Computer vision: Homework #2

1 Task

Given a set of photos (all from the same camera) of a checker-board the required tasks are:

- Detects the checker-board in every image;
- Calibrates the camera;
- Compute the mean projection error;
- Show the name of the images with the best and worst re-projection error;
- Un-distort and rectify a test image acquired with the same camera as the calibration set.

1.1 Detection:

The photo set I've decided to use is "IAS_LAB", so I took 55 pics for the calibration and I left one aside as a test image for the un-distortion.
After loading all the images in my program, I tried to find the checker-board and its corners and i used the function *cv::drawChessboardCorners()* as debugger to check if it succeeded. All the checker-boards are detected and in figure 1 I show the result on one image.

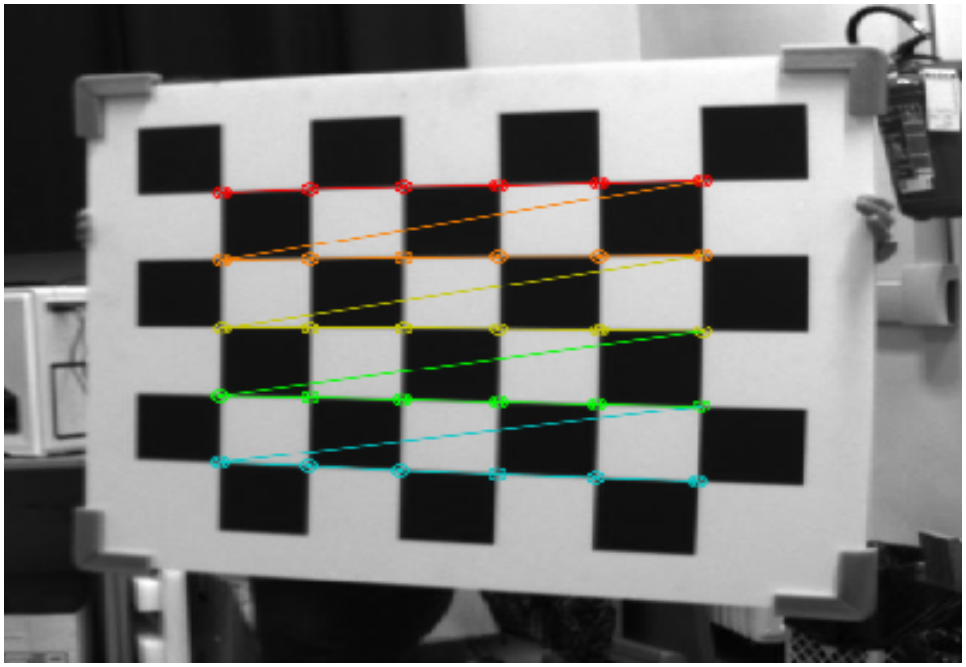

Figure 1: Detail of the checkerboard in an image of the "IAS_LAB" set

2 Calibration and mean projection error results

Then, using the *cv::calibrateCamera()* function, I found the following results:

	Image	Value
Mean re-projection error	-	0.329991
Max re-projection error	Image 27	2.17936
Min re-projection error	Image 38	0.0505603

So, the worst calibration is performed on image 27 and the best on image 38.

3 Undistortion and rectification of an image

Finally, for the un-distortion, I firstly computed the new camera matrix and used *cv::initUndistortRectifyMap()* and *cv::remap()*, as suggested, to fix the aforementioned test image. The results are reported in figure 2 and 3.

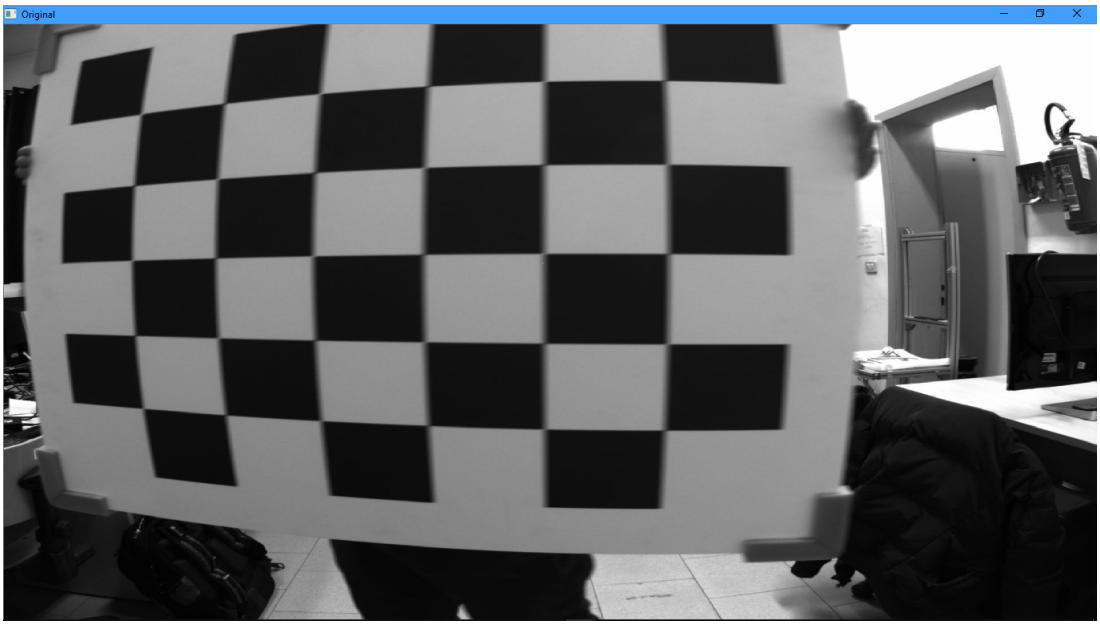

Figure 2: Test image without correction

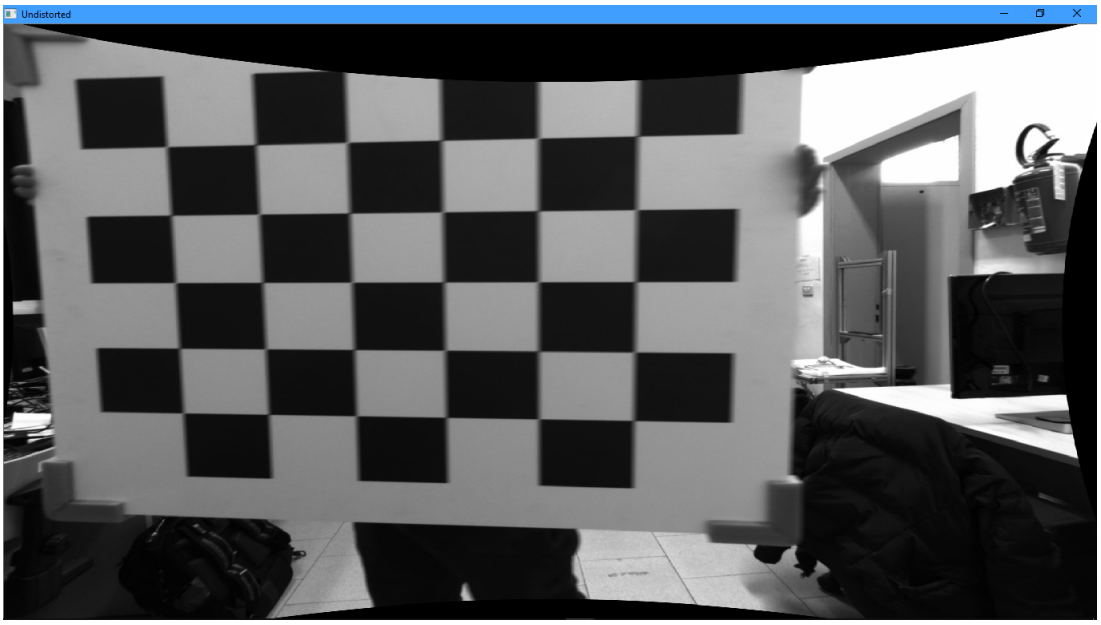

Figure 3: Test image after correction

Observing the now corrected test image, we can clearly see on the checker-board and the door frame how the lines are now straight, but we also notice some black on the border, that makes the pic assume a sort of “pillow” effect. This is caused by the geometric reconstruction of the image.