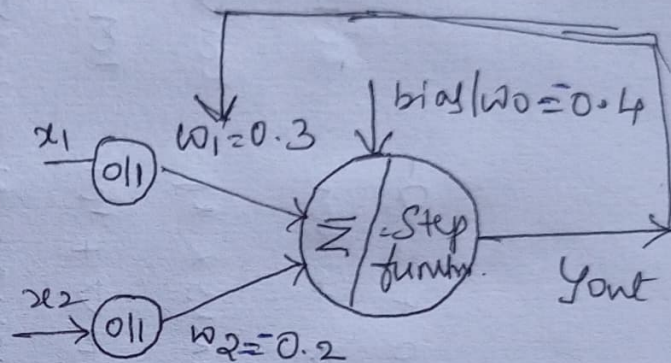


Boolean AND function.

$w_1 = 0.3$   $w_2 = -0.2$  learning rate = 0.2, bias/ $w_0 = 0.4$

Truth table.

$x_1$	$x_2$	$Y_{des}$
0	0	0
0	1	0
1	0	0
1	1	0



$$Y_{est} = w_1 x_1 + w_2 x_2 + w_0$$

Epoch	$x_1$	$x_2$	$y_{des}$	$y_{est}$	Error	$w_1$	$w_2$	Page 2 Status
1	0	0	0	$Step(0 \times 0.3 + 0 \times (-0.2) - 0.4)$ $= 0$	0	0.3	-0.2	No change
	0	1	0	$Step(0 \times 0.3 + 1 \times (-0.2) - 0.4)$	0	0.3	-0.2	No change
	0	0	0	$Step(0 \times 0.3 + 0 \times -0.2 - 0.4)$ $= 0$	0	0.3	-0.2	No change
	1	1	1	$Step(1 \times 0.3 + 1 \times (-0.2) - 0.4)$ $Step(-0.3) = 0$	1	<u>0.5</u>	<u>0</u>	change

For input (1,1) the weights are updated as follows

$$\Delta w_1 = lr \times \text{error} \times x_1 = 0.2 \times 1 \times 1 = 0.2$$

$$w_1 = w_1 + \Delta w_1 = 0.3 + 0.2 = 0.5$$

$$\Delta w_2 = lr \times \text{error} \times x_2 = 0.2 \times 1 \times 1 = 0.2$$

$$w_2 = w_2 + \Delta w_2$$

$$= -0.2 + 0.2 = 0$$



Epoch	$x_1$	$x_2$	$y_{des}$	$y_{est}$	Error	$w_1$	$w_2$	Status
2	0	0	0	$Step(0 \times 0.5 + 0 \times 0 - 0.4) = 0$	0	0.5	0	No change
	0	1	0	$Step(0 \times 0.5 + 1 \times 0 - 0.4) = 0$	0	0.5	0	No change
	1	0	0	$Step(1 \times 0.5 + 1 \times 0 - 0.4) = 1$	-1	0.3	0	change
	1	1	1	$Step(1 \times 0.3 + 1 \times 0.0 - 0.4) = 0$	1	<u>0.5</u>	<u>0.2</u>	change..

For input (1,0) update the weights

$$\Delta w_1 = lr \times Error \times x_1 = 0.2 \times -1 \times 1 = -0.2$$

$$w_1 = w_1 + \Delta w_1 = 0.5 + (-0.2) = 0.3$$

$$\Delta w_2 = lr \times Error \times x_2 = 0.2 \times -1 \times 0 = 0.0$$

$$w_2 = w_2 + \Delta w_2 = 0 + 0 = 0.$$

For input (1,1) Update the weights

$$\Delta w_1 = lr \times Error \times x_1 = 0.2 \times 1 \times 1 = 0.2$$

$$w_1 = w_1 + \Delta w_1 = 0.3 + 0.2 = \underline{0.5}$$

$$\Delta w_2 = lr \times Error \times x_2 = 0.2 \times 1 \times 1 = 0.2$$

$$w_2 = w_2 + \Delta w_2 = -0.0 + 0.2 = \underline{0.2}$$

Epoch	$x_1$	$x_2$	$y_{des}$	$y_{est}$	Error	$w_1$	$w_2$	Status
	0	0	0	Step ( $0 \times 0.5 + 0 \times 0.2 - 0.4$ ) = 0	0	0.5	0.2	No change
3	0	1	0	Step ( $0 \times 0.5 + 1 \times 0.2 - 0.4$ ) = 0	0	0.5	0.2	No change
	1	0	0	Step ( $1 \times 0.5 + 0 \times 0.2 - 0.4$ ) = 1	-1	0.3	0.2	change
	1	1	1	Step ( $1 \times 0.3 + 1 \times 0.2 - 0.4$ ) = 1	0	0.3	0.2	No change

For input (1,0) update the weights

$$\Delta w_1 = \eta \times \text{Error} \times x_1 = 0.2 \times -1 \times 1 = -0.2$$

$$w_1 = w_1 + \Delta w_1 = 0.5 - 0.2 = 0.3$$

$$\Delta w_2 = \eta \times \text{Error} \times x_2 = 0.2 \times -1 \times 0 = 0$$

$$w_2 = w_2 + \Delta w_2 = 0.2 + 0 = 0.2$$



Epoch	$x_1$	$x_2$	$y_{des}$	$Y_{est}$	Error	$w_1$	$w_2$	Status
4.	0	0	0	$step(0 \times 0.3 + 0 \times 0.2 - 0.4) = 0$	0	0.3	0.2	No change
	0	1	0	$step(0 \times 0.3 + 1 \times 0.2 - 0.4) = 0$	0	0.3	0.2	No change
	1	0	0	$step(1 \times 0.3 + 0 \times 0.2 - 0.4) = 0$	0	0.3	0.2	No change
	1	1	1	$step(1 \times 0.3 + 1 \times 0.2 - 0.4) = 1$	0	0.3	0.2	No change

Final values of  $w_1$  &  $w_2$  are Epoch = 4.

$w_1 = 0.3$   
 $w_2 = 0.2$  with  $x_1$  &  $x_2$  as input  
 $w_0 = -0.4$