Critical Perspectives on Time-Varying Models for BOLD Functional Connectivity

Tuesday, Jun 19: 2:45 PM - 4:00 PM
3552
Symposium
Tuesday - Symposia PM
In recent years, "dynamic" functional connectivity or functional connectivity that changes with time has become an emerging area of investigation in fMRI. However, other types of time-varying models of functional connectivity are also possible where the time-varying parameters are not functional connectivity but rather other second-order statistics of the BOLD signal such as the autocorrelation or the signal variance. For example, there is a growing interest in "temporal networks" that capture dependencies between individual time-points during rest or task-fMRI. Moreover, multiple and distinct time-varying models may fit the same fMRI data equally well. Consequently, it is unclear whether the time-varying aspects of the inferred models have neurobiological significance.

This symposium seeks to achieve the following objectives

1) Illustrate the spectrum of time-varying statistical models where the time-varying parameters could be either spatial i.e. functional connectivity or temporal i.e. autocorrelation.
2) Demonstrate statistical tradeoffs between model complexity vs. efficient/reliable estimation
3) Critically evaluate conclusions that i) functional connectivity is changing in time as opposed to other characteristics of the observed fMRI signals, ii) whether the time-varying parameters have a neuronal basis.

Achieving these objectives will provide clarity on choosing between relevant statistical models that might explain “dynamics” in fMRI signals and spur constructive discussion on how best to validate neural and non-neural time-varying components of BOLD functional connectivity.
Objective

Objective 1: Understand that time-varying models for functional connectivity do not necessarily require functional connectivity to be time-varying. Rather nuisance parameters or other aspects of the signal could be time-varying.

Objective 2: Learn about statistical as well as empirical techniques to test the validity of time-varying models in fMRI
Target Audience

Anyone whose work intersects with fMRI and either dynamic functional connectivity or other types of time-varying properties of the BOLD signal. Researchers could be on the modeling/analysis or experimental side.
Organizer

Manjari Narayan, Stanford University

Presentations

Model-based approaches towards assessing Dynamic Connectivity (index.cfm?do=ev.viewEv&ev=1710)

In this talk we describe some of the benefits of using a model-based approach towards assessing dynamic connectivity, and contrast these approaches to the more commonly used sliding-window approaches. In addition, we illustrate how using a model-based approach illuminates the necessary assumptions needed to avoid `illusory` dynamic connectivity that can often occur in neuroimaging data.

Presenter

Martin Lindquist, Johns Hopkins University School of Public Health

Separable Spatiotemporal Models of Functional Connectivity with Nonstationary Autocorrelation (index.cfm?do=ev.viewEv&ev=1711)

This talk introduces a general class of spatiotemporal models for functional connectivity related to matrix variate distributions. In addition to modeling dependence between spatial variables, such models permit flexible nonstationary dependence or autocorrelation between time-points and global variance. Importantly, these models lead to efficient estimates of either functional connectivity or temporal networks, while accounting for reduced effective sample size due to non-independent measurements. However, such models enforce separability, that is they assume every voxel or region exhibit the same temporal structure. We consider issues of goodness of fit and tradeoffs between employing such separable, yet nonstationary models against popular non-separable, yet stationary autoregressive models in fMRI studies.

Presenter

Manjari Narayan, Stanford University

Neural and non-neural correlates of time-varying resting-state functional connectivity (index.cfm?do=ev.viewEv&ev=1712)

A recent advance in the resting-state fMRI research field is the development of a set of statistical tools that extract and quantify time-varying information from resting-state fMRI data. However, the neural basis and non-neural correlates of such resting-state fMRI dynamics remains largely elusive. In this talk, I will discuss recent advances in understanding how the dynamic changes in resting-state functional connectivity are related to certain electrophysiological events, non-neuronal structural noise, as well as human behaviors.

Presenter

Xiao Liu, Pennsylvania State University