Vidyavardhini's College of Engineering & Technology Department of Computer Engineering

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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

There are literally hundreds of methods in OpenCV that pertain to the conversion of color spaces. In general, three color spaces are prevalent in modern day computer vision: gray, BGR, and Hue, Saturation, Value (HSV).

Gray is a color space that effectively eliminates color information translating to shades of gray: this color space is extremely useful for intermediate processing, such as face detection.

BGR is the blue-green-red color space, in which each pixel is a three-element array, each value representing the blue, green, and red colors: web developers would be familiar with a similar definition of colors, except the order of colors is RGB.

In HSV, hue is a color tone, saturation is the intensity of a color, and value represents its darkness (or brightness at the opposite end of the spectrum).

The Fourier Transformation

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.

The Fourier Transform is used in a wide range of applications, such as image analysis, image filtering, image reconstruction and image compression. In this blogpost, we will be creating an application with GUI, through which we would be able to make changes to the given image by making changes to its frequency domain.

High pass filter

A high pass filter (HPF) is a filter that examines a region of an image and boosts the intensity of certain pixels based on the difference in the intensity with the surrounding pixels. HPF filters help in finding edges in the images.

Take, for example, the following kernel:
[[0, -0.25, 0],
[-0.25, 1, -0.25],
[0, -0.25, 0]]

A kernel is a set of weights that are applied to a region in a source image to generate a single pixel in the destination image. For example, a ksize of 7 implies that 49 (7 x 7) source pixels are considered in generating each destination pixel. We can think of a kernel as a piece of frosted glass moving over the source image and letting through a diffused blend of the source's light.

After calculating the sum of differences of the intensities of the central pixel compared to all the immediate neighbors, the intensity of the central pixel will be boosted (or not) if a high level of changes are found. In other words, if a pixel stands out from the surrounding pixels, it will get boosted.

This is particularly effective in edge detection, where a common form of HPF called high boost filter is used

Low pass Filter

Low pass filtering (aka smoothing), is employed to remove high spatial frequency noise from a digital image. The low-pass filters usually employ a moving window operator which affects one pixel of the image at a time, changing its value by some function of a local region (window) of pixels. The operator moves over the image to affect all the pixels in the image.

Conclusion:

Successful completion of the experiment understanding the importance of image processing techniques in machine vision applications. The understanding of color space conversion,fourier transformation,high pass filter,low pass filter.