Computer Vision

e-Yantra , SVPCET Nagpur

What is Image processing?

Image processing is a method to perform some operations on an image in order to get an enhanced image or to extract some useful information from it.

What is Computer vision?

Computer vision is an interdisciplinary scientific field that deals with how computers can give high level understanding from digital images or videos.

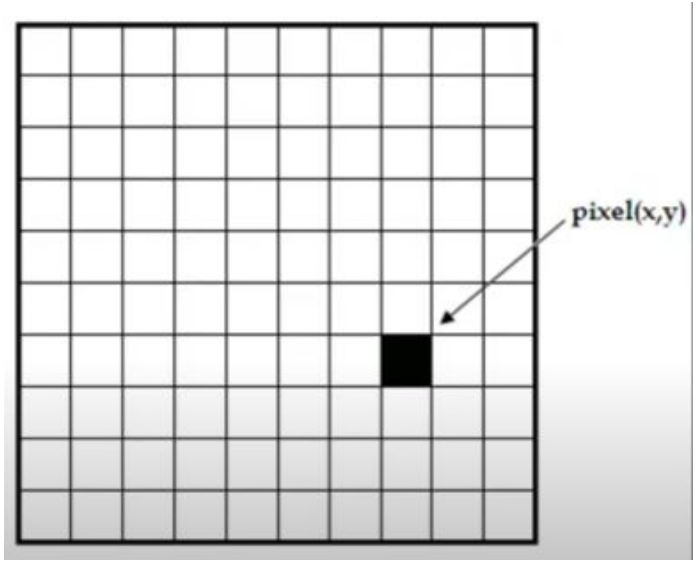
OpenCV

- OpenCV is an open source programming library with real time computer vision capabilities.
- Started at Intel in 1999 by **Gary Bradsky** and the first release came out in 2000
- Available on Mac, Windows , linux.
- Works in C, C++ and Python.
- Open source and free.
- Easy to use and install.
- BSD Licensed (Berkeley source distribution)

Image

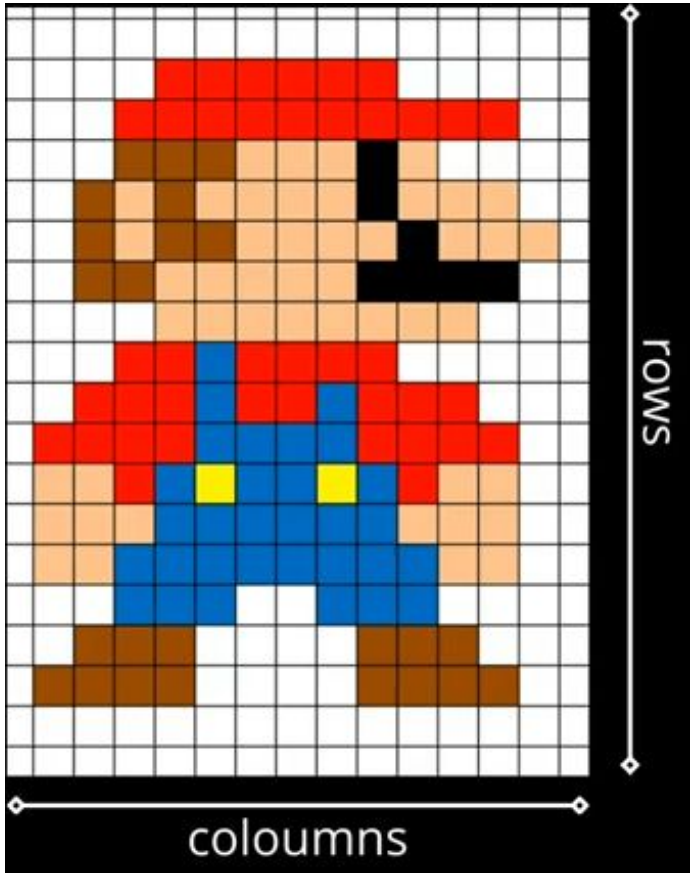
Image can be described as a 2D- function f(x,y), where (x,y) are the coordinates and the value of f at any point (x,y) is proportional to the brightness or the gray level of the image.

- A 2-Dimensional array
- X - number of row
- Y - number of column

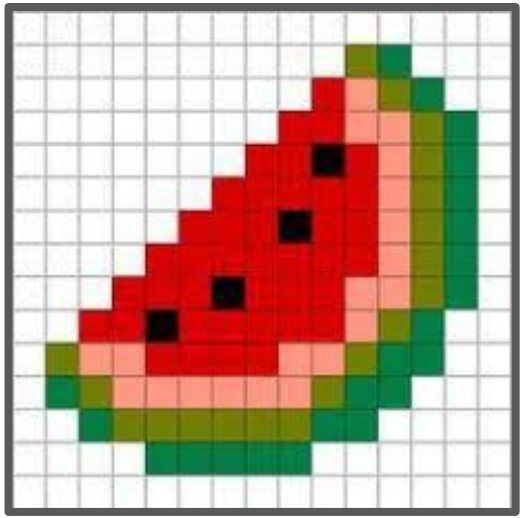


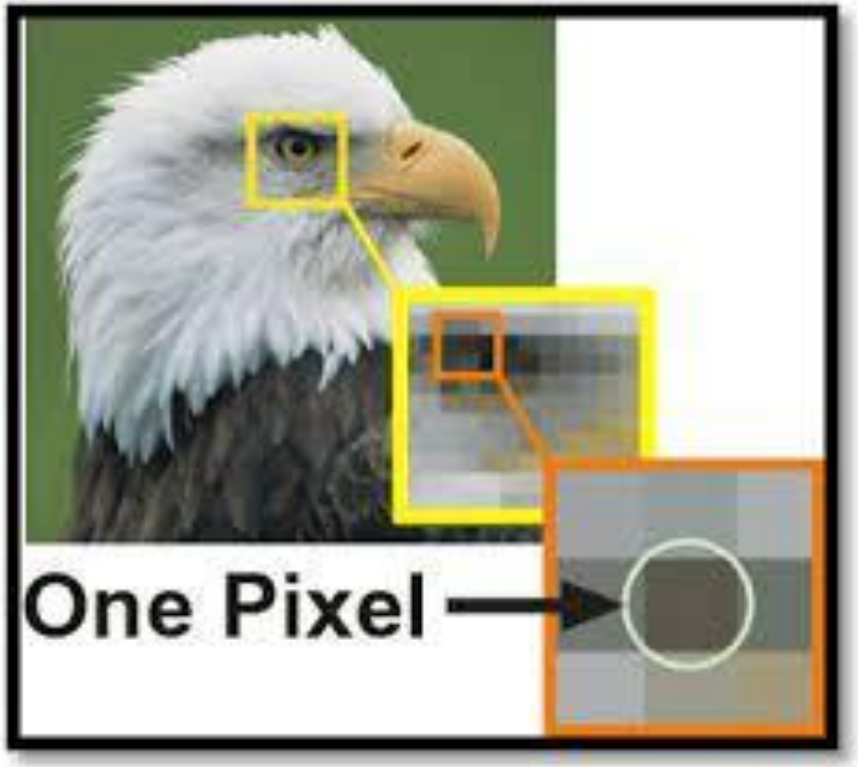
- X (0, h-1), h = Height of image
- Y (0,w-1), w = Width of image
- f(x,y) =(0,L-1), where L =256

  (For 8 bit image)



- Image is a collection of different pixels.
- Pixel is a smallest unit in an image which contains color value.
- PPI - pixel per inch (minimum 300 pixels required per inch)
- Video is a collection of multiple images





Why only 256 values?

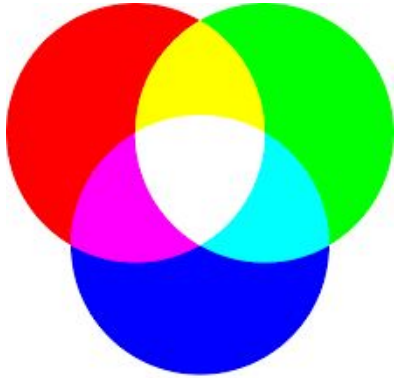
1 bit = 2 values (0,1)
N bits = 2^N

Image = 8 bit(1 byte)
➔ 2^8 = 256

Types of Image

1. **Grayscale Image** (Single channel) :
   The value of each pixel represents only the intensity information of the light.

2. **Colour Image** (3 channel):
   RGB Image(R = Red, G =Green, B= Blue)



RGB Model

We can form range of colors using RGB Model

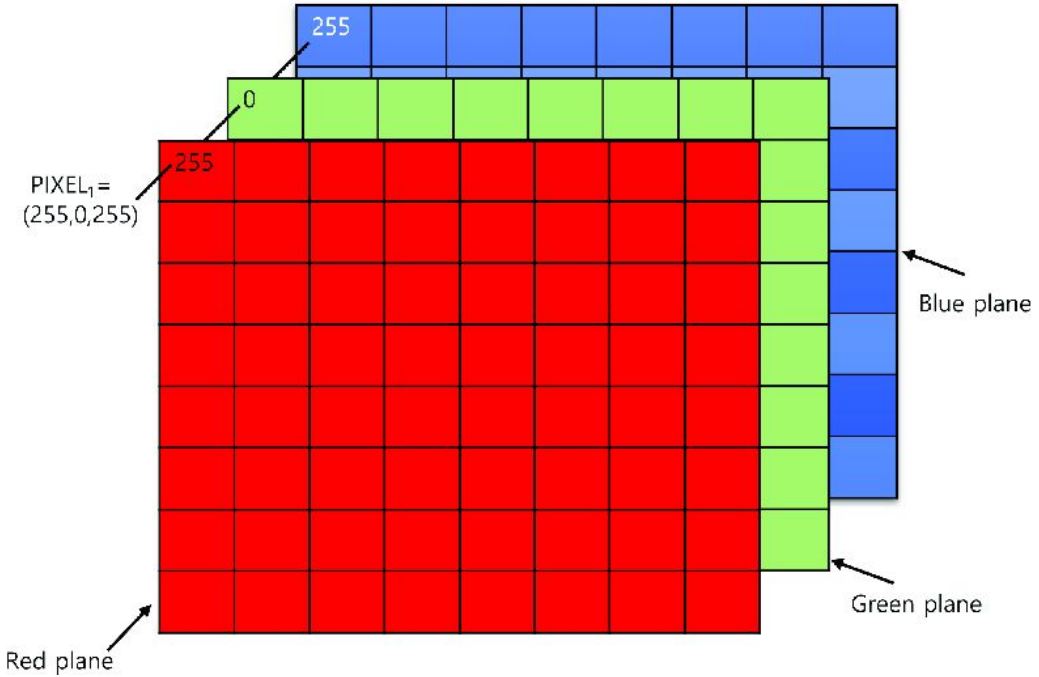
Red = (255,0,0)

Green = (0,255,0)

Blue =(0,0,255)

Black = (0,0,0)

White = (255,255,255)



Every Pixel needs three values for the color to be displayed. So each color would be represented by three functions.

Color Depth

Number of bits used to indicate the color of single image.

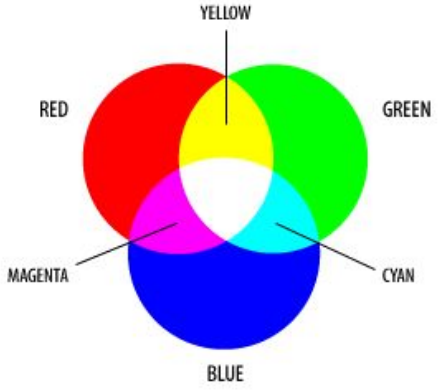
Total Depth = 3*8 = 24 bits

Color Spaces

A color space is a mathematical model describing the way colors can be represented using tuples of numbers

Yellow = (255,255,0)

Brown =(128,0,0)

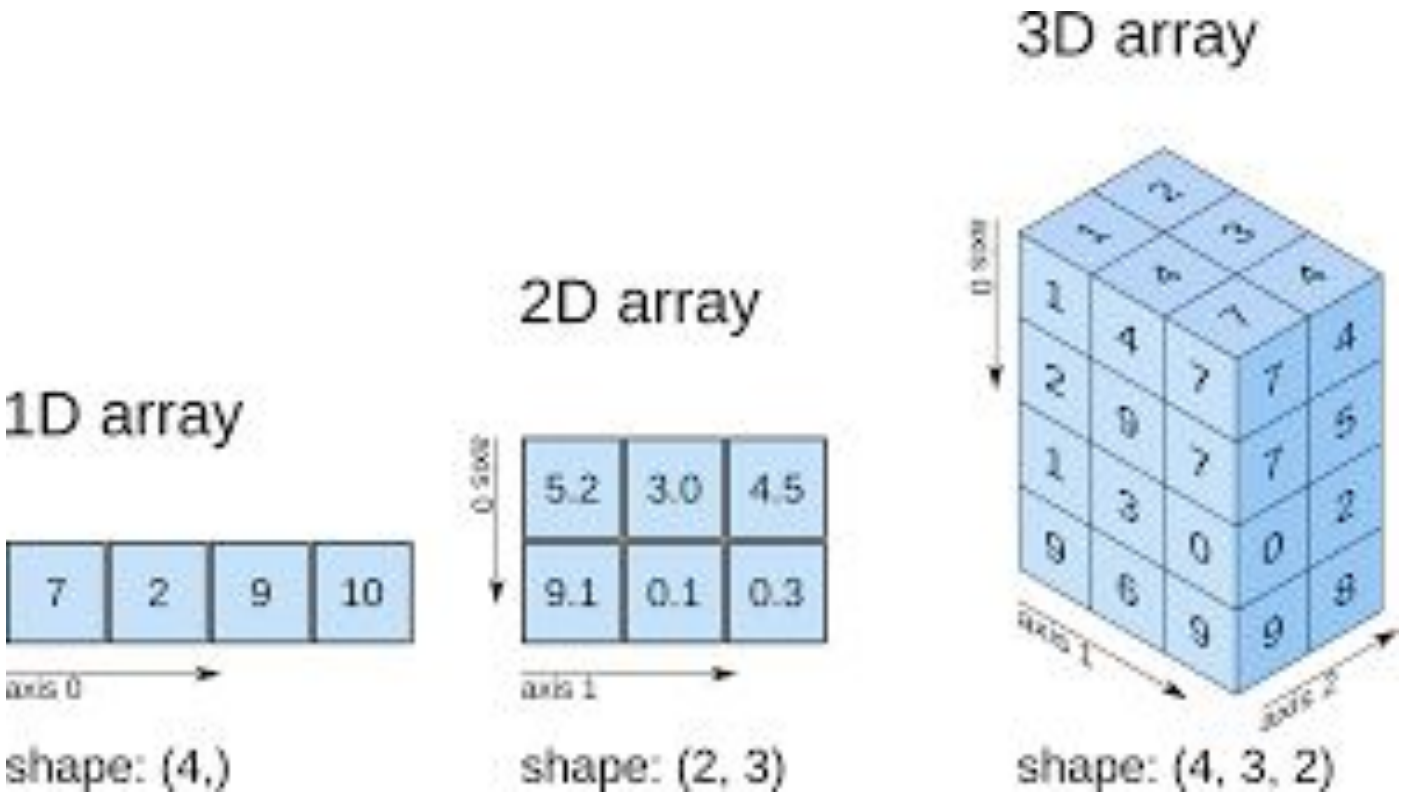


Numpy

- NumPy is a Python package that stands for ‘Numerical Python’
- NumPy is a general-purpose array-processing package.
- It provides a high-performance multidimensional array object, and tools for working with the arrays.

- Numpy Array is divided in two types as

1. Single Dimensional array
2. Multi Dimensional array


1D array
7
2
9
10
axis 0
shape: (4,)
2D array
axis 0
5.2
3.0
4.5
9.1
0.1
0.3
axis 1
shape: (2, 3)
3D array
axis 0
axis 1
axis 2
shape: (4, 3, 2)