許笙杰 E14075304 機械四乙

**Final Project**

1. 由於原影像解析度不足，因此我把影像的解析度提升為16倍，將影像zero padding到高1024、寬4096像素再做2D FFT。在處理第一張影像時，因測量時傾斜關係導致影像上方有陰影產生。為了減少陰影對分析結果的影響，我使用adaptive thresholding的方法將其轉換為二值化影像再進行FFT。在分析結果中，最高點位於中點，利用第二高點到中點的距離即可得到週期。

Background pattern

Description automatically generated with medium confidence

Figure (a)

中點：(2049,513)

第二高點：(2169,514)

計算得頻率f = 7.5002 Hz

圖形週期 T = 199.9956 nm

圖形角度θ = -0.3805° (CW)

與直接觀察比較：T = 200 nm, θ = -1° (CW)

Background pattern

Description automatically generated

Figure (b)

中點：(2049,513)

第二高點：(2161,505)

計算得頻率f = 7.0113 Hz

圖形週期 T = 213.9394 nm

圖形角度θ = 3.2577° (CCW)

與直接觀察比較：T = 214 nm, θ = 5° (CCW)

img\_w = 1500;

img\_h = 300;

img1 = imread("1-1.jpg");

img1\_gray = rgb2gray(img1);

fsx1 = img\_w/size(img1,2);

fsy1 = img\_h/size(img1,1);

T = adaptthresh(img1\_gray,0.4,'ForegroundPolarity','dark');

BW = imbinarize(img1\_gray,T);

F1 = fft2(BW,16\*2^nextpow2(size(img1,1)),16\*2^nextpow2(size(img1,2)));

figure(1);

imagesc(abs(fftshift(F1)));

img2 = imread("1-2.jpg");

img2\_gray = rgb2gray(img2);

fsx2 = img\_w/size(img2,2);

fsy2 = img\_h/size(img2,1);

F2 = fft2(img2\_gray,16\*2^nextpow2(size(img2,1)),16\*2^nextpow2(size(img2,2)));

figure(2);

imagesc(abs(fftshift(F2)));

2.

(a)

A person wearing a hat

Description automatically generated

(b)

A picture containing text

Description automatically generatedA picture containing text

Description automatically generated

img = imread("Lenna.jpg");

img\_gray = rgb2gray(img);

figure(1);

imshow(img\_gray);

title("Grayscale Lenna.jpg");

sobelx = [-1 0 1; -2 0 2; -1 0 1];

Gx = zeros(size(img\_gray));

for i = 2:size(img\_gray,1)-1

for j = 2:size(img\_gray,2)-1

Gx(i,j) = sum(flip(flip(sobelx,1),2).\*double(img\_gray(i-1:i+1,j-1:j+1)),'all');

end

end

sobely = [-1 -2 -1; 0 0 0; 1 2 1];

Gy = zeros(size(img\_gray));

for i = 2:size(img\_gray,1)-1

for j = 2:size(img\_gray,2)-1

Gy(i,j) = sum(flip(flip(sobely,1),2).\*double(img\_gray(i-1:i+1,j-1:j+1)),'all');

end

end

G = abs(Gx) + abs(Gy);

G = uint8(G);

figure(2);

imshow(G);

title("Sobel Lenna using G = |G\_x|+|G\_y|");

G(G<127) = 0;

figure(3);

imshow(G);

title("Sobel Lenna after thresholding");