Problem:

The main goal of this homework is to do image rectification that eliminates the projective and affine distortions in an image. Use the following two methods to carry out the needed rectification.

1. A two-step method. Eliminate the projective distortion by first estimating the vanishing line using pairs of parallel line in the image and constructing a rectifying homography that takes $l_{VL} \rightarrow l_{\infty}$. Second, remove the affine distortion by using the constraint $l^\prime C^*_\infty m^\prime = 0$ where $l^\prime$ and $m^\prime$ are the image lines for two perpendicular world line.

2. A single step method. The projective and affine distortions are defined by specifying the dual conic $C^*_\infty$ using five pairs of physically orthogonal lines. This method is very sensitive to the choice of lines and so some tweaking of the lines may be required to get a good result. (See pages 55-57 of the textbook for how to implement this solution.)

As for homework 3, record the pixel coordinates by xview in Windows and Gimp in Linux. Obviously, once you have the pixel coordinates, you can construct the line parameters using the usual cross-product formulas. Apply your solution code to the set of images that you used for Homework2. Additionally, you must submit the results on at least two images you have taken with your own digital camera. Don’t forget that you need to show all lines you selected in each image for eliminating the projective and affine distortions.
Submission of Your Work:

You should turn in a report in pdf format of your homework solution using the blackboard. The report should include

1. A brief outline of both above mentioned methods including relevant equations.

2. A brief comparison of the results of the two methods with discussing their merits.

3. A description and illustration of how you used two methods respectively to remove the projective and affine distortions.

4. Your source code along with comments.

You are permitted to look at sample solutions form previous semesters available at http://cobweb.ecn.purdue.edu/~kak/courses-i-teach/ECE661.08/index.htm or https://engineering.purdue.edu/ece661/index.htm. However, the work you turn in must be your own!

Notes.

- Clearly identify the steps you have taken to solve the problem with your own words.

- Your grade depends on the completeness and clarity of your work as well as the results.