

CS543/ECE549 Assignment 5

Your Name: <name>

Your NetId: <netid>

Part 1: Fundamental Matrix Estimation, Camera Calibration, Triangulation

1. For the **lab** and **library** image pairs, display your result (points and epipolar lines) and report your residual for both unnormalized and normalized fundamental matrix estimation.
2. For the **lab** image pair, show your estimated 3x4 camera projection matrices. Report the residual between the projected and observed 2D points.
- 3-4. For the **lab** and **library** image pairs, visualize 3D camera centers and triangulated 3D points.
5. For the **house** and **gaudi** image pairs, display your result and report your number of inliers and average inlier residual for normalized estimation without ground truth matches.

Part 1 Extra Credit (optional)

Part 2: Affine factorization

A: Display the 3D structure (you may want to include snapshots from several viewpoints to show the structure clearly). Report the Q matrix you found to eliminate the affine ambiguity. Discuss whether or not the reconstruction has an ambiguity.

B: Display three frames with both the observed feature points and the estimated projected 3D points overlaid.

C: Report your total residual (sum of squared Euclidean distances, in pixels, between the observed and the reprojected features) over all the frames, and plot the per-frame residual as a function of the frame number.

Part 2 Extra Credit (optional)

Part 3: Binocular stereo

A: Display best output disparity maps for both pairs.

B: Study of implementation parameters:

1. Search window size: show disparity maps for several window sizes and discuss which window size works the best (or what are the tradeoffs between using different window sizes). How does the running time depend on window size?
2. Disparity range: what is the range of the scanline in the second image that should be traversed in order to find a match for a given location in the first image? Examine the stereo pair to determine what is the maximum disparity value that makes sense, where to start the search on the scanline, and which direction to search in. Report which settings you ended up using.
3. Matching function: try sum of squared differences (SSD), sum of absolute differences (SAD), and normalized correlation. Show the output disparity maps for each. Discuss whether there is any difference between using these functions, both in terms of quality of the results and in terms of running time.

C: Discuss the shortcomings of your algorithm. Where do the estimated disparity maps look good, and where do they look bad? What would be required to produce better results? Also discuss the running time of your approach and what might be needed to make stereo run faster.

Part 3 Extra Credit (optional)