

CS-E4850 Computer Vision

Exercise Round 11

The following instructions are for the Matlab version. The instructions for the Python version are in Github. Matlab is available on Aalto computers and also for students' own computers via <https://download.aalto.fi>.

The problems should be solved before the exercise session and solutions returned via the MyCourses page. Upload a one PDF file containing your answers to the exercise problem 1.

Get the example m-files by downloading `Exercise11.zip` from the MyCourses page.

Exercise 1. Two-view structure from motion. (Matlab exercise)

In this exercise you will estimate the fundamental matrix for a pair of uncalibrated images and recover a pair of camera projection matrices that are compatible with the estimated fundamental matrix. Thereafter, triangulation of point correspondences using the aforementioned projection matrices gives a projective reconstruction of the scene, which is visualized in the example script.

Proceed as follows (do the tasks and answer the questions):

- a)* Run the Matlab example script `two_view_structure_from_motion_example.m` from `Exercise11.zip`.
- b)* The first part of the script visualizes the inlier correspondences for the fundamental matrix. Explain why all inliers may not be correct correspondences.
- c)* The second part of the code calibrates the cameras using known dimensions of the shelf and visualizes a wireframe model of the shelf projected onto the images.
- d)* The third part triangulates and visualizes a projective reconstruction of the wireframe model. Give an explanation why the model looks distorted but is anyway correct. (See discussion in slides of Lecture 10.)
- e)* In the fourth part you should project the distorted wireframe model onto the two images and check that it matches the outlines of the book shelf. Include a picture that illustrates the projected model.
- f)* Describe what kind of information could be used to upgrade the projective reconstruction to a similarity reconstruction, where angles and ratios of lengths are the same as in the real one, without knowing the dimensions of the book shelf. (Hint: See lecture slides.)

Demo 1. Structure from motion with calibrated images. (Just a demo, no points given)

Run and study the Matlab built-in example `StructureFromMotionExample.m`.

(The description is also available at <https://se.mathworks.com/help/vision/examples/structure-from-motion-from-two-views.html>)