

CS 4476: Computer Vision, Fall 2025

PS3

Instructor: Judy Hoffman

Due: Tuesday October 21, 11:59 pm ET

Instructions

1. The assignment must be done in Python3. No other programming languages are allowed.
2. Fill your answers in the answer sheet PPT provided and submit the file under the name: First-Name_LastName_PS3.pdf on Gradescope. Please do not modify the layout of the boxes provided in the answer sheet and fit your answers within the space provided.
3. Please enter your code in the designated areas of the template Python files. Please do not add additional functions/imports to the files. Points will be deducted for any changes to code/file names, use of static paths and anything else that needs manual intervention to fix.
4. Please submit your code and output files in a zipped format, using the helper script `zip_submission.py` with your GT username as a command line argument (using `--gt_username`), to Gradescope. Please do not create subdirectories within the main directory. The `.zip_dir_list.yml` file contains the required deliverable files, and `zip_submission.py` will fail if all the deliverables are not present in the root directory. Feel free to comment and uncomment them as you complete your solutions.
5. For the implementation questions, make sure your code is bug-free and works out of the box. Please be sure to submit all main and helper functions. Be sure to not include absolute paths. Points will be deducted if your code does not run out of the box.
6. If plots are required, you must include them in your Gradescope report and your code must display them when run. Points will be deducted for not following this protocol.
7. Ensure that you follow the instructions very carefully. Check the TODOs carefully and paste the images at the appropriate slides in the report.

Setup

Note that we will be using a new conda environment for this project! If you run into import module errors, try `pip install -e .` again, and if that still doesn't work, you may have to create a fresh environment.

1. Install Miniforge. Refer to the [Mac/Linux instructions](#) or the [Windows instructions](#). This will install the conda and mamba commands on your machine.
2. Open the terminal
 - (a) On Windows: open the installed **Miniforge Prompt** to run the command.
 - (b) On MacOS: open a terminal window to run the command
 - (c) On Linux: open a terminal window to run the command

3. Navigate to the folder "ps3_configs" where you have the conda configuration files.
4. Create the conda environment for this project
 - (a) On Windows: `mamba env create -f ps3_env_win.yml`
 - (b) On MacOS: `mamba env create -f ps3_env_mac.yml`
 - (c) On Linux: `mamba env create -f ps3_env_linux.yml`
5. Activate the newly created environment: use the command `mamba activate ps3`
6. Install the project files as a module in this conda environment using `pip install -e .` (**Do not forget the .**). Run this command on the folder where setup.py file exists.

Run the notebook using `jupyter notebook ./ps3_code/ps3.ipynb`. Be sure to run it with this path.

At this point, you should see the jupyter notebook in your web browser. Follow all the instructions in the notebook for both the code + report portions of this project.

Submission Instructions

Recheck you pass all local unit tests by entering the `ps3_unit_tests` directory and running the command `pytest ./`. This command will run all the unit tests once more, and you need to add a screenshot to the report. Ensure that the conda environment `ps3` is being used.

- Submit the code as zip on Gradescope at [PS3 - Code](#).
- Submit the report as PDF on Gradescope at [PS3 - Report](#).

There is no submission to be done on Canvas.

Rubric

Code: The score for each part is provided below. Please refer to the submission results on Gradescope for a detailed breakdown.

| | |
|--|-----------------|
| Part 1: Projection Matrix on provided images | 28 |
| Part 3: Fundamental Matrix | 20 |
| Part 4: RANSAC | 20 |
| EC1: Fundamental Matrix decomposition | 10 |
| <i>Total</i> | <i>68 (+10)</i> |

Report: The report is worth 32 points. Please refer to the pptx template where we have detailed the points associated with each question.

Deliverables

The following code deliverables will be uploaded as a zip file on Gradescope.

1. `ps3_code/fundamental_matrix.py`
 - (a) `point_line_distance()`
 - (b) `signed_point_line_errors()`

2. `ps3_code/least_squares_fundamental_matrix.py`

(a) `optimize()`

3. `ps3_code/projection_matrix.py`

(a) `objective_func()`

(b) `projection()`

(c) `estimate_camera_matrix()`

(d) `decompose_camera_matrix()`

(e) `calculate_camera_center()`

4. `ps3_code/ransac.py`

(a) `calculate_num_ransac_iterations()`

(b) `find_inliers()`

(c) `ransac_fundamental_matrix()`

5. `ps3_code/recover_rot_translation.py`

(a) `recover_E_from_F()`

(b) `recover_rot_translation_from_E()`

6. `ps3_code/ps3.ipynb`

7. `ps3_code/get_points.py`

8. `ps3_code/two_view_data.py`

9. `ps3_code/utils.py`

Do not create this zip manually. You are supposed to use the command `python zip_submission.py --gt_username <username>` for this.

The second thing to upload is the PDF export of the report on gradescope.

This iteration of the assignment is developed by Shashank Srikanth, Wantian Zhao, and Judy Hoffman.

This assignment was developed and maintained by Shashank Srikanth, Wantian Zhao, Ayush Baid, Haoxin Ma, Jacob Knaup, Jing Wu, Julia Chen, Stefan Stojanov, Frank Dellaert, James Hays, and Judy Hoffman based on the similar assignment by Aaron Bobick.