

Assignment Network Plasticity

Neural Computation 2016-2017. Mark van Rossum

23rd October 2017

Note that this is a **non assessed**, so called **formative assessment**. It's goal is to show you what can be expected in assignments, and for me to see the general level of the class.

Practical info

Organize your answers according to the questions; don't merge them. Plots should include axis labels and units (either on the plot, or mentioned in the text), see the link on the course website. Some answers might require units as well.

Deadline will be announced via email and the website.

Submit using the submit system: <http://computing.help.inf.ed.ac.uk/submit>

Model and setup

In this assignment we study the response of a population of 1000 integrate and fire neurons. We are interested in how this population reacts when the input changes. Simulate for 400ms. For the first 200ms, all neurons receive a small background current with a certain mean and independent Gaussian noise. The next 200 ms a strong stimulus is presented, firing the neurons at some 50..100Hz. To analyze the population response plot the PSTH (averaged over the population) with 2ms bins.

You can use the script of the practical on the website as basis.

Questions

Question 1 Examine how 1) the background stimulus strength, and 2) the standard deviation of the noise influence the response of the population to the stimulus. Explain the findings. (No fully extensive parameter sweeps needed).

Question 2 What would happen if multiple populations from the previous question were chained in succession in the low noise regime?

Next, replace the background and stimulus current with synaptic input currents driven by a Poisson process. The synaptic events have a decay time constant of 5ms.

Question 3 State how you implemented the Poisson input. How can you get the high and low noise regimes from Question 1?