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BE Comp 2

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SCOA Assignment 3

1) Explain Hebb Learning using an example?

Ans. Donald O. Hebb learning using an example to update the weights between neurons in a neural network. This method of weight updation enables neurons to learn which is named as Hebbian learning. According to the Hebb Rule, the weight vector is found to increase proportionally to the product of the input and learning signal.

$w_i(new) = w_i(old) + x_i y$

Example.

Hebb network to implement logic AND function (bipolar inputs)

x_1	x_2	b	y
1	1	1	1
1	-1	1	-1
-1	1	1	1
-1	-1	1	0

Initially $w_1 = w_2 = b = 0$

* First input $= [x_1 \; x_2 \; b] = [1 \; 1 \; 1]$

Target (-1) = 1

$w_i(new) = w_i(old) + x_i y$

$b_i(new) = b_i(old) + y$

$w_1(new) = 0 + 1(1) = 1$

$w_2(new) = 0 + 1 = 1$

$b(new) = 0 + 1 = 1$

These weights will now be used as initial weights for the next input.

* Second input $= [x_1 \; x_2 \; b] = [1 \; -1 \; 1]$

Target = -1

$w_1(new) = (1) + 1(-1) = 0$

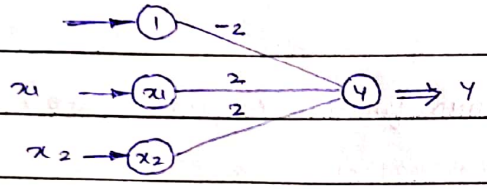
$w_2(new) = 1 - (-1) = 2$

$b(new) = 1 + (-1) = 0$

Similarly, processing all inputs.

Inputs				weights		
y	x_1	x_2	b	w_1	w_2	b
1	1	1	1	1	1	1
-1	1	-1	1	0	2	0
-1	-1	1	1	1	1	-1
-1	-1	-1	1	2	2	-2

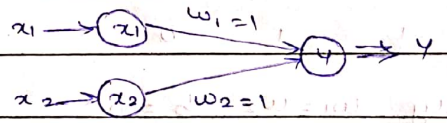
Final architecture :



2) Explain Mc Culloch - Pitts Neuron in brief by considering AND gate example

Ans.

x_1	x_2	y
1	1	1
1	0	0
0	1	0
0	0	0



In MP neuron, only analysis is being done

Assume $w_1 = 1$ and $w_2 = 1$

With these assumed weights, net I/P is calculated for 4 inputs.

(1,1) $y_{in} = x_1 w_1 + x_2 w_2 = 1(1) + 1(1) = 2$

(1,0) $y_{in} = x_1 w_1 + x_2 w_2 = 1(1) + 0(1) = 1$

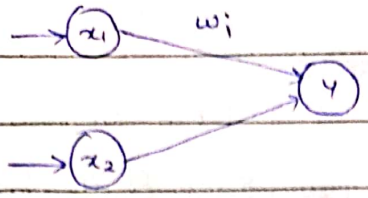
(0,1) $y_{in} = 0(1) + 1(1) = 1$, (0,0) in $y_{in} = 0(1) + 0(1) = 0$

For AND, O/P is high if both I/Ps are high. ∴ Net I/P calculate is 2

∴ Threshold = 2 ∴ $y = f(y_{in}) = \begin{cases} 1, & y_{in} \geq 2 \\ 0, & y_{in} < 2 \end{cases}$

3) Implement AND function using McCulloch - pitts neuron.

Ans:



x_1	x_2	y
1	1	1
1	0	0
0	1	0
0	0	0

$y_{in} = \Sigma x_i w_i$

$= x_1 w_1 + x_2 w_2$

$y_{in} = 1+1 = 2$

$y_{in} = 1+0 = 1$

$y_{in} = 0+1 = 1$

$y_{in} = 0+0 = 0$

$\theta = nw - p$

$= 2(1) - 0$ $\quad p = 0, w = 1, n = 2$

$= 2$

$\therefore y = f(y_{in}) = \begin{cases} 1, & \text{if } y_{in} \geq 2 \\ 0, & \text{if } y_{in} < 2 \end{cases}$