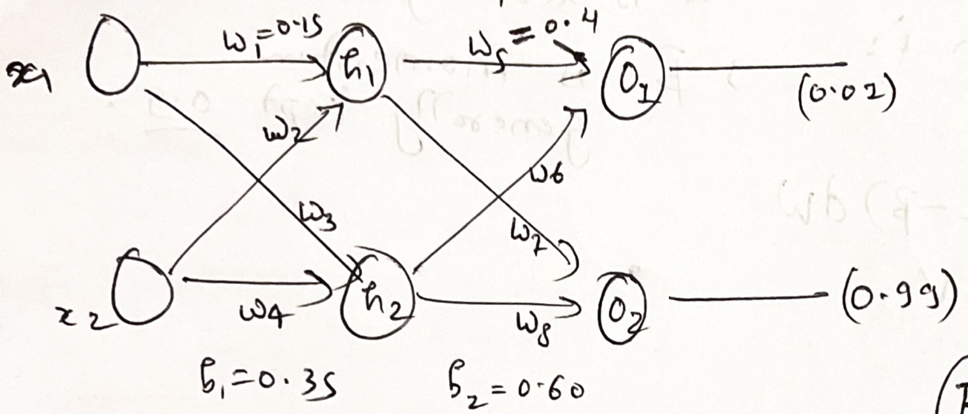
# Backpropagation | Backword propagation of error




$E_{total} = E_{O1} +$

Back propagation

(Forword propog

$$\boxed{h_1(in) = w_1 x_1 + w_2 x_2 + b_1} \quad -(1)$$

$$\boxed{O_1(in) = w_5 \times h_1(out) + w_6 \times h_2(out) + b_2} \quad -(2)$$

(net $O_1$)

where; $h_1(out) = \dfrac{1}{1+e^{-h(in)}} = 0.5932$

& $O_1(out) = \dfrac{1}{1+e^{-O_1(in)}} = \dfrac{1}{1+e^{-1.105}} = 0.7513$

(2) Similarly, $O_2(out) = 0.7729$

(3) $E_{Total} = \sum \frac{1}{2} (\text{Target} - O/P)^2$

$E_{O1} = 0.274$, $E_{O2} = 0.0235$

$\therefore \boxed{E_{total} = 0.2983}$ (or $E_{O1} + E_{O2}$)

Note:
Now, the idea is to update the weights ($w_1$ --- $w_8$) - $w_n$ to minimize $E_{total}$ which can be neglected.

⇓ (Backpropagation)

Backpropagation (for adjusting $w_5$)

$$\frac{\partial E_{total}}{\partial w_5} = \underbrace{\frac{\partial E_{total}}{\partial out_{o1}}}_{\mathrm{I}} * \underbrace{\frac{\partial out_{o1}}{\partial net_{o1}}}_{\mathrm{II}} * \underbrace{\frac{\partial net_{o1}}{\partial w_5}}_{\mathrm{III}}$$ → Chain rule

I

$$\frac{\partial E_{total}}{\partial out_{o1}} = O_{out_{o1}} - Target_{o1}$$

$$= 0.751365 - 0.01$$

$$= 0.741365$$

II

$$\frac{\partial out_{o1}}{\partial net_{o1}} = Out_{o1}(1 - Out_{o1})$$

$$= 0.751365(1 - 0.751365)$$

$$= 0.18681$$

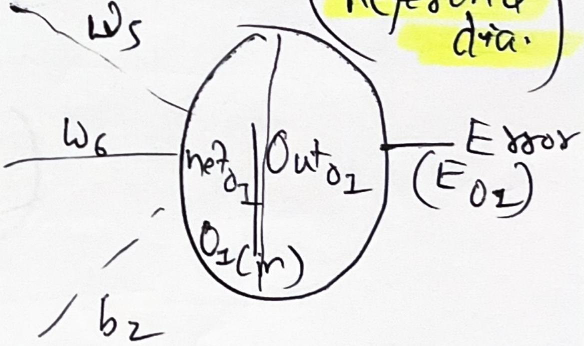
III or $O_1(in)$    or $h_1(out)$

$$\frac{\partial net_{o1}}{\partial w_5} = Out_{h1} = 0.593$$

$$\Downarrow$$

$$\frac{\partial O_1(in)}{\partial w_5} = h_1(out)$$

Reference dia.




$$w_5^* = w_5 - \alpha \frac{\partial E_{total}}{\partial w_5} = 0.4 - 0.6 * 0.0821$$

$$= 0.35069$$