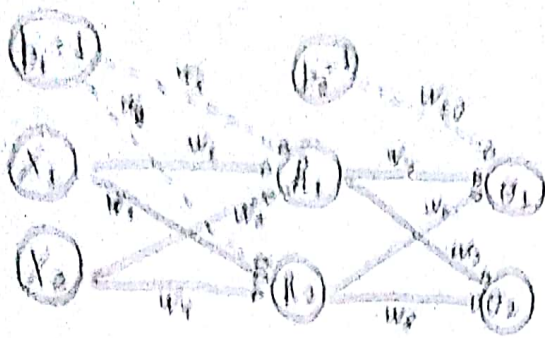


Initialization in Perceptron



$$\begin{aligned}
 w_1 &= 0.15 & w_3 &= 0.20 & w_5 &= 0.25 & w_7 &= 0.30 & w_9 &= 0.35 \\
 w_2 &= 0.40 & w_6 &= 0.75 & w_8 &= 0.30 & w_{10} &= 0.55 \\
 w_4 &= 0.35 & w_{10} &= 0.60 & \phi(z) &= \frac{1}{1 + e^{-z}} \\
 x_1 &= 0.05 & x_2 &= 0.1 & \eta &= 0.5 \\
 x_2 &= 0.10 & h_1 &= 0.39 & & & & &
 \end{aligned}$$

Feed Forward (Epoch = 1st)

$$\begin{aligned}
 h_1 &= w_1 \cdot x_1 + w_2 \cdot x_2 + w_3 \cdot b_1 \\
 h_1 &= 0.15 \cdot 0.05 + 0.20 \cdot 0.10 + 0.35 \cdot 1 \\
 h_1 &= 0.3975
 \end{aligned}$$

$$\begin{aligned}
 \text{OUT}_1 h_1 &= \phi(h_1) = 0.593269992 \\
 h_2 &= w_4 \cdot x_1 + w_5 \cdot x_2 + w_6 \cdot b_1 \\
 h_2 &= 0.25 \cdot 0.05 + 0.3 \cdot 0.1 + 1 \cdot 0.35 \\
 h_2 &= 0.3825
 \end{aligned}$$

$$\begin{aligned}
 \text{OUT}_2 h_2 &= \phi(h_2) = 0.5968844378 \\
 o_1 &= w_7 \cdot \text{OUT}_1 h_1 + w_8 \cdot \text{OUT}_2 h_2 + w_9 \cdot b_1 \\
 \text{OUT}_1 o_1 &= \phi(o_1) = 0.75536507 \\
 o_2 &= w_{10} \cdot \text{OUT}_1 h_1 + w_{11} \cdot \text{OUT}_2 h_2 + w_{12} \cdot b_1 \\
 \text{OUT}_2 o_2 &= \phi(o_2) = 0.77292846
 \end{aligned}$$

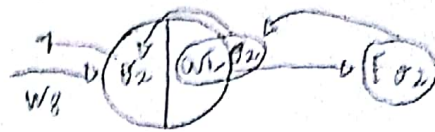
$$J(w) = \sum \frac{1}{2} (y^i - \hat{y}^i)^2$$

$$E_{o1} = \frac{1}{2} (0.1 - 0.75536507)^2 = 0.274845083$$

$$E_{o2} = \frac{1}{2} (0.99 - 0.77292846)^2 = 0.023560026$$

$$E_{\text{TOTAL}} = E_{o1} + E_{o2} = 0.298371109$$

$$\frac{\partial J(w)}{\partial w_8} = \frac{\partial E_{\text{TOTAL}}}{\partial w_8} = \frac{\partial E_{o1}}{\partial w_8} + \frac{\partial E_{o2}}{\partial w_8}$$



$$\begin{aligned}
 \frac{\partial E_{\text{TOTAL}}}{\partial w_8} &= \frac{\partial E_{o2}}{\partial w_8} = \frac{\partial \text{OUT}_2 o_2}{\partial w_8} \cdot \frac{\partial o_2}{\partial \text{OUT}_2 o_2} \\
 &= \frac{\partial}{\partial w_8} \left(w_8 \cdot \text{OUT}_1 h_1 + w_9 \cdot \text{OUT}_2 h_2 + w_{10} \cdot b_1 \right) \cdot (1 - \text{OUT}_2 o_2) \cdot (1 - \text{OUT}_2 o_2) \\
 &= (-0.21707154) \cdot (0.77292846) \cdot (0.22707154) \\
 &= -0.022740245
 \end{aligned}$$

$$w_8^+ = w_8 - \eta \Delta w_8$$

$$w_8^+ = 0.55 - 0.5 \cdot (-0.022740245)$$

$$w_8^+ = 0.561370123$$