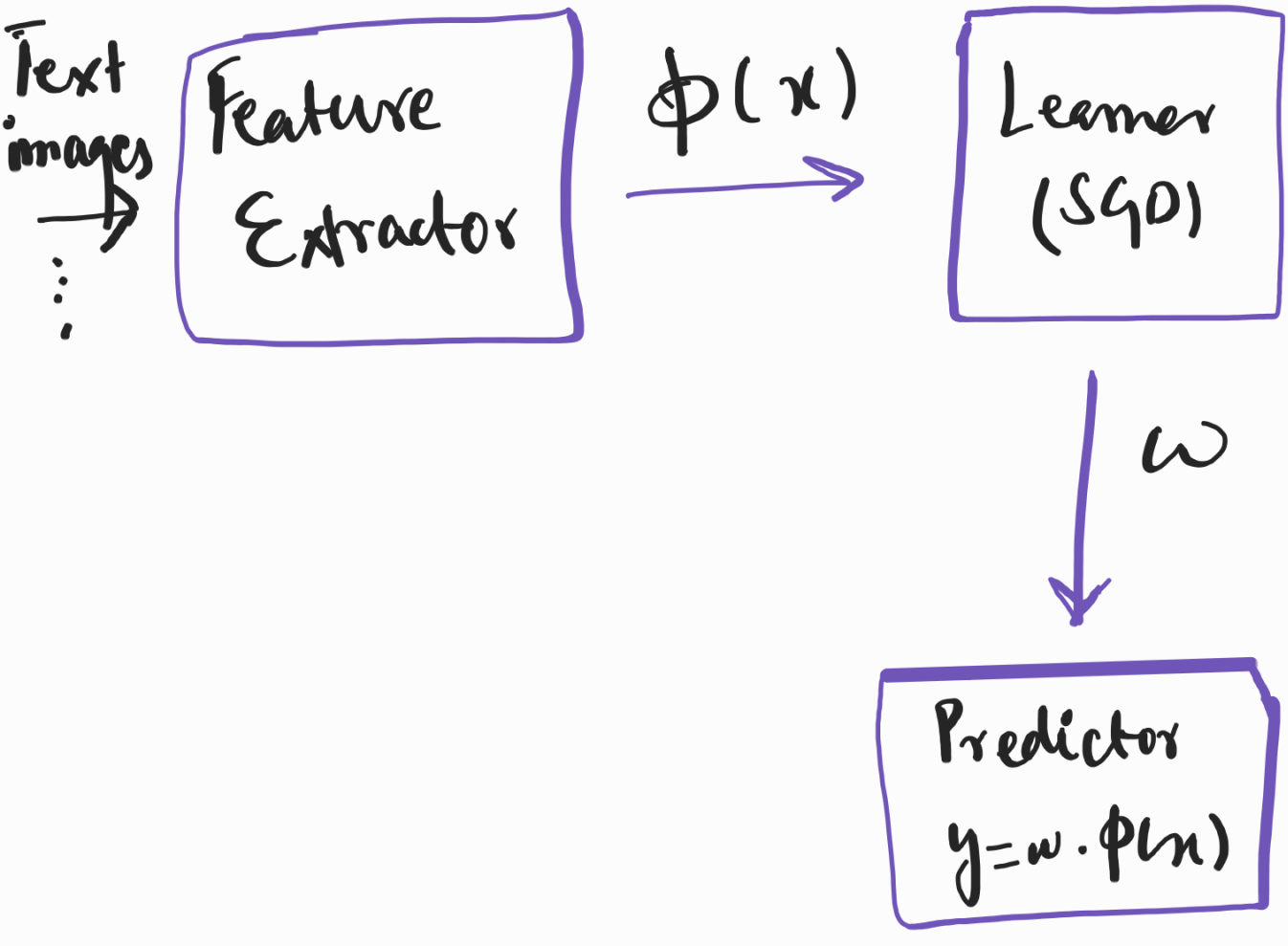
# AI Theory

## Neural Networks

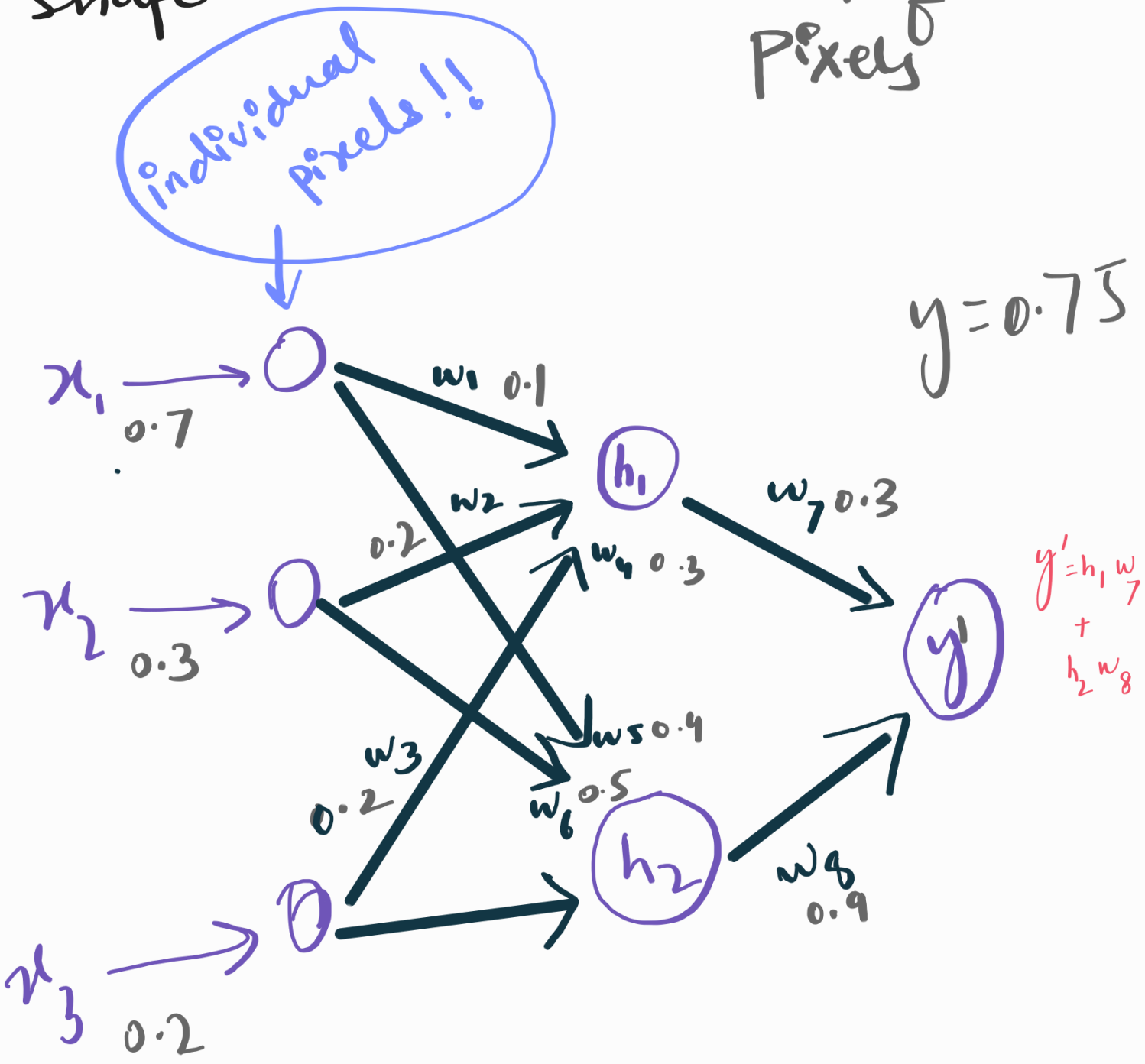
## Back & forward propagation




How does an image work?

ref : (MNIST dataset)

Shape = 60 x 60 → matrix of 3600 Pixels




# Dry Run of Gradient Descent:

$$h_1 = w_1 x_1 + w_2 x_2 + w_3 x_3$$

$$= 0.1 \times 0.7 + 0.3 \times 0.2 + 0.2 \times 0.2$$

$$h_1 = 0.17$$

$$h_2 = w_4 x_1 + w_5 x_2 + w_6 x_3$$

$$= 0.4 \times 0.7 + 0.5 \times 0.3 + 0.2 \times 0.3$$

$$h_2 = 0.49$$

$$\boxed{y' = 0.492}$$

$$\text{Loss} = (y' - y)^2$$

$$\text{Loss} = 0.097$$

Question: How do we update the weights?

update individually:

$$w_7 = w_7 - \alpha \frac{\partial L}{\partial w_7}$$

Here:

$$\frac{\partial L}{\partial w_7} = \frac{\partial L}{\partial y'} \times \frac{\partial y'}{\partial w_7}$$

$$= 2(y' - y) \, 1 \times h_1$$

Putting values

$$= 2(0.438 - 0.75) \times 0.17$$

$$= -0.1060$$

Putting

$$w_7 = 0.3 - (0.01 \times -0.1060)$$

$$= 0.3 + 0.00106$$

$$\boxed{w_7 = 0.30106}$$

Similarly, we can update $w_8$.

Let's try to update $w_4$.

$$w_4 = w_4 - \alpha \frac{\partial L}{\partial w_4}$$

$$\frac{\partial L}{\partial w_4} = \frac{\partial L}{\partial y'} \times \frac{\partial y'}{\partial h_2} \times \frac{\partial h_2}{\partial w_4}$$

$$= 2(y' - y) \times w_8 \times x_1$$

$$= 2(0.438 - 0.75) \times 0.9 \times 0.7$$

$$= -0.39$$

$$w_4 = w_4 - (-0.39 \times 0.01)$$

$$\boxed{w_4 = 0.69}$$

This method of updating the weights is called back-propagation.

MORE COURSE:

(Assignment, paper, Quiz

Intro to Deep Learning

weeks 1-3