CENG471 Introduction to Image Processing
Fall 2020-2021
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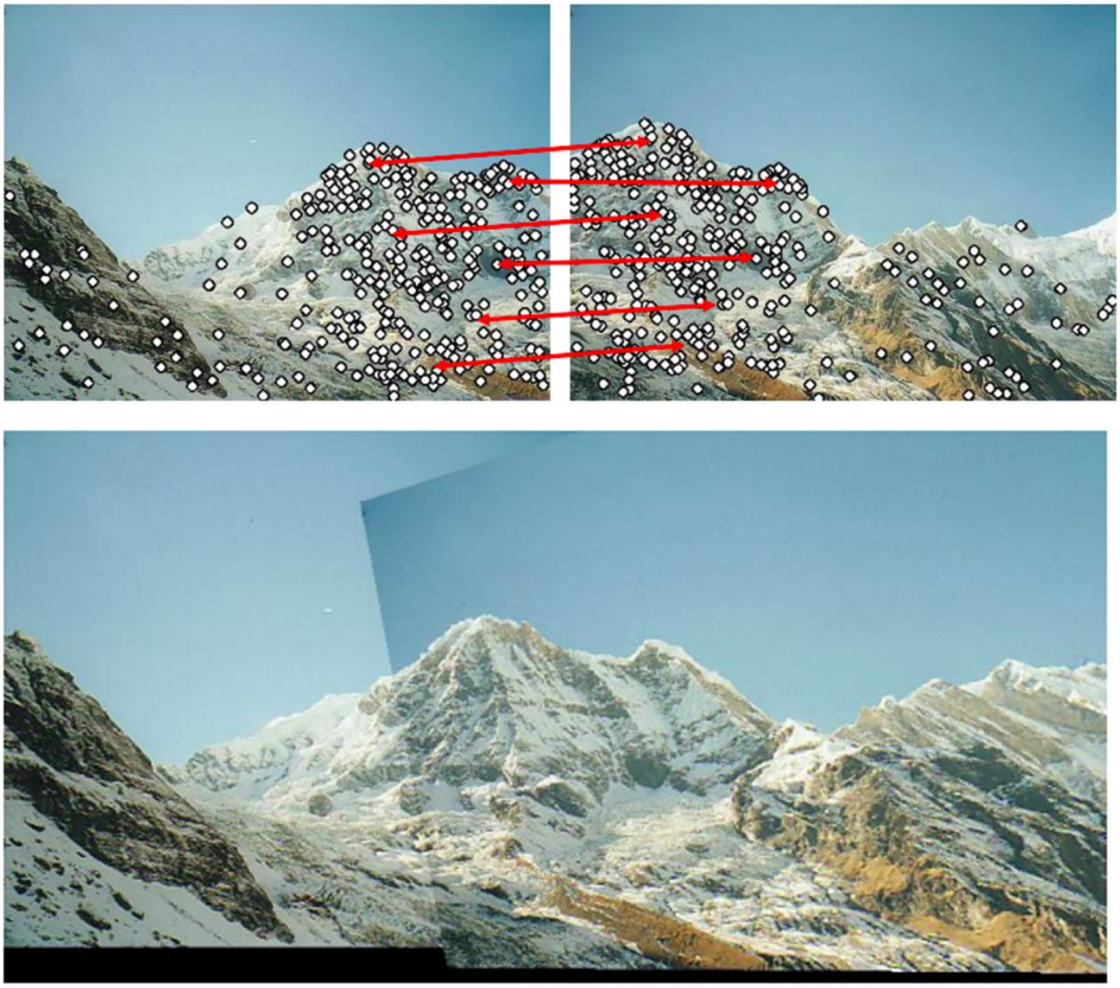
Assignment 3 due on 18th of January, Monday 23:59



Background Information:

Image stitching or photo stitching is the process of combining multiple photographic images with overlapping fields of view to produce a segmented panorama or high-resolution image. Commonly performed through the use of computer software, most approaches to image stitching require nearly exact overlaps between images and identical exposures to produce seamless results[1][2]. Some digital cameras can stitch their photos internally.

Ref: https://en.wikipedia.org/wiki/Image_stitching
[1] Mann, Steve; Picard, R. W. (November 13–16, 1994). "Virtual bellows: constructing high-quality stills from video" (PDF). Proceedings of the IEEE First International Conference on Image Processing. IEEE International Conference. Austin, Texas: IEEE.
[2] Ward, Greg (2006). "Hiding seams in high dynamic range panoramas". Proceedings of the 3rd Symposium on Applied Perception in Graphics and Visualization. ACM International Conference. 153. ACM. doi:10.1145/1140491.1140527. ISBN 1-59593-429-4.

Overview:

The goal of this assignment is to automatically create a panoramic image using two images. These two images can be found in the folder provided with the Assignment. For this assignment, you are not allowed to use built-in stiching/mosaicing/panoramic image methods of computer vision libraries such as OpenCV etc., however, you can use methods provided by these libraries for each step of the algorithm (for example, you can use the keypoint detection and SIFT descriptor methods, methods to compute homography etc.)

The process of creating a panoramic image can be broken down into the following steps:

1. Detect keypoints and compute descriptors for both of the images, show these keypoints and descriptors on images (15 points)

2. Compute distances between every descriptor in one image and every descriptor in the other image. Show best matches (top matches with a distance that is smaller than a threshold) (15 points)

3. Apply the RANSAC method to estimate homography (15 points)

4. Apply transformation (warping) on one image, while keeping one as reference (15 points)

5. Stitch images together (15 points)

The report (25 points)

Submission:

You will submit a jupyter notebook (ipynb file) with executable Python script and a short report. Please do not forget to add comments at the top of the related section(comment line). You will write Python scripts, and you will use the libraries we covered in class (opencv, numpy, matplotlib, scikit-image) – except for the built in image stiching/mosaicing/panoramic image methods. You should import all the libraries you will use at the top of your notebook. Please refer to course slides, tutorials and practicals to set up a running Python environment, Jupyter notebook and to import these libraries. You can check the documentation of each library (available online) to get more information about the functions you will use.

Your report should contain;

- a brief overview of the problem in your own words,
- the details of your approach,
- the details of the methods used (you need to provide detailed information about what these methods are, the algorithm used, how it works etc.)
- The image that shows keypoints and descriptors
- The image that shows best matching keypoints (the best matches will be connected with a line)
- The stitching result of your algorithm using the two images
- If your algorithm failed to give a satisfactory result, provide a brief explanation of the reason(s).

Please, give all references that you used.

Important Note:

This is an individual assignment, meaning that you will be working on it alone (please check the Class Rules and Expectations below, also available in the syllabus)

Grading

The assignment will be graded out of 100: You will receive full points only when your script 1)executes, 2)gives the correct answer, and when 3)the explainations are provided.

Course Rules and Expectations

All work on programming assignments must be done individually unless stated otherwise. You are encouraged to discuss with your classmates about the given assignments, however, everything that is turned in for each assignment must be your own work. In particular, it is not acceptable to: submit another person's assignment as your own work (in part or in its entirety), get someone else to do all or a part of the work for you, submit a previous work that was done for another course in its entirety (self- plagiarism), submit material found on the web as is etc. These acts are in violation of academic integrity (plagiarism), and these incidents will not be tolerated. Homeworks, programming assignments, exams and projects are subject to Turnitin (https://www.turnitin.com/) checks.