

Report for I&F Neuronal Network Simulation

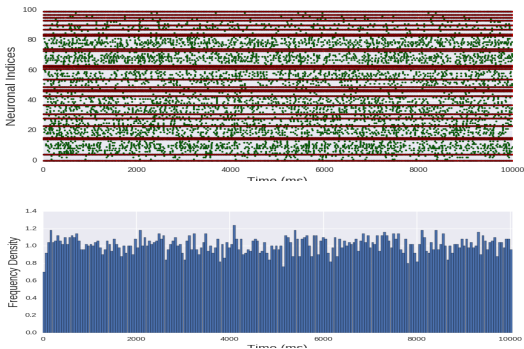
Week 11

Kai Chen

May. 5, 2017

Raster Plots

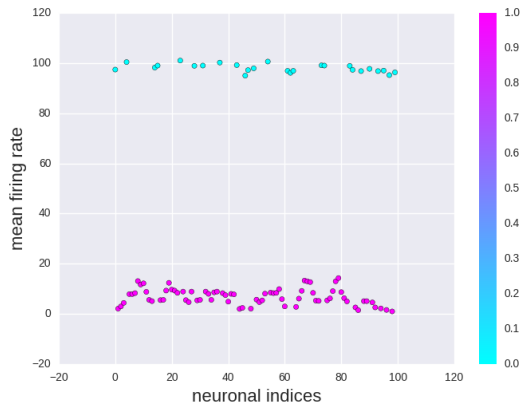
System setups: Pre-network consists 74 excitatory neurons and 26 inhibitory neurons. And post-network contains 100 excitatory neurons. For excitatory neurons, they are driven by 1.5 kHz feedforward Poisson process, while inhibitory ones are driven by 4.5 kHz Poisson process.



Raster plot and histogram of spikes. In the lower panel, vertical axis indicates the number of spikes per millisecond.

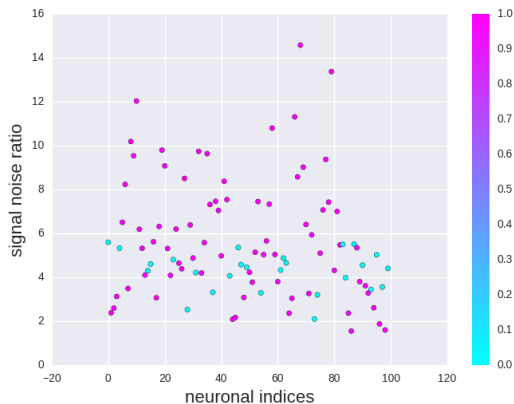
Mean Firing Rate

Pink dots represent that spike train in TMDI is from excitatory pre-network neurons, and blue ones represents those from inhibitory neurons.



Signal Noise Ratio

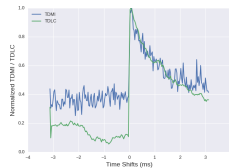
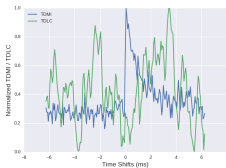
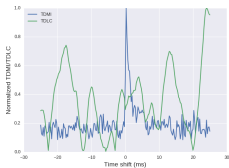
Pink dots represent that spike train in TMDI is from excitatory pre-network neurons, and blue ones represents those from inhibitory neurons.



Blue dots are located between 2 and 6 SNR(signal-noise ratio), which indicates the effective TMDI signal of inhibitory spike trains and LFP in this configuration.

Comparison between TDMI and TDLC

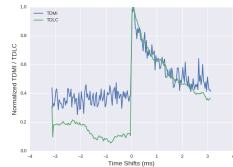
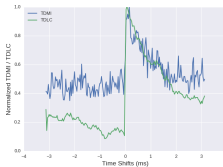
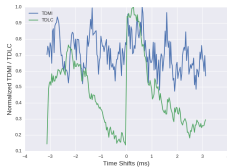
Three figure below illustrate the TDMI and TDLC of an excitatory neuron and LFP generated by its 11 directly connected post-network excitatory neurons. The timing step of time delay is 0.25 ms, 0.0625 ms and 0.03125 ms, respectively.



By changing timing step in TDLC(time-delayed linear correlation) calculation, program shows completely different results, which is quite an abnormal things. The code for TDLC calculation would be checked again later.

Comparison between TDMI and TDLC

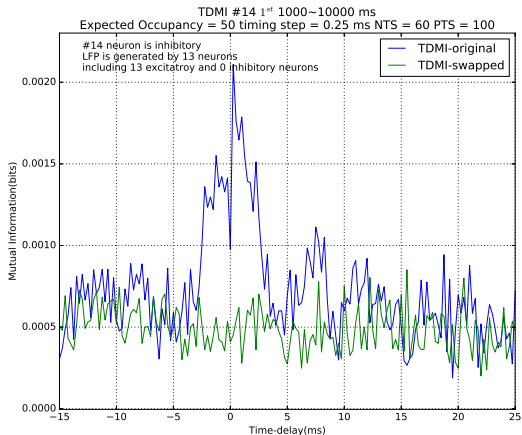
Three figure below illustrate the TDMI and TDLC of an excitatory neuron and LFP generated by its directly connected post-network excitatory neurons. The number of connected neurons that contributed to LFP is 1, 7 and 11, respectively. The timing step of time delay is 0.03125 ms.



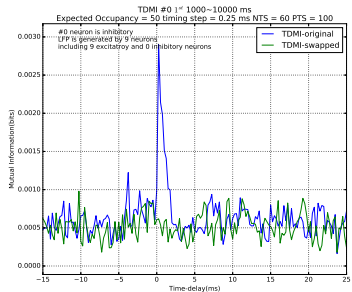
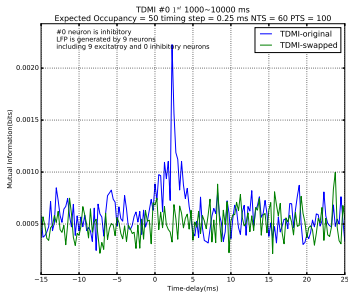
The result would be checked again after debugging.

Strange behavior for fewer Noise Ratio

More analysis about the causality of pre-network neuron and post-network neurons would be done.



System with spike transmitting delay



In the left subfigure, 2 ms spike transmitting delay is applied. According to this result, the primary hypothesis is that TDMI analysis can indicate the direction of the network system.

To do list

- 1 Seperate the excitatory current term and inhibitory term in LFP, and analysis the causality of interactions between different types of neurons across networks.
- 2 Check the code of calculation of linear correlation.
- 3 Return to the previous simulating setups. Check whether TDMI analysis can indicates direction of information flow among all dynamic region or within specific circumstances.