

HW02: Camera and Stereo

1 Input

Under the data folder, we provide:

1. Under the images subfolder, with two images taken from a stereo camera, one is from the left image, one is from the right image;
2. calibration.yaml: intrinsic and extrinsic calibration matrix.
3. depth.csv, the reference depth estimation from these two images;

2 Feature Matching

Develop program to read in the two images, extract features and match features between the two images.
Set of candidate features:

1. the SURF local feature detector;
2. SIFT feature;
3. Harris Features.

Help and Hints: <https://www.mathworks.com/help/vision/ref/matchfeatures.html>

3 Filtering with epipolar constraint

Filter out bad matches using the epipolar constraint.

Help and Hints: https://en.wikipedia.org/wiki/Epipolar_geometry

4 Sparse depth calculation

Through the calibrated intrinsic and extrinsic matrix of the camera, calculate the depth value of each matched feature points (after filtering with epipolar constraint).

Hint: you could ignore the rotation in the extrinsic matrix and only consider the baseline shift.

Also, output the RMSE (root mean square error) of your estimated sparse depth with the reference depth estimation.

5 Optional: Disparity Map (dense depth)

Write program to output the disparity map and describe the list of soft and hard constraints you used for the estimation.

Also, output the RMSE (root mean square error) of your estimated depth with the reference depth estimation.

6 Submission Instruction

Recommended programming language: Matlab, python, C++

Please place your answers under one .zip file with a formatted file name: 01_ASUID.zip (for example, if your asu ID is 101010101010, then the file name should be 01_101010101010.zip), and submit it on Canvas. The .zip file shall include one folder with your source code (and a Readme file describing how to compile) under name “code” and one report in .pdf format. It is an individual homework and not a group assignment.

This assignment is due on 10 pm Feb 28th.