EC60007 Computational Neuroscience- Project III

1. Stimulus Nature
   The output obtained from the autocorrelation function of the stimulus $R(\tau)$ is given below in **Figure 1**. It was similar to a Dirac-delta function and the variance was 0.0338 which was also where the peak was observed. Hence the given stimulus is a Gaussian distribution.

2. PSTH
   The PSTH was evaluated and the corresponding plot is given in **Figure 2**.

3. Poisson or Non-Poisson
   Poisson or Non-Poisson nature was determined by plotting the values of variance against means for different neurons at various time bins. They are given in **Figures 3-8**.

   The observations from the figures are as follows
   - Figure 3 (10 ms)- All the 4 Neurons are Poisson in nature.
   - Figure 4 (20 ms)- Neurons 2 and 3 exhibit Poisson behavior.
   - Figure 5 (50 ms)- Neuron 3 exhibits Poisson behavior.
   - Figure 6 (100 ms)- Neuron 3 exhibits Poisson behavior.
   - Figure 7 (200 ms)- No neurons exhibit Poisson behavior.
   - Figure 8 (500 ms)- No neurons exhibit Poisson behavior.

4. STA and Correction for non-Gaussianity
   h(t) for all the 4 neurons with and without correction is given in **Figure 9** and **Figure 10** respectively. In Neurons 2&3 selectivity to certain stimulus was observed from STA whereas in Neurons 1&4 the response of STA was the same throughout.

5. Determining Output Non-Linearity
   Plot of PSTH vs y(t) for the Neurons 1-4 is given in **Figure 11**. **Figures 12-15** gives the induvial fit for all the neurons. With r^2 values being low, the fit is not very accurate. The significance of prediction for Neurons 2&3 is comparable whereas that of Neurons 1&4 are least significant.

6. Prediction performance and pruning of filter parameters
   Figure 16 gives the PSTH vs Prediction for all the Neurons. **Figures 17 &18** give the Plot of Predicted performance for the Neurons. **Figure 19** gives the output of the Linear filter for the Neurons and **Figure 20** gives the output of the FFT of Filter for different Neurons.

7. (B) Discrimination based on Victor and Purpura (VP) Spike Distance Metric (SDM) The plot of MI(q) vs q for 100 trials is given in **Figure 21**. The plot is indicative of the sensitivity of Neurons to the spike timings and spike counts.

Figures

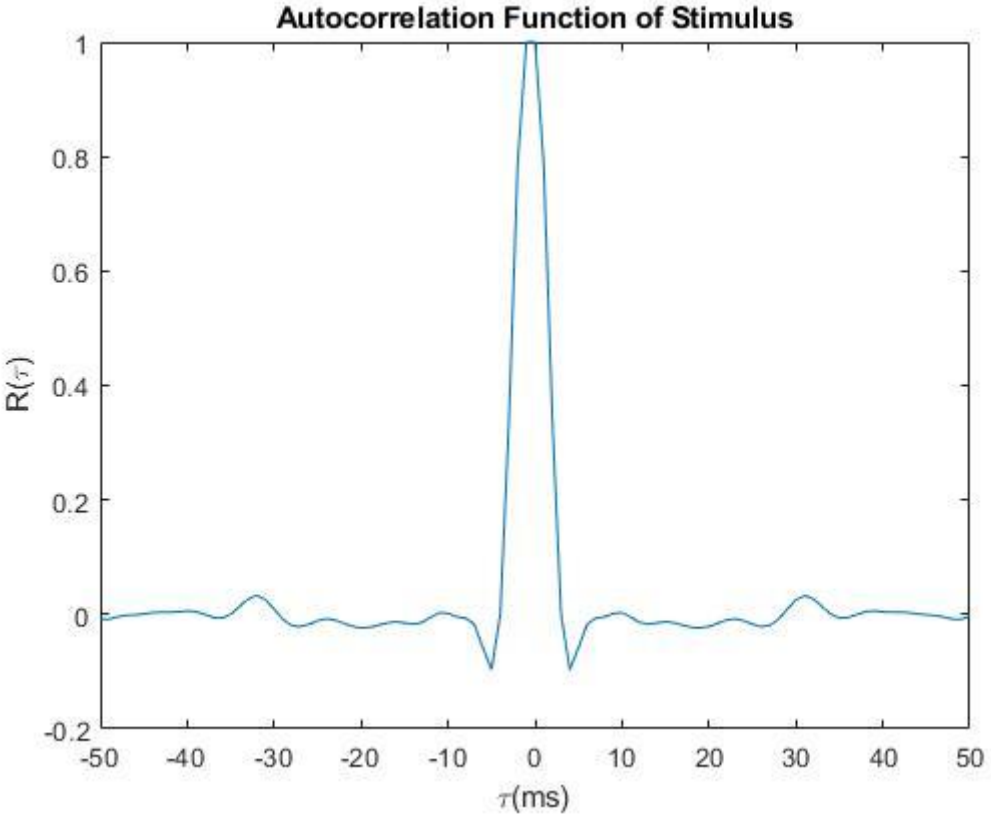


Figure 1

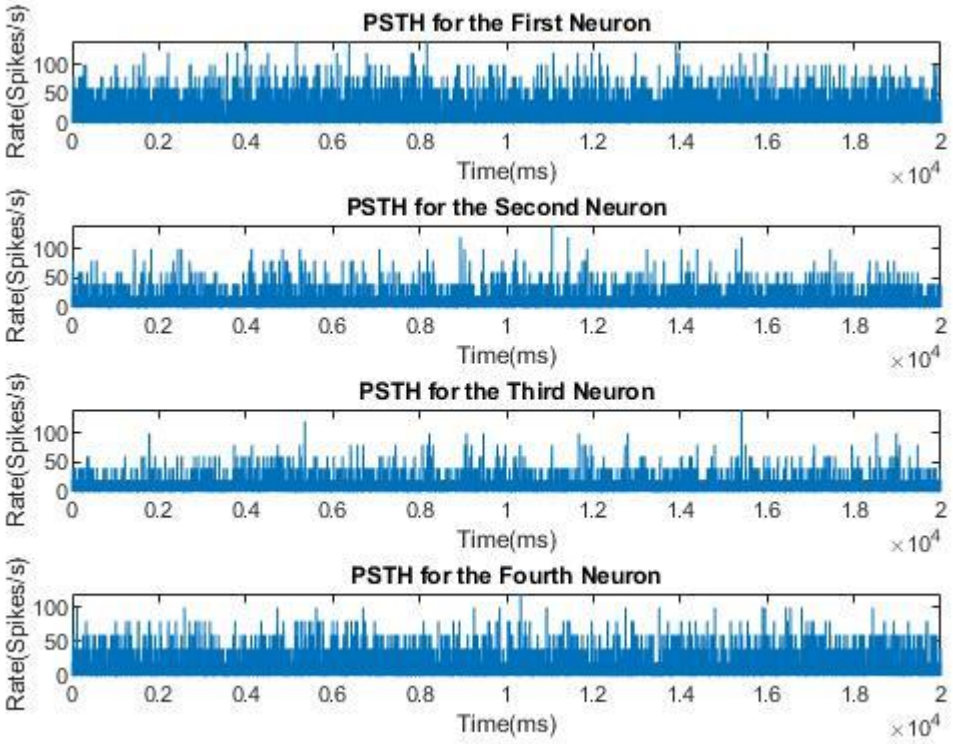


Figure 2

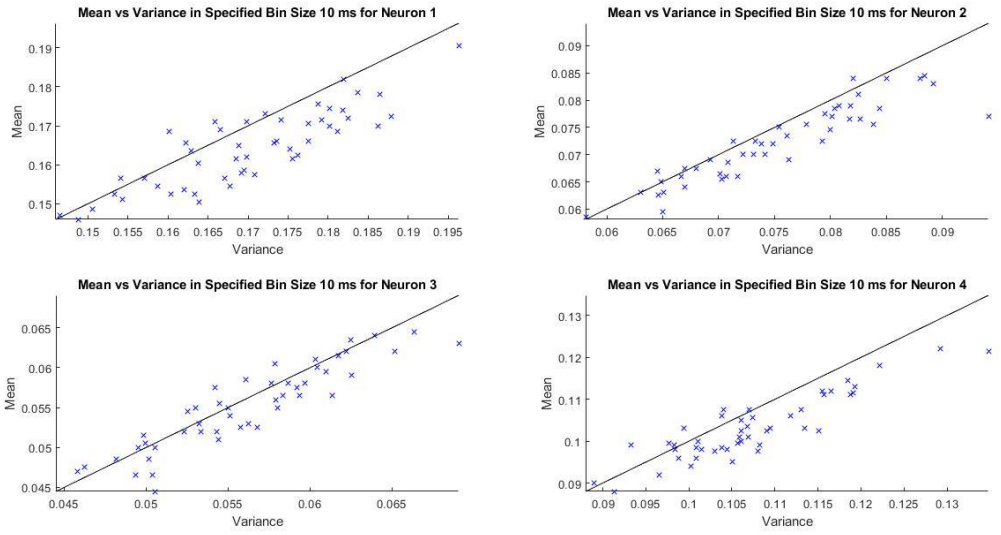


Figure 3

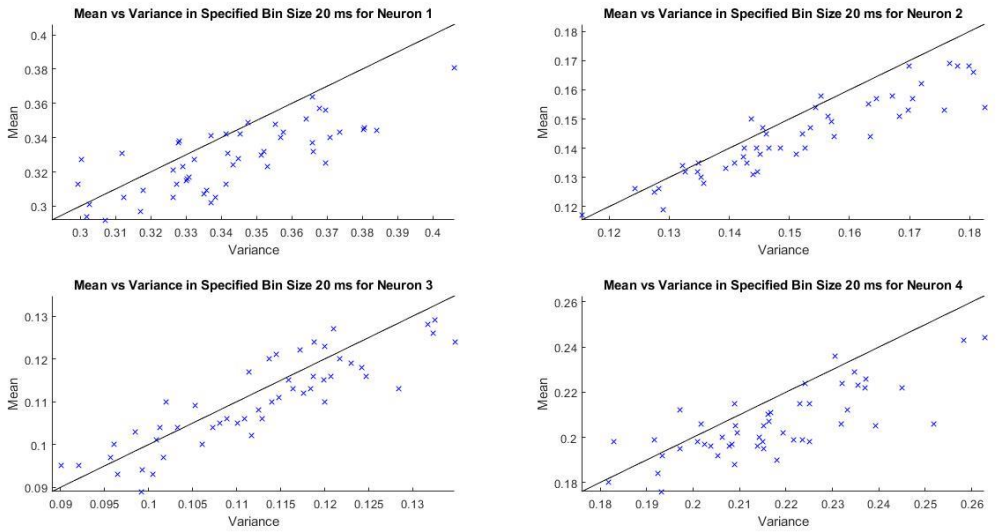


Figure 4

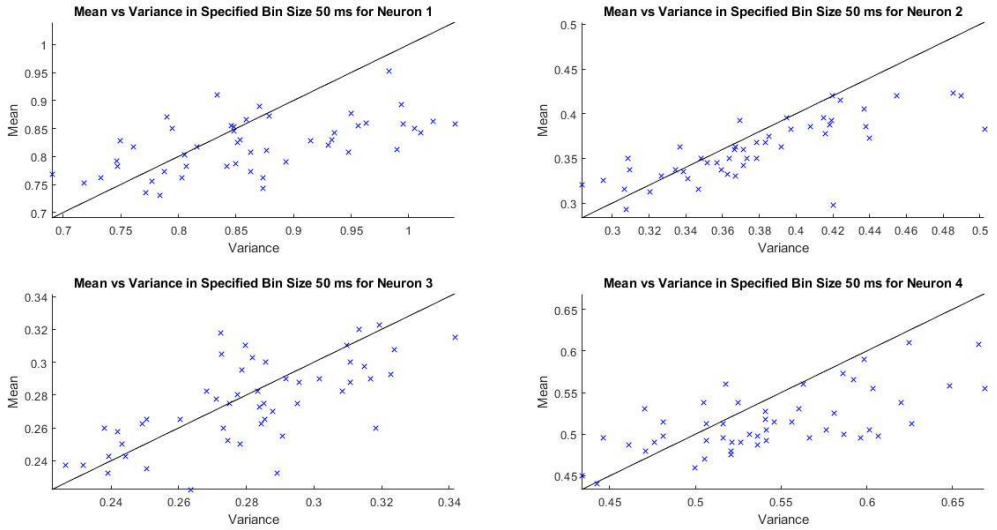


Figure 5

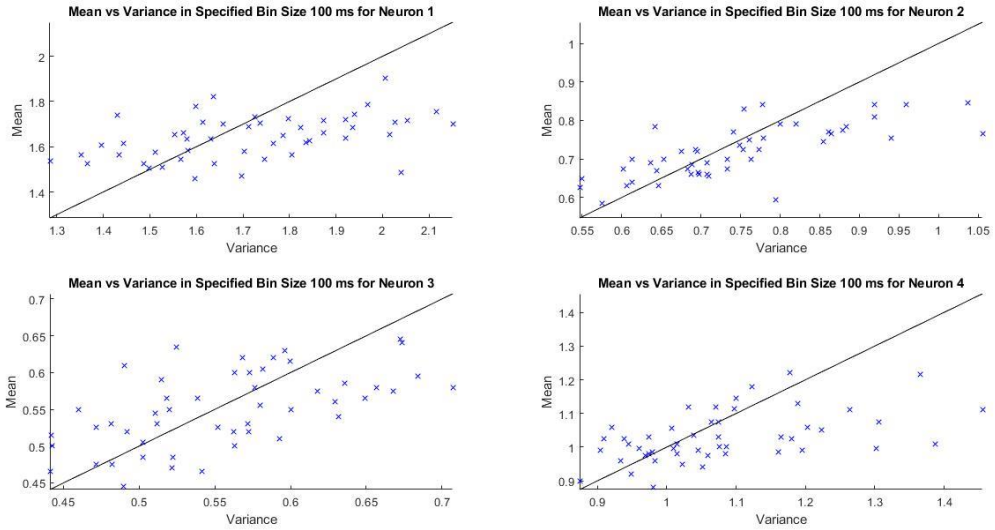


Figure 6

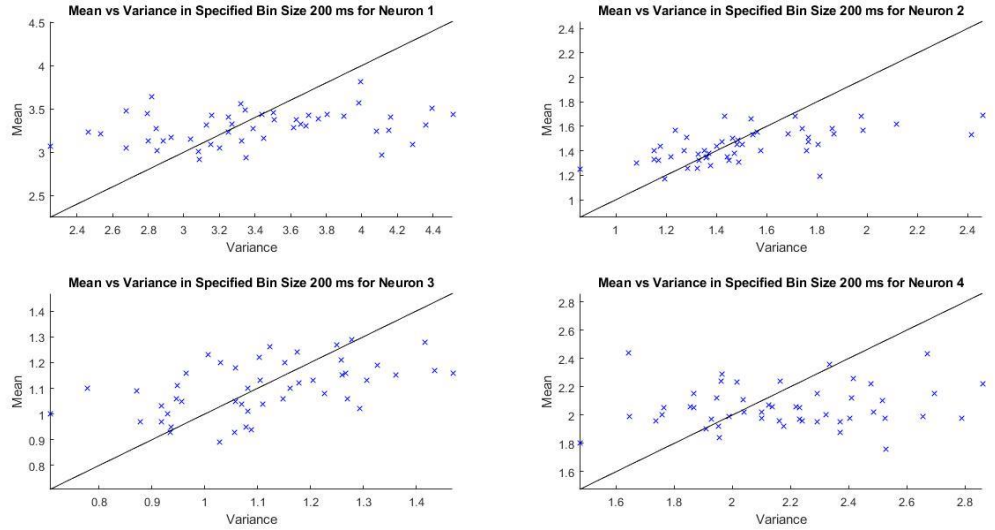


Figure 7

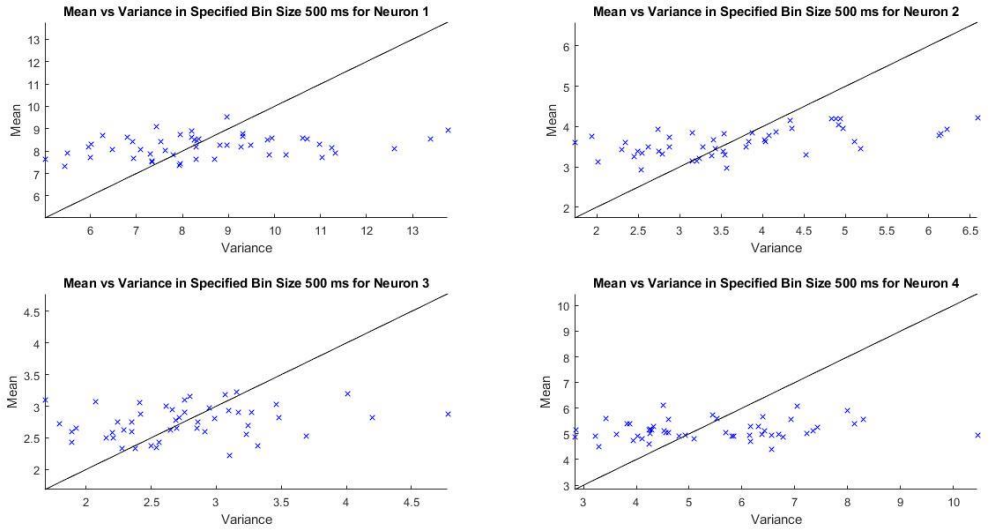


Figure 8

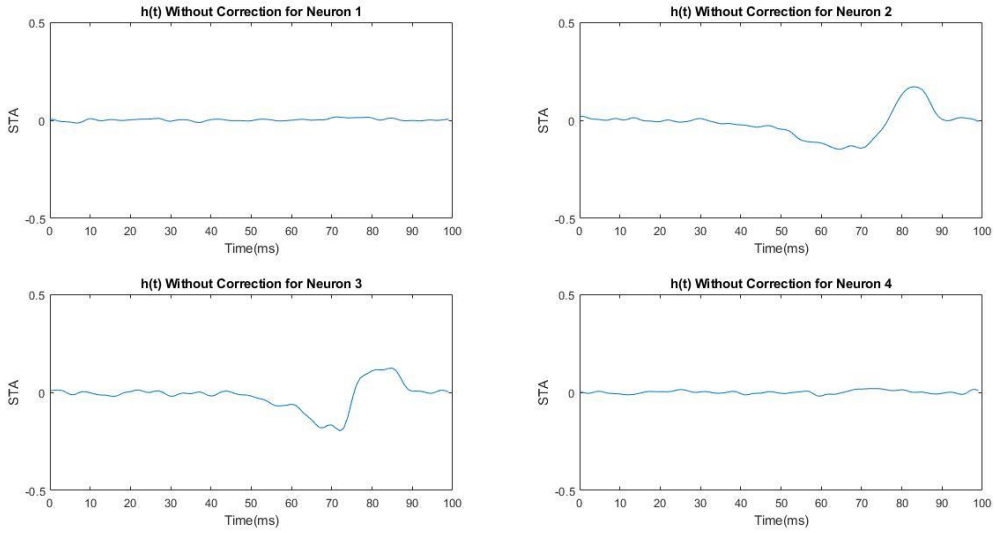


Figure 9

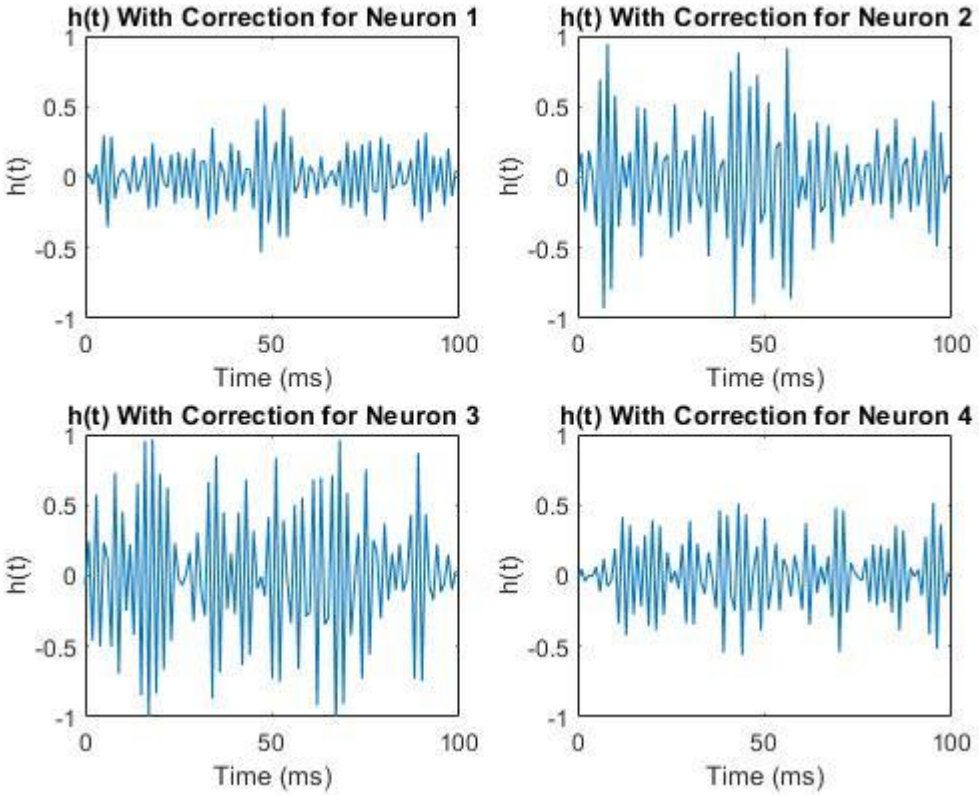


Figure 10

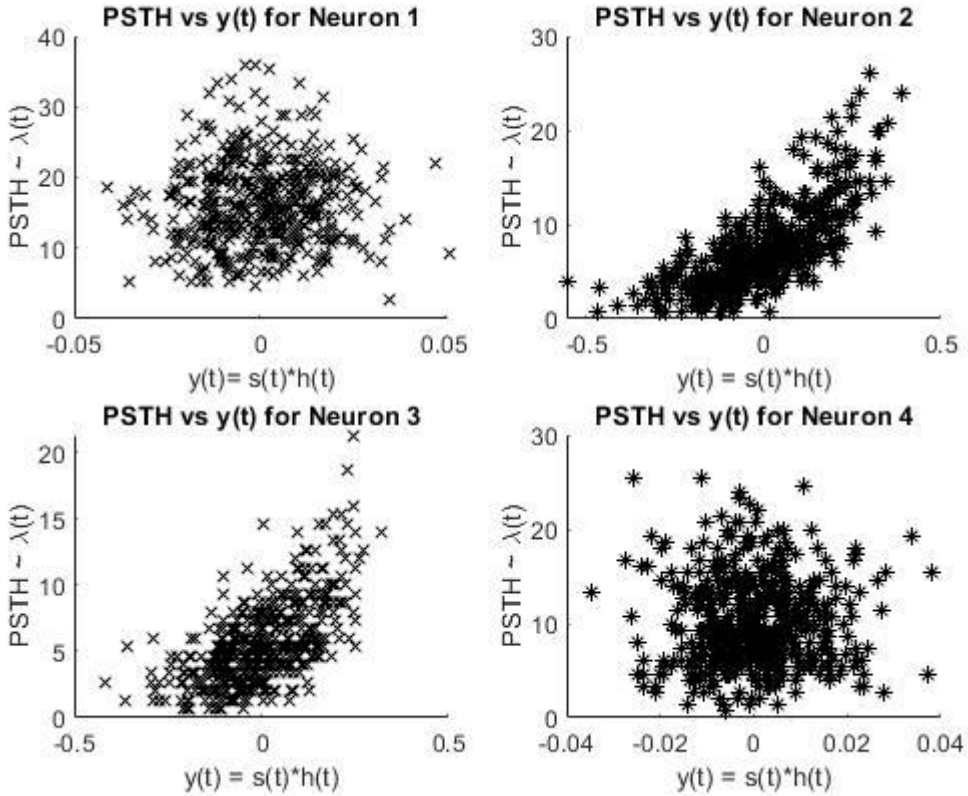


Figure 11

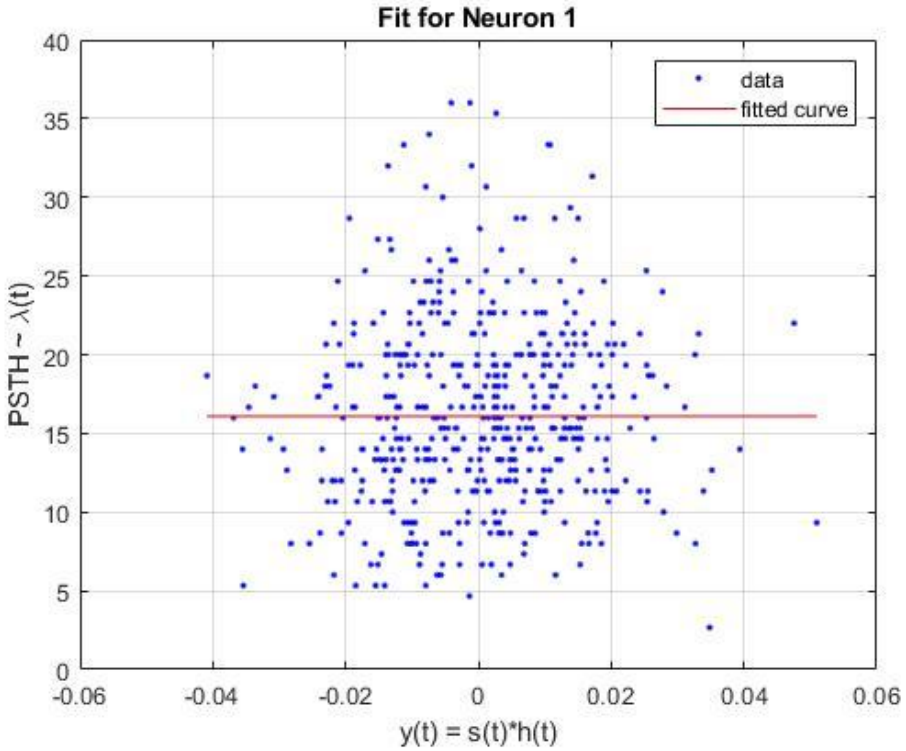


Figure 12

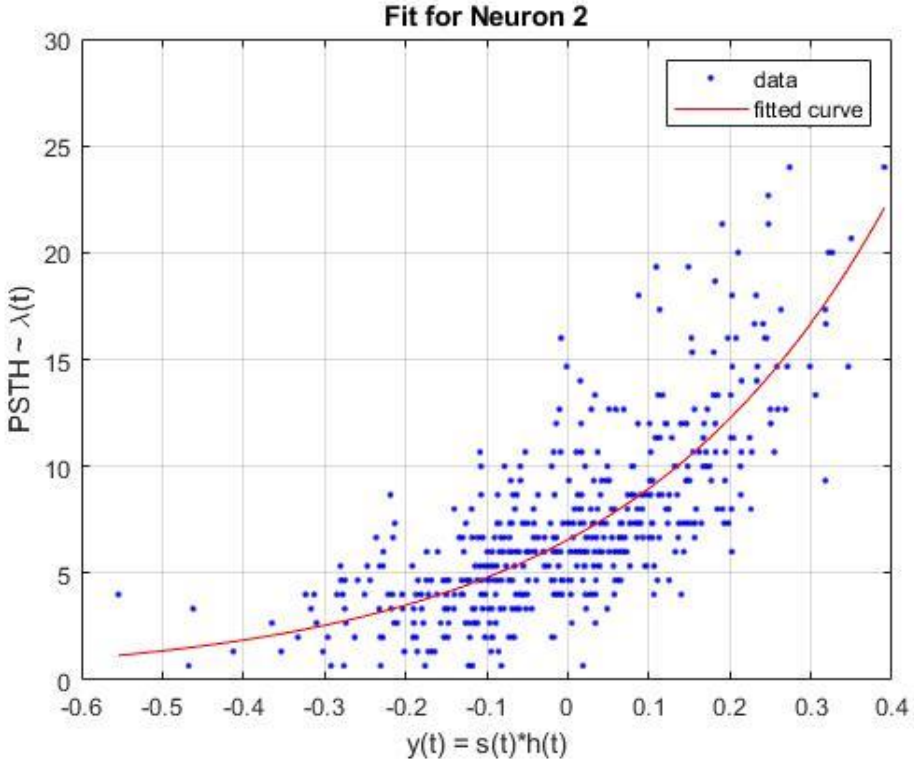
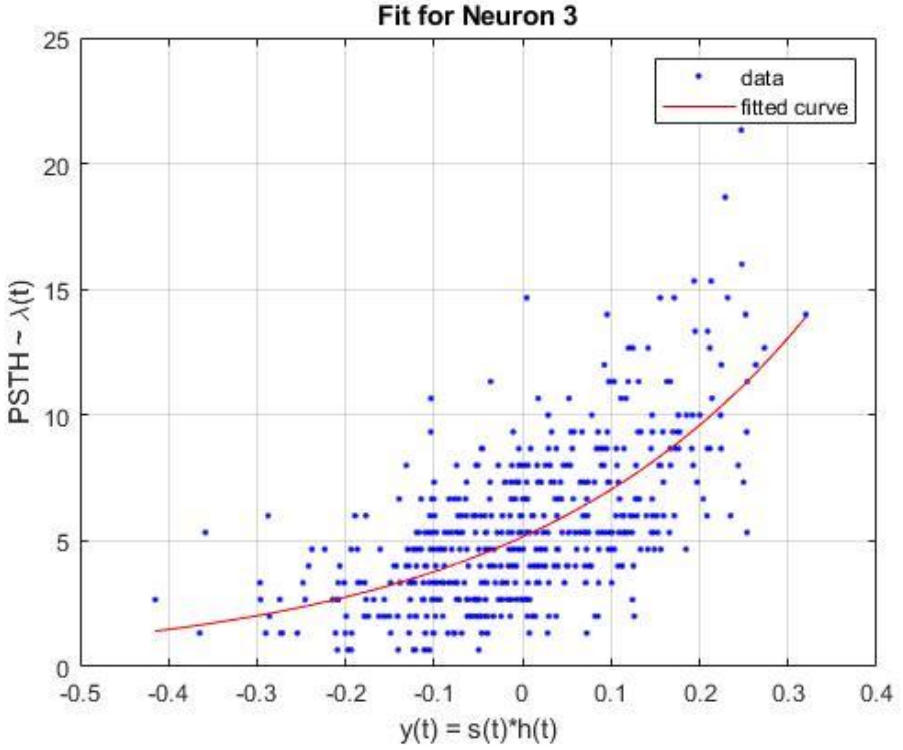


Figure 13



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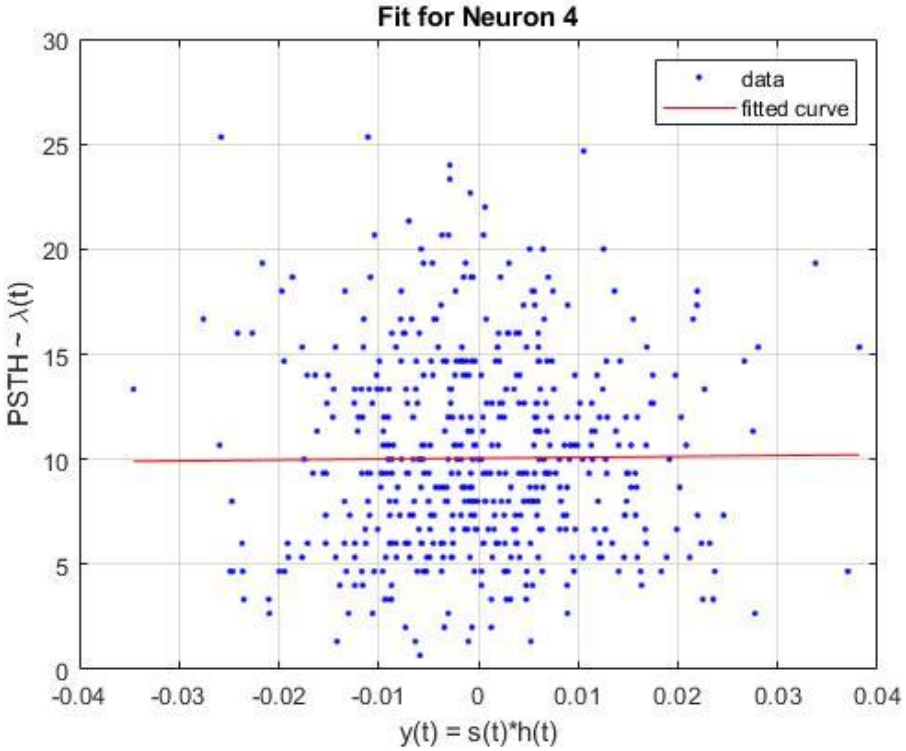

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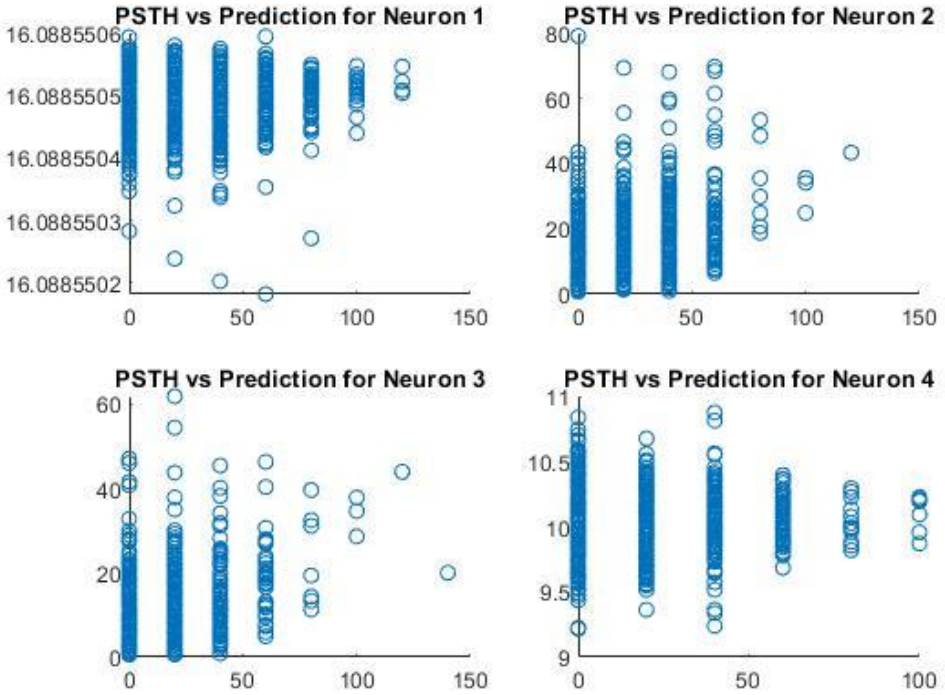

Figure 16

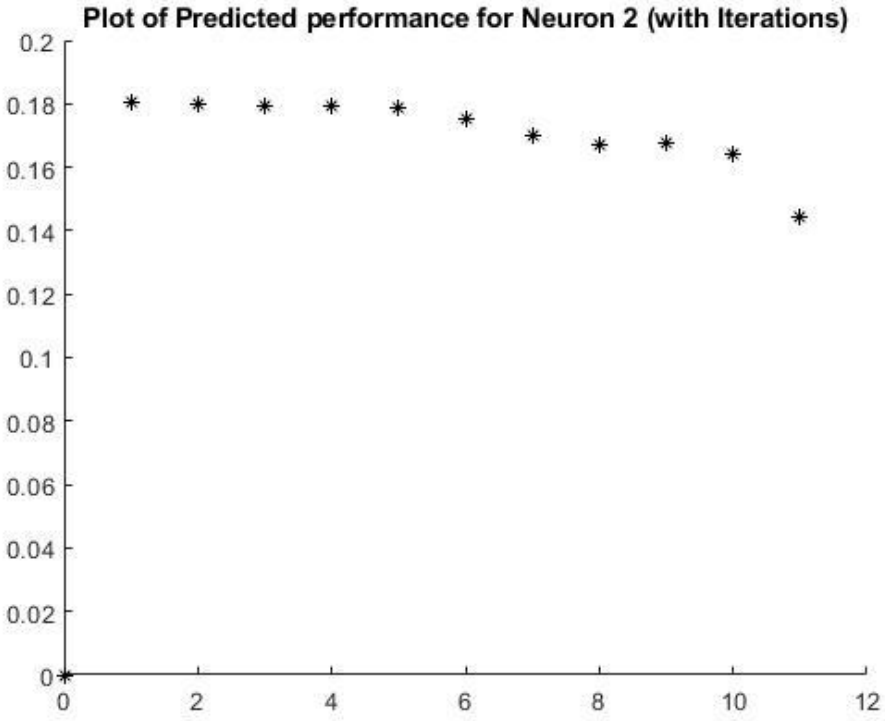

Figure 17

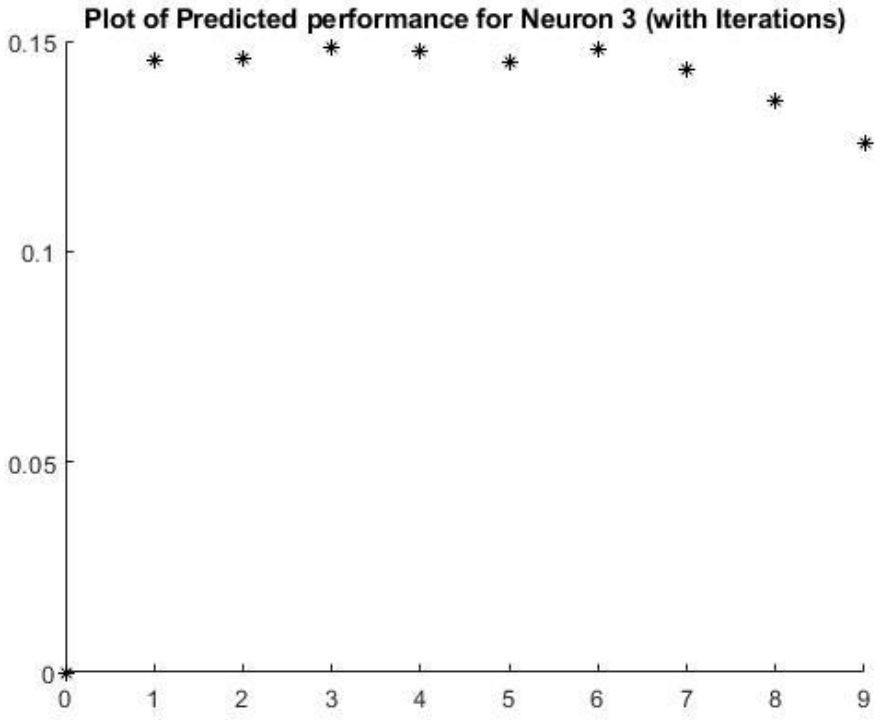

Figure 18

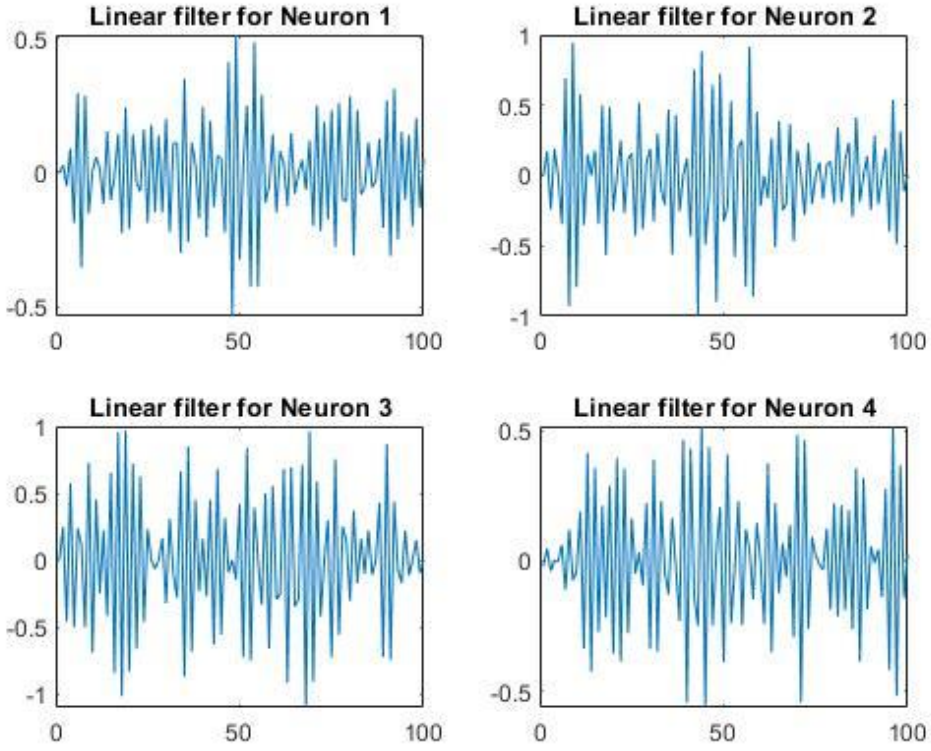

Figure 19

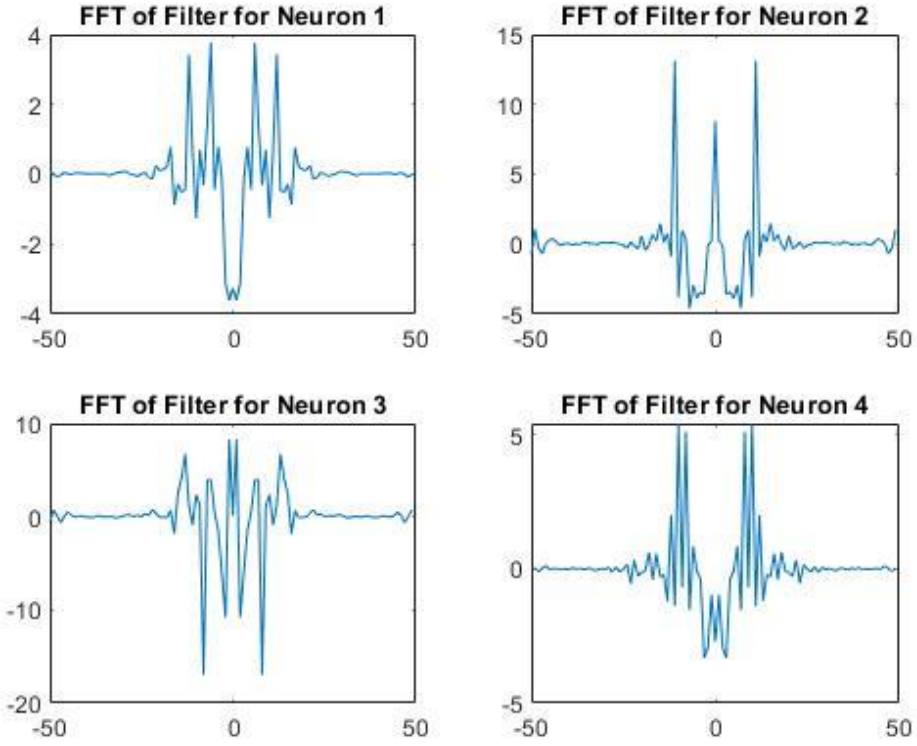

Figure 20

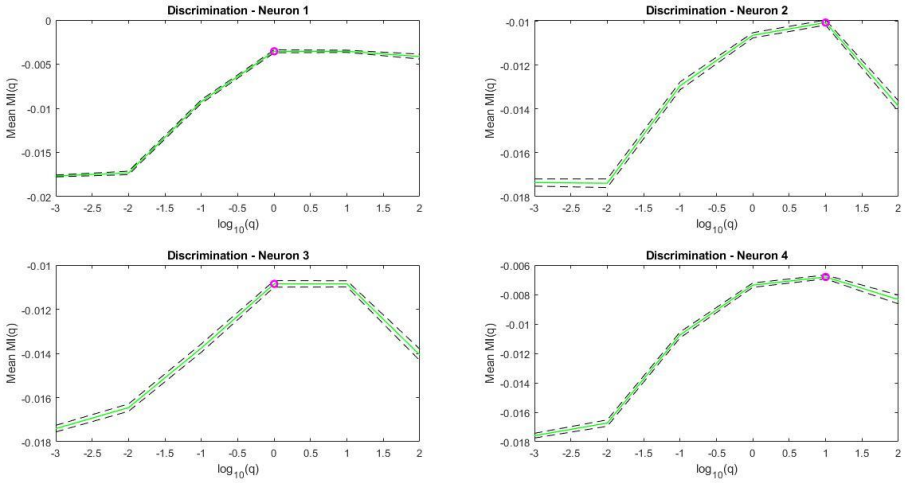

Figure 21