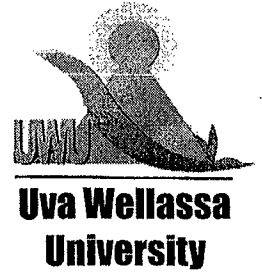




Uva Wellassa University, Sri Lanka
Faculty of Science & Technology
Computer Science & Technology Degree Program
1st Semester Examination – February/March 2012
CST 416-2 Neural Network



Time: **Two (02) hours**

Total **04 Questions**

Answer **ALL** questions

Question 1.

(25 marks)

- (a) Considering the processing function to be *Step processing function* with a threshold, show the functioning mechanism of a neuron in a simple feed forward Artificial Neural Network.
- (b) *McCulloch-Pitts* neurons are the simplest form of model neurons. Describe the operation of a *McCulloch-Pitts* model neuron and its relationship to a real neuron.
- (c) Design networks of *McCulloch-Pitts* neurons that implement logical NOT, AND, OR and XOR gates. Draw each network and label all the weight and threshold values. In what way is XOR more difficult?
- (d) Comment on the following statements:
 - (i) *Sigmoid function* is introduced to ANN processing functions as it is similar to *Step processing function*.
 - (ii) Use of *Bias* in Artificial Neural Network.
 - (iii) *Momentum* can be used to avoid paralyzed training in ANN.
 - (iv) Human use associate memory space as well as rule base in computing mathematical operation.

Question 2.

(25 marks)

- (a) For a minimum distance classifier with one input variable, what is the decision boundary between two classes?
- (b) With a *supervised learning* algorithm, we can specify target output values, but we may never get close to those targets at the end of learning. Give two reasons why this might happen.
- (c) What is the difference between a neural network designed as an approximator and one designed as a classifier?
- (d) Why can't the *XOR problem* be solved by a one-layer perceptron?
- (e) Describe the relationship between the *Self-Organizing Map* algorithm, and the *Learning Vector Quantization* algorithm.

Question 3.

(25 marks)

- (a) In the application of the *backpropagation algorithm*, there are two passes of computation: the *forward pass* and the *backward pass*. How will you distinguish between these two passes? Illustrate your answer by using a diagram showing the activations involved in each pass of a backpropagation network.
- (b) Explain why the weights in a neural network which are to be trained by the backpropagation algorithm are given random initial starting values rather than identical starting values?
- (c) The network shown in Figure-1 when properly trained should respond with $[1, 0.6]^T$ to the input pattern $[1, 2, -2]^T$ and with $[0.6, 1]^T$ to the input pattern $[0.5, -2, 0.9]^T$. Perform a single cycle of the network using the backpropagation algorithm for $\eta = 0.9$ and $\lambda = 1$. For calculation assume $f(net) = \frac{2}{1+e^{-\lambda net}} - 1$, $f'(net) = \frac{1}{2}(1 - f(net)^2)$ and $E_{max} > error$.

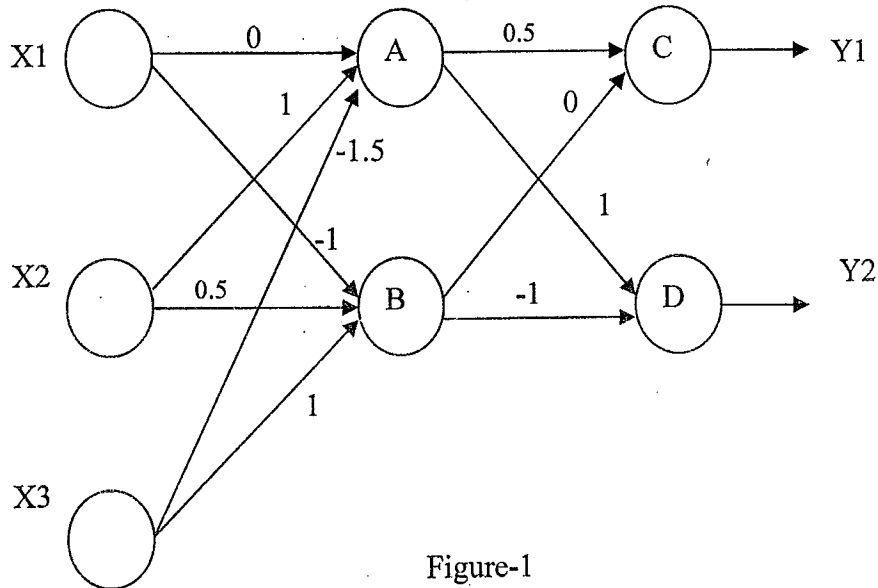


Figure-1

- (d) The following are deficiencies of the backpropagation algorithm. Explain the deficiency and suggest remedies to minimize their influence on the learning/training/usage of the neural network.
- Deficiencies associated with the gradient descent method when applied to the weight update.
 - Deficiencies associated with network paralysis as a result of using the sigmoid activation function.

Question 4.

(25 marks)

Discuss in detail using a realistic example, how artificial neural networks can be used to solve real world problems.

Your discussion should cover the following: reasons for using neural networks to solve your selected example problem; selection and formatting/pre-processing of neural network inputs and outputs; training, testing and generalization issues; choice of neural network structure; an algorithm of the neural network learning strategy proposed; and, possible problems arising in practice and ways to minimize them.

--- The End ---

