# Brain Network Analysis Seminars

## Wiley Conference Center (2nd floor), Waisman Center

## University of Wisconsin-Madison

**November 14, 2017 2:00-4:00pm**

2:00-3:00pm


## Guorong Wu

Department of Radiology, University of North Carolina-Chapel Hill


## Computational Brain Connectome: From Reverse Engineering the Brain to Understand Brain Connectivity


*Abstract:* Neuroimaging research has developed rapidly in last decade, with various applications of brain mapping technologies that provide mechanisms for discovering neuropsychiatric disorders *in vivo*. The human brain is something of an enigma. Much is known about its physical structure, but how it manages to marshal its myriad components into a powerhouse capable of performing so many different tasks remains a mystery. In this talk, I will demonstrate that it is more important to understand how the brain regions are connected rather than study each brain region individually. I will introduce my recent research on human brain connectome, with the focus on revealing high-order brain connectome and functional dynamics using learning-based approaches, and the successful applications in identifying neuro-disorder subjects such as Autism and Alzheimer's disease.


*Short Bio:* Dr. Guorong Wu is an Assistant Professor in Department of Radiology at University of North Carolina, Chapel Hill (http://www.unc.edu/~grwu). His primary research interests are medical image analysis, big data mining, scientific data visualization, and computer assisted diagnosis. He has been working on medical image analysis since he started my PhD study in 2003. Dr. Wu has released more than 10 image analysis software packages to the medical imaging community, which count to more than 15,000 downloads since 2009. Dr. Wu is the recipient of NIH Career Development Award (K01) and PI of NIH Exploratory/Developmental Research Grant Award (R21). He also serves as the Co-PI and Co-Investigator in other NSF and NIH grants.


Contact Moo K. Chung mkchung@wisc.edu for additional information.

3:00-3:30pm

Amr Moussa

Department of Radiology, University of North Carolina-Chapel Hill

## Demonstration of visualizing brain network in virtual reality

*Abstract:* We will do the demonstration of visualizing brain network in virtual reality. We will demonstrate the virtual reality in the Oculus goggle and the LCD projector. The audience will given an opportunity try on goggle.

3:30-4:00pm

Yuan Wang

Department of Statistics, University of Wisconsin-Madison

## Topological invariance in high-density electroencephalographic power maps

*Abstract:* Topology is the mathematical study of invariant properties preserved through continuous deformations of the underlying object. Topological invariance interpreted in a statistical context has recently found important application in epileptic electroencephalographic (EEG) signals. Our latest work extends the univariate method to quantify the geometric patterns of spectral power maps on a high-density EEG layout. The two-dimensional method reveals geometric characteristics of an EEG power map by tracking topological feature changes in a graph filtration on the layout of spectral powers. We propose a statistical test for comparing the topological features of two groups of power maps. The test is shown through simulation studies to be invariant under topology-preserving transformations of the power maps, such as translation and scaling; it is also shown to be sensitive to tearing of the power maps. In data application, we use the test to compare the spectral power maps of meditators and controls during their non-REM sleep to investigate neuroplastic effect of long-term meditation. Significant difference between the two groups is found in the beta-band power pattern during early non-REM sleep stage.