Experiment No. 2
Processing image with opencv 3
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Aim: Processing image with opencv 3

Objective: : Conversion between different color space, the fourier transform,high/low pass filters

Theory:

Open cv is a library function of programming language for processing mainly real time computer vision originally developed by intel .

Opencv3 is compatible with windows,Linux,Android,IOS,Blackberry os.

conversion between color space:

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).open cv's default color space is RBG but it is stored as BGR format as it give different colors of red, green, blue. There are more than 150 color-space conversion methods available in OpenCV. For color conversion, we use the function cv.cvtColor(input_image, flag) where flag determines the type of conversion. For BGR → Gray conversion, we use the flag cv.COLOR_BGR2GRAY. Similarly for BGR → HSV, we use the flag cv.COLOR_BGR2HSV. CSDL7011 : Machine Vision Lab The fourier transform

The Fourier transform maps a signal into its component frequencies. It does not change the original signal, only its representation. It is an extremely useful operator used in many fields

$$X(\omega) = \int_{-\infty}^{\infty} x(t) e^{-i\omega t}\, dt$$

Low pass filter: In machine vision, a low-pass filter is a common image processing technique used to enhance or extract certain features from an image while reducing noise or removing high-frequency components. The purpose of a low-pass filter is to smooth the image by attenuating high-frequency variations or rapid changes in pixel intensity, which are often associated with noise or unwanted details. Low-pass filters work by averaging pixel values in the neighborhood of each pixel in the image. The result is a new image with reduced noise and enhanced structural features. The size of the neighborhood, known as the kernel size or filter size, determines the extent of smoothing. The most basic low-pass filter is the mean filter, where each pixel in the output image is set to the average value of its neighboring pixels within the kernel. Other types of low-pass filters include Gaussian filters and median filters, each having different effects on the image. Choosing the appropriate low-pass filter depends on the specific application and the nature of the noise or unwanted components in the image. It's essential to strike a balance between noise reduction and preserving relevant information in the image.

High Pass Filter: A high-pass filter is an image processing technique that emphasizes the high-frequency components of an image while suppressing the low-frequency information. High-pass filtering is used to highlight edges, textures, and other fine CSDL7011 : Machine Vision Lab details in an image while reducing the influence of smooth and slowly varying regions. The primary purpose of a high-pass filter is to sharpen an image and enhance its local contrast by accentuating the transitions in pixel intensity. This can be beneficial for various computer vision tasks, such as edge detection, feature extraction, and image segmentation. High-pass filtering should be used with caution as it can amplify noise and other unwanted artifacts in the image. To avoid noise amplification, it is common to apply some form of noise reduction or smoothing (e.g:Gaussian filtering) before applying high-pass filtering.

Conclusion:

OpenCV 3 provides a robust toolkit for diverse image processing tasks, encompassing filtering, transformations, edge detection, object recognition, and more. Its user-friendly interface and thorough documentation facilitate accessible implementation of complex algorithms, spanning industries like healthcare and entertainment. OpenCV 3's foundational role in advancing computer vision remains relevant, serving as a crucial stepping stone for mastering image processing, while its evolution in OpenCV 4 and beyond promises continued innovation. Harnessing the capabilities of OpenCV 3 empowers individuals to push boundaries in image processing and computer vision, driving technological progress.