

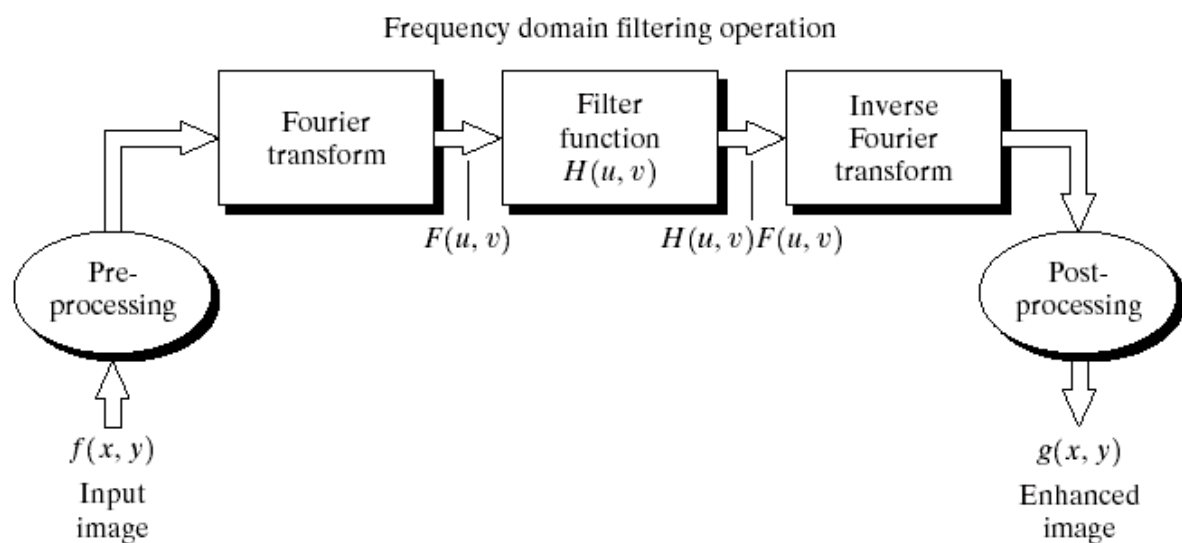
LAB-08: Frequency Domain and Image Analysis in Frequency Domain-II

Objective:

The objective of this lab is to apply different filters on images in frequency domain.

Theory:

As discussed before, applying a filter on an image involves the following steps:



We only need to define the filter that we need to apply on the image of whose Fourier Transform has been taken.

Some Useful Commands:

No new commands are needed for this lab.

Lab Tasks:

Lab Task 1:

Create an ideal low pass filter using the distance map. The size of the distance map should be equal to the size of the image. Now using this low pass filter, create an ideal high pass filter. This can be achieved by subtracting the low pass filter from 1. Take DFT of the Fig01.tif and

multiply the transformed image and the high pass filter. Take inverse DFT of the image and display the results.

Lab Task 2:

Create Gaussian low pass filter by using the following equation:

$$H(x, y) = e^{-D^2(x,y)/2\sigma^2}$$

Where σ is standard deviation of the filter.

Now, create a Gaussian high pass filter using the following equation:

$$H_{hp} = \max(H_{lp}) - H_{lp}$$

Apply both the low pass and high pass filter to the image Fig01.tif and display the results.

Lab Task 3:

Filters that are created in spatial domain can be applied in frequency domain. In order to do that, DFT of both the image and filter is to be taken, dot multiplied in the frequency domain and then converted back to spatial domain. Before converting both the image and the filter in frequency domain, their size has to be made the same. This can be done by making the size of both the image and filter equal to:

$$(\text{Image size} + \text{Filter Size}) - 1$$

And placing the image and the filter in the top left corner.

Create a Gaussian filter of 9x9 in spatial domain. Then after making sure that the size of the image and the filter is same (in accordance to the above formula) convert them both into frequency domain. Dot multiply the image and the filter in frequency domain and then convert them back to spatial domain to check the effects.

Also display the Gaussian filter in frequency domain.

Conclusion:

This lab has given an introduction of Fourier transform for image processing and application of different filters for image enhancement.