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

This technique is critical for image processing, computer graphics, printing, and other applications where colour representation must be consistent across multiple contexts. .Color spaces are different ways of representing colors in an image. The most commonly used color spaces are RGB (Red Green Blue), HSV (Hue SaturationValue), and CMYK (Cyan Magenta Yellow Black).

RGB: The RGB colour space is the most often used colour space in electronic displays and digital imaging. Colours are represented as mixtures of red, green, and blue light. The intensity of each channel dictates the brightness of the colour. It's additive, which means that combining all three channels at full intensity yields white..

HSV: HSV colour representation consists of three components: hue, saturation, and value. The primary wavelength of the colour is defined by hue, the intensity or vividness of the colour is measured by saturation, and the brightness is represented by value. HSV is frequently preferred due to its perceptual relevance, which makes it easier to alter colour qualities intuitively.

CMYK: In colour printing, CMYK is commonly used. It is an abbreviation for cyan, magenta, yellow, and black (key). Colours are formed by subtracting light wavelengths from white in a subtractive colour model. In print, the combination of these colours produces a wide range of hues.

The Fourier Transformation

The Fourier Transform is a mathematical operation that transforms a signal (in this example, an image) from the spatial domain to the frequency domain. In the context of pictures, the 2D Fourier Transform analyses the frequency components of the image. It's particularly good for filtering, compression, and noise reduction. In image processing, the Fast Fourier Transform (FFT) is widely used to efficiently compute the Fourier Transform of an image. The resulting converted picture (commonly referred to as the frequency domain representation) is made up of complex numbers that reflect the amplitude and phase of various frequencies present in the image.

High pass filter

A high-pass filter is a signal processing tool that allows high-frequency components of a signal to pass through while attenuating or reducing low-frequency componentsHigh-pass filters work by amplifying variations in intensity between neighboring pixels. This filtering technique is essential for tasks like sharpening images and extracting features like edges and textures. High-pass filters are a fundamental tool in both image enhancement and analysis applications.

Low pass Filter

Low-pass filters enable low-frequency signal components to pass through while reducing high-frequency components. They are used for noise reduction, smoothing, and anti-aliasing in various domains such as audio, image processing, and control systems. Filters have a cut-off frequency determining the transition point, and different types like Butterworth and Chebyshev offer specific response characteristics. In the digital realm, algorithms like FIR filters implement digital low-pass filtering. Overall, low-pass filters are essential tools for emphasizing desired signal aspects while mitigating noise and high-frequency disturbances.

Conclusion:

Finally, these concepts serve as the foundation for image processing using OpenCV3. We can conduct a variety of tasks such as colour alteration, frequency analysis, and image enhancement by learning and implementing these approaches. Colour space conversion helps in the manipulation of colour information, the Fourier Transform reveals frequency content, and high/low-pass filters aid in the enhancement or reduction of certain visual elements.