SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

ELUCIDATING FUNCTIONAL ADVANTAGES OF DYNAMIC ARCHITECTURE IN NEURONAL NETWORKS

PhD Preliminary Research Examination

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Abstract: A fundamental question in theoretical neuroscience pertains to the link between dynamics (the time-varying activity of networks in the brain) and function (the ostensibly associated computations performed by said networks). This research aims to investigate the dynamics of neural circuits through system-theoretic approaches with a specific focus on elucidating putative functional advantages of dynamic network architectures, i.e., the constant adaption of neuronal networks and the connections therein to ongoing activity. In particular, I propose methods for inference, design and learning of dynamic connections in neuronal networks. To infer network connectivity, I consider the problem of optimal probing to learn connections in an evoked dynamic network. Such a network, in which each edge measures an input-output relationship between two sites in a sensor/actuator-space, is relevant to emerging applications in neural mapping and neural connectivity estimation. Then, I study the problem of recovering a high dimensional network input, over time, from observation of only a subset of the network states to ascertain how the network dynamics lead to performance advantages, particularly, in scenarios for which both the input and output are corrupted by disturbance and noise, respectively. Subsequently, I demonstrate how enhancement of short term memory in a sparse recurrent neural network is achieved with connection dynamics that resemble biologically observed rules of neural plasticity. Finally, I propose a data driven approach for analyzing real neural data to be able to track dynamic connectivity and provide insights on spatiotemporal motifs across resting state networks.

DATE:	Thursday, September 17, 2015
TIME:	10:10 a.m.
PLACE:	Green Hall, Room 0120

Thesis advisor:
Dr. ShiNung Ching

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

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