

Digital Image Processing

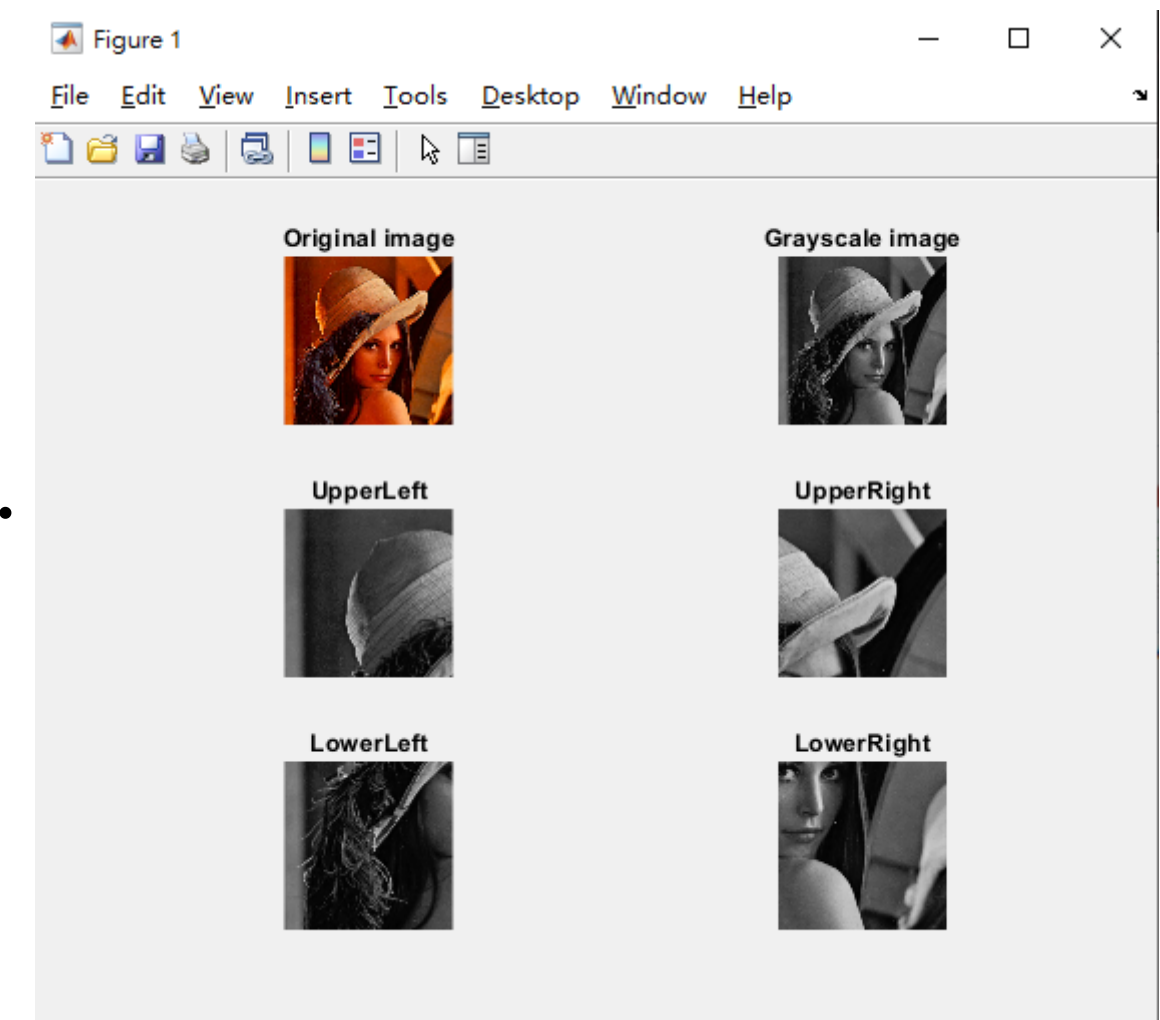
資工四乙 406262462 羅韋杰

Introduction

- 本作業會分成兩個部分
 - 第一部分是使用"Lenna.tif" 練習DIP
 - 第二部分是使用貓咪的圖片去縮小，並且以三種不同的方法放大，觀察結果



Digital Image Processing (DIP) in MATLAB



```
1 grayI = rgb2gray(I);
2 I1 = grayI(1:round(row/2), 1:round(col/2));
3 I2 = grayI(1:round(row/2), round(col/2)+1:end);
4 I3 = grayI(round(row/2)+1:end, 1:round(col/2));
5 I4 = grayI(round(row/2)+1:end, round(col/2)+1:end);
6 subplot(3,2,3), imshow(I1), title('UpperLeft')
7 subplot(3,2,4), imshow(I2), title('UpperRight')
8 subplot(3,2,5), imshow(I3), title('LowerLeft')
9 subplot(3,2,6), imshow(I4), title('LowerRight')
```

Image Sampling

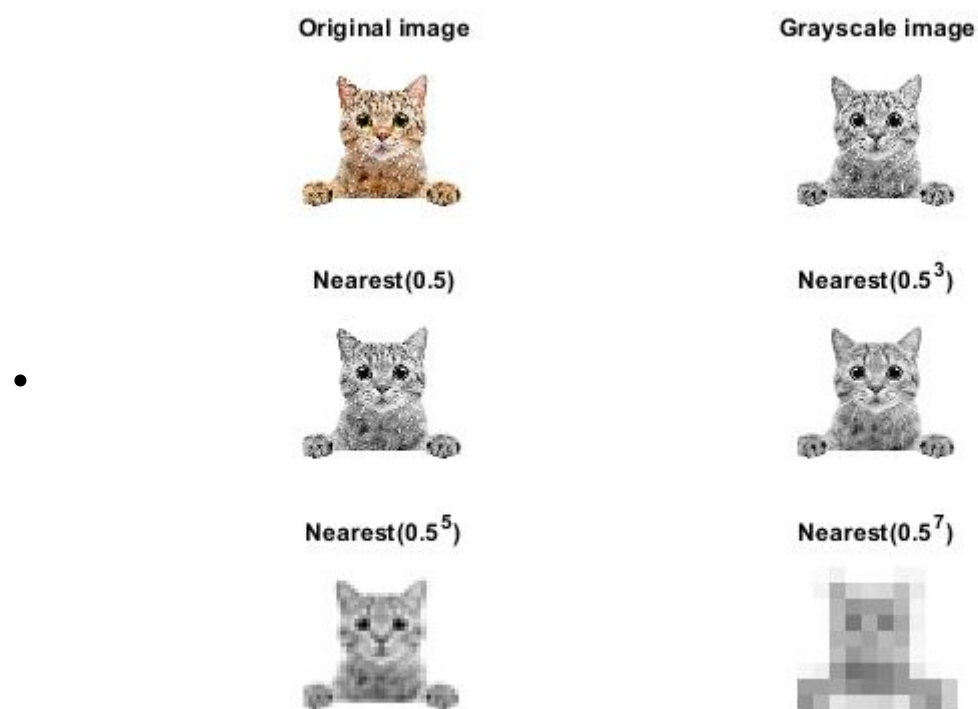
- 首先，我把我的原圖，以四種規格去進行縮小
 - 0.5
 - 0.5^3
 - 0.5^5
 - 0.5^7

- 再來，以三種不同的插值方法將圖片變回原本的大小
 - Nearest
 - Bilinear
 - Bicubic



1st Method : Nearest

- Nearest 是最簡單的方法，他會直接將鄰近的像素數值拿來使用

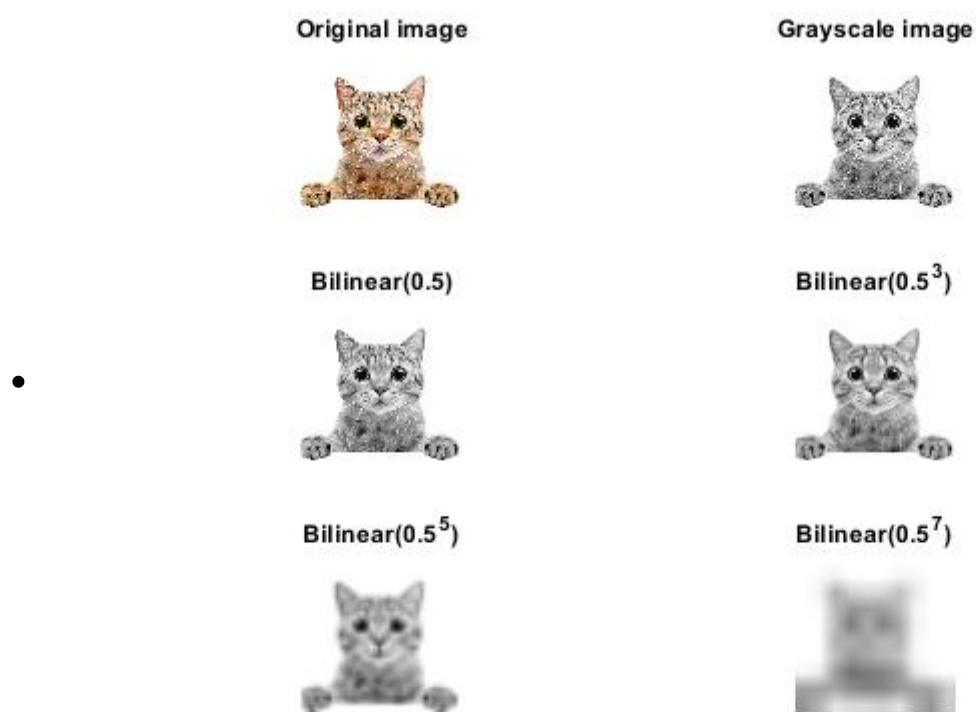


```

1  % resize the image with Nearest in 4 different size
2
3  small1 = imresize(grayI, 0.5);
4  small2 = imresize(grayI, 0.5^3);
5  small3 = imresize(grayI, 0.5^5);
6  small4 = imresize(grayI, 0.5^7);
7
8  nearest1 = imresize(small1 , 2 , 'nearest');
9  nearest2 = imresize(small2 , 2^3 , 'nearest');
10 nearest3 = imresize(small3 , 2^5 , 'nearest');
11 nearest4 = imresize(small4 , 2^7 , 'nearest');
12
13 subplot(3,2,3), imshow(nearest1), title('Nearest(0.5)');
14 subplot(3,2,4), imshow(nearest2), title('Nearest(0.5^3)');
15 subplot(3,2,5), imshow(nearest3), title('Nearest(0.5^5)');
16 subplot(3,2,6), imshow(nearest4), title('Nearest(0.5^7)');
```

2nd Method : Bilinear

- Bilinear 是利用周圍 2X2 · 4個鄰居的像素數值去做線性內插



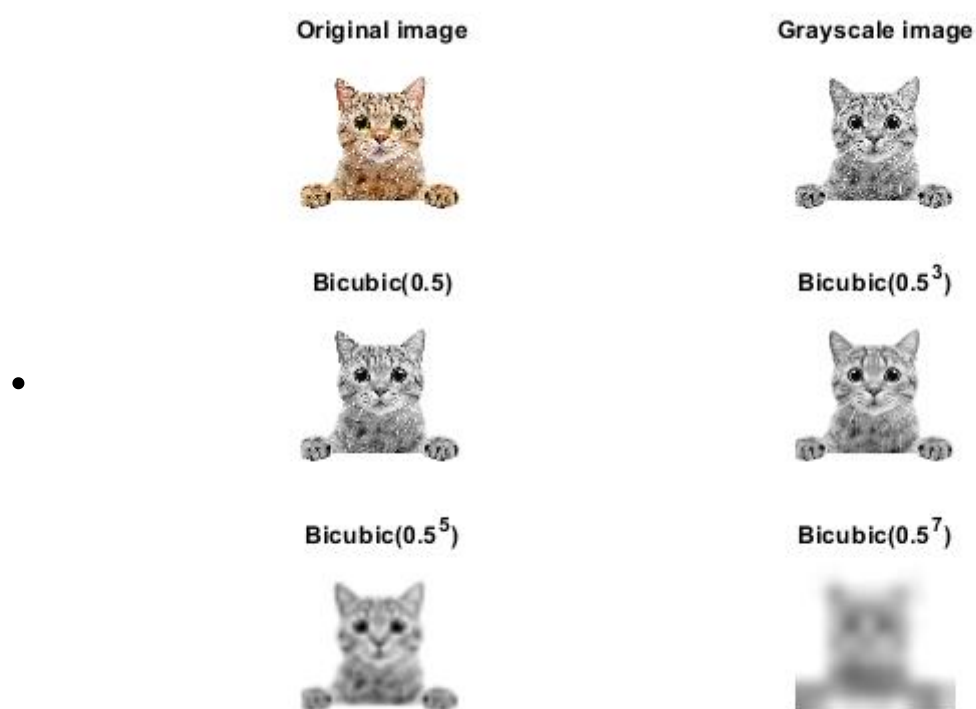
```

1  % resize the image with Bilinear in 4 different size
2
3  small1 = imresize(grayI, 0.5);
4  small2 = imresize(grayI, 0.5^3);
5  small3 = imresize(grayI, 0.5^5);
6  small4 = imresize(grayI, 0.5^7);
7
8  bilinear1 = imresize(small1 , 2 , 'bilinear');
9  bilinear2 = imresize(small2 , 2^3 , 'bilinear');
10 bilinear3 = imresize(small3 , 2^5 , 'bilinear');
11 bilinear4 = imresize(small4 , 2^7 , 'bilinear');
12
13 subplot(3,2,3), imshow(bilinear1), title('Bilinear(0.5)');
14 subplot(3,2,4), imshow(bilinear2), title('Bilinear(0.5^3)');
15 subplot(3,2,5), imshow(bilinear3), title('Bilinear(0.5^5)');
16 subplot(3,2,6), imshow(bilinear4), title('Bilinear(0.5^7)');
17

```

3rd Method : Bicubic

- Bicubic 是利用周圍 4X4 · 16個鄰居像素數值去做內插，並且依照遠近的不同會有不同的權重



```
1 % resize the image with Bicubic in 4 different size
2
3 small1 = imresize(grayI, 0.5);
4 small2 = imresize(grayI, 0.5^3);
5 small3 = imresize(grayI, 0.5^5);
6 small4 = imresize(grayI, 0.5^7);
7
8 bicubic1 = imresize(small1 , 2 , 'bicubic');
9 bicubic2 = imresize(small2 , 2^3 , 'bicubic');
10 bicubic3 = imresize(small3 , 2^5 , 'bicubic');
11 bicubic4 = imresize(small4 , 2^7 , 'bicubic');
12
13 subplot(3,2,3), imshow(bicubic1), title('Bicubic(0.5)');
14 subplot(3,2,4), imshow(bicubic2), title('Bicubic(0.5^3)');
15 subplot(3,2,5), imshow(bicubic3), title('Bicubic(0.5^5)');
16 subplot(3,2,6), imshow(bicubic4), title('Bicubic(0.5^7)');
```

Conclusion

- 根據觀察，這三種方法在還原過程中，Nearest還原的效果最差，而導致此現象的原因就是 Nearesr在放大過程中，像素不夠就是直接複製旁邊的像素，所以瑕疵很多，但優點是計算速度快
- 在比較 Bilinear 以及 Bicubic 的過程中，發現以 Bicubic 方法放大的圖，品質明顯比 Bilinear 以及 Nearest 好了許多。這是因為 Bicubic 在放大的過程中，他採用了原圖周圍16個像素去進行插值，所以放大後尚能保留原圖的細緻。