Date: 07.03.24

TITLE

IMPLEMENTATION AND ANALYSIS OF SINGLE LAYER AND MULTI LAYER PERCEPTRON

1. Train the network for implementing single layer perceptron classifier for the following logic functions.

(i) AND   (ii) OR

The AND logic		
X1	X2	target
0	0	0
0	1	0
1	0	0
1	1	1

The OR logic		
X1	X2	target
0	0	0
0	1	1
1	0	1
1	1	1

2. CHECK IF SINGLE LAYER PERCEPTRON CAN BE USED TO IMPLEMENT XOR LOGIC FUNCTION.

   (XOR gate -needs a hidden layer)

The XOR logic		
X1	X2	Target
0	0	0
0	1	1
1	0	1
1	1	0

Solve XOR logic function using Multilayer Perceptron.

3. Apply Single Layer Linear Perceptron Learning algorithm to the following dataset. Perform a maximum of four iterations one for each data sample. Show the equation of the separating line at the end of four iterations. Show step by step result. Assume initial weights for [X_1, X_2, bias] [w_1, w_2, w_3] as [0.75, 0.5, -0.6] and learning rate L = 0.2.

X_1	X_2	Class Output
7.0	7.0	-1
2.8	0.8	1
1.2	3.0	1
7.8	6.1	-1

4. In the perceptron shown in Figure 1, what will be the output of the perceptron if the input was (0,1) (1,1) and (1,0)? What if we change the bias weight to -0.5?
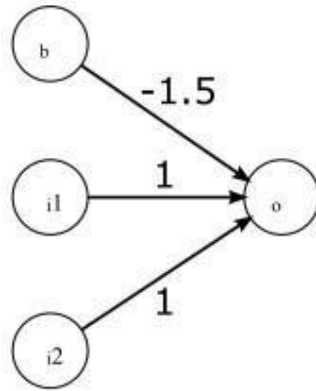
Figure 1: Perceptron

Record the output and your observation on the following:

Bias = −1.5			Bias = −0.5		
Input	Weighted sum	Output	Input	Weighted sum	Output
(0,0)	−1.5		(0,0)	−0.5	
(0,1)	−0.5		(0,1)	0.5	
(1,0)	−0.5		(1,0)	0.5	
(1,1)	0.5		(1,1)	1.5	

5. A Single layer perceptron neural network is used to classify the 2 input logical gate OR shown in Figure 2. Using a learning rate of 0.1, train the neural network for the first three epochs. Use limiting function.
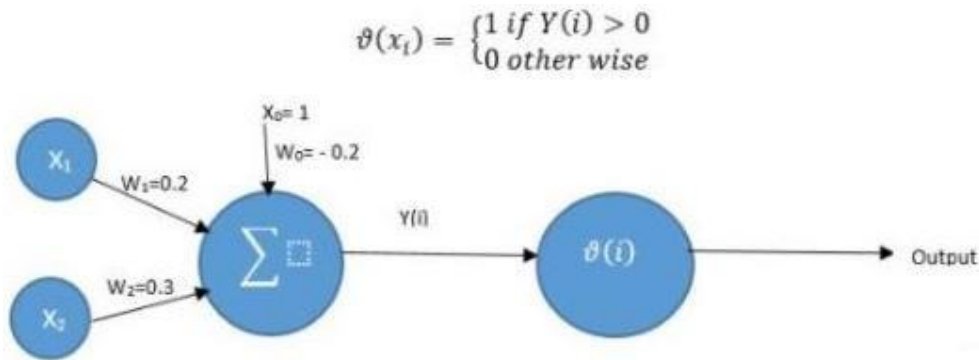
$$\vartheta(x_i) = \begin{cases} 1 \ if \ Y(i) > 0 \\ 0 \ other \ wise \end{cases}$$

Figure 2: 2 input Logical Gate OR

6. A Multilayer perceptron for a two-class classification problem is given in Figure 3. The units at the hidden and output layers are sigmoid (sign) functions. The weights determined through training are:

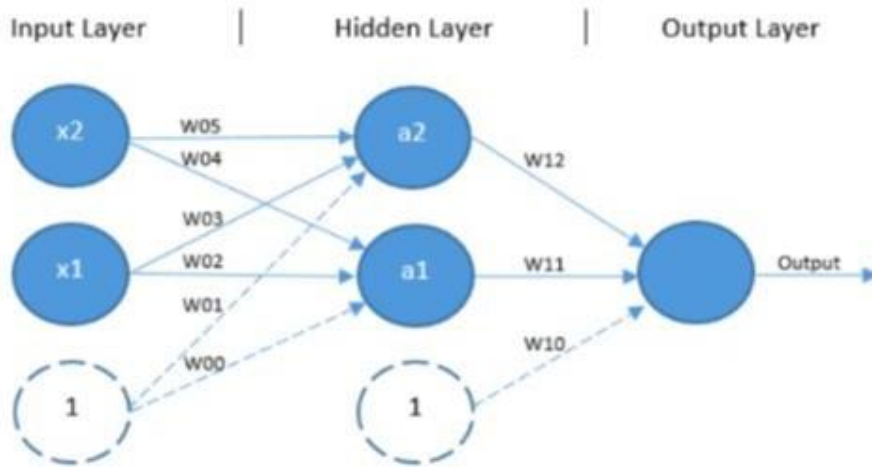W00=0.5; W01=1; W02=0.7; W03=1; W04=-0.6; W05=1; W10=-0.5; W11=-1; W12=1.

Figure 3: Multilayer Perceptron

(a) Classify (x1,x2)=(0,0)

(b) Classify (x1,x2)=(1,1)