

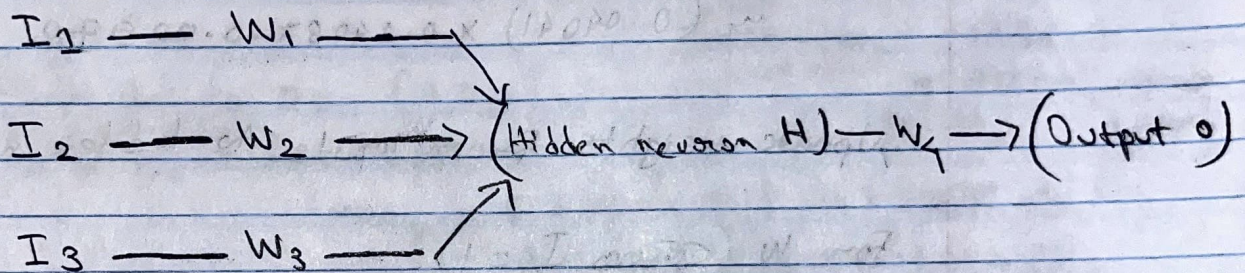
Quiz-3

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Initial weights/value of $W_1 = 0.8, W_2 = 0.1, W_3 = 0.3$
learning rate, $\eta = 0.01$

Activation Function is sigmoid, $f = 1 / (1 + e^{-u})$

i) Neural Network Architecture:



hidden neuron, $net_H = W_1 I_1 + W_2 I_2 + W_3 I_3 = 0.40$
 $H = f(net_H) = \frac{1}{1 + e^{-0.40}}$
 ≈ 0.5987

Output neuron $net_O = W_4 H, O = f(net_O) \approx 0.544$
 $= 0.30 \times 0.5987 \approx 0.1796$

Error, $E = \frac{1}{2} (d - O)^2 = \frac{1}{2} (0 - 0.544)^2 \approx 0.148$.

Output -neuron, $\delta_O = (d - O) O (1 - O) = -0.544 \times 0.544 \times 0.456 = -0.1347$
 $= 0 - 0.544 = -0.544$

Update weight $W_4, W_4 \leftarrow W_4 + \eta \delta_O H$
 $= 0.30 + 0.01 \times (-0.1347) \times (0.5987)$

~~Hidden neuron delta, $\delta_H = \delta_O \times W_4$~~

~~$\delta_H = -0.1347 \times 0.30 = -0.04041$~~
 $W_4 \approx 0.30 + 0.01 \times (-0.1347) \times (0.5987)$
 $\approx 0.30 - 0.000806 \approx 0.29919$

Hidden-neuron delta, use old W_4

$$\delta_H = \delta_o \times (W_4^{old}) H(1-H)$$

$$\therefore H(1-H) \approx 0.5987 \times 0.4013 \\ \approx 0.2403$$

$$\therefore \delta_H \approx (-0.1347 \times 0.30) \times 0.2403 \\ \approx (-0.04041) \times 0.2403 \approx -0.00970$$

\therefore Update weights from inputs to hidden neuron:

For W_1 (~~0.30~~ $I_1 = 1$):

$$W_1 \leftarrow 0.30 + 0.01 \times (-0.00970) \times 1 \\ \approx 0.30 - 0.000097 \\ = 0.29990$$

For W_2 ($I_2 = 1$):

$$W_2 \leftarrow 0.10 + 0.01 \times (-0.00970) \times 1 \\ \approx 0.10 - 0.000097 = 0.09990$$

For W_3 ($I_3 = 0$):

W_3 remains 0.20.

\therefore Weights after

$$W_1 \approx 0.29990, W_2 \approx 0.09990, \\ W_3 = 0.20, W_4 \approx 0.29919.$$

Test first sample (1, 0, 0)

Hidden neuron ~~net~~ input,

$$\text{net}_H = 0.2999 \cdot 1 + 0.09988 \cdot 0 \\ + 0.20008 \cdot 0 = 0.29990$$

hidden neuron output, $H = \sigma(0.29990)$
 ≈ 0.5744

Output neuron input:

$$\text{net}_0 = W_4 \cdot H = 0.29914 \times 0.5744 \\ \approx 0.1717$$

Final output, $O = \sigma(0.1717)$

$$\approx 0.5428$$

since $0.5428 > 0.45$,
prediction: class 1

present, true
positive, cond.

Test sample 2: (0, 0, 1)

hidden neuron input,

$$\text{net}_H = 0.29990 \cdot 0 + 0.09988 \cdot 0 \\ + 0.20008 \cdot 1 = 0.20008$$

hidden neuron output, $H = \sigma(0.20008)$
 ≈ 0.5500

Output neuron input:

$$\text{net}_0 = W_4 \cdot H = 0.29914 \times 0.5500 \\ \approx 0.1645$$

Final output: $O = \sigma(0.1645)$
 ≈ 0.5410

; since, $0.5410 > 0.45$,
prediction: class 1

positive, present, true
cond.