CS543 Assignment 4

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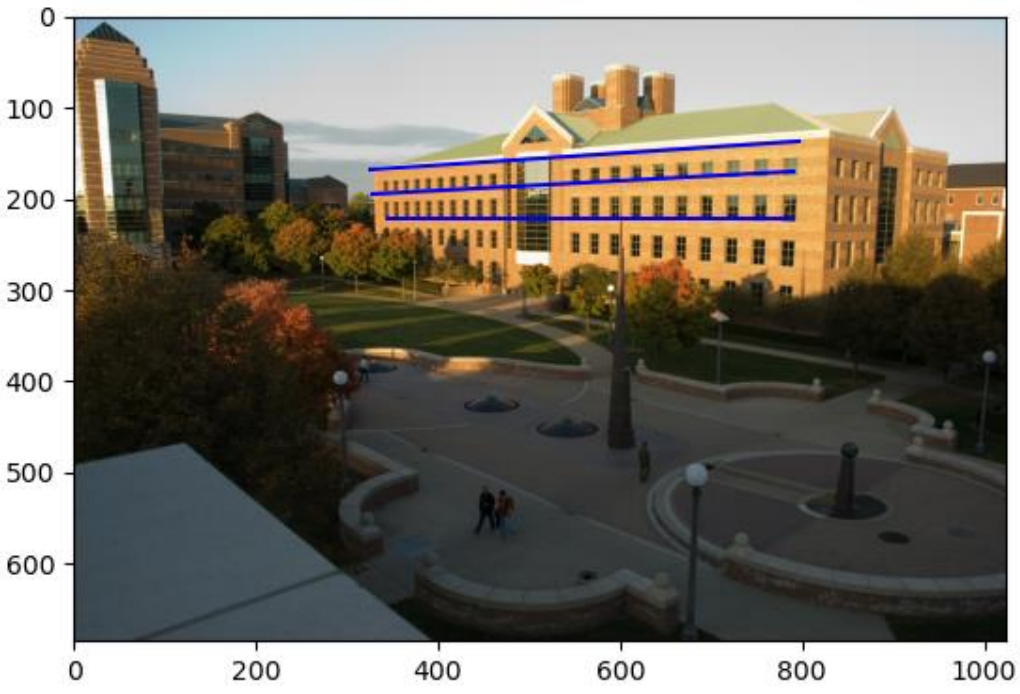
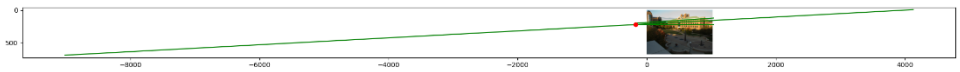
Part 1 Single-View Geometry:

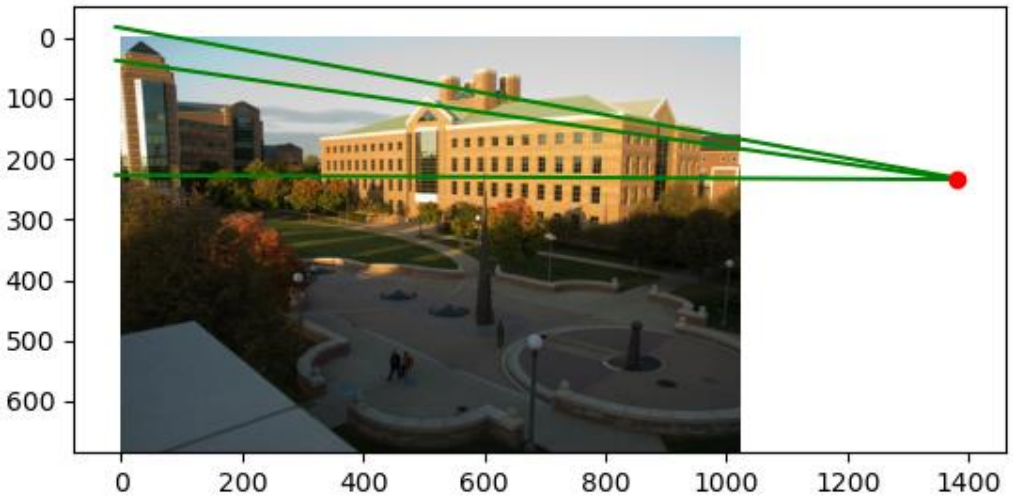
Plot the VPs and the lines used to estimate them on the image plane using the provided code.

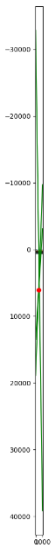


0
100
200
300
400
500
600
0
200
400
600
800
1000


0
500
−8000
−6000
−4000
−2000
0
2000
4000

0
100
200
300
400
500
600
0
200
400
600
800
1000


0
100
200
300
400
500
600
0
200
400
600
800
1000
1200
1400

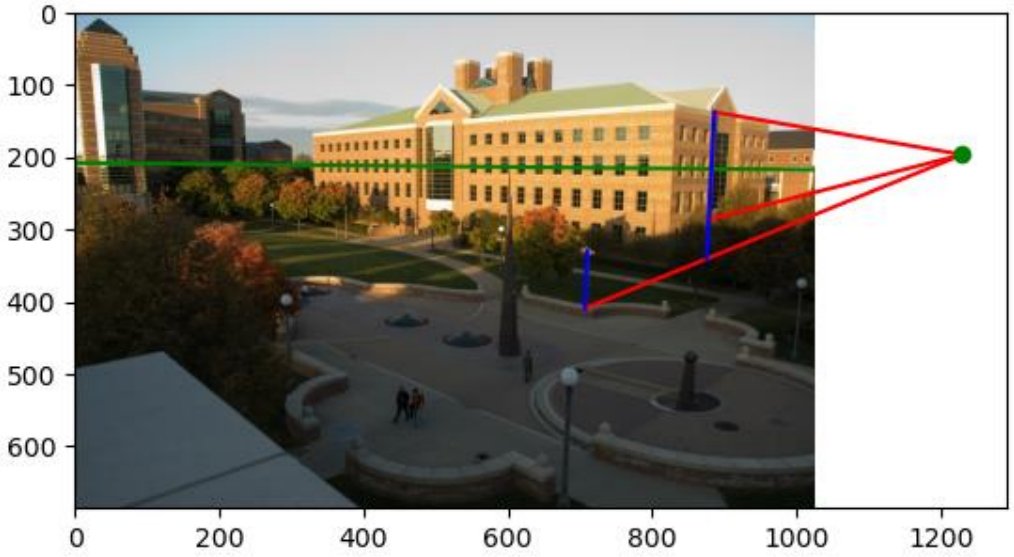


Specify the VP pixel coordinates.

```
[-173.2311828    221.43225806     1.          ]
[1.38116518e+03 2.33930755e+02 1.00000000e+00]
[4.58986113e+02 6.04595451e+03 1.00000000e+00]
```

Plot the ground horizon line and specify its parameters in the form a * x + b * y + c = 0. Normalize the parameters so that: a^2 + b^2 = 1.

Using the interface, construct the lines on the image that establish that the two gables on the CSL building are the same height. Explain why these lines do so.

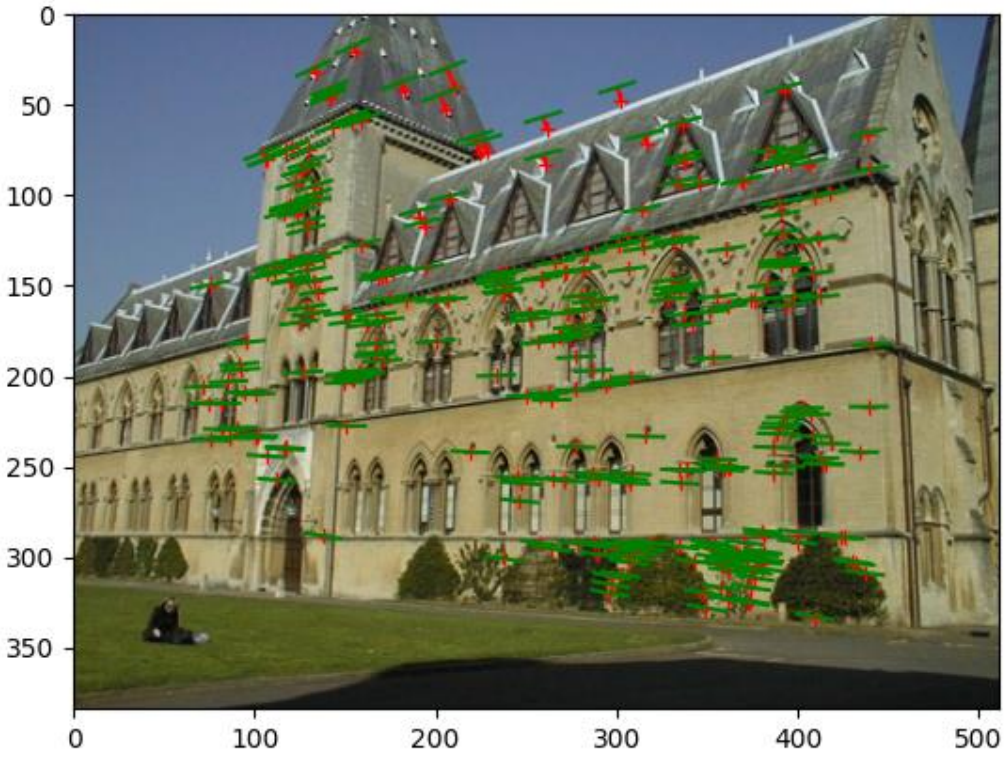


```
Estimating height of front gable
height of front gable is 3.992703724086958 times lamp height
Estimating height of side gable
height of side gable is 3.8041487175791115 times lamp height
```

according to the output result, both the side gable and the front gable are nearly 4 time as tall as the lamp, considering the ploting deviation, we can conclude tha t the side gable and the front gable are the same height.

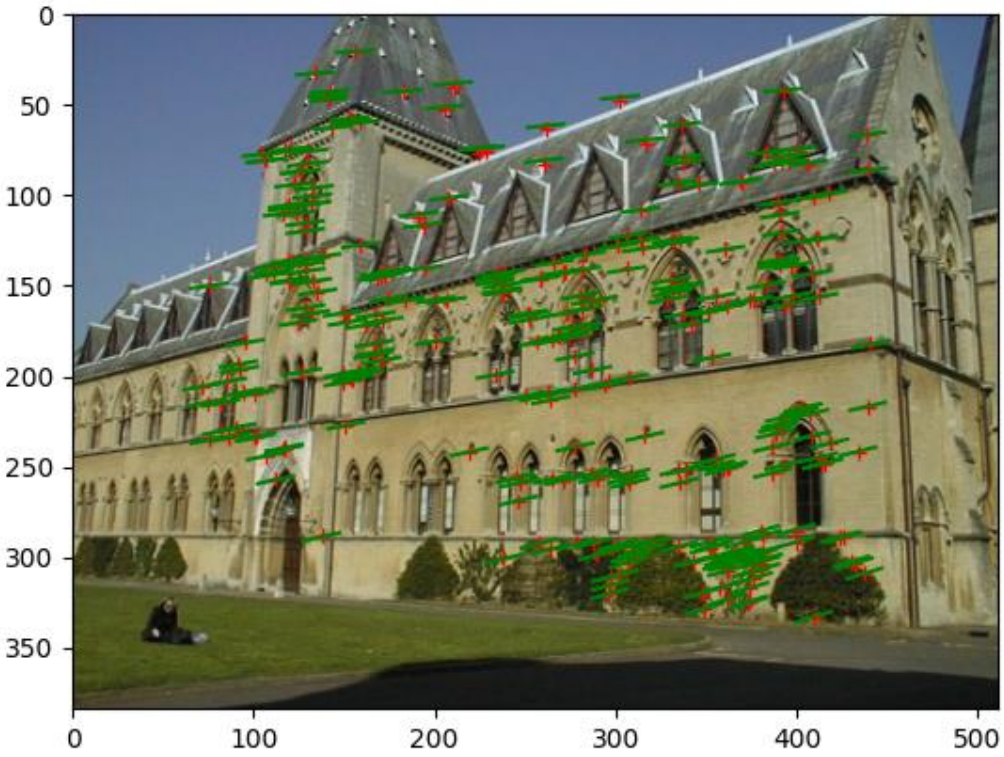
Part 2 Fundamental Matrix Estimation, Camera Calibration, Triangulation:

For the lab and library image pairs, display your result (points and epipolar line s) and report your residual for both unnormalized and normalized fundamental matri x estimation.



residual:

```
t2.py
residual for normalize = True algorithm of library is 0.20481474922140067
```

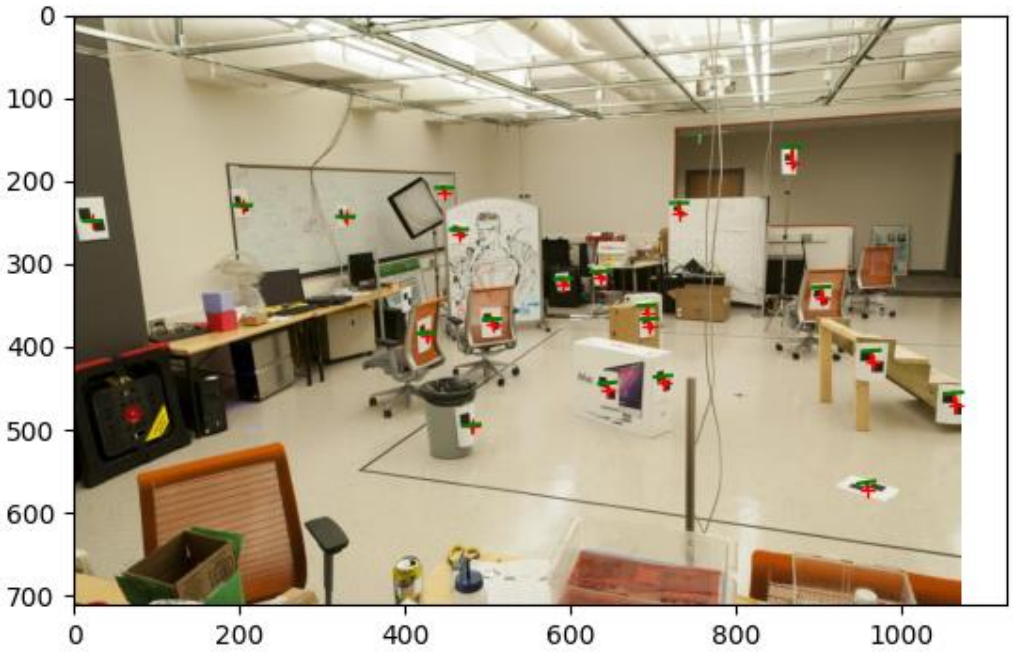


residual:

```
residual for normalize = False algorithm of library is 0.00895857184218139
```

residual:

```
residual for normalize = True algorithm of lib is 0.33542521351105226
```



residual:

```
residual for normalize = False algorithm of lib is 0.18775086194917967
```

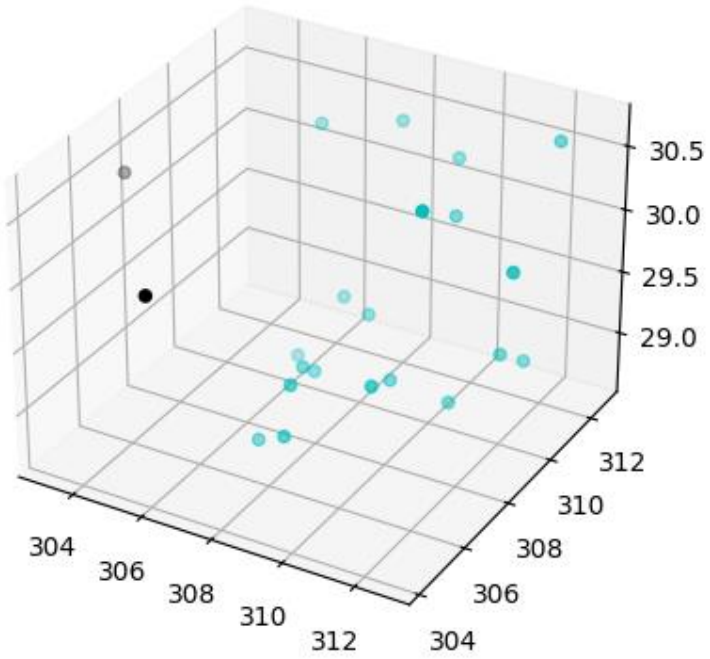
For the lab image pair, show your estimated 3x4 camera projection matrices. Report the residual between the projected and observed 2D points.

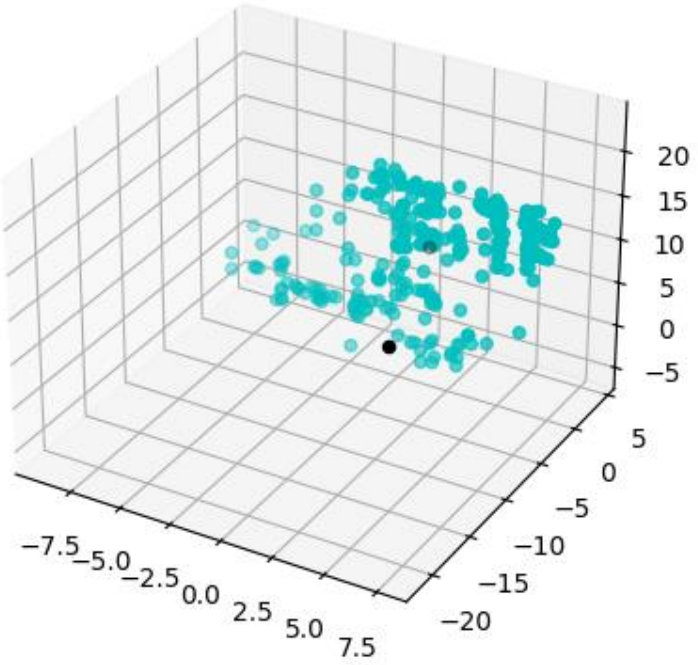
```
left camera matrix:
[[-4.53187041e+03 -2.13760331e+02  6.55731767e+02  1.43125880e+06]
 [-4.48880176e+02 -9.31617589e+02  4.05512341e+03  2.98472081e+05]
 [-2.45529487e+00 -4.01727798e+00  1.00000000e+00  1.94283277e+03]]

right camera matrix:
[[-3.64428424e+03  2.11186971e+03  6.97164388e+02  4.34640617e+05]
 [-8.13701852e+02 -5.38648854e+02  3.82454420e+03  2.95748507e+05]
 [-4.00069964e+00 -1.95030316e+00  1.00000000e+00  1.78129302e+03]]
left residual: 13.545832895784535
right residual: 15.544953461808563
```

For the lab and library image pairs, visualize 3D camera centers and triangulated 3D points.

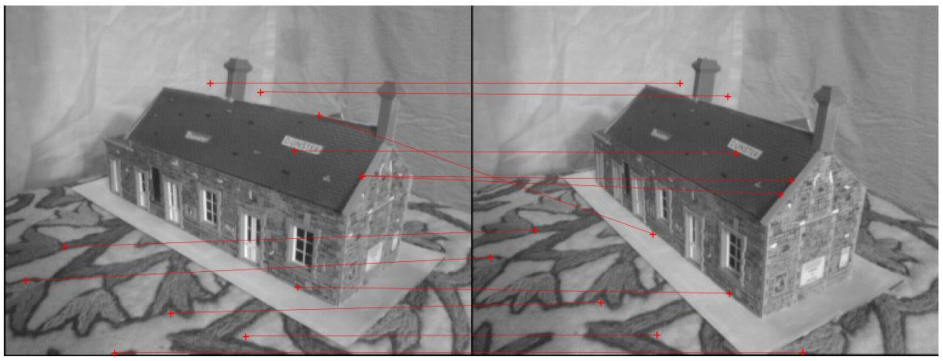
```
lab left center coordinate: [305.83276769 304.20103826  30.13699243   1.        ]
lab right center coordinate: [303.10003925 307.18428016  30.42166874   1.        ]
library left center coordinate: [  7.28863053 -21.52118112  17.73503585   1.        ]
library right center coordinate: [  6.89405488 -15.39232716  23.41498687   1.        ]
```

```
lab residual for left is 11.332279080917273
lab residual for right is 13.888776951376181
library residual for left is 51.53227122136155
library residual for right is 81.28132134985131
```





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.



```
MP3_part2_data/gaudi number of inliers: 12
 average residual: 0.008237009073687278
MP3_part2_data/house number of inliers: 4
 average residual: 7.785502584247676e-21
```

Extra Credit:

In Part 1, I implemented a better way of proving that the gables are the same heig ht,this is a more generalized method which can be used to compare whateven object on the graph.

```
Estimating height of front gable
height of front gable is 3.992703724086958 times lamp height
Estimating height of side gable
height of side gable is 3.804148717579115 times lamp height
```

Besides,I implemented the extra functions which are not required, and I was wonder ing if it worths some points.