CS 6301 - Machine Learning Lab - Week 4

Date: 25.08.23

TITLE

IMPLEMENTATION AND ANALYSIS OF SINGLE LAYER AND MULTI LAYER PERCEPTRON

TASKS

1. Implement Perceptron Algorithm with 2-bit Binary Input for the following:
   a) AND Logic Gate
   b) OR Logic Gate
   c) NOR Logic Gate
   d) XOR Logic Gate

2. 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

3. 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?

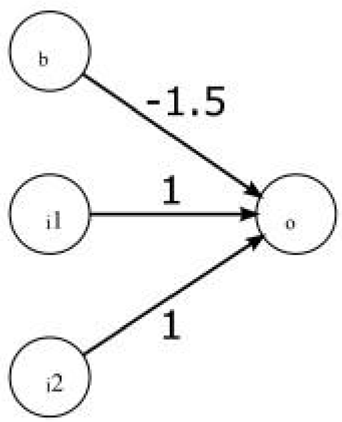

Figure 1: Perceptron

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	

4. 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.

$$\vartheta(x_i) = \begin{cases} 1 \; if \; Y(i) > 0 \\ 0 \; other \; wise \end{cases}$$

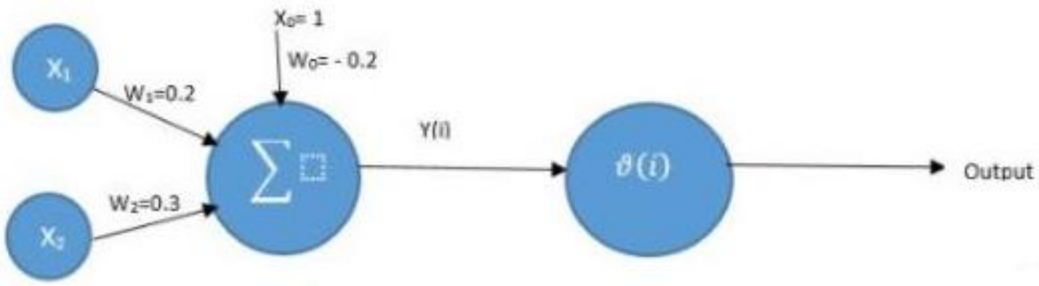

Figure 2: 2 input Logical Gate OR

5. 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.

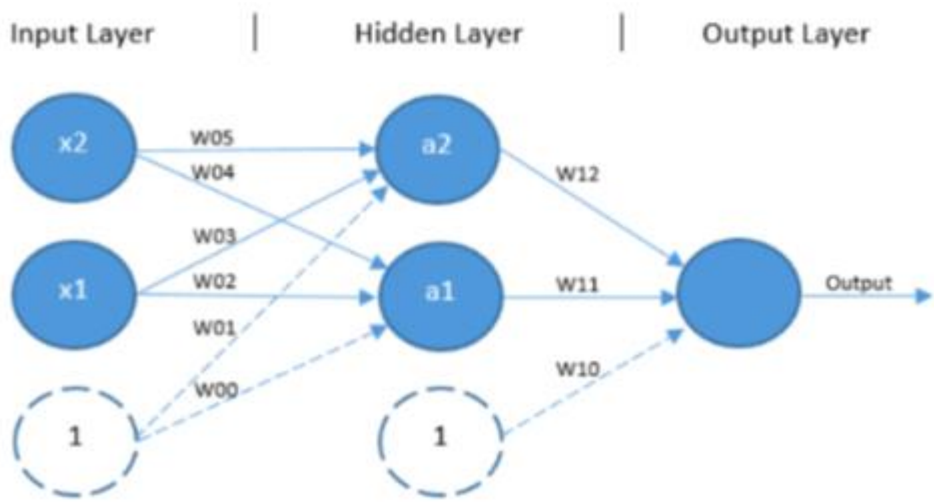

Figure 3: Multilayer Perceptron

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

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