Intro to OpenCV

OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision software library. OpenCV was started at Intel in 1999 by Gary Bradsky and the first release came out in 2000. Vadim Pisarevsky.

It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.

We'll be looking at image processing with OpenCV

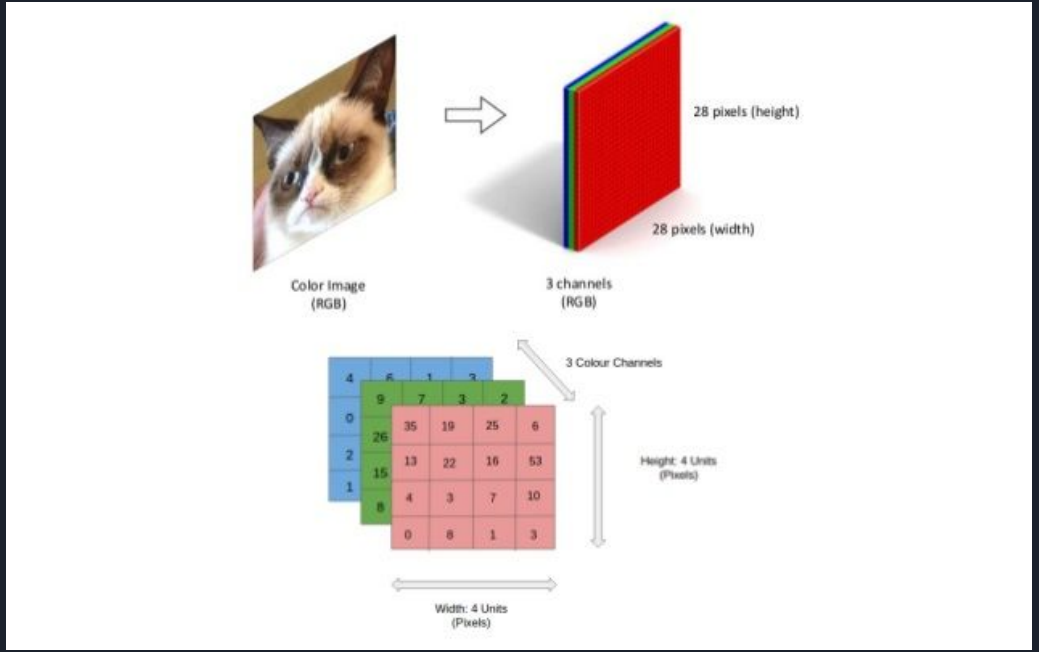
What is an image?

Generally, we can consider an image as a matrix whose elements are numbers between 0 and 255.

The size of this matrix is (image height) x (image width) x (# of image channels).

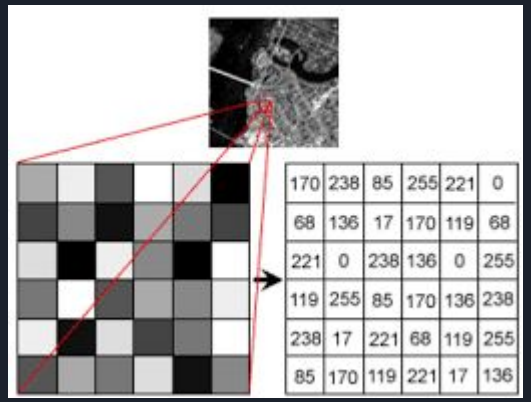
A grayscale image has 1 channel where a color image has 3 channels (for RGB).

Each value mentioned above is a 8-bit number. i.e, it can take values between 0-255. These values correspond to the shade of that particular parameter. 0 for minimum and 255 for maximum.

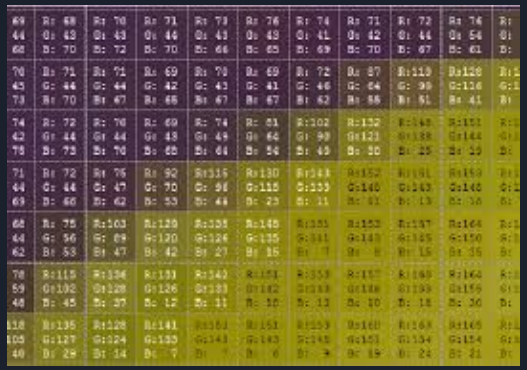


Grayscale and RGB Images

For Grayscale Images:
Each pixel has one channel represented by an 8-bit number (from 0 to 255). A pixel value of 0 corresponds to Black, while 255 corresponds to white. The values in between correspond to different shades in between.



RGB Images:
Each pixel has three associated channels-
Red- from 0 to 255
Green- from 0 to 255
Blue- from 0 to 255
(0, 0, 0) => Black
(255, 255, 255) => White
The colour of an RGB image, coming from any pixel, is a mixture of the colours from the three channels.



Colourspaces

A colour space is a map from a certain colour to a set of numbers (usually 8-bit in size). Different colour spaces (functions) may be advantageous for different purposes.

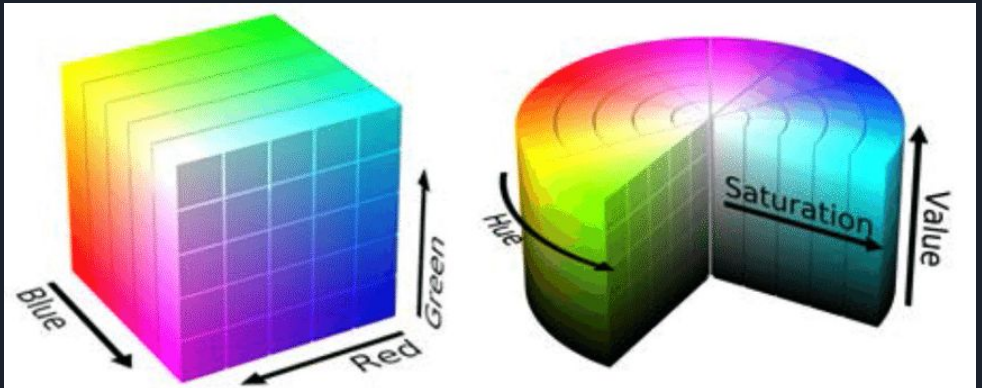
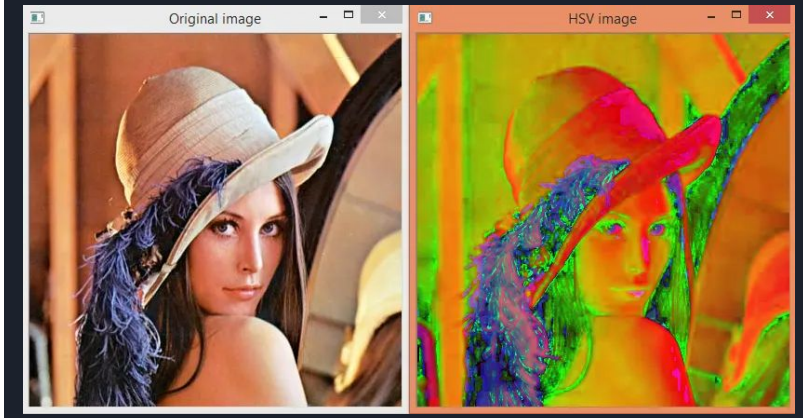


Fig_1:RGB Color Space

Fig_2: HSV Color Space

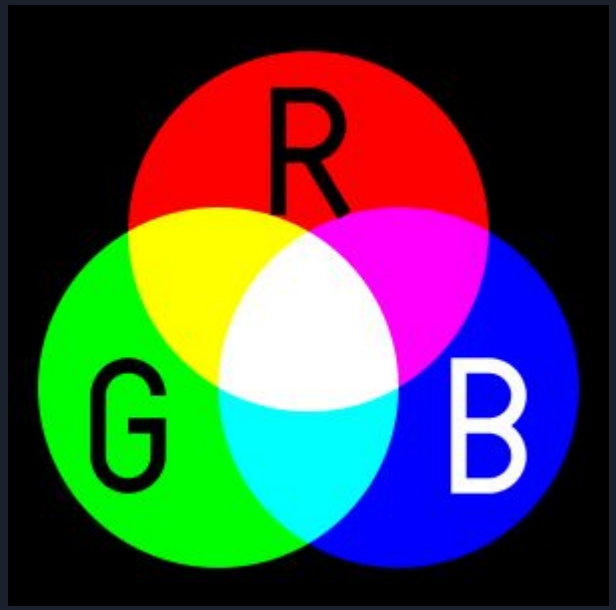


BGR Colourspace

BGR- Various colours are obtained by a linear combination of Blue, Green and Red values. (2^24 = 16,777,216 possibilities)

The three channels are correlated by the amount of light hitting the surface.

In BGR colour space, chrominance (colour related information) and luminance (intensity related information) tend to get mixed. This makes colour based segmentation (separation of components of the image) difficult in BGR colourspace. Also, a difference in lighting would alter the values of the three channels quite drastically.



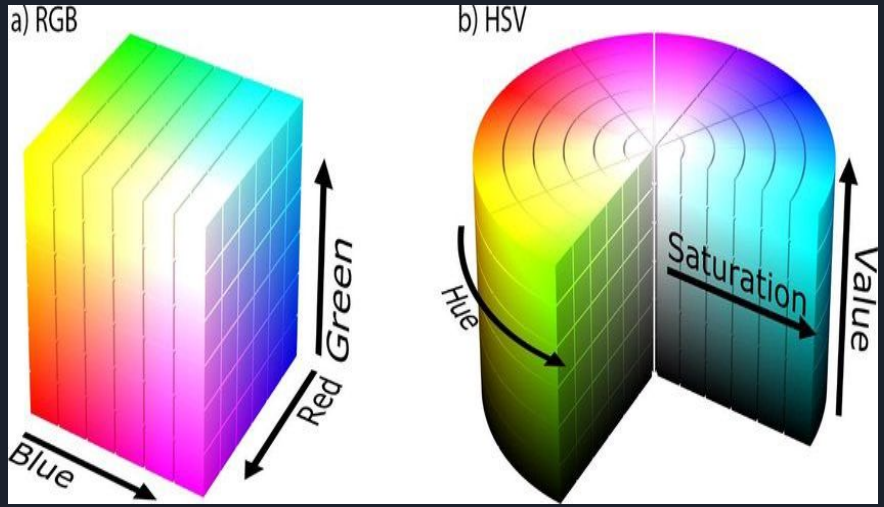
HSV Colourspace

HSV- HSV images have three components:

a. Hue (Dominant Wavelength Information)
b. Saturation (Purity or shades of the colour)
c. Value (Intensity)

Since there is only one variable giving the information about the colour, it is easier to segment images based on colour in the HSV space.

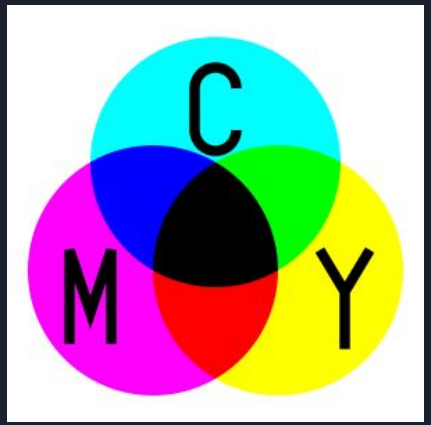
HSV is a transformation of an RGB color space, and its components and colorimetry are relative to the RGB color space from which it was derived.



CMYK Colourspace

CMYK uses subtractive color mixing used in the printing process, because it describes what kind of inks need to be applied so the light reflected from the substrate and through the inks produces a given color.

One starts with a white substrate (canvas, page, etc.), and uses ink to subtract color from white to create an image. CMYK stores ink values for cyan, magenta, yellow and black.



References and Sources

- Digital Image Processing - 4th edition - Gonzalez, C. Rafael • Woods, E. Richard
- https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_colorspaces/py_colorspaces.html#converting-colorspaces
- https://en.wikipedia.org/wiki/Color_space
- Google Images