CS663, Assignment 5 **Yash Sanghvi, Pradyot Prakash**
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Question 3

Problem Statement

Consider the barbara256.png image from the homework folder. Implement the following in MATLAB: (a) an ideal low pass filter with cutoff frequency D 40, 80, (b) a Gaussian low pass filter with 40, 80. Show the effect of these on the image, and display all images in your report. Display the frequency response (in log Fourier format) of all filters in your report as well. Comment on the differences in the outputs. Make sure you perform appropriate zero-padding! [20 points]

Explanation

An ideal low pass filter is one which does not allow any high frequencies to pass through above a radius 'D'. We achieved this by multiplying the fourier transform of the image with a circular window of radius 'D' centered at the origin.

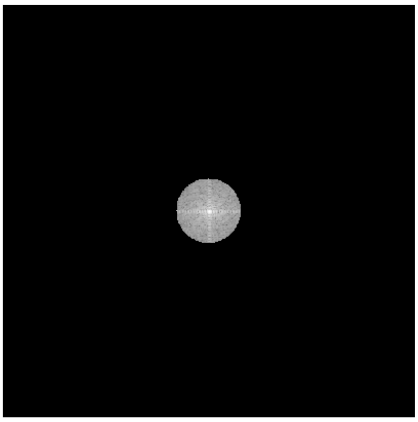

Figure 1: Ideal low pass filter with D = 40

This image is understandably bad because higher frequencies are needed for the formation of edges. Without them the image is averaged out as is the case here.

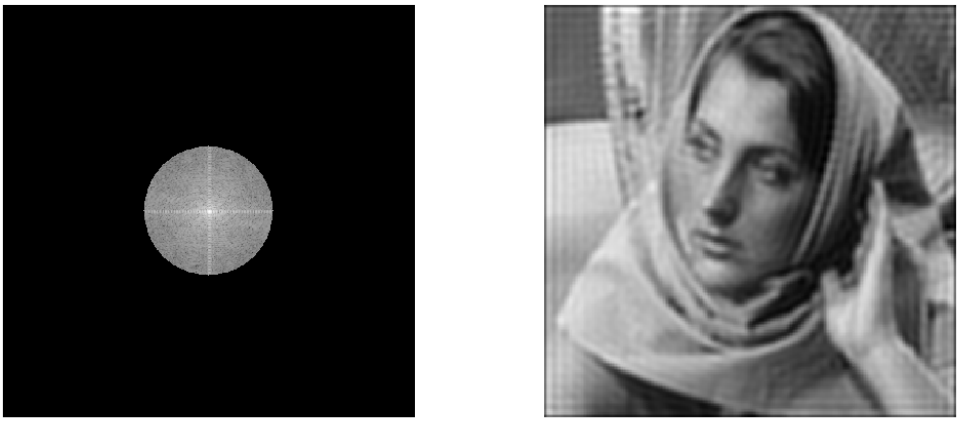

Figure 2: Ideal low pass filter with D = 80

This image looks way better compared to the previous image. More higher frequencies are present so more edges were able to be formed. However, there are lines present because a cross section of the fourier transform looks somewhat like the box-function and the box-function is known to give sinc on performing the inverse transform. This image looks similar to the first image but worse compared to the second image. The function decays uniformly and hence ringing artifacts are not present as compared to the first or the second image.

This image is better than the previous image due to inclusion of more higher frequencies. Also, it lacks the ringing artifacts as present in the second image. The inverse transform of the gaussian function is gaussian itself. The gaussian function decays uniformly and hence the artifacts are not present.

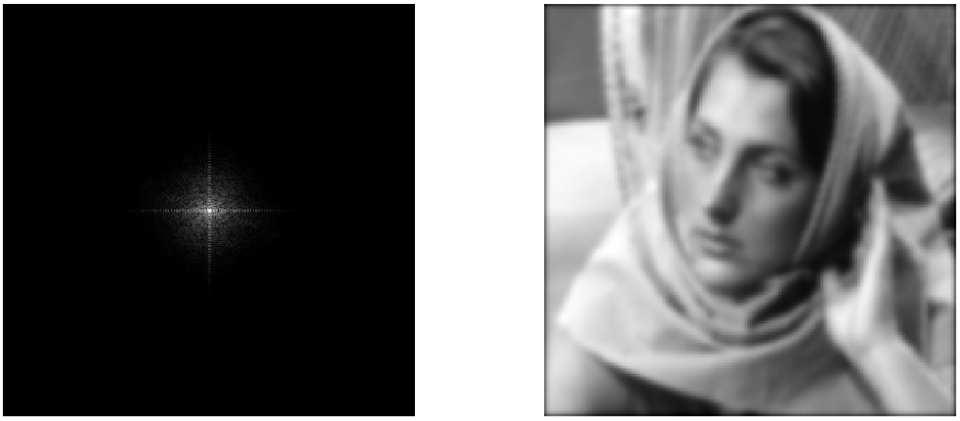

Figure 3: Gaussian low pass filter with $\sigma = 40$

Figure 4: Ideal low pass filter with $\sigma = 80$