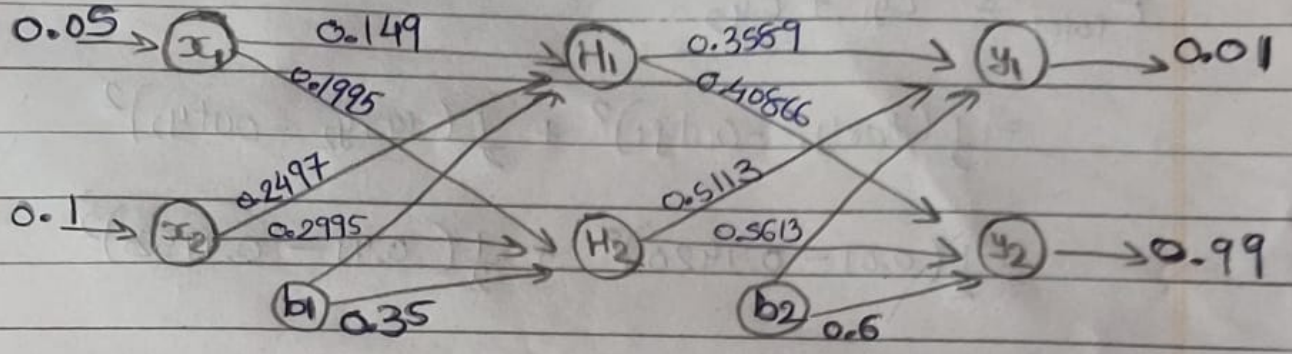

$$Net H_1 = w_1 x_1 + w_2 x_2 + b_1$$
$$= 0.149 \times 0.05 + 0.1995 \times 0.10 + 0.35$$
$$= 0.37744$$

$$Net H_2 = w_3 x_1 + w_4 x_2 + b$$
$$= 0.2497 \times 0.05 + 0.2995 \times 0.1 + 0.35$$
$$= 0.3924$$

$$out H_1 = \frac{1}{1+e^{-net H_1}} = 0.5932$$

$$out H_2 = \frac{1}{1+e^{-net H_2}} = 0.59686$$

$$Net y_1 = w_5 \times H_1 + w_6 \times H_2 + b_2$$
$$= 0.3589 \times 0.5932 + 0.40866 \times 0.5968 + 0.6$$
$$= 1.05684$$

$$out y_1 = \frac{1}{1+e^{-net y_1}} = 0.742088$$

$$net y_2 = w_7 \times H_1 + w_8 \times H_2 + b_2$$
$$= 0.5113 \times 0.5932 + 0.5613 \times 0.5968 + 0.6$$
$$= 1.23839$$

$$out y_2 = \frac{1}{1+e^{-net y_2}} = 0.77528$$

$E_{Total} = E_{y_1} + E_{y_2}$

$= \frac{1}{2}(tary_1 - outy_1)^2 + \frac{1}{2}(tary_2 - outy_2)^2$

$= \frac{1}{2}(0.01 - 0.7420)^2 + \frac{1}{2}(0.99 - 0.77528)^2$

$E_{tot} = 0.29102$

* Backpropagation.

i) Δw_5

$$\frac{\partial E_{tot}}{\partial w_5} = \frac{\partial E_{tot}}{\partial out_{y_1}} \times \frac{\partial out_{y_1}}{\partial net_{y_1}} \times \frac{\partial net_{y_1}}{\partial w_5}$$

$= (out_{y_1} - tary_1) \times out_{y_1}(1 - out_{y_1}) \times out_{H_1}$

$= (0.74208 - 0.01) \times 0.74208(1 - 0.74208) \times 0.593256$

$= 0.083125$

ii) Δw_6

$$\frac{\partial E_{tot}}{\partial w_6} = \frac{\partial E_{tot}}{\partial out_{y_1}} \times \frac{\partial out_{y_1}}{\partial net_{y_1}} \times \frac{\partial net_{y_1}}{\partial w_6}$$

$= (0.74208 - 0.01) \times 0.74208(1 - 0.74208) \times 0.596869$

$= 0.08363$

iii) Δw_7

$$\frac{\partial E_{tot}}{\partial w_7} = \frac{\partial E_{tot}}{\partial out_{y_2}} \times \frac{\partial out_{y_2}}{\partial net_{y_2}} \times \frac{\partial net_{y_2}}{\partial w_7}$$

$= (out_{y_2} - tary_2) \times out_{y_2}(1 - out_{y_2}) \times out_{H_1}$

$= (0.7752 - 0.99) \times (0.7752)(1 - 0.7752) \times 0.593256$

$= -0.0221921$

iv) Δw_8

$$\frac{\partial E_{tot}}{\partial w_8} = \frac{\partial E_{tot}}{\partial out_{y2}} \times \frac{\partial out_{y2}}{\partial net_{y2}} \times \frac{\partial net_{y2}}{\partial w_8}$$

$$= (0.7752 - 0.99) \times (0.7752)(1-0.7752) \times 0.596869$$

$$= -0.022327$$

v) Δw_1

$$\frac{\partial E_{tot}}{\partial \Delta w_1} = \frac{\partial E_{tot}}{\partial out_{H1}} \times \frac{\partial out_{H1}}{\partial net_{H1}} \times \frac{\partial net_{H1}}{\partial w_1}$$

$$\frac{\partial E_{tot}}{\partial \Delta w_1} = \left[\frac{\partial E_{y1}}{\partial out_{H1}} + \frac{\partial E_{y2}}{\partial out_{H1}}\right] \times \frac{\partial out_{H1}}{\partial net_{H1}} \times \frac{\partial net_{H1}}{\partial w_1}$$

$$\Rightarrow \frac{\partial E_{y1}}{\partial out_{H1}} = \frac{\partial E_{y1}}{\partial out_{y1}} \times \frac{\partial out_{y1}}{\partial net_{y1}} \times \frac{\partial net_{y1}}{\partial out_{H1}}$$

$$= (0.74208 - 0.01) \times 0.74208 (1 - 0.74208) \times 0.3589$$

$$= 0.05029$$

$$\Rightarrow \frac{\partial E_{y2}}{\partial out_{H1}} = \frac{\partial E_{y2}}{\partial out_{y2}} \times \frac{\partial out_{y2}}{\partial net_{y2}} \times \frac{\partial net_{y2}}{\partial out_{H1}} = [0.77528 - 0.99] \times 0.7758(1-0.7758) \times 0.5113$$

~~$= (0.74208 - 0.99) \times 0.74208 (1 - 0.74208) \times 0.40866$~~

$$= -0.01912$$

$$\frac{\partial E_{tot}}{\partial \Delta w_1} = [0.05029 - 0.01912] \times 0.5932 (1 - 0.5932) \times 0.05$$

$$= 0.031163 \times 0.5932 (1 - 0.5932) \times 0.05$$

$$\frac{\partial E_{tot}}{\partial \Delta w_1} = 0.00037$$

vi) Δw_2

$$\frac{\partial E_{tot}}{\partial \Delta w_2} = \frac{\partial E_{tot}}{\partial out_{H1}} \times \frac{\partial out_{H1}}{\partial net_{H1}} \times \frac{\partial net_{H1}}{\partial w_2} = [0.05029 - 0.01912] \times 0.5932(1-0.5932) \times 0.1$$

$$= 0.000761$$

vii) Δw_3

$$\frac{\partial E_{tot}}{\partial w_3} = \frac{\partial E_{tot}}{\partial out_{h2}} \times \frac{\partial out_{h2}}{\partial net_{h2}} \times \frac{\partial net_{h2}}{\partial w_3}$$

$$\frac{\partial E_{y1}}{\partial out_{h2}} = \frac{\partial E_{tot y1}}{\partial out_{y1}} \times \frac{\partial out_{y1}}{\partial net_{y1}} \times \frac{\partial net_{y1}}{\partial out_{h2}}$$

$= (0.742088 - 0.01) \times (0.742088)(1 - 0.742088) \times 0.40866$

$= 0.057260$

$$\frac{\partial E_{y2}}{\partial out_{h2}} = \frac{\partial E_{tot y2}}{\partial out_{y2}} \times \frac{\partial out_{y2}}{\partial net_{y2}} \times \frac{\partial net_{y2}}{\partial out_{h2}}$$

$= (0.7752 - 0.99) \times 0.7752 (1 - 0.7752) \times 0.5613$

$= -0.020999$

$$\frac{\partial E_{tot}}{\partial w_3} = [0.05726 - 0.02099] \times 0.59686(1 - 0.59686) \times 0.05$$

$= 0.000436$

viii) Δw_4

$$\frac{\partial E_{tot}}{\partial w_4} = \frac{\partial E_{tot}}{\partial out_{h2}} \times \frac{\partial out_{h2}}{\partial net_{h2}} \times \frac{\partial net_{h2}}{\partial w_4}$$

$= (0.7752 - 0.99) \times 0.7752 (1 - 0.7752) \times$

$= [0.05726 - 0.02099] \times 0.59686(1 - 0.59686) \times 0.01 = 0.0008830$

New w_{ei}

$\Delta w_1 = w_1 - \gamma \times \frac{\partial E}{\partial w_1} = 0.1497 - 0.5 \times 0.0003759 = 0.149592$

$\Delta w_2 = w_2 - \gamma \times \frac{\partial E}{\partial w_2} = 0.1995 - 0.5 \times 0.000761 = 0.199175$

$\Delta w_3 = w_3 - \gamma \times \frac{\partial E}{\partial w_3} = 0.2495 - 0.5 \times 0.00043 = 0.24953$

$\Delta w_4 = w_4 - \gamma \times \partial E / \partial w_4 = 0.2995 - 0.5 \times 0.00088 = 0.299054$

$\Delta w_5 = w_5 - \gamma \times \partial E / \partial w_5 = 0.3589 - 0.5 \times 0.083121 = 0.317353$

$w_6 = w_6 - \gamma \times \partial E / \partial w_6 = 0.40866 - 0.5 \times 0.083631 = 0.3668$

$\Delta w_7 = w_7 - \gamma \times \partial E / \partial w_7 = 0.5113 - 0.5 \times (-0.02219) = 0.5223$

$\Delta w_8 = w_8 - \gamma \times \partial E / \partial w_8 = 0.5613 - 0.5 \times (-0.02232) = 0.5725$

THE END