CN510 Assignment 10: Pair-Based STDP and Correlated input

Due Thursday Dec 5, 2013

The purpose of this assignment is to put plasticity on top of the network from the previous assignment. It relies heavily on your previous work in assignments 6, 8 and 9. All parameters that are not explicitly set here remain the same as in these assignments.

Plasticity

Add the same pair-based STDP as in assignment 8 to modify your weights

$$\Delta w_{ij}(n) = F_+(w_{ij}(n))x_i(n)q_j(n) - F_-(w_{ij}(n))y_j(n)s_i(n) \quad (1)$$

Pick $F_+(w_{ij}(n))$ and $F_-(w_{ij}(n))$ as you wish (any combination of additive, multiplicative, or power-based from the lecture) but keep $w_{max} = 1$ and learning rate $\eta = 0.02$. For extra credit you can do two values of μ: one below the critical level and one above.

Use the best set of initial weights that you have found in the assignment 9. Run the complete simulation with weight updates. Plot resulting weight changes for two of the weights against time for the whole simulation. Provide an additional zoom in on the plot for times between 1000 and 2000 ms.

Take the final values of the weights and generate a histogram of these weights splitting the [0,1] interval into 25 bins. Compare with the initial weights and with weighs from assignment 8.

Look at the activity of postsynaptic cells through time, compare them with the input traces and see if any of the postsynaptic cells picked up the correlated traces as their primary source of input. Plot what you think is the most helpful to see these results: a set of correlated inputs through time on the same plot as the activity of the output cell if it shows how the output aligns with input as the learning progresses, a set of weights for the correlated inputs showing increase in them vs a set of weights for other inputs showing decrease in weighs, etc. Be creative, if you have good looking learning results find a way to convince the reader that you do, if the network did not do what it was expected to do prove that it did not and explain why you think it did not work.

Grading Rubric:

100 points	**Learning Outcome**
40 points	Well-formatted plots with readable labels and parameter meanings listed in the caption
60 points	Discussion of results including everything that you have expected but did not achieve in this assignment as well as everything you have achieved but did not expect.