

**MICHIGAN STATE UNIVERSITY**  
Department of Statistics and Probability

# COLLOQUIUM

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## Big Data in Neuroscience: Analysis Challenges for the Coming Decades

**Tuesday, January 10, 2017**  
**10:20 a.m. - 11:10 am**  
**Refreshments 10:00 am**  
**C405 Wells Hall**

### **Abstract**

New technologies, such as optical imaging, are bringing high-throughput data to experimental neuroscience, as big data came to genomics a decade earlier. As microarrays transformed genomics and stimulated research in statistics, the new high-throughput neural technologies give rise to significant data analysis challenges. However the statistical methods and computational infrastructure to analyze and interpret these data are as yet largely undeveloped.

I will introduce these new kinds of data and summarize the kinds of challenges they pose; then will survey progress to date and discuss open problems in analysis of these new kinds of data. A key issue with all new technologies is pre-processing to remove artifacts and reduce noise; these pre-processing problems have only partly been solved. A second issue is exploratory analysis and visualization; classical dimension reduction methods, while useful, do not capture much variance. A third issue is how to characterize brain dynamics; a fourth is inference of network connections and communication. New video-tracking methods promise to soon give us high-throughput behavioral data simultaneous with neural data, but few methods have been proposed for integrating high-throughput neural data with high-throughput behavioral analyses.

I will discuss promising approaches, such as constrained regressions, and Bayesian inference, and discuss their current limitations. Statisticians may need some pointers to overcome the challenges of how to access and understand these new complex data, but these new issues will stimulate development of many new statistical methods in the coming decade.

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