CS554 - Fall 2023 Homework:

You are allowed to work as a group of two students or –if required– individually. If you cannot form a group and you will work individually, then you need to inform me via email (dibeklioglu@cs.bilkent.edu.tr) as soon as possible. Subject line of the email needs to be: cs554_2023f_hw_group

Due date: November 28th, 2023, 23:59 (Turkish time).

Homeworks should be submitted through the Moodle page of the course.

Your submission should be a single zip archive named "BilkentID1_BilkentID2.zip" that includes a report (must be a pdf file), README file and source code files. If you work as a pair, only one file should be submitted for the pair. Each submission should include a README file that provides the name(s) of the authors and a brief summary of contents of other files in the zip archive. Late submissions will not be accepted.

In your report, explain all the techniques/parameters/etc that you use (together with your motivations), provide and discuss the results. The source file(s) you submit should provide a main code for each task that runs the whole procedure. The quality of the report is important. You may loose points up to 40 points, due to poor presentation and/or missing results in the report. Your report has to be 5 pages at most. The number of pages is not a factor in grading. Reports must be prepared using the IEEE double-column transactions article template.

There are two tasks to be completed in this homework. Any programming language may be used. Data/images for the experiments should be downloaded from:

http://www.cs.bilkent.edu.tr/~dibeklioglu/teaching/cs554/docs/homework_dataset.zip

Details of the tasks will be given below.

1- Image Stitching (55 points)

In the first task you will work on image stitching as discussed in the lecture. First, you should find and match feature points using SIFT. Consequently, employing the matched points you will compute the homography between the target image pair to be stitched. Notice that RANSAC would help you to obtain a more accurate homography. Input images will then be aligned based on the computed homography, and combined. For a smooth transition between images, you should at least use alpha blending (you may get bonus points if you also include seam finding in your implementation; the total grade of the homework may not exceed 100 points).

You should use existing code packages for detecting feature points and feature descriptor (SIFT). You are expected to implement the code for matching feature points, fitting homography (including RANSAC), and alignment by your own.

For the experiments, you should use the images included in the “data_image_stitching” folder.

2- Disparity Map Estimation (45 points)

As the second task, you will implement disparity map estimation through image pairs (as described in the lectures). Notice that a dense disparity map should be computed as the output. Therefore, you need to find pixel-to-pixel matching between given pair of images. The input will be a rectified pair of images (e.g., left.png and right.png), and the output is a disparity map whose values indicate the disparity of the stereo correspondence for each pixel in the left image. You can assume that the input images have been rectified (i.e., epipolar lines are horizontal) and that the disparity in any input image pair is at most 65 pixels.

For finding pixel-to-pixel matching, you can use the normalized correlation-based matching. Finally, you will compute the disparity for each pixel, and visualize the disparity map. Please notice that you are expected to implement pixel-to-pixel matching by your own.

For the experiments, you should use the images included in the “data_disparity_estimation” folder. This folder also includes actual disparity maps for each image pair. You should compare your results with the provided disparity maps.