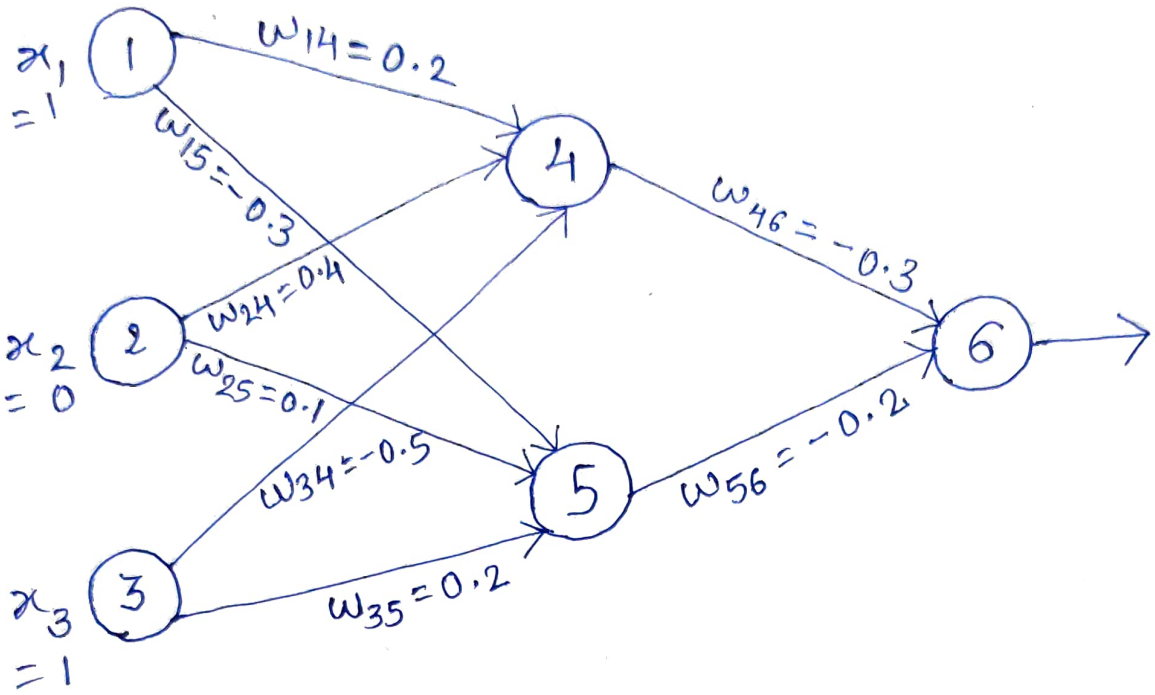


## (I) Net Input calculations

$$I_j = \sum_i w_{ij} O_i + \theta_j$$

- Net Input $I_j$
- $w_{ij}$ is the weight of the connection from unit $i$ in the previous layer to unit $j$
- $O_i$ is the output of unit $i$ from the previous layer
- $\theta_j$ is the bias of the unit

$$I_4 = x_1 \times w_{14} + x_2 \times w_{24} + x_3 \times w_{34} + \theta_4$$

$$= 1 \times 0.2 + 0 \times 0.4 + 1 \times -0.5 + (-0.4)$$

$$= 0.2 + 0 - 0.5 - 0.4$$

$$= -0.7$$

Output $O_j$

$$O_j = \frac{1}{1 + e^{-I_j}}$$

$$O_4 = \frac{1}{(1 + e^{0.7})} = 0.332$$

$$I_5 = x_1 \times w_{15} + x_2 \times w_{25} + x_3 \times w_{35} + \theta_5$$
$$= 1 \times -0.3 + 0 \times 0.1 + 1 \times 0.2 + 0.2$$
$$= -0.3 + 0 + 0.2 + 0.2$$
$$= 0.1$$

$$\text{output } O_5 = \frac{1}{(1 + e^{-0.1})} = 0.525$$

$$I_6 = \underset{w_{46}}{(-0.3)} \times \underset{O_4}{(0.332)} + \underset{w_{56}}{(0.2)} \times \underset{O_5}{(0.525)} + \underset{\theta_6}{0.1}$$
$$= -0.105$$

$$O_6 = \frac{1}{(1 + e^{0.105})} = 0.474$$

(II) Calculation of the Error at Each Node

$$Err_j = O_j (1 - O_j)(T_j - O_j)$$

$O_j$ is actual output of unit j

$T_j$ is target value of given training tuple

$$Err_6 = O_6 (1 - O_6)(T_j - O_6)$$

$$= (0.474)(1 - 0.474)(1 - 0.474)$$

$$= 0.1311$$

~~$Err_5 = (0.525)(1 - 0.525)$~~

The error of hidden layer unit j is

$$Err_j = O_j (1 - O_j) \sum_K Err_K w_{jK}$$

$$Err_5 = (0.525)(1 - 0.525)(0.1311)(-0.2)$$

$$= -0.0065$$

$$Err_4 = (0.332)(1 - 0.332)(0.1311)(-0.3)$$

$$= -0.0087$$

(III) Calculations for weight & Bias Updating

$$\Delta w_{ij} = (l) Err_j O_i$$

$$w_{ij} = w_{ij} + \Delta w_{ij}$$

$l$ is learning rate, a constant typically having a value between 0.0 and 1.0

$$w_{ij}^{46} = w_{46} + l\, Err_6\, O_4$$

$$= -0.3 + (0.9)(0.1311)(0.332)$$

$$= -0.261$$

$w_{56}$

$w_{14}$

$w_{15}$

$w_{24}$

$w_{25}$

$w_{34}$

$w_{35}$

Bias updation

$$\Delta\theta_j = (l)\, Err_j$$

$$\theta_j = \theta_j + \Delta\theta_j$$

$$\theta_6 = \theta_6 + (l)\, Err_6 = 0.1 + (0.9)(0.1311)$$
$$= 0.218$$

$\theta_5 =$

$\theta_4 =$