Computer Vision HW1 Report

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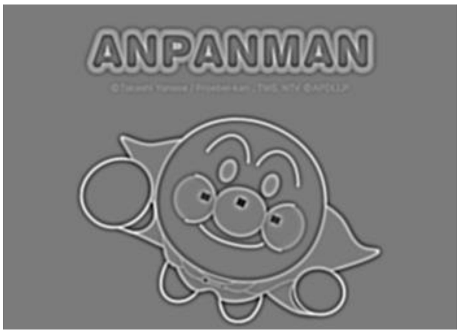
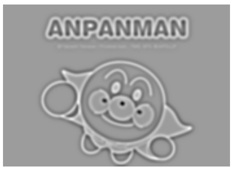
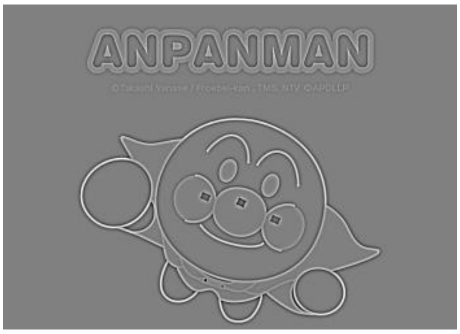
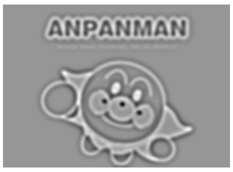
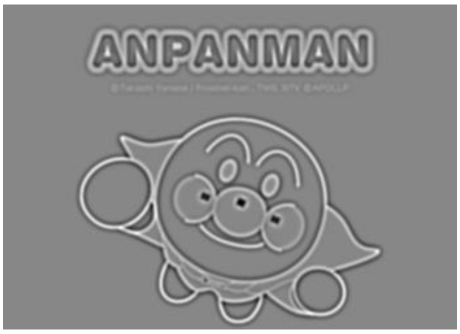
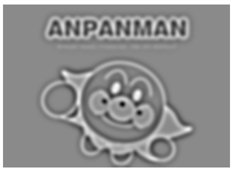
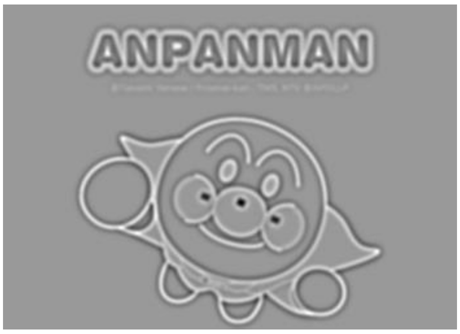
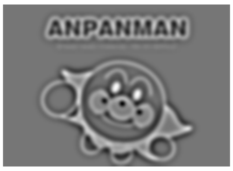
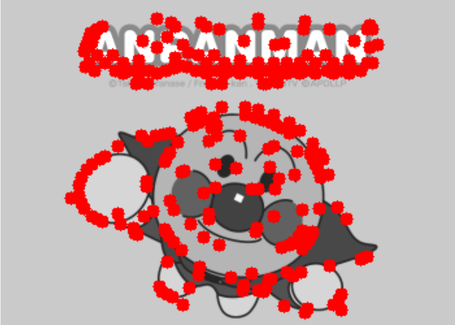
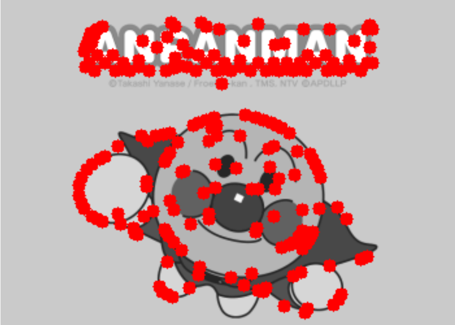
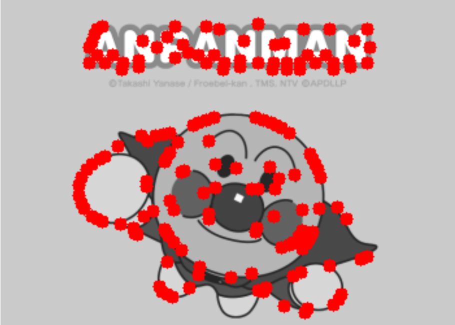
Part 1.

- **Visualize the DoG images of 1.png.**

	DoG Image (threshold = 3)		DoG Image (threshold = 3)
DoG1-1.png		DoG2-1.png	
DoG1-2.png		DoG2-2.png	
DoG1-3.png		DoG2-3.png	
DoG1-4.png		DoG2-4.png	

- **Use three thresholds (1,2,3) on 2.png and describe the difference.**

Threshold	Image with detected keypoints on 2.png

1	
2	
3	

由上面幾張圖的結果可知，當 threshold 增加時，key points 會減少。threshold = 1 時，key points 超級多，而且稍有不準。Threshold = 3 時，邊緣處理得比較精準，key points 不會像 1 時這麼亂。

Part 2.

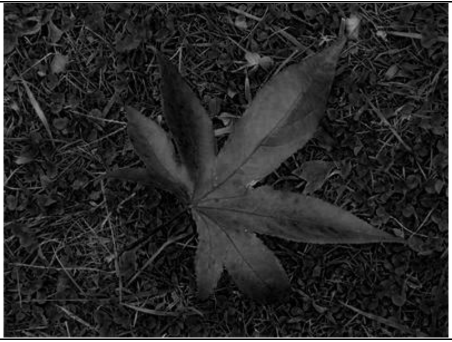
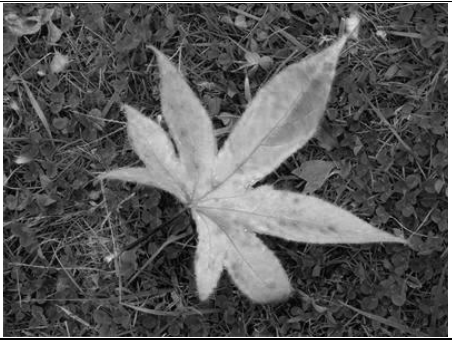
- **Report the cost for each filtered image.**

Gray Scale Setting	Cost (1.png)
cv2.COLOR_BGR2GRAY	1207799
R*0.0+G*0.0+B*1.0	1439568
R*0.0+G*1.0+B*0.0	1305961
R*0.1+G*0.0+B*0.9	1386209
R*0.1+G*0.4+B*0.5	1277424
R*0.8+G*0.2+B*0.0	1127895

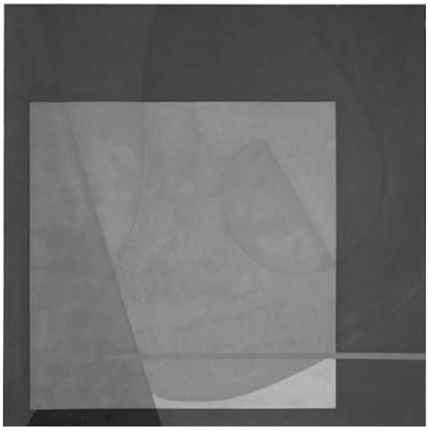
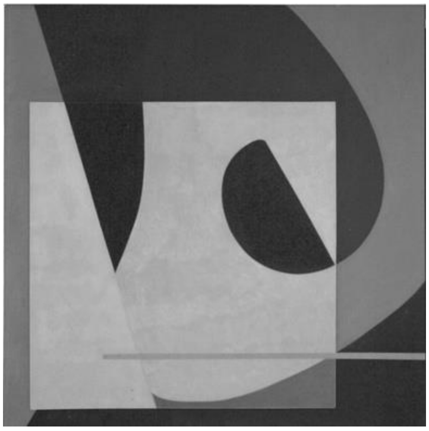
Gray Scale Setting	Cost (2.png)
cv2.COLOR_BGR2GRAY	183851
R*0.1+G*0.0+B*0.9	78454
R*0.2+G*0.0+B*0.8	86422
R*0.2+G*0.8+B*0.0	187520
R*0.4+G*0.0+B*0.6	128825
R*1.0+G*0.0+B*0.0	110862

- **Show original RGB image / two filtered RGB images and two grayscale images with highest and lowest cost.**

Original RGB image (1.png)	Filtered RGB image and Grayscale image of Highest cost	Filtered RGB image and Grayscale image of Lowest cost

從 cost 最高的 gray image 來看，很不好看出楓葉與旁邊的草。而從 cost 最低的 gray image 來看，可以輕易地分辨楓葉和旁邊的草。這表示由權重 (0.8, 0.2, 0.0) 生成的 gray image 是將 rgb image 轉換成灰階影像的最好的參數。

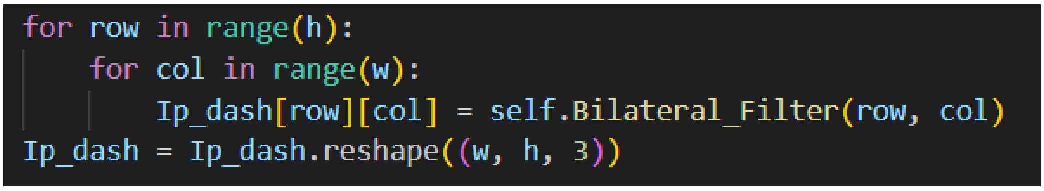
Original RGB image (2.png)	Filtered RGB image and Grayscale image of Highest cost	Filtered RGB image and Grayscale image of Lowest cost
		

從 cost 最高的 gray image 來看，這個酷酷的抽象畫的紋理變得很淡，不好看出來。相較之下，cost 最低的 gray image 來看，紋理非常明顯。這表示由權重 (0.1, 0.0, 0.9) 產生的 gray image 是將 rgb image 轉換成灰階影像的最好的參數。

- **Describe how to speed up the implementation of bilateral filter.**

原本的方法：

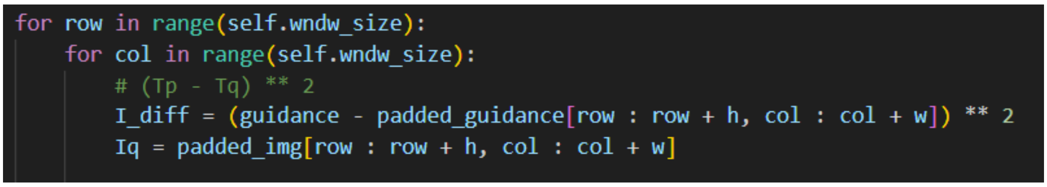
用 for 迴圈去遍歷原圖得所有 pixed，但這樣做會有個缺點，當圖像越大時，就會跑得越久。



```
for row in range(h):
    for col in range(w):
        Ip_dash[row][col] = self.Bilateral_Filter(row, col)
Ip_dash = Ip_dash.reshape((w, h, 3))
```

改進後的方法：

用 for 迴圈去遍歷 kernal，在計算時，用 numpy 的矩陣運算一次把整張圖算進去，能省去不少時間。



```
for row in range(self.wndw_size):
    for col in range(self.wndw_size):
        # (Tp - Tq) ** 2
        I_diff = (guidance - padded_guidance[row : row + h, col : col + w]) ** 2
        Iq = padded_img[row : row + h, col : col + w]
```