Name: Mayur Pimpude
Roll no : 43
class : D11AD
Subject : ML

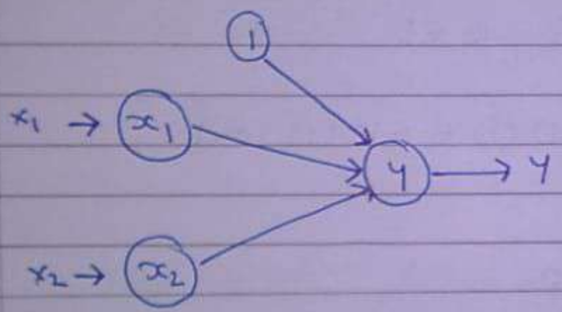
Assignement - 2

1. Implement AND function using perceptron network for bipolar input & targets

→

$w_1 = w_2 = 0$; $b = 0$; $\theta = 0$
$\alpha = 1$

x_1	x_2	t
1	1	1
1	-1	-1
-1	1	-1
-1	-1	-1



$$y_{in} = b + x_1 w_1 + x_2 w_2$$
$$= 0 + 1 \times 0 + 1 \times 0 = 0$$

$$y = f(y_{in}) \begin{cases} 1 & y_{in} > 0 \\ 0 & y_{in} = 0 \\ -1 & y_{in} < 0 \end{cases}$$

$t = y$
$t = 1$ & $y = 0$ $\quad t \neq y$

$w_i(\text{new}) = w_i(\text{old}) + \alpha t x_i$

$i = 1, 2$

$w_1(\text{new}) = w_1(\text{old}) + \alpha t x_1$
$= 0 + 1 \times 1 \times 1 = 1$

$w_2(\text{new}) = w_2(\text{old}) + \alpha t x_2$
$= 0 + (1)(1)(1) = 1$

$b(\text{new}) = b(\text{old}) + \alpha t$
$= 0 + (1)(1) = 1$

$w_1 = 1,\ w_2 = 1,\ b = 1$

$y_{in} = 1 + (1)(1) + (-1)(1) = 1$

$y_{in} = 1 > 0$

$t = y$
$t = -1 \quad \& \quad y = 1 \quad t \neq y$

$w_1(\text{new}) = w_1(\text{old}) + \alpha t x_1$
$= 1 + (1)(-1)(1) = 0$

$w_2(\text{new}) = w_2(\text{old}) + \alpha t x_2$
$= 1 + (1)(-1) = 0$

$w_1 = 0 \quad w_2 = 2 \quad b = 0$

$x_1 = -1, x_2 = 1, t = -1$

$w_1 = 0, w_2 = 2, b = 0$

$y_{in} = 0 + (-1)(0) + 1(2) = 2$

$y_{in} = 2 > 0$

since $t = -1, y \neq t$

$= w_1(old) + \alpha t x_1$

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

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

$b(new) = b(old) + \alpha t$

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

new weights are $w_1 = 1, w_2 = 1, b = -1$

$x_1 = -1, x_2 = -1, t = -1$ & $w_1 = 1, w_2 = 1, b = -1$

$y_{in} = -1 + (-1)(1) + (-1)(1) = -3$

$-3 < 0$

$t = -1$ & $y = -1 \quad t = y$ //

$w_1 = 1, w_2 = 1, b = -1$

VIVEKANAND EDU...

DATE:

Q.2 Solution:-

The equation of the above problem is given as.

$$y = \begin{cases} 1 & \text{if } y_{in} > 0 \\ 0 & \text{if } y_{in} = 0 \\ -1 & \text{if } y_{in} < 0 \end{cases}$$

Truth table

x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	b	target
1	1	1	-1	1	-1	1	1	1	1	+1
1	1	1	1	1	1	1	-1	-1	1	-1

Initially weights are assigned to zero

$w_1 = w_2 = w_3 = w_4 = w_5 = w_6 = w_7 = w_8 = w_9 = 0$

and $b = 0$

assume $\alpha = 1$ and $\theta = 0$

$$y_{in} = b + x_1 w_1 + x_2 w_2 + x_3 w_3 + x_4 w_4 + x_5 w_5 + x_6 w_6 + x_7 w_7 + x_8 w_8 + x_9 w_9.$$

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

$y = 0$ but $t = 1$ $y \neq t$

weight updation.

DATE:

weight will be updated

$$w_{new} = w_{old} + \alpha t x_n$$
$$b_{new} = b_{old} + \alpha t.$$

$w_1 new = w_1 old + \alpha t x_1$
$= 0 + (1)(1)(1) = 1$

$w_2 new = w_2 old + \alpha t x_2$
$= 0 + 1(1)(1).$

∴ the new updated weights will be

$w = \{1, 1, 1, -1, 1, -1, 1\ 1\ 1\ 1\}.$ ← updated weights.

Now again
$y_{in} = b_0 + w_1 x_1 + \cdots w_9 x_9.$

$y_{in} = 2 \quad y = 1 \quad t = -1 \quad y \neq t.$

again weight updation.

$w_1 new = 1 + (1)(-1)(1) = 0$ $\quad w_2 new = 1 + (1)(-1)(1) = 0$
$w_3 new = 1 + (1)(-1)(1) = 0$ $\quad w_4 new = -1 + (1)(-1)(1) = -2$
⋮
$w_9 new = 1 + (1)(-1)(-1) = 2$
$b\ new = 1 + (1)(-1) = 0.$

∴ New updated weights are.

$[0\ 0\ 0\ -2\ 0\ -2\ 0\ 2\ 2\ 0]$

FOR EDUCATIONAL USE

DATE:

∴ based on new weights.

$y_{in} = 0 + (0)(1) + (0)(1) + 0(1) + (1)(-2) + (0)(1) + (1)(-2)$
$+ 0(-1) + 2(-1) + 2(+1) + 0(1)$
$= -4$

$y = f(-4) = -1$. $y = t$ network converget.

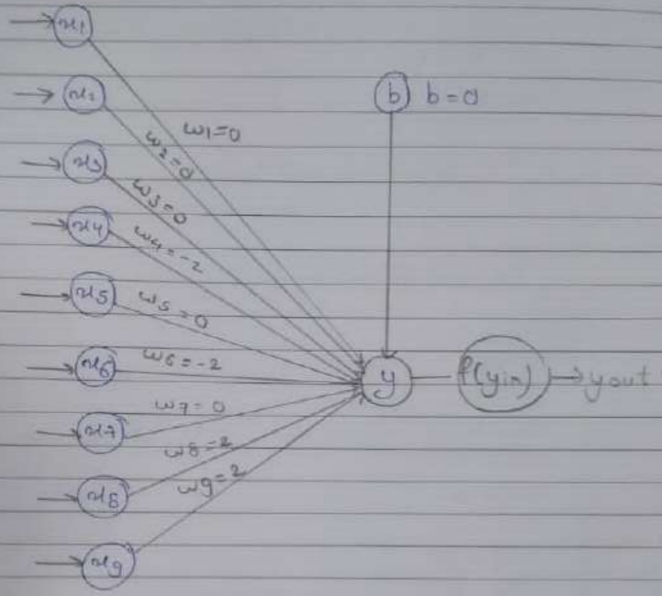
∴ the no update will done.

∴ The weights are

$w_1 = 0$
$w_2 = 0$
$w_3 = 0$
$w_4 = 0$
$w_5 = -2$
$w_6 = 0$
$w_7 = -2$
$w_8 = 0$
$w_9 = 2$
$b_0 = 0$.

$$y = \begin{cases} 1 & \text{if } y_{in} > 0 \\ 0 & y_{in} = 0 \\ -1 & y_{in} < 0 \end{cases}$$

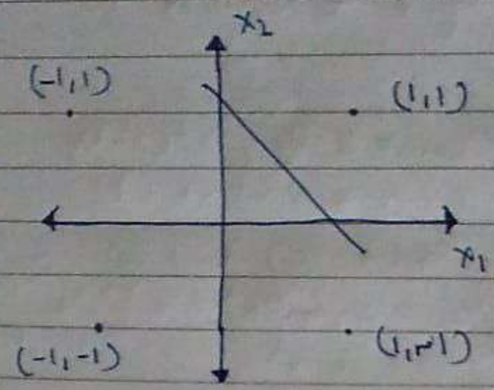
DATE:



Network architecture

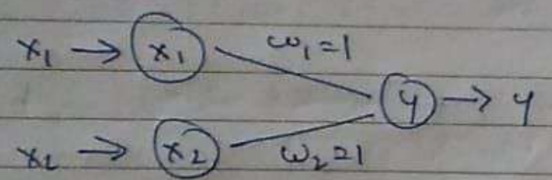
FOR EDUCATIONAL USE

$$b + x_1 w_1 + x_2 w_2 = 0$$



Q3. Implement AND fn MP - neuron.

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



(1,1) $- y_{in} = x_1 w_1 + x_2 w_2 = 1\times1 + 1\times1 = 2$

(1,0) " " $= 1\times1 + 0\times1 = 1$

(0,1) " " $= 1\times0 + 1\times1 = 1$

(0,0) " " $= 0\times1 + 0\times1 = 0$

③

$\theta \geq n\omega - p$

$n = 2$, $\omega = 1$, $p = 0$

$\theta \geq 2 \times 1 - 0$

$\theta \geq 2$

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

Q2

FOR EDUCATIONAL USE