UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): A biomimetic SNN to reproduce the dynamics of in vivo neuronal networks

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Description

Motivation and application domain

To create bioelectrical therapeutic solution for health care, a real-time interface between a computational device and a biological system is mandatory. Within this traineeship, the student will be involved in scientific and technical activities aimed at building a â€˜neuromorphic prosthesisâ€™ to be tested at preclinical level, where an artificial system is interfaced to a biological one to restore functional behavior. To achieve this ambitious goal, it will be necessary to : 1) Analyze data (from in vivo electrophysiological recordings) to be used to compile a library of typical spontaneous and evoked activity patterns; 2) based on the analysis performed at point 1, realize a realistic (i.e. biomimetic) neural network model using an artificial SNN; 3) tune the parameters of neuron models, synapses, connectivity and plasticity rules, to mimic the actual biological dynamics of the in vivo network; 4) use the obtained SNN to perform experiments to see whether and how the biological network respond to a neural-like stimulation.

General objectives and main activities

During the Master Thesis work, the student will primarily perform activities related to task 1), 2) and 3). The student will be instructed on how to analyze the neural data, how to compute biomarkers of interest, how to realize or contribute to realize a realistic SNN and how to tune it to meet the biological requirements. We expect the student to learn coding, data analysis, computational modelling and hw implementation. If time will allow to, also activity 4) will be performed, in direct collaboration with the DIBRIS Labs at the San Martino Hospital.

Training Objectives (technical/analytical tools, experimental methodologies)

The thesis will allow training in computational neuroscience, modelling, neuromorphic engineering, hardware implementation, signal processing, neural data analysis, in vivo experiments.

Place(s) where the thesis work will be carried out: IMS Lab, University of Bordeaux, Bordeaux, France & DIBRIS, UNIGE

Additional information

Pre-requisite abilities/skills: Coding expertise is mandatory

Maximum number of students: 1

Financial support/scholarship: YES