DGCN05 – Practical Training & Thesis

Project proposal

Project title: Population-dependent criticality in cortical networks

On-site supervisor¹: Federico Stella

Principal Investigator: Francesco P. Battaglia

Donders Theme(s): Theme 4: Natural Computing & Neurotechnology

Research centre: DCN

Project description:

Recent theories of cortical functioning have put the stress on it supposedly being poised on the edge of a critical transition. Such critical state is thought to maximize performance in multiple aspects of cortical computations. Importantly, in these analyses the network is generally assumed to be homogeneous and achieve criticality on a global level. Nevertheless, various components of the cortical structure and most importantly learning are known to differentially affect distinct populations of neurons.

We aim at devising an algorithmic analysis based on the statistical properties of critical systems to identify sub groups of cortical neurons which are closer to the critical transition. Such method can be potentially built upon an iterative search akin to Genetic Algorithms. After developing and testing on synthetic data, the analysis will be applied to real experimental cortical recordings of different types.

This project offers the possibility to apply ideas and model derived from statistical analysis of interacting physical systems to complex neural data. The candidate will have the chance to familiarize with large, complex experimental dataset of different nature, and to develop expertise in advanced analysis techniques. Good programming skills (in MATLAB or Python) and a general knowledge of statistical mechanics are welcomed.

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

For examples of the analysis techniques we are planning to employ:


More information:

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