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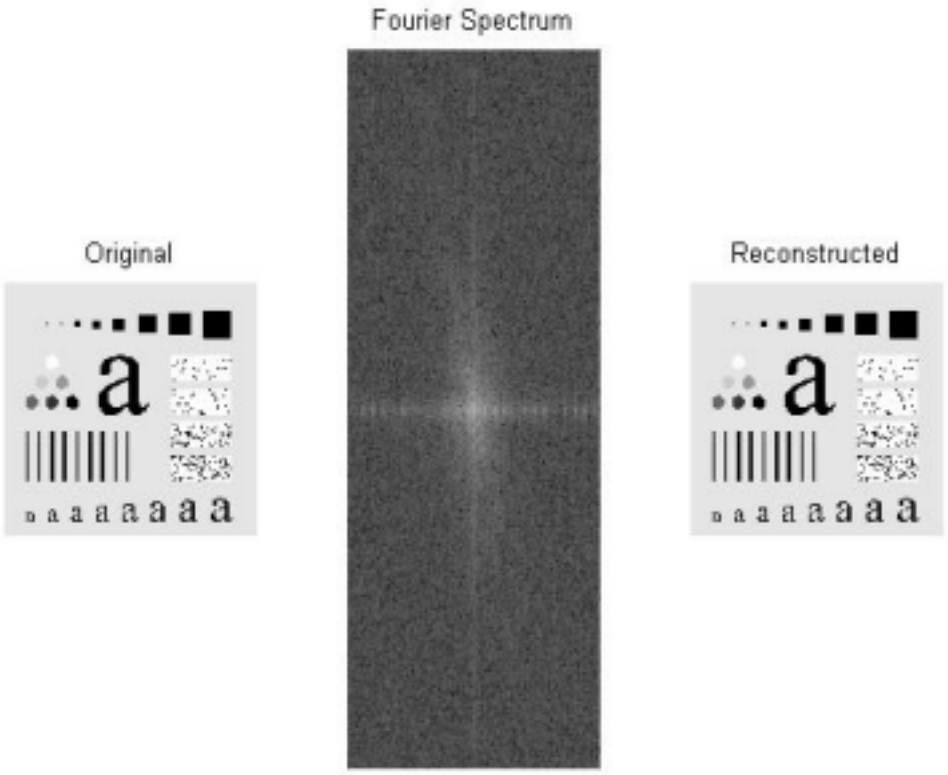
3. Exercises

Exercise1: Apply FFT and IFFT.

```
%ex1.m
close all
clear
clc
%====================================
% 1) Displaying the Fourier Spectrum:
%====================================
I=imread('Lab8_1.jpg');
I=im2double(I);
FI=fft2(I); %(DFT) get the frequency for the image
FI_S=abs(fftshift(FI));%Shift zero-frequency component to center
of  img_spectrum.
I1=ifft2(FI);
I2=real(I1);
subplot(131),imshow(I),title('Original'),
subplot(132),imagesc(0.5*log(1+FI_S)),title('Fourier Spectrum'),axis
off subplot(133),imshow(I2),title('Reconstructed')
%imagesc: the data is scaled to use the full colormap.
```


Output:



Exercise2: Apply lowpass filter.

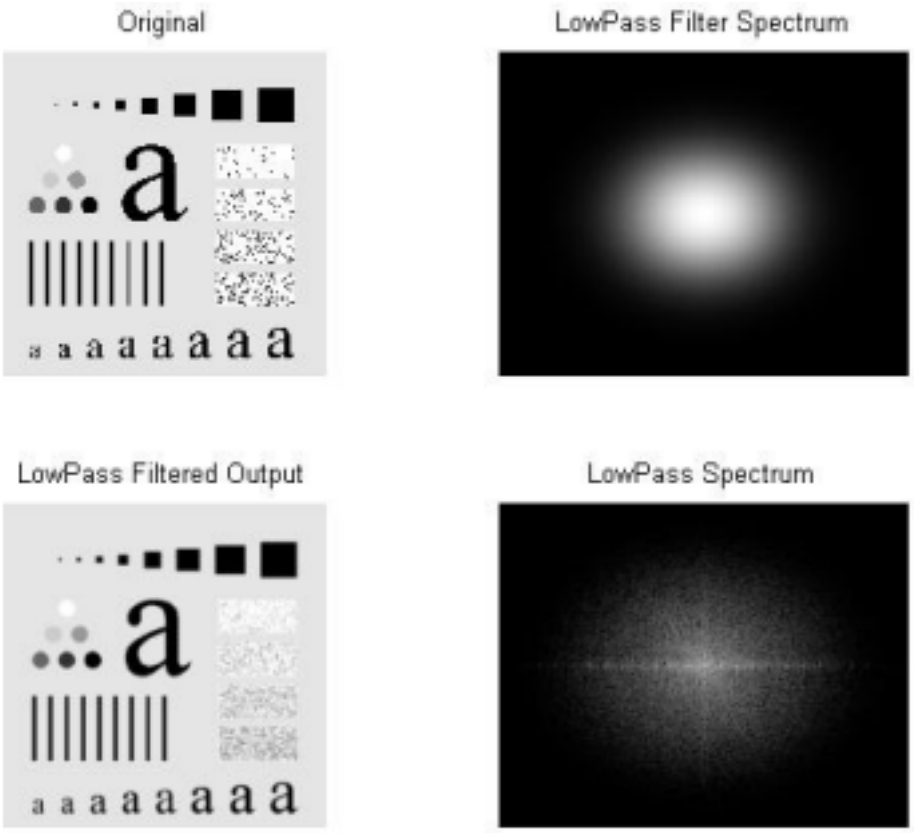
```
%ex2.m
close all
clear
clc
%============================
% 2) Low-Pass Gaussian Filter:
%============================
I=imread('Lab8_1.jpg');
I=im2double(I);
FI=fft2(I); %1.Obtain the Fourier transform
LP=fspecial('gaussian',[11 11],1.3); %2.Generate a Low-Pass
filter  FLP=fft2(LP,size(I,1),size(I,2)); %3. Filter padding
LP_OUT=FLP.*FI; %4.Multiply the transform by the
filter I_OUT_LP=ifft2(LP_OUT); %5.inverse DFT
I_OUT_LP=real(I_OUT_LP); %6.Obtain the real part(Output)

%%%%spectrum%%%%
FLP_S=abs(fftshift(FLP));%Filter spectrum
LP_OUT_S=abs(fftshift(LP_OUT));%output spectrum

subplot(221),imshow(I),title('Original'),
subplot(222),imagesc(0.5*log(1+FLP_S)),title('LowPass
Filter  Spectrum'),axis off
subplot(223),imshow(I_OUT_LP),title('LowPass Filtered Output')
```

```
subplot(224),imagesc(0.5*log(1+LP_OUT_S)),title('LowPas
s  Spectrum'),axis off
```

Output:



Exercise3: Apply Ideal lowpass filter.

```
%ex3.m
close all
clear
clc
a=imread('Lab8_2.tif');
 [M N]=size(a);
a=im2double(a);
F1=fft2(a); %1.Obtain the Fourier transform

% Set up range of variables.
u = 0:(M-1); %0-255
v = 0:(N-1);%0-255
 % center (u,v) = (M/2,N/2)
% Compute the indices for use in meshgrid
idx = find(u > M/2);% indices 130-255
u(idx) = u(idx) - M;
idy = find(v > N/2);
v(idy) = v(idy) - N;
```

```
%set up the meshgrid arrays needed for
% computing the required distances.
 [U, V] = meshgrid(u, v);

% Compute the distances D(U, V).
D = sqrt(U.^2 + V.^2);

disp('IDEAL LOW PASS FILTERING IN FREQUENCY DOMAIN');

D0=input('Enter the cutoff distance==>');
% Begin filter computations.
H = double(D <= D0);

G=H.*F1; %Multiply
G=ifft2(G);
G=real(G);
ff=abs(fftshift(H));
subplot(131),imshow(a),title('original image')
subplot(132),imshow(ff),title('IDEAL LPF Image')
subplot(133),imshow(G),title('IDEAL LPF Filtered
Image') figure, mesh(ff),axis off,grid off
```

Output:

IDEAL LOW PASS FILTERING IN FREQUENCY DOMAIN
Enter the cutoff distance==>30