Experiment No. 2

Aim: Generate ANDNOT function using McCulloch-Pitts neural 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 the equations

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 Function:

Output Function ANDNOT Function:

$$g(x_1, x_2, x_3, \ldots, x_n) = g(\mathbf{x}) = \sum_{i=1}^{n} x_i$$

$$y = f(g(\mathbf{x})) = 1 \quad if \quad g(\mathbf{x}) \geq \theta$$
$$= 0 \quad if \quad g(\mathbf{x}) < \theta$$

TRUTH TABLE:

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

ANN 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 0 = 1. Yin is an activation value
X1= 1, X2= 1,
Yin = W1*X1+W2*X2=1*1+(-1)*1=0, Yin< © , so Y=0
X1 = 1, X2 = 0
Yin = 1*1+0*(-1) = 1, Yin = ©, so Y = 1
X1 = 0, X = 1
Yin = 0-1 = -1, Yin< 8, so Y = 0
X1 = 0, X2 = 0
Yin = 0, Yin< 8, so Y = 0
So, Y = [010 0]

Applications:

1. To design logical operations
2. To implement basic logic gates like AND, OR, and NOT

Input:

Weights of Neuron:

w1=1
w2=-1
Threshold:
Theta=1
Output:
w1=1
w2=-1
Threshold:
Theta=1
With Output of Neuron:
0100

Conclusion:

We have successfully implemented ANDNOT function using McCulloch-Pitts neural net.

Outcome:

Upon completion of this experiment, students will be able to:

Experiment level outcome (ELO1): Perform basic logic gates like AND, OR, and NOT.

Questions:

1. What are the limitations of the McCulloch-Pitts neuron model?
2. What is the MP neural network model?