BIOMATH SEMINAR

Friday, September 11 1-2 pm Harris 4119

Firing Rate Statistics with Intrinsic and Network Heterogeneity

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Abstract: Heterogeneity of neural attributes has recently gained a lot of attention and is increasing recognized as a crucial feature in neural processing. Despite its importance, this physiological feature has traditionally been neglected in theoretical studies of cortical neural networks. Thus, there is still a lot unknown; specifically, how combining network (synaptic heterogeneity) and intrinsic heterogeneity interact and they drive neural activity is mysterious despite the fact that both are known to exist and have significant roles in neural coding/processing. In a canonical recurrent spiking neural network model, we study how these two forms of heterogeneity lead to different distributions of firing rates. To analytically characterize our observations, we employ a dimension reduction method that relies on a combination of simulations and probability density function equations. The relationship between intrinsic and network heterogeneity can lead to amplification or attenuation of firing rate heterogeneity, and these effects depend on whether the recurrent network is firing asynchronously or rhythmically. Further analysis based on the reduction methods yield useful analytic descriptions, which provide compact and descriptive formulas for how the relationship between intrinsic and network heterogeneity determines the firing rate heterogeneity dynamics in various settings.

All students are welcome and encouraged to attend!