#Neuron Project 04.11.2017
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SPIKING NETWORK SIMULATION

This project is based on the paper of Nicholas Brunel <<Dynamics of sparsely connected networks of excitatory and inhibitory spiking neurons>>. It contains 2 classes, Neurone and Network, the main, a file of constants and a file with the experiments functions. It simulates a network of N = 12500 neurons, Ne = 10000 being excitatory and Ni = 2500 inhibitorcy. All neurons receive a connection from 10% of the total of neurons on the network (Ce = 1000 excitatory connections and Ci = 250 inhibitory connections). This connections are done randomly in a uniform distribution. They also receive Ce = 1000 connections from outside the network with a rate in poisson distribution.The simulation depends on the constants g = Ji/Je, where J is the post synaptic potential that is passed from one neuron to another (i for inhibitory and e for excitatory), and Je = 0.1mV; and eta = nu_ext/nu_thr, where nu_ext is the rate of firing from the neurons outside the network and nu_thr is the rate necessary to attend threshold.

4 experiments are made with different input parameters, recreating Fig.8 of Brunel's paper:

- -experiment A: Fig.8A: almost sincronized neurons, g=3, eta=2;
- -experiment B: Fig.8B: Fast oscillation of the global activity, g=6, eta=4;
- -experiment C: Stationary global activity (see paper) Fig.8C: g=5, eta=2;
- -experiment D: Fig.8D: inhibition is predominant, g=4.5, eta=0.9.

TESTING

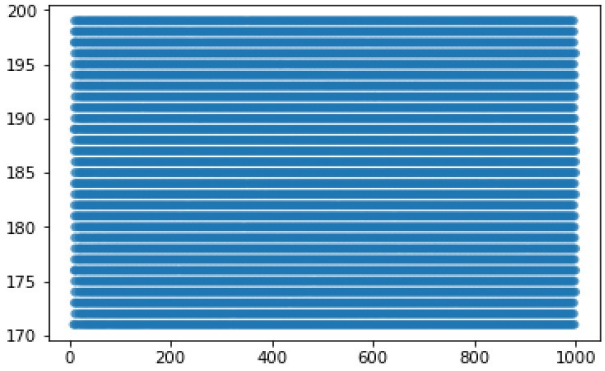
Google unittests are use to test some aspects of the program, such as the number of connections and the spike receive delay.

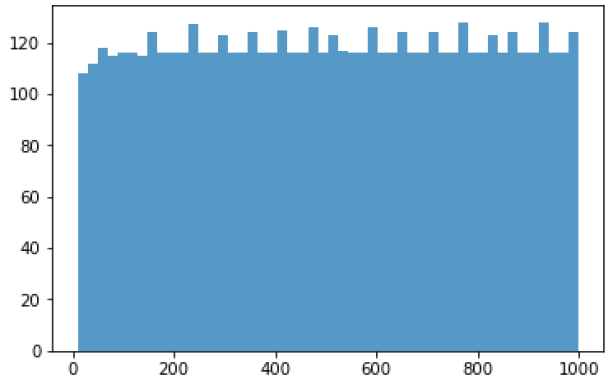
COMPILING AND DOCUMENTATION

The program is compiled with cmake. It is documented with Doxygen.

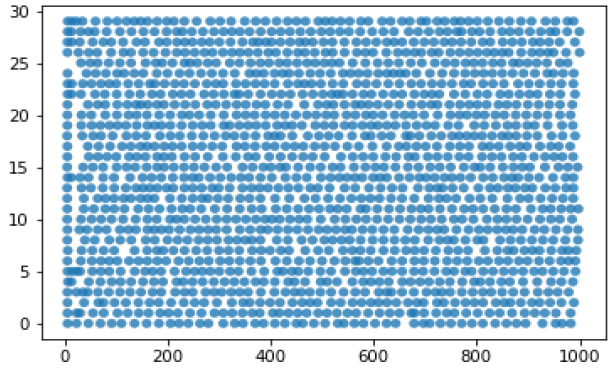
SIMULATION RESULTS

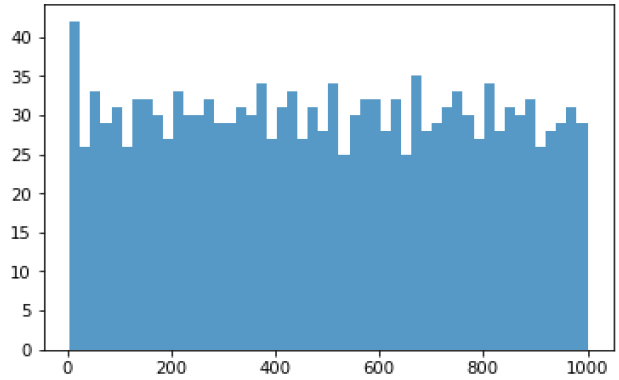
The simulation create 4 files with the simulation-time of spikes and the neuron that spiked. The results can be seen in a histogram plot on python and the figures are:



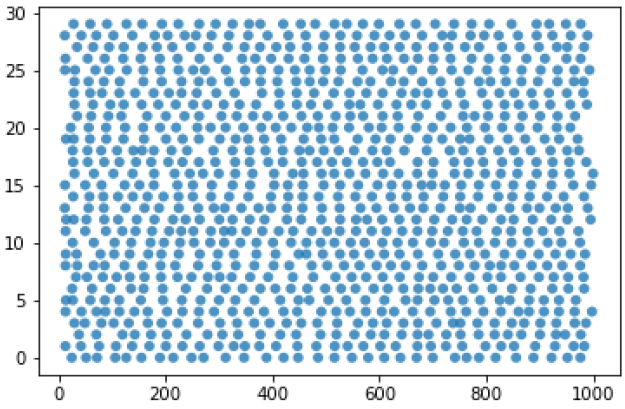


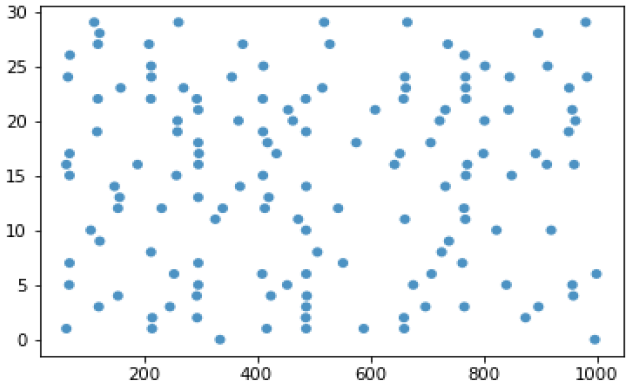
Experiment A

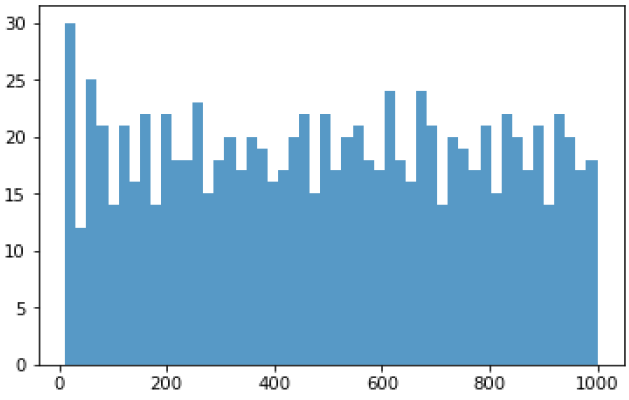




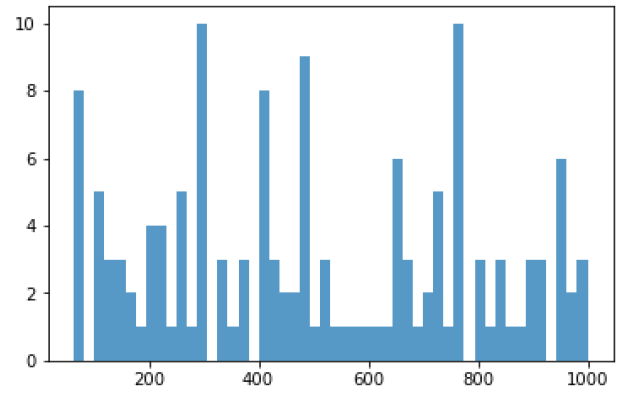
Experiment B







Experiment C



Experiment D