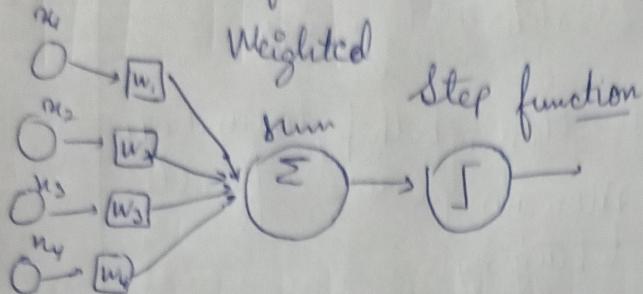


~~It contains N-sized binary array~~

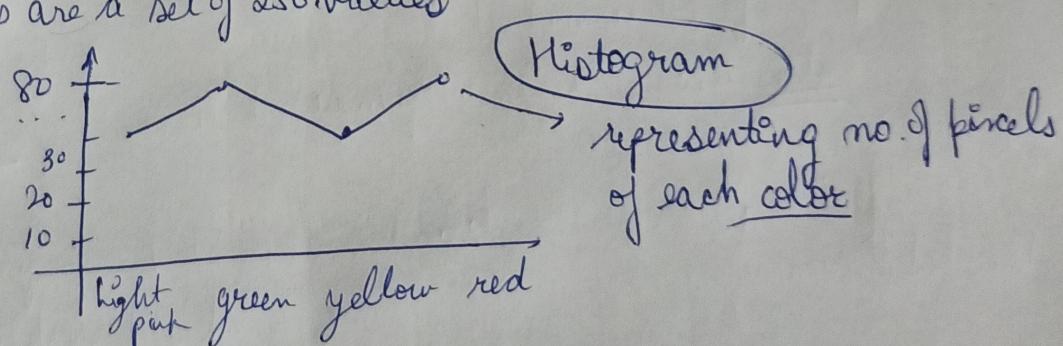
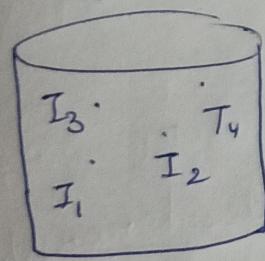
- Artificial neural networks are a class of machine learning algorithms that learn from data and specialize in pattern recognition.
- A perceptron with a linear activation function (regardless of depth) was merely a linear classifier. Example



Hierarchical Feature Learning Feature Extraction

- Color
- Texture
- Shape
- position
- Using colour content

We can store image in a database using features of colors or vector of color features. Images are a set of 256 values



Two problem

1) Dimensional - Each image is have large no. of features

2) Cross talk

Bright red of query needs also be compared to pink orange so increase time complexity

* (R, G, B) colours.

$$\text{Ravg} = \frac{-}{3}, \text{Gavg}, \text{Bavg} \quad (\text{Take average of all the colours})$$

Vector calculation

- Take an image suppose 150×800 resized to 64×128 .

It is considered as a 8×16 grid where each box is a square of 8 pixels

35	20	10
40	60	70
85	70	100

20
40
60
70

$$X\text{ direction} = |40 - 70| = 30$$

$$Y\text{ direction} = |20 - 70| = 50$$

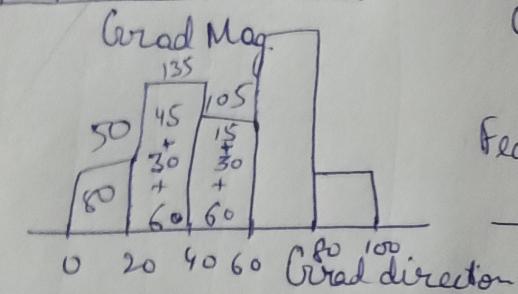
$$\text{Grad mag} = \sqrt{30^2 + 50^2} = 58$$

$$\text{Grad dir} = \tan^{-1}(30/50) \approx 30^\circ$$

Grad-direction: $\frac{0-180^\circ}{9}$

60	60	60	60
60	60	60	60

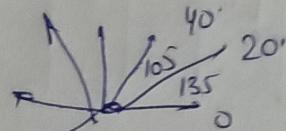
20	40	30	25
20	40	30	25



Grad direction

→ Vector of size 9:1

$$\text{Feature vector} = [50, 135, 105, \dots]$$



Feature vector of size 9

$$7^2 + 15^2 = 36 = 3780$$

$$\boxed{4} \quad \sqrt{12^2 + 4^2} = 4.472$$

$\frac{2}{4.472}, \frac{4}{4.472} = 0.4472$ HOG - Histogram of Oriented Gradients

Hierarchical learning - Each layer in network uses the output of various layers as "building blocks" to construct increasingly more abstract concepts.