CS543/ECE549 Assignment 4

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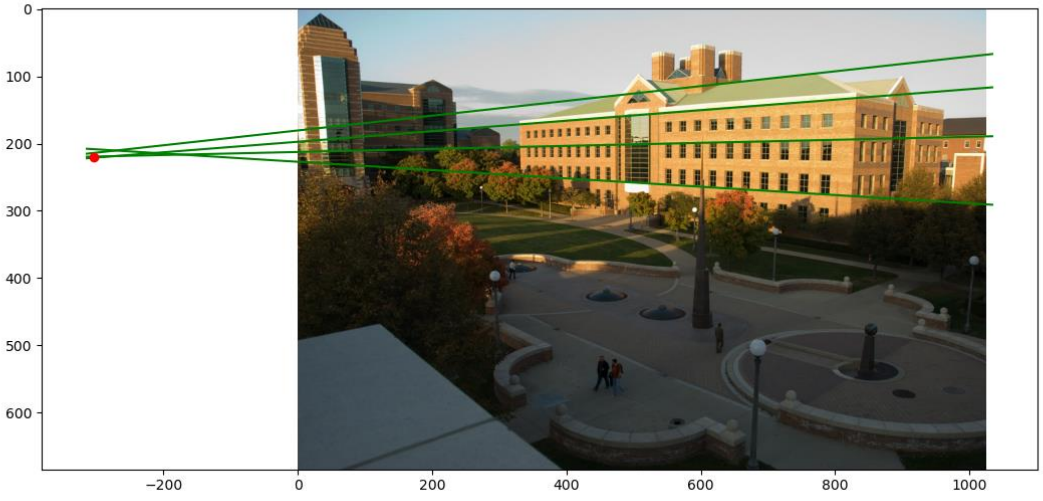
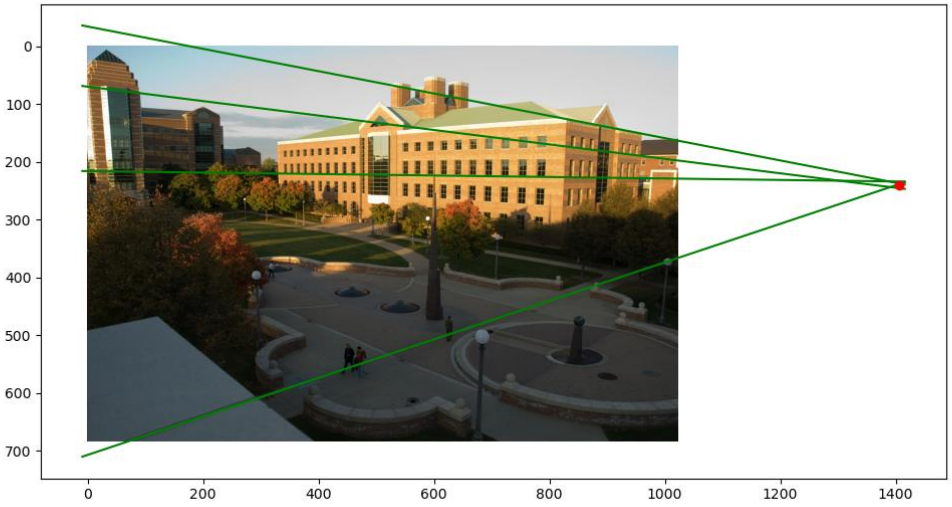
Part 1: Single-View Geometry

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

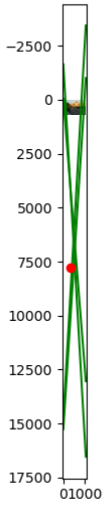
- Left most vanishing point:



- Right most vanishing point:



- Vertical vanishing point:

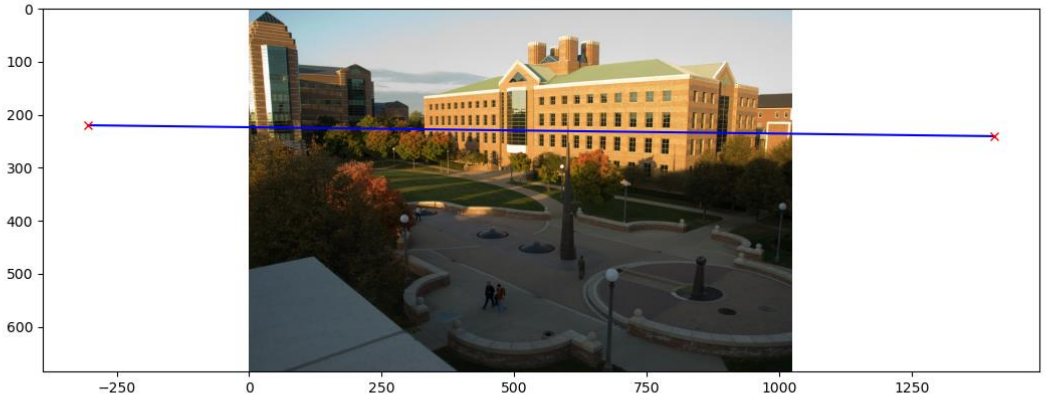


Specify the VP pixel coordinates.

- Left most vanishing point: [-304.06, 219.72, 1]
- Right most vanishing point: [1405.80, 240.33, 1]
- Vertical vanishing point: [331.61, 7784.17, 1]

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.

a = -1.20558055e-02, b = 9.99927326e-01, c = -2.23366601e+02



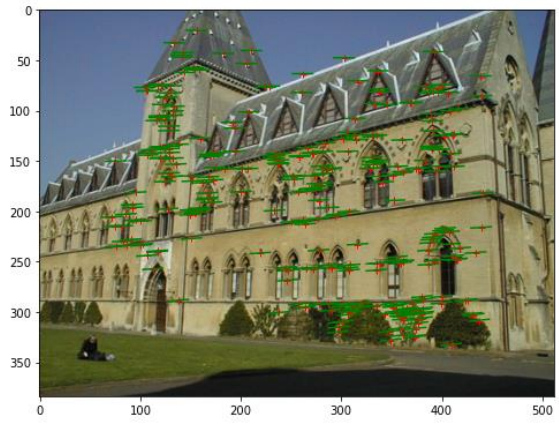
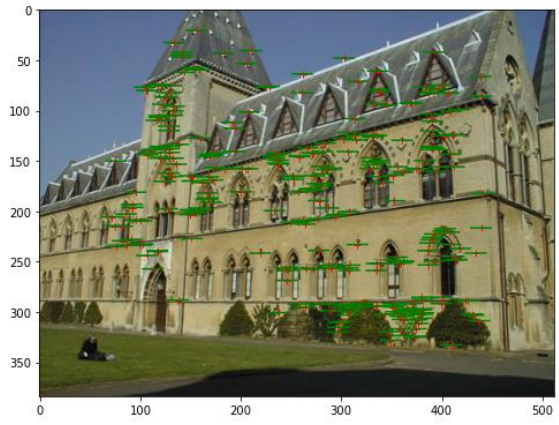
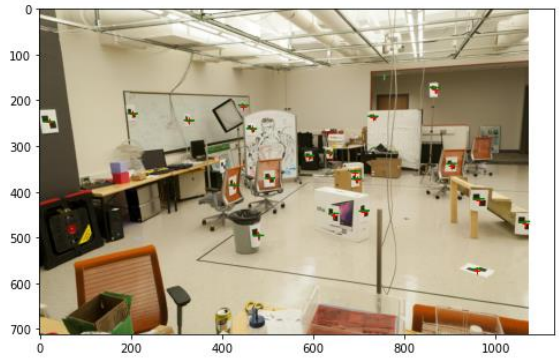
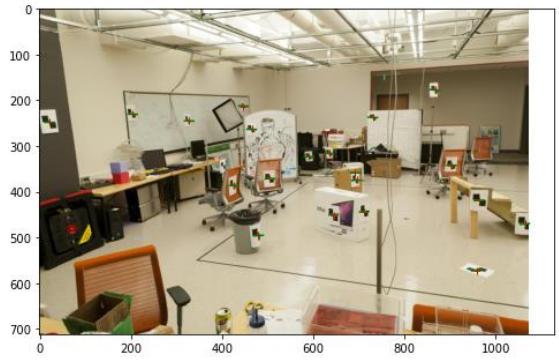
Using the interface, construct the lines on the image that establish that the two gables on the CSL building are the same height. Explain why these lines do so.

- Top coordinate of the left gable: [507.1463, 98.9204, 1]
- Bottom coordinate of the left gable: [505.6950, 148.5188, 1]
- Top coordinate of the right gable: [900.4324, 98.2741, 1]
- Bottom coordinate of the right gable: [898.9812, 146.8113, 1]
- The cross-ratio is: 1.1026

⇒ Because the cross-ratio is near 1, the two gables on the CSL building 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 lines) and report your residual for both unnormalized and normalized fundamental matrix estimation.

	Unnormalized	Normalized
Lab		
	Residual = 0.3385	Residual = 0.1836
Library		
	Residual = 2.2380	Residual = 0.6173

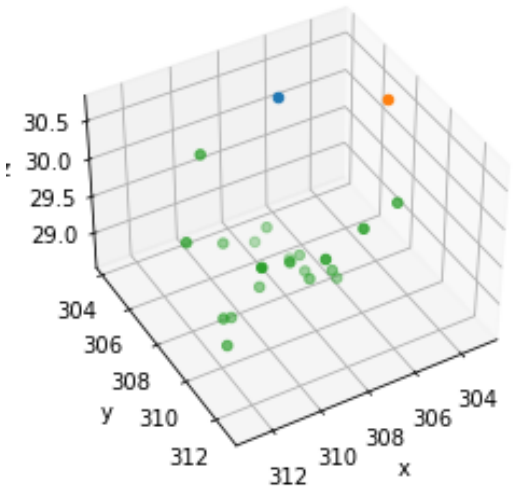
For the lab image pair, show your estimated 3x4 camera projection matrices. Report the residual between the projected and observed 2D points.

- Estimated camera projection matrix for "lab1":
  [[3.0997e-03, 1.4625e-04, -4.4835e-04, -9.7897e-01]
  [3.0674e-04, 6.3681e-04, -2.7738e-03, -2.0393e-01]
  [1.6799e-06, 2.7456e-06, -6.8339e-07, -1.3284e-03]]
- Estimated camera projection matrix for "lab2":
  [[-6.8897e-03, 3.9642e-03, 1.3926e-03, 8.2828e-01]
  [-1.5390e-03, -1.0208e-03, 7.2296e-03, 5.6018e-01]
  [-7.5860e-06, -3.7229e-06, 2.0383e-06, 3.3813e-03]]
- The residual between the projected and observed 2D points for "lab1": 13.7655
- The residual between the projected and observed 2D points for "lab2": 17.7811

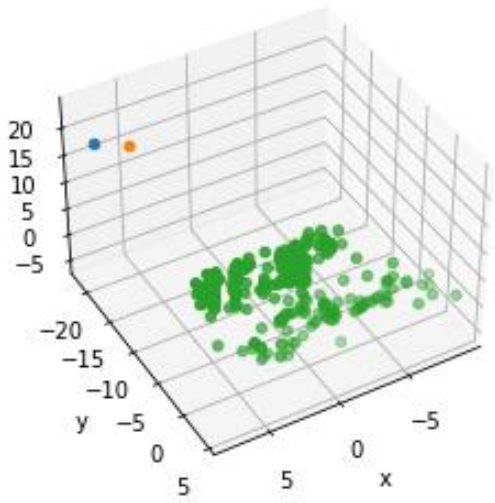
For the lab and library image pairs, visualize 3D camera centers and triangulated 3D points.

- Lab1 center: [305.8338, 304.2007, 30.1378, 1.]
- Lab2 center: [303.1400, 307.2116, 30.4296, 1.]
- Library1 center: [7.2886, -21.5211, 17.7350, 1.]
- Library2 center: [6.8940, -15.3923, 23.4149, 1.]

Lab:



Library:



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.