Computer Vision HW1 Report

Student ID: R12521502
Name: 陳冠言
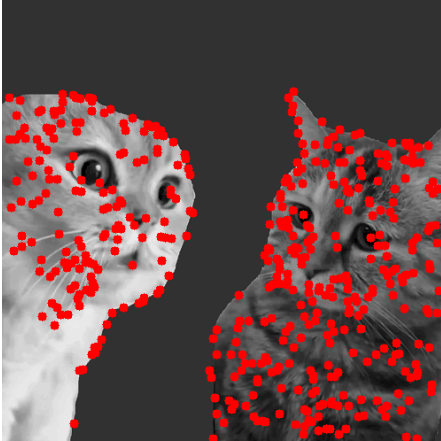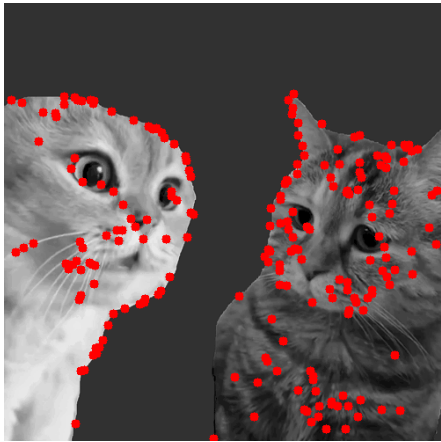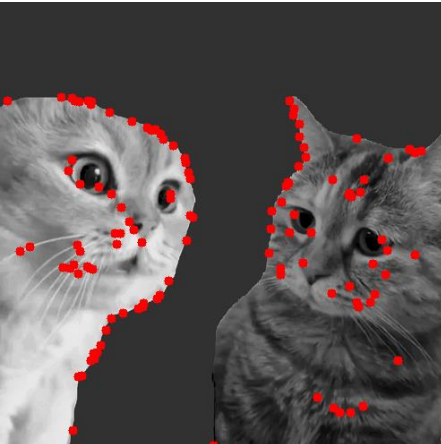
Part 1.

- **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)

From the above images, it can be observed that as the thresholds decrease, the number of keypoints increases. It can be inferred that as the thresholds decrease, the model is more sensitive to local subtle changes, resulting in more regions being identified as keypoints. Conversely, as the thresholds increase, the sensitivity to local changes decreases, and only more prominent regions are identified as keypoints, hence the fewest keypoints are observed when the threshold equals 3. Overall, as the thresholds increase, the number of detected keypoints decreases, but the detected keypoints may be more prominent and distinct.

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	1393620
R*0.1+G*0.4+B*0.5	1279697
R*0.8+G*0.2+B*0.0	1127913
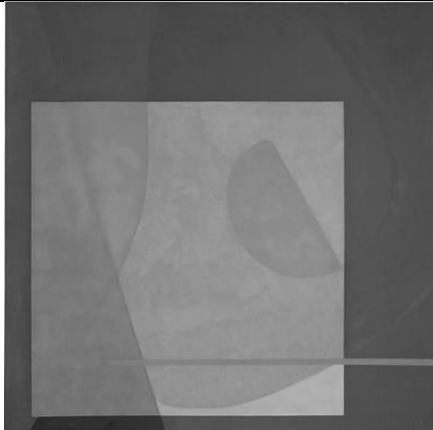
Gray Scale Setting	Cost (2.png)
cv2.COLOR_BGR2GRAY	183850
R*0.1+G*0.0+B*0.9	77882
R*0.2+G*0.0+B*0.8	86023
R*0.2+G*0.8+B*0.0	188019
R*0.4+G*0.0+B*0.6	128341
R*1.0+G*0.0+B*0.0	110862

- **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)

From the above image, it can be observed that the grayscale image with the highest cost appears darker in brightness and lacks color detail and contrast between different colors. Conversely, the grayscale image with the lowest cost maintains a better proportion of RGB adjustments, resembling the original image's color balance. This enables the grayscale image to preserve color details and contrast more effectively from the original color image.

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)

From the above image, it is evident that the grayscale image with the highest cost lacks color detail and contrast between different colors, resulting in a relatively uniform appearance across the image. Conversely, the grayscale image with the lowest cost maintains a better adjustment of RGB proportions, aligning more closely with the color balance of the original image. This allows the grayscale image to preserve details and contrast from the original color image more effectively, thereby enhancing the clarity and distinguishability of the image for observation.

- **Describe how to speed up the implementation of bilateral filter.**
    The primary approach involves replacing the scanning of for loops with the utilization of tables for recording. Precomputing the spatial and range Gaussian weights beforehand, as opposed to continuously computing within for loops, reduces time complexity by trading space for time. Additionally, the code endeavors to maximize the use of vectorization, executing operations on entire matrices at once, thereby enhancing speed.