Aim: To Processing Image with OpenCV3

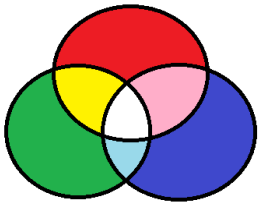
Objective: To Conversion between different color spaces, The Fourier Transformation , high pass filter, Low pass filter

Theory:

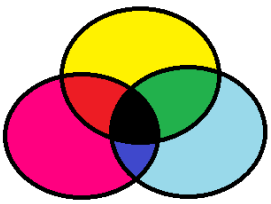
Converting between different color spaces

Color spaces are a way to represent the color channels present in the image that gives the image that particular hue. There are several different color spaces and each has its own significance. Some of the popular color spaces are RGB (Red, Green, Blue), CMYK (Cyan, Magenta, Yellow, Black), HSV (Hue, Saturation, Value), etc.

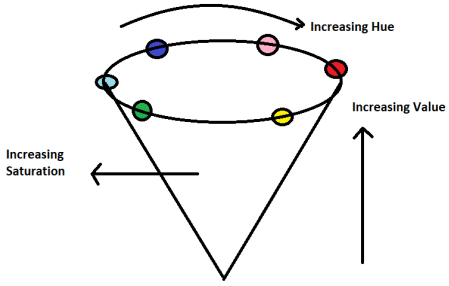
1) BGR color space: OpenCV's default color space is RGB. However, it actually stores color in the BGR format. It is an additive color model where the different intensities of Blue, Green and Red give different shades of color.



2) CMYK color space:Unlike RGB it is a subtractive color space. The CMYK model works by partially or entirely masking colors on a lighter, usually white, background. The ink reduces the light that would otherwise be reflected. Such a model is called subtractive because inks “subtract” the colors red, green and blue from white light. White light minus red leaves cyan, white light minus green leaves magenta, and white light minus



3) HSV color space:It stores color information in a cylindrical representation of RGB color points. It attempts to depict the colors as perceived by the human eye. Hue value varies from 0-179, Saturation value varies from 0-255 and Value value varies from 0-255. It is mostly used for color segmentation purposes.



The Fourier Transformation

The Fourier transform is a representation of an image as a sum of complex exponentials of varying magnitudes, frequencies, and phases. The Fourier transform plays a critical role in a broad range of image processing applications, including enhancement, analysis, restoration, and compression.

If f(m,n) is a function of two discrete spatial variables m and n, then the two-dimensional Fourier transform of f(m,n) is defined by the relationship:

$$F(\omega_1, \omega_2) = \sum_{m=-\infty}^{\infty} \sum_{n=-\infty}^{\infty} f(m,n) e^{-j\omega_1 m} e^{-j\omega_2 n}.$$

The Fourier Transform is an important image processing tool which is used to decompose an image into its sine and cosine components. The output of the transformation represents the image in the Fourier or frequency domain, while the input image is the spatial domain equivalent. In the Fourier domain image, each point represents a particular frequency contained in the spatial domain image.

High pass filter

Derivative masks are also called high pass filters.

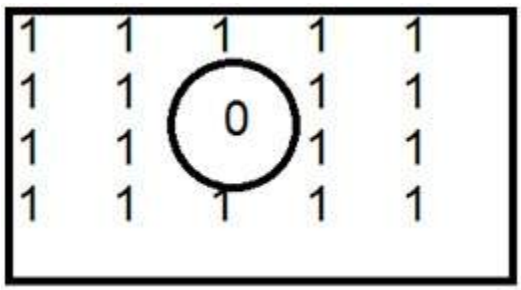
A derivative mask has the following properties.

1)A derivative mask have positive and as well as negative values

2)The sum of all the values in a derivative mask is equal to zero

3)The edge content is increased by a derivative mask

4)As the size of the mask grows , more edge content is increased



Eg : This is a common example of a high pass filter.

Low pass Filter

Blurring masks are also called as low pass filter

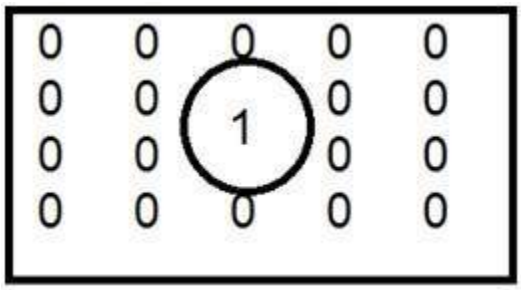
A blurring mask has the following properties.

1)All the values in blurring masks are positive

2)The sum of all the values is equal to 1

3)The edge content is reduced by using a blurring mask

4)As the size of the mask grow, more smoothing effect will take place



Eg : This is the common example of a low pass filter.

Conclusion: Low-pass and high-pass filters are two fundamental types of filters used in signal processing. These filters have opposite characteristics and are used to filter out unwanted frequency components from a signal and understand how to convert an image from one color space to another using the OpenCV library and since Images are non – periodic.Since the images are non periodic , the Fourier transform is used to convert them into frequency domains that we understand through this experiment.