Towards a Transformative Framework for Behavioral Analysis in Naturalistic Contexts

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BMI Classroom 4004

Woodruff Memorial Research Building

Or

Join us on Zoom link:

https://zoom.us/j/93039325399

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Abstract: When a mouse freely explores its environment, it continuously perceives sensory inputs, selects actions, and generates behavior. Understanding how these processes unfold and are coordinated in the brain has long been a central goal in neuroscience. Historically, this problem has been studied primarily in highly controlled experimental settings, with constrained tasks, simplified stimuli, and stereotyped behaviors. While these approaches have yielded important insights, extending them to naturalistic scenarios introduces substantial new modeling challenges.

Naturalistic behavior is inherently more complex, involving self-paced, unstructured, and variable actions that unfold across multiple timescales. In this talk, I will present our recent efforts to develop reinforcement learning and inverse reinforcement learning–based models that capture this complexity and uncover meaningful cognitive and motor representations linked to underlying brain function. Although the work is grounded in animal behavior, the modeling framework is designed to be general, emphasizing principles that extend beyond species or task boundaries.

More broadly, emerging experimental paradigms increasingly rely on rich, multidimensional stimuli and spontaneous behavior, calling for a shift in how neural and behavioral data are analyzed. By advancing data-driven approaches for freely moving, naturalistic settings, this work aims to contribute to a more general understanding of the neural basis of cognition and behavior, with direct relevance to both animal and human neuroscience.

Biography: Dr. Wu is an Assistant Professor at the School of Computational Science and Engineering (CSE), Georgia Institute of Technology. She was a Postdoctoral Research Fellow at the Center for Theoretical Neuroscience, the Zuckerman Mind Brain Behavior Institute, Columbia University. She received her Ph.D. degree in Computational and Quantitative Neuroscience and a graduate certificate in Statistics and Machine Learning from Princeton University. Anqi was selected for the MIT Rising Star in EECS, DARPA Riser, Alfred P. Sloan Fellow, and Kavli Fellow by National Academy of Sciences. Her research focuses on developing scientifically grounded statistical models to uncover structure in neural and behavioral data at the intersection of machine learning and computational neuroscience. She is broadly interested in creating data-driven models to advance both animal and human studies in systems and cognitive neuroscience.

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