Neural Networks Tutorial

1- A neural network is trained to recognize the patterns shown in Figs_(1) and (2). The associated patterns are shown.

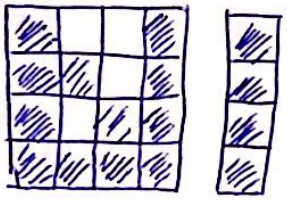


Fig.(1)

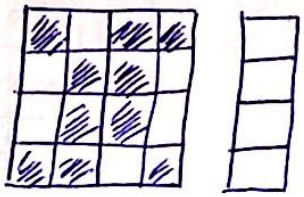


Fig-(2)

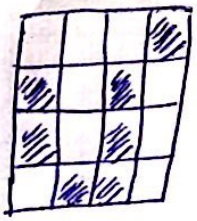
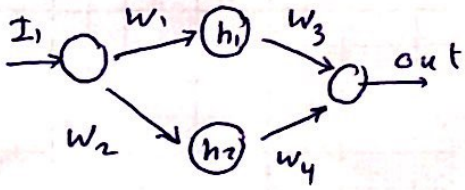


Fig-(3)

For the pattern shown in Fig-(3) what will be the output of the neural network?

2- For the network shown, find the error, if the input is I_1 and the target is A.



solution:

$$net\ h_1 = I_1 w_1$$

$$out\ h_1 = \frac{1}{1 + e^{-I_1 w_1}}$$

$$net\ h_2 = I_1 w_2 \qquad out\ h_2 = \frac{1}{1 + e^{-I_1 w_2}}$$

$$net\ o_1 = out\ h_1 * w_3 + out\ h_2 * w_4$$

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

$$E = \frac{1}{2}\left[A - out\ o_1\right]^2$$

3- In problem 2, find $\frac{\partial E}{\partial w_3}$.

solution:

Using the chain rule:

$$\frac{\partial E}{\partial w_3} = \frac{\partial E}{\partial out_1} * \frac{\partial out_{o1}}{\partial net_{o1}} * \frac{\partial net_{o1}}{\partial w_3}$$

$$\frac{\partial E}{\partial out_{o1}} = \frac{\partial}{\partial out_{o1}} [A - out_{o1}]^2 \cdot \frac{1}{2}$$

$$= 2 * \frac{1}{2} * (A - out_{o1}) * -1$$

$$= -A + out_{o1} \quad \text{---- (1)}$$

$$\frac{\partial out_{o1}}{\partial net_{o1}} = \frac{\partial}{\partial net_{o1}} \left[\frac{1}{1 + e^{-net_{o1}}} \right]$$

$$= out_{o1} * (1 - out_{o1}) \quad \text{--- (2)}$$

$$\frac{\partial net_{o1}}{\partial w_3} = \frac{\partial}{\partial w_3} [out_{h1} * 3 + out_{h2} * w_4]$$

$$= out_{h1} \quad \text{---- (3)}$$

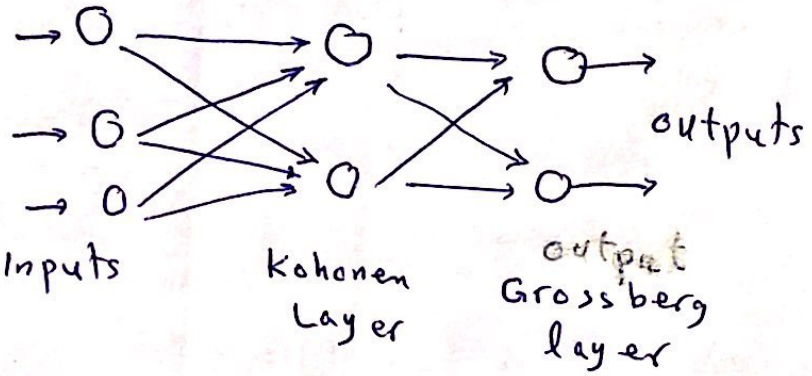
Combining (1), (2), and (3) we have:

$$\frac{\partial E}{\partial w_3} = (-A + out_{o1}) * out_{o1} * (1 - out_{o1}) * out_{h1}$$

4- (a) Draw the diagram of the feed forward counter propagation neural network.

(b) How does this network work?

(a) Feed forward counter propagation NN



(b) Kohonen Layer:

Neurons sum all of the weighted inputs received. The neuron with the largest sum outputs a 1 and the other neurons output a 0.

Grossberg layer:

Each Grossberg neuron merely outputs the weight of the connection between itself and the one active Kohonen neuron.