Instructions:

You can see the code for doing some basic MATLAB operations with images in the Implementation Notes section.

Each student is required to submit an individual report of the project.

Problem 1:(30 points, 2 pages max)

The objective of this part of the project is to understand image filtering in spatial and frequency domains.

You can read the images required for this problem into MATLAB by loading the attached mat file using load('DIP1.mat');

P1.1: Read the image `'cameraman.tif'`. This image is copied in your MATLAB directory when you install MATLAB. Find the 2D FFT of this image and display it. Make sure your axis of the FFT are labeled. You'll get no credit if the FFT frequencies are not labeled.

P1.2: Read the image `'Cam1b.tif'` and display it. This image is of the same cameraman except it is distorted by a pattern. Recover the original cameraman image(with no distortions) from this distorted one.
Explain the procedure you used to recover the original image.

P1.3: (a) Load the built-in image `'coins.png'` and apply the filter $\frac{1}{9}\begin{bmatrix}1 & 1 & 1\\ 1 & 1 & 1\\ 1 & 1 & 1\end{bmatrix}$ to it using `imfilter` MATLAB command. Display the output and explain what the filter did.
(b) Apply the same filter to this image but now in frequency domain. By making use of the convolution property, use the 2D FFTs of the image and the filter to explain what the filter did.

P1.4: Read the image `'Cam1d.tif'` and display it. The image is visibly distorted. Is there a way you can still restore the original cameraman image?

Hint: Image has been multiplied with a cosine image.

Implementation Notes

MATLAB has an extensive help available online. If some MATLAB command is missing here, or for more details on any of these commands, you can use MATLAB's help at www.mathworks.com

```
f=imread('MyImageFileIn.tif');% Read an image file

imwrite(f,'MyImageFileOut.tif');% Write an image file

imagesc(f);colormap(gray);colorbar;% Display an image
imshow(f);% Display an image

hist(f(:),[0:255]);% Display histogram of the read image

grayimg=rgb2gray(colorimg);% Convert a color image to gray
scale

Filt=[0,1,0;1,0,1;0,1,0];
g=imfilter(f,Filt);% Filter an image f to produce g

F=fft2(f);
F=fftshift(F);
imagesc(abs(F))% Find 2D FFT F(u,v) of an image f(x,y)
 % Sometimes the dynamic range of FFT is too large, so you may
see one or two impulses only while actually there is more.  To
see such a FFT, use imagesc(log(abs(F))) to squeeze the dynamic
range.

fr=ifft2(ifftshift(F));
imagesc(abs(fr))% Find Inverse 2D FFT fr(x,y) of a 2D FFT
F(u,v)

surf(X,Y,Z)% Plot a surface Z = f(X,Y)

imhist(f) or hist(f(:))% Plot histogram of image f
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