ANN LAB PRACTICAL2 THEORY

LABORATORY NO.: 3	**Title:** ANDNOT function using McCulloch-Pitts Neural Net

Aim: Write a Python program to generate ANDNOT function using McCulloch-Pittsneural net.

Objective:
Learning to design MP models for logic functions like ANDNOT.

Theory:
McCulloch-Pitts neural model:
The early model of an artificial neuron is introduced by Warren McCulloch and Walter Pitts in 1943. The McCulloch-Pitts neural model is also known as linear threshold gate. It is a

neuron of a set of inputs and one output . The linear threshold gate simply

classifies the set of inputs into two different classes. Thus the output is binary. Such a function can be described mathematically using these equations:

$$Sum = \sum_{i=1}^{N} I_i W_i,$$

$$y = f(Sum).$$

$I_1, I_2, I_3, \ldots, I_m$ y

$(0,1)$ y $(-1,1)$

are weight values normalized in the range of either or and associated with each input line, is the weighted sum, and is a threshold constant.

f

The function is a linear step function at threshold as shown in figure below. The symbolic representation of the linear threshold gate is shown in figure.

$W_1, W_2, W_3, \ldots, W_m$

Sum T

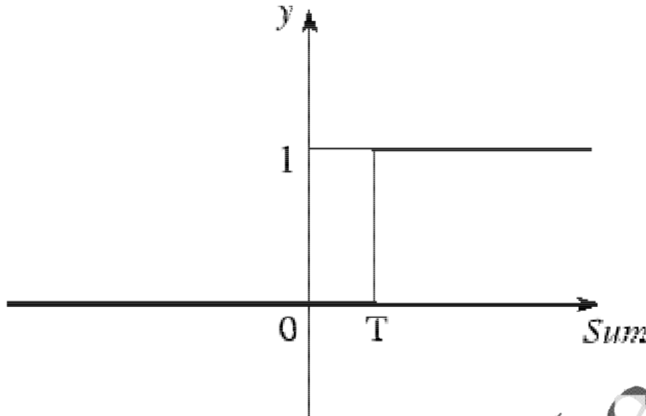
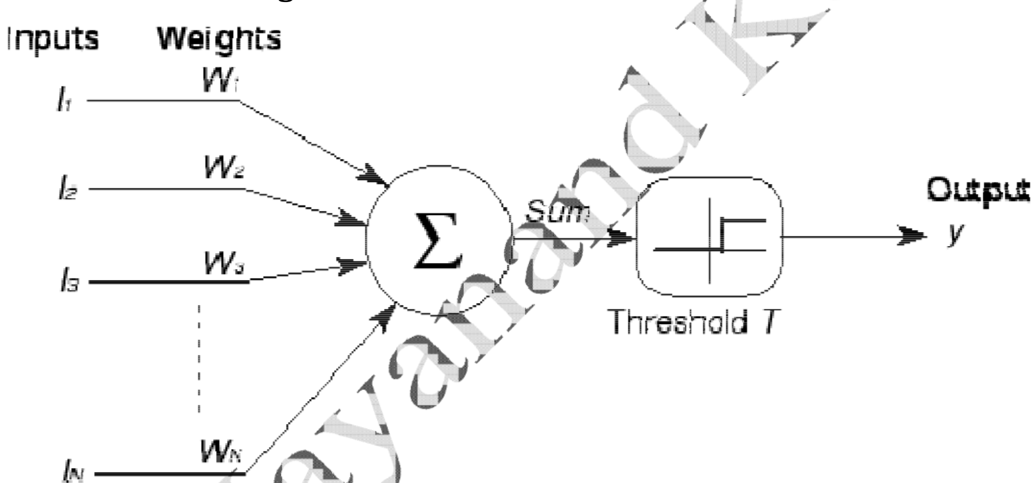


Figure 2.3: Linear Threshold Function



Symbolic Illustration of Linear Threshold Gate

The McCulloch-Pitts model of a neuron is simple yet has substantial computing potential. It also has a precise mathematical definition. However, this model is so simplistic that it only generates a binary output and also the weight and threshold values are fixed. The neural computing algorithm has diverse features for various applications. Thus, we need to obtain the neural model with more flexible computational features.

Activation Value: X= $\left(\sum_{i=0}^{n} w_i x_i\right)$

Output Function

$$y = f(y_{\text{in}}) = \begin{cases} 1 & \text{if } y_{\text{in}} \geq \theta, \\ 0 & \text{if } y_{\text{in}} < \theta. \end{cases}$$

ANDNOT Function:

Truth Table:

X1	X2	Y
1	1	0
1	0	1
0	1	0
0	0	0

A NN with two input neurons and a single output neuron can operate as an ANDNOT logic function if we choose weights

W1 = 1, W2 = -1 and threshold ϴ = 1.

Yin is a activation value
X1=1, X2=1,
Yin= W1*X1+W2*X2=1*1+(-1)*1=0, Yin< ϴ , so Y=0
X1=1, X2=0
Yin=1*1+0*(-1)=1, Yin= ϴ , so Y=1
X1=0, X=1
Yin=0-1=-1, Yin< ϴ , so Y=0
X1=0, X2=0
Yin=0, Yin< ϴ , so Y=0
So , Y=[0 1 0 0]

EXPECTED OUTPUT / CALCULATION / RESULT:

Weights of Neuron:
w1=1
w2=-1
Threshold:
Theta=1

Output:

w1=1
w2=-1
Threshold:
Theta=1

With Output of Neuron:
0 1 0 0