Title (tentative): Analytical tools to study the effects of electrical microstimulation to guide cortical plasticity

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Motivation and application domain

The goal of this project is to investigate the electrophysiological effects of intracortical microstimulation on healthy/damaged cortical networks in animal models (in vivo). The motivation behind the study consists of exploring novel strategies of ‘invasive’ neuromodulation to re-establish the functionality of cortico-cortical pathways affected by motor cortical lesions with neurorehabilitation purposes. To this end, open and closed-loop approaches are employed.

General objectives and main activities

The general objectives and activities are following:
1. Understand how experiments are conducted, the different phases the main motivations and objectives of the present study.
2. Establish the computation pipeline and data analysis tools aimed to describe the effect of intracortical microstimulation (ICMS) on the underlying neural dynamics and to interpret the results obtained during previously performed experiments.
3. Design and realize an experimental set-up for in vivo electrophysiology, together with suitable experimental protocols for acute experiments in rats. If there will be the possibility and there is interest, perform experiments either at IIT or in collaboration with KUMED.

Training Objectives (technical/analytical tools, experimental methodologies)

• Analysis of in vivo neuronal activity and statistical testing
• Interpretation of obtained results in light of the applied experimental protocols
• In vivo set-up use and optimization
• How to perform experiments in vivo.

Place(s) where the thesis work will be carried out: Istituto Italiano di Tecnologia, NBT department with the possibility to perform experiments at the University of Kansas Medical Center (KUMED, Kansas City, KS, USA)

Additional information

Pre-requisite abilities/skills: MATLAB programming skills, signal processing, statistics, attitude to experimental work

Curriculum: Neuroengineering

Maximum number of students: 1
Financial support/scholarship: -