Digital Image Processing-Computer Assignment 1

Name:李羚甄 Student ID: R09525064 Department:工海碩一

1. Spatial Resolution (35%)

* Part 1

Question:

Will you obtain the same result? State the effective resolution of each command and explain why.

(a) imresize(imresize(x, 1/4), 4);

(b) imresize(imresize(x, 1/8), 8);

(c) imresize(imresize(x, 1/16), 16);

(d) imresize(imresize(x, 1/32), 32);

Result:

imresize(imresize(x, 1/4), 4)

imresize(imresize(x, 1/8), 8)

imresize(imresize(x, 1/16), 16)

imresize(imresize(x, 1/32), 32)

Explanation:

四行指令結果不同，可以看到縮小越大的比例後再等比放大會越模糊，即使四張圖片最後的 size 是一樣大的。

Matlab 中 imresize 的指令在做縮小的動作時會依據參數將區塊的分成好幾等分，並在該區塊利用指定的算法(nearest、bilinear、bicubic)取出值填入縮小後的圖的對應位置；而在放大的時候，imresize 會依據放大後的圖的每個位置，取用指定的算法(nearest、bilinear、bicubic)得到該位置的值，皆是以原圖的值作為參考。

下表說明 imresize(imresize(x, 1/4), 4);。

x11	x12	x13	x14	x15	x16	x17	x18
x21	x22	x23	x24	x25	x26	x27	x28
x31	x32	x33	x34	x35	x36	x37	x38
x41	x42	x43	x44	x45	x46	x47	x48
x51	x52	x53	x54	x55	x56	x57	x58
x61	x62	x63	x64	x65	x66	x67	x68
x71	x72	x73	x74	x75	x76	x77	x78
x81	x82	x83	x84	x85	x86	x87	x88

做完縮小後會變成下表，x'11 是從左上方的 16 個值而得，其他以此類推。

x'11	x'12
x'21	x'22

接著再放大如下表。

x''11	x''11	x''11	x''11	x''12	x''12	x''12	x''12
x''11	x''11	x''11	x''11	x''12	x''12	x''12	x''12
x''11	x''11	x''11	x''11	x''12	x''12	x''12	x''12
x''11	x''11	x''11	x''11	x''12	x''12	x''12	x''12
x''21	x''21	x''21	x''21	x''22	x''22	x''22	x''22
x''21	x''21	x''21	x''21	x''22	x''22	x''22	x''22
x''21	x''21	x''21	x''21	x''22	x''22	x''22	x''22
x''21	x''21	x''21	x''21	x''22	x''22	x''22	x''22

故可以推知若縮小越多，則放大時的參考點就會越少，填上的值都是相同的，所以就會變得越模糊。

* Part 2

Question:

Now, use different interpolation methods below to resize the image to 1/8 of the original dimension and show me the results:

(e) nearest

(f) bilinear

(g) bicubic

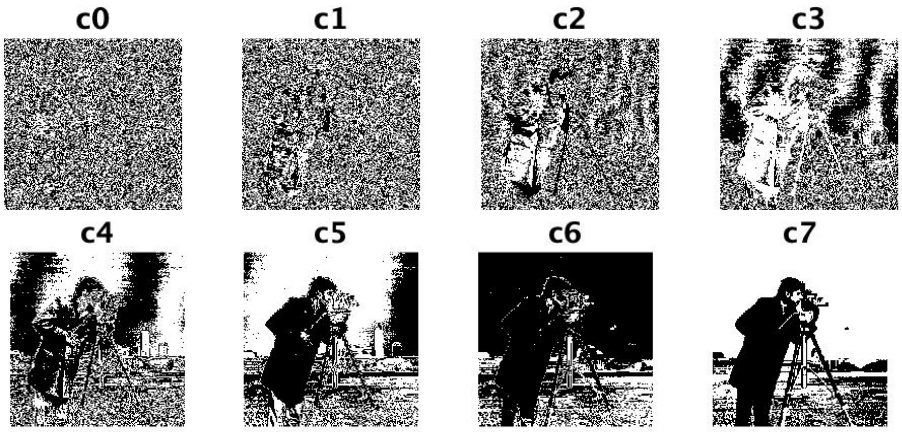
Result:

2. Bit Planes (35%)

* Part 1

Question:

where c0 is called the least significant bit plane and c7 the most significant bit plane. Show me the 8 bit planes of the cameraman image.

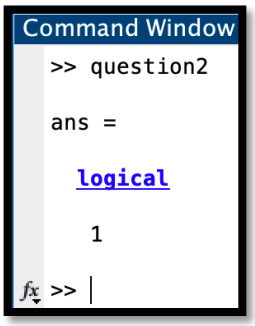


* Part 2

Question:

Are they (c7 and ct) identical?

Answer: Yes



Question:

You can verify your answer by using all(c7(:) == ct(:));

What will you get by executing this command?

Answer: 1

* Part 3

Question:

Now, reconstruct the image using the following bit planes:

(a) c7

(b) c6 and c7

(c) c4 to c7

Show me the reconstructed images and display the difference images between the reconstructed images and the original image. What do you observe?

Result & Answer:

original image

only using plane c7

using plane c7 and c6

using plane c7 to c4

疊加越多張 bit plane，會與原圖越接近。

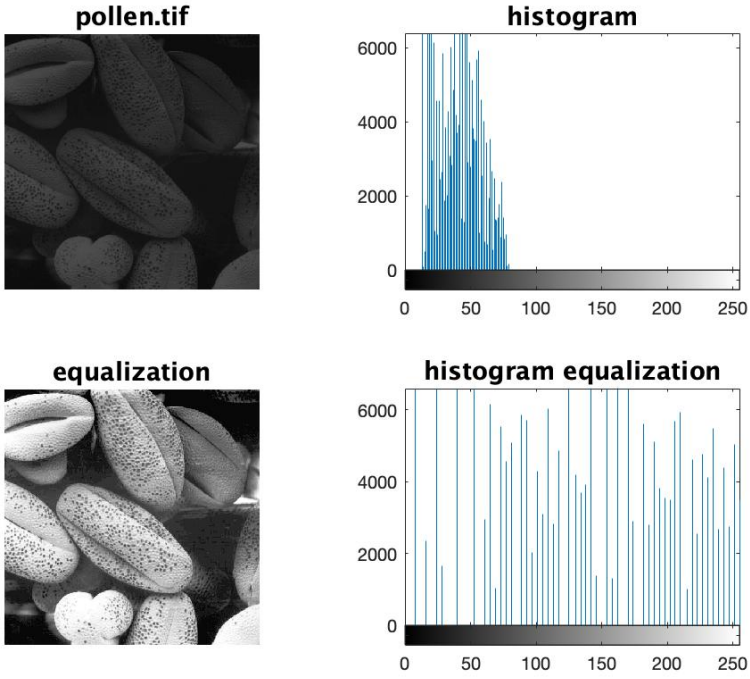
3. Histogram Operation (30%)

* pollen.tif Part 1

Question:

Apply the histogram equalization to this image using the *histeq* function and show me the result associated with its equalized histogram.

Result:

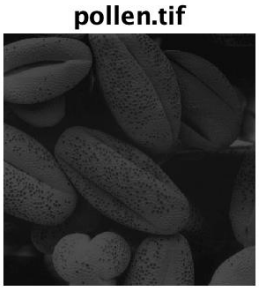


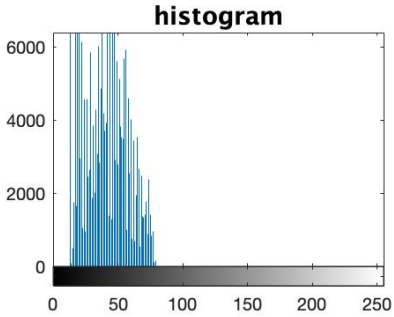
* pollen.tif Part 2

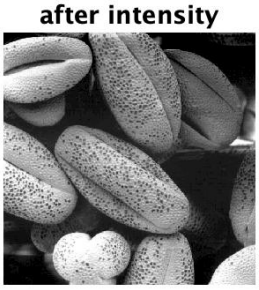
Question:

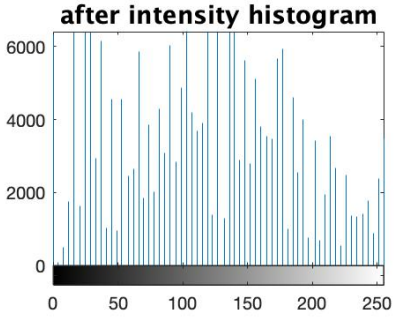
Perform histogram stretching to this image using the *imadjust* function and show me the result associated with its adjusted histogram. You will need to manually select the parameters in *imadjust* in order to make the adjusted image more appealing.

Result:



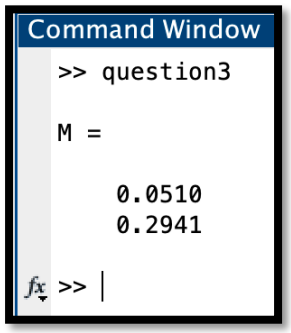






Explanation:

imadust 指令是對影像的灰度做調整，需要找到要變換的灰度範圍，在對應到變換後的灰度範圍，而調整的參數就是要變換的灰度範圍，由上圖可知原圖範圍皆在 0~100 之間，而我使用 stretchlim 指令找的範圍的兩個極值，並且是正規化後的值(0~1)，再將此參數帶入 imadjust 中執行，因原圖範圍非常集中，所以得到很好的效果，使圖片不會太暗。



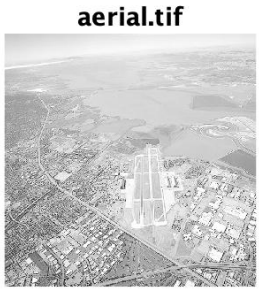
對應 0~255 的值為：13~75

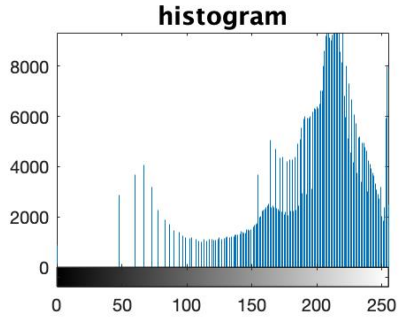
* aerial.tif　Part 1 & 2

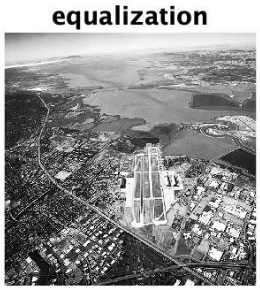
Question:

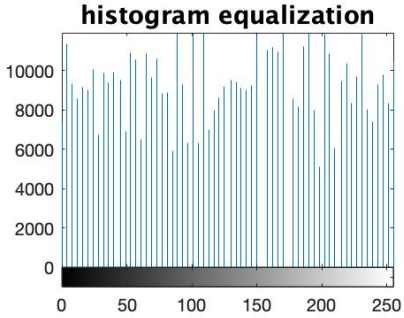
Repeat all processes for aerial.tif.

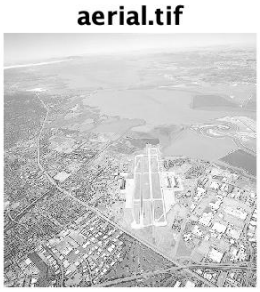
Result:

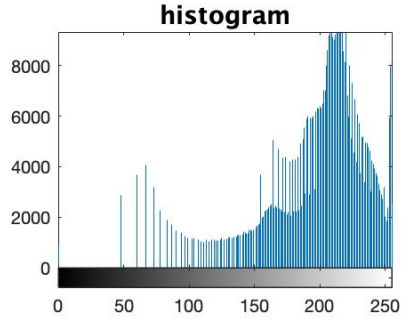


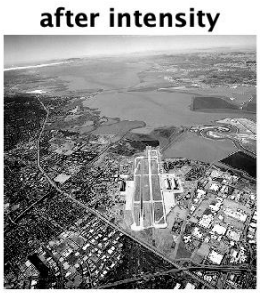


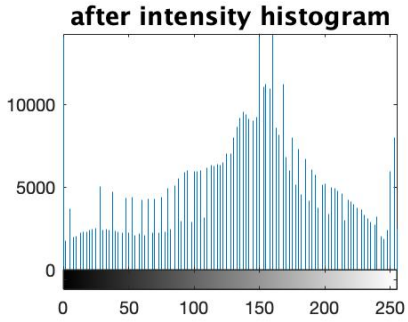












Explanation:

因為該圖 histogram 分佈不集中，使用 srtretchlim 取得兩端極值後帶入效果並不顯著，所以利用手動調整參數，我選擇的範圍是 155~255，看起來較為集中的區域，再手動正規化帶入 imadjust 指令中呈現，使圖片不會過亮。

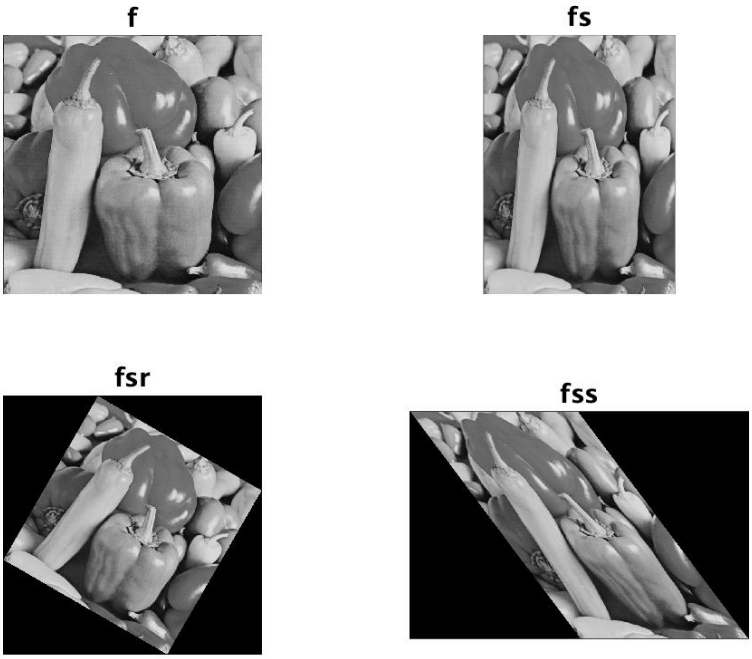
4. Transformations and Registration (80%)

* Part 1

Question:

Obviously, **fss** and **fsr** are created based on **fs**. Display the transformed images, **fs**, **fsr**, and **fss** associated with the original image **f**.

Result:



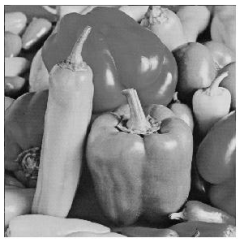
* Part 2

Question:

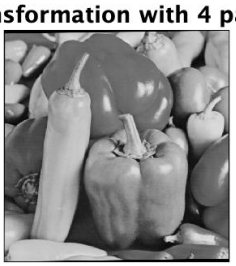
Show the registered image **fs2**, the target image **fs**, the source image **f**, and the difference image **fs2** - **f**. What do you observe? Increase the number of tie points using 8 pairs. Do the results look better?

Result:

f

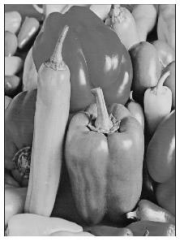


transformation with 4 pairs

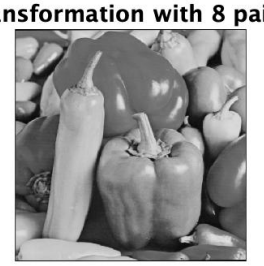


difference with 8 pairs

fs



transformation with 8 pairs



difference with 8 pairs

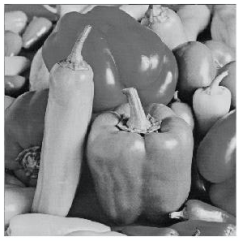
* Part 3

Question:

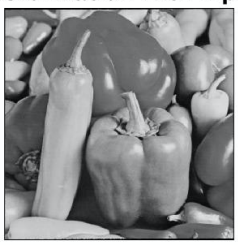
Repeat the process for the target images **fsr**.

Result:

f



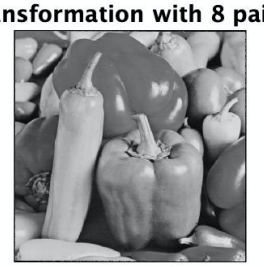
transformation with 4 pairs



difference with 8 pairs

fsr

transformation with 8 pairs



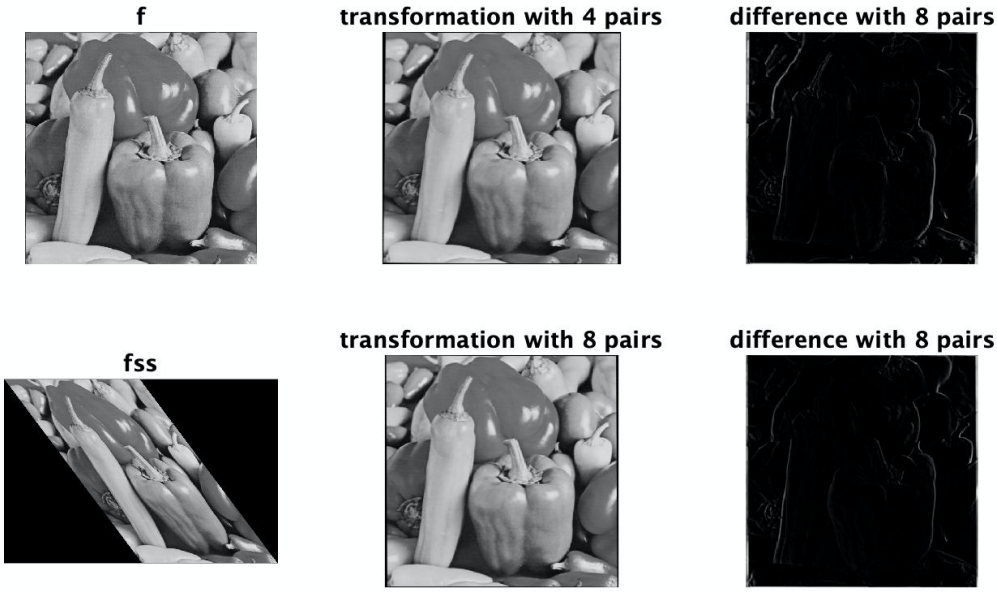
difference with 8 pairs

* Part 4

Question:

Repeat the process for the target images **fss**.

Result:



Explanation:

從 difference 圖可以看到 8 pairs 比 4 pairs 的白色部分更不明顯，由此可知 8 pairs 與原圖差異更小一點，選擇的點越多，校正後的圖會與原圖越接近。

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