Computer Vision HW1 Report

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Part 1.

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

	DoG Image (threshold = 5)		DoG Image (threshold = 5)
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 (2, 5, 7) on 2.png and describe the difference.**

Threshold	Image with detected keypoints on 2.png
2	
5	
7	

(describe the difference)

From the figures above, we can find out that when threshold equals to 2, the number of detected keypoints is the largest. On the other hand, when the threshold equals to 7, there are only few keypoints. If we take a look closely, we can find out that there are a lot of keypoints on the Japanese words in the image when threshold equals to 2, but there are barely no keypoints on them when threshold equals to 5 and 7.

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

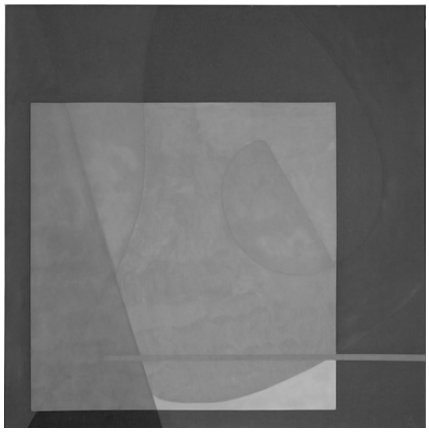
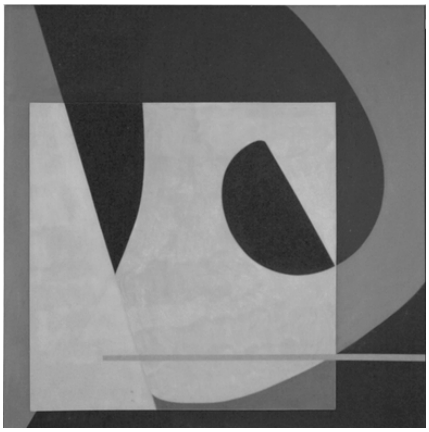
Gray Scale Setting	Cost (2.png)
cv2.COLOR_BGR2GRAY	183851
R*0.1+G*0.0+B*0.9	77883
R*0.2+G*0.0+B*0.8	86023
R*0.2+G*0.8+B*0.0	188019
R*0.4+G*0.0+B*0.6	128341
R*1.0+G*0.0+B*0.0	110862

- **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 images above, we can find out the difference in color of the leaf. The gray image with highest cost is darker than the gray image with lowest cost. Moreover, The detail of the background is clearer in the image of the lowest cost.

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 images above, we can find out that the gray image with the lowest cost preserve the details of the original image better than that of the highest cost. We can easily see outline of the shape in the gray image of lowest cost. However, it is hard to see the detailed outline of the image with the highest cost.

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

First of all, we always use numpy array to do the computations instead of using list or for-loops. Note that the spatial kernel is always constant and symmetric no matter how the window slides, so we save the result so as to reduce computations. Finally, when computing range kernel, the difference of the pixel value is always between 0 and 255. Thus, we only need to compute once and save all the results in a numpy array. Since the pixel value must be normalized to [0,1], so we need to divide the original range kernel formula by 255^2.