

Hw1_Spatial Image Enhancement

1 Technical description

(1) Power-law ($s = cr^\gamma$)

係數為 $c=2$, $\gamma=1.5$

```
I_Power_Law = 2*(I_d.^1.5);
```

(2) histogram equalization

1. 建立影像pixel value的PDF
2. 計算影像pixel value的CDF
3. 根據CDF計算灰階亮度的對應關係
4. 根據3.的結果產生新的灰階

```
function I_Histogram = myhisteq(I)

%image size
[r,c] = size(I);
I_Histogram = uint8(zeros(r,c));

% pixels
n = r*c;

% 初始化
f = zeros(256,1);
cdf = zeros(256,1);
out = zeros(256,1);

%array index 1~256
%value 0~255

%計算每個value出現次數
for i = 1:r
    for j = 1:c
        • value = I(i,j);
        • f(value+1) = f(value+1)+1;
    end
end

%計算每個value出現的比例並加入cdf
%round(cdf(i)*L) => 將每個出現的 cdf 轉成對應的gray level
sum = 0;
L = 255;

for i = 1:256
    sum = sum + f(i);
    cdf(i) = sum/n;
    out(i) = round(cdf(i)*L);
end
```

```

%將對應的gray level取代原本的值
for i = 1:r
    for j = 1:c
        • I_Histogram(i,j) = out(I(i,j)+1);
    end
end
end
end

```

(3) image sharpening using the Laplacian

1. 建立 Laplacian mask
2. 用Laplacian mask產生原圖銳化結果
3. 將原圖和2.的結果重疊

```

function I_S = mylap(I)

I_S = im2double(I);

% mask = [0,-1,0;-1,4,-1;0,-1,0];
%resp為原圖經過轉換的結果
[m,n] = size(I_S);
resp = I_S;
for i = 2:m-1
    for j = 2:n-1
        • resp(i,j) = 4*I_S(i,j)-I_S(i+1,j)-I_S(i-1,j)-I_S(i,j+1)-I_S(i,j-1);
    end
end

%將mask處理的圖加上原圖
I_S = I_S + resp;
end

```

2 Experimental results

3 Discussions

(1)power-law transformation

$\gamma > 1$, 凸顯顏色較深處 , 整體顏色變深

$\gamma < 1$, 凸顯顏色較淺處 , 整體顏色變淺

(2)histogram equalization

histogram equalization後的圖無法完全平均各個gray level的出現頻率,因為discrete的圖算面積平均分佈時 · discrete分布的結果會出現小數,作round之後,會使其分佈到某一gray level時會不平均

(3)image sharpening using the Laplacian

用mylap做出來的結果和內建函式做出來的有差異,內建函式可能在sharpening後還有做正規化的動作

4 References and Appendix

(1)power-law transformation

<https://www.youtube.com/watch?v=x-mLSCZdUok>

<https://blog.xuite.net/viplab/blog/307263602-Image+Enhancement+in+the+Spatial+Domain>

(2) histogram equalization

<https://www.youtube.com/watch?v=0wpg3RXdOOQ&t=152s>

<https://jason-chen-1992.weebly.com/home/-histogram-equalization>

(3) image sharpening using the Laplacian

<https://www.mathworks.com/matlabcentral/answers/387179-my-matlab-code-for-laplacian-filter-of-image-sharpening-is-below-plz-tell-the-necessary-correction>

<https://www.mathworks.com/matlabcentral/answers/484801-laplacian-for-image-sharpening-implementation>

<https://stackoverflow.com/questions/36688103/laplacian-image-filtering-and-sharpening-images-in-matlab>