Modeling and Analysis Methods II

Wednesday, Jun 20: 10:30 AM - 11:45 AM
Oral Sessions
Wednesday - Oral Session

Presentations

2654: Validity of summary statistics-based mixed-effects group fMRI

10:30 AM - 10:42 AM
Statistical analysis of multi-subject functional Magnetic Resonance Imaging (fMRI) data is traditionally done using either: 1) a mixed-effects GLM (MFX GLM) where within-subject variance estimates are used and incorporated into per-subject weights or 2) a random-effects General linear model (GLM) (RFX GLM) where within-subject variance estimates are not used. Both approaches are implemented and available in major neuroimaging software packages including: SPM (MFX analysis; 2nd-Level statistics), FSL (FLAME; OLS) and AFNI (3dMEMA; 3dttest++). While MFX GLM provides the most efficient statistical estimate, its properties are only guaranteed in large samples, and it has been shown that RFX GLM is a valid alternative for one-sample group analyses in fMRI [1]. We recently showed that MFX GLM for image-based meta-analysis could lead to invalid results in small samples. Here, we investigate whether this issue also affects group fMRI.

Presenter

Camille Maumet, INRIA

2434: Visibility graphs for fMRI data: multiplex temporal graphs and their spatiotemporal modulations

10:42 AM - 10:54 AM
Visibility algorithms map time series into graphs, such as that the tools of graph theory can be used for the characterization of time series. This approach has proved a convenient tool and visibility graphs have found applications across several disciplines. Here we test their application to fMRI time series, following two main motivations, namely that (i) this approach allows to simultaneously capture and process relevant aspects of both local and global dynamics in an easy and intuitive way, and (ii) this provides a suggestive bridge between time series and network theory.

Presenter

Daniele Marinazzo, Ghent University

2510: A probabilistic method for modelling cortical layer composition in sub-voxel resolution

10:54 AM - 11:06 AM

The ability to investigate the cortical layers is greatly hindered by limitation resolution. We recently developed a method for probabilistic classification of the cortex into sub-populations of grey matter based on multi-component sub-voxel T1 analysis [1] and mixture modelling. We used multiple Inversion Recovery (IR) scans with varying Inversion Times (TIs) from which we calculated the barin T1 distribution. We were then able to identify several sub-populations of cortical grey matter. Some of the statistical considerations we faced concern using mixture models on classifying the whole-brain T1 distributions. We focus here on the advantages of using a mixture of t-distributions [2] instead of a Gaussian mixture model. The reason for that is that the IR optimization analysis is noisy, and t-distributions are more robust against noise in the data. Another area we focus on is the number of components in the mixture model, which is difficult to determine when the distribution modes are not well separated. While our method has spatial limitations, as it is a probabilistic and not a volumetric method, it enables us to break the resolution barrier, which will allow for research into cortical layers and their clinical and behavioral implications.

Presenter

Omri Tomer, Tel Aviv University

2352: Spontaneous reconfiguration of waves in a model of large-scale brain dynamics

11:06 AM - 11:18 AM

Advances in mapping the human connectome have yielded increasingly-detailed descriptions of large-scale brain networks, prompting growing interest in the dynamics that emerge from this structural connectivity. However, most efforts to date have concentrated on simple static functional connectivity measures, which are offering diminishing returns. More recently, interest has turned toward the more complex repertoire of brain dynamics, which unfolds on multiple time scales. Here, we analyze the spontaneous wave dynamics that emerge from a neural mass model with network connectivity derived from densely-seeded probabilistic tractography.

Presenter

James Roberts, QIMR Berghofer Medical Research Institute

2512: ASD Brain Biomarker Detection on fMRI Images by Analyzing Deep Neural Network

11:18 AM - 11:30 AM

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder. It emerges early in life and is generally associated with lifelong disability. Early diagnosis and precise treatment are critical. Finding the biomarkers associated with ASD is extremely helpful to understand the underlying roots of the disorder and can lead to earlier diagnosis and more targeted treatment [1]. Here, we address the problem of interpreting biomarkers by analyzing the reliable classifier outcomes in classifying ASD vs. control.

Presenter

Xiaoxiao Li, Yale University

2471: A generative model for inferring whole-brain effective connectivity

11:30 AM - 11:42 AM

Developing whole-brain models that infer the effective (directed) connectivity among neuronal populations from neuroimaging data represents a central challenge for computational neuroscience. Dynamic causal models (DCMs; Friston et al., 2003) of functional magnetic resonance imaging (fMRI) data have been used frequently for inferring effective connectivity, but are presently restricted to small graphs (up to 10 regions) to keep model inversion feasible. Here, we introduce regression DCM (rDCM; Frässle et al., 2017, Frässle et al., under review) as a novel variant of DCM for fMRI that enables whole-brain effective connectivity analyses.

Presenter

Stefan Frässle, Translational Neuromodeling Unit