Revealing Fine-Scale Representations and Processing with High-Resolution fMRI and MVPA

Organizer:
Amir Shumel
MNI, McGill University, Montreal, QC, Canada

The uniformity of the mammalian cortex has led to the proposition that there exist elementary cortical units of operation, consisting of several hundred or thousand neurons that are repeated within and across cortical areas (Lorente de No', 1938). Cortical columns and layers of neocortex are prominent examples of such structurally and functionally specialized units. Functional properties and connectivity are similar for neurons within a column but are known to vary between columns. It can therefore be argued, based on information-theory, that the optimal spatial scale for studying the relationship between brain function and behavior is that of cortical columns (and layers, for similar reasons).

The symposium will focus on cutting-edge methods and results of combining high-resolution functional imaging and multivariate pattern analysis (MVPA) for probing fine-scale cortical representations and processing. It will analyze the relationship between fine-scale neuronal patterns and fMRI response patterns. It will address the potential of pattern-information fMRI to capture columnar-scale representations. It will feature studies that successfully implemented these methods, and will emphasize correct interpretation of the results. It will critically assess the potential and limitations of different analysis techniques and present recent theoretical advances in understanding the processing of sensory information these methods have enabled. It will feature deep neural network models that put higher-level representations within the reach of computational modelling, but require detailed representational analyses to be empirically tested.

The symposium will expand the awareness among the OHBM community of the benefits and limitations of combining high-resolution functional imaging with MVPA for probing fine-scale cortical organizations and processing.

Multiple scales of representation in human cortex
Elisha Merriam, *New York University, New York, NY, United States*

Evaluating contributions of fine-scale irregularities, low-frequency organizations, macroscopic blood vessels and spatiotemporal responses to fMRI-based orientation decoding
Amir Shumel, *MNI, McGill University, Montreal, QC, Canada*

Layer specific brain imaging of top-down internal models induced by visual and auditory context
Lars Muckli, University of Glasgow, Glasgow, United Kingdom

Testing deep neural networks models of cortical processing with fMRI
Nikolaus Kreigeskorte, MRC Cognition and Brain Sciences Unit, Cambridge, United Kingdom