

CSE 398/498 - Assignment 4

Image Warping and Stitching

Logistics

The submission should be made on Course site in the form of a zip file named as **<your_full_name>_cv_22.zip** by **November 21, 2022 5:00pm (EST)**.

Contents of the compressed folder should be organized in the following manner:

- **data/** - folder containing input images
- **output/** - folder containing output or any helpful intermediary images
- **src/** - containing your MATLAB scripts, comment your code well
- **readme.md/readme.txt** - containing verbose description of the steps required to run your code and other observations/comments you may have for your submission. Treat this as a short report. Include any links you may have referred to in this document.

Credit: 4% of course total

Due date: November 21, 2022, 5:00 pm

Pre-assignment

- Prepare your laptop. Install Matlab

- it's free for Lehigh students; follow the instructions at:
<https://www.mathworks.com/academia/tah-portal/lehigh-university-1147403.html#get>
- We will use Computer Vision Toolbox, but I recommend installing a full set of toolboxes (there may be some dependencies among Toolboxes)
- Downloading and installing Matlab takes a few hours – start early to have your laptop ready for the assignment. You can also use MATLAB online, though installing it might be the preferred option.

- Take 3 photos that you want to stitch and add them to the data folder. Consider at least **~30% of overlap** between adjacent images. **Reduce the resolution** (something between 640x480 and 1280x960 is good).

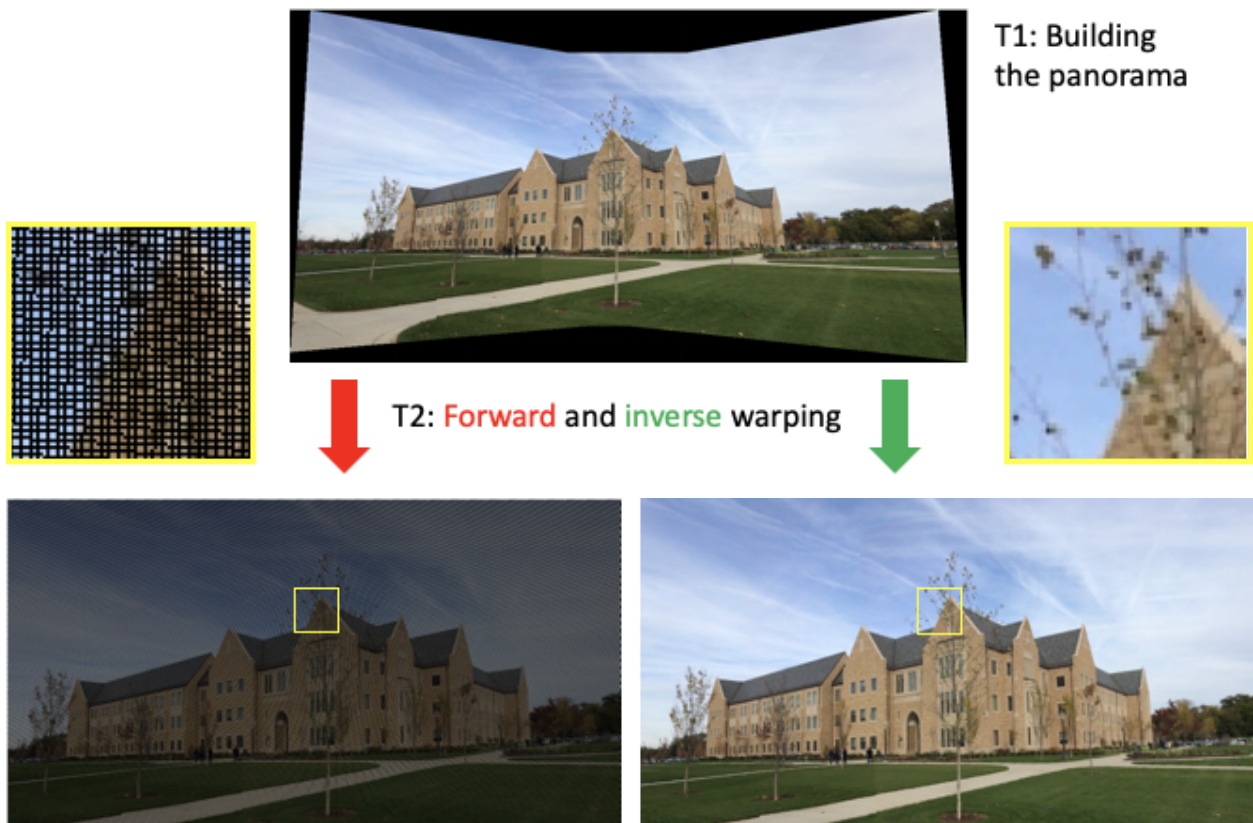


- Run “testSURF.m” on your images to see if:

- a) the Computer Vision toolbox works properly,
- b) your images deliver good keypoints.

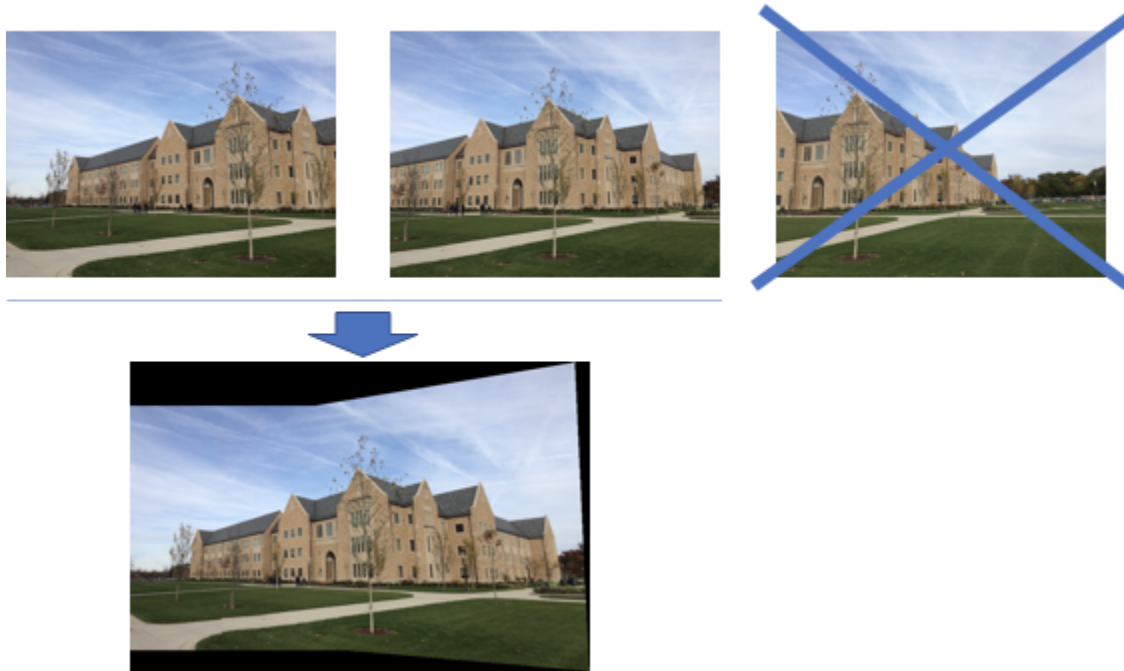


We are going to be performing image stitching. Please revise Projective Geometry and Homography Matrices for a better understanding. Also, refer to Chapter 9 of this [book](#). Major steps involved are shown below:



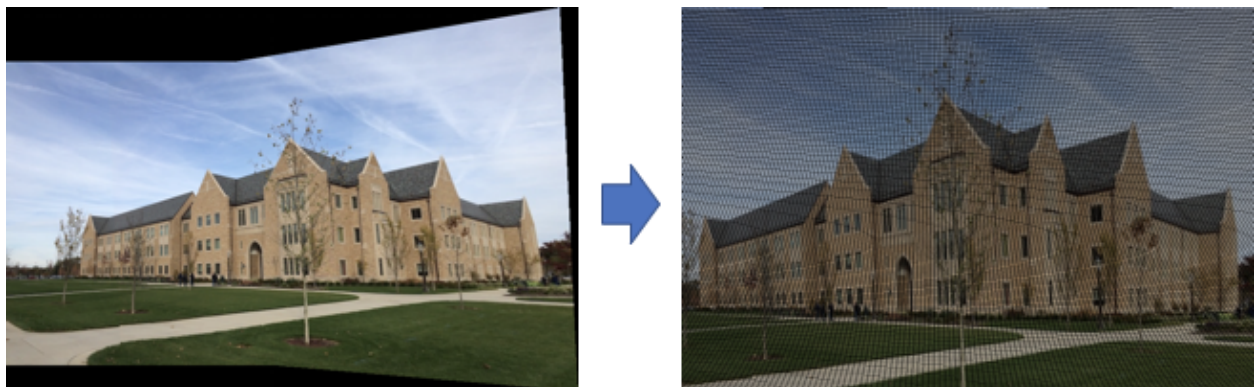
Helpful MATLAB scripts related to all the major steps are provided in the assignment package.

- Check how `imageStitching_2images.m` works on your two images (left and middle)



Use `forwardWarpingInteractive.m` to crop and correct geometrical deformations in your panorama.

You will see a lot of gaps and the result will not be satisfactory:



Trouble shooting:

If you are facing troubles install MATLAB, please contact the instructor ASAP. If you are unfamiliar with MATLAB, the following tutorials can help:

[MATLAB Introductory Tutorial](https://www.cs.tau.ac.il/~dcor/Graphics/cg-slides/MATLAB-tutorial.pdf)

<https://www.cs.tau.ac.il/~dcor/Graphics/cg-slides/MATLAB-tutorial.pdf>

[Get started with Computer Vision Toolbox](#)

Task 1 (1 point):

- Modify `forwardWarpingInteractive.m` to implement the **inverse warping**.
- Save the resulting code as `inverseWarpingInteractive.m`
- **Hint:** only two (!) lines of the `forwardWarpingInteractive.m` code require modification



Task 2 (1.5 point):

- Add your right (third) picture and modify `imageStitching_2images.m` code to stitch all three images into a panorama. Assume (as in task 1) that the left image is your reference.
- Save the resulting code as `imageStitching_3images.m`



Task 3 (1 point):

- The result of task 2 is not great: the right image is heavily deformed. What could be the reason for this? Write the answer in your report.
- Modify the code developed in task 2 to make the middle picture your reference picture.
- Save the resulting code as `imageStitching_3images_reordered.m` and store output image



- You can apply your `inverseWarpingInteractive.m` code (developed in task 1) to generate a final, nice result:



Task 4 (0.5 point): Repeat task 3 for your own set of images to create panoramic picture.

Rubric

Task 1 : 1 point for correct implementation and displaying output.

Task 2 : 1.5 points for correct implementation and stitched output.

Task 3 : 0.5 point for correct explanation and 0.5 for implementing code to improve stitched output

Task 4 : 0.5 points for clean stitched output.

Deadline Extensions and Late Submissions:

- First deadline extension request will be granted with a 3-day extension automatically and you won't be penalized. ***Applicable to Assignments and Projects***
- For subsequent late submissions, you will lose 10% for each day late for the programming projects. This means anytime within the first 24 hours after the due date count as 1 full day, up to 48 hours is two and 72 for the third late day. Beyond that, your submission will not be graded. ***Applicable to only Assignments***

Please clarify this with the instructor if the policy is not clear before you submit late.

Statement on Academic Integrity

University -We, the Lehigh University Student Senate, as the standing representative body of all undergraduates, reaffirm the duty and obligation of students to meet and uphold the highest principles and values of personal, moral and ethical conduct. As partners in our educational community, both students and faculty share the responsibility for promoting and helping to ensure an environment of academic integrity. As such, each student is expected to complete all academic course work in accordance to the standards set forth by the faculty and in compliance with the University's Code of Conduct.

Course - The work you do in this course must be your own. This means that you must be aware when you are building on someone else's ideas—including the ideas of your classmates, your professor, and the authors you read—and explicitly acknowledge when you are doing so. Feel free to build on, react to, criticize, and analyze the ideas of others but, when you do, make it known whose ideas you are working with. If you ever have questions about drawing the line between others' work and your own, ask me and I will give you clear guidance or you may visit Lehigh Library's 'Proper Use of Information' page at <http://libraryguides.lehigh.edu/plagiarism>

Grade Specific - Zero assigned to the Quiz/Assignment for first offense and the student will Fail the class on second offense.

For assignments, you can discuss with peers but the code should be your own. For quizzes, no consultation with a living or non-living entity is allowed.

University COVID Policy:

To meet the challenge of teaching and learning during the COVID-19 pandemic, Lehigh instructors and students will be adopting new forms of instruction and interaction; following new

guidelines around classroom behaviors; enhancing communications; and doing our best to be patient, flexible, and accommodating with each other. In remote synchronous meetings, students are expected to attend just as they would any other Lehigh class. Zoom classes work best when all students come to class ready to participate and follow the instructor's guidelines regarding use of web-cameras. You may be asked to turn your camera on during active learning sessions in Zoom. If you have a strong preference not to do so, please contact your instructor to let them know. Students should respect the in-classroom privacy of their instructors and fellow students by not taking screenshots or recording class sessions. Some instructors will record Zoom sessions; however, any recorded live sessions will be shared only with students in the class and will be deleted at the end of the semester.

In our physical classrooms, Lehigh has established a policy requiring everyone to wear face coverings when in public spaces inside buildings on our campus and to maintain social distance. This policy applies to our physical classroom. Thank you in advance for following this rule. Students who do not wear a face covering during in-class meetings will be reminded to put their face covering on. If they do not do so, they will be asked once again to do so or leave the classroom.