Project 3 - ENPM 673

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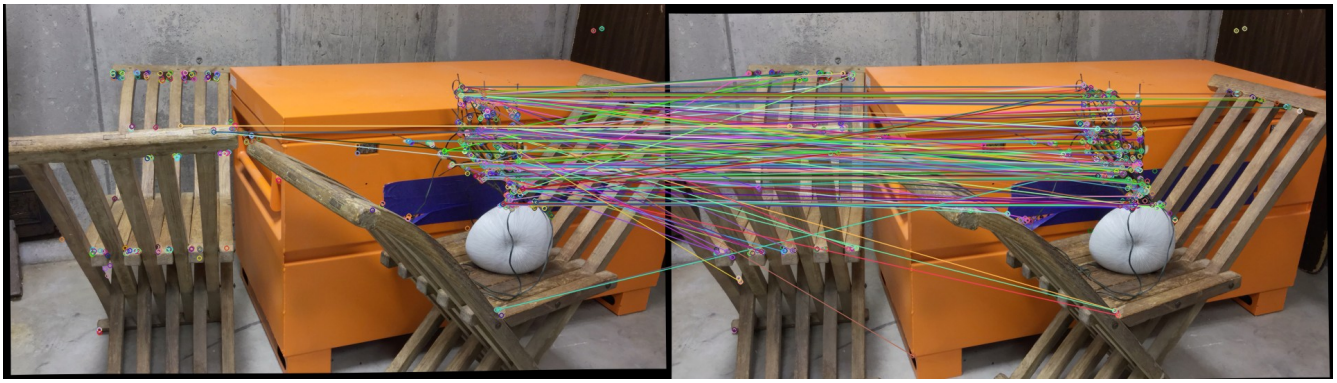
1. Calibration

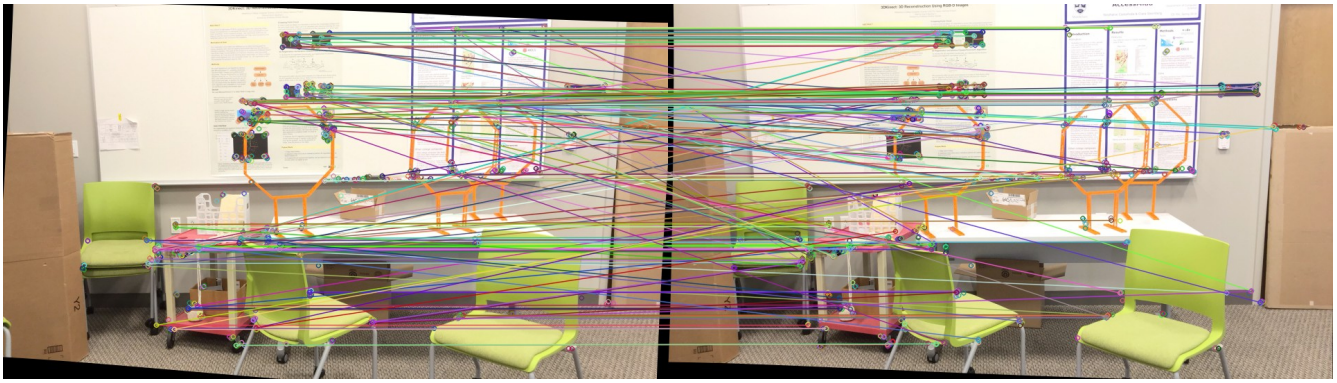
1. To obtain the corner points, I used ORB (Oriented Fast and Rotated Brief) feature detector, which is a good and then used FLANN based matcher to detect the matching features between two images and KNN matcher to match them.
2. The result obtained is as shown in figure 1.
3. Then fundamental matrix (F) is calculated using the 8 point algorithm and for this RANSAC is used to eliminate the outliers
4. From the obtained fundamental matrix, essential matrix (E) can be estimated by using camera parameters K1 and K2. It can be estimated as follows:

$$E = K_1.F.K_2$$

5. The essential matrix can be used to calculate camera pose. The posture of camera 2 is calculated taking camera 1 as origin.



(a)



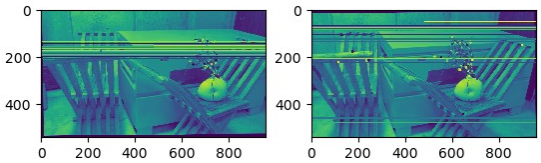
(b)

(c)

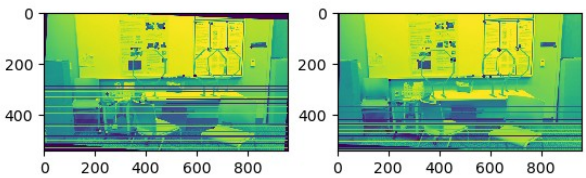
Figure 1: Feature matching using FLANN based KNN matcher and ORB feature detection

2. Rectification

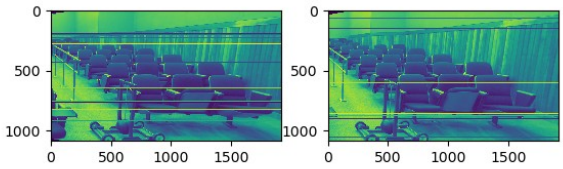
1. Using fundamental matrix and feature points, we can obtain epipolar lines for both the images.
2. The rectification can be done by using the inbuilt Open CV function ‘cv2.stereoRectifyUncalibrated’, the output for which will be two homography matrices H_1 and H_2 for each image.



(a) Curule output after rectification



(b) Octagon output after rectification



(c) Pendulum output after rectification

Figure 2: Output of 3 data sets after rectification

3. Correspondence

1. This is done by a method called block matching.
2. Here we take a small region from left image and try to find the corresponding closest match to it in the right one.
3. The blocked comparison method I used in the process is 'Sum Squared Difference' as it gives a decent result in moderate computation time.

4. Computing the depth and disparity

1. The disparity can be found out by taking the absolute difference between source and matched pixels' locations.
2. The depth (d) at a point is found out by using baseline (b), focal length (f) and disparity at the point.
3. The formula is as follows:

$$d = (f*b)/disparity$$