Computer Vision HW1 Report

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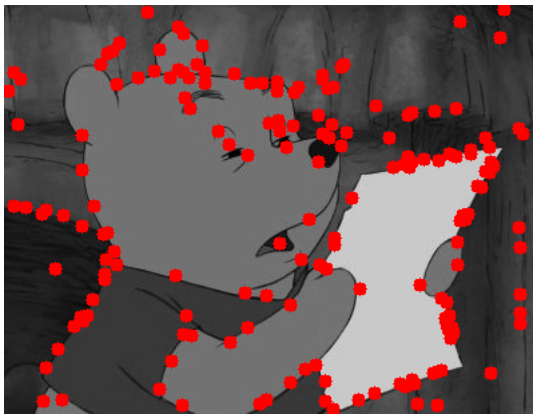
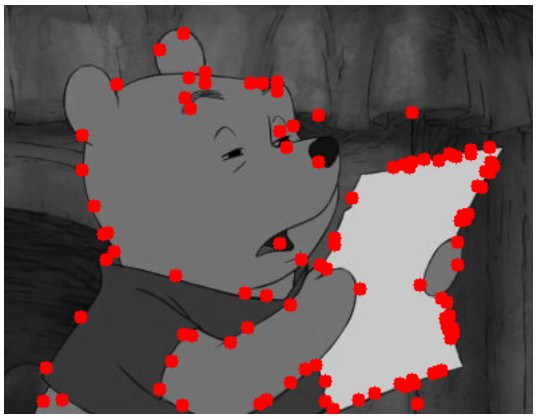
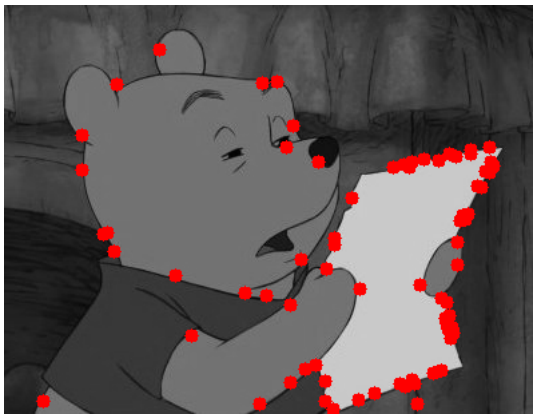
Part 1.

- **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)

The difference among the 3 outcomes is that the higher the threshold is, the less keypoints it captures. But the keypoints that still stays as the threshold rises are more accurate. They focus on the main features more rather than capturing the surrounding items.

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

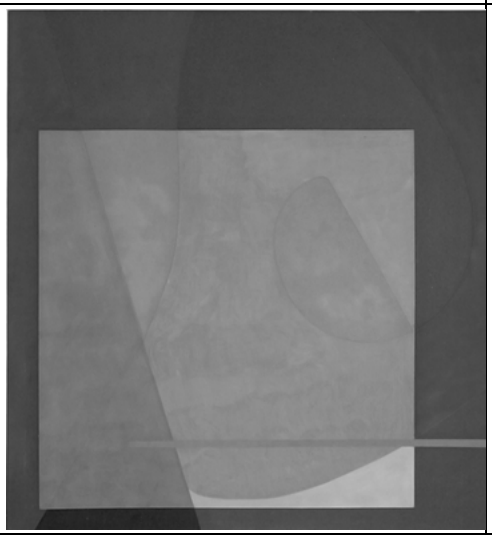
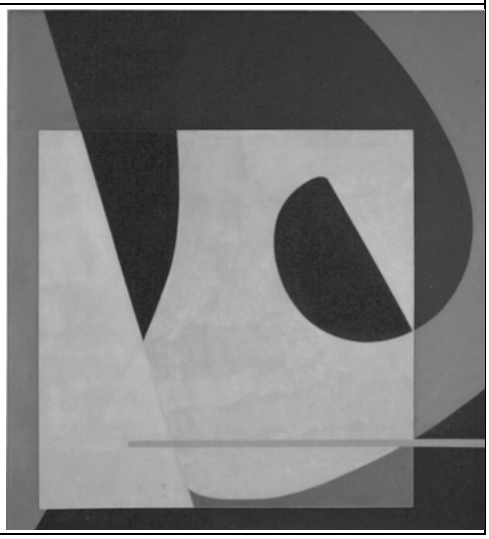
Gray Scale Setting	Cost (2.png)
cv2.COLOR_BGR2GRAY	183850
R*0.1+G*0.0+B*0.9	77884
R*0.2+G*0.0+B*0.8	86023
R*0.2+G*0.8+B*0.0	188019
R*0.4+G*0.0+B*0.6	128341
R*1.0+G*0.0+B*0.0	110862

- **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)

The guidance image with the lowest cost is brighter and thus clearer. There are bigger differences between the main item and the surroundings.

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)

The guidance image with the lowest cost has more obvious features rather than vague borders. Also, better color conversion leads to preserving the differences between color blocks.

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

  I created a look up table for the exponential calculations of the range kernel. The range of the difference of f(x-i , y-j) and f(x,y) is limited (0,255). Thus,I can create a static table to check rather than calculate every time.

  Also, I use np.multiply() ans np.sum() to avoid for loop multiplications/summations.