Lab 4

Deadline: 11:59 PM on Monday, March 16, 2020

This homework will look at the role and use of calibrated cameras for simple photo mosaicing. We assume throughout that you will be using your phone's camera for all the imaging associated with this homework.

What to Submit for Lab4?

Part 1 - Camera Calibration

Take a look at the Caltech Camera Calibration toolbox. Print out a calibration pattern and stick it firmly to a really flat object. Now take pictures of the calibration object from different angles while making sure that the calibration object fills most of the image. Use the example that is provided to figure out how to calibrate your phone camera. Try and make sure that the reprojection error after calibration is reasonable. **Report mean projection error and submit plots showing the errors.**

Part 2 - Photo Mosaicing

1. Go out on Forsyth street and take multiple, overlapping images of the mural on the Latino Students Center building. You should have at least five or six images.

   Note: Do not collect the images while standing in one spot. Walk sideways as you take the images, trying to keep the orientation of the camera similar between images.

2. Compensate these images for the intrinsic camera parameters you have derived from your camera calibration exercise. **Submit a sample before / after image showing the distortion correction.**

3. Play with the harris feature detector file provided with his homework (note you also need the convolve2.m file - also provided) to get features well distributed across the image.

4. Use the Matlab example code to figure out how to make a panoramic mosaic of the entire building but make sure you use the harris detector that has been provided as opposed to the feature detector the Matlab example uses.

Note: Do not attempt to use the full resolution images. Resize the images to approx 1 megapixel. **Do Not Submit The Full Resolution** images to your git repo.

5. Estimate and plot the position at which each camera was located for the images.

6. Finally blend the images into a composite mosaic.

Part 3 - Mosaicing with varying overlap

1. Now repeat the mosaicing exercise (should not have to recalibrate the camera) with images of a cinder block wall just like the example shown in class (again use 5-6 images that overlap by about 50%).
2. Collect one last set of images (of any other piece of graffiti art anywhere on campus) where the overlap is considerably smaller (say 15%). Does your mosaicing algorithm still work? What changes if any did you have to make.

Grading Rubric (10 Points)

- 3 points for camera calibration (part1)
- 4 points for Photo mosaicing (part2)
- 2 points for part 3
- 2 Points for data analysis and report.

Late submission policy is mentioned in the syllabus.

Submission Instructions

- Put all the data, matlab scripts and any other relevant files in a folder called "LAB4" in your gitlab repository. Limit your submissions to about 100MB. **Do Not Submit Full Resolution Images.**

- Your repo structure should look similar to
  '<Path_to_repo>/EECE5554_RoboticsSensing/LAB4/images/<source and mosaic files>'
  '<Path_to_repo>/EECE5554_RoboticsSensing/LAB4/analysis/<your analysis files>'
  '<Path_to_repo>/EECE5554_RoboticsSensing/LAB4/analysis/report.pdf'

- Push your local commits to (remote) gitlab server. You can verify this by visiting gitlab.com and making sure you can see the commit there.
- Upload your report in pdf format to Blackboard Assignments under Lab_2