COMPUTER VISION 1

Homework 2

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Computer Vision Report – Homework 2

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Write a program to generate:

a binary image (threshold at 128)

將影像取二值化，就是將影像變成 1.0 這兩種二元值。也就是說，當亮度大於 128 的值就顯示成白色（255）;反之小於 128 的值就顯示成黑色(0)。 在簡化來說就是將影像變成黑白兩種色階。由臨界值 128 來決定此圖片的 0 或是 1 位元。

lena.bmp

binarizelena.bmp

Source Code (binary)

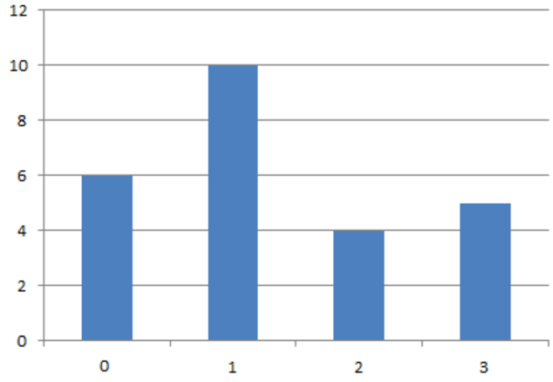
```
LENA = imread('lena.bmp');
INFO = imfinfo('lena.bmp');
for x = 1:INFO.Height,
      for y = 1:INFO.Width,
          T = 128;                          %設定binary門檻值
          if LENA(x,y) > T,
             LENA(x,y) = 255;               %超過門檻值，顯示白色（1）
          else
             LENA(x,y) = 0;                 %低於門檻值，顯示黑色（0）
          end; end;
end;
imwrite(LENA,'binarizelena.bmp');
```

Source Code (histogram)

histogram 直方圖就是計算每一個像素值出現的次數，依此頻率所繪製的直線圖(bar圖)，首先將影像載入程式中，再針對每個像素逐一計算 256(0-255)種灰度值出現的頻率，如以下圖作為概念:

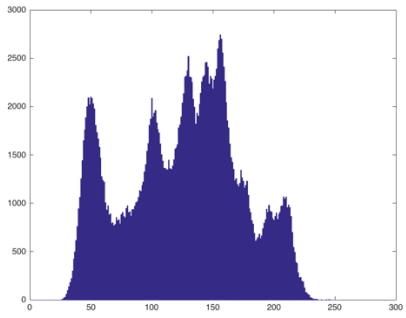
0	2	2	3	3
1	0	0	1	1
1	2	3	0	1
0	1	1	0	1
1	1	2	3	3

2-bits source image



histogram of left image

lena.bmp

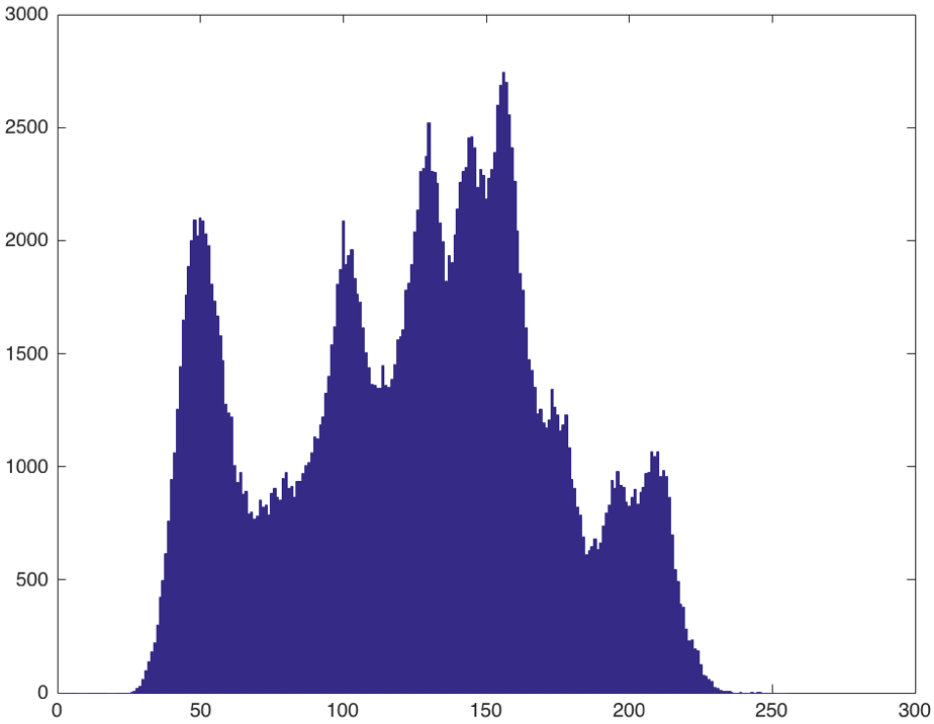


LENA Histogram

計算 LENA 中 0-255 位元數出現次數 做成統計圖

```
LENA = imread('lena.bmp');
INFO = imfinfo('lena.bmp');
HISTO = zeros(256,1);
for i = 1:INFO.Height,
    for j = 1:INFO.Width,
        HISTO(LENA(i,j)+1) = HISTO(LENA(i,j)+1)+1; %計算每個元素的次數
    end;
end;
```

```
bar(HISTO)
```



histogram.bmp

Source Code (connected components :regions with + bounding box)

參考課本內容中提到的的方法『An Iterative Algorithm』，以及 『4-connected neighborhood detection』來實現此題的圖像 connected components 分析。iterative的流程三步驟(1)將圖像中每個像素做初始化，至對應的標籤 label 中。(2)分別從 top-down & bottom-up passes ,來與鄰近相鄰的點做比較，取較小的編號值。(3)檢視到兩個方向的 pass 都沒有變化後才算成功。

lena.bmp

binarizelena.bmp

4-connected component

```
LENA = imread('lena.bmp');
INFO = imfinfo('lena.bmp');
for x = 1:INFO.Height,
      for y = 1:INFO.Width,
         T = 128;                                  % binarize lena
         if LENA(x,y) > T,
            LENA(x,y) = 255;
         else
            LENA(x,y) = 0;
         end;
      end;
end;
imwrite(LENA,'bilena.bmp')
```

An Iterative Algorithm

```
LENA1 = imread('bilena.bmp');
INFO1 = imfinfo('bilena.bmp');
mm = 0;
LABEL = zeros(INFO1.Height,INFO1.Width);      % label binarizedlena
for x = 1:INFO1.Height,
     for y = 1:INFO1.Width,
        if LENA1(x,y) > 0,
           mm = mm + 1;
           LABEL(x,y) = mm;
        end;
     end;
end;
change = 1;
while change > 0,
  change = 0;
  for x = 1:INFO1.Height,
     for y = 1:INFO1.Width,
        if LABEL(x,y) > 0,
           min = LABEL(x,y);
```

```
            if x > 1 && LABEL(x-1,y) ~= 0 && LABEL(x-1,y) < min,
               min = LABEL(x-1,y);              % top-to-bottom
            end;
            if y > 1 && LABEL(x,y-1) ~= 0 && LABEL(x,y-1) < min,
               min = LABEL(x,y-1);              % left-to-right
            end;
            if min ~= LABEL(x,y),
               change = 1;
               LABEL(x,y) = min;
            end;
         end;
      end;
      for x = INFO1.Height:-1:1,
         for y = INFO1.Width:-1:1,
            if LABEL(x,y) > 0,
               min = LABEL(x,y);
               if x<INFO1.Height && LABEL(x+1,y)~=0 && LABEL(x+1,y)< min,
                  min = LABEL(x+1,y);                  % bottom-to-top
               end;
               if y<INFO1.Width && LABEL(x,y+1)~=0 && LABEL(x,y+1)< min,
                  min = LABEL(x,y+1);                  % right-to-left
               end;
               if min ~= LABEL(x,y),
                  change = 1;
                  LABEL(x,y) = min;
               end;
            end;
         end;
      end;
   end;
```

Regions

```
REGION = zeros(mm,1);
for x = 1:INFO1.Height,
    for y = 1:INFO1.Width,
        if LABEL(x,y) > 0,
          REGION(LABEL(x,y)) = REGION(LABEL(x,y))+1;
        end;
    end;
end;
```

bounding box

```
for r = 1:mm;
  if REGION(r) >= 500,
     top = INFO1.Height;
     bottom = -1;
     left = INFO1.Width;
     right = -1;
     for x = 1:INFO1.Height,
         for y = 1:INFO1.Width,
             if LABEL(x,y) == r,
                if x < top,
                      top = x;
                end;
                if x > bottom,
                      bottom = x;
                end;
                if y < left,
                      left = y;
                end;
                if y > right,
                      right = y;
                end;
             end;
         end;
     end;
     for i = top:bottom,
```

```
        LENA1(i,left) = 128;
        LENA1(i,right) = 128;
    end;
    for j = left:right,
        LENA1(top,j) = 128;
        LENA1(bottom,j) =128;
    end;
    imwrite(LENA1,'four_connected_iterative1.bmp')
  end;
end;
```

lena.bmp

binarizelena.bmp

結果圖

four_connected_iterative1.bmp