

Photogrammetric Computer Vision

Final Project

Submitted By

Group E

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1.0 Task 1

- a) The Calibration Matrix K_1 and K_2 were determined from the following steps:
- Obtaining the two image coordinates from the file provided.
 - Calculating the fundamental matrix through a series of conditioning, scaling and SVD.
 - The projection Matrix is then obtained for both image pairs assuming one projection matrix as P_{Normal} as per lecture.
 - The respective calibration matrices were now obtained from QR Decomposition of the projective matrices.

The result for the calibration matrices for the two cameras is shown in figure 1

```
The Calibration Matrix is:
2.7705 -122.8686  78.0376
      0  24.0528 -120.6930
      0          0  1.0000

The Calibration Matrix is:
1      0      0
0      1      0
0      0      1
```

Figure 1: Calibration Matrix for both Cameras.

- b) The Essential Matrix E is determined from the calibration matrix and the result is displayed as shown in figure 2.

```
The Essential Matrix is
0.0000  0.0000  0.0054
-0.0004 -0.0011 -0.0110
-0.0041 -0.0115  0.0011
```

Figure 2: Figure showing Computed Essential Matrix

- c) The Fourfold Ambiguity is implemented on the Essential Matrix and the resulting Rotational Matrix and Translational Vector is shown in figure 3.

```

The Rotational Matrix is:
    0.6937   -0.7203   -0.0007
    0.7167    0.6903   -0.0995
   -0.0721   -0.0685   -0.9950

The translational matrix is:
   -0.8972
   -0.4398
    0.0415

```

Figure 3: Figure showing the Rotational Matrix and Translational Vector

- d) The Epipolar Lines are calculated from the Essential Matrix and shown in Figure 4. However, the epipolar lines and image point do not intersect as this is suspected to be because of conditioning. When tested with Fundamental Matrix, the plot are perfect.

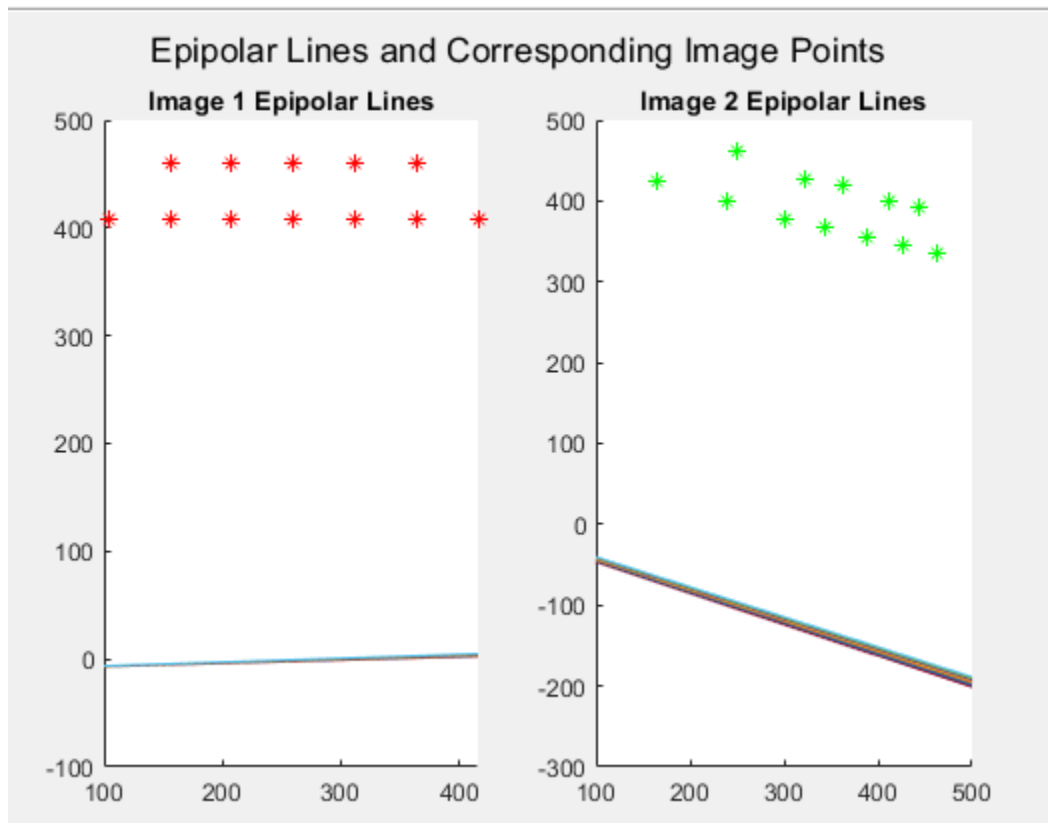


Figure 4: Plot Visualizing Epipolar Lines and Image points.

2.0 Task 2

- a) Computing the Geometric Error Based on Task 1 yields 2.9907.
- b) Performing Non-Linear Optimization using Minimum Distance as in Lecture 8, the new Geometric Error is $1.4160e-10$.

3.0 References

- 1. Hartley, R., & Zisserman, A. (2003). Multiple view geometry in computer vision (2nd ed.). Cambridge University Press. (Chapter 9).
- 2. Nocedal, J., & Wright, S. J. (2006). Numerical optimization (2nd ed.). Springer Science & Business Media. (Chapter 4).