Homework 3

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1.

How to run: put the script bag_of_word.py in the folder CV_Assignment3 and run “python bag_of_word.py 0(or 1; 0: KNN, 1: SVM)”.

Runtime: it takes about 5 minutes to run through all procedures and print the accuracy on my laptop.

Accuracy: Nearest Neighbors with TF-IDF: 38.69%; SVM with TF-IDF: 46.89%.

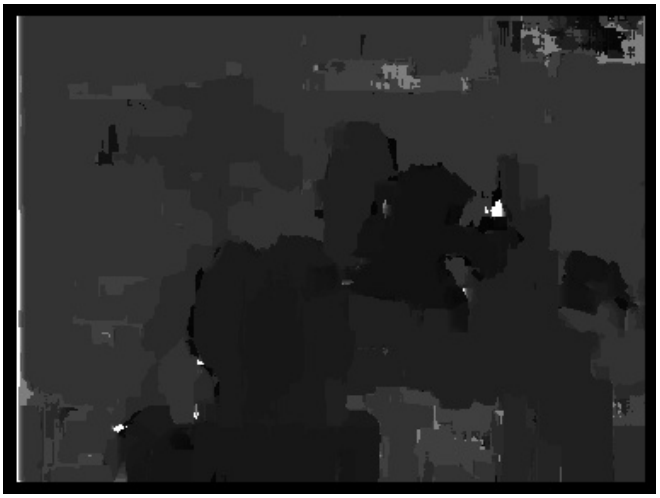
Analysis: I think the performance of SVM is better because the data are in a high dimensional space and nearest neighbors algorithm is more sensitive to outliers.

2.

How to run: put the script stereo_matching.py in the folder contains the two test image and run “python stereo_matching.py”. An image and a text file will be generated.

Runtime: it takes about 30 seconds to run through the script on my laptop.

a.



b. From the depth image above we can find a few reasonable regions like the head and the lamp. It’s not hard to realize that these regions have a significant different of color distribution from its surrounding area. We can notice that many parts of the background look very similar so if we only use NCC to find corresponding points, we will fail to find the correct one in many cases which results the bad depth map.

3.

a. According to matrix K, we can find that the focal length is 1072 and the image center of the camera is (500, 390).

b. According to matrix C, the position of the camera is (25, 50, 0) and the orientation is 45 degrees around X axis.

c. If we want to rotate 10 degrees around the camera X axis, we can just multiply a corresponding rotation matrix on the right side of the original one:

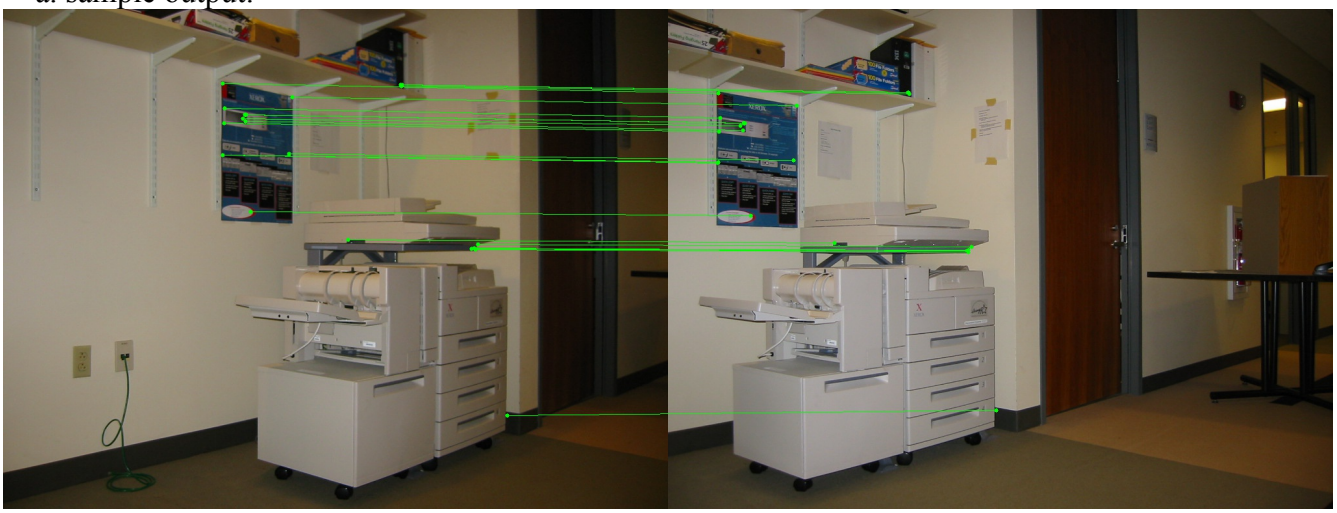
$$\begin{pmatrix} 1.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.7071 & -0.7071 \\ 0.0000 & 0.7071 & 0.7071 \end{pmatrix} \times \begin{pmatrix} 1.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.9848 & -0.1736 \\ 0.0000 & 0.1736 & 0.9848 \end{pmatrix} = \begin{pmatrix} 1.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.5736 & -0.8191 \\ 0.0000 & 0.8191 & 0.5736 \end{pmatrix}$$

d. Since the camera is translated along the world positive X axis, it means the camera is closer to the origin of world coordinate. Therefore the new vector C is (15, 50, 0).

4.

How to run: put the script fundamental.py in the folder contains the two test image and run “python fundamental.py”. Two images will be generated and the fundamental matrix will be printed to the terminal.

a. sample output:



c. sample output: