

Manarat International University (MIU)

Department of Computer Science and Engineering (Fall 2019)

Neural Network and Fuzzy Systems (CSE-433)

Home Work-1

1. Write equations for a the complete Backpropagation algorithm of a multi-layer neural network. (Use slides)

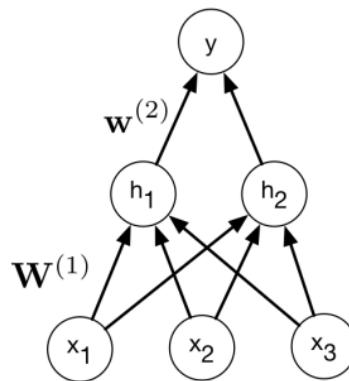
2. Riadul Islam Designs a multi-layer perceptron which receives three binary-valued (i.e. 0 or 1) inputs x_1 , x_2 , x_3 , and outputs 1 if exactly two of the inputs are 1, and outputs 0 otherwise. He uses following activation function for all of the units.

$$\mathbf{W}^{(1)} = \underbrace{\left(\begin{array}{ccc} & & \end{array} \right)}_{2 \times 3 \text{ matrix}}$$

$$\mathbf{b}^{(1)} = \left(\begin{array}{c} \end{array} \right)$$

$$\mathbf{w}^{(2)} = \left(\begin{array}{c} \end{array} \right)$$

$$b^{(2)} =$$



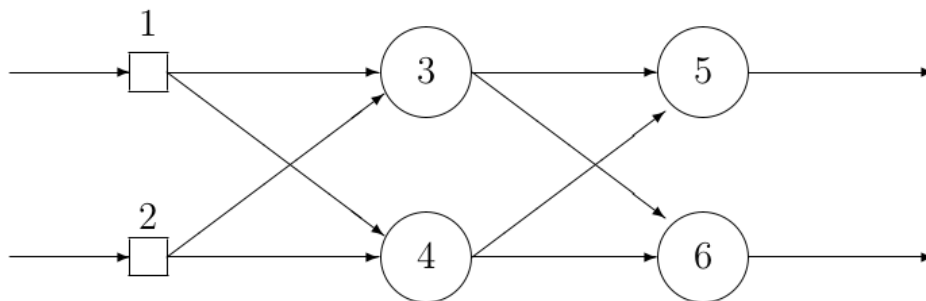
$$z = \begin{cases} 1 & \text{if } z \geq 0 \\ 0 & \text{if } z < 0 \end{cases}$$

Now, specify weights and biases which correctly implement his network.

Note: You do not need to explain your solution.

Hint: One of the hidden units should activate if 2 or more inputs are on, and the other should activate if all of the inputs are on.

3. The following diagram represents a feed-forward neural network with one hidden layer



A weight on connection between nodes i and j is denoted by w_{ij} , such as w_{13} is the weight on the connection between nodes 1 and 3. The following table lists all the weights in the network:

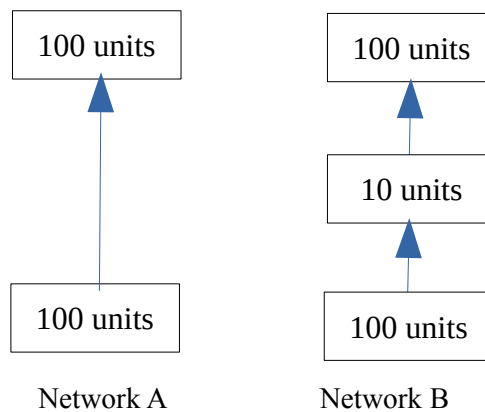
$w_{13} = -2$	$w_{35} = 1$
$w_{23} = 3$	$w_{45} = -1$
$w_{14} = 4$	$w_{36} = -1$
$w_{24} = -1$	$w_{46} = 1$

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

$\varphi(v)$ is the activation function of all the nodes. Where v denotes the weighted sum of a node. Each of the input nodes (1 and 2) can only receive binary values (either 0 or 1). Calculate the output of the network (y_5 and y_6) for each of the input patterns:

Pattern:	P_1	P_2	P_3	P_4
Node 1:	0	1	0	1
Node 2:	0	0	1	1

4. Consider the following two multi-layer perceptrons, where all of the layers use linear activation functions



- Mention the advantages of implementing Network A over Network B.
- Mention the advantages of implementing Network B over Network A.