

Coursework 2

The coursework should be handed into the Documentation Administrator (Wendy Field) by 3:00pm on Thursday 22nd April 1999.

Every page should have on it

- The page number
- Your name
- Your login
- The course code and name (i.e. G5BAIM – Artificial Intelligence Methods (AIM)).
- The lecturers name (i.e. Graham Kendall)

Given the following truth table

I1	0	0	0	0	1	1	1	1
I2	0	0	1	1	0	0	1	1
I3	0	1	0	1	0	1	0	1
O	1	1	0	0	1	1	0	0

Show how a perceptron can learn to produce the required outputs. In doing so assume the following

- There are four input neurons (I0..I3). I0's activation is always -1.
The activation of I1, I2 and I3 is set to the relevant input values from the truth table.
- There is one output neuron; O.
- The initial weights, W0..W3, are 0.5, 0.3, 0.2 and 0.1
- The learning rate is set at 0.1
- The activation of the output unit is defined as follows

$$O = \text{Step}_0 \left(\sum_{j=0}^3 I_j W_j \right)$$

Where $\text{Step}_0(x)$ is defined as returning 1 if $x > 0$ else return 0

1. Show the following figures for each stage of learning

The Epoch Number, the values of I0..I3, the required output, the values of W0..W3, the value received by the output neuron; O, the value returned from the $\text{step}_0(x)$ function and the error value produced

Produce your answer in a format similar to this

Epoch	I0	I1	I2	I3	Reqd Output	W0	W1	W2	W3	O	Step(0)	Err
1	-1	0	0	0	1	0.5	0.3	0.2	0.1	??	??	?
Etc.												

Note : You can do this manually but you might find it easier to automate the process – although this does not necessarily mean writing a program.

2. What is the effect if you change the learning rate from 0.1 to 0.03?
3. What is the effect of changing the required output for the [1,1,1] input to 1?
4. What is the effect of changing the required output for the [0,1,0] input to 1 (and leaving the [1,1,1] output as 1)?

In answering questions 2, 3 and 4 state at what epoch the network now converges using the same initial weights and for learning rates of 0.1 and 0.03.