowledge Discovery; Bioinformatics, Neuroinformatics.*

Biodata:

Professor Nikola Kasabov is the Founding Director and the Chief Scientist of the Knowledge Engineering and Discovery Research Institute (KEDRI), Auckland (www.kedri.info/). He holds a Chair of Knowledge Engineering at the School of Computing and Mathematical Sciences at Auckland University of Technology. He is a Fellow of the Royal Society of New Zealand, Fellow of the New Zealand Computer Society and a Senior Member of IEEE. He is the President-Elect of the International Neural Network Society (INNS) and the President of the Asia Pacific Neural Network Assembly (APNNA). He is a member of several technical committees of the IEEE Computational Intelligence Society and of the IFIP AI TC12. Kasabov is on the editorial boards of several international journals, that include IEEE Trans. NN, IEEE Trans. FS, Information Science, J. Theoretical and Computational Nanoscience. He chairs a series of int. conferences ANNES/NCEI in New Zealand. Kasabov holds MSc and PhD from the Technical University of Sofia. His main research interests are in the areas of intelligent information systems, soft computing, neuro-computing, bioinformatics, brain study, speech and image processing, novel methods for data mining and knowledge discovery. He has published more than 400 publications that include 15 books, 120 journal papers, 60 book chapters, 32 patents and numerous conference papers. He has extensive academic experience at various academic and research organisations: University of Otago, New Zealand; University of Essex, UK; University of Trento, Italy; Technical University of Sofia, Bulgaria; University of California at Berkeley; RIKEN and KIT, Japan; T.University Kaiserslautern, Germany, and others. More information of Prof. Kasabov can be found on the KEDRI web site: http://www.kedri.info.