The University of Chicago

Department of Statistics

Seminar Series

BYRON YU

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and Gatsby Computational Neuroscience Unit, UCL

Extracting Single-trial Views of Brain Activity

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133 Eckhart Hall, 5734 S. University Avenue
Refreshments following the seminar in Eckhart 110.

ABSTRACT

Advances in neural recording technologies (including multi-electrode arrays and optical imaging techniques) have transformed systems neuroscience from a field that is data-limited to one that is limited by the available analytical methods. While we have well-established methods for studying the activity of one or perhaps a pair of neurons, we are currently unprepared to deal with the activity of the tens to hundreds of neurons that we can now monitor simultaneously. To make further scientific progress with the ever-growing volume of neural data being collected, new analytical methods are needed that can leverage the simultaneous recording of large populations of neurons. In this talk, I will take a step in this direction by describing how low-dimensional "neural trajectories" can be extracted from the high-dimensional recorded activity as it evolves over time. The neural trajectories can be extracted on single experimental trials (rather than having to average across multiple experimental trials, as is the case for many traditional methods), which is critical for many neuroscientific studies. Such an approach facilitates data visualization and studies of neural dynamics under different experimental conditions. In its application to neural activity recorded in premotor cortex, we obtained the first direct view of single-trial trajectories converging during motor preparation, suggestive of attractor dynamics. I will then show how such methods can be a powerful tool for relating the neural activity across a neural population to the subject's behavior on a single-trial basis. In sum, the development of statistical tools for analyzing single-trial neural population activity has the potential to further our understanding of neural mechanisms and uncover computational principles employed by the brain.

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