THE UNIVERSITY OF CHICAGO

Department of Statistics

MASTER'S THESIS PRESENTATION

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Learning Fixed Point Attractors and Temporal Sequences in Rate Models with Plasticity

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ABSTRACT

Fixed point attractors and transient temporal sequences of activity have been proposed as two independent mechanisms of memory formation in biological neuronal networks. It has been shown that biologically plausible learning rules can lead networks to both regimes. However, the mechanisms by which networks can transit between these two types of dynamics in an stimulus dependent fashion are not understood.

In this paper we used a new formalism for population of neurons with plastic synapses to relate stimulation features with the underlying network dynamics after learning. Studying analytically and numerically a two excitatory population network with and without inhibition we fully characterized its parameter space, identifying the exact boundary between fixed point and sequences of activity.

In the last part of this work, we considered the general case of a network of arbitrary number of excitatory populations in a simplified transfer function setting. We theoretically found a parameter region where sequences of activity are robustly transmitted trough the network without attenuation. We provided theoretical insights and numerical evidence to understand the mechanism underlying this phenomena.

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