DGCN05 – Practical Training & Thesis

Project proposal

Project title: Extraction of brain activity representation from calcium imaging without sources segmentation.

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Principal Investigator: Francesco Battaglia

Donders Theme(s): Theme 4

Research centre: DCN

Project description:

State-of-the-art neural populations' analysis requires a huge number of neurons to be recorded at the moment of experimentation. Pre-processing steps require to separate sources: spike sorting in the case of electrophysiology and segmentation of image in the case of calcium imaging. Often, afterwards, neural data analysis is initiated by reducing the dimensionality of neural space. It has been shown, [1], that spike sorting is not necessarily required for further processing when some conditions are satisfied.

Currently, preprocessing of calcium imaging (source extraction) requires fine-tuning multiple parameters and lots of computational resources. The aim of this project is to explore the validity of doing feature extraction from calcium imaging without source extraction (equivalent to non-spike sorting).

For this purpose, in this project, we will explore a complete data set consisting of one-photon calcium imaging. With this set of images we propose to run multiple analysis steps that include: dimensionality reduction (using PCA, CCA, etc.) and decoders, and afterwards compare results from analysis of raw images with the current results of the lab (that were obtained after pre-processing steps). As a comparison with a higher quality imaging technique, we also propose that there will be an exploration of calcium imaging videos from a two-photon microscope.

Good programming skills are required, as well as basic general Machine Learning knowledge. Image processing general knowledge is also relevant.

¹ If more on-site supervisors are involved, please add their names as well.