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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 different ways of representing colors in an image. The most commonly used color spaces are RGB (Red Green Blue), HSV (Hue Saturation Value), and CMYK (Cyan Magenta Yellow Black).

RGB: This is the most common color space, where each pixel is represented as a combination of red, green, and blue components. It is suitable for displays and cameras as they work with red, green, and blue light.

HSV: HSV represents colors based on their perceived attributes: hue, saturation, and value. Hue corresponds to the dominant wavelength of light, saturation controls the purity of the color, and value represents the brightness.

CMYK: CMYK is mainly used for printing. It represents colors using the combinations of cyan, magenta, yellow, and black inks. It's a subtractive color model, unlike RGB which is additive.

The Fourier Transformation

The Fourier Transform is a mathematical operation that transforms a signal (in this case, an image) from the spatial domain to the frequency domain. In the context of images, the 2D Fourier Transform analyzes the frequency components present in the image. It's particularly useful for tasks like filtering, compression, and noise reduction. In image processing, the Fast Fourier Transform (FFT) is commonly used to efficiently compute the Fourier Transform of an image. The resulting transformed image (often called the frequency domain representation) consists of complex values representing the magnitude and phase of various frequencies present in the image.

High pass filter

A high-pass filter is used to enhance the edges and fine details in an image by allowing high-frequency components to pass through while attenuating the low-frequency components. This helps in sharpening the image and highlighting the fine structures. High-pass filtering is useful for tasks like edge detection and emphasizing texture.

Low pass Filter

A low-pass filter does the opposite of a high-pass filter. It allows low-frequency components to pass while attenuating high-frequency components. This is useful for tasks like blurring and noise reduction. Low-pass filtering can help in smoothing out an image and reducing noise, making it more suitable for further processing or analysis.OpenCV provides functions like cv2.filter2D() and cv2.GaussianBlur() to apply both high-pass and low-pass filters to images.

Conclusion:

In conclusion these concepts provide the foundational knowledge for image processing using OpenCV3. By understanding and applying these techniques, we can perform a wide range of tasks including color manipulation, frequency analysis, and image enhancement. Converting between color spaces helps to manipulate color information, the Fourier Transform reveals frequency content, and high/low-pass filters help to enhance or reduce specific image features.