In the name of GOD

Project 2 (LIF population)

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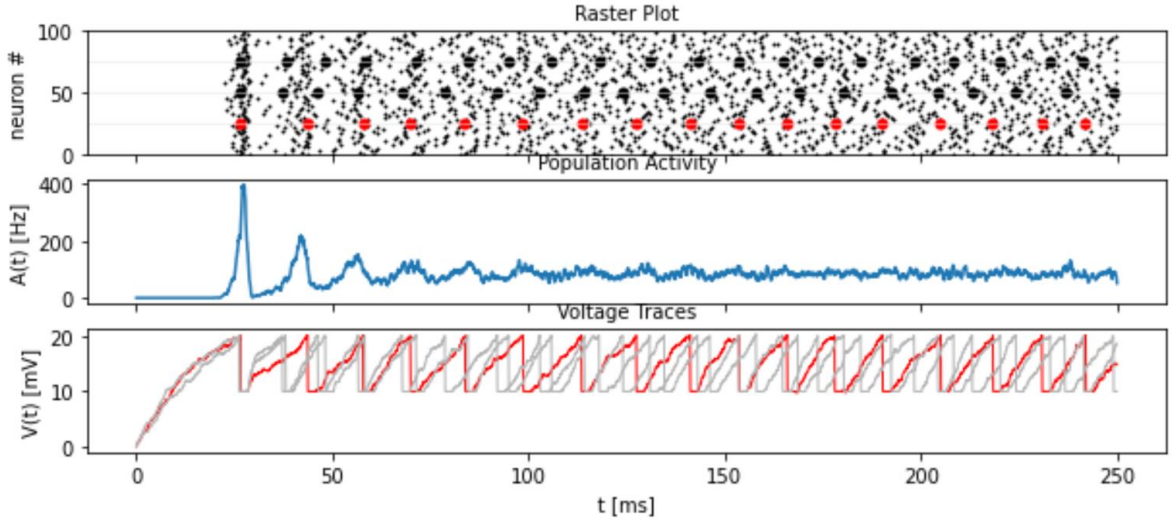
In this project we want to see how a neural populations with different parameters responds to various situations.

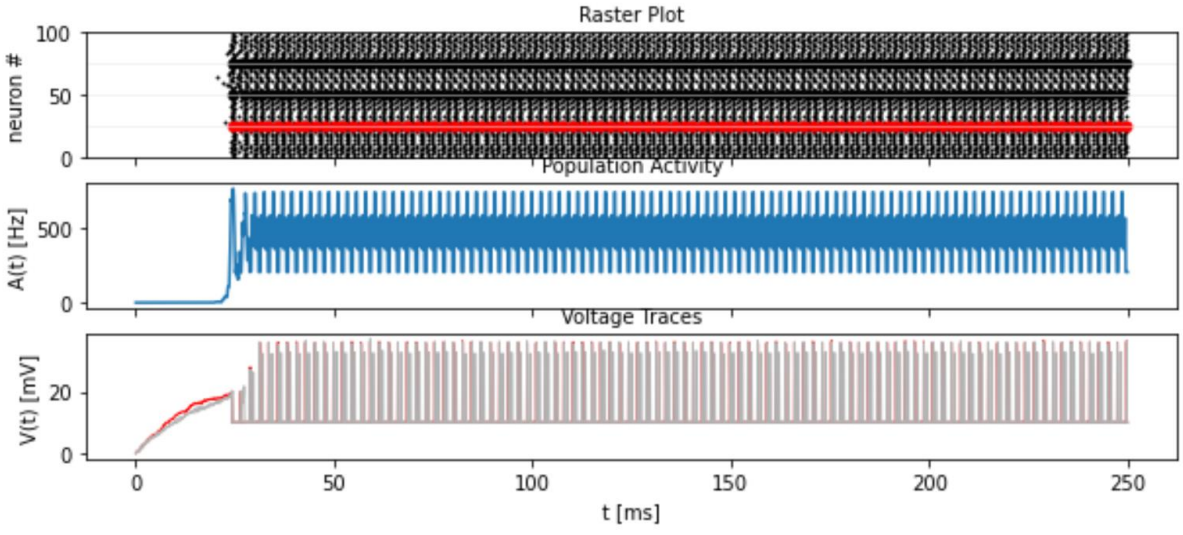
We use neurodynex library for convenience and brian2 for units .

Using global variables combined with a function, enables us to easily change parameters and test the population. It also makes the code short and easy to understand .

We first run a population of 800 excitatory and 200 inhibitory with default neurodynex parameters:

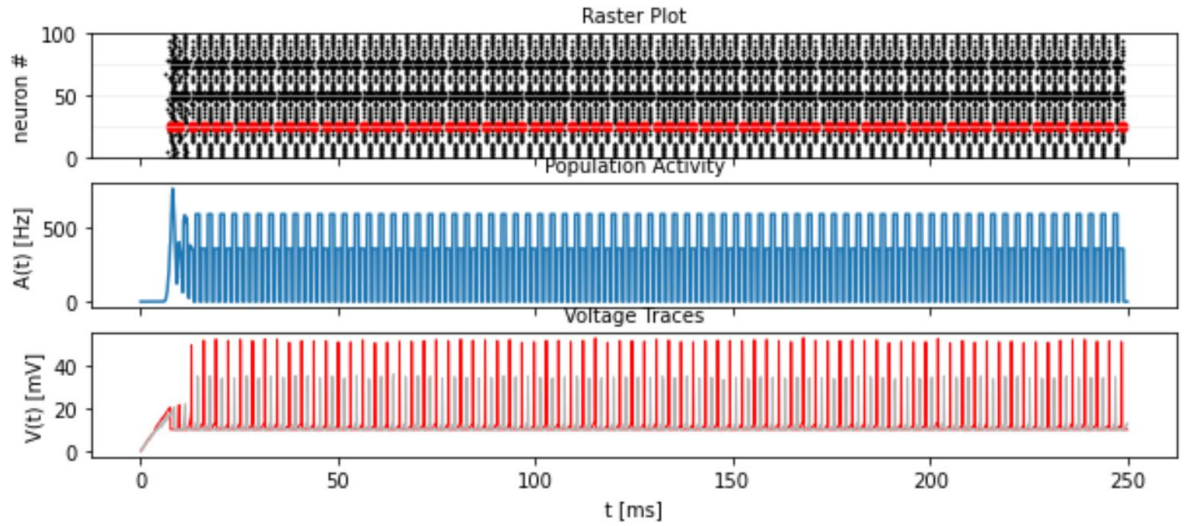


Now we change some parameters to se what happens let's first connect all cells together and see how the network evolves :



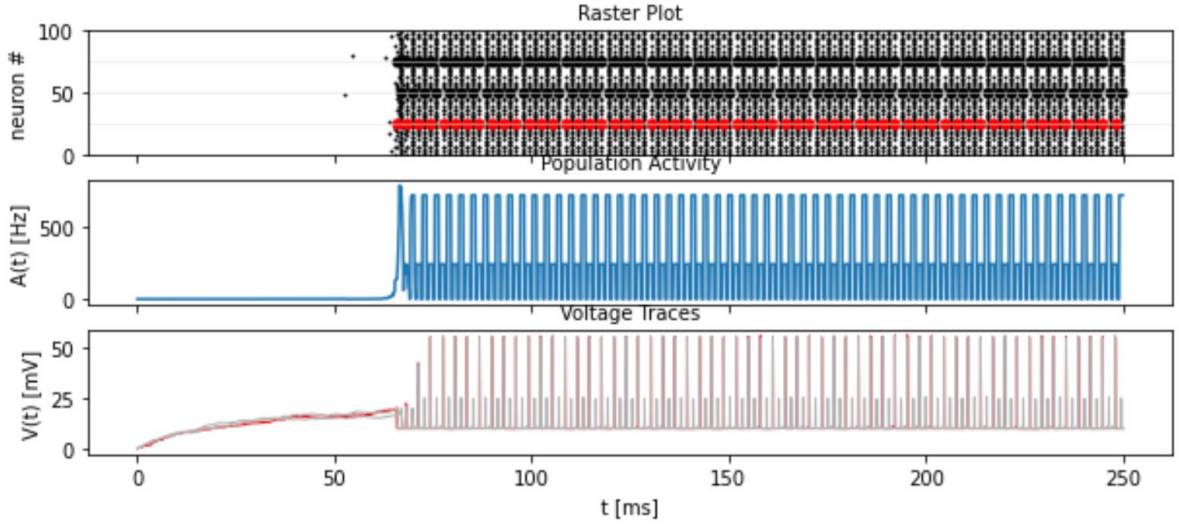
We can see that when some portion of neurons fire, suddenly all the network sparks. It's because when all neurons are connected to eachother they have great influence on the whole network.

Now I change input current to 30. * b2.Hz :



It changes the fire rate and the correlation of the network .

Then change input current to 9. * b2.Hz:

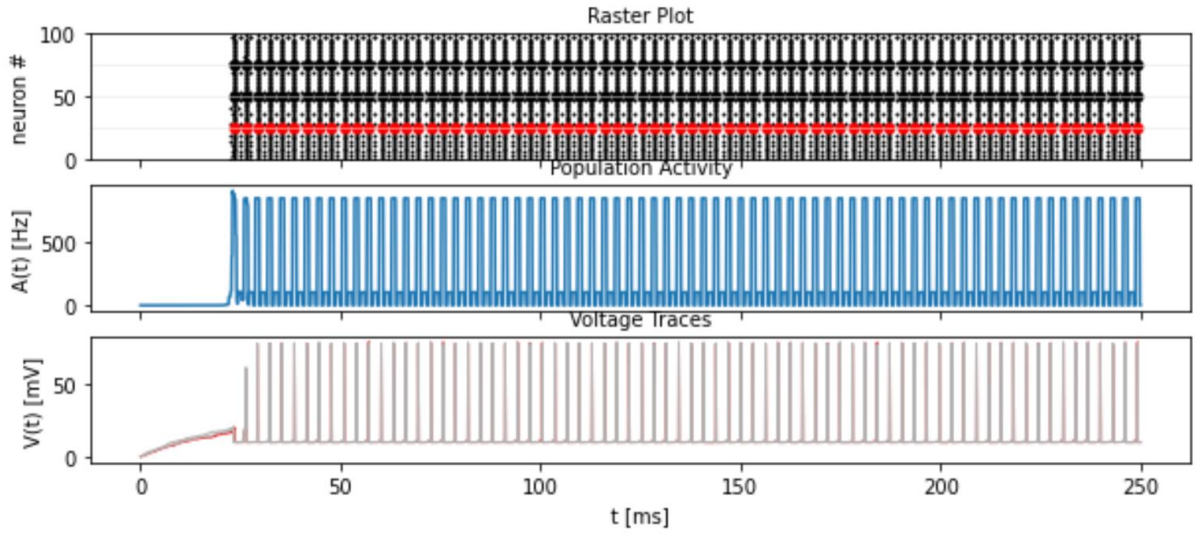


We see the decrease of fire rate as expected .

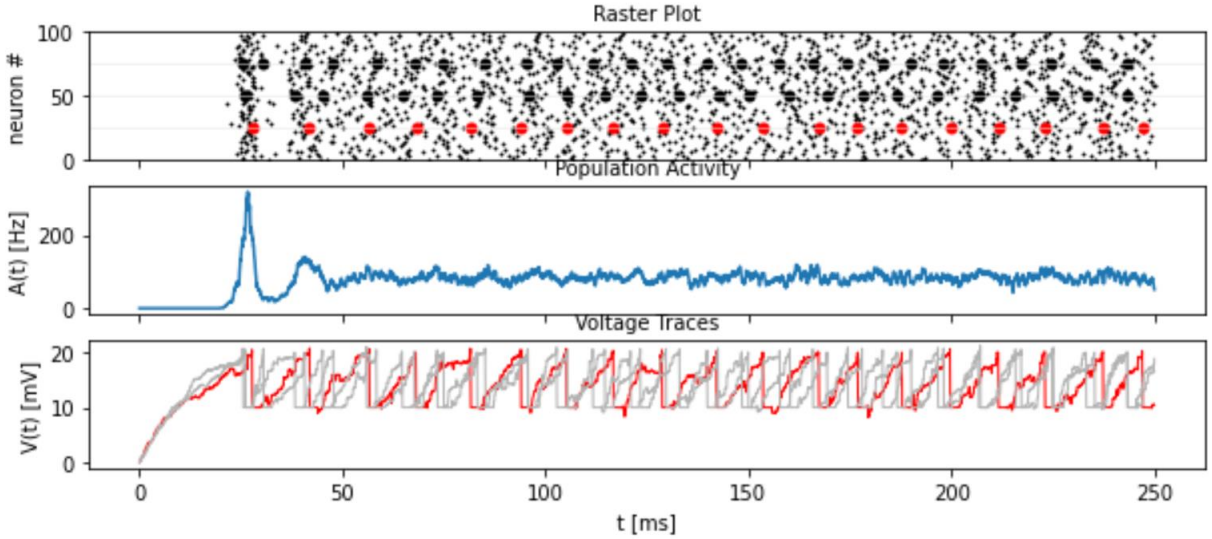
Now we turn the input back to default and play with connection_probability, weight of synapses and importance of inhibitory cells :

connection_probability = 1

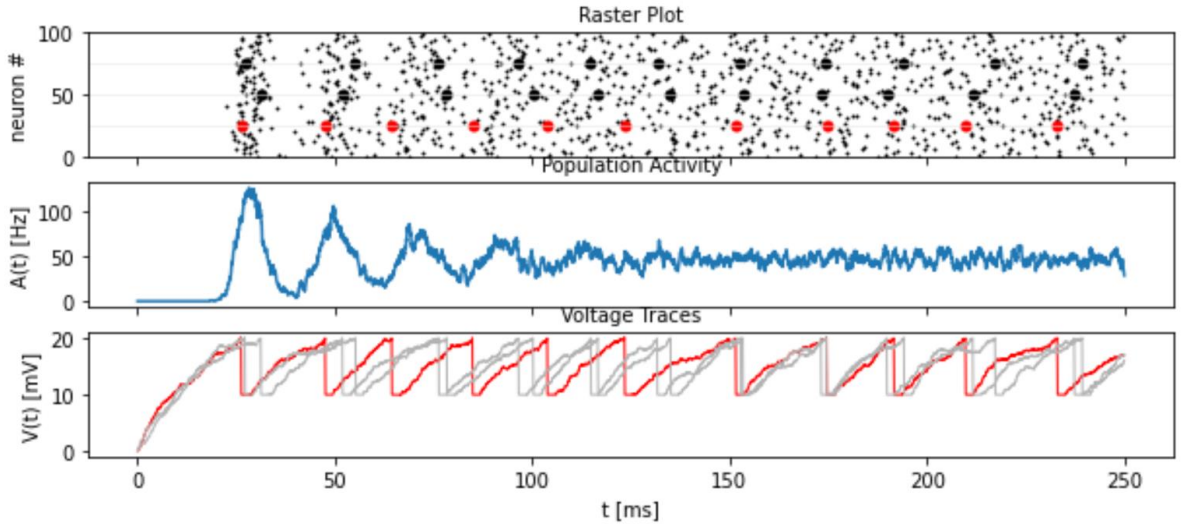
w0 = 1 * b2.mV



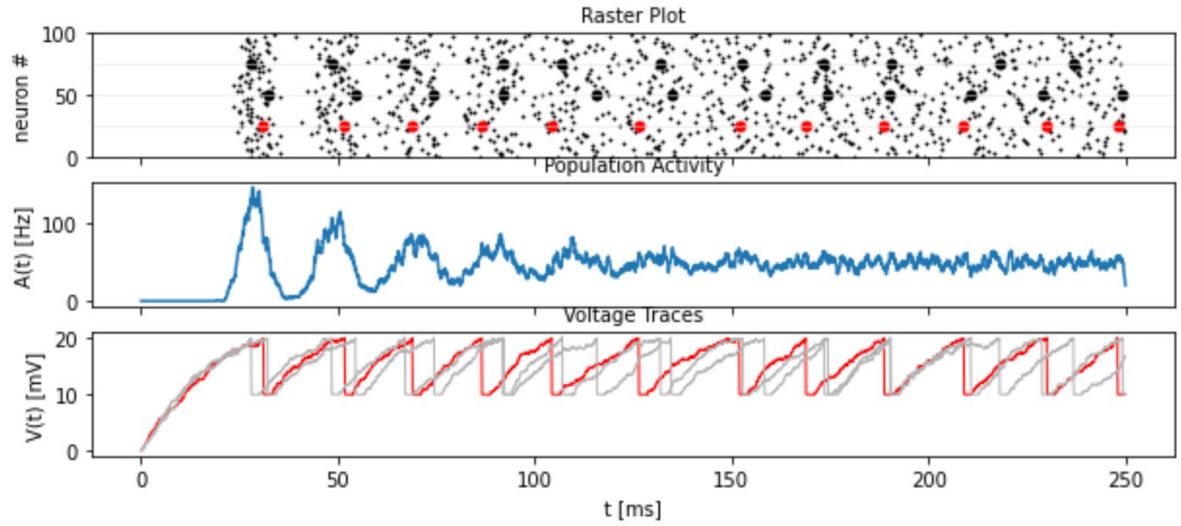
connection_probability = 0.01



w0 = 0.01 * b2.mV :

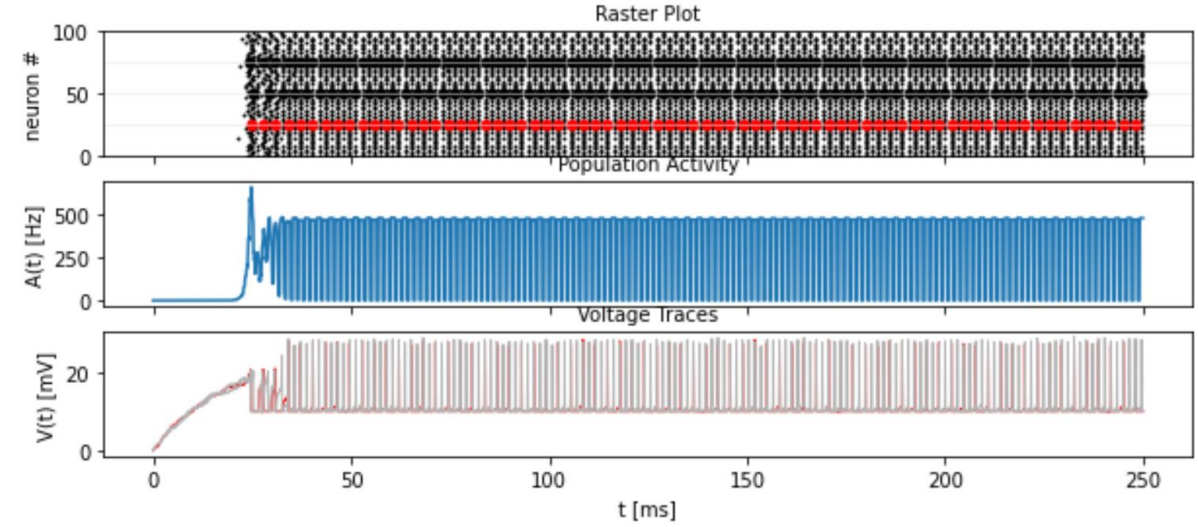


connection_probability = 0.1:

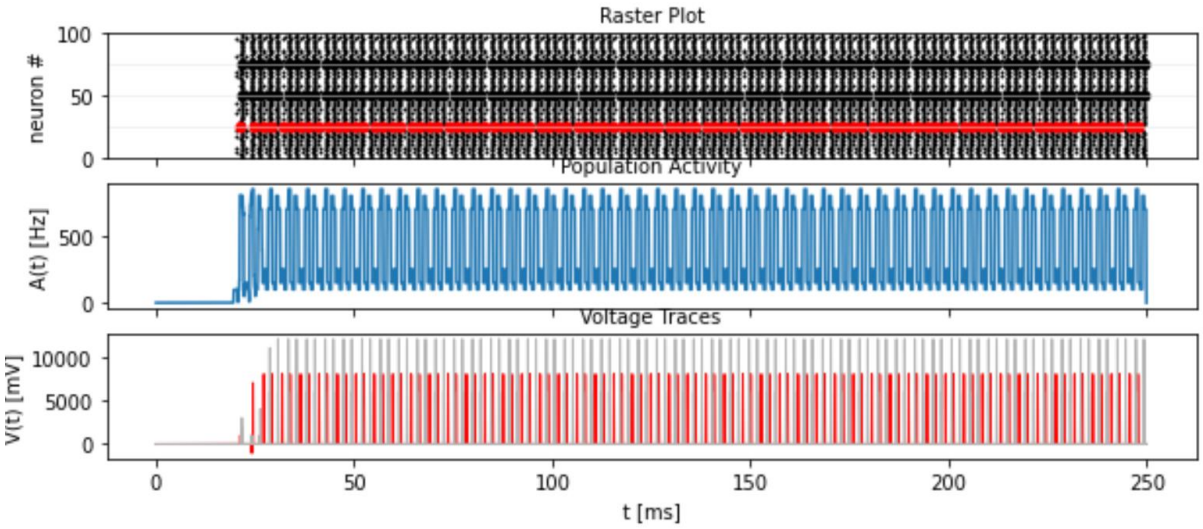


connection_probability = 0.1

w0 = 0.5*b2.mV:



w0 = 1000 * b2.mV:



We reset the parameters to see how importance of inhibition affects our network:

N_Excit = 800

N_Inhib = 200

connection_probability = 0.1

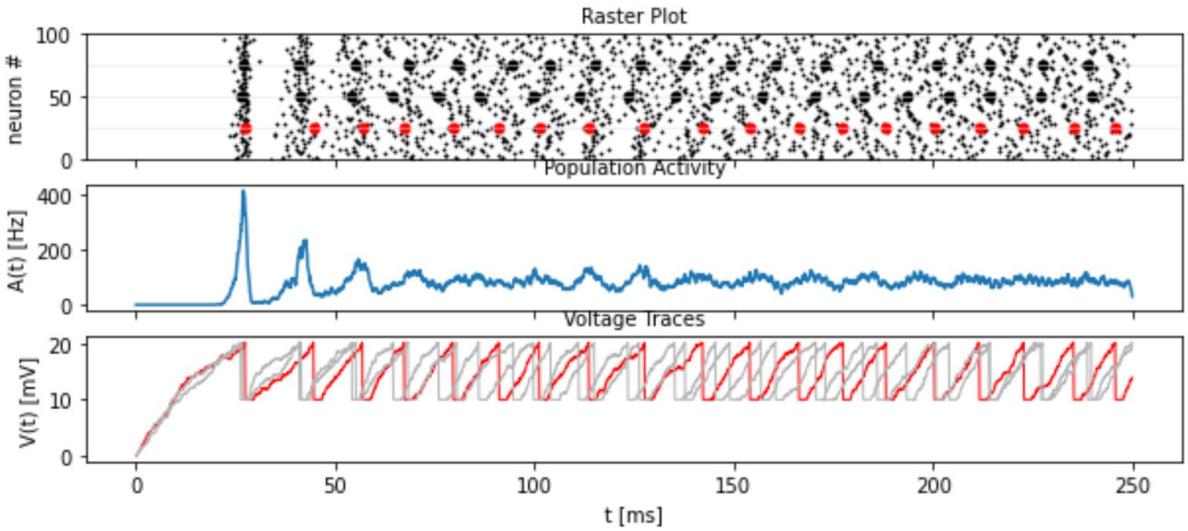
w0 = 0.1 * b2.mV

g = 1

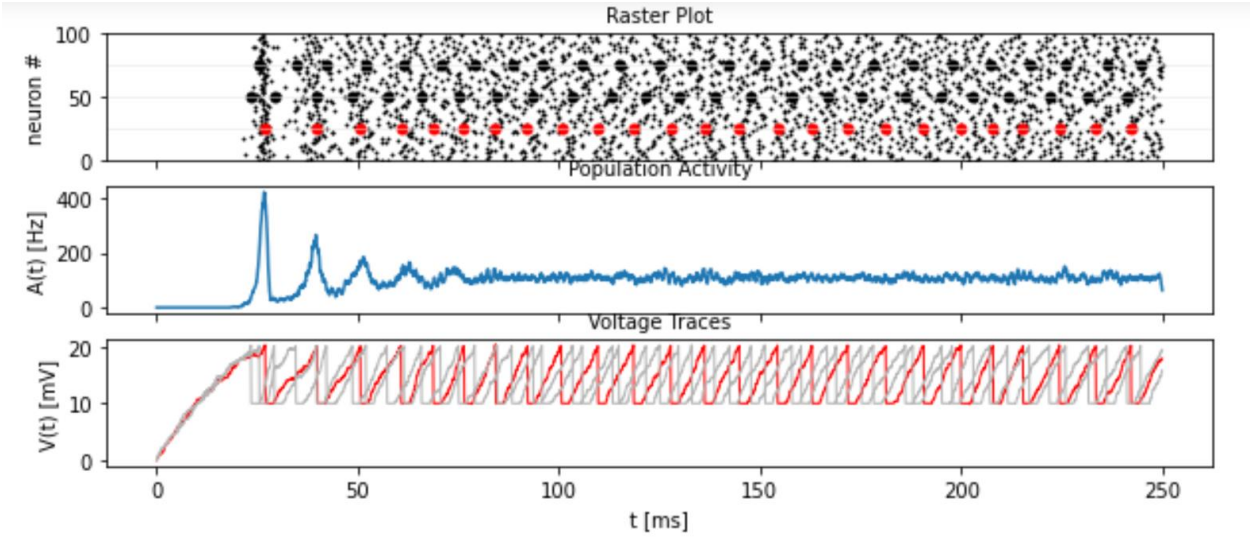
poisson_input_rate = 13. * b2.Hz

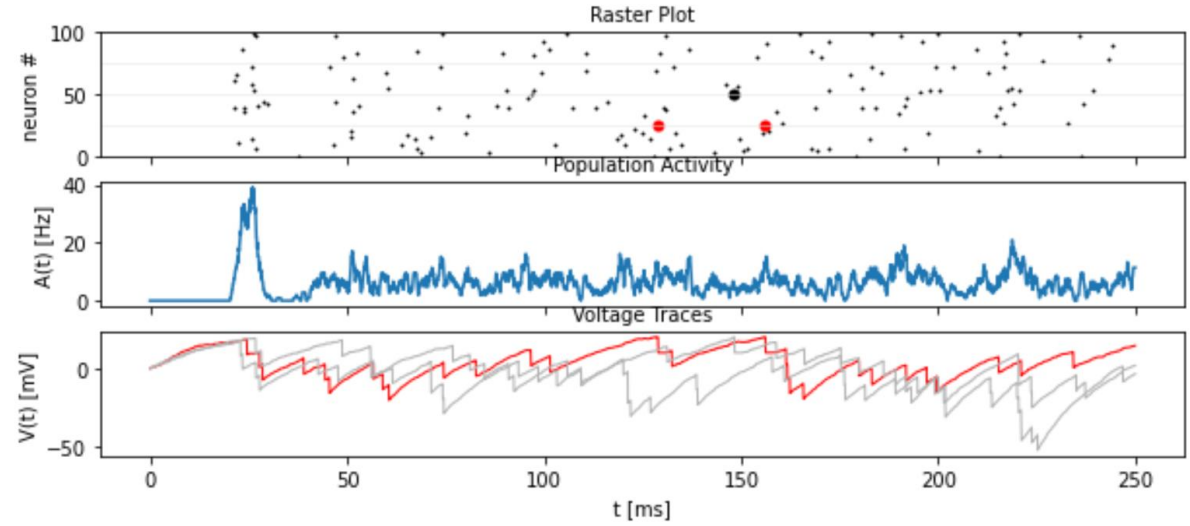
w_external = 0.1 * b2.mV

sim_time = 250. * b2.ms

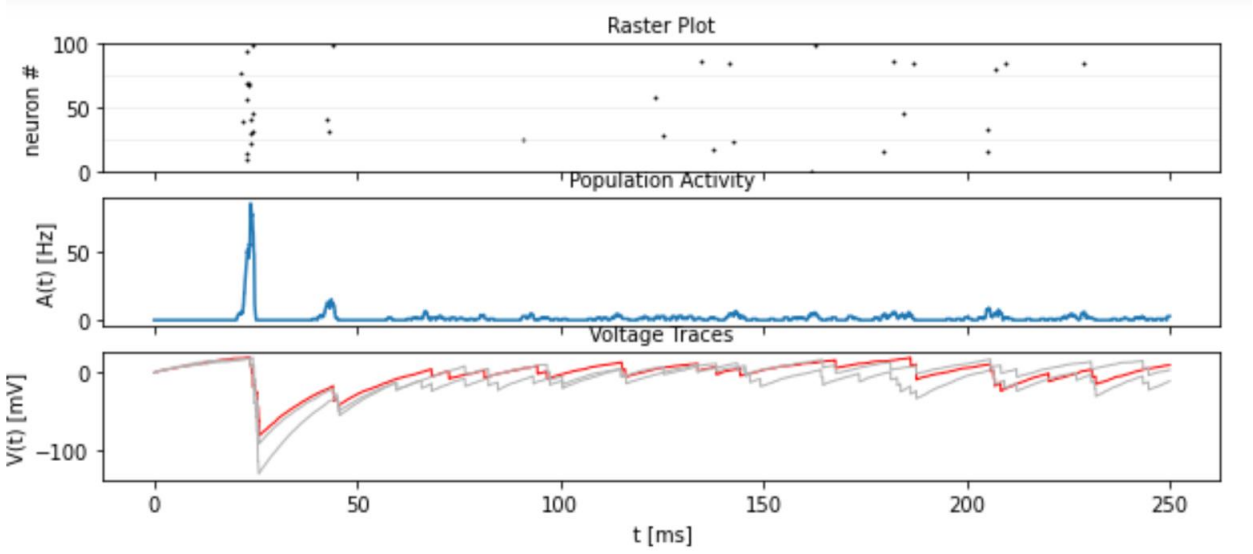


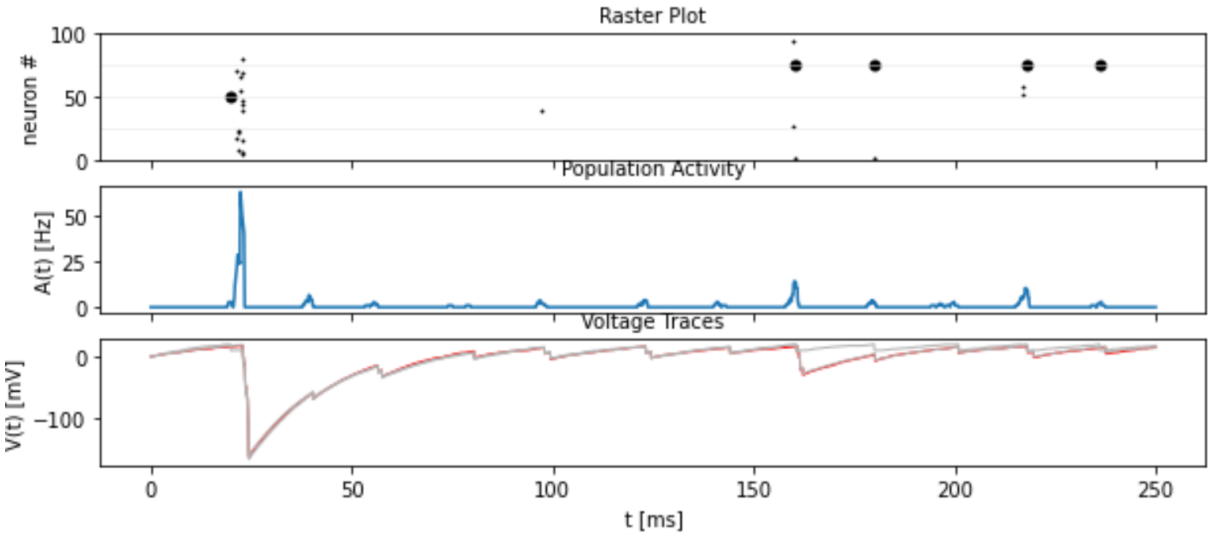
Now change g to 0 and 100 :



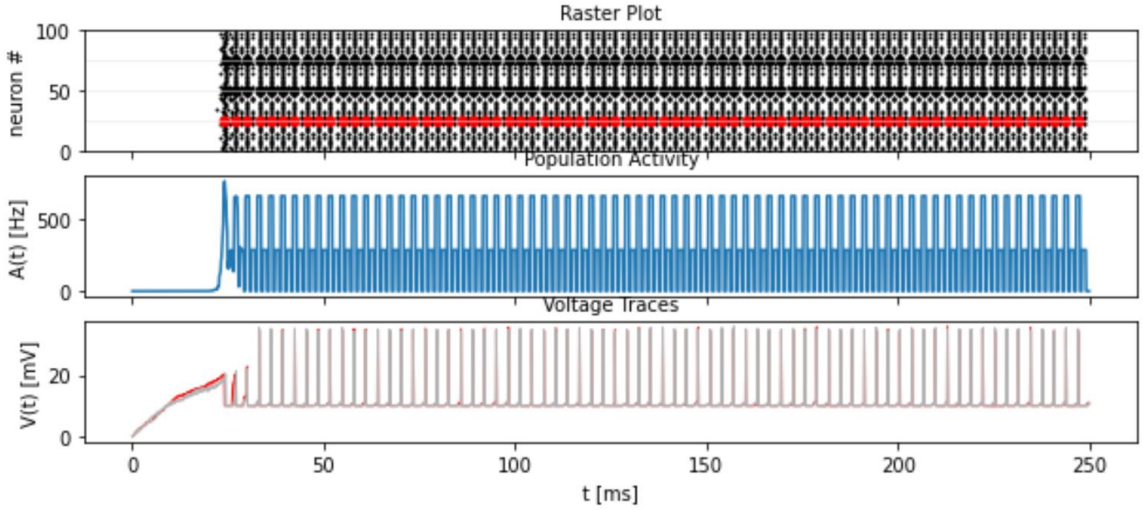


Now that g is high lets change connection_probability to 0.5 and 1 :





At the end we change g to 0 :



If you look close enough you can see the difference in the potential plot .