Brain-inspired Neurotechnologies for Predictive Modelling in Health

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Abstract

Brain-inspired neurotechnologies (BINT), based on spiking neural networks (SNN) and neuromorphic systems, have proofed already their efficiency not only in their minimal power consumption and massive parallelism, but in predictive modelling as well, due to their spike-based/event-based information processing [1, 2]. They can learn from data both time and space in their dynamic interaction and provide explainability and adaptability to new data. They are by far superior for spatio/spectro-temporal data processing [1, 2]. *Predictive* BINT are complementary to the current *generative* LLM and their integration is on the way. Recently, new methods and systems of BINT have emerged, such as evolving spatio-temporal associative memories, spike-transformers, hybrid SNN-quantum systems [3] and more.

The talk presents first computational principles of novel BINT and then presents briefly compelling examples of their current application for predictive modelling in health, such as: modelling of neuroimaging data; early prediction of individual stroke, psychosis, dementia, depression, epilepsy; brain-machine interfaces for paralysed people; mental state diagnosis using voice; discovering spatio-temporal brain patterns during treatment with sound; brain-state detection, such as emotion, using audio- and audio-visual information; understanding and modelling conscious perception in humans and machines.

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3. R K Jha, N Kasabov, S Bhattacharyya, D Coyle and G Prasad, A hybrid spiking neural network - quantum framework for spatio-temporal data classification: a case study on EEG data, *EPJ Quantum Technologies*, (2025) 12:130, 1-23, https://doi.org/10.1140/epjqt/s40507-025-00443-1