Duncan Miller

Brian Morales

Training Excitatory-Inhibitory RNN's

We have chosen H.Francis Song's *Training Excitatory-Inhibitory Recurrent Neural Networks for Cognitive Tasks.* This paper discusses neural networks, specifically RNN's in their relation to excitatory and inhibitory neurons. Notoriously artificial neural networks have disregarded the process in which the successful outcome was achieved and only focused on positive results. This paper dives into how we can improve RNN models by forcing realistic parameters on our neural networks. For example, only allowing positive firing as negative firing is not observed in nature. Song uses stochastic gradient descent (SGD) training through a Python library called Theano to train these RNN's. He applies these methods to well known experimental paradigms such as perceptual decision making and multisensory integration. Our goal for this paper is to expand on the results of these training models by either adding inputs, adjusting initial conditions, and/or the system to different parameters.

Mathematical and Computational Questions:

Analyze how Song implemented RNN's with varying excitatory and inhibitory populations. Experiment with the different variable inputs and analyze how they affect the output of the model. Explore the mathematical computation of stochastic gradient descent training on our system.

Research Question we will ask:

In this paper, the authors implement their modified SGD model to experiment on two variants of perceptual decision-making. We would like to know what would happen if we increased or decreased the number of units (100) for each variant. Alternatively, we can keep the number of units for each variant constant while changing the ratio of excitatory and inhibitory inputs. Finally, we consider adjusting the number of variants used in the model (increasing or decreasing the number of stimuli tested on).

Similarly for variable stimuli-version of the task we can extend the study by setting different reaction time's and explore the results. We can ask similar questions for the multisensory integration task: changing the number of excitatory and inhibitory inputs, the total number of units, and which inputs will receive visual, auditory and null inputs.