

ECE661: Homework 5

Fall 2014

Deadline : October 14, 2014 , 1:30 pm

Turn in typed solutions via Blackboard. Additional instructions can be found at [1]

1 Introduction

Nowadays, most smart-phones let you shoot a panoramic view of a scene where, as you shoot a sequence of images, they are stitched together to give you a picture of the whole scene. Image mosaicing involves similar concepts with the difference that the pictures are flattened out onto a 2-D plane and stitched together. In this assignment, you will create such an image mosaic by using homographies. The steps involved are described below.

2 Steps for Creating An Image Mosaic

1. Collect n photos by standing in a fixed location and turning through some angle as you take each successive shot. Ensure that there is sufficient overlap between successive photos, otherwise you will not be able to establish good correspondences between images. A minimum of $n = 5$ photos is recommended.
2. For each pair of adjacent images, do the following
 - Use a feature-matching algorithm to establish interest point correspondences between successive images. You can use the Harris Corner detector that you developed for the previous homework, or SURF or SIFT from OpenCV or MATLAB.
 - Implement your own RANSAC algorithm to discard outliers from the estimated correspondences. You will need to set suitable values for the three RANSAC parameters -: δ , M and N , where δ is the threshold to select the inlier set, M is the minimum size of an acceptable inlier set and N controls the number of iterations. If you wish, you could try to use the 10 % rule described in the Lecture notes for deciding the value of δ . Refer the lecture notes for tips on setting M and N as well.
 - Using the linear-least squares method, calculate the homography between the pairs of images with the help of the selected inlier set of correspondences. (note - This involves finding the eigenvector that corresponds to the smallest eigenvalue in the SVD of a matrix.)
 - Implement the Dog-Leg method (refer Lecture notes) to refine your homography estimates.

- Using the computed homographies, stitch the images together by chaining the homographies in order to project them into the coordinate frame of the center image as shown in Figure 1.



Figure 1: A sample of image mosaicking with the central image boxed in the upper row

Figure 1

2.1 Notes

Draw lines to indicate the selected correspondences. **Do not** use the built-in Ransac function and the built in Dog-Leg functions in MATLAB or OpenCV. You can look at sample solutions from previous years to get an understanding of how to solve the problems. **Your final report must be your own.**

3 Submission

- Turn in a typed pdf of your report via Blackboard.
- Your pdf must include
 - A good description on your implementation of RANSAC algorithm, the least squares method to estimate homographies and your implementation of the Dog-Leg algorithm to refine them with relevant equations.
 - A description of the steps involved in your image mosaicking method, with relevant equations.
 - The extracted correspondences between sets of adjacent images.
 - The outliers and selected inliers for at least two pairs of images.
 - The final output mosaic.
 - The parameters that you chose for good feature matching.
 - Your source code.

References

[I] <http://web.ics.purdue.edu/~bcomandu/ECE661/home/>

[II] Figure 1 was taken from https://engineering.purdue.edu/kak/computervision/ECE661_Fall12012/homework/hw5.pdf