

1 ...

2 Sparse Reconstruction

2.1 Implement the eight point algorithm

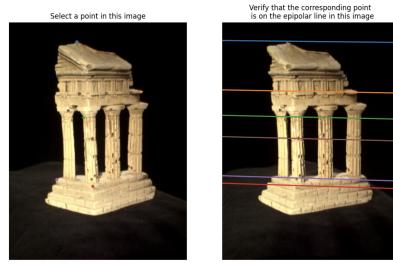


Figure 1: Epipolar Line Visualization

$$F: \begin{bmatrix} 2.61452871e - 07 & 2.97508940e - 06 & -1.87578007e - 03 \\ -1.24876890e - 05 & 1.31158569e - 07 & 5.77817527e - 02 \\ 2.73293767e - 03 & -5.56022694e - 02 & -2.16180940e - 01 \end{bmatrix}$$

2.2 Find epipolar correspondences

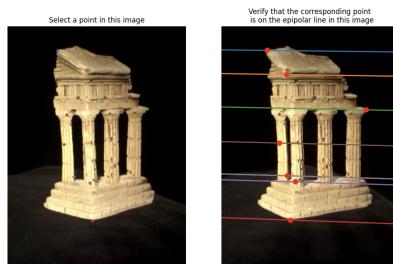


Figure 2: Epipolar Match Visualization

The similarity metric used was Euclidean Distance. I grab a patch from the first image, and compare it to patches of the same size in the second image, the smaller the euclidean distance the more similar the patches are. I made the images gray scale to use the euclidean distance between the pixel gray-scale intensities around my selected points. It fails a on flatter points, which I believe is due to the lack of variation in intensity.

2.3 Write a function to compute the essential matrix

$$E: \begin{bmatrix} 0.60437868 & 6.90214303 & -1.61508643 \\ -28.97116816 & 0.30538578 & 82.45788682 \\ -0.41180897 & -83.42165681 & -0.09706734 \end{bmatrix}$$

2.4 Q3.4

To determine the correct extrinsic matrix I needed to which gave the most not negative z values. This was done by keeping track of the values. It ends up being that the best one has the most 3D points facing the camera.

Mean reprojection error: 0.8226636856865649

2.5 Temple Coords Test

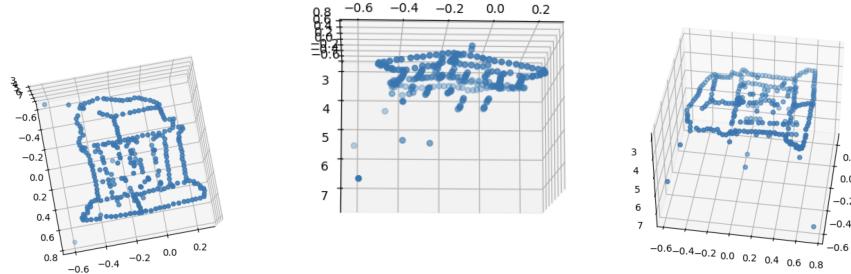


Figure 3:

3 Dense Reconstruction

3.1 Image Rectification

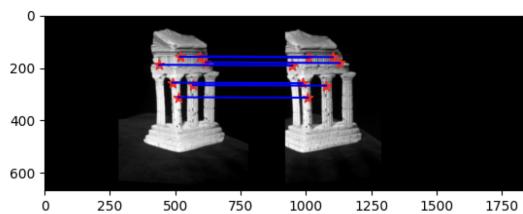


Figure 4: result of test rectify

3.2 Dense window matching to find per pixel disparity

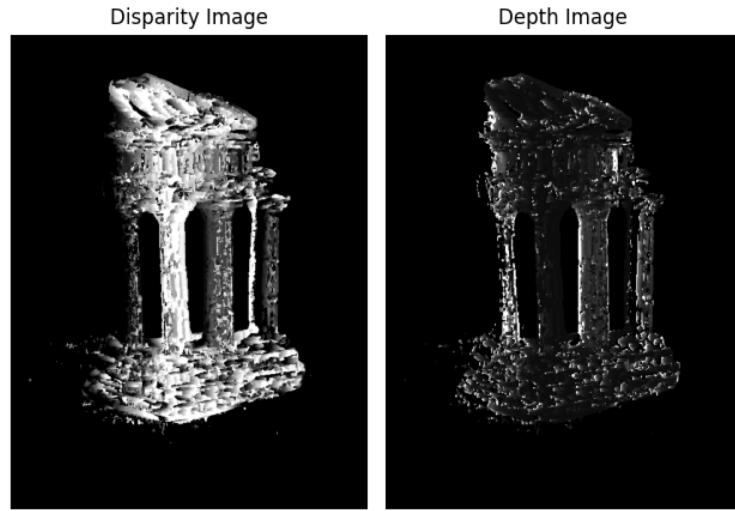


Figure 5: disparity and depth image

4 Pose Estimation

4.1 Estimate camera matrix P

```
Reprojection Error with clean 2D points: 2.46381419663177e-10
Pose Error with clean 2D points: 4.5071139664792025e-12
Reprojection Error with noisy 2D points: 12.028140820537766
Pose Error with noisy 2D points: 0.9820938431595403
```

Figure 6: pose test result

4.2 Estimate Intrinsic / extrinsic parameters

```
Intrinsic Error with clean 2D points: 3.0113551073976444e-12
Rotation Error with clean 2D points: 7.843750862326541e-13
Translation Error with clean 2D points: 2.996546928949121
Intrinsic Error with noisy 2D points: 0.7802725190078612
Rotation Error with noisy 2D points: 0.002912219277396206
Translation Error with noisy 2D points: 3.06337185569383
```

Figure 7: params test result