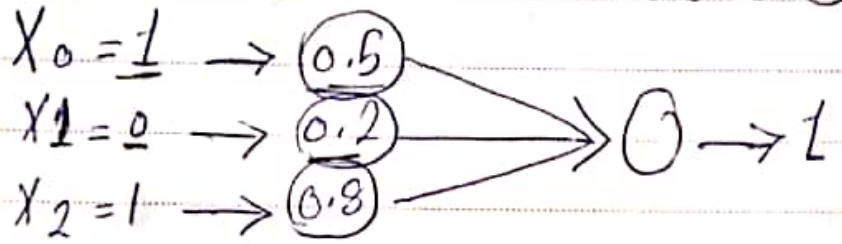
Perceptron



desired = 0
Threshold = 1.2
$\eta = 1$

#Step 0

Sol

$\Sigma = (1 * 0.5) + (0.2 * 0) + (0.8 * 1)$

$= 1.3$

$1.3 > 1.2 \rightarrow \boxed{+1} \rightarrow$

Need To Recalculate Weight

$W_{n+1} = W_n + \eta [d(n) - d(y)] X(n)$

$W_1 = W_0 + 1 [0 - 1] X(n)$

$W_1 = [0.5, 0.2, 0.8] + (-1)[1, 0, 1]$

$W_1 = [0.5, 0.2, 0.8] + [-1, 0, -1]$

$W_1 = [-0.5, 0.2, -0.2]$

Step 1

$(-0.5 * 1) + (0.2 * 0) + (-0.2 * 1)$

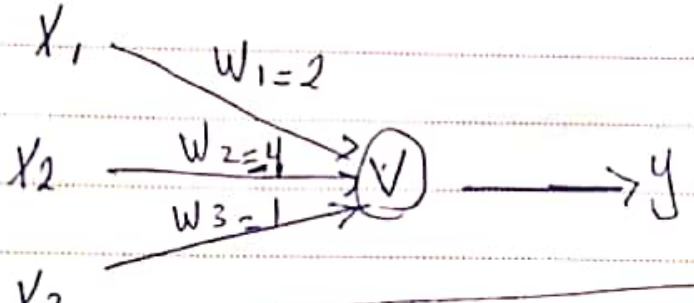
$= -0.7$

$1.2 > -0.7 \rightarrow 0$

No

W_2

$$\begin{cases} 1 & \text{if } V \geq 0 \\ 0 & \text{otherwise} \end{cases}$$



$W_1 = 2$
$W_2 = -4$
$W_3 = 1$

Pattern	P_1	P_2	P_3	P_4
X_1	1	0	1	1
X_2	0	1	0	1
X_3	0	1	1	1

First Pattern = $(1*2) + (-4*0) + (1*0)$
$= 2 \rightarrow 1$

Second Patten = $-3 \rightarrow 0$

Third Patten = $3 \rightarrow 1$

Forth Pattern = $-1 \rightarrow 0$ //

(2)

Second Weight update $\begin{bmatrix} 0.2 & 0.6 & 0.5 & 0.9 \\ 0.92 & 0.76 & 0.28 & 0.12 \end{bmatrix}$

$$d^2_{(1)} = (0.2-0)^2 + (0.6-0)^2 + (0.5-0)^2 + (0.9-1)^2$$

$$= 0.66 \Leftarrow \text{winner}$$

$$d^2_{(2)} = (0.92-0)^2 + (0.76-0)^2 + (0.28-0)^2 + (0.12-1)^2$$

$$= 2.28$$

update weight

$$W_{(new)} = W_{old} + h[x - W_{old}]$$

$$W_{(new)} = [0.2 \quad 0.6 \quad 0.5 \quad 0.9] + 0.6\,[0 \quad 0 \quad 0 \quad 1] - [0.2 \quad 0.6 \quad 0.5 \quad 0.9]$$

$$= [0.08 \quad 0.24 \quad 0.20 \quad 0.96]$$

$$\begin{bmatrix} 0.08 & 0.24 & 0.20 & 0.96 \\ 0.92 & 0.76 & 0.28 & 0.12 \end{bmatrix}$$

- out6 ياخذ ناتج الرقم وواحد من الرقم (2) من واحد واضربه مرة كمان بالناتج finish

- والخمسة باخذ ناتج واحد من الرقم هنا واضربه في finsh6
- الاربعة بناخذ ناتج واحد من الرقم واضربه في finsh 6 وضربها بالرقم اللي عليه

Step 2 Calculate Error of Each Node →

out 6 → $0.475(1-0.475)(1-0.475) = 0.1311$

Hidden 5 → $0.525(1-0.525)(0.1311)(-0.2) = -0.0065$ (W_{56})

Hidden 4 → $0.332(1-0.332)(0.1311)(-0.3)$ (W_{46})
$= -0.0087$

Step 3 update weight

$W_{46} = -0.3 + 0.9(0.1311 * 0.332) = -0.261$

$W_{56} = -0.2 + 0.9(0.525 * 0.1311) = -0.138$

$W_{14} = 0.2 + 0.9(1 * -0.0087) = 0.192$

$W_{15} = -0.3 + 0.9(1 * 0.0065) = -0.306$

(3)

Third weight update $\begin{bmatrix} 0.08 & 0.24 & 0.20 & 0.96 \\ 0.92 & 0.76 & 0.28 & 0.12 \end{bmatrix}$

$$d_{(1)}^2 = (0.08-1)^2 + (0.24-0)^2 + (0.20-0)^2 + (0.96-0)^2$$

$$= 1.87$$

$$d_{(2)}^2 = (0.92-1)^2 + (0.76-0)^2 + (0.28-0)^2 + (0.12-0)^2$$

$$= 0.68 \Leftarrow \text{winner}$$

update weight

$$W_{(new)} = W_{old} + \eta [x_{new} - W_{old}]$$

$$= [0.92 \quad 0.76 \quad 0.28 \quad 0.12] + 0.6 [1 \quad 0 \quad 0 \quad 0] - [0.92 \quad 0.76 \quad 0.28 \quad 0.12]$$

$$= [0.97 \quad 0.30 \quad 0.11 \quad 0.05]$$

$$\begin{bmatrix} 0.08 & 0.24 & 0.20 & 0.96 \\ 0.97 & 0.30 & 0.11 & 0.05 \end{bmatrix}$$

#SOM

* $\eta(t) = 0.6$; $1 <= t <= 4$ ⇐

* Initial Weight Matrix (Value between 0 , 1)

$$\begin{matrix} \text{unit 1} \\ \text{unit 2} \end{matrix} \begin{bmatrix} 0.2 & 0.6 & 0.5 & 0.9 \\ 0.8 & 0.4 & 0.7 & 0.3 \end{bmatrix}$$

* i1 : (1 , 1 , 0 , 0)
  i2 : (0 , 0 , 0 , 1)
  i3 : (1 , 0 , 0 , 0)
  i4 : (0 , 0 , 1 , 1)

first weight update

Step 1 ⇒ $d^2 = \sum (W_{ij} - X_i)^2$

$d^2_{(1)} = (0.2-1)^2 + (0.6-1)^2 + (0.5-0)^2 + (0.9-0)^2 = \boxed{1.86}$

$d^2_{(2)} = (0.8-1)^2 + (0.4-1)^2 + (0.7-0)^2 + (0.3-0)^2 = \boxed{0.98}$ ⇑

Unit 2 ⇒ Winner

يعني ال update هيتغير unit 2

update Weight

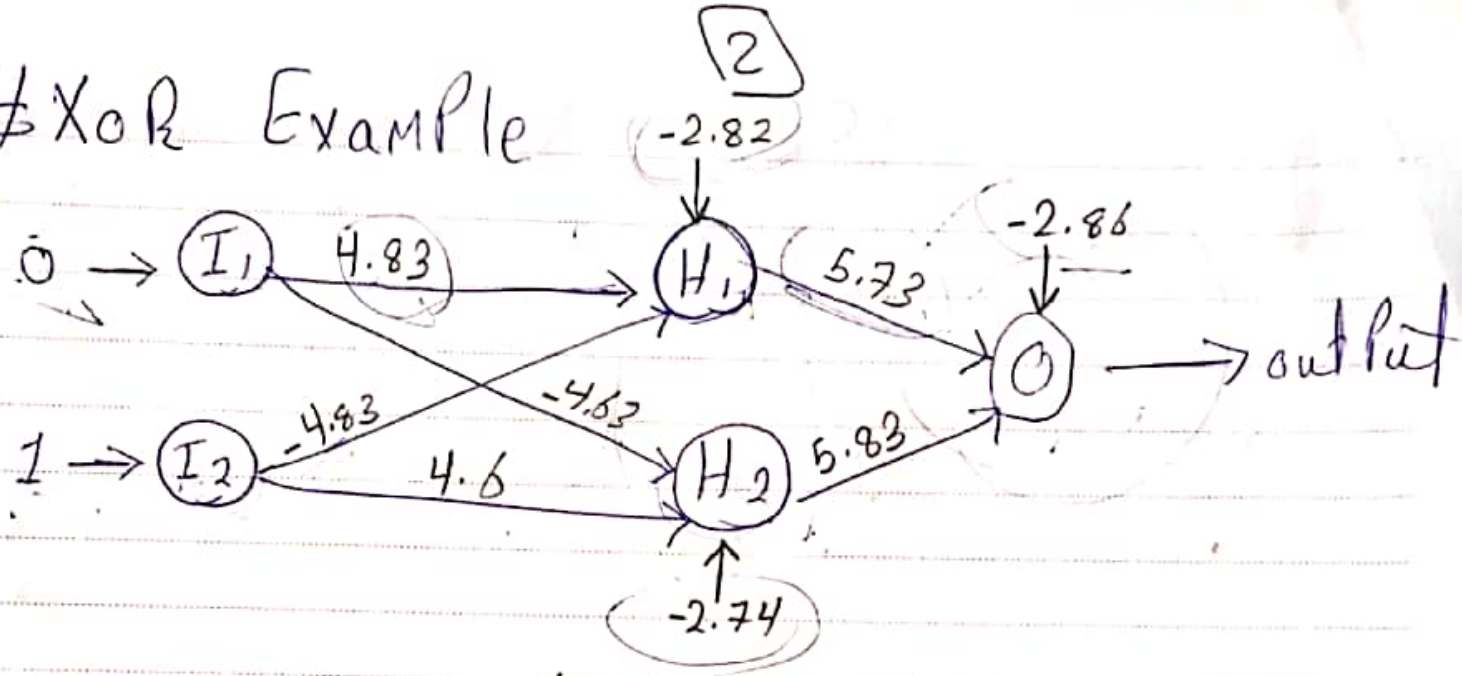
$W_{new} = W_{old} + \eta [X - W_{(old)}]$

$= [0.8 \quad 0.4 \quad 0.7 \quad 0.3] + 0.6 \left[[1 \quad 1 \quad 0 \quad 0] - [0.8 \quad 0.4 \quad 0.7 \quad 0.3] \right]$

$= [0.92 \quad 0.76 \quad 0.28 \quad 0.12]$

$$\begin{matrix} \text{unit 1} \\ \text{Unit 2} \end{matrix} \begin{bmatrix} 0.2 & 0.6 & 0.5 & 0.9 \\ 0.92 & 0.76 & 0.28 & 0.12 \end{bmatrix}$$

XOR Example



$H_1 = (0 * 4.83) + (1 * -4.83) - 2.82 = -7.65$

$\text{output} = 1/1+e^{7.65} = 4.758 \times 10^{-4}$

$\frac{1}{1+e^{-}}$

$H_2 = (0 * -4.63) + (1 * 4.6) - 2.74 = 1.86$

$\text{output} = 1/1+e^{-1.86} = 0.8652$

$O = (4.758 \times 10^{-4} * 5.73) + (0.8652 * 5.83) - 2.86$

$= 2.187$

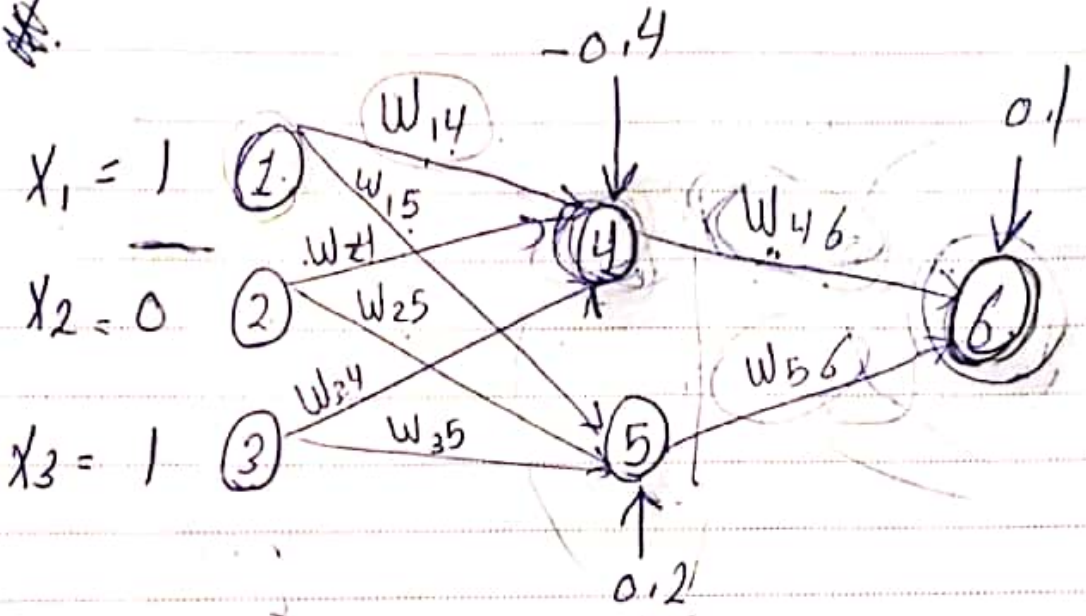
$\text{output} = 1/1+e^{-2.187} = 0.8991 = \text{"1"}$

#

Downsterolin

#BackProb.

*



$W_{14} = 0.2$
$W_{15} = -0.3$
$W_{24} = 0.4$
$W_{25} = 0.1$
$W_{34} = -0.5$
$W_{35} = 0.2$
$W_{46} = -0.3$
$W_{56} = -0.2$

Step 1

*out 4 → $(W_{14} * X_1) + (W_{24} * X_2) + (W_{34} * X_3) + (-0.4)$

$= -0.7 = \frac{1}{1+e^{0.7}} = 0.332$

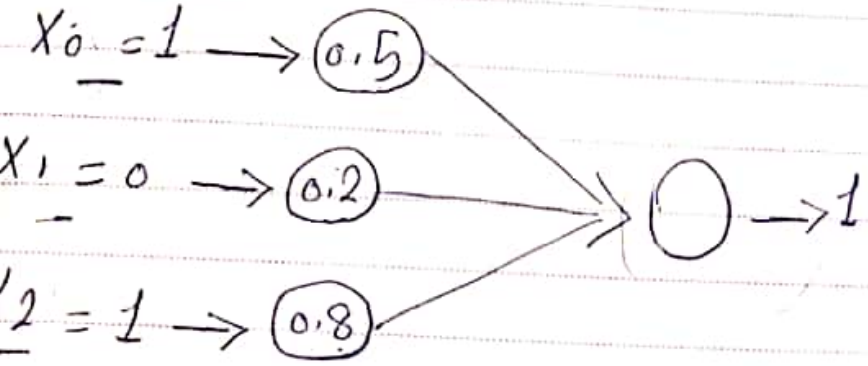
*out 5 → Same Way = 0.525

*out 6 = $(0.332 * W_{46}) + (0.525 * W_{56}) + 0.1$

$= -0.475$

Perceptron

step 0



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Threshold = 1.2
$\eta = 1$

$\Sigma = (1 * 0.5) + (0.2 * 0) + (0.8 * 1)$
$= 1.3$

$1.3 > 1.2 = +1$

Need To Recalculate Weight

$W_{(n+1)} = W_{(n)} + \eta [d(n) - d(y)] X(n)$

$W_1 = W_0 + 1 [0 - 1] [1, 0, 1]$

$W_1 = [0.5, 0.2, 0.8] + [-1, 0, -1]$

$= [-0.5, 0.2, -0.2]$ #