Computer Vision HW1 Report

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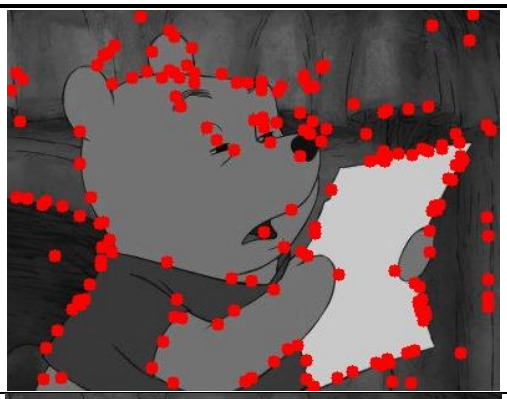
Part 1.

- **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		

(describe the difference)

當 threshold 提高，key points 便會變少，這當然是因為有更多不是很清楚的邊界被篩選掉了。其中 threshold 是 1 的時候只要色塊亮度差異較大，就很容易被認為是邊界，因此有很多誤判的點；threshold 是 2 的時候效果好很多，能看出原圖輪廓或是辨認出原圖上比較明顯的線；threshold 是 3 的時候則是標的點正確率很高且標的點數較少。

Part 2.

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

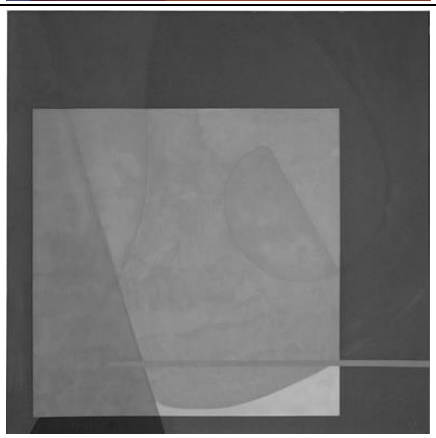
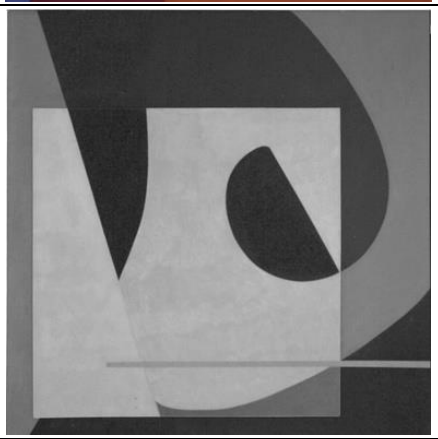
Gray Scale Setting	Cost (1.png)	Gray Scale Setting	Cost (2.png)
cv2.COLOR_BGR2GRAY	1207799	cv2.COLOR_BGR2GRAY	183850
R*0.0+G*0.0+B*1.0	1439568	R*0.1+G*0.0+B*0.9	77883
R*0.0+G*1.0+B*0.0	1305961	R*0.2+G*0.0+B*0.8	86023
R*0.1+G*0.0+B*0.9	1393620	R*0.2+G*0.8+B*0.0	188019
R*0.1+G*0.4+B*0.5	1279697	R*0.4+G*0.0+B*0.6	128341
R*0.8+G*0.2+B*0.0	1127913	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
		
		

(Describe the difference between those two grayscale images)

Highest cost 的灰階圖很暗，非常難以辨認原圖中的楓葉與其背景草地的差異性。反之，lowest cost 的灰階圖很明顯的看出楓葉，並由明亮差異可以更清晰的看出背景草地的紋路與材質。

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

(Describe the difference between those two grayscale images)

Highest cost 的灰階圖不同色塊混在一起，幾乎變成只有中間的亮色塊以及旁邊的暗色塊，非常難以辨認原圖中不同的色塊。反之，lowest cost 的灰階圖很明顯的看出色塊的明暗以及邊界，可以更清晰的看出原圖中的不同色塊。

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

在實作中，由於距離$\pm 3\sigma_s$的 window 所構成的 spatial kernel 每一次迴圈都會是$e^{-\frac{x^2+y^2}{2\sigma_s^2}}$，所以可以預先建立 spatial kernel 不用每次重算；我也建立了 look up table 存$-\frac{n^2}{2(255*\sigma_r^2)}$,$n \in 0, 1, \ldots, 255$的值，可以減少之後在算 range kernel 指數部分時的計算。為了再讓他快個幾毫秒我預先判斷 guidance 為灰階或彩色，以減少在迴圈中多餘的判斷式。