Homework 1

Part 1

For this first HW, you are to implement Zhang’s algorithm for camera calibration. The set of images of the calibration pattern for both ‘training’ and testing will be provided. The goal is to measure the error in pixel coordinate and report its statistics for two conditions: with and without considering camera distortion.

You may implement the Levenberg-Marquardt algorithm as explained in the handout from class or use the Matlab lsqnonlin() function. Everything else must be coded by you. Be careful with the handout on the LM algorithm: 1) it is only a pseudo-code and some lines are ‘spelled out’ instead of actually implemented; 2) it considers only one position of the pattern – i.e. one single rotation R and translation T for a total of 11 unknowns. A full implementation should have 4, 5,... positions of the pattern for a total of 29, 35,... unknowns; and 3) the unknowns are not being normalized in that handout. As I mentioned in class, this may lead to biases in the LM minimization towards the larger parameters.

Suggestions to turn in a better HW

1. Apply another distortion model (Strongly recommended!) (e.g. from the “self-consistency/universality” paper that was handed out)

2. Use another minimization method, instead of Levenberg-Marquardt (e.g. Genetic Algorithm? Swarm Optimization? ...?)

3. What if one of the data points, from one of the positions of the pattern, is too noisy? Can your algorithm automatically detect that data set and assign a lower weight to that set so it doesn’t affect the overall result as much?

Part 2

Since we have a paper review already assigned, this time there will be no Part 2 question (Theory).