ELSC Seminar - Prof. Gadi Goelman, Dec. 08, 2016 at 17:00

December 4, 2016 - December 9, 2016

Nonlinear coherences among multiple time-series: Use of MRI data to identify brain temporal organization and directionality of information flow

ELSC cordially invites you to the lecture given by:

Prof. Gadi Goelman

MRI Lab of the Human Biology Research Center, Hadassah Medical Center

On the topic of:

"Nonlinear coherences among multiple time-series: Use of MRI data to identify brain temporal organization and directionality of information flow"

The lecture will be held on Thursday December 8th, at 17:00

at ELSC: Silberman Bldg., 3rd Wing, 6th Floor,

Edmond J. Safra Campus

Light refreshments served at 16:45

Abstract:

Networks are advancing the field of neuroimaging. They are generally constructed from pairwise interactions with an assumption of linear relations between them. I will describe a novel high-order statistical framework to calculate interactions among multiple coupled time-series. Based on wavelet
analysis and spectral coherence, the mathematical expression for 4 time-series was derived and its validity 
and dependency on coupling strength and noise was tested by computer simulations of the Kuramoto 
model. The analysis enables to characterize quartets of time-series (i.e. brain regions) as linear, nonlinear 
or of higher (>4) order networks. Phase delays between time-series are used to obtain network’s temporal 
hierarchy and to infer directionality of information flow. The analysis can be used in a variety of disciplines 
including fMRI, electrophysiology, EEG or MEG. I will demonstrate the analysis strength using resting-state 
fMRI data to show that the ventral visual system is composed of linear networks and exhibits its known 
temporal hierarchy, while the motor system and the default mode network (DMN) are composed of 
nonlinear networks. The motor system exhibits center-out hierarchy and the DMN has dorsal?ventral 
and anterior?posterior organizations. If time permitted, I will describe applications in fMRI 
hyperscanning data aiming to identify directionality of information flow during live social interactions.

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