Neural Networks

Assignment 3

Ravikiran Bhat
Rubanraj Ravichandran
Ramesh Kumar

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1 Exercise 2.1

The equation 2.3 gives the weight adjustment Δw_{kj} applied to synaptic weight $w_{kj}(n)$ according to the delata rule:

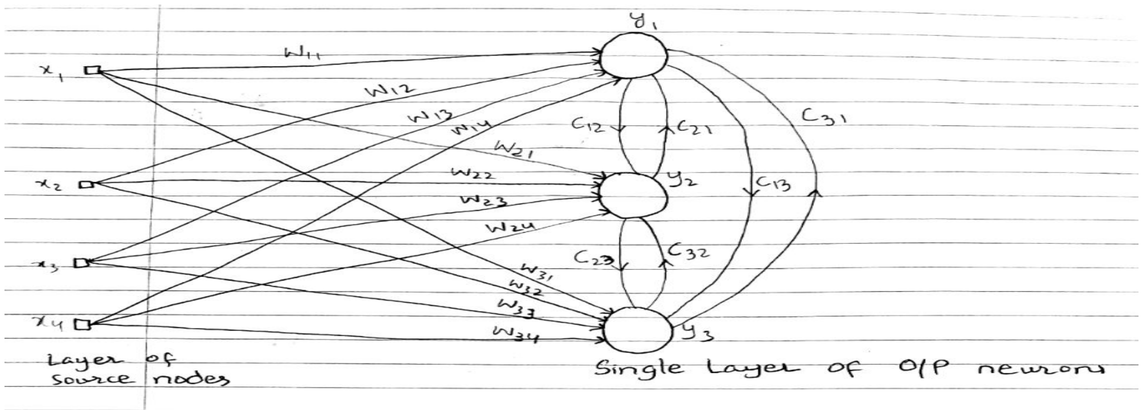
$$\Delta w_{kj} = \eta e_k(n) x_j(n)$$

The equation 2.9 gives the weight adjustment Δw_{kj} as:

$$\Delta w_{kj} = \eta y_k(n) x_j(n)$$

The main distinguishing feature between these two rules is that in case of the delta rule, the adjustment to synaptic weight of a neuron is proportional to the product of the error signal and input signal of the synapse, whereas the Hebb's rule gives the synaptic weight w_{kj} for neuron k as a function of presynaptic signal (i.e, the input signal) and postsynaptic signal (i.e, the output signal).

2 Exercise 2.10:



x_1 to x_4 = Input Signal

w_{ji} = synaptic weight from input i to neuron j where $i = 1,2,3,4$ and $j = 1,2,3$

C_{kj} = weight of lateral connection from neuron k to neuron j, i.e $C_{12}, C_{21}, C_{32}, C_{23}, C_{13}, C_{31}$

v_j = induced local field of neuron j

$y_j = \phi(v_j)$

$$y_j = \begin{cases} 1 & \text{if } v_j > v_i \text{ for all } i,\ i \neq j \\ 0 & \text{otherwise} \end{cases}$$

Weight adjustment can be written as:

$$\Delta w_{ji} = \begin{cases} \eta(x_i - w_{ji}) & \text{if neuron } j \text{ wins} \\ 0 & \text{if neuron } j \text{ loses the Competition} \end{cases}$$

The local field generated for a neuron should be larger than other neurons local field. Local field of neuron 'k' is nothing but, sum of the vector products of input 'j' and synapse weight 'k'. Let say, there are 3 output neurons in the network and the local field of neuron 2 is greater than neuron 1 and 3. In this case the neuron 2 is the winner and we update only the synapse weights which is connected with neuron 2.

$$y_j = \phi(\sum_{i=1}^{4} w_{ji}x_i + \sum_{k=1,k\neq j}^{3} c_{kj}y_k)$$

, where k_1, k_2 are numbers from 1 to 3 those are not equal j.