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Semester-2
Section = CSE
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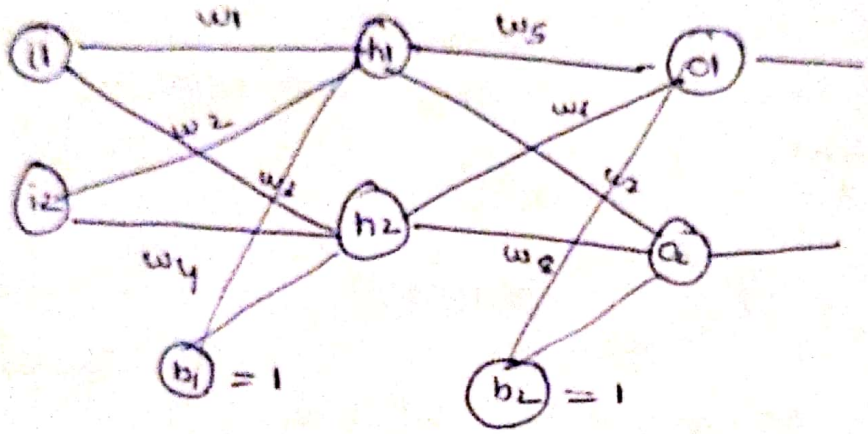
Assignment = 4



Phase-I Feed Forward Phase

Total net input for h_1

$$net_{h_1} = w_1 * i_1 + w_2 i_2 + b_1 * 1$$

$$out_{h_1} = \frac{1}{1 + e^{-net_{h_1}}}$$

$$net_{h_2} = w_3 * i_1 + w_4 i_2 + b_1 * 1$$

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

$$net\ o_1 = w_5 * out\ h_1 + w_6 + out\ h_2 + b_2 * 1$$

$$out\ o_1 = \frac{1}{1 + e^{-net\ o_1}}$$

$$net\ o_2 = w_7\ out\ h_1 + w_8\ out\ h_2 + b_2 * 1$$

$$out\ o_2 = \frac{1}{1 + e^{-net\ o_2}}$$

$$E\ total = \sum \frac{1}{2} (target - output)^2$$

$$E_{o1} = \frac{1}{2} (target_{o1} - out_{o1})^2$$

$$E_{o2} = \frac{1}{2} (target\ o_2 - out\ o_2)^2$$

$$E\ total = E_{o1} + E_{o2}$$

Pause II : Back Propogation of Error ~~and~~ calculate

Phase III Weight & bias updation

$$\frac{\partial E\ total}{\partial w_5}$$ by applying chain rule

$$w_5\ (new) = w_5\ (old) - \eta * \frac{\partial E\ total}{\partial w_5}$$ [η = learning rate]

similarly ~~Repeat~~ repeat for w_6, w_7 and w_8

Updating w_1

$$\frac{\partial E\ total}{\partial w_1} = \frac{\partial total}{\partial out\ h_1} * \frac{\partial out\ h_1}{\partial net\ h_1} * \frac{\partial net\ h_1}{\partial w_1}$$

$$w_1\ (new) = w_1\ (old) - \eta \frac{\partial E\ total}{\partial w_1}$$

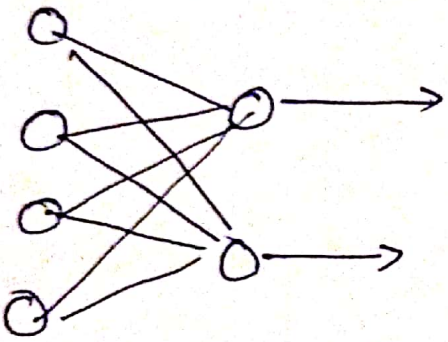
similarly ~~Repeat~~ repeat for w_2, w_3 and w_4

is decomposed as:-

$$\frac{\partial L}{\partial w_{old}} = \frac{\partial L}{\partial o_{21}} \cdot \frac{\partial o_{21}}{\partial z_3} * \frac{\partial z_3}{\partial w_{5\,old}}$$

$$\frac{\partial (y - \hat{y})^2}{\partial o_{21}} = \frac{\partial (y - o_{21})^2}{\partial o_{21}} \qquad \frac{\partial (y - \hat{y})^2}{\partial o_{21}} = \frac{\partial (y - o_{21})^2}{\partial o_{21}} \qquad \frac{\partial z_3}{\partial w_{5old}} = \frac{\partial (o_{11} w_5 + o_{12} w_6 + b_2)}{\partial w_{5old}}$$

Single Layer Neural Network model	Multi Layer Neural Network model
→ Has only 2 layer input layer and output layer	has more than 2 input and output layer
→ single layer perceptron	multi layer perceptron
→ Activation function used = limiting function	Activation fn = sigmoid activation
→ has connection between input and output layer.	→ has connection between input and hidden layer, hidden layer and output layer
→ No hidden layer	



input layer output layer

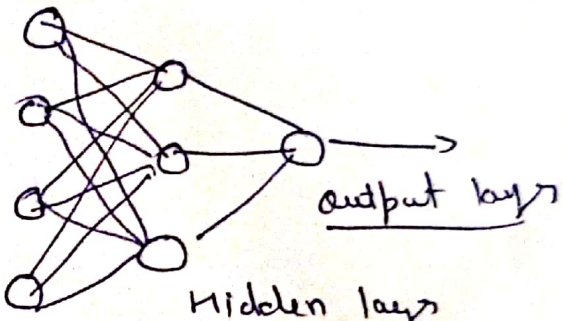
Activation function: $f(x) \begin{cases} 0 & \text{if } x \le 0 \\ 1 & \text{if } x > 0 \end{cases}$

where $X = wa + b$

w — weight

a — input

b — bias



Sigmoid Activation function $f(x) = \frac{1}{1+e^{-x}}$ $\begin{cases} 1 & \text{if } f(x) > 0.5 \\ 0 & \text{if } f(x) \le 0.5 \end{cases}$

where $x = wa + b$

w ← weights

a ← input

b ← bias