Computational Neuroscience Seminar

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Bayesian Inference with Oscillator Models: A Possible Role of Neural Rhythms.

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4:00-5:00pm
Fung Auditorium, Powell-Focht Bioengineering Building
University of California San Diego

Prediction is believed to be a fundamentally important computational function for any intelligent system. Bayesian inference in probability theory is a well-known mechanism to implement prediction. This has led to historical and recent interest in Bayesian inference for biological sensory systems: The Bayesian model of sensory (e.g., visual) signal processing suggests that the cortical networks in the brain encode a probabilistic 'belief' about reality. The belief state is updated based on comparison between the novel stimuli (from senses) and the internal prediction. A natural question to ask then is whether there is a rigorous methodology to implement complex forms of prediction via Bayes rule at the level of neurophysiologically plausible spiking elements? In this talk, I will provide a qualified answer to this question via coupled oscillator models. A single oscillator is a simplified model of a single spiking neuron. The coupled oscillator model solves an inference problem: The population encodes a belief state that is continuously updated (in a Bayes optimal fashion) based on noisy measurements. The methodology is described with the aid of a model problem involving estimation of a `walking gait cycle' using noisy measurements. This is joint work with several students and collaborators at the University of Illinois.

Prashant Mehta is an Associate Professor in the Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign. He received his Ph.D. in Applied Mathematics from Cornell University in 2004. Prior to joining Illinois, he was a Research Engineer at the United Technologies Research Center (UTRC). His research interests are at the intersection of dynamical systems and control theory, including mean- field games, model reduction, and nonlinear control. He has received several awards including an Outstanding Achievement Award for his research contributions at UTRC, several Best Paper awards together with his students at Illinois, and numerous teaching and advising honors at Illinois.

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