Project 5
3D Reconstruction

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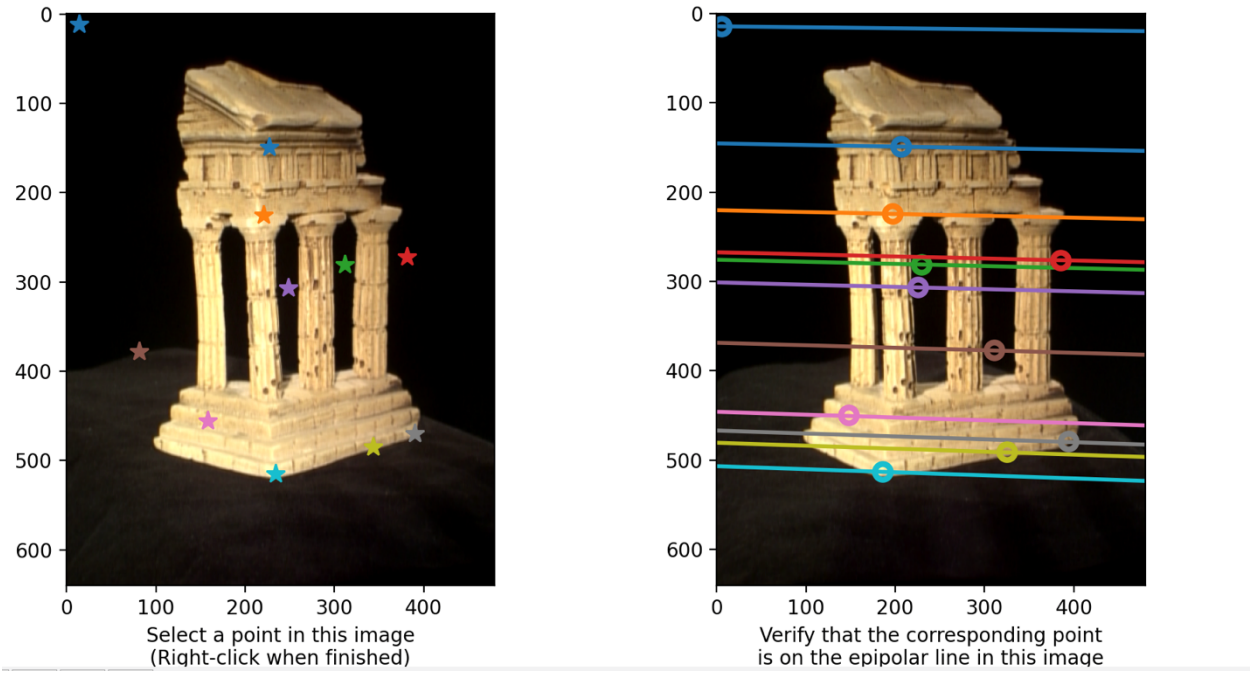
3.1.1 Eightpoint algorithm

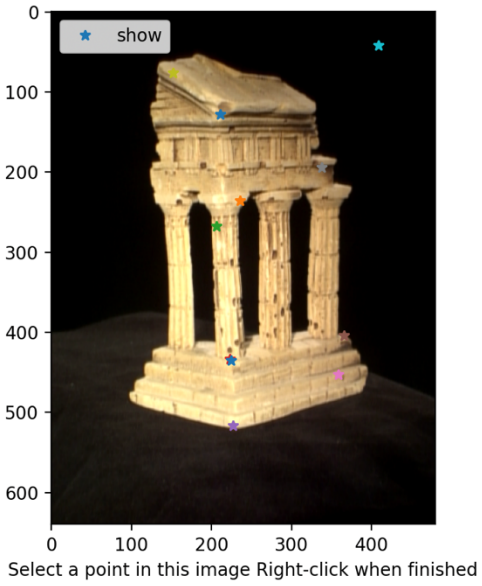
After processing the data points from pts1 and pts2 my recovered F matrix is:

```
[[-1.33676575e-09  2.31692748e-08  5.53445308e-06]
 [ 6.29439448e-08 -1.61712592e-09 -5.11123486e-04]
 [-1.41705665e-05  4.92078104e-04  1.98672814e-03]]
```

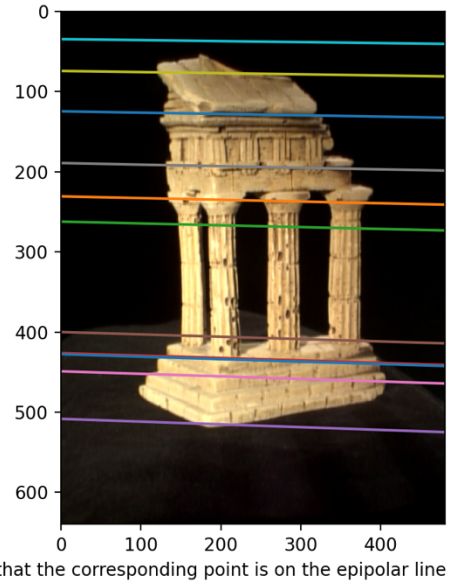
3.1.2 Epipolar lines



I first converted the points to homogeneous coordinates and then computed the epipolar lines corresponding to them for Figure 2. Set the RANGE of x-values and the corresponding y-values for that, and then compare to pick the shortest Manhattan distance when I come up with the most compatible window size of 10*10. But when I check the black empty space excluding the temple, it gives inaccurate results. But overall, the Manhattan distance is much more accurate than the Euclidean distance results.



Select a point in this image Right-click when finished



Verify that the corresponding point is on the epipolar line in this image

3.1.3 Essential Matrix

essential matrix:

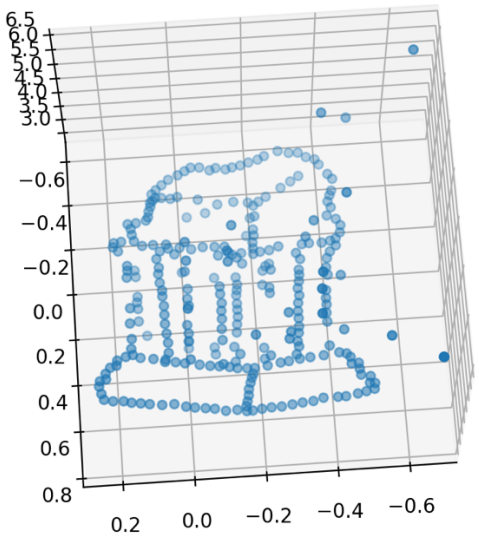
```
[[-0.00309009  0.05375222  0.01649652]
 [ 0.14602859 -0.00376527 -0.75149582]
 [ 0.00146608  0.76094103  0.00088034]]
```

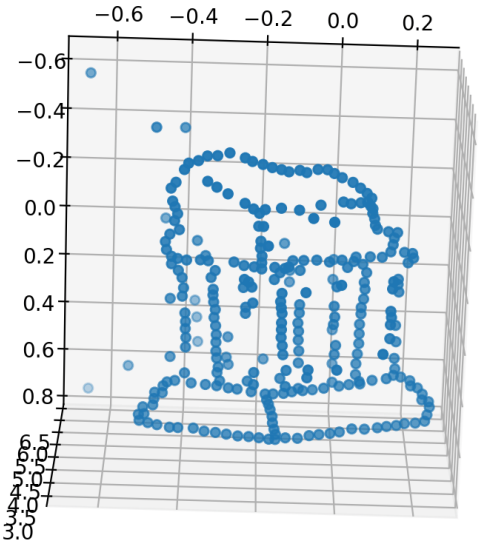
3.1.4 Triangulation

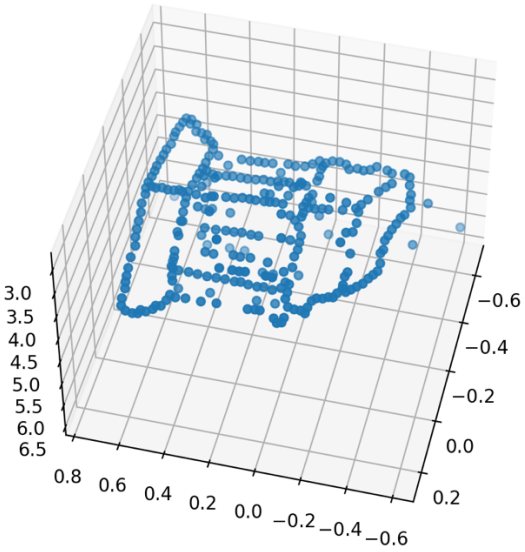
To determine the correct P2 from the four possibilities, I projected triangulated 3D points onto both cameras and checked which configuration would result in all points having positive depth. When re-projected back to both images, these points have the smallest re-projection error. I also checked the sign of the Z-values of the triangulated points and made sure, they were positive.

As for projection error, I get 0.2576 for pts1 and 0.2587 for pts2.

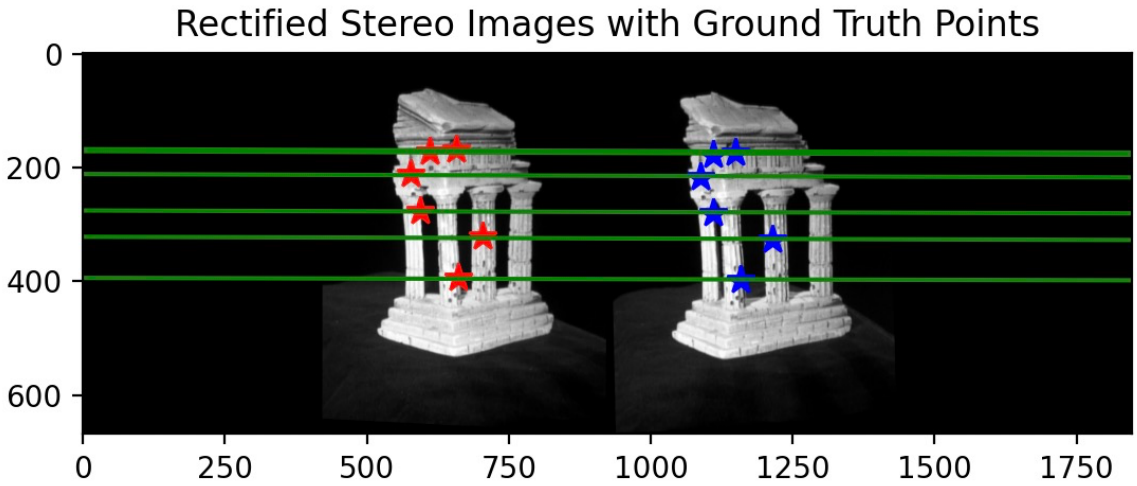
3.1.5 Test TempleCoords



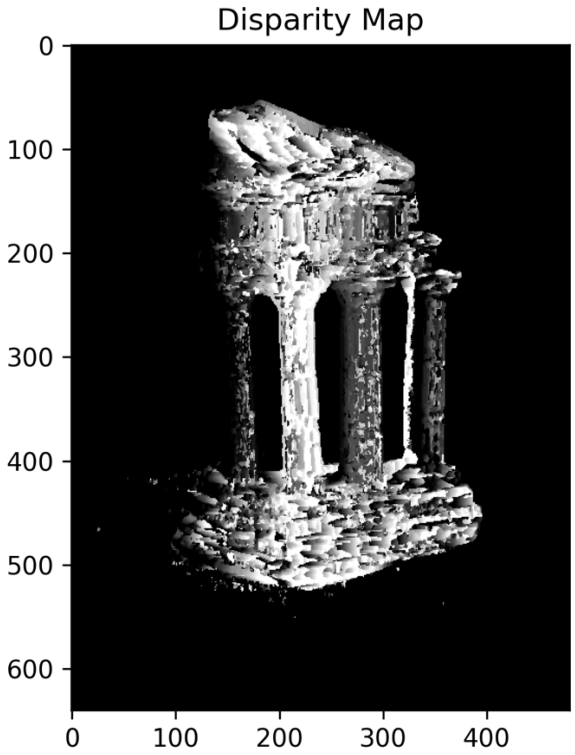




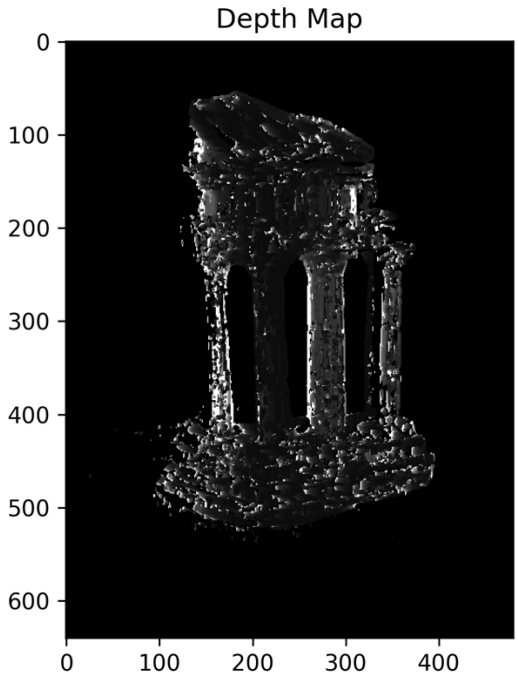
3.2.1 Image rectification



3.2.2 Disparity Map



3.2.3 Depth map



3.3.1 Camera Matrix Estimation

```
(base) sakura@Sakuras-MacBook-Pro python % python3 testPose.py
Reprojected Error with clean 2D points is 0.0000
Pose Error with clean 2D points is 0.0000
------------------------------
Reprojected Error with noisy 2D points is 8.9456
Pose Error with noisy 2D points is 0.0481
```

3.3.2 Intrinsic and Extrinsic Matrices Estimation

```
(base) sakura@Sakuras-MacBook-Pro python % python3 testKRt.py
Intrinsic Error with clean 2D points is 0.0000
Rotation Error with clean 2D points is 0.0000
Translation Error with clean 2D points is 1.7882
------------------------------
Intrinsic Error with noisy 2D points is 3.0329
Rotation Error with noisy 2D points is 2.8284
Translation Error with noisy 2D points is 2.1495
```