CSC3022H: Machine Learning

Lab 5: Artificial Neural Networks II

Department of Computer Science
University of Cape Town

August 26, 2018

Due: Friday, 7 September, 2018, 10.00 AM

Problem Description

Implement (in C++) a fully connected feed-forward neural network that consists of 3 input neurons, 2 hidden layer neurons and 1 output neuron. The hidden layer neurons and output neuron use the *Sigmoid* (chapter 4 [Mitchell, 1997]) activation function.

The ANN input nodes 1, 2 and 3, respectively, have the following inputs:

$$x = [\ 1.30,\ 2.70,\ 0.80\ ]$$

The ANNs expected output is:

$$y = 0.36$$

Table 1 specifies the weights connecting the inputs to the hidden layer neurons. Note that each column denotes a given node connected to a given hidden layer. For example, the top value in column 1 is the value of the weight connecting input node 1 to hidden layer node 1, and the bottom value in column 1 is the value of weight connecting input node 1 to hidden layer node 2.

The bias values for the hidden layer neurons 1 and 2, respectively, are:

$$\mathrm{b} = [\ 0.1,\ -0.3\ ]$$

Table 1: Values of weights connecting input to hidden layer nodes.

Input 1	Input 2	Input 3
0.1	0.2	0.5
-0.4	1.0	-0.6

Question 1:

Given the ANN input x, what are the output values of hidden layer neurons 1 and 2 ?

Question 2:

Given that the weights from hidden layer nodes 1 and 2, respectively, are:

$$\mathrm{w} = [\ 0.8,\ 1.0\ ]$$

And the bias value for the output node is: $\mathrm{b} = -0.3$, and the ANN input x, what is the output value of the output neuron ?

Question 3:

Given this output, what is the *Mean Squared Error* for ANN input x.

In a ZIP file, place the source code, executable, and a text file containing your list of training examples, as well as answers to questions 1, 2 and 3. Upload the ZIP file to *Vula* before 10.00 AM, 7 September, 2018.

References

[Mitchell, 1997] Mitchell, T. (1997). *Machine Learning.* McGraw Hill, New York, USA.