

Assignment -2

Title: AND NOT function using McCulloch-Pitts Neural Net

Aim: Write a MATLAB program to 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 these 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.

$$f\left(\sum_{i=1}^n x_i w_i\right)$$

Activation Function:

Output Function ANDNOT Function:

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

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

$W_1 = 1$, $W_2 = -1$ and threshold $\Theta = 1$.

Y_{in} is a activation value

$X_1=1, X_2=1$,

$Y_{in} = W_1 * X_1 + W_2 * X_2 = 1 * 1 + (-1) * 1 = 0$, $Y_{in} < \Theta$, so $Y=0$

$X_1=1, X_2=0$

$Y_{in} = 1 * 1 + 0 * (-1) = 1$, $Y_{in} = \Theta$, so $Y=1$

$X_1=0, X_2=1$

$Y_{in} = 0 * 1 + (-1) * 1 = -1$, $Y_{in} < \Theta$, so $Y=0$

$X_1=0, X_2=0$

$Y_{in}=0$, $Y_{in} < \Theta$,

so $Y=0$ So, $Y=[0 \ 1 \ 0 \ 0]$

EXPECTED OUTPUT/CALCULATION/ RESULT:

Weights of Neuron:

$w_1=1$

$w_2=-1$

Threshold:

$\Theta=1$

Output:

$w_1=1$

$w_2=-1$

Threshold:

$\Theta=1$

With Output of Neuron:

0 1 0 0

Conclusion:

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

Questions:

1. Explain McCulloch-Pitts Model in detail.
2. Explain Adaline Model.
3. What is Supervised Learning?
4. Explain basic learning laws.
5. Explain features of ANN.