Name :

Date : 200

Examination : Branch/Semester

Subject : Hebbian

Junior Supervisor's full Signature with Date
10/6

Question No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Marks Obtained													

Hebbian Learning Rule (Unsupervised learn

Q $X_1 = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$, $X_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, $X_3 = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$

$X_4 = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$

$w_1 = [1 \quad -1]^t$, $c = 1$

& learning constant

Bipolar binary

$$net_i = w_i^t X$$

$$O_i = f(net_i) = sign(net_i)$$

$$\Delta w_i = c\, O_i\, x$$

Step 1 : set $X = X_1$

$$X = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$$

$$net_1 = w_1^t X = [1 \quad -1] \begin{bmatrix} 1 \\ -2 \end{bmatrix} = 3$$

$$O_1 = \text{sign}(net_1) = \boxed{1}$$

$$\Delta W_1 = c\, O_1\, X$$

$$= (1)(1)\begin{bmatrix} 1 \\ -2 \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$$

$$W_2 = W_1 + \Delta W_1 = \begin{bmatrix} 1 \\ -1 \end{bmatrix} + \begin{bmatrix} 1 \\ -2 \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \end{bmatrix}$$

Step 2: Set $X = X_2$

$$X = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$net_2 = W_2^t X$$

$$= \begin{bmatrix} 2 & -3 \end{bmatrix}\begin{bmatrix} 0 \\ 1 \end{bmatrix} = -3$$

$$O_2 = \text{sign}(-3) = \boxed{-1}$$

$$\Delta W_2 = c\, O_2\, X$$

$$= (1)(-1)\begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

$$W_3 = W_2 + \Delta W_2 = \begin{bmatrix} 2 \\ -3 \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

$$W_3 = \begin{bmatrix} 2 \\ -4 \end{bmatrix}$$

Step 3: Set $x = x_3$

$$x = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$$

$$net_3 = w_3^t x$$

$$= \begin{bmatrix} 2 & -4 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix} = -8$$

$$o_3 = sign(-8) = -1$$

$$\Delta w_3 = c o_3 x$$

$$= (1)(-1) \begin{bmatrix} 2 \\ 3 \end{bmatrix} = \begin{bmatrix} -2 \\ -3 \end{bmatrix}$$

$$w_4 = w_3 + \Delta w_3$$

$$= \begin{bmatrix} 2 \\ -4 \end{bmatrix} + \begin{bmatrix} -2 \\ -3 \end{bmatrix} = \begin{bmatrix} 0 \\ -7 \end{bmatrix}$$

Step 4: Set $x = x_4$

$$x = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

$$net_4 = w_4^t x$$

$$= \begin{bmatrix} 0 & -7 \end{bmatrix} \begin{bmatrix} 0 \\ -1 \end{bmatrix} = 7$$

$$o_4 = sign(7) = 1$$

$$\Delta W_4 = c O_4 X$$

$$= (1)(1)\begin{bmatrix} 0 \\ -1 \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

$$W_5 = W_4 + \Delta W_4$$

$$= \begin{bmatrix} 0 \\ -7 \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ -8 \end{bmatrix}$$

Use bipolar continuous

$$net_i = w_i^t X$$

$$O_i = f(net_i) = \frac{2}{1 + e^{-\lambda net}} - 1$$

$$\boxed{\lambda = 1}$$

$$\Delta w_i = c O_i X$$

$$net_1 = 3$$

$$O_1 = 0.9053$$

$$\Delta W_1 = \begin{bmatrix} 0.905 \\ -1.810 \end{bmatrix}$$

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$$W_2 = W_1 + \Delta W_1 = \begin{bmatrix} 1.905 \\ -2.81 \end{bmatrix}$$

Set $X = X_2$ $\quad X = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$

$net_2 = -2.81$

$$O_2 = f(net_2) = \frac{2}{1 + e^{2.81}} - 1$$

$$= -0.886$$

$$\Delta W_2 = \begin{bmatrix} 0 \\ -0.886 \end{bmatrix}$$

$$W_3 = W_2 + \Delta W_2$$

$$= \begin{bmatrix} 1.905 \\ -3.696 \end{bmatrix}$$

Set $X = X_3 = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$

$net_3 = -7.278$

$O_3 = -0.9986$

$\Delta W_3 = c O_3 X$

$$w_4 = w_3 + \Delta w_3$$

$$w_4 = \begin{bmatrix} -0.092 \\ -6.691 \end{bmatrix}$$

Set $X = X_4 = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$

$$net_4 = 6.691$$

$$O_4 = 0.9975$$

$$\Delta w_4 =$$

$$w_5 = w_4 + \Delta w_4$$