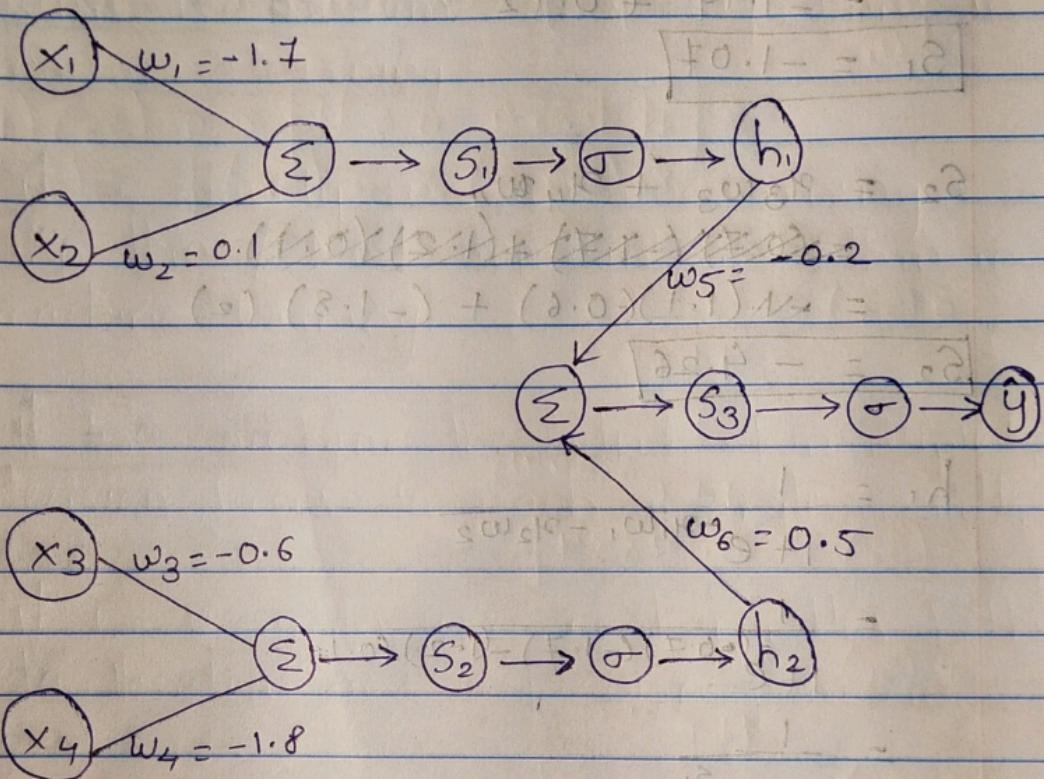


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Deep Learning - Assignment-2

Ans 1 Given:



$$\sigma(x) = \frac{1}{1 + e^{-x}}; h_1 = \frac{1}{1 + e^{-x_1 w_1 - x_2 w_2}}$$

$$[x_1, x_2, x_3, x_4] = [0.7, 1.2, 1.1, 2]; [y = 0.5]$$

$$L_2 = \|y - \hat{y}\|^2, \frac{\partial L}{\partial w_1} = 2 \|y - \hat{y}\|$$

(1)

(2)

3001

○ thermodynamic - principal part

$$\begin{aligned} S_1 &= \gamma_1 w_1 + \gamma_2 w_2 \\ &= (0.7)(-1.7) + (1.2)(0.1) \\ &= -1.19 + 0.12 \end{aligned}$$

$$\boxed{S_1 = -1.07}$$

$$\begin{aligned} S_2 &= \gamma_3 w_3 + \gamma_4 w_4 \\ &\approx (0.8)(-1.7) + (1.2)(0.1) \\ &= -1.1(1.1)(-0.6) + (-1.8)(2) \end{aligned}$$

$$\boxed{S_2 = -4.26}$$

$$h_1 = \frac{1}{1 + e^{-\gamma_1 w_1 - \gamma_2 w_2}}$$

$$= \frac{1}{1 + e^{-(0.7)(-1.7) - (1.2)(0.1)}}$$

$$= \frac{1}{1 + e^{-1.07}}$$

$$= \frac{1}{1 + e^{+1.07}}$$

~~$$h_1 = \frac{1}{1 + e^{-1.07}}$$~~

$$\boxed{h_1 = 0.2554}$$

$$h_2 = \frac{1}{1 + e^{-S_2}}$$

$$= \frac{1}{1 + e^{+4.26}}$$

$$\boxed{h_2 = 0.0139}$$

(3)

$$S_3 = h_1 w_5 + h_2 w_6 \\ = (0.2554)(-0.2) + (0.0139)(0.5) \\ = -0.05108 + 0.00695$$

$$S_3 = -0.04413$$

$$\hat{y} = \frac{1}{1 + e^{-S_3}} \\ = \frac{1}{1 + e^{0.04413}}$$

$$\hat{y} = 0.4889$$

Using Back-propagation

$$\frac{dE}{dw_1} = \frac{dE}{d\hat{y}} \times \frac{d\hat{y}}{ds_3} \times \frac{ds_3}{dh_1} \times \frac{dh_1}{ds_1} \times \frac{ds_1}{dw_1}$$

$$\frac{dE}{d\hat{y}} = 2 ||\hat{y} - y|| \quad \dots \text{(given)} \quad \text{--- (1)}$$

$$\sigma'(z) = \sigma(z) [1 - \sigma(z)] \quad \text{--- (2)}$$

$$\left[\frac{ds_3}{dh_1} = w_5 \right] ; \left[\frac{ds_1}{dw_1} = z_1 \right] \quad \text{--- (3)}$$

(4)

By using ①, ② and ③ we get,

$$\frac{dE}{dw_1} = 2 \| \hat{y} - y \| \times \sigma'(s_3) \times w_5 \times \sigma'(s_1) \times z_1,$$

$$= 2 \left[\| \hat{y} - y \| \right] \times \sigma(s_3) (1 - \sigma(s_3))$$

$$\times (-0.2) \times \sigma(s_1) [-\sigma(s_1)] \times (0.7)$$

$$\sigma(s_3) = \frac{1}{1 + e^{-s_3}}$$

$$= \frac{1}{1 + e^{-0.04413}}$$

$$\boxed{\sigma(s_3) = 0.4889}$$

$$\sigma(s_1) = \frac{1}{1 + e^{-s_1}} = \frac{1}{1 + e^{+1.07}}$$

$$\boxed{\sigma(s_1) = 0.2554}$$

$$\frac{dE}{dw_1} = [2 \times \boxed{(0.107)}] \times 0.2554 [1 - 0.2554]$$

$$\times (-0.2) \times 0.4889 [1 - 0.4889] \times 0.7$$

$$\boxed{\frac{dE}{dw_1} = -0.0014}$$