Hebb Net Solved Numerical Example:

+	+	+
	+	
+	+	+

"I"

+	+	+
+		+
+	+	+

"O"

Using the Hebb rule, find the weights required to perform the following classifications of the given input patterns shown in above Figure.

The pattern is shown as 3x3 matrix form in the squares.

The "+" symbols represent the value "1" and empty squares indicate "-1".

So,

Pattern	b	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	Target y
I	1	1	1	1	-1	1	-1	1	1	1	1
O	1	1	1	1	1	-1	1	1	1	1	-1

Set the initial weights and bias to zero.

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

$b = 0$

→ Presenting first input pattern (I), we calculate change in weights :

$W_i(new) = W_i(old) + \Delta W_i \qquad [\Delta W_i = X_i Y]$

$\Delta W_1 = \Delta W_2 = \Delta W_3 = \Delta W_5 = \Delta W_7 = \Delta W_8 = \Delta W_9 = 1$

$\Delta W_4 = \Delta W_6 = -1$

$\Delta b = Y = 1$

$W_1(new) = W_2(new) = W_3(new) = W_5(new) = W_7(new)$
$= W_8(new) = W_9(new) = 1$

$W_4(new) = W_6(new) = -1$

$b = 1$

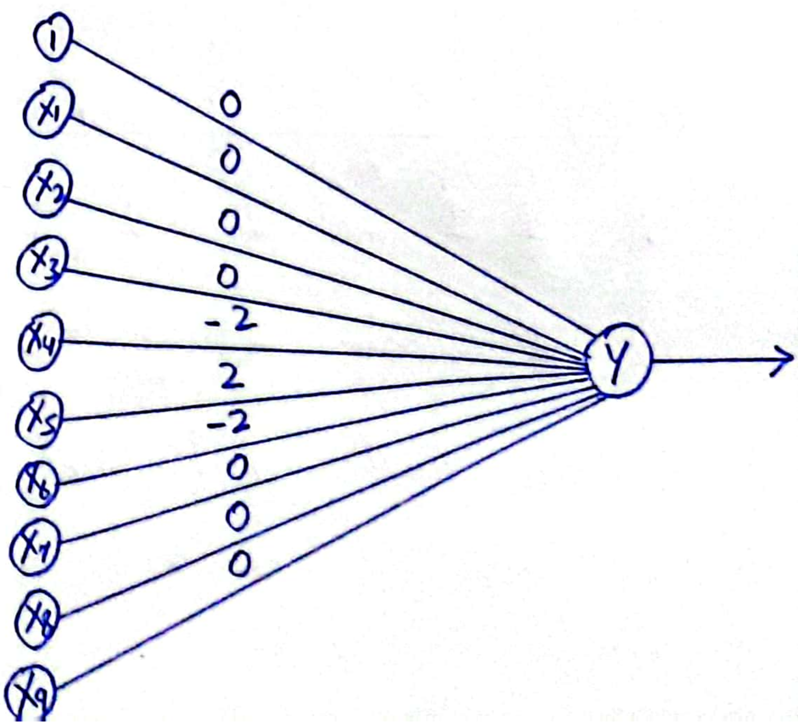
→ Present second input pattern (O), we calculate change in weights :

$W_1(new) = W_2(new) = W_3(new) = W_7(new)$
$= W_8(new) = W_9(new) = 0$

$W_5(new) = 2$

$W_4 = W_6 = -2$

$b = 0$



Perceptron Network (Rule) Solved Example:

→ Find the weights required to perform the following classification using perceptron network.

→ The vectors (1,1,1,1) and (-1,1,-1,-1) are belonging to the class 1, vectors (1,1,1,-1) and (1,-1,-1,1) are belonging to the class -1.

→ Assume learning rate as 1 and Initial weights as 0.

$$Y_{in} = b + x_1 w_1 + x_2 w_2 + x_3 w_3 + x_4 w_4$$

$$Y = f(Y_{in}) = \begin{cases} 1 & \text{if } Y_{in} > 0 \\ 0 & \text{if } Y_{in} = 0 \\ -1 & \text{if } Y_{in} < 0 \end{cases}$$

$$\Delta w_i = a t x_i$$
$$\Delta b = at$$

1

Inputs X_1	X_2	X_3	X_4	Target t	Net Input Y_{in}	Output Y	Weight Changes Δb	ΔW_1	ΔW_2	ΔW_3	ΔW_4	Weights W_1	W_2	W_3	W_4
1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
-1	1	-1	-1	1	-1	-1	1	-1	1	-1	-1	0	2	0	0
1	1	1	-1	-1	4	1	-1	-1	-1	-1	1	-1	1	-1	1
1	-1	-1	1	-1	1	1	-1	-1	1	1	-1	-2	2	0	0

b
1
2
1
0

②

Inputs				Target	Net input	Output	Weight changes					Weights				
X_1	X_2	X_3	X_4	t	Y_{in}	Y	ΔW_1	ΔW_2	ΔW_3	ΔW_4	Δb	W_1	W_2	W_3	W_4	b
1	1	1	1	1	0	0	1	1	1	1	1	-1	3	1	1	1
-1	1	-1	-1	1	3	1	0	0	0	0	0	-1	3	1	1	1
1	1	1	-1	-1	4	1	-1	-1	-1	1	-1	-2	2	0	2	0
1	-1	1	1	-1	-2	1	0	0	0	0	0	-2	2	0	2	0

③

Inputs				Target	Net input	Output	Weight Changes					Weights				
X_1	X_2	X_3	X_4	t	Y_{in}	Y	ΔW_1	ΔW_2	ΔW_3	ΔW_4	Δb	W_1	W_2	W_3	W_4	b
1	1	1	1	1	2	1	0	0	0	0	0	-2	2	0	2	0
-1	1	-1	-1	1	2	1	0	0	0	0	0	-2	2	0	2	0
1	1	1	-1	-1	-2	-1	0	0	0	0	0	-2	2	0	2	0
1	-1	-1	1	-1	-2	-1	0	0	0	0	0	-2	2	0	2	0