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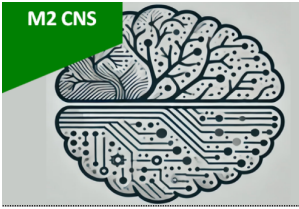
Project title: Deciphering Nested Neural Rhythms During Visual Attention Tasks

Project summary:

Neural activity in the brain spans multiple scales, encompassing both spatial (inter- and intra-areal) and temporal (slow and fast) dynamics. It is hypothesized that slower rhythms (alpha/beta bands) mediate top-down control, while faster rhythms (gamma band) facilitate bottom-up processing. During cognitive tasks, these rhythms interact and nest within mesoscale and macroscale circuits. This internship will focus on investigating the nested neural rhythms recorded during a visual-attention task. The objective is to uncover the relationship between the neural substrates and temporal properties of these nested rhythms, leveraging mathematical models that incorporate the laminar circuitry of neocortical columns. Familiarity with dynamical systems, mathematical models and proficiency with Python are required.

References:

1. Bonnefond M, Kastner S, Jensen O. Communication between Brain Areas Based on Nested Oscillations. *eNeuro*. 2017 Mar 1;4(2).
2. Köksal-Ersöz E, Lazazzera R, Yochum M, Merlet I, Makhlova J, Mercadal B, et al. Signal processing and computational modeling for interpretation of SEEG-recorded interictal epileptiform discharges in epileptogenic and non-epileptogenic zones. *J Neural Eng*. 2022 Sep;19(5):055005.
3. Sanchez-Todo R, Bastos AM, Lopez-Sola E, Mercadal B, Santarnecchi E, Miller EK, et al. A physical neural mass model framework for the analysis of oscillatory generators from laminar electrophysiological recordings. *NeuroImage*. 2023 Apr 15;270:119938.



4. Zheng T, Sugino M, Jimbo Y, Ermentrout GB, Kotani K. Analyzing top-down visual attention in the context of gamma oscillations: a layer- dependent network-of- networks approach. *Front Comput Neurosci.* 2024 Sep 23;18.