Neural Networks
- Homework 3 -

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Lecture date: 17 October 2016

1 Exercises

1.1 Exercise 2.1

The delta rule described in the following equation:
$\Delta w_{kj}(n) = \eta e_k(n) x_j(n)$
and Hebb's rule described in:
$\Delta w_{kj}(n) = \eta y_k(n) x_j(n)$
represent the two different methods of learning. List the features that distinguish these two rules from each other.

Solution:

- Learning rule: delta rule is a part of error-correction learning, whereas Hebb's rule is a part of memory-based learning.
- Adjustment: in delta rule it is based on the difference between desired and actual output (the error) and in Hebb's rule - on correlation, whether two neurons connected by synapse that is being considered are activated simultaneously or not.

1.2 Exercise 2.10

Formulate the expression for the output y_j of neuron j in the network of Fig. **??**, where:

$x_i = i^{th}$ input signal,
w_{ji} = synaptic weight from input i to neuron j,
c_{kj} = weight of lateral connection from neuron k to neuron j,
$y_j = \phi(v_j)$.

What is the condition that would have to be satisfied for neuron j to be the winning neuron?

Solution:

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

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

Neuron j is a winning neuron if $v_j > v_k$ for all $k \neq j$.

Figure 1: Competitive neural network with feedforward connections.