

Hippocampal Network Analysis Using a Multi-electrode Array (MEA)

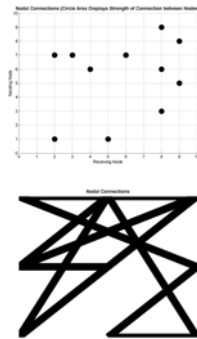
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Outline

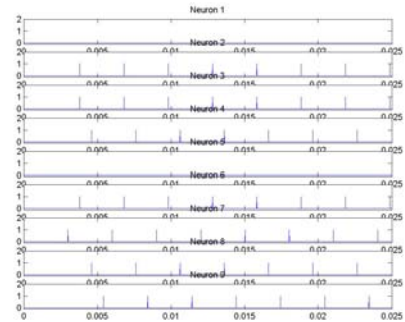
- Goal: To create a neuron level map of the dissociated hippocampal network
- Take correlations between stimulated neurons and all other neurons; Use result to assign unidirectional connection strength
- Will use spike sorting to connect electrode level to neuron level
- First lets see if this correlation makes sense by applying it to an artificial network
- Possible applications
 - Integrating man and machine
 - Understanding and repairing diseases/damages

Toy Network – Step I

- 9 Neurons with first order connections, the magnitude of these connections is specified
 - Any pair of neurons can be connected
- Model includes parameters for
 - Synaptic delay
 - Refractory Period Length
- Benefit of model is infinite signal to noise ratio
- Program generates nine "data" sets, each one corresponding to the "stimulation" of one of the neurons

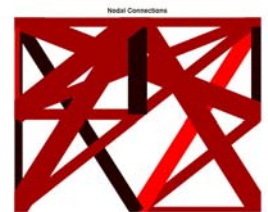
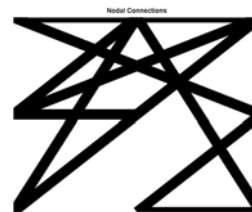
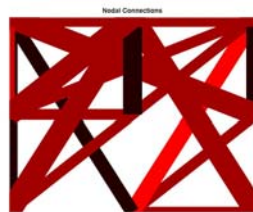
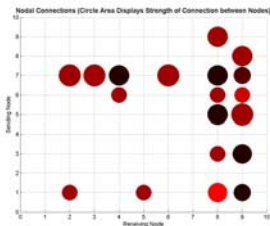


Toy Network – Step II

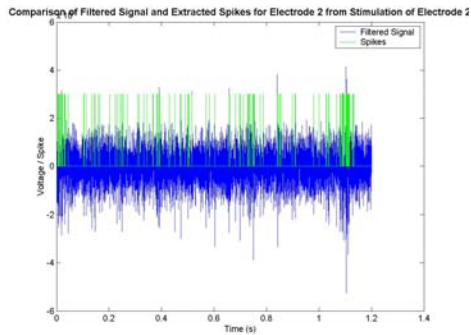


Toy Network – Step III

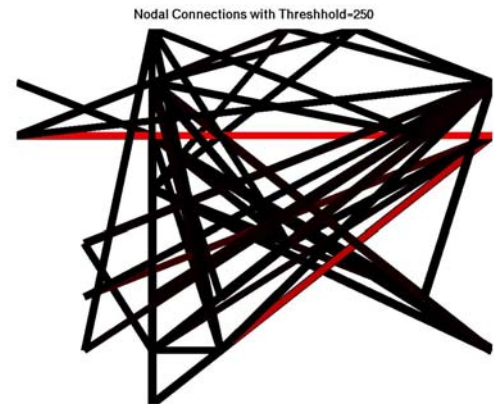
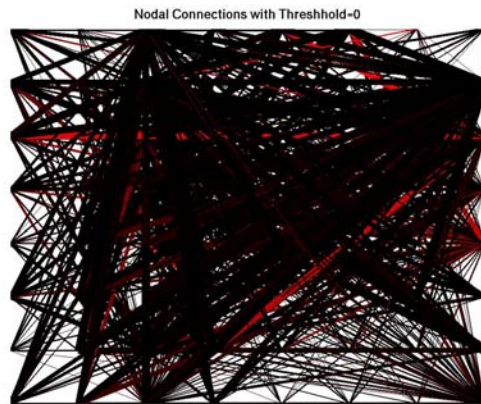
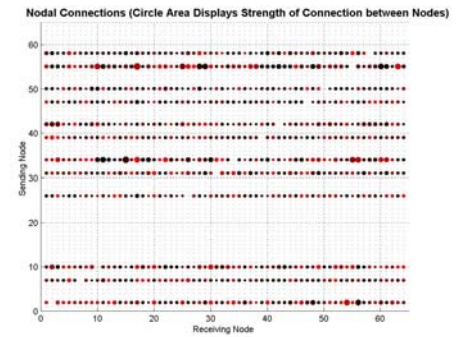
Toy Network



Hippocampal Network – Step II

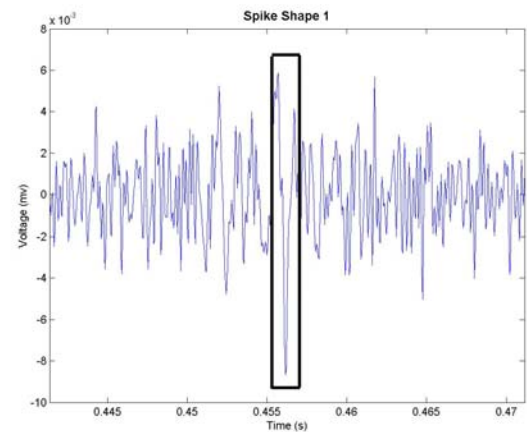
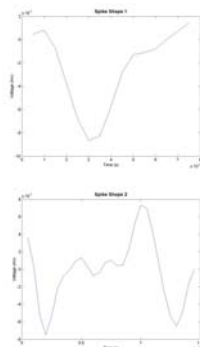


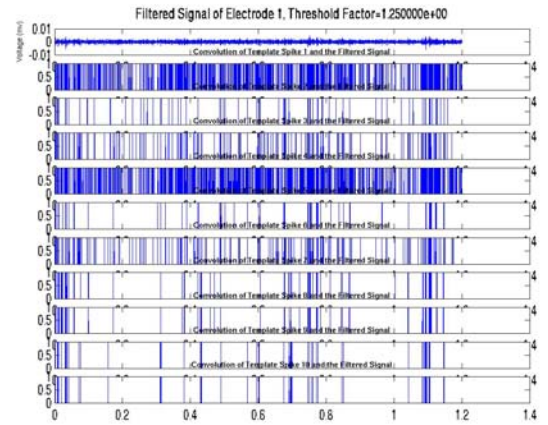
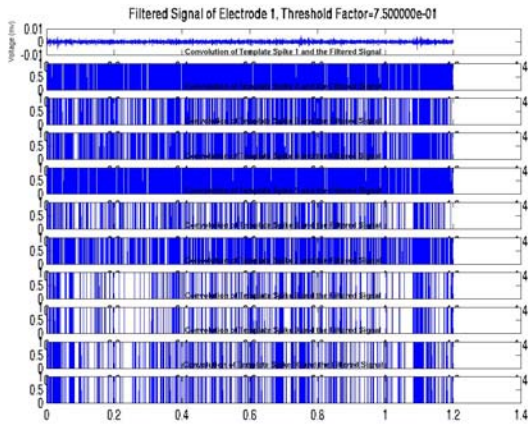
Hippocampal Network – Step III



Spike Sorting

- Goal is to connect level of electrodes to the level of individual neurons
- Idea is to attribute spikes to individual neurons by performing convolutions and then look at the correlations between the spike trains of neurons
- Method requires the assumption no two neurons at one electrode spike with the same shape
- This requires a low neuron density as well as ten different spike shapes randomly distributed among in the culture.





Works Cited

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