Experiment: 02

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 space conversion is the translation of the representation of a color from one basis to another. This typically occurs in the context of converting an image that is represented in one color space to another color space, the goal being to make the translated image look as similar as possible to the original.

RGB -

The RGB color model is implemented in different ways, depending on the capabilities of the system used. RGB uses additive color mixing, because it describes what kind of light needs to be emitted to produce a given color. RGB stores individual values for red, green and blue. RGBA is RGB with an additional channel, alpha, to indicate transparency.

Common color spaces based on the RGB model include sRGB, Adobe RGB, ProPhoto RGB, scRGB, and CIE RGB.

CMYK -

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. There are many CMYK color spaces for different sets of inks, substrates,

and press characteristics (which change the dot gain or transfer function for each ink and thus change the appearance).

HSV -

HSV (hue, saturation, value), also known as HSB (hue, saturation, brightness) is often used by artists because it is often more natural to think about a color in terms of hue and saturation than in terms of additive or subtractive color components. 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.

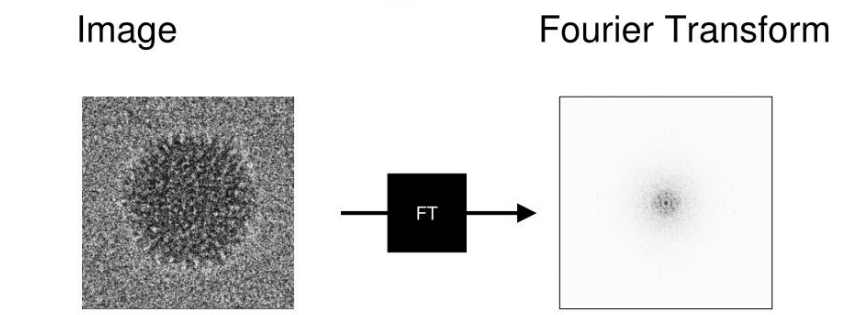
HSL -

HSL (hue, saturation, lightness/luminance), also known as HLS or HSI (hue, saturation, intensity) is quite similar to HSV, with "lightness" replacing "brightness". The difference is that the brightness of a pure color is equal to the brightness of white, while the lightness of a pure color is equal to the lightness of a medium gray.

YUV -

YUV is the most useful color space used in TV broadcast technology, image and video coding applications (codecs, cameras, camcorders) and many technical applications where color is necessary. For some reasons YUV was derived based on special requirements of color tv broadcasting over existing black and white tvs with compatibility in mind. Y channel carries the brightness of the scene and is typically used to replace the black and white image. U and V channels carry color value and saturation information.

The Fourier Transformation -



Fourier transforms is an extremely powerful mathematical tool that allows you to view your signals in a different domain, inside which several difficult problems become very simple to analyze. At a high level, the Fourier Transform will allow us to convert our data to a different form where we can easily pick and choose the most important components and remove all of the noise.

At a conceptual level, the Fourier Transform tells us what is happening in the image in terms of the frequencies of those sinusoids. For example, if we have a picture of a plain wall, the values of the pixels change very little as we go from left to right or from top to bottom. In the frequency domain that means that our image contains low frequencies, but no high frequencies.

On the other hand, if we have a picture of a picket fence, then the values of the pixels change all the time as we go from left to right. So in the Fourier domain we have high frequencies in the X direction, but not in the Y direction. Finally, if we have a picture of a checkerboard, then the pixel values change a lot in both directions. Thus the Fourier transform of the image will have high frequencies in both X and Y.

In Image processing, because the Fourier Transform tells us what is happening in the image in terms of the frequencies of those sinusoidal. For example, eliminating high frequencies blurs the image. Eliminating low frequencies gives you edges. And enhancing high frequencies while keeping the low frequencies sharpens the image.

Fast Fourier Transform is used extensively in image processing and computer vision. For example, convolution, a fundamental image processing operation, can be done much faster by using the Fast Fourier Transform. The Wiener filter, used for image deblurring, is defined in terms of the Fourier transform. But more importantly, even when the Fourier transform is not used directly, it provides a very useful framework for reasoning about the image processing operations.

High pass filter -

A high pass filter is the basis for most sharpening methods. An image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness. A high pass filter tends to retain the high frequency information within an image while reducing the low frequency information. The kernel of the high pass filter is designed to increase the brightness of the center pixel relative to neighboring pixels.

Low pass Filter -

The most basic of filtering operations is called "low-pass". A low-pass filter, also called a "blurring" or "smoothing" filter, averages out rapid changes in intensity. The simplest low-pass filter just calculates the average of a pixel and all of its eight immediate neighbors. The result replaces the original value of the pixel. The process is repeated for every pixel in the image.

Conclusion:

Two essential categories of filters used in signal processing are low-pass and high-pass filters. Since images are non-periodic, it is important to know how to transform a picture from one color space to another using the OpenCV library. These filters have opposite characteristics and are used to remove undesired frequency components from a signal.The Fourier transform is used to translate the images into frequency domains, which we can comprehend from this experiment, because they are not periodic.