



## ***Professor Nikola Kasabov***

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### **Topic: Brain-Inspired Artificial Intelligence and Deep Learning with Spiking Neural Networks: Methods, Systems, Applications**

**ABSTRACT.** Brain-inspired AI (BI-AI) is the contemporary phase in the AI development that is concerned with the design and implementation of highly intelligent machines that utilise information processing principles from the human brain, along with their applications. Spiking neural networks (SNN) and deep learning algorithms make it possible for the BI-AI to gain a fast progress nowadays.

This presentation has two parts. The first part covers generic methodological aspects, including: Learning and understanding evolving processes in space and time. Data, Information and Knowledge; The human brain as a deep learning, evolving system; A Brief history of AI; Methods of Spiking Neural Networks (SNN); Brain-inspired SNN architectures; Evolutionary and quantum-inspired optimisation of SNN.

The second part presents specific methods, systems and applications based on deep learning in SNN and BI-AI for various applications, including: Deep learning of audio/visual data; Deep learning of brain EEG data; Deep learning of fMRI data; Brain-Computer Interfaces (BCI) and human-machine symbiosis; Computational Neurogenetic Modelling in Bio/Neuroinformatics; Personalised modelling in Bio/Neuroinformatics; Multisensory predictive modelling of ecological and environmental data; Neuromorphic computer systems. It concludes with discussions and future directions.

A brain –inspired SNN architecture NeuCube is used as illustration. Development software and application systems based on NeuCube can be found on: <http://www.kedri.aut.ac.nz/neucube/>

### **Biodata:**

Professor Nikola Kasabov is Fellow of IEEE, Fellow of the Royal Society of New Zealand, DVF of the Royal Academy of Engineering, UK and the Scottish Computer Association. He is the Director of the Knowledge Engineering and Discovery Research Institute (KEDRI), Auckland and Professor at the School of Engineering, Computing and Mathematical Sciences at Auckland University of Technology. Kasabov is President-Elect of the Asia Pacific Neural Network Society (APNNS) to serve as the President in 2019. He is a Past President of the International Neural Network Society (INNS) and APNNS. He is a member of several technical committees of IEEE Computational Intelligence Society and a Distinguished Lecturer of the IEEE CIS (2012-2014). He is a Co-Editor-in-Chief of the Springer journal *Evolving Systems* and serves as Associate Editor of *Neural Networks*, *IEEE TrNN*, *-Tr CDS*, *-TrFS*, *Information Science*, *Applied Soft Computing* and other journals. Kasabov holds MSc and PhD from the TU Sofia, Bulgaria. His main research interests are in the areas of neural networks, intelligent information systems, soft computing, bioinformatics, neuroinformatics. He has published more than 600 publications that include 15 books, 200 journal papers, 28 patents and numerous chapters and conference papers. He has extensive academic experience at various academic and research organisations in Europe and Asia, including: TU Sofia Bulgaria; University of Essex UK; University of Otago, NZ, Advisor Professor at the Shanghai Jiao Tong University, Visiting Professor at ETH/University of Zurich and Robert Gordon University in the UK. Prof. Kasabov has received a number of awards, among them: the APNNA ‘Outstanding Achievements Award’; the INNS Gabor Award for ‘Outstanding contributions to engineering applications of neural networks’; the EU Marie Curie Fellowship; the Bayer Science Innovation Award; the APNNA Excellent Service Award; the RSNZ Science and Technology Medal, and others. He has supervised to completion 46 PhD students. More information of Prof. Kasabov can be found on the KEDRI web site: <http://www.kedri.aut.ac.nz>.