# Image Processing HW8+

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Programing language: C++

OpenCV version (if needed): 3.2

Develop environment: Visual Studio 2015

A. Program flow

1. 
```
Mat SrcImg = imread("Q1.tif", CV_LOAD_IMAGE_GRAYSCALE);
```
讀檔

2. 
```
copyMakeBorder(SrcImg, padded, 0, m - SrcImg.rows, 0, n - SrcImg.cols, BORDER_CONSTANT, Scalar::all(0));
Mat planes[] = { Mat_<float>(padded), Mat::zeros(padded.size(), CV_32F) };
```
做 zero padding

3. 
```
for (int i = 0; i<SrcImg.rows; ++i)
    for (int j = 0; j<SrcImg.cols; ++j)
    {
        in[i][j] = SrcImg.at<uchar>(i, j);
    }

for (int i = 0; i<SrcImg.rows; ++i)
    for (int j = 0; j<SrcImg.cols; ++j)
    {
        for (int k = 0; k<SrcImg.cols; ++k)
        out1[i][j] += in[k][j] * polar(1.0, -k*j*w1);

    }

for (int i = 0; i<SrcImg.cols; ++i)
    for (int j = 0; j<SrcImg.rows; ++j)
    {
        for (int k = 0; k < SrcImg.rows; ++k) {
            out2[i][j] += out1[k][j] * polar(1.0, -k*j*w2);
        }
        DstImg.at<uchar>(i, j) = (256 / log(256))*log(abs(out2[i][j])+1);

    }
```
做傅立葉

4. 
```
split(complexImg, planes);
```
虛，實部分離

5. 
```
magnitude(planes[0], planes[1], planes[0]);
```
取強度

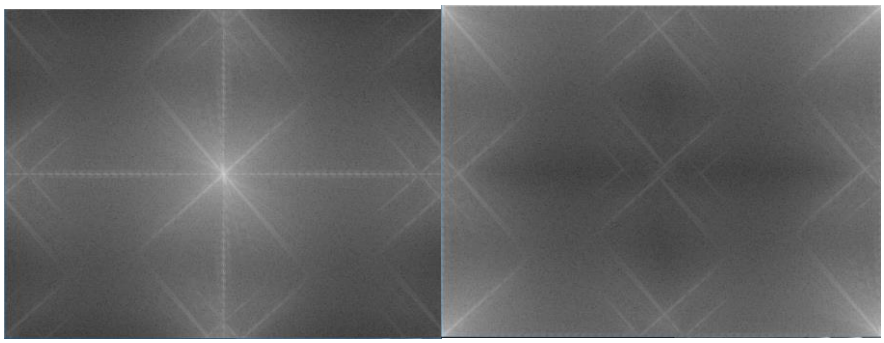
6. 
```
int cx = magI.cols / 2;
int cy = magI.rows / 2;

Mat q0(magI, Rect(0, 0, cx, cy));
Mat q1(magI, Rect(cx, 0, cx, cy));
Mat q2(magI, Rect(0, cy, cx, cy));
Mat q3(magI, Rect(cx, cy, cx, cy));

Mat tmp;
q0.copyTo(tmp);
q3.copyTo(q0);
tmp.copyTo(q3);
q1.copyTo(tmp);
q2.copyTo(q1);
tmp.copyTo(q2);
```
將區塊重排，讓原點在影像的中央

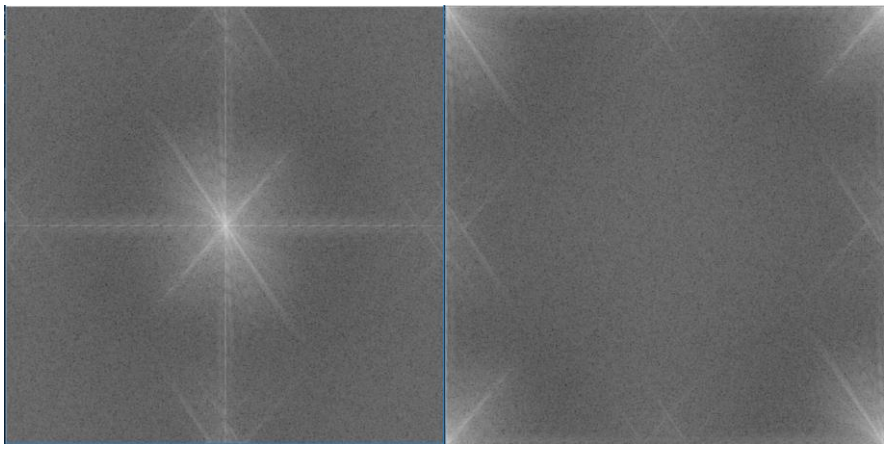
B. Result and Analysis

I. Fig. 4.29

a. 

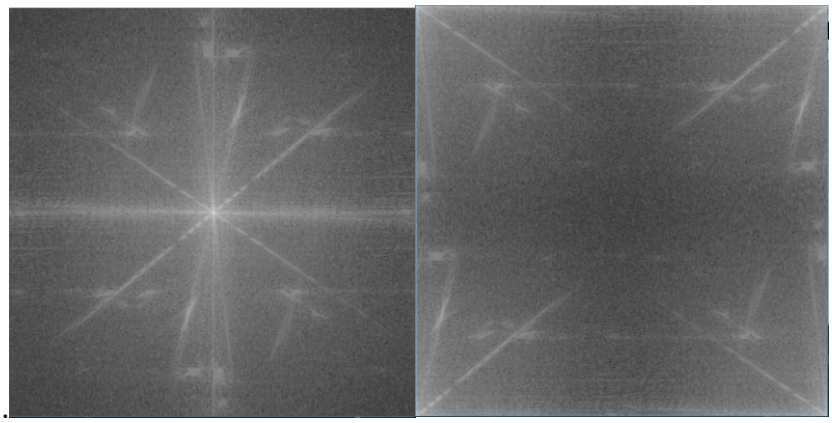
b. 左側有經重排讓原點在影像的中央，右側無左側較接近 pdf 的圖

II. Fig. 4.36

a. 

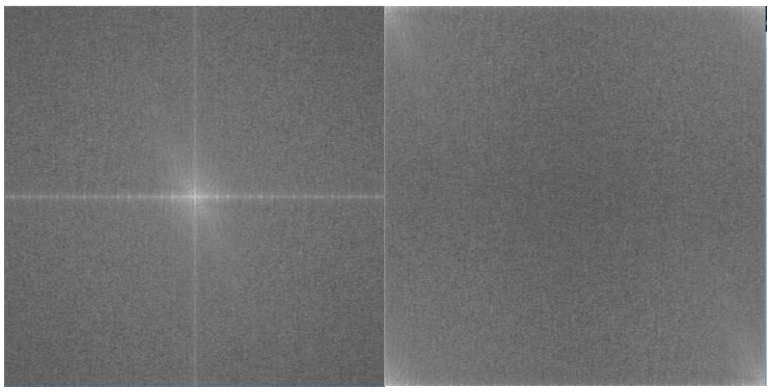
b. 左側有經重排讓原點在影像的中央，右側無左側較接近 pdf 的圖

III. Fig. 4.38

a. 

b. 左側有經重排讓原點在影像的中央，右側無左側較接近 pdf 的圖

IV. Fig. 4.41

a. 

b.左側有經重排讓原點在影像的中央，右側無
左側較接近 pdf 的圖