CSE 573 HW3 Report

Part 1 - Homography Estimation

1. Extracting harris corners, the parameters of harris.m are:
   Sigma = 2, threshold = 0.05, radius = 2,
   where,
   Sigma: standard deviation of smoothing Gaussian.
   Threshold: the threshold of harris.
   Radius: radius of region considered in non-maximal.

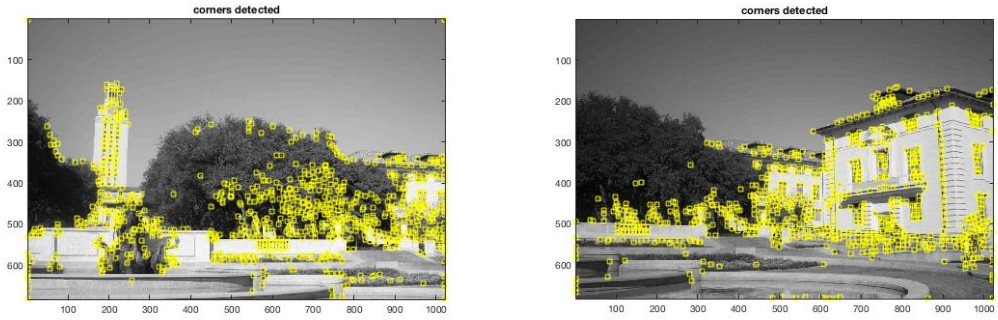


Figure 1. Harris Corners of the Uttower

2. Extract local neighborhoods around every keypoint in both images, and form descriptors simply by "flattening" the pixel values in each neighborhood to one-dimensional vectors.

Figure 2. Extracted Descriptors

3. Run the RANSAC to estimate the homography matrix and transform one image. Then, stitching the warpped image to the other one.

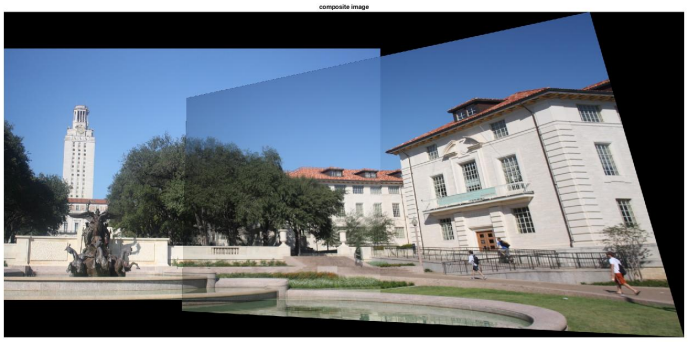


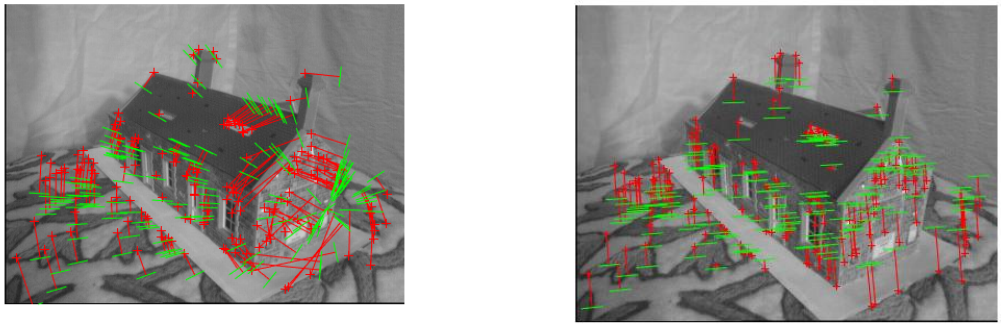
Figure 3. The Composite Image

Part 2 – Fundamental Matrix Estimation and Triangulation

1. For both image pairs, for both unnormalized and normalized estimation using ground truth matches, and display the results and the residuals.

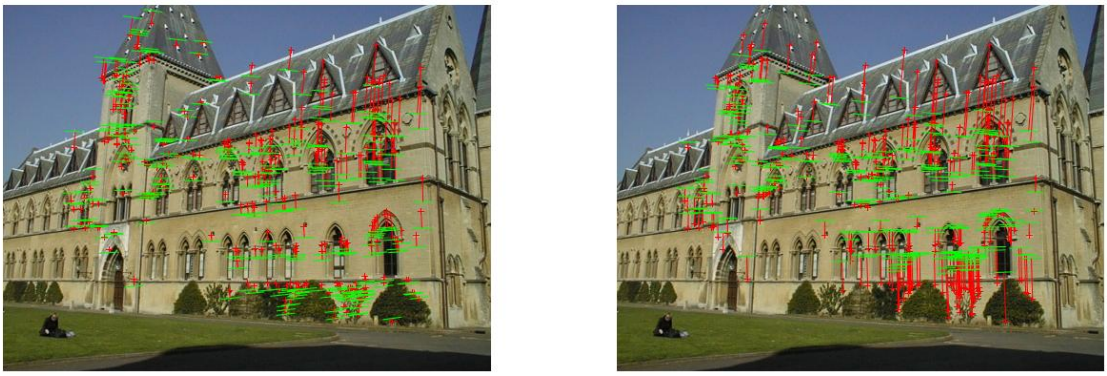
Table 1. Residuals of Ground Truth

Image	Un-Normalized	Normalized
House	11.3273	7.7545
Library	75.5939	15.7671



Un-Normalized Normalized

Figure 4. Epipolar Lines for House from GroundTruth



Un-Normalized Normalized

Figure 5. Epipolar Lines for Library from GroundTruth

2. Run RANSAC to estimate the fundamental matrix and get the epipolar lines.
   For harris parameters:
   Sigma = 2, threshold = 0.01, radius = 2, neighbors_size = 6;
   residual threshold of house image = 0.001, residual threshold of library image = 0.001

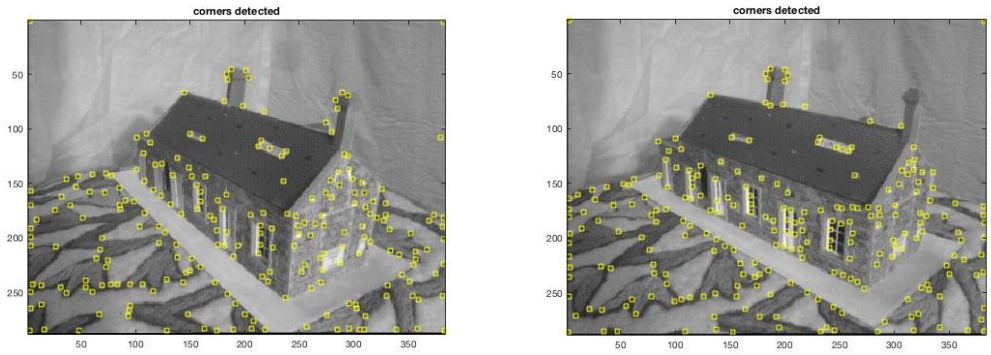


Figure 6. Harris Corners of House Images

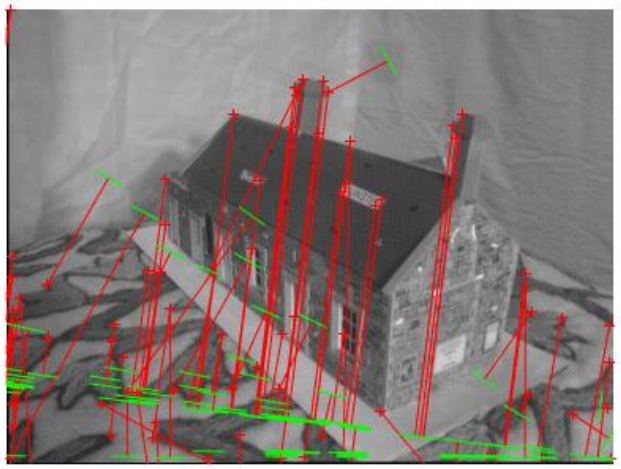


Figure 7. Epipolar Lines from RANSAC (House Imge)

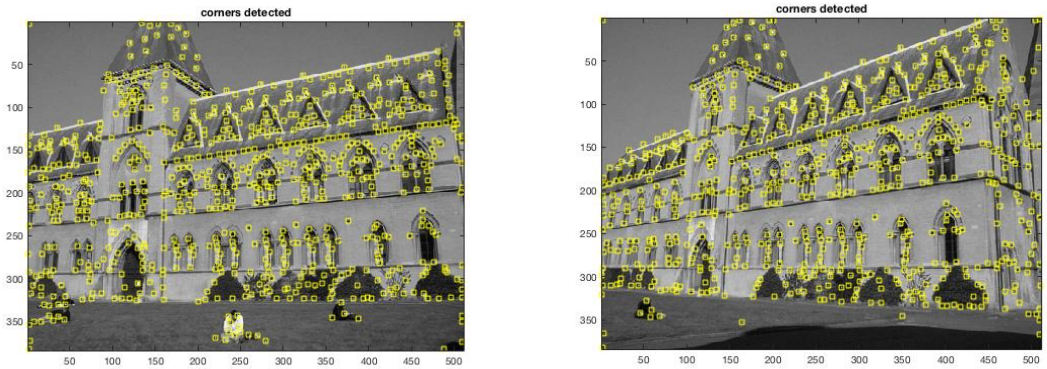


Figure 8. Harris Corners of Library Images

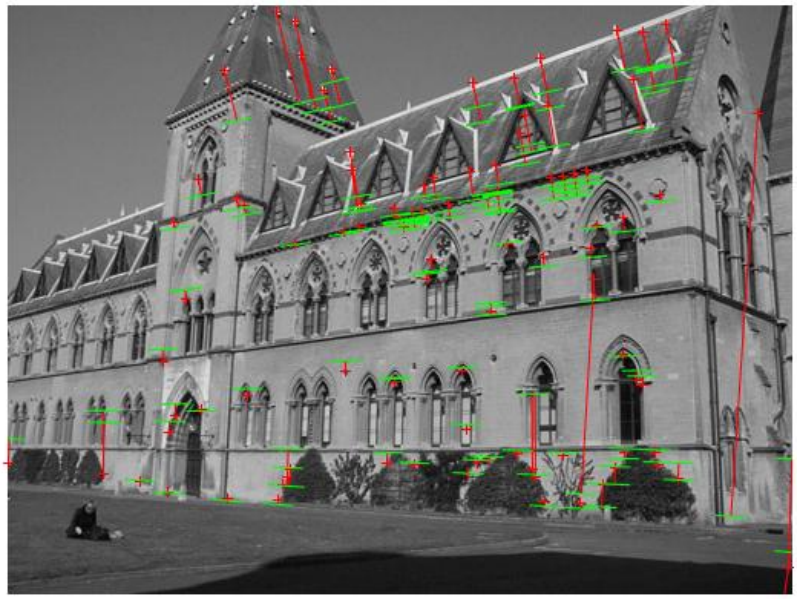


Figure 9. Epipolar Lines from RANSAC (Library Image)

Table 3. Residuals from RANSAC Estimation of Fundamental Matrix

Image	Number of Inliers	Mean Inlier Residual
House	49	0.00020686
Library	57	0.0002468

3. For both image pairs, visualize 3D camera centers and triangulated 3D points.

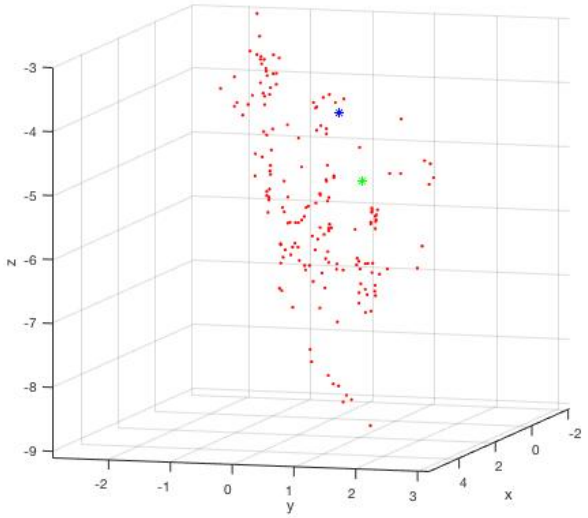


Figure 10. Triangulation of House Image

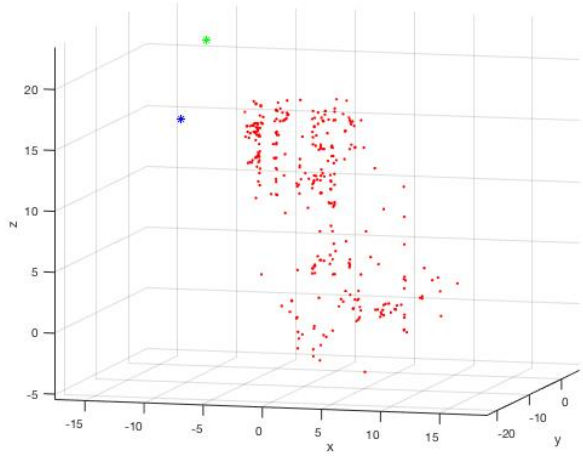


Figure 11. Triangulation of Library Image

Table 3. Mean Residuals of Triangulation

Image	Mean Residual Img1	Mean Residual Img2
House	0.0025221	0.15655
Library	0.073128	0.26768