Digital Image Processing-Assignment 03

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I. 實驗說明

Apply Fourier transform to Lena image via ILPF,GLPF, and BLPF with n=1. Discuss the difference of results among each filter.

II. 程式碼

```
im = imread('lena.tif');
im(:,:,4) = [];
im = rgb2gray(im);
[m,n] = size(im);

F = fft2(im);

for i = 0.2:0.2:1.4
    H = ILPF(m, i);
    Fout = F .* H;
    im2 = ifft2(Fout);
    %figure, imshow(im2);
    imwrite(im2, "ILPF" + i + ".jpg");
end

for i = -0.5:0.1:0.5
    H = GLPF(m, i);
    Fout = F .* H;
    im2 = ifft2(Fout);
    %figure, imshow(im2);
    imwrite(im2, "GLPF" + i + ".jpg");
end

for i = 0:10:50
    H = BLPF(m, i);
    Fout = F .* H;
    im2 = ifft2(Fout);
    %figure, imshow(im2);
    imwrite(im2, "BLPF" + i + ".jpg");
end

function H = ILPF(Isize, D0)
    % Ideal Lowpass Filters [0.6,1.2]
    [f1,f2] = freqspace(Isize,'meshgrid')
        ;
    D = sqrt(f1.^2 + f2.^2);
    H = double(D<=D0);
    %figure, imshow(H);
end

function H = GLPF(Isize, D0)
    %         [-0.3,0.3]
    [f1,f2] = freqspace(Isize,'meshgrid')
        ;
    D = sqrt(f1.^2 + f2.^2);
    H = exp(-(D.^2)./(2*(D0^2)));
    %figure, imshow(H);
end

function H = BLPF(Isize, D0)
    % Butterworth Lowpass Filters [10,30]
    [f1,f2] = freqspace(Isize,'meshgrid')
        ;
    D = sqrt(f1.^2 + f2.^2);
    H = 1./(1+(D0./D).^2); % n = 1
    %figure, imshow(H);
end
```

III. 成果

原圖

Fig. 1. lena

A. ILPF

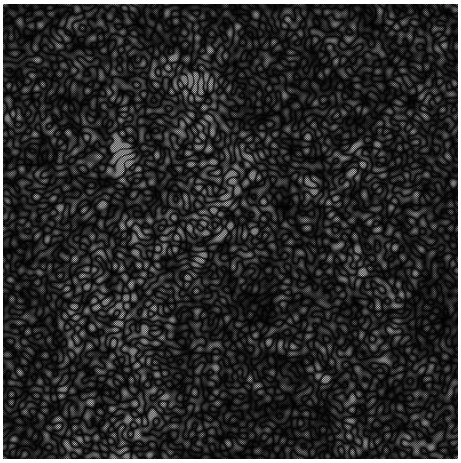

Fig. 2. ILPF, D_0 = 0.2

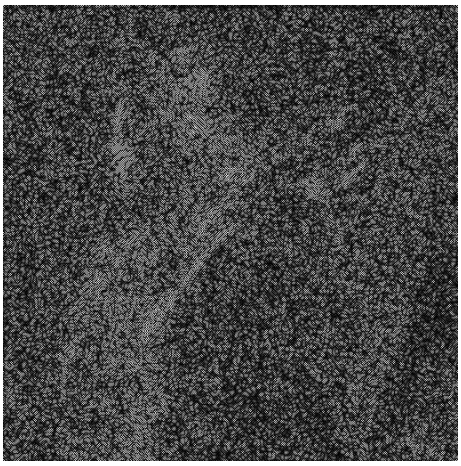

Fig. 3. ILPF, D_0 = 0.4

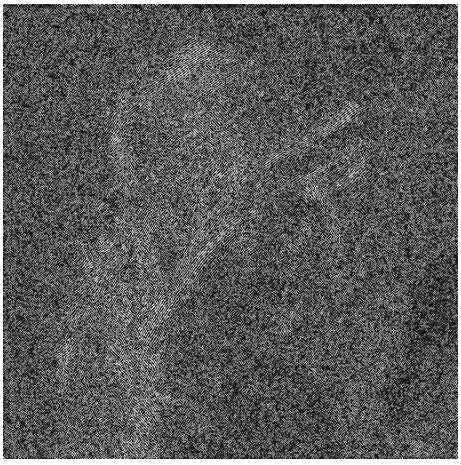

Fig. 4. ILPF, D_0 = 0.6

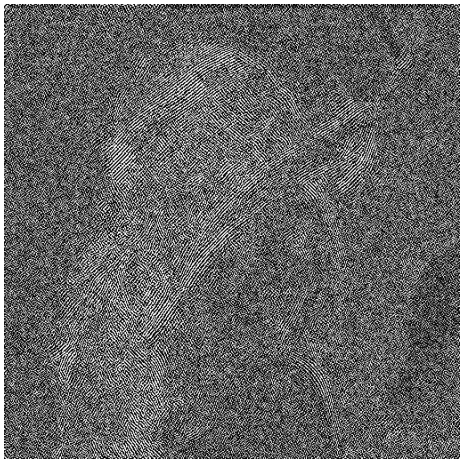

Fig. 5. ILPF, D_0 = 0.8

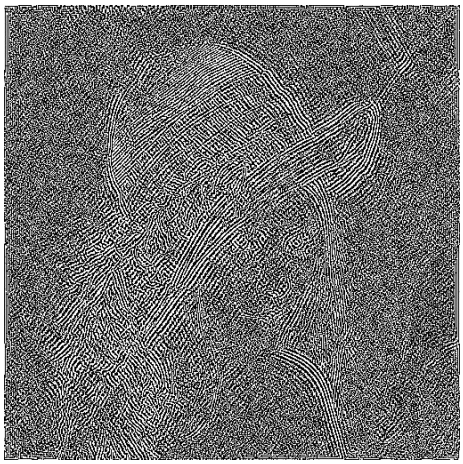

Fig. 6. ILPF, D_0 = 1.0

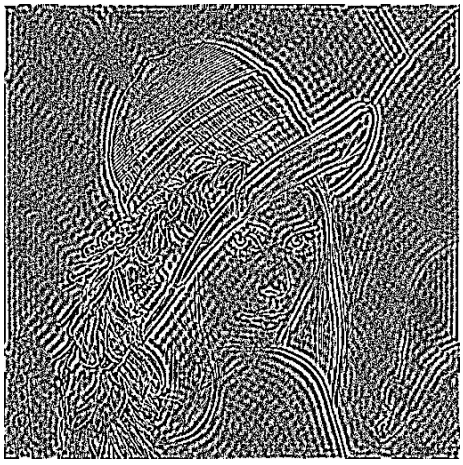

Fig. 7. ILPF, D_0 = 1.2

Fig. 8. ILPF, $D_0 = 1.4$

Fig. 11. GLPF, $D_0 = -0.3$

B. GLPF

Fig. 9. GLPF, $D_0 = -0.5$

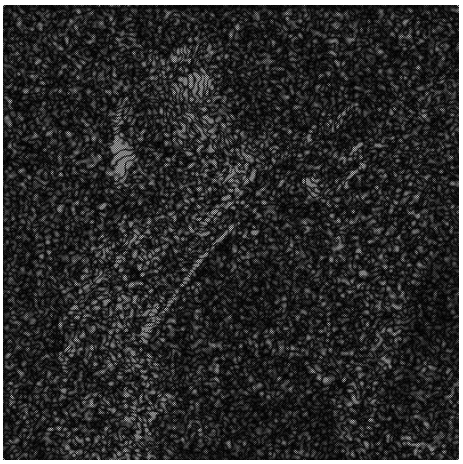

Fig. 12. GLPF, $D_0 = -0.2$

Fig. 10. GLPF, $D_0 = -0.4$

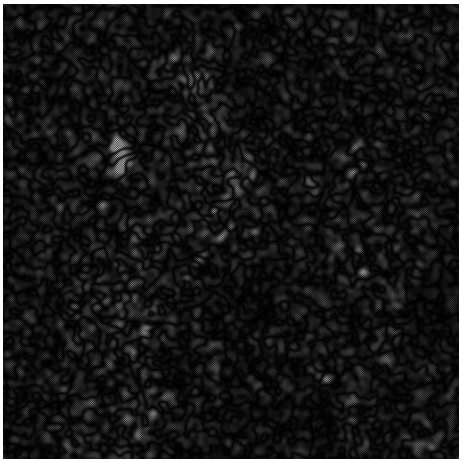

Fig. 13. GLPF, $D_0 = -0.1$

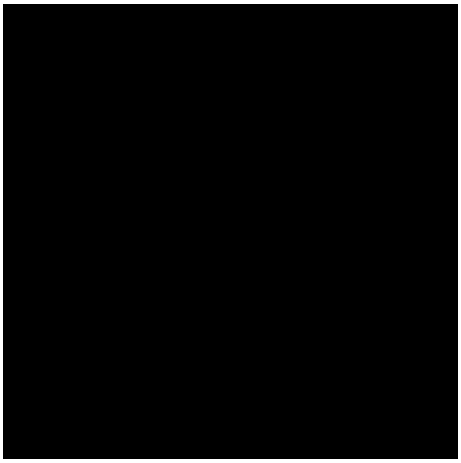

Fig. 14. GLPF, $D_0 = 0.0$

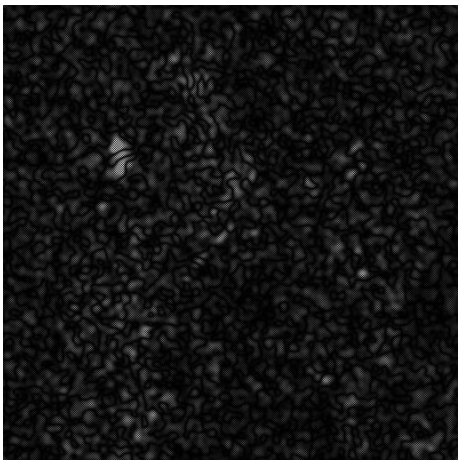

Fig. 15. GLPF, $D_0 = 0.1$

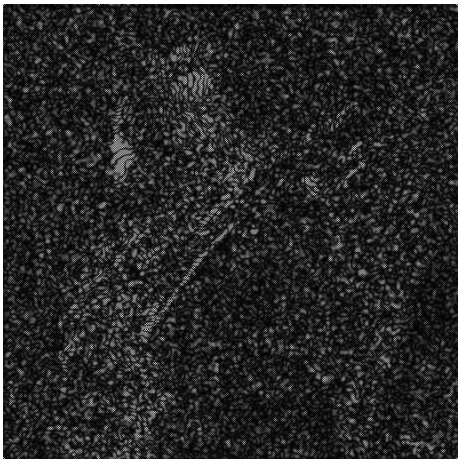

Fig. 16. GLPF, $D_0 = 0.2$

Fig. 17. GLPF, $D_0 = 0.3$

Fig. 18. GLPF, $D_0 = 0.4$

Fig. 19. GLPF, $D_0 = 0.5$

C. BLPF

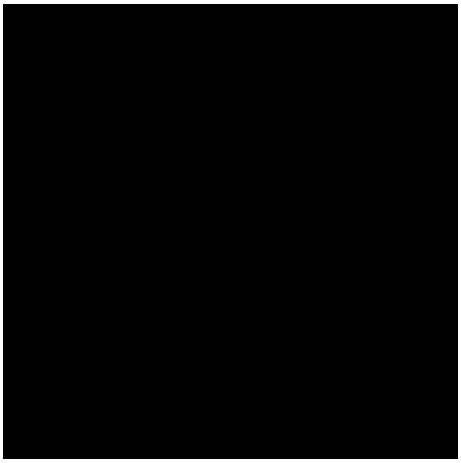

Fig. 20. BLPF, $D_0 = 0$

Fig. 21. BLPF, $D_0 = 10$

Fig. 22. BLPF, $D_0 = 20$

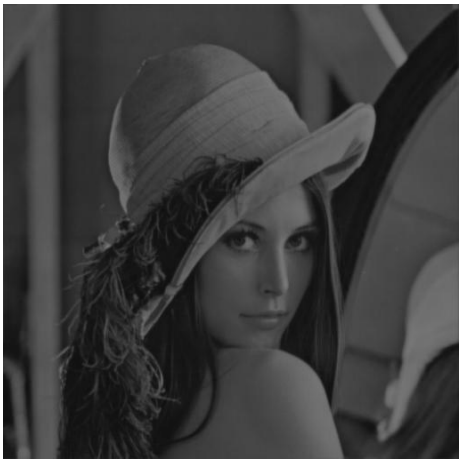

Fig. 23. BLPF, $D_0 = 30$

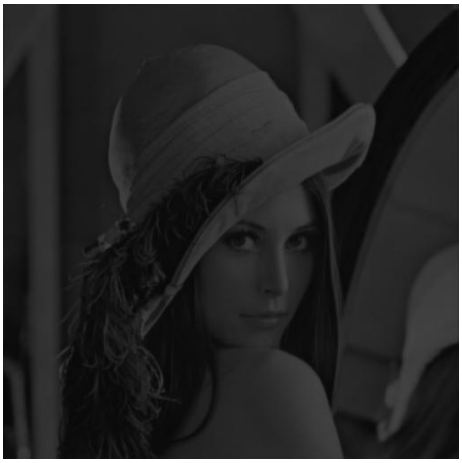

Fig. 24. BLPF, $D_0 = 40$

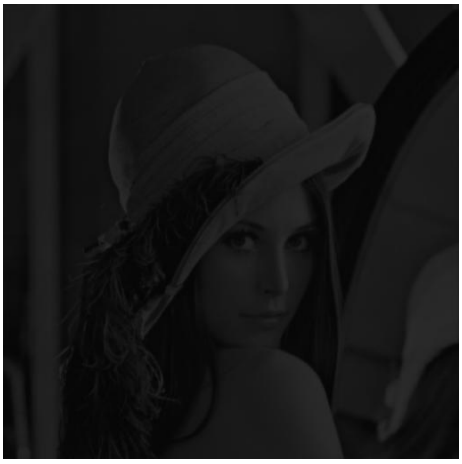

Fig. 25. BLPF, $D_0 = 50$

IV. 比較

ILPF 改變圖片的對比度，D_0 越大，對比度越強烈，GLPF 改變圖片模糊程度，$D_0 = x$ 或 $-x$ 的效果相同，D_0

越大越模糊。BLPF 改變圖片明亮度，D_0 越大，圖片越暗 ($D_0 = 0$ 除外)。