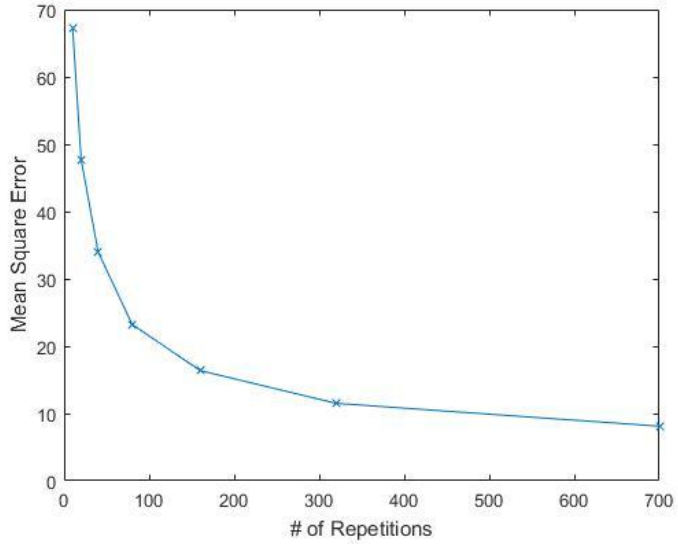
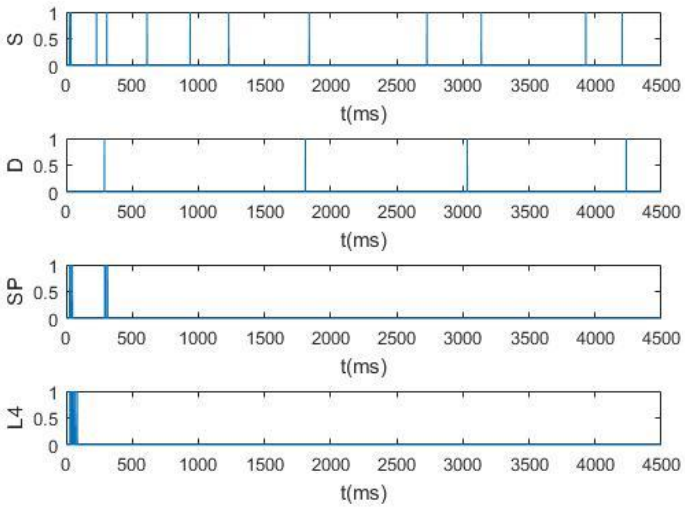
Project 4

Saurabh Dash (14EC32013)

Part 1

Generating an inhomogenous Poisson spike train and verifying that the PSTH approaches λ(t)

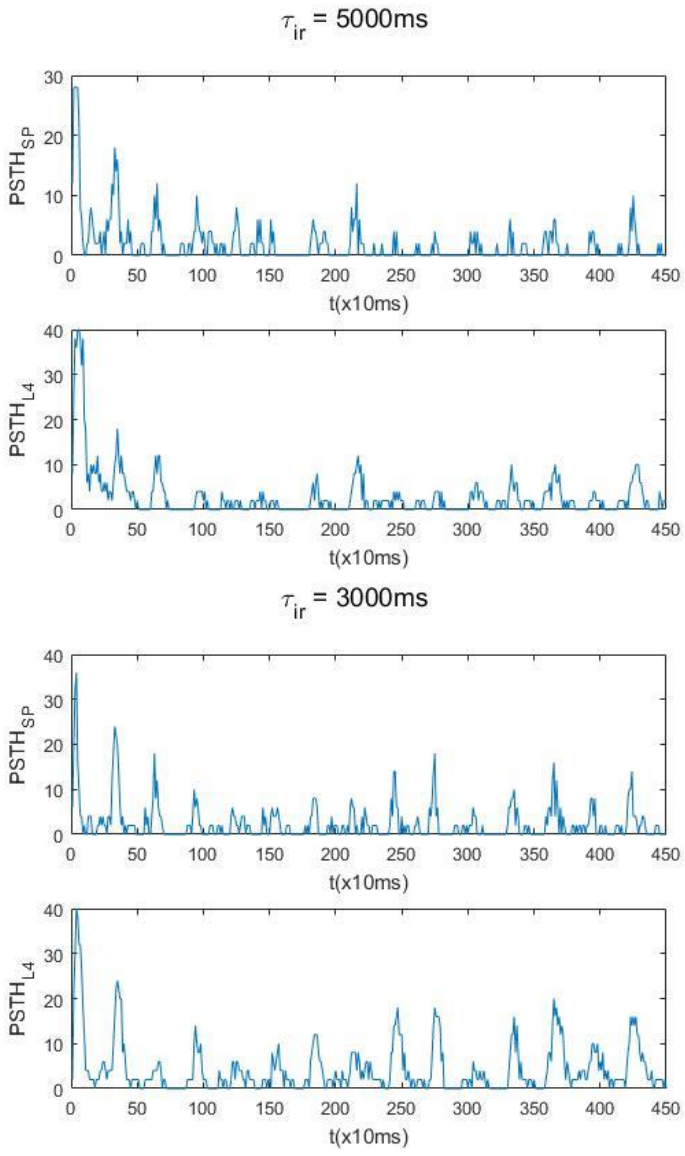


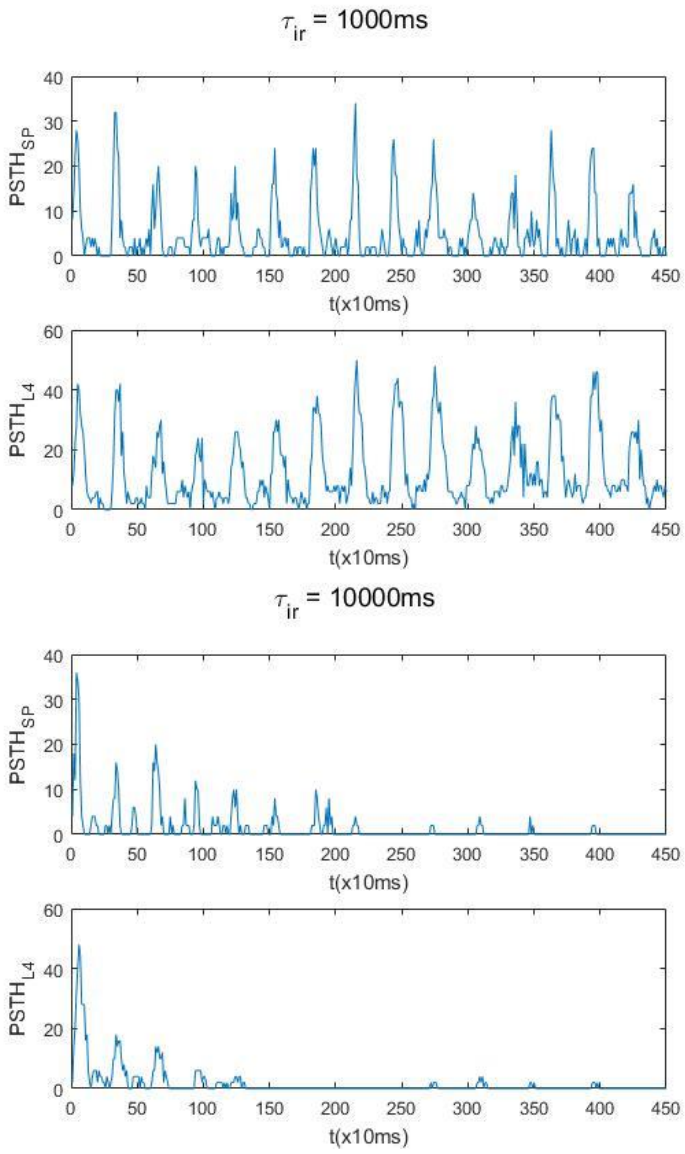


Response of the VerNoP network the ODDBALL Stimulus

Part 2 & 3

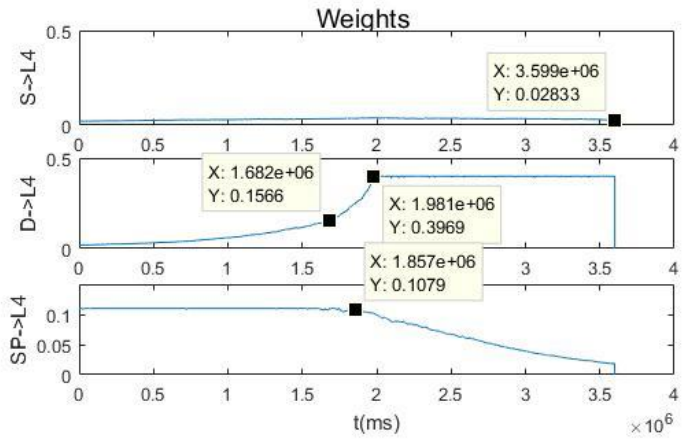
PSTH of the VerNoP network with different τ_{ir} values. We can see that on decreasing τ_{ir} The spiking activity becomes more frequent due to quick replenishment of the neurotransmitter leading to greater fraction of the neurotransmitter in the effective pool.





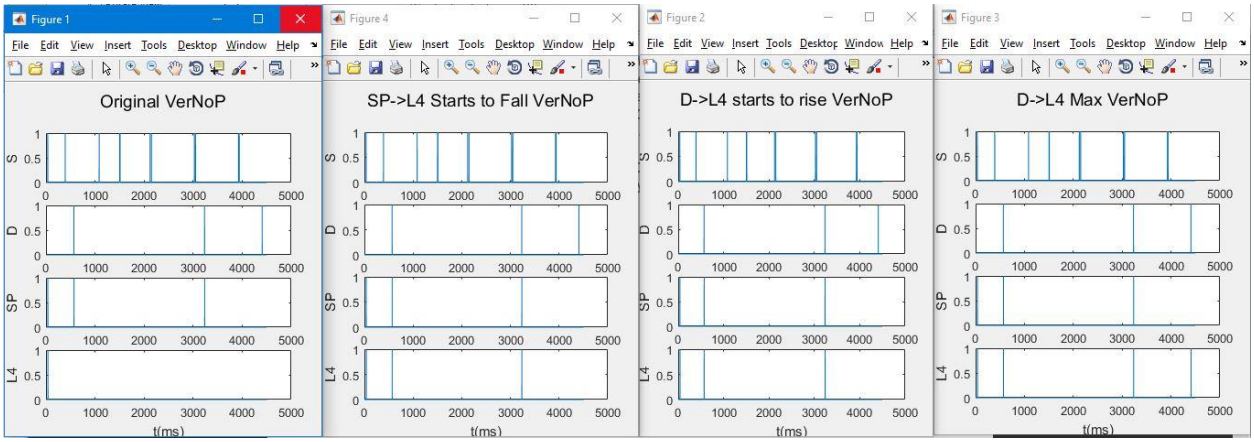
Part 4

Now including Long Term Plasticity in the model and running for 60 Minutes to a Stimulus which contains 90% Standard and 10% Deviant Stimuli, we see the following trend in the values of the weights



We can see that the weight of synapse that D makes on L4 reaches a Saturation value while the weight of the synapse that Subplate neuron makes on L4 slowly depresses. There is a gradual increase in the value of the weight that the Standard Thalamic Neuron makes on the L4 neuron.

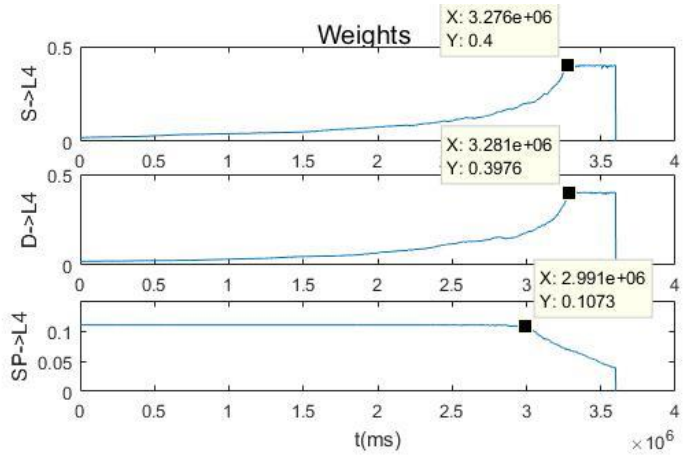
Running the VerNoP model at the points of interest i.e the points where D starts rising, the point where D saturates, the point where Subplate starts to fall, we see the following results.



Since the synapses on Subplate by S and D do not change over time due to lack of Long Term Plasticity, the spike trains remain the same in all the cases, the only difference arises in the Spiking activity of the L4 neuron.

In the case where VerNoP runs with the initial weight values, L4 spikes only once.
In the case where D starts to rise, the large value of D helps L4 spike a greater number of times.
In the case where D reaches maximum value, it's value is so large that even the absence of S and Subplate only the presence of D can make L4 spike.

Part 5



In the case where the both S and D occur with equal probability, since the network becomes symmetric, there is no differentiation between S & D and both behave similarly. As time progresses S & D become strong enough to cause L4 to spike without the help of Subplate leading to long term depression in the Subplate to L4 synapse.