Techniques of Artificial Intelligence

Exercises – Neural Networks & Evaluating Hypothesis

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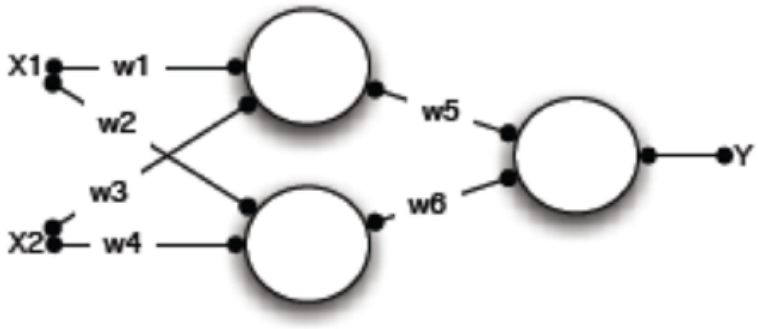
April 11, 2016

18. **Neural networks**
Consider the neural network which is shown above. Suppose it is a linear neural network, such



that the output value of each node is the weighted some of the inputs.

Give an equation for the values of the three output nodes.

Design a perceptron which will provide exactly the same output as the linear neural network above. Show that the output equation of the perceptron is the same as the one of the neural net shown above.

19. **Perceptrons** (exercise 4.3 in the course book)
Consider two perceptrons defined by the threshold expression $w_0 + w_1x_1 + w_2x_2 > 0$.
Perceptron A has weight values $w_0 = 1$, $w_1 = 2$, $w_2 = 1$
Perceptron B has weight values $w_0 = 0$, $w_1 = -2$, $w_2 = -1$
Is perceptron A more general than perceptron B? Motivate.

20. **Perceptrons** (exercise 4.5 in the course book)
Derive a gradient descent training rule for a single unit with output o, where:
$O = w_0 + w_1x_1 + w_1x_1^2 + ... + w_nx_n + w_nx_n^2$

21. **Evaluating Hypothesis**
When testing a hypothesis h, we used a sample set containing 30 samples. We learnt that 3 samples were misclassified. Calculate the 95% and the 50% confidence interval. You observe that the 95% confidence interval is almost 4 times bigger than the 50% confidence interval. What is the meaning of this interval? Using 95% confidence intervals, is it possible that the true error rate is:

(a) actually 1% instead of 10%?

(b) actually 0% instead of 10%?

22. **Evaluating Hypothesis**
When testing a hypothesis h, we used a sample set containing n samples. We learnt that 10% of the samples were misclassified. We want to be 95% sure (this means "with 95% confidence") that the true error rate is between 5% and 15%. How many samples do we need in order to be able to assure this?