

Assignment 5

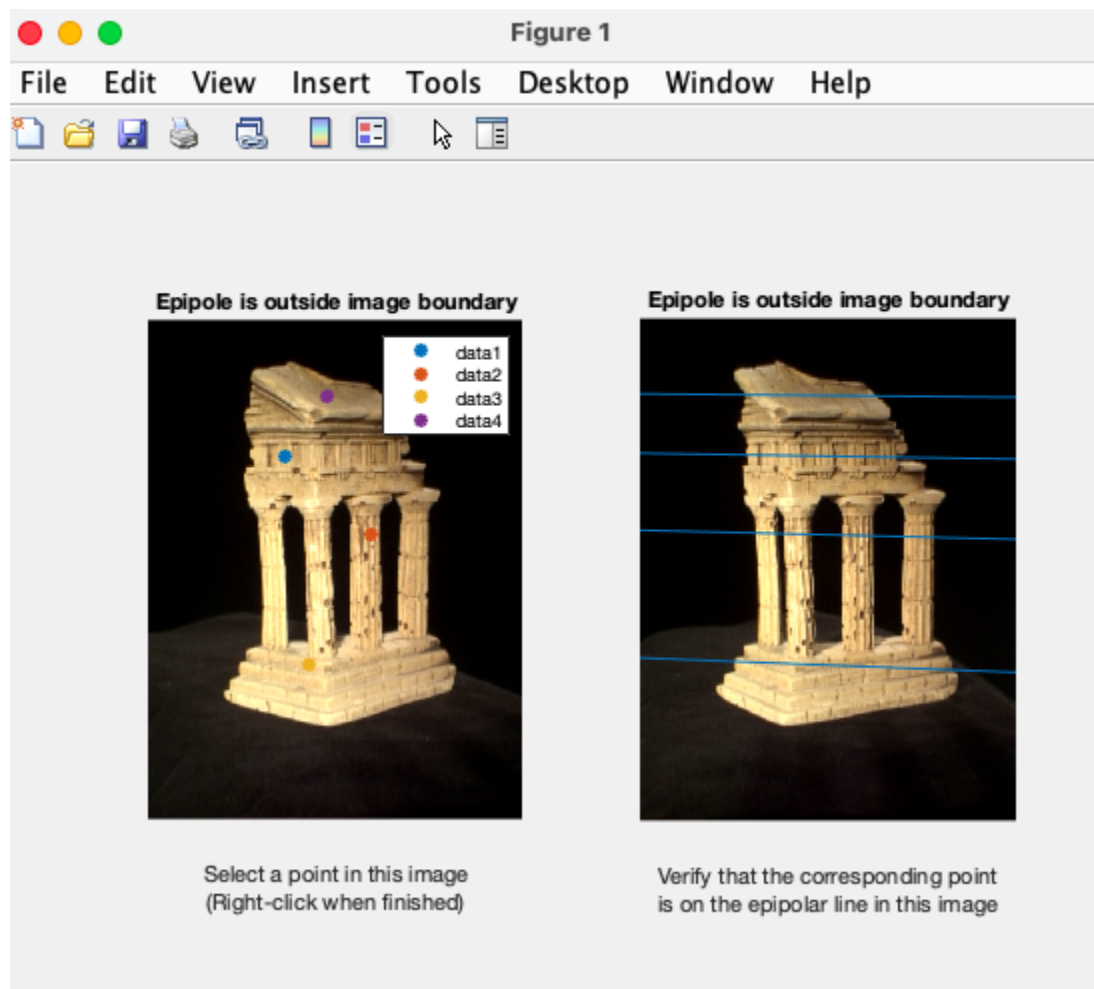
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Use 2 late days

3.1 Sparse reconstruction

Q 3.1.1

```
>> test_3_1_5  
F =  
-0.0000    0.0000    0.0000  
 0.0000   -0.0000   -0.0067  
-0.0001    0.0065    0.0269
```

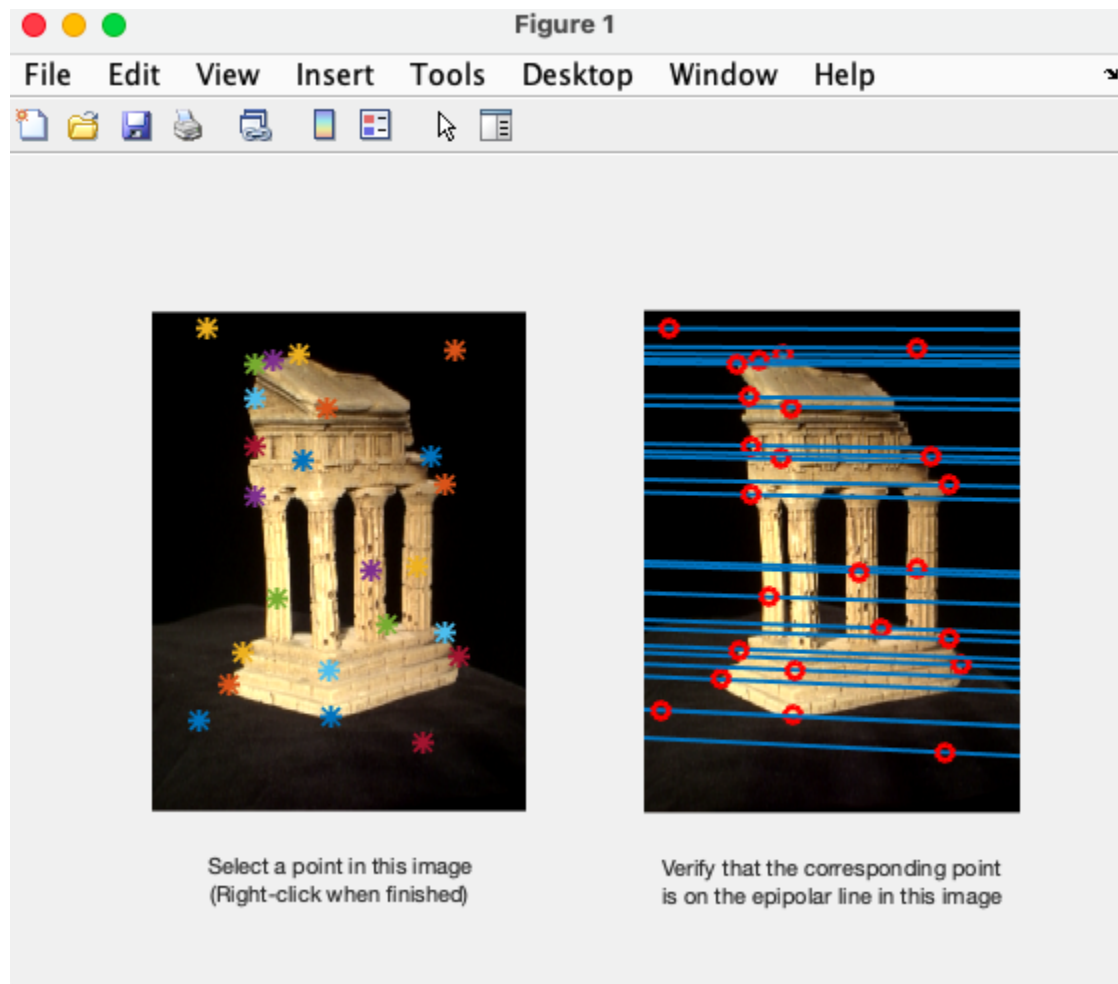


Q 3.1.2

I use Euclidean distance to calculate the distance of windows for two images.

Case where matching algorithm consistently fails:

When selecting points in the black background, the matchings are usually not that accurate. The reason can be the pixel window of the points are all black, which is similar to many other points in the black background. So it's confusing when comparing distances of those points and figuring out the optimal matching point.



Q 3.1.3

Estimated Essential Matrix example:

```
Command Window

E =
    -0.0256    1.3001    0.2169
     1.3197   -0.0068   -9.9839
     0.0224   10.1086    0.0115
```

Q 3.1.4

How you determined which extrinsic matrices are correct:

I loop through the four extrinsic matrices loaded from camera2(E) function. Then use triangulate() function to calculate the pts3d point set for each extrinsic matrix. Next, implementing positive depth test, by calculating Z-score of each 3d point set and selecting the set with the largest sum of the count of the positive values, since this means positive depth. In this way, we find the second matrix as the optimal one.

I use mean, standard deviation to normalize points and refineF() function in eightpoint.m file. Re-projection error is within 1 pixel as below:

```
Command Window

optimal_intrinsic2 index:
    2

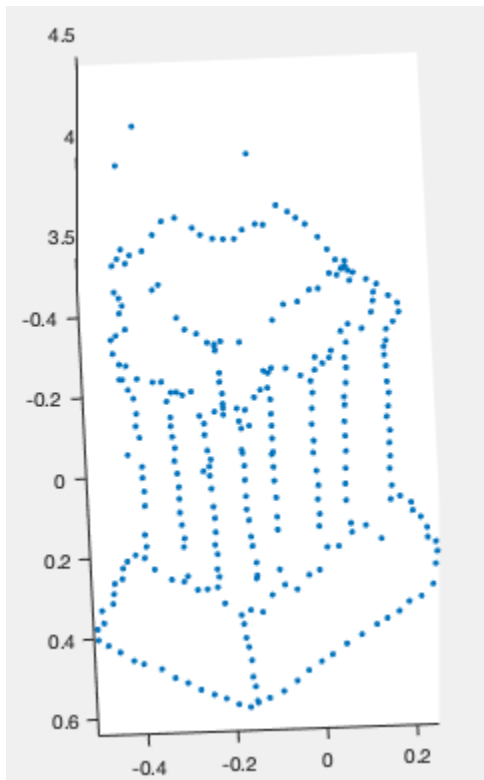
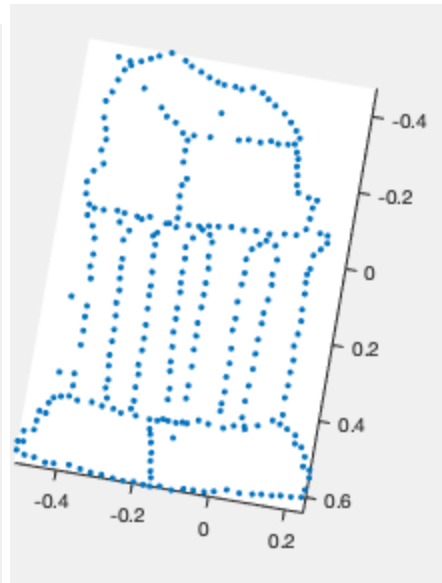
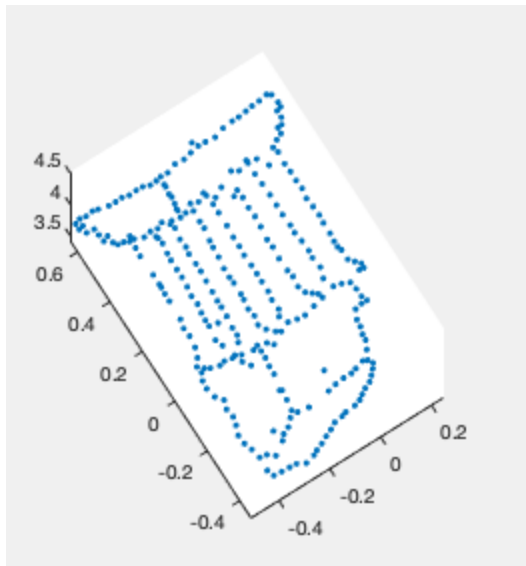
Re-projection error for image1 is:
    0.1751

Re-projection error for image2 is:
    0.1733

fx >>
```

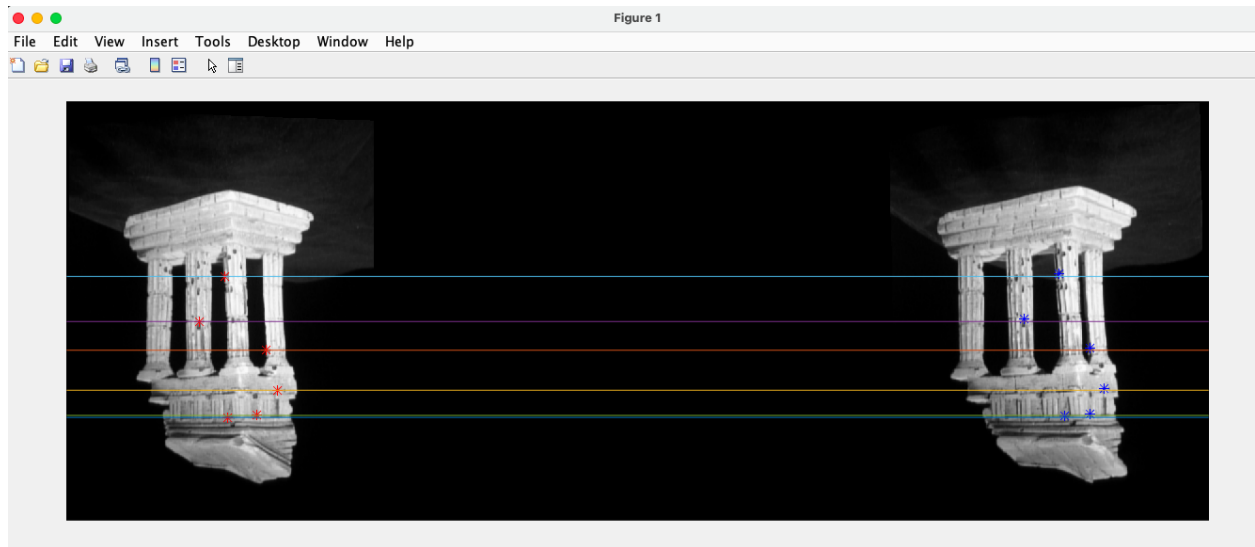
Q 3.1.5

Plots from three angles:



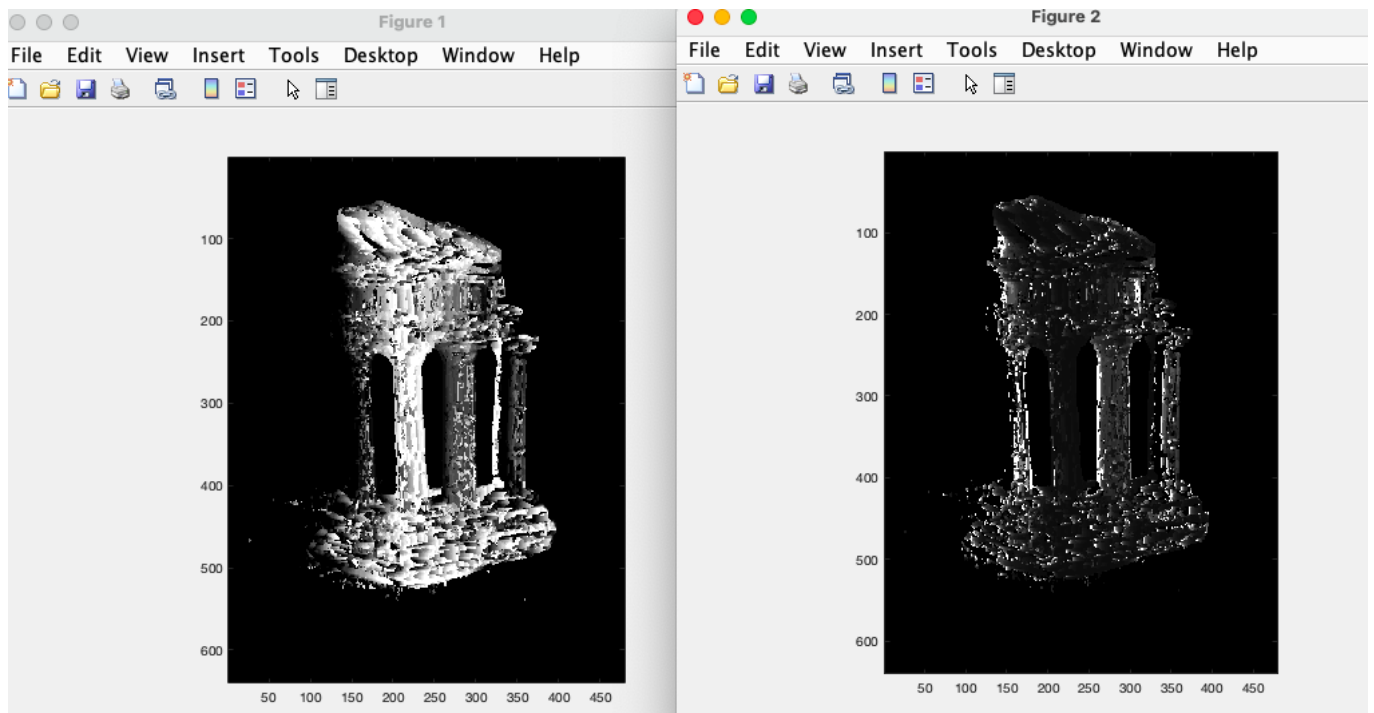
3.2 Dense reconstruction

Q 3.2.1



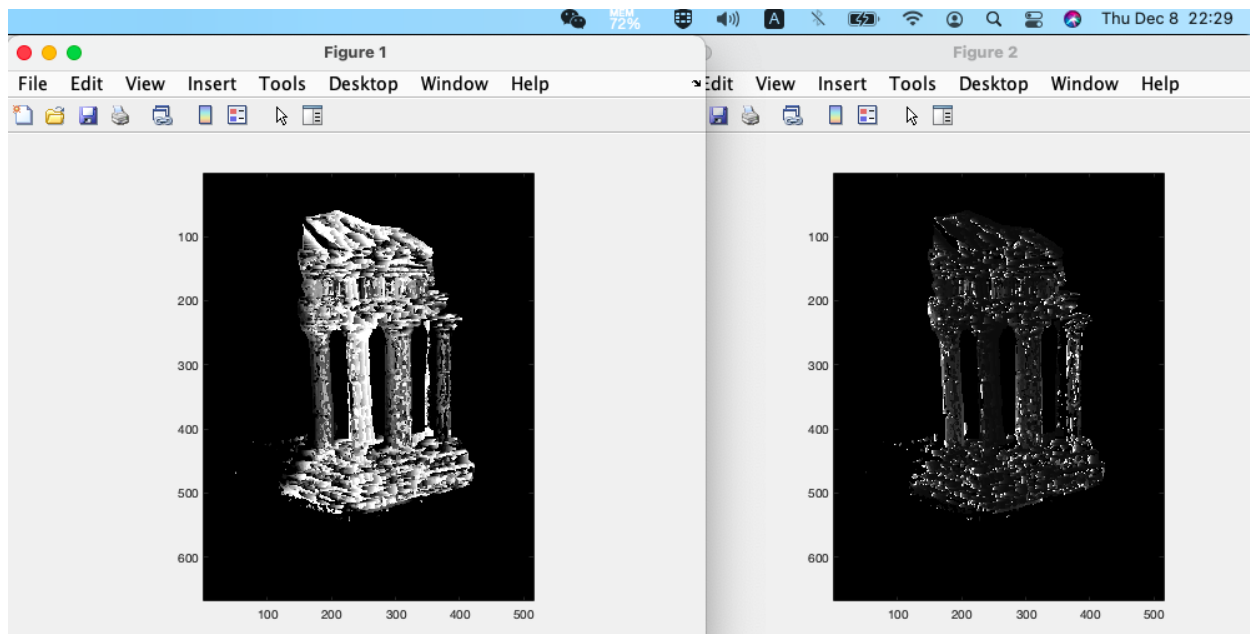
Q 3.2.2

disparity map and depth map from before-rectified images (im1, im2):



Q 3.2.3

disparity map and depth map from rectified images (im1, im2):



3.3 Pose estimation

Q 3.3.1

```
>> testPose
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 2.8597
Pose Error with noisy 2D points is 0.5196
>>
```

Q 3.3.2

```
>> testKRt
Intrinsic Error with clean 2D points is 0.0000
Rotation Error with clean 2D points is 1.7957
Translation Error with clean 2D points is 2.0631
-----
Intrinsic Error with clean 2D points is 0.6867
Rotation Error with clean 2D points is 1.0897
Translation Error with clean 2D points is 1.4224
>>
```