

pixel

pixel represent element of an image



pixel value ranges from 0 to 255

→ 8 bit image.

$$2^8 = 256 = 255$$

$$2^1 = 2$$

$$2^1 = 1$$



8 bit = 2 colors.

$$8 \text{ bit} = 2^8 = 255$$

24 bit = 16 million colors

pixels are always into sq. form.

Basic Building Block of Image.

pixels/ inch (↑) Quality (↑) Image

you  
144x144  
1080x1080  
2160x2160

Every pixels has its own logical address.

$$100 \times 144 \times 144 \times 3$$



4x4

0 → absence of light black.

255 → presence of light white color.

Applications.

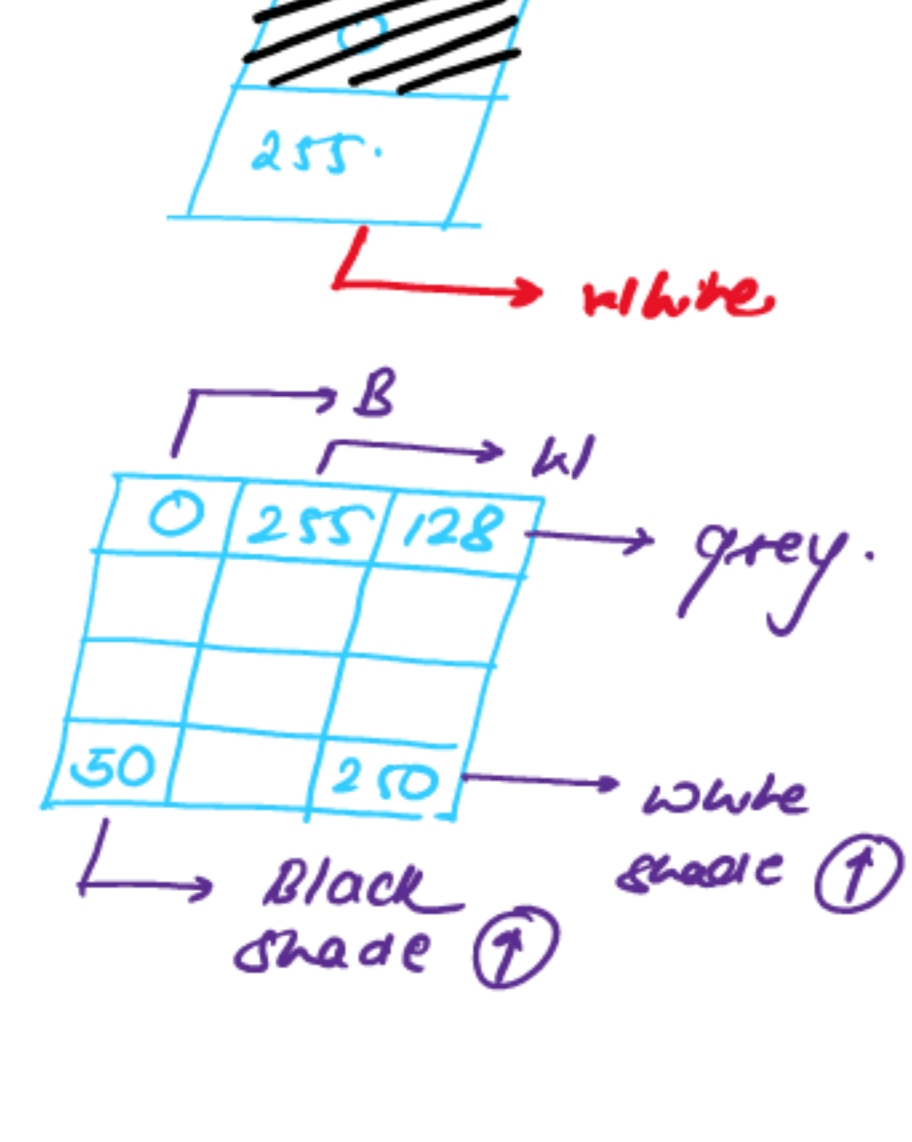
- ① Image processing.
- ② Basic image.
- ③ sharpen image.
- ④ enhance image.
- ⑤ object detection.

Grayscale Image

pixel value ranges from 0 to 255.

0 = black

255 = white



Images are always stored in form of numpy array

① homogeneous.

② fast

→ C++

Grayscale Image will have only 1 channel.

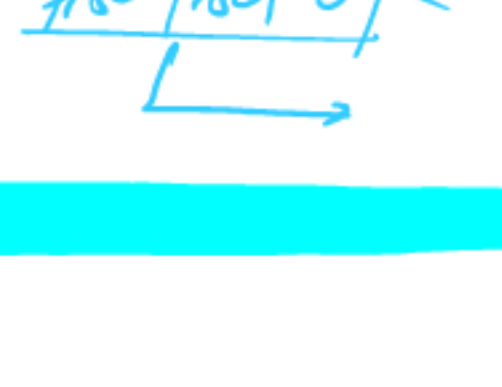
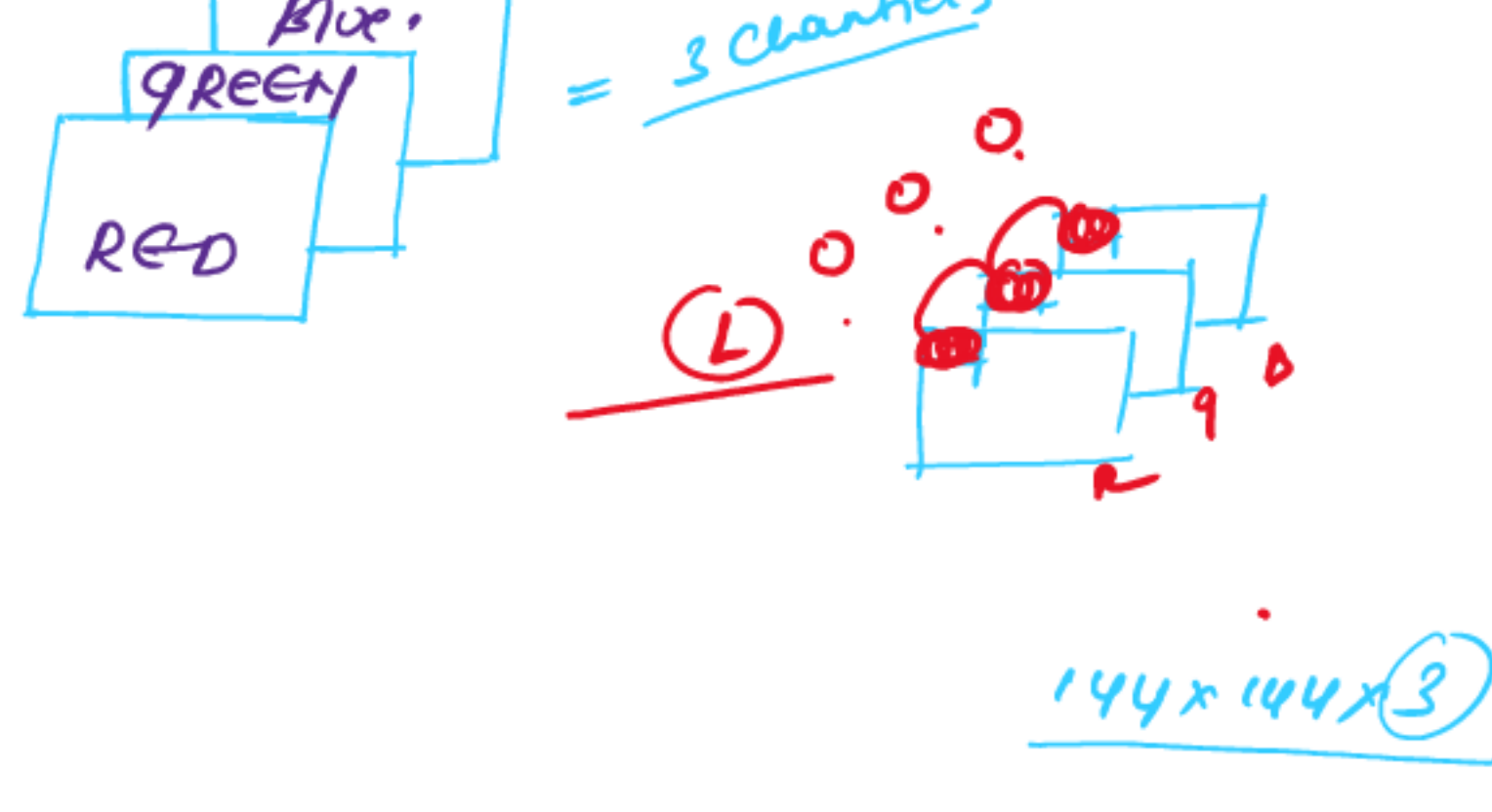
RGB Image.

Image consist of mainly all colors and can be generated by using 3 primary colors.

R → Red  
G → Green  
B → Blue

0 - 255



144x144x3

each matrix has value ranging from 0 to 255 finally all matrix are super imposed.

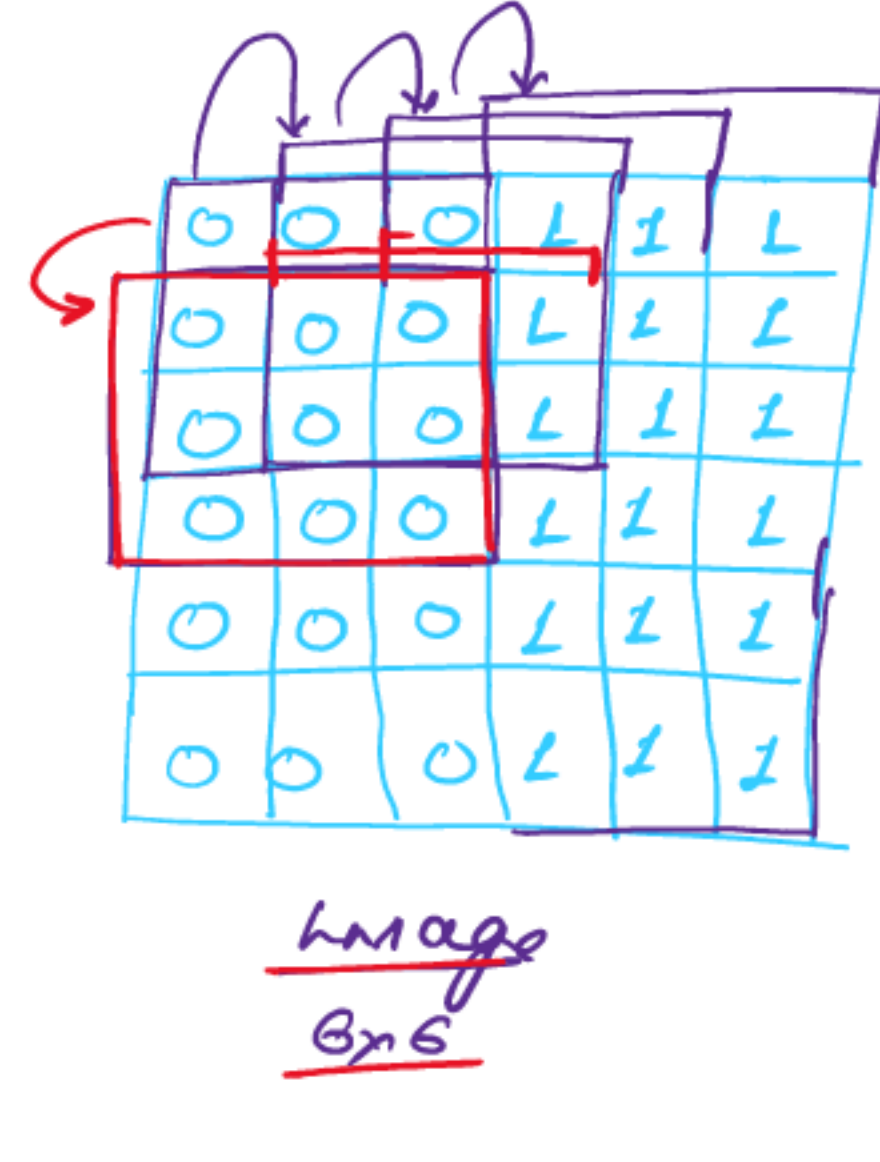
R	G	B	
255	0	0	Red.
0	255	0	Green
128	128	128	grey.
50	150	80	pink.

2x2  
Image  
Grayscale

2x2  
Image  
RGB.

$$\begin{bmatrix} 0 & 0 \\ 255 & 255 \end{bmatrix}$$

$$\begin{bmatrix} 255, 0, 0 & 0, 255, 0 \\ 0, 0, 255 & 0, 0, 0 \end{bmatrix}$$

Convolution.

\*

Filter  
3x3

$$= 1 \times 0 + 0 \times 0 + 1 \times 0 + 2 \times 0 + 0 \times 0 + -2 \times 0 + 1 \times 0 + 0 \times 0 + 1 \times 0 = 0$$

$$= 1 \times 0 + 0 \times 0 + 1 \times 1 + 2 \times 0 + 0 \times 0 + -2 \times 1 + 1 \times 0 + 0 \times 0 + -1 \times 1 = -4$$

$$\begin{bmatrix} 0 & -4 & -4 & 0 \\ 0 & -4 & -4 & 0 \\ 0 & -4 & -4 & 0 \\ 0 & -4 & -4 & 0 \end{bmatrix}$$

Feature map.

4x4.

Filter

Roof Building can you Non shiny Spect face eyes ears

HL ↓

Primitive features.

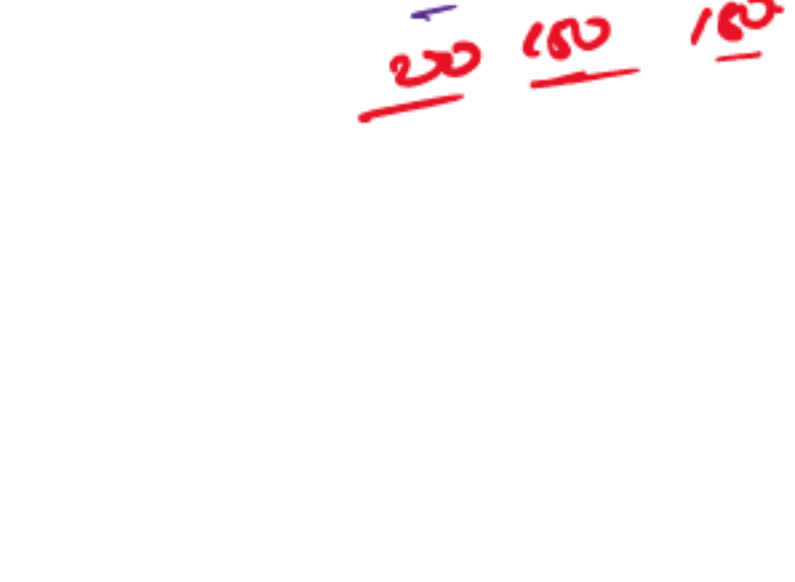
HL ↑

Complex features.

Whenever intensity of light changes it is called as an edge

$$n - f + 1 = fm$$

→ filter



Size of filter is always odd

$$\frac{28 \times 28}{3} = 25.33$$

$$25 + 1 = 26 \times 26$$



144x144

2160x2160



1 1 1 1 1