DIP Project 3

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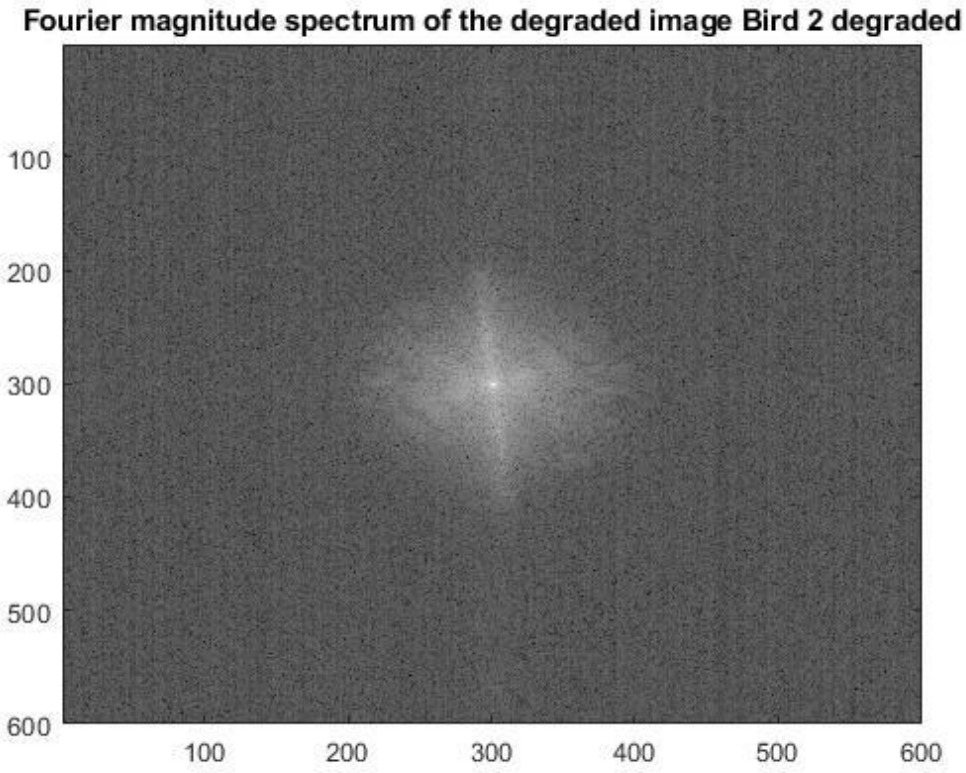
1. Source code

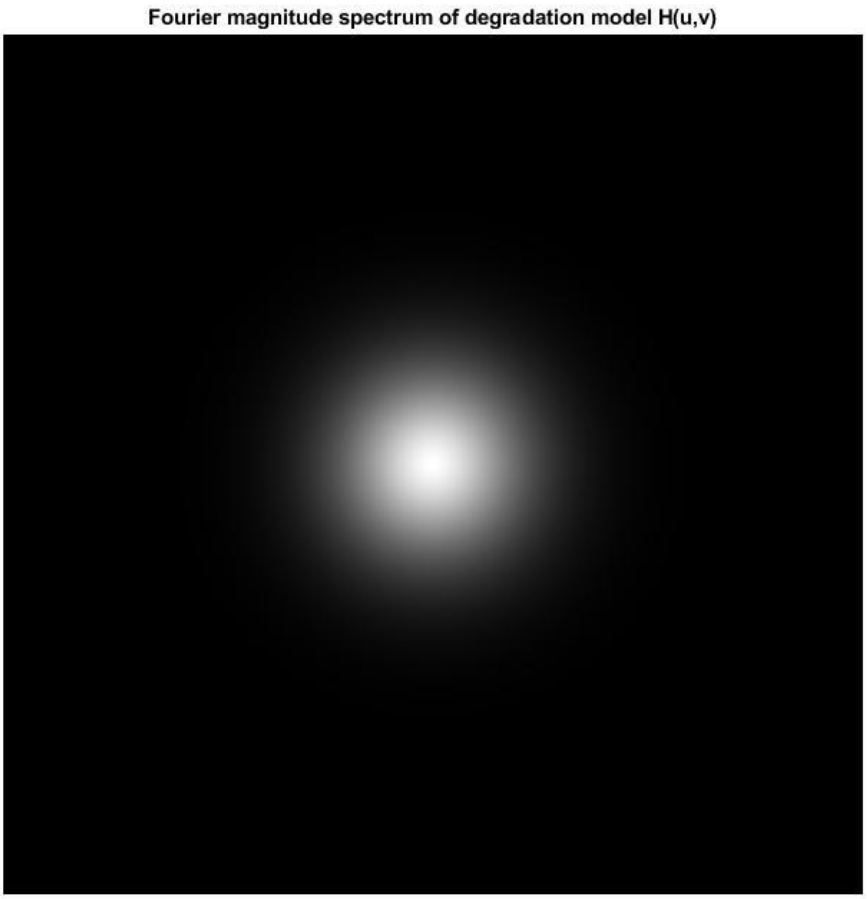
```
image = imread('Bird 2 degraded.tif');

%Hufnagel & Stanley
H = [600, 600];
k = 0.001; %using k=0.001 for mild turbulence
for u = 1:600
    for v = 1:600
        H(u,v) = exp(-k*(((u-300)^2+(v-300)^2)^(5/6)));
    end
end
figure, imshow(H);
title("Fourier magnitude spectrum of degradation model H(u,v)");

%DFT
im_dft = fftshift(fft2((image)));
figure, imagesc(log(abs(im_dft)));
title("Fourier magnitude spectrum of the degraded image Bird 2 degraded");
colormap gray;

%mask on G and H
G_50 = [600, 600];
G_85 = [600, 600];
G_120 = [600, 600];
H_50 = [600, 600];
H_85 = [600, 600];
H_120 = [600, 600];
for i = 1:600
    for j = 1:600
        if((i-300)^2+(j-300)^2<50*50)
            H_50(i, j) = H(i, j);
            G_50(i, j) = im_dft(i, j);
        else
            H_50(i, j) = 1;
            G_50(i, j) = 1;
        end

        if((i-300)^2+(j-300)^2<85*85)
            H_85(i, j) = H(i, j);
            G_85(i, j) = im_dft(i, j);
        else
            H_85(i, j) = 1;
            G_85(i, j) = 1;
        end

        if((i-300)^2+(j-300)^2<120*120)
            H_120(i, j) = H(i, j);
            G_120(i, j) = im_dft(i, j);
        else
            H_120(i, j) = 1;
            G_120(i, j) = 1;
        end
    end
end

%inverse filter
F_50_fft = [600,600];
F_50_fft = G_50./H_50;
F_50 = ifft2(ifftshift(F_50_fft));
figure, imshow(uint8(abs(F_50)));
title("radius = 50");

F_85_fft = [600,600];
F_85_fft = G_85./H_85;
F_85 = ifft2(ifftshift(F_85_fft));
figure, imshow(uint8(abs(F_85)));
title("radius = 85");

F_120_fft = [600,600];
F_120_fft = G_120./H_120;
F_120 = ifft2(ifftshift(F_120_fft));
figure, imshow(uint8(abs(F_120)));
title("radius = 120");
```

2. Figure of the Fourier magnitude spectrum of the degraded image

   Bird2 degraded



3. Figure of the Fourier magnitude (frequency response) of degradation model H(u,v)



4. Figures of the output images using different radii (50,85,120) of inverse filtering

radius = 85

radius = 120

5. Model parameter k

   For mild atmospheric turbulence, choose k=0.001