CS663 Assignment 5 Question 4 Report

Shreya Laddha, Archishman Biswas, Shreyan Jabade, Rishabh Arya

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1 Overview

In this part, we have compared the effects of applying a Gaussian LPF and an ideal LPF on the final image obtained. The code used and results obtained are explained below.

2 Algorithm implementation

In the first section we have simply calculated the FT of the given image. Then in the following two sections the frequency response of the ideal LPF and the Gaussian LPF are obtained. The frequency response for the ideal LPF is taken as:

$$H_{ideal}(u,v) = 1; u^2 + v^2 \leq D$$

and, the frequency response for the Gaussian LPF is taken as:

$$H_{gauss}(u,v) = exp(-\frac{u^2+v^2}{2\sigma^2})$$

Finally, in the next two sections, the output images are obtained using the ifft2() routine. The images are obtained for two parameters D1 = 40 and D2 = 80 in both kind of filters.

3 Results

The Fourier transform of the image in the log magnitude scale is shown in below figure 1:

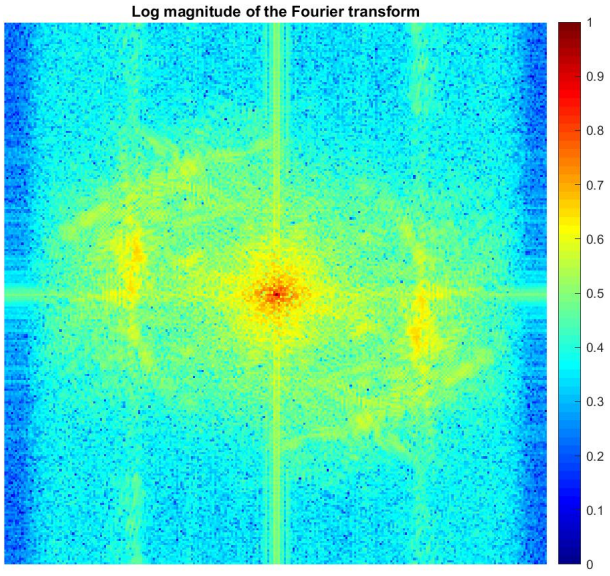

Figure 1: Log magnitude of FT of original image

3.1 Frequency response

The frequency response obtained for the ideal low pass filter is shown in the below figure:

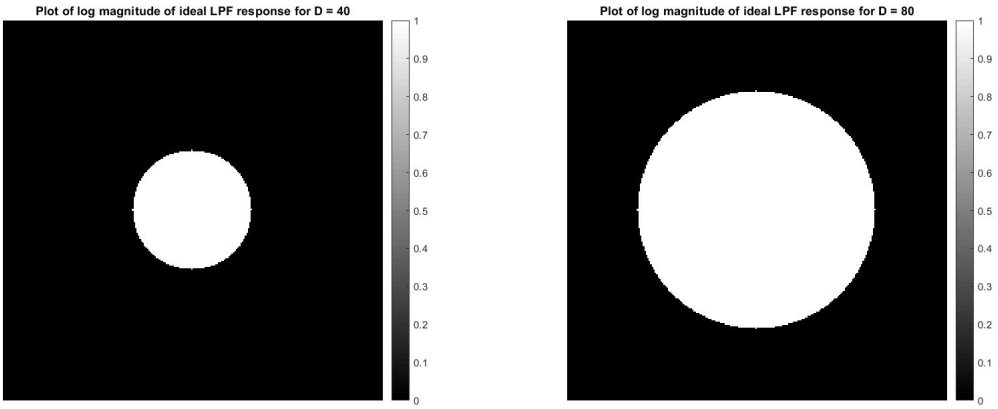

Figure 2: Frequency response of ideal LPF

The frequency response obtained for the Gaussian low pass filter is shown in the below figure:

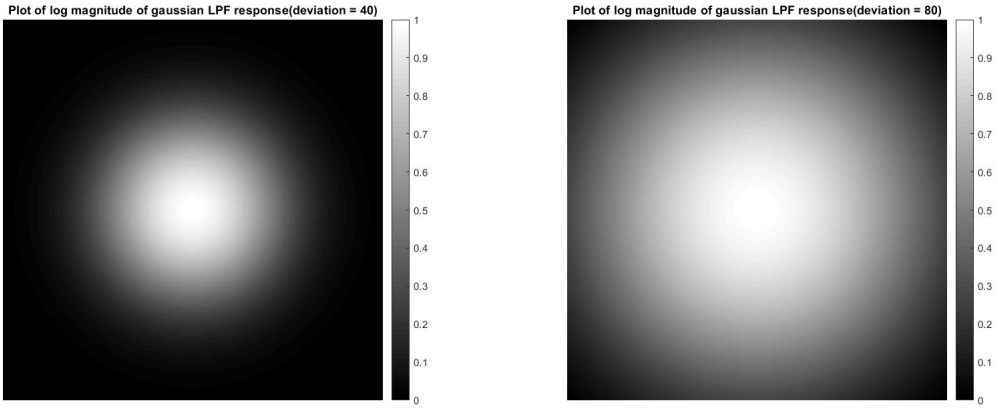

Figure 3: Frequency response of Gaussian LPF

Thus from the figures above, we can observe that both the filters will preserve the lower frequencies and hence will cause blurring in the output images. But, as the ideal response has discontinuity, we will see ringing artifacts in the output image.

3.2 Output images

The output image we obtain for the ideal LPF are shown in the below figures:

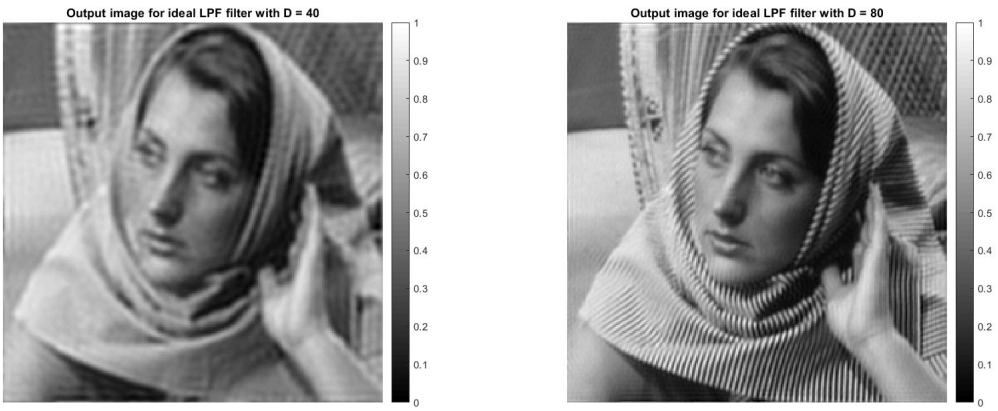

Figure 4: Output images of ideal LPF

As, we can see that there are very prominent ringing artifacts in the first image(i.e. for D = 40). These artifacts are also present in the output for D = 80, but are much insignificant.

The output image for the Gaussian LPF are plotted in the below figure:

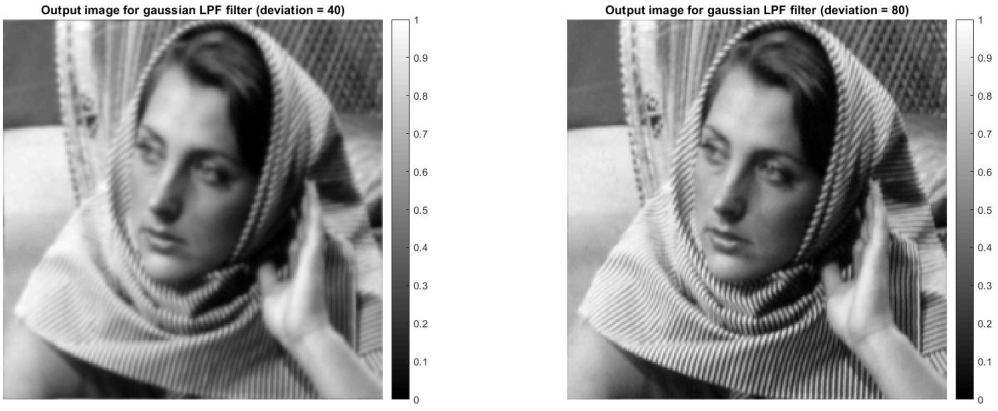

Figure 5: Output images of Gaussian LPF

We can observe in the above diagrams that the blurring effect due to both ideal LPF and Gaussian LPF are similar. But there is presence of ringing artifacts in the ideal LPF. For the second images in both the filters there is very less blurring. This is due to case that for D = 80, we take in almost all the frequencies.