Practical Exercises for Image Processing

Exercise C

C1. By using ‘fft2’ , take the Fourier transform of Lena image. Now by using ‘fftshift’, shift the zero-frequency to the centre and display the result.

C2. By using ‘dct2’, calculate the discrete cosine transform of the Lena image.

C3. By using ‘fft2’, compute the discrete Hartley transform of the Lena image.

C4. Compose a Gaussian filter with standard deviation of 10 in a grid with the same size of the Lena image. Now add some Gaussian noise (with standard deviation of 20) to the Lena image by using ‘randn’ command.

A) By using ‘conv2’ command in matlab, filter the noisy Lena image by convolving the filter with the noisy image and display the result.
B) Now increase the standard deviation of the filter to 20 and 30, what do you observe and why?
C) Then decrease the standard deviation of the filter to 5 and 3, what results do you get and why?

C5. Take the Fourier transform of the noisy Lena image and the Gaussian filter in C4A (by using ‘fft2’). By multiplying (pixel by pixel) the Fourier transform of the Gaussian filter by the Fourier transform of the noisy Lena image and taking the inverse Fourier transform of the result (the product), you can produce the image filtered by the Gaussian filter you have created for C4A. In order to ensure that your calculations are correct, you need to check the imaginary parts of the output of the inverse Fourier transform. Your calculations are correct, if all imaginary parts of all pixels calculated from the inverse Fourier transform are zero. Otherwise you need to correct your calculations. Now repeat C4B and C4C by using the Fourier transform method in C5. Is there a difference between the methods discussed in C4 and C5.

C6. Filter the noisy Lena image with an averaging filter (Box function) with sizes of 5x5, 10x10 and 20x20 with two methods discussed in C4 and C5.

C7. By using ‘medfilt2’, filter the noisy Lena image with a 3x3, 5x5 and 7x7 median filters.

C8. Add a uniform noise to the Lena image by using ‘rand’, and repeat C4, C6 and C7.