

Time-varying connectivity in resting-state fMRI: from methods to interpretations

Half Day Morning Course/ 8:00-12:00

Organizers:

Raphael Liegeois

National University of Singapore

Vince Calhoun

Mind/UNM, Albuquerque, New Mexico, United States

Recent converging evidence suggests that a static representation of FC, e.g. based on the correlation between entire fMRI time series, misses important information encoded in fMRI data. Hence, various methods have been developed in recent years to exploit the information encoded beyond such static measures. The researcher interested in exploring time-varying FC properties has to select among the multitude of proposed methods, each one having different properties and underlying assumptions. It is then also necessary to have a basic understanding of the processes generating the observed FC fluctuations in order to interpret the results. This educational course is aimed at guiding the researcher through these two steps. To this end, we will first recall the definition of the most important mathematical terms needed to characterize temporal fluctuations of functional connectivity. This is of particular importance as some notions (e.g., '(non-)stationarity', 'static', 'dynamic', 'time-varying') may easily be misused, potentially leading to imprecise interpretations or confusion in the field. We will provide an overview of the main approaches that have been used to explore functional connectivity beyond the classical static paradigm (e.g. brain states, co-activation patterns, autoregressive models). We will also go into detail on methods that have shown the most promising results, using toy-examples and applications on real datasets. The second part of the course will be devoted to the interpretation of FC fluctuations. We will detail their links to micro-scale (i.e. neuronal) dynamics as well as their behavioral counterparts. We will conclude by summarizing the main remaining controversies of the field. In order to maximize learning outcomes for participants, we will include two active learning components. First, online multiple-choice questions covering each talk will be proposed to the audience before the course. Answers to these questions will be provided at the end of each talk. In addition, an online question submission system will be made available to the audience in order for everyone to have the opportunity to comment on the talks and ask questions in advance or during the course.

The course website URL is: https://raphaelliegeois.github.io/OHBM2018_TVFC_Course

Course Schedule:

8:00-8:35

Time-varying connectivity: introduction and terminology

Raphael Liegeois, National University of Singapore, Singapore

8:35-9:10

The Dynamic Functional Connectome: Methodological Framework

Maria Giulia Preti, Ecole Polytechnique Fédérale de Lausanne (EPFL) / Université de Genève, Switzerland

9:10-9:45

Time-varying connectivity: Data-driven approaches and clinical applications

Vince Calhoun, Mind/UNM, United States

9:45-10:00

Break

10:00-10:35

Neuronal models of dynamic functional connectivity: Linking scales and data modalities

Michael Breakspear, QIMR Berghofer, Australia

10:35-11:10

Cognitive and behavioral interpretations of time-varying changes in functional connectivity estimates

Jessica Cohen, University of North Carolina, United States

11:10-11:45

What we talk about when we talk about 'dynamics' in resting state fMRI

Timothy Laumann, Washington University in St. Louis, United States

11:45-12:00

Questions and Answers