CS543 Assignment 3

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# Part 1: Homography estimation

**Describe your solution, including any interesting parameters or implementation choices for feature extraction, putative matching, RANSAC, etc.**

**For the image pair provided, report the number of homography inliers and the average residual for the inliers.**

|  |  |  |
| --- | --- | --- |
|  | **LEFT as reference** | **RIGHT as reference** |
| Number of inliers | 21 | 23 |
| Average residuals | 0.185227 | 0.210508 |

**Also, display the locations of inlier matches in both images.**

|  |  |
| --- | --- |
| **LEFT**  **as reference** |  |
| **RIGHT**  **as reference** |  |

**Display the final result of your stitching.**

|  |  |
| --- | --- |
| **LEFT**  **as reference** |  |
| **RIGHT**  **as reference** |  |

# Part 2: Fundamental Matrix Estimation, Camera Calibration, Triangulation

**For both image pairs, for both unnormalized and normalized fundamental matrix estimation, display your result (points and epipolar lines) and report your residual.**

|  |  |  |
| --- | --- | --- |
| **Unnormalized** |  | |
|  | **Residuals**  0.179213 px |
| **Normalized** |  |
|  | **Residuals**  0.085709 px |

TODO residuals follow website definition

**For the lab image pair, show your estimated 3x4 camera projection matrices.**

*Please find the matrices in next question.*

**Report the residual between the projected and observed 2D points.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Projection matrix** | **Residuals** | **Average**  **squared distance** |
| **lab1** |  | 13.55 | 0.39 |
| **lab2** |  | 15.54 | 0.37 |

**For both image pairs, visualize 3D camera centers and triangulated 3D points.**

It is hard to visualize triangulated results when camera center is in the view.

|  |  |  |
| --- | --- | --- |
|  | **3D distribution**  (Camera centers) | **Triangulation**  (ground truth; estimated) |
| **Lab** | (314.5, -305.4, -108.9) (69.8, -61.8, -71.2) | (marker radius proportional to error) |
| **Library** | (-7.8, -5.2, -3.2) (-8.1, -6.5, -1.9) | *(no ground truth)* |

# Part 3: Single-View Geometry

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

**Specify the VP pixel coordinates.**

**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 fact that the vanishing directions are orthogonal, solve for the focal length and optical center (principal point) of the camera. Show all your work.**

**Compute the rotation matrix for the camera.**

**Estimate the heights of (a) the CSL building, (b) the spike statue, and (c) the lamp posts assuming that the person nearest to the spike is 5ft 6in tall. In the report, show all the lines and measurements used to perform the calculation.**

**How do the answers change if you assume the person is 6ft tall?**

# Extra Credit

Don’t forget to include references, an explanation, and outputs to receive credit. Refer to the assignment for suggested outputs.

**Part 1**

**Extend homography estimation to work on multiple images**

|  |  |
| --- | --- |
| **Hill** |  |
| **Ledge** |  |
| **Pier** |  |

**Register difficult image pairs**

**Bundle adjustment**

**Image blending techniques**

**Part 2**

**Part 3**