High Pass,Low Pass and Band Pass Filter using Fourier Transform

By - Team Curioners

28^{th} October 2021

Contents

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0.1 Abstract

We have written the code of high pass filter,low pass and band pass filter using fourier transformation and we applied these techniques on the real time images that we captured using our laptop webcam. Every time we capture the image we call the functions high pass,low pass and bandpass filters which we have created. We have created these three functions for each of the filtering. We are explaining each of the function one by one:

0.2 High Pass Filter

A high pass filter is the basis for most sharpening methods. An image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness. A high pass filter tends to retain the high frequency information within an image while reducing the low frequency information. The kernel of the high pass filter is designed to increase the brightness of the center pixel relative to neighboring pixels.

0.2.1 Approach

In this Function we have first read the image that we have captured. Then, we converted it into the fourier transformed image of the input image using dft function of opencv library further shifting the image using dftshift function otherwise it starts from at the top left corner. We have taken the magnitude of all the complex output given by the dft function because we got the complex output and it is only for showing the output. Then, we created a mask of circle shape because the distribution of frequency is equally spreaded and in the mask area we have assigned it value zero and all the values other than mask area to one and by using this masking on the fourier image we have emitted the low frequency and only the high frequency remained in the fourier image. Then, we have used idft function of open cv to inverse the fft masked image to normal grayscale image and we plotted these images. Finally, we can see all the low frequency components are removed from the image and only the high frequency components, mainly the edges are showed in the output image. Basically, it is used as an edge detection for the input image.

0.2.2 Result

Refer Figure 1

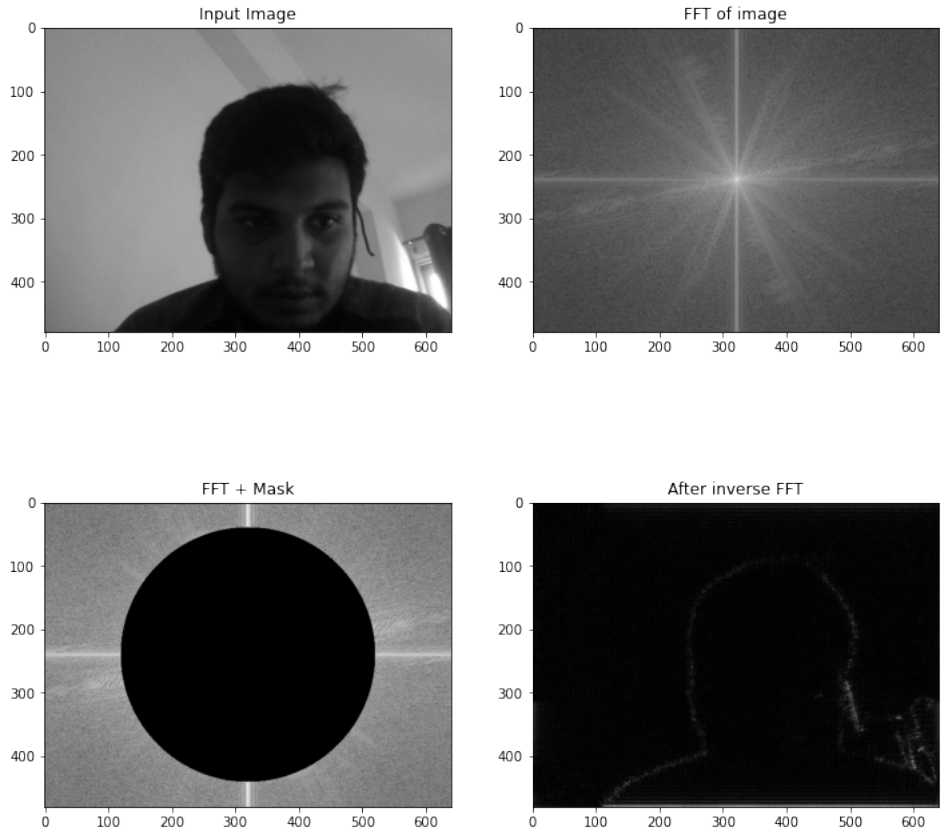

Figure 1: Result: High Pass Filter

0.3 Low Pass Filter

A low pass filter is the basis for most smoothing methods. An image is smoothed by decreasing the disparity between pixel values by averaging nearby pixels. Using a low pass filter tends to retain the low frequency information within an image while reducing the high frequency information.

0.3.1 Approach

In this Function we have first read the image that we have captured and then we convert it into the fourier transform image of the input image using dft function of opencv library and then shift the image using dftshift function otherwise it starts from at the top left corner then we have taken the magnitude of all the complex output given by the dft function because we have got the complex output and it is only for showing the output and then we create a mask of circle shape because the distribution of frequency is equally spreaded and in the mask area we have given the value to this one and all the values other than mask area to zero and by using this masking on the fourier image we have emitted the high frequency and low frequency remained in the fourier image and then we have used the idft function of open cv to inverse the fft masked image to normal grayscale image and the we plot these images and we see all the high frequency components are removed from the image and only the low frequency components remained in the image it means it gives smoothing effect and the noise are removed from the input image.

0.3.2 Result

Refer Figure 2

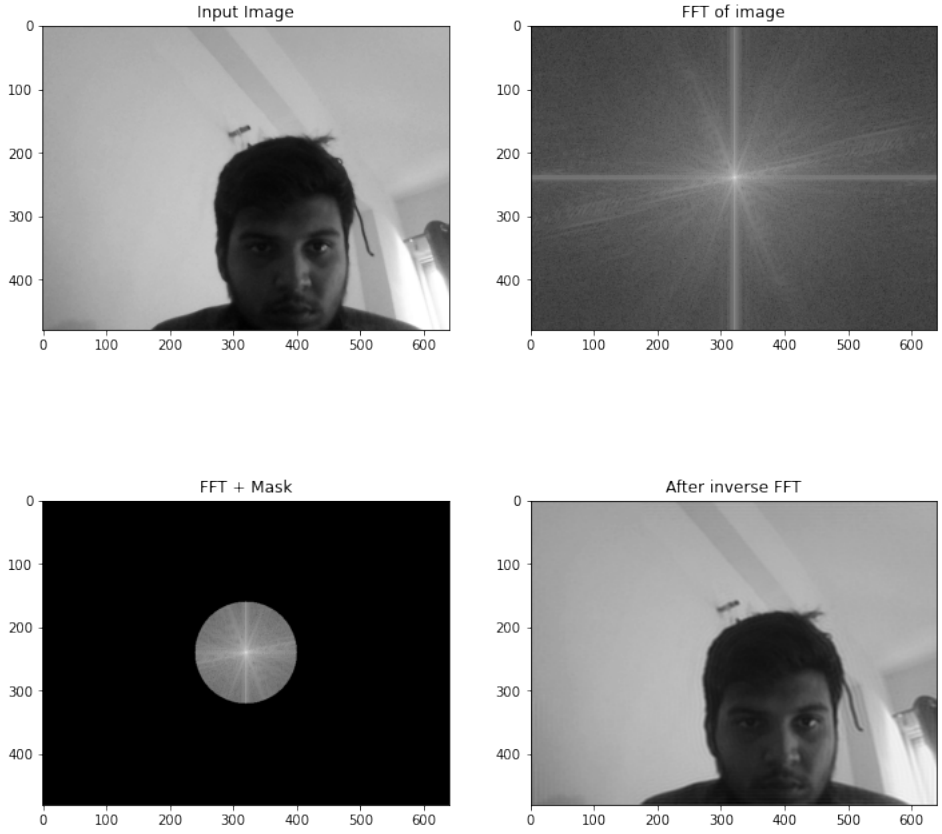

Figure 2: Result: Low Pass Filter

0.4 Band Pass Filter

Band-pass filters attenuate signal frequencies outside of a range (band) of interest. In image analysis, they can be used to denoise images while at the same time reducing low-frequency artifacts such as uneven illumination. Band-pass filters can be used to find image features such as blobs and edges.

0.4.1 Approach

In this we try to create a band filter where we filter a band of frequencies. For this first we create two concentric circles. Inner circle has radius 10 pixel and outer circle has radius of 80 pixels. Then we created masking layer by taking 'and' of two masks, first mask with all points whose distance from center is greater than 10 pixel and the second mask with all points whose distance from the center is less than 80 pixels. The final mask will have value of all points between the two concentric circles as 1 and rest all 0 .Then we multiplied it with our shifted discrete fourier transformed image. Then we converted the image back from the frequency domain to image domain. This mask masks out both low frequency as well as high frequency.

0.4.2 Result

Refer Figure 3

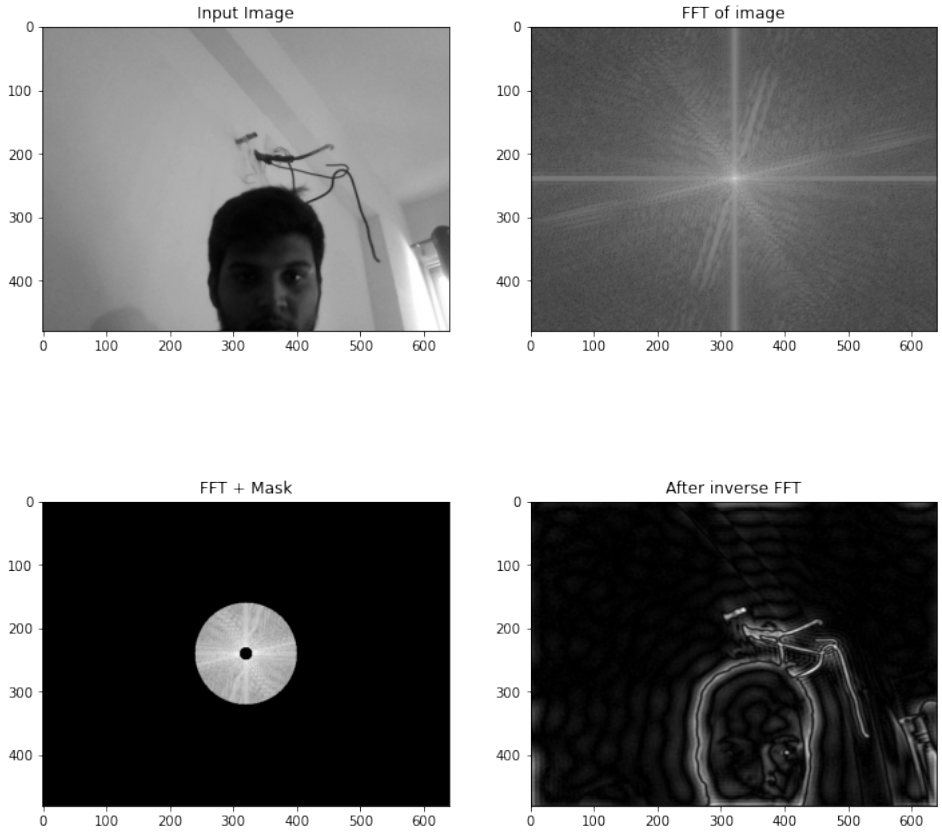

Figure 3: Result: Band Pass Filter