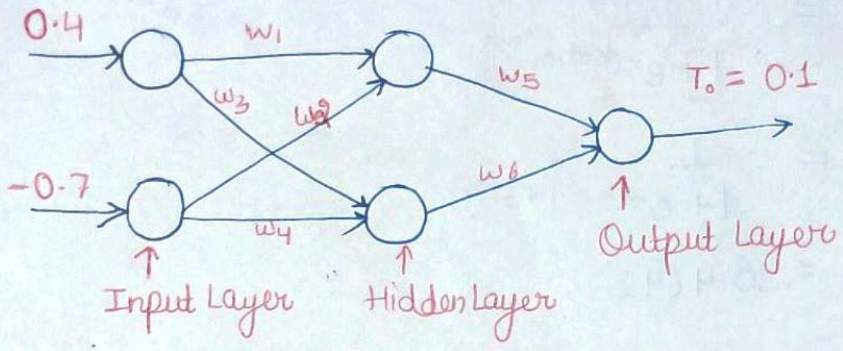
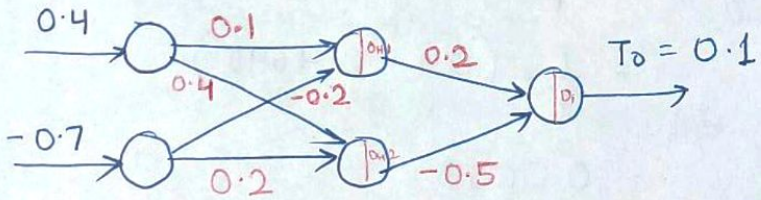
EXAMPLE

(DIKSHA ARORA)

{ F/w and B/w propagation }



Step 1 Initialize the weights from 1 to -1



Step2 $Net_{H_1} = w_1 * i_1 + w_2 * i_2 + (b_1 * 1)$ → If it is not given let it be 0

$Net_{H_1} = 0.1 * 0.4 + (-0.2) * (-0.7) + 0 * 1$

$= 0.18$

$Net_{H_2} = 0.4 * 0.4 + (-0.7) * (0.2)$

$= 0.02$

Step3 $O_{H_1} = \frac{1}{1+e^{-neth1}} = \frac{1}{(1+e^{-0.18})} = 0.5448$

$O_{H_2} = \frac{1}{1+e^{-neth_2}} = \frac{1}{1+e^{-0.02}} = 0.505$

Step4 [redacted]

$Net_{O1} = \Sigma w_i x_i$

$= 0.5448 * 0.2 + 0.505 * (-0.5)$

$= -0.14354$

[redacted]

Step 5 $O_{o1} = \frac{1}{1+e^{-net_{o1}}}$

$= \frac{1}{1+e^{-(-0.14354)}}$

$= 0.4642$

Step 6 $E_{o1} = E_{Total} = \frac{1}{2}(t_{o1} - O_{o1})^2$

(Because there is only one output)

$= \frac{1}{2} \times (0.1 - 0.4642)^2$

$= 0.0663$

Back Propagation :→ (How to adjust weights)

Step 7 $\frac{\partial E}{\partial w_5} = \frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial w_5}$

$\frac{\partial E}{\partial O_{o1}} = -(t_{o1} - O_{o1})$

$= -(0.1 - 0.4642) = 0.3642$

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

$= 0.4642(1 - 0.4642)$

$= 0.2487$

$\frac{\partial net_{o1}}{\partial w_5} = O_{h1} = 0.5448$

$\frac{\partial E}{\partial w_5} = 0.3642 * 0.2487 * 0.5448$

$= 0.0493$

Step 8 $w_5^+ = w_5 - \eta * \frac{\partial E}{\partial w_5}$

Let $\eta = 0.6$

$= 0.2 - 0.6 * 0.0493$

$= 0.17042$

Step 9 $\frac{\partial E}{\partial w_6} = \frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial w_6}$

$= 0.3642 * 0.2487 * O_{h_2}$

$= 0.3642 * 0.2487 * 0.505$

$= 0.0457$

Step 10) $w_6^+ = w_6 - \eta \times \frac{\partial E}{\partial w_6}$

$= -0.5 - 0.6 \times 0.0457$

$= -0.52742$

Now we have to update the weights associated with hidden layer.

Step 11

$\frac{\partial E}{\partial w_1} = \frac{\partial E}{\partial O_{h1}} \times \frac{\partial O_{h1}}{\partial net_{h1}} \times \frac{\partial net_{h1}}{\partial w_1}$

$\Downarrow$ {Chain Rule}

$\left(\frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial O_{h1}} \right)$

$\frac{\partial E}{\partial w_1} = \frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial O_{h1}} \times \frac{\partial O_{h1}}{\partial net_{h1}} \times \frac{\partial net_{h1}}{\partial w_1}$

$= 0.3642 * 0.2487 * w_5 * O_{h1}(1 - O_{h1}) * i_1$

$= 0.3642 * 0.2487 * 0.2 * 0.5448(1 - 0.5448) * 0.4$

$= 0.3642 * 0.2487 * 0.2 * 0.248 * 0.4$

$= 0.001796$

Step 12: $\boxed{w_1^+} = w_1 - \eta * \frac{\partial E}{\partial w_1}$

$= 0.1 - 0.6 * 0.001796$

$= 0.0989$

Step 13: $\frac{\partial E}{w_2} = \frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial O_{h1}} \times \frac{\partial O_{h1}}{\partial neth_1} \times \frac{\partial neth_1}{\partial w_2}$

$= 0.3642 \times 0.2487 \times w_5 \times O_{h1}(1 - O_{h1}) * i_2$

$= 0.3642 * 0.2487 * 0.2 * 0.248 * (-0.7)$

$= -0.0031448$

$\boxed{w_2^+} = w_2 - \eta * \frac{\partial E}{w_2}$

$= -0.2 - 0.6 * (-0.0031448)$

$= -0.1981$

Step 14 $\frac{\partial E}{\partial w_3} = \frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial O_{h2}} \times \frac{\partial O_{h2}}{\partial neth_2} \times \frac{\partial neth_2}{\partial w_3}$

$= 0.3642 * 0.2487 * w_6 * O_{h2}(1 - O_{h2}) * i_1$

$= 0.3642 * 0.2487 * (-0.5) * 0.505(1 - 0.505) * 0.4$

$= -0.004528$

$\boxed{w_3^+} = w_3 - \eta \frac{\partial E}{\partial w_3} = 0.4 - 0.6 * (-0.004528)$

$= 0.4027$

Step 15 $\frac{\partial E}{\partial w_4} = \frac{\partial E}{\partial O_{o1}} \times \frac{\partial O_{o1}}{\partial net_{o1}} \times \frac{\partial net_{o1}}{\partial O_{h2}} \times \frac{\partial O_{h2}}{\partial neth_2} \times \frac{\partial neth_2}{\partial w_4}$

$= 0.3642 \times 0.2487 \times w_6 \times 0.24998 \times i_2$

$= 0.3642 \times 0.2487 \times (-0.5) \times 0.24998 \times (-0.7)$

$= 0.00792$

$\boxed{w_4^+} = w_4 - \eta \times \frac{\partial E}{\partial w_4} = 0.2 - 0.6 * 0.00792$

$= 0.1952$

With the updated weights, error is calculated again and next training set is taken and error will be adjusted.