

NEURAL ENGINEERING SEMINAR SERIES

cne.psu.edu

Neural Population Interactions Between Cortical Areas

<https://psu.zoom.us/j/94639233394>

April 12, 2023

12:15 -1:15 p.m. (E.T.)

W306 Millennium Science
Complex



Matthew Smith, Ph.D.

Associate Professor,
Biomedical Engineering
and Carnegie Mellon
Neuroscience Institute

Carnegie Mellon

ABSTRACT:

Neural activity observed within a brain area may reflect local computations within the area, inputs from another area, or shared computations/inputs across many areas. Ideally, these distinct mechanisms could be studied separately. However, because multiple processes can influence groups of neurons, it is not obvious how to separate the neural signals that should be attributed to each process. We investigated the different behavioral roles of neural variability shared across hemispheres and neural variability local to each hemisphere. To do this, we applied dimensionality reduction methods to bilateral prefrontal cortex (PFC) array recordings. We were able to identify latent variables representing activity shared across hemispheres, as well as latent variables representing activity local to each hemisphere. We found that variability shared across hemispheres was dominated by a process that slowly evolved across trials and was highly correlated with trial-to-trial fluctuations in mean pupil diameter - a potential neural correlate of fluctuations in arousal. By decoding this signal from neuronal population activity, we were able to predict a constellation of aspects of the animal's task and eye movement behavior. Overall, our work demonstrates how distributed cognitive processes and states can be hidden in subtle shifts in the responsiveness of individual neurons, but accessed and decoded from simultaneously recorded populations of neurons.

BIOGRAPHY:

Matt Smith's core interest lies in understanding the brain's mechanisms for interpreting visual inputs, processing them, and generating motor outputs. His work merges a host of backgrounds, from computational approaches to electrophysiology, to better understand how groups of neurons give rise to visual perception, cognition, and action.

Smith is an Associate Professor of Biomedical Engineering and the Carnegie Mellon Neuroscience Institute. He was a recipient of a NIH K99/R00 Pathway to Independent Award and a Career Development Award from Research to Prevent Blindness. His work has been funded by the NIH, NSF, Research to Prevent Blindness, Schaffer Foundation for Glaucoma Research, and Hillman Foundation.