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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:

1. Converting between different color spaces:

A color space is a specific organization of colors. In combination with color profiling supported by various physical devices, it supports reproducible representations of color. It can be easily done using OpenCV. There are more than 150 color-space conversion methods available in OpenCV. But most widely used ones: BGR \leftrightarrow Gray and BGR \leftrightarrow HSV.

Example:

#Converting From RGB to HSV

```
img = io.imread(path)
```

```
rgb_img = img
```

```
hsv_img = rgb2hsv(rgb_img)
```

2. The Fourier Transformation:

The Fourier transform is a powerful tool for analyzing signals and is used in everything from audio processing to image compression. SciPy provides a mature implementation in its `scipy.fft` module. The Fourier transform is a crucial tool in many applications, especially in scientific computing and data science. As such, SciPy has long provided an implementation of it and its related transforms.

Example:

```
#Fourier Transform Example
from scipy.fft import fft, fftfreq
N = SAMPLE_RATE * DURATION
yf = fft(normalized_tone)
xf = fftfreq(N, 1 / SAMPLE_RATE)
```

3. High pass filter:

A high pass filter is a technique used to enhance or extract the high-frequency components of an image while suppressing the low-frequency components. High-frequency components represent the fine details and edges in an image, making them crucial for tasks such as edge detection and sharpening. It works by attenuating the low-frequency components and preserving or amplifying the high-frequency components. This can be achieved by convolving the image with a high pass filter kernel, also known as a high pass filter mask or a sharpening filter.

Example:

```
#Implementing High Pass Filter In Python
from scipy.ndimage import convolve
kernel = np.array([[0, -1, 0],[-1, 4, -1],[0, -1, 0]])
filtered_image = convolve(gray_image, kernel)
```

4. Low pass Filter:

A Low-Pass Filter is used to remove the higher frequencies in a signal of data. It passes signals with a frequency lower than a certain cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency.

Conclusion:

In this experiment, we explored various image processing techniques in OpenCV3. We explored different techniques for conversion between different color spaces which includes RGB to HSV and vice-versa conversion and also The Fourier Transformation, High pass and Low pass filtering methods for smoothing of image.