CSC3022H: Machine Learning

Lab 6: Artificial Neural Networks III

Department of Computer Science
University of Cape Town, South Africa

September 4, 2018

Due: Friday, 21 September, 2018, 10.00 AM

Problem Description

In C++ implement the multi-layered *Artificial Neural Network* shown in figure 1, using *Sigmoid* activation functions for the hidden layer and output nodes.

Given the inputs, $x_1 = 0$, $x_2 = 1$, target outputs $t_1 = 1$, $t_2 = 0$ (for output nodes: y_1, y_2, respectively), and connection weight values: v_{11}, v_{12}, v_{21}, v_{22}, w_{11}, w_{12}, w_{21}, w_{22} (shown in figure 1), use the *Back-Propagation* algorithm (chapter 4 [Mitchell, 1997]), to do one forward pass and one backward pass and calculate the following:

- Hidden node outputs (activations) in first forward pass.
- Outputs (y_1, y_2) in first forward pass.
- Error for each output node after first forward pass.
- New weights for layer 2 connections (hidden to output node weights: w_{11}, w_{12}, w_{21}, w_{22}) in first backward pass.
- Hidden node errors in first backward pass.
- New weights for layer 1 connections (input to hidden node weights: v_{11}, v_{12}, v_{21}, v_{22}) in first backward pass.

In a ZIP file, place your source code, makefile, and a text file containing answers to the above node output, error and weight calculations.

Upload the ZIP file to *Vula* before 10.00 AM, Friday 21 September.

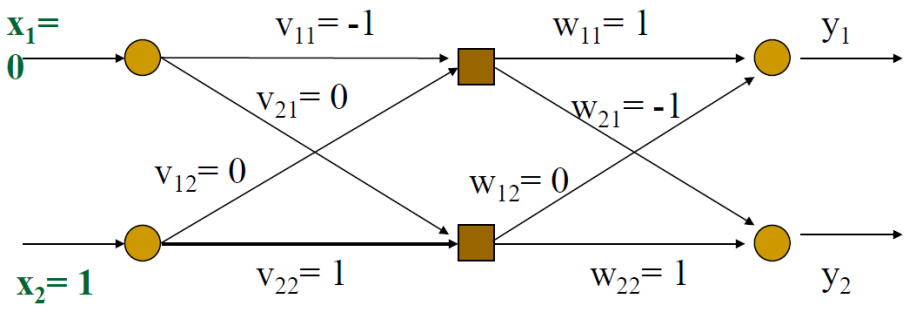

Figure 1: Multi-layered Artificial Neural Network with *Sigmoid* activation function for hidden and output nodes. Initial connection weights (v_{11}, v_{12}, v_{21}, v_{22}, w_{11}, w_{12}, w_{21}, w_{22}), and input values ($x_1 = 0$, $x_2 = 1$) are shown.

References

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