

Image Processing Project #3

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I. Source codes (With Matlab)

```
%%%%%%%%%%%%%% load image %%%%%%%%%%%%%%%
Img=im2double(imread('Bird 1.tif'));
[m,n] = size(Img);
%%%%%%%%%%%%%% padding %%%%%%%%%%%%%%%
pad = zeros(2*m,2*n);
pad(1:m,1:n)=Img;
%%%%%%%%%%%%%% multiple -1^x+y %%%%%%%%%%%%%%%
neg = zeros(2*m,2*n);
for i = 1:2*m
    for j = 1:2*n
        neg_matrix(i,j) = (-1)^((i-1)+(j-1));
    end
end
neg = pad.*neg_matrix;
%%%%%%%%%%%%%% DFT %%%%%%%%%%%%%%%
F = fft2(neg);
%%%%%%%%%%%%%% Laplacian filter %%%%%%%%%%%%%%%
H = zeros(2*m,2*n);
for i = -1*m:m-1
    for j = -1*n:n-1
        H(i+m+1,j+n+1) = (i*i+j*j);
    end
end
normA = H ./ max(abs(H(:)));
%%%%%%%%%%%%%% Output spectrum %%%%%%%%%%%%%%%
filt = normA.* F;
%%%%%%%%%%%%%% Plot figure %%%%%%%%%%%%%%%
figure
imshow(abs(filt),[])
title('Fourier magnitude spectra after applying Laplacian filtering')
saveas(gcf,'Fourier after laplacian filter','png');

S2 = log(1+abs(filt));
figure
imshow(S2,[])
```

```

title('Fourier magnitude spectra after applying Laplacian filtering(using log scale)')
saveas(gcf,'Fourier after laplacian filter(using log)','png');

```

```

figure
imshow(abs(normA),[])
title('Figure of the Fourier magnitude of Laplacian filter H(u,v)')
saveas(gcf,'Laplacian filter H(u,v)','png');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% Inverse Fourier,decentering %%%%%%%%%%%%%%
y = ifft2(filt);
idft = zeros(2*m,2*n);
for i = 1:2*m
    for j = 1:2*n
        idft(i,j) = real(y(i,j))*((-1)^((i-1)+(j-1)));
    end
end
result = idft(1:m,1:n);
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% Plot figure %%%%%%%%%%%%%%
figure
imshow(result,[])
title('Figure of the output image')
saveas(gcf,'Figure of the output image','png');

```

```

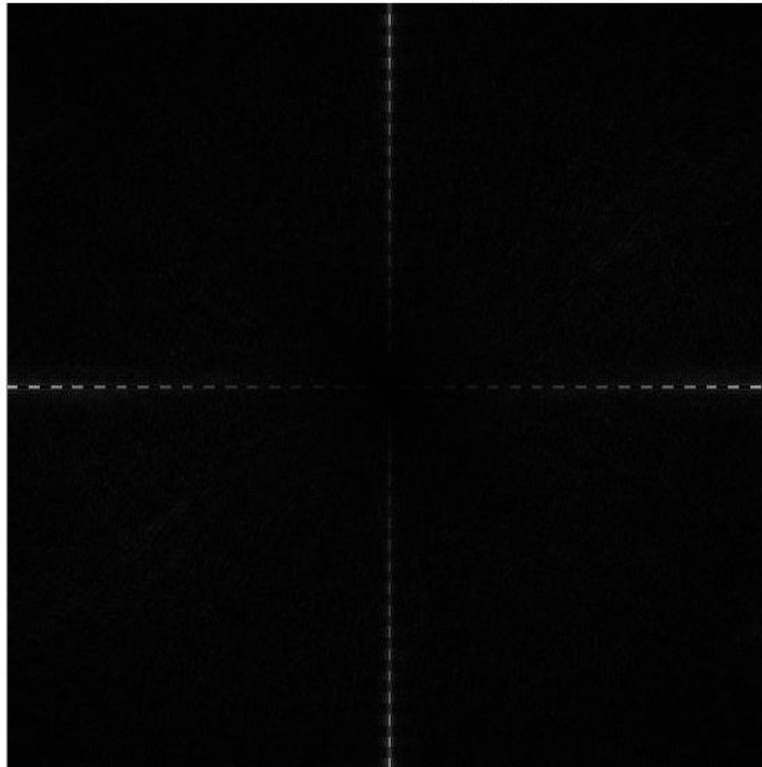
re = 255 * result;
figure
imshow(re)
title('Figure of the output image * 255')
saveas(gcf,'Figure of the output image_times_255','png');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% obtain largest 25 DFT %%%%%%%%%%%%%%
temp = abs(filt);
linearIndexesOfMaxes = zeros(25,1);
Maxes = zeros(25,3);
for i = 1:25
    [maxValue, linearIndexes] = max(temp(:));
    Maxes(i,3) = maxValue;
    [rowsOfMaxes colsOfMaxes] = find(temp == maxValue);
    Maxes(i,1) = rowsOfMaxes(1,1);
    Maxes(i,2) = colsOfMaxes(1,1);
    temp(Maxes(i,1), Maxes(i,2)) = -inf;
end

```

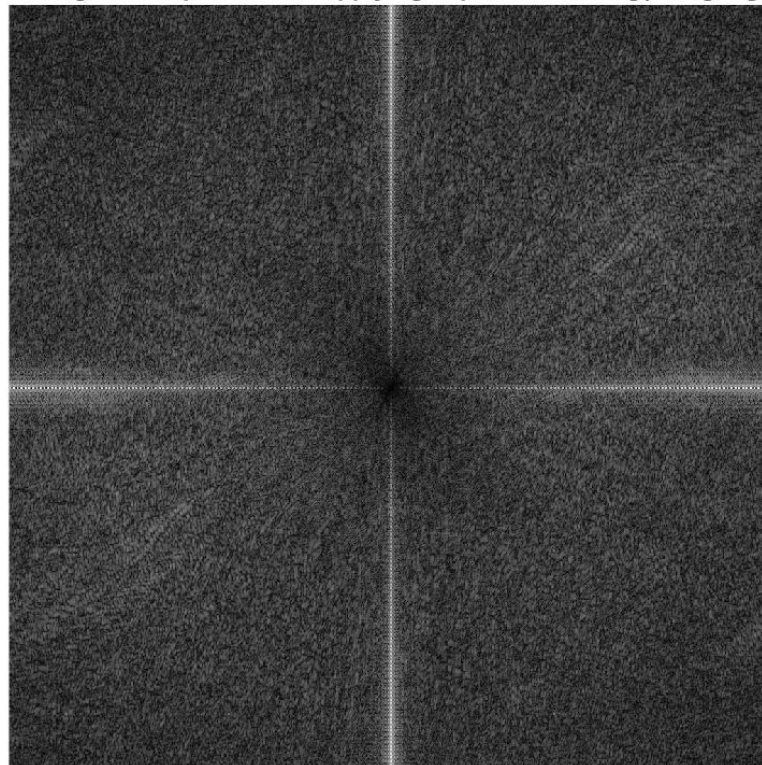
end

II. Figures of the Fourier magnitude spectra of the bird image after applying Laplacian filtering

Fourier magnitude spectra after applying Laplacian filtering

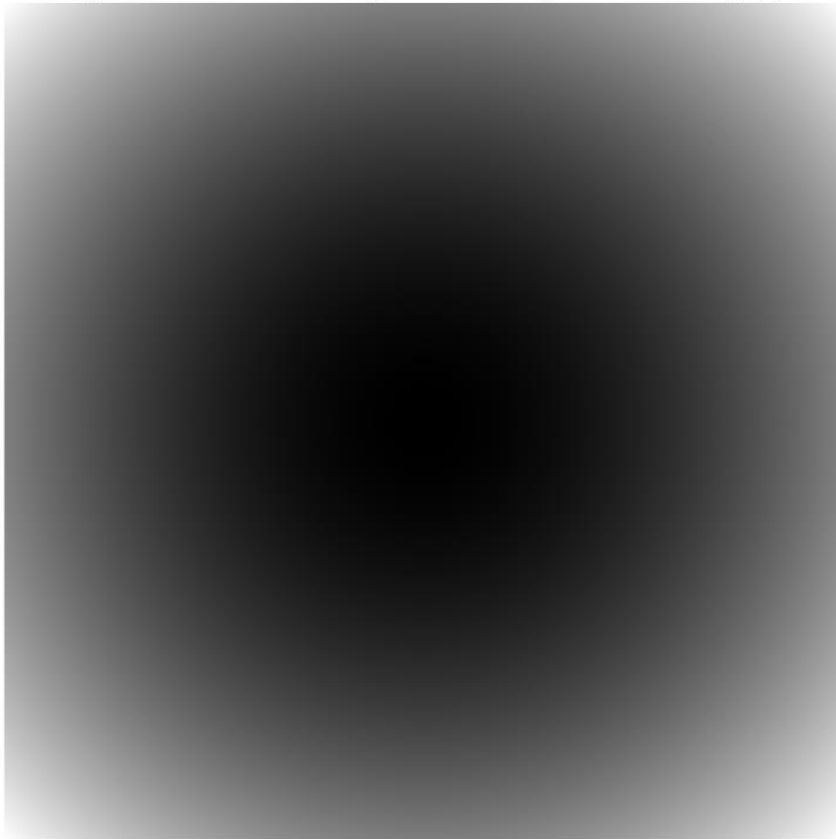


Fourier magnitude spectra after applying Laplacian filtering(using log scale)



III. Figure of the Fourier magnitude of Laplacian filter $H(u,v)$

Figure of the Fourier magnitude of Laplacian filter $H(u,v)$



IV. Figure of the output image

Figure of the output image

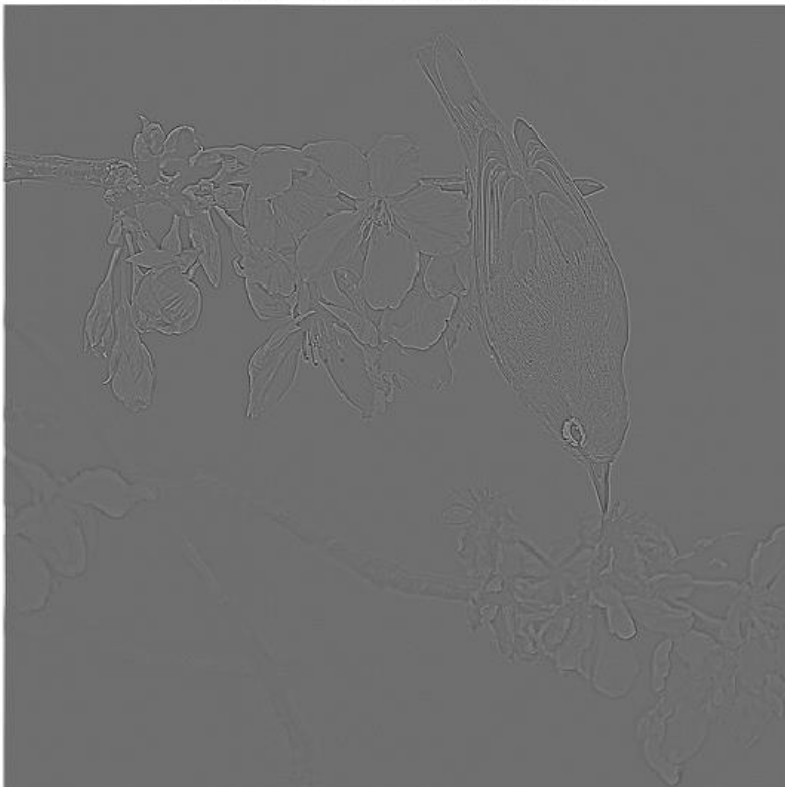


Figure of the output image * 255



V. Table of top 25 DFT frequencies (u v) after Laplacian filtering

Largest	u	v
1st	513	4
2nd	513	1022
3rd	513	2
4 th	513	1024
5 th	513	8
6 th	513	1018
7 th	513	14
8 th	513	1012
9 th	513	10
10 th	513	1016
11 th	513	18
12 th	513	1008
13 th	513	12
14 th	513	1014
15 th	513	6
16 th	513	1020
17 th	513	16
18 th	513	1010

19 th	513	22
20 th	513	1004
21 st	513	24
22 nd	513	1002
23 rd	513	28
24 th	513	998
25 th	513	20