… difference between the predicted output and the true O/P

These Components work together to enable a perceptron to learn and make predictions while a Single perceptron can perform binary classification, more Complex tasks requires the use of multiple perceptron organized into layers forming a neural network.

Example:-

Implement AND function using perceptron N/w for bipolar i/ps and targets

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

$w_1 = w_2 = b = 0, \quad \alpha = 1$

for epoch 1 :

for 1^{st} i/p Case

$[x_1 \ x_2 \ t] = [1 \ 1 \ 1]$

$[w_1 \ w_2 \ b] = [0 \ 0 \ 0], \ \alpha = 1$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (1 \times 0) + (1 \times 0) + 0$

$y_{in} = 0$

The O/P Y is Computed by applying activation function over the net i/p Calculated

$Y = f(y_{in}) = 1$ if $y_{in} > 0$

0 if $y_{in} = 0$ $\quad \boxed{Y = 0}$

-1 if $y_{in} < 0$

Here the O/P $y = 0$, Since $y_{in} = 0$
Now target $(t) = 1$ and $y \neq t$
Hence, we need to update the weights and bias

$w_1(new) = w_1(old) + \alpha t x_1 = 0 + 1 \times 1 \times 1 = 1$
$w_2(new) = w_2(old) + \alpha t x_2 = 0 + 1 \times 1 \times 1 = 1$
$b(new) = b(old) + \alpha t = 0 + 1 \times 1 = 1$
Now we need to find the actual O/P with modified weights and repeat this procedure for all the remaining i/ps

For the second i/ps pattern

$[x_1, x_2, t] = [1, -1, -1]$
$[w_1, w_2, b] = [1, 1, 1]$ $\alpha = 1$

$y_{in} = x_1 w_1 + x_2 w_2 b$
$= (1 \times 1) + (-1 \times 1) + 1 = 1 - 1 + 1$

$y_{in} = 1$

The O/P y is computed by applying activations over the net I/P calc

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

$\boxed{y = 1}$

Now target $(t) = -1$ and $y \neq t$
Hence we need to update the weights

$w_1(new) = w_1(old) + \alpha t x_1 = 1 + (1 \times -1) \times 1 = 0$
$w_2(new) = w_2(old) + \alpha t x_2 = 1 + (1 \times (-1)) \times (-1) = 2$
$b(new) = b(old) + \alpha t = 1 + (1 \times (-1)) = 0$

For third input pattern

$[x_1, x_2 ; t] = [-1, 1, -1]$

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

$\alpha = 1$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (-1 \times 0) + (1 \times 2) + 0$

$y_{in} = 2$

applying activation function

$\boxed{y = 1}$

...d weights o

Since $y \neq t$

Hence we need to update the weight and bias

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

$w_2(new) = w_2(old) + \alpha t x_2 = 2 + (1 \times -1 \times 1) = 1$

$b(new) = b(old) + \alpha t = 0 + (1 \times -1) = -1$

For 4th i/p pattern case

$[x_1, x_2 ; t] = [-1, -1, -1]$

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

net i/p

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (-1 \times 1) + (-1 \times 1) + (-1)$

$= -1 - 1 - 1$

$y_{in} = 3$

applying activation function

$\boxed{y = -1}$

Here $\boxed{y = t}$

don't need to update the weight and bias

for epoch 2 :-

first i/p case

$[x_1, x_2, t] = [1, 1, 1]$

$[w_1, w_2, b] = [1, 1, -1]$ $\alpha = 1$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (1 \times 1) \times (-1 \times 1) + (-1)$

$= 1 - 1 - 1$

$y_{in} = -1$

applying activation function

$y = t$

don't need to update the weight and bias

for 3rd input case

$[x_1 x_2 \ t] = [-1, 1, -1]$

$[w_1 \ w_2 \ b] = [1 \ 1 \ -1] \quad \alpha = 1$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (-1 \times 1) + (1 \times 1) + (-1)$

$= -1 + 1 - 1$

$= -1$

applying activation function

$\boxed{y = -1}$

$y = t$

Don't need to update the weight and bias

for 4th i/p case

$[x_1 \ x_2 \ t] = [-1 \ -1 \ -1]$

$[w_1 \ w_2 \ b] = [1 \ 1 \ -1]$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (-1 \times 1) + (-1 \times 1) + (-1)$

$= -1 - 1 - 1$

$y_{in} = -3$

applying activation function

$y = -1 \quad y = t$

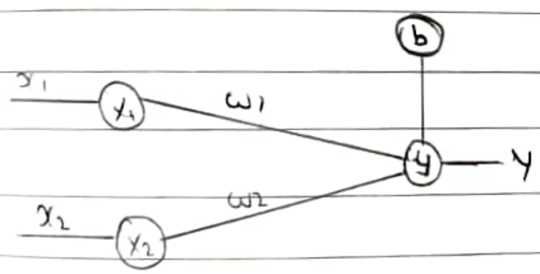
don't need to update the weight and bias epoch table 1

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

epoch table 2

x_1	x_2	y	w_1	w_2	b
1	1	1	1	1	-1
1	-1	-1	1	1	-1
-1	1	-1	1	1	-1
-1	-1	-1	1	1	-1

2) Implement OR function using perceptron network for binary i/ps and bipolar targets



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

The initial weights and threshold are set to zero

i.e $w_1 = w_2 = b = 0$, $\theta = 0$ and $\alpha = 1$

For 1^{st} i/p case

$[x_1 \; x_2 \; t] = [1 \; 1 \; 1]$

$[w_1 \; w_2 \; b] = [0 \; 0 \; 0]$, $\theta = 0$, $\alpha = 1$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (1 \times 0) + (1 \times 0) + 0$

$y_{in} = 0$

$y = f(y_{in}) = 1 \; ; \; y_{in} > 0$

$0 \; ; \; y_{in} = 0$

$-1 \; ; \; y_{in} < 0$

$\therefore y = 0$

Then $y \neq t$

Hence we need to Update the weight and bias

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

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

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

For 2nd i/p case

$[x_1 \; x_2 \; t] = [1 \; -1 \; 1]$

$[w_1 \; w_2 \; b] = [1 \; 1 \; 1]$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= 1 + (1 \times 1) + 1 = 1$

$y_{in} = 1$

Applying activation function

$y = 1$

$\therefore y = t$

Hence we ~~need~~ will not Update the weights and bias

$w_1(new) = w_1(old) = 1$

$w_2(new) = w_2(old) = 1$

$b(new) = b(old) = 1$

For 3rd input case

$[x_1 \; x_2 \; t] = [-1 \; 1 \; 1]$

$[w_1 \; w_2 \; b] = [1 \; 1 \; 1]$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (0 \times 1) + (1 \times 1) + 1$

$y_{in} = 2$

Applying activation function

$y = 1 \quad \therefore y = t$

don't ~~we~~ need to update weights and bias

$w_1(new) = w_1(old) = 1$

$w_2(new) = w_2(old) = 1$

$b(new) = b(old) = 1$

for 4^{th} i/p case

$[x_1\ x_2\ t] = [-1\ -1\ -1]$

$[w_1\ w_2\ b] = [1\ 1\ 1]$

$y_{in} = x_1w_1 + x_2w_2 + b$

$= (-1\times1) + (-1\times1) + 1$

$= -1 - 1 + 1$

$y_{in} = -1$

applying activation function

$y = -1$

$y = t$

don't need to update weights and bias

epoch table 1

x_1	x_2	y	w_1	w_2	b
1	1	0	1	1	1
1	-1	1	1	1	1
-1	1	1	1	1	1
-1	-1	-1	1	1	1

for epoch table 2

for 1^{st} i/p case

$[x_1\ x_2\ t] = [1\ 1\ 1]$

$[w_1\ w_2\ b] = [1\ 1\ 1]$

$y_{in} = x_1w_1 + x_2w_2 + b$

$= (1\times1) + (1\times1) + (1)$ $y_{in} = 3$ $\boxed{y_{in} = 1}$

don't need to update weights and bias

$w_1(new) = w_1(old) = 1$

$w_2(new) = w_2(old) = 1$

$b(new) = b(old) = 1$

for 2nd i/p case

$[x_1 \; x_2 \; t] = [1, -1, 1]$

$[w_1 \; w_2 \; b] = [1 \; 1 \; 1]$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (1 \times 1) + (-1 \times 1) + 1$

$= 1 - 1 + 1$

$y_{in} = 1$

applying activation function

$y = 1$

$y = t$

don't need to update weight and bias

$w_1(new) = w_1(old) = 1$

$w_2(new) = w_2(old) = 1$

$b(new) = b(old) = 1$

for 3rd i/p case

$[x_1 \; x_2 \; t] = [-1 \; 1 \; 1]$

$[w_1 \; w_2 \; b] = [1 \; 1 \; 1]$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (-1 \times 1) + (1 \times 1) + 1$

$= -1 + 1 + 1$

$y_{in} = 1$

applying activation function

$y = 1$

$y = t$

don't need to update weight and bias

$w_1(new) = w_1(old) = 1$

$w_2(new) = w_2(old) = 1$

$b(new) = b(old) = 1$

For 4th i/p Case

$[x_1 \ x_2 \ t] = [-1 \ -1 \ -1]$

$[w_1 \ w_2 \ b] = [1 \ 1 \ 1]$

$y_{in} = x_1 w_1 + x_2 w_2 + b$

$= (-1 \times 1) + (-1 \times 1) + (-1)$

$= -1 - 1 + 1$

$y_{in} = -1$

applying activation function

$y = -1$

$\therefore y = t$

epoch table: 2

x_1	x_2	y	w_1	w_2	b
1	1	1	1	1	1
1	-1	1	1	1	1
-1	1	1	1	1	1
-1	-1	-1	1	1	1

Conclusion :- Here we have Studied to implement perceptron network for AND and OR Logic.

GB