

Digital Image Processing-Assignment 02

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I. 實驗說明

調整 window size, σ , threshold 參數，觀察是否有⁷改變。

- window size: 3,5,7
- σ : 0.1, 0.3, 0.5, 0.7, 0.9
- threshold: 20, 30, 40, 50, 60
- 圖片: lena, headCT

II. 程式碼

```
1 % read image and convert to grayscale
2 im = imread('lena.tif');
3 im(:,:,4) = [];
4 grayIm = rgb2gray(im);
5
6 for windowSz = 3:2:7
7     for sigma = 0.1:0.2:0.5
8         for threshold = 0:10:40
9             h_filter = Laplacian_mask(
10                 windowSz,sigma);
11             grayIm2 = filter2(h_filter,
12                 grayIm);
13             [Gmag,Gdir] =
14                 Gradient_magnitude(grayIm2
15                 );
16             resIm = Zero_crossing(Gmag,
17                 Gdir,threshold);
18             imwrite(resIm, "lena_" +
19                 windowSz + "_" + sigma + "
20                 _" + threshold + ".png");
21         end
22     end
23 end
24
25 % obtain gradient magnitude
26 function [Gmag,Gdir] = Gradient_magnitude
27     (im)
28     [Gmag,Gdir] = imgradient(im,'prewitt'
29     );
30 end
31
32 % returns a rotationally symmetric
33 Gaussian lowpass filter
34 function h = Laplacian_mask(hsize,sigma)
35     h = fspecial('gaussian',hsize,sigma);
```

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26 end
27
28 function im = Zero_crossing(Gmag,Gdir,
29     threshold)
30     dir = [-1,0 ; 1 0 ; 0 1; 1 0];
31     [sz1,sz2] = size(Gmag);
32     im = zeros(sz1, sz2);
33     for i = 1:sz1
34         for j = 1:sz2
35             cnt1 = 0; % the number of
36                 point has difference >
37                 threshold
38             cnt2 = 0; % the number of
39                 point show different sign
40                 with (i,j)
41             for k = 1:4
42                 x = i + dir(k,1);
43                 y = j + dir(k,2);
44                 % test if (x,y) is out of
45                 boundary
46                 if x < 1 || x > sz1 || y <
47                     1 || y > sz2
48                     continue
49                 end
50                 if abs(Gmag(i,j) - Gmag(x,
51                     y)) > threshold
52                     cnt1 = cnt1 + 1 ;
53                 end
54                 if Gdir(i,j) * Gdir(x,y) <
55                     0
56                     cnt2 = cnt2 + 1 ;
57                 end
58             end
59             if cnt1 >= 1 && cnt2 >= 2
60                 im(i,j) = 1;
61             end
62         end
63     end
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III. Lena

原圖



Fig. 1. lena



Fig. 3. window size = 3, $\sigma = 0.1$, threshold = 30

越大的 threshold 下，白點會明顯地越少。



Fig. 2. window size = 3, $\sigma = 0.1$, threshold = 20



Fig. 4. window size = 3, $\sigma = 0.1$, threshold = 40

越大的 σ ，邊界的白點會些許的減少。

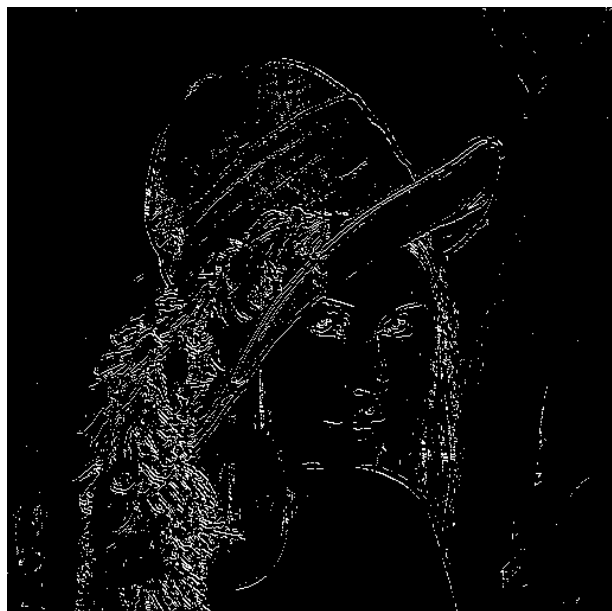


Fig. 5. window size = 3, $\sigma = 0.3$, threshold = 40



Fig. 7. window size = 3, $\sigma = 0.7$, threshold = 40



Fig. 6. window size = 3, $\sigma = 0.5$, threshold = 40



Fig. 8. window size = 3, $\sigma = 0.9$, threshold = 40

至於調整不同的 window size，則沒有太大的差異。

IV. headCT

原圖



Fig. 9. headCT

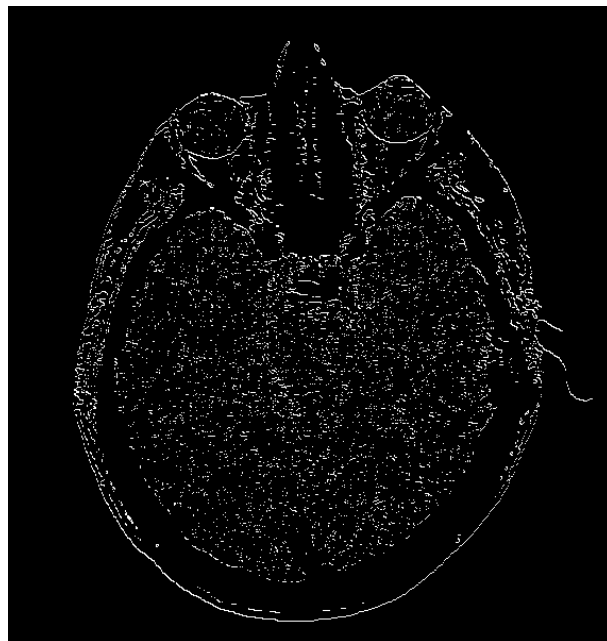


Fig. 11. window size = 3, $\sigma = 0.1$, threshold = 30

headCT 圖片情況和 lena 相同。

不同的 threshold。



Fig. 10. window size = 3, $\sigma = 0.1$, threshold = 20

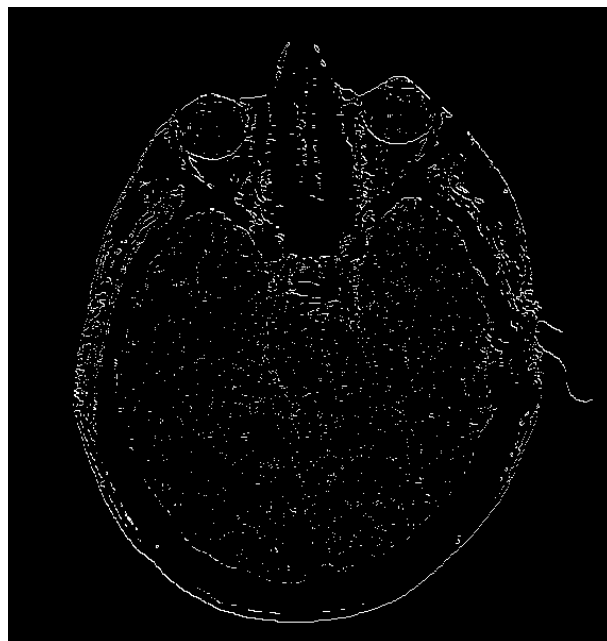


Fig. 12. window size = 3, $\sigma = 0.1$, threshold = 40

不同的 σ 。

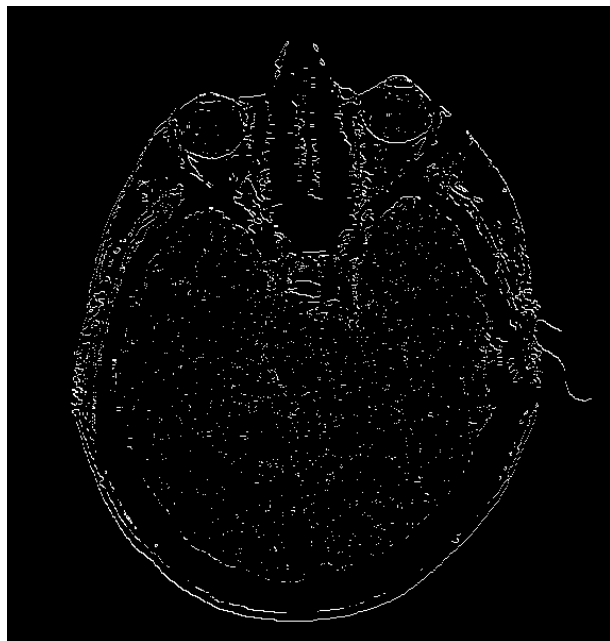


Fig. 13. window size = 3, $\sigma = 0.3$, threshold = 40



Fig. 15. window size = 3, $\sigma = 0.7$, threshold = 40

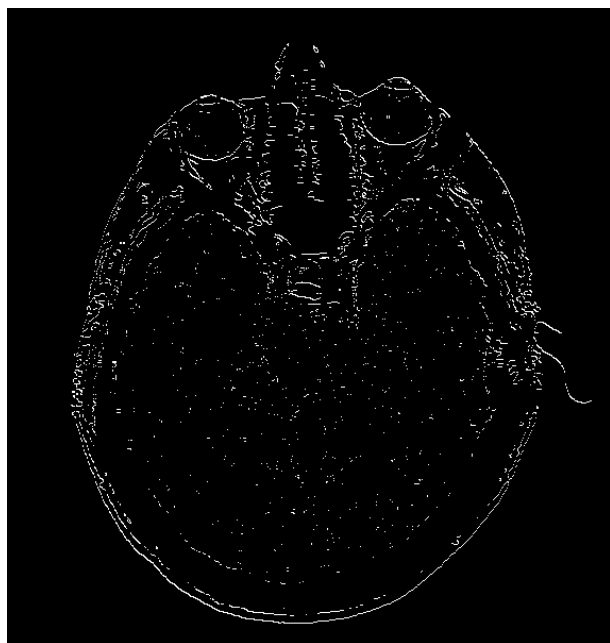


Fig. 14. window size = 3, $\sigma = 0.5$, threshold = 40



Fig. 16. window size = 3, $\sigma = 0.9$, threshold = 40