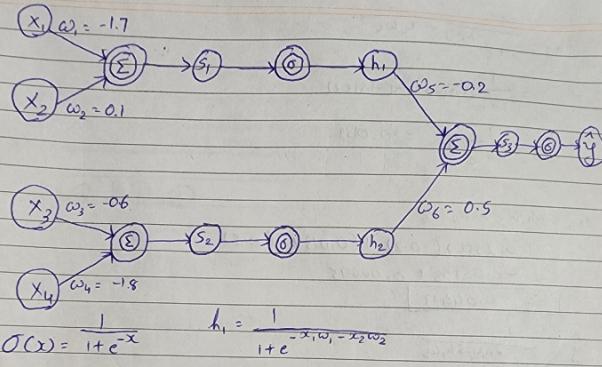


DL - Que. 1



$$\begin{bmatrix} x_1, x_2, x_3, x_4 \end{bmatrix} = \begin{bmatrix} 0.7, 1.2, 1.1, 2 \end{bmatrix}, y = 0.5 \\ L_2 = \|y - \hat{y}\|^2, \frac{\delta L}{\delta w_1} = 2\|y - \hat{y}\| \cdot \dots \end{math>$$

Computing:

$$\begin{aligned} S_1 &= x_1 w_1 + x_2 w_2 \\ &= (0.7)(-1.7) + (1.2)(0.1) \\ &= -1.19 + 0.12 \\ &= -1.07 \end{aligned}$$

$$\begin{aligned} S_2 &= x_3 w_3 + x_4 w_4 \\ &= (1.1)(-0.6) + (-1.8)(2) \\ &= -0.66 - 3.6 \\ &= -4.26 \end{aligned}$$

also,

$$h_1 = \frac{1}{1+e^{-x_1 w_1 - x_2 w_2}} = \frac{1}{1+e^{-(0.7)(-1.7)-(1.2)(0.1)}} = \frac{1}{1+e^{-1.07}} = 0.2554$$

$$\begin{aligned} h_2 &= \frac{1}{1+e^{-x_3 w_3 - x_4 w_4}} \\ &= \frac{1}{1+e^{-(1.1)(-0.6) - (-1.8)(2)}} \\ &= \frac{1}{1+e^{-4.26}} = 0.0139 \end{aligned}$$

$$\begin{aligned} S_3 &= h_1 w_5 + h_2 w_6 \\ &= (0.2554)(-0.2) + (0.0139)(0.5) \\ &= -0.05108 + 0.00695 \\ &= -0.04413 \end{aligned}$$

$$\begin{aligned} \hat{y} &= \frac{1}{1+e^{-h_1 w_5 - h_2 w_6}} \\ &= \frac{1}{1+e^{-(0.2554)(-0.2) - (0.0139)(0.5)}} \\ &= \frac{1}{1+e^{-0.04413}} = 0.4889 \end{aligned}$$

Back propagation:

$$\frac{\delta E}{\delta w_1} = \frac{\delta E}{\delta \hat{y}} \times \frac{\delta \hat{y}}{\delta S_3} \times \frac{\delta S_3}{\delta h_1} \times \frac{\delta h_1}{\delta S_1} \times \frac{\delta S_1}{\delta w_1}$$

Given,

$$\frac{\delta E}{\delta \hat{y}} = 2\|\hat{y} - y\| \quad @$$

also we know:

$$\sigma'(x) = \sigma(x)[1 - \sigma(x)] \quad \textcircled{B}$$

$$\left[\frac{\delta s_3}{\delta h_i} = w_3 \right] \quad \left[\frac{\delta s_1}{\delta w_i} = x_i \right] \quad \textcircled{C}$$

using \textcircled{A} & \textcircled{B}, \textcircled{C}

$$\frac{\delta E}{\delta w_i} = 2 \| \vec{y} - \vec{y}^* \| \times \sigma'(s_3) \times \omega_3 \times \sigma'(s_1) \times x_i^2,$$

$$= 2 [\| 1.254 - 0.5 \|] \times \sigma(s_3)(1 - \sigma(s_3)) \times (-0.2) \times \sigma(s_1)(1 - \sigma(s_1))$$

\times (0.7)

$$\sigma(s_3) = \frac{1}{1 + e^{-h_1 \omega_3 - h_2 w_3}} \\ = \frac{1}{1 + e^{-0.06413}} = 0.6881$$

$$\sigma(s_1) = \frac{1}{1 + e^{-x_1 \omega_1 - x_2 w_2}} \\ = \frac{1}{1 + e^{-0.7}} = 0.2554$$

$$= 2 \times 0.754 \times 0.2554 [1 - 0.2554] \times 0.2 \times 0.4889$$

[1 - 0.4889] \times 0.7

$$\left[\frac{\delta E}{\delta w_i} \approx 0.01 \right]$$