

Question: Design an Auto - Associator to store the pattern $\begin{bmatrix} 1 \\ 1 \\ 1 \\ -1 \end{bmatrix}$, the synaptic weight \bar{w} is given as

$$\bar{w} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ -1 \end{bmatrix} \times [1 \quad 1 \quad 1 \quad -1] = \begin{bmatrix} 1 & 1 & 1 & -1 \\ 1 & 1 & 1 & -1 \\ 1 & 1 & 1 & -1 \\ -1 & -1 & -1 & 1 \end{bmatrix}$$

Solution :

a . We first test the network with $\begin{bmatrix} 1 \\ 1 \\ 1 \\ -1 \end{bmatrix}$ to check whether we obtain $[1 \quad 1 \quad 1 \quad -1]$

- We know that $\bar{w} = \sum_{i=1}^n x_i \times y_i^T$
- Therefore we test for the above pattern as follows:

$$\rightarrow \text{Test } [1 \quad 1 \quad 1 \quad -1] , \quad \begin{bmatrix} 1 \\ 1 \\ 1 \\ -1 \end{bmatrix} \times \begin{bmatrix} 1 & 1 & 1 & -1 \\ 1 & 1 & 1 & -1 \\ 1 & 1 & 1 & -1 \\ -1 & -1 & -1 & 1 \end{bmatrix} = [4 \quad 4 \quad 4 \quad -4]$$

\rightarrow Dividing the entire row matrix by 4 we get the answer as $[1 \quad 1 \quad 1 \quad -1]$

- Hence, the network remembers the pattern.

b . We now test the network with $\begin{bmatrix} -1 \\ 1 \\ 1 \\ -1 \end{bmatrix}$ to check whether we obtain $[1 \quad 1 \quad 1 \quad -1]$

- We know that $\bar{w} = \sum_{i=1}^n x_i \times y_i^T$
- Therefore we test for the above pattern as follows:

$$\rightarrow \text{Test } [1 \quad 1 \quad 1 \quad -1] , \quad \begin{bmatrix} -1 \\ 1 \\ 1 \\ -1 \end{bmatrix} \times \begin{bmatrix} 1 & 1 & 1 & -1 \\ 1 & 1 & 1 & -1 \\ 1 & 1 & 1 & -1 \\ -1 & -1 & -1 & 1 \end{bmatrix} = [2 \quad 2 \quad 2 \quad -2]$$

→ Dividing the entire row matrix by 2 we get the answer as $\begin{bmatrix} 1 & 1 & 1 & -1 \end{bmatrix}$

- Hence, the network remembers the pattern.