International Institute of Information Technology, Hyderabad

CSE578: Computer Vision. Assignment 1: Camera Calibration

Summary:
The goal of this assignment is to implement and compare the two camera calibration techniques. We would also like to test the quality of the parameters estimated from these calibration methods. You are expected to do the following:

1. Implement the DLT (Direct Linear Transformation) based calibration that we discussed in the class. You could use C/C++ or Matlab for this. However, you are expected to implement it yourselves and not use an existing implementation.
2. Implement the RANSAC based variant of the calibration that we discussed in the class. Note that these two algorithms use a set of known correspondences between real-world points and image points.
3. Use the image that is provided along with this assignment along with the real-world measurements that are given to you to compute the camera's internal and external parameters using each of the above algorithms. Note that you need to manually estimate the image co-ordinates of the given world points. You may implement and use the Harris Corner detector to help select these points. Describe your observations regarding the results.
4. Repeat the above experiments after correcting for radial distortion. Estimate the radial distortion parameters from the straight lines in the image. What do you observe regarding the resulting parameters?
5. Use the real-world measurements that are provided along with the estimated camera parameters to compute the image of a wireframe of the object. Note that you will be computing the location of image points as $x_i = \mathbf{P}.X_i$, and not use the image points. Overlay (draw) the wireframe over the actual image of the object using straight lines between the computed points x_i. What do you observe about the overlay?
6. Repeat the calibration of the camera using Zhang's method using either the available OpenCV or Matlab implementation. How does your results compare with DLT based method?
7. Repeat the overlay of wireframe using the internal parameters estimated from Zhang's method. Describe your observations.
8. Select a camera that you would like to use for the assignments. Note that you might be using this camera for future assignments also. This could be your laptop camera, mobile phone camera or any other digital camera that you have access to.
9. Repeat the 3 calibration methods using your own camera and your own calibration object for which you measure and determine the world co-ordinates. Use a printed checkerboard pattern for Zhang's method. Describe and comment on the results of each method.
10. Write a detailed report of your findings and results as mentioned in the previous steps, and submit it as a pdf file. You should also include your code and images that you acquired for the experiments at the end of the pdf file that you submit. Note that you are to submit a single pdf file containing your report, code and images.