Week 5: Learning and Decision Trees (Week 5 Lecture)

Tutorial 9: Perceptron Learning

9.1 (Activity 8.1: Decision Trees - Open Learning)

Activity 8.3: Perceptron Learning

1. Construct by hand a Perceptron which correctly classifies the following data; use your knowledge of plane geometry to choose appropriate values for the weights w_0, w_1 and w_2.

Training Example	x_1	x_2	Class
a.	0	1	-1
b.	2	0	-1
c.	1	1	+1

2. Demonstrate the Perceptron Learning Algorithm on the above data, using a learning rate of 1.0 and initial weight values of

$$w_0 = -0.5$$
$$w_1 = 0$$
$$w_1 = 1$$

In your answer, you should clearly indicate the new weight values at the end of each training step.

9.2 (Week 9.1: Neural Networks and Logical Functions - Open Learning)

Complete the Activity on the Multi-Layer Neural Networks page:

Explain how each of the following could be constructed:

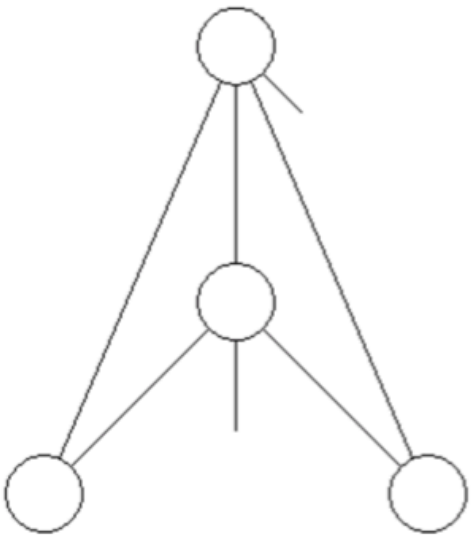
1. Perceptron to compute the OR function of *m* inputs, i.e. $y = x_1 \vee \ldots \vee x_m$
2. Perceptron to compute the AND function of *n* inputs, i.e. $z = y_1 \wedge \ldots \wedge y_n$
3. 2-Layer Neural Network to compute any (given) logical expression, assuming it is written in Conjunctive Normal Form. (Note: remember that, in each disjunctive clause, some of the literals may be negated).

9.3 (Week 7.2: Computing XOR with One Hidden Unit - Open Learning)

Complete the Activity on the Backpropagation page:

We have seen how to compute XOR using a Neural Network with two inputs, two hidden units and one output.

Can you construct a Neural Network to compute XOR which has only **one** hidden unit, but also includes shortcut connections from the two inputs directly to the (one) output?



Hint: start with a network that computes the inclusive OR, and then try to think of how it could be modified.