

ECSE 6650 Computer Vision Project 2

Due date and time: 11:59 pm, 11/8/2019

In this project, you will perform 3D reconstruction of a human face from its 2 images taken from two different view points. 28 facial landmark points are detected and are superimposed on each image. The project includes the following tasks:

1. Compute the intrinsic parameters W of the cameras respectively for each view using the calibration data attached and the camera calibration procedure you developed for last project. Compare the W for each view ? Are they the same ? If not, why ?
2. Derive the relative orientation and translation R and T of the two cameras based on the absolute orientation computed for each camera from task 1. Construct the fundamental matrix F using W_l and W_r from task 1 and R and T .
3. Given the matched 2D calibration points and their coordinates, use the 8-point method in the lecture notes. More on the 8-point method may be found at https://en.wikipedia.org/wiki/Eight-point_algorithm to setup a system of linear equations to compute the fundamental matrix F . Try to impose the rank constraint on F either during optimization (using the constraint $F_3 = \alpha F_2 + \beta F_1$) or through post-processing via SVD analysis. Compare the computed fundamental matrix with the one computed in task 2. If different, explain why.
4. Given the fundamental matrix computed in tasks 2 or 3, produce the rectified left and right facial images using the rectification procedure introduced in the lecture notes. Write down the rectification process, display the rectified images, and verify the results with example epipolar lines before and after the rectification.
5. Reconstruct the 3D facial points from the matched corresponding image points using the full 3D reconstruction method in the lecture notes.

Your report should include

- introduction
- discuss the theories for the method(s) of computing F and output the results.
- discuss rectification theory and display the rectified images. Given the four corners of the eyes and the mouth on the left image, draw the epipolar lines on the right images before and after rectification.
- discuss the theory of reconstruction.
- Output the 3D coordinates of the 28 facial landmark points in a text file as well as a 3D line draw of the 3D facial points.

- Compute the width of the person's eyes (left and right eye) as well as his mouth width.
- summary and conclusion

Submit to me and the TA the link to your report and code. Zip your files and name the zip file using the same name convention as for project 1, i.e., project2_yourlastname_firstname.zip.