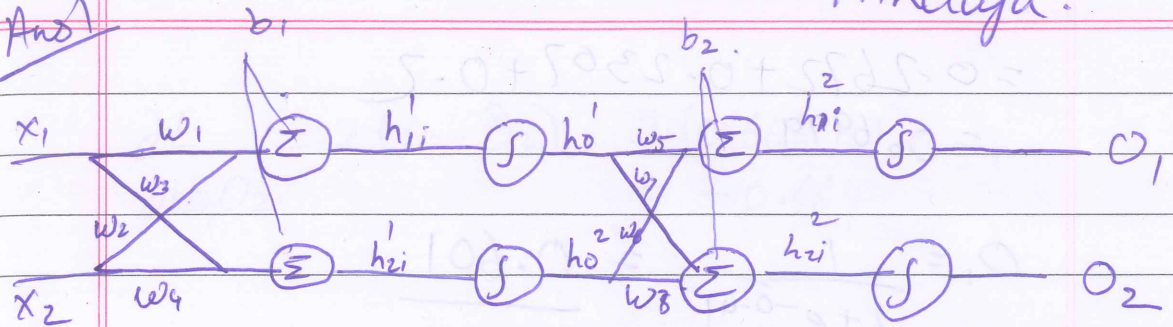


Hinduja.

Ans 1



$$h_{1i}^1 = x_1 w_1 + x_2 w_2 + b_1$$

$$= 0.2 + 0.4 + 0.1 = 0.7$$

$$h_{2i}^1 = x_2 w_4 + x_1 w_3 + b_1$$

$$= 0.8 + 0.3 + 0.1 = 1.2$$

$$h_{o1}^1 = \frac{1}{1 + e^{-h_{1i}^1}} = \frac{1}{1 + e^{-0.7}} = \frac{1}{1.497} = 0.668$$

$$h_{o2}^1 = \frac{1}{1 + e^{-h_{2i}^1}} = \frac{1}{1 + e^{-1.2}} = 0.769$$

$$h_{1i}^2 = h_{o1}^1 w_5 + h_{o2}^1 w_7 + b_2$$

$$= 0.2(0.668) + 0.1(0.769) + 0.2$$

$$= 0.1336 + 0.0769 + 0.2$$

$$= 0.41$$

$$h_{2i}^2 = h_{o1}^1 w_6 + h_{o2}^1 w_8 + b_2$$

$$= 0.4(0.668) + 0.3(0.769) + 0.2$$

$$= 0.2672 + 0.2307 + 0.2$$

$$= 0.6979$$

$$O_1 = \frac{1}{1 + e^{-0.41}} = \underline{0.601}$$

$$O_2 = \frac{1}{1 + e^{-0.6979}} = \underline{0.668}$$

Ans 2

$$L = (O_1 - \hat{O}_1)^2 + (O_2 - \hat{O}_2)^2$$

$$\frac{\partial L}{\partial w_7} = \frac{\partial L}{\partial O_1} \cdot \frac{\partial O_1}{\partial h_{1i}^2} + \frac{\partial L}{\partial O_2} \cdot \frac{\partial O_2}{\partial h_{2i}^2} \cdot \frac{\partial h_{2i}^2}{\partial w_7}$$

$$\frac{\partial h_{1i}^2}{\partial w_7} = 0 \quad \text{as } h_{1i}^2 \text{ has no component of } w_7$$

$$\frac{\partial L}{\partial w_7} = \frac{\partial L}{\partial O_2} \cdot \frac{\partial O_2}{\partial h_{2i}^2} \cdot \frac{\partial h_{2i}^2}{\partial w_7}$$

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$$\frac{\partial L}{\partial w_1} = 2(O_2 - \hat{O}_2) = 2(0.668 - 1) = -0.664$$

$$\frac{\partial O_2}{\partial h_1^2} = \frac{\partial}{\partial h_1} \left(\frac{1}{1 + e^{-h_1^2}} \right) = \frac{e^{-h_1^2}}{(1 + e^{-h_1^2})^2} = 0.498 \times (0.668)^2 = 0.222$$

$$\frac{\partial h_1^2}{\partial w_1} = h_0' = 0.668$$

$$\frac{\partial L}{\partial w_1} = (-0.664)(0.222)(0.668) = \underline{\underline{-0.098}}$$

$$\frac{\partial L}{\partial \omega_3} = \frac{\partial L}{\partial O_1} \cdot \frac{\partial O_1}{\partial h_{ii}^2} \left[\frac{\partial h_{ii}^2}{\partial h_o^2} \left[\frac{\partial h_o^2}{\partial h_{ii}'} \cdot \frac{\partial h_{ii}'}{\partial \omega_3} \right] \right]$$

$$+ \frac{\partial h_{ii}^2}{\partial h_o^2} \left[\frac{\partial h_o^2}{\partial h_{ii}'} \cdot \frac{\partial h_{ii}'}{\partial \omega_3} \right]$$

$$+ \frac{\partial L}{\partial O_2} \cdot \frac{\partial O_2}{\partial h_{ii}^2} \left[\frac{\partial h_{ii}^2}{\partial h_o^2} \left[\frac{\partial h_o^2}{\partial h_{ii}'} \cdot \frac{\partial h_{ii}'}{\partial \omega_3} \right] \right]$$

$$+ \frac{\partial h_{ii}^2}{\partial h_o^2} \left[\frac{\partial h_o^2}{\partial h_{ii}'} \cdot \frac{\partial h_{ii}'}{\partial \omega_3} \right]$$

$$\frac{\partial h_{ii}'}{\partial \omega_3} = 0 \quad \text{as } h_{ii}' \text{ has no component } \omega_3.$$

$$\frac{\partial L}{\partial \omega_3} = \frac{\partial L}{\partial O_1} \cdot \frac{\partial O_1}{\partial h_{ii}^2} \cdot \frac{\partial h_{ii}^2}{\partial h_o^2} \cdot \frac{\partial h_o^2}{\partial h_{ii}'} \cdot \frac{\partial h_{ii}'}{\partial \omega_3}$$

$$+ \frac{\partial L}{\partial O_2} \cdot \frac{\partial O_2}{\partial h_{ii}^2} \cdot \frac{\partial h_{ii}^2}{\partial h_o^2} \cdot \frac{\partial h_o^2}{\partial h_{ii}'} \cdot \frac{\partial h_{ii}'}{\partial \omega_3}$$

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$$= \frac{\partial L_o^2}{\partial h_{zi}} \frac{\partial h_{zi}}{\partial w_3} \left[\frac{\partial L}{\partial o_1} \frac{\partial o_1}{\partial h_{ii}^2} \frac{\partial h_{ii}^2}{\partial L_o^2} + \frac{\partial L}{\partial o_2} \frac{\partial o_2}{\partial h_{zi}^2} \frac{\partial h_{zi}^2}{\partial L_o^2} \right]$$

$$\frac{\partial L}{\partial o_1} = 2(o_1 - \hat{o}_1) = 2(0.601 - 0) = 1.202$$

$$\frac{\partial L}{\partial o_2} = -0.669$$

$$\frac{\partial o_1}{\partial h_{ii}^2} = \frac{e^{-h_{ii}^2}}{(1 + e^{-h_{ii}^2})^2} = 0.669 \times (0.601)^2 = 0.24$$

$$\frac{\partial o_2}{\partial h_{zi}^2} = 0.222$$

$$\frac{\partial h_{ii}^2}{\partial L_o^2} = w_6 = 0.1$$

$$\frac{\partial h_{zi}^2}{\partial L_o^2} = w_8 = 0.3$$

$$\frac{\partial h_0^2}{\partial h_i} = h_0^2 (1 - h_0^2)$$

$$= 0.178$$

$$\frac{\partial h_i}{\partial w_3} = X_i = 1$$

$$= 1 \times 0.178 \times (1.202 \times 0.24 \times 0.1 + (-0.664) \times 0.22)$$

$$= 0.178 (0.029 - 0.044)$$

$$= \underline{\underline{-0.00267}}$$

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