Università degli Studi di Padova

Department of Information Engineering

Master degree in ICT for Internet and Multimedia

Course: Computer Vision

Lab 2 report

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Camera calibration

This lab's aim is the calibration of a camera through a set of a ten of images (which we were given) representing a square-chessboard pattern seen from different point of views taken by the same camera held still on the same position.

Loading images. Chessboard corner detection. Calibration.

A series of images that we were provided were loaded. The ones from the D3300 folder were chosen since others were either too many or too heavy causing the code to slow down in a unacceptable manner.
For each image, chessboard corners were detected by using the OpenCV function cv::findChessboardCorners() and their position were refined with cv::cornerSubPix(). At this point it was possible to call the OpenCV function cv::calibrateCamera() to calibrate the camera, using the coordinates of the corners computed earlier and the calibration chessboard pattern points in the calibration pattern coordinate space. In this way the intrinsic (cameraMatrix and distCoeffs) and the extrinsic (rvecs and tvecs) parameters were obtained and the root mean square reprojection error computed.

Figure 1. Corner detection example image

Mean reprojection error.

To get the mean reprojection error, it' s necessary, to compute the Euclidean distance pixels-to-pixels between the corners coordinates detected earlier and chessboard pattern 3D-points projected on their particular virtual image plane, for each image. Such parameter allow us to choose the images for which the calibration performs best and worst, thus solving step (5) of this lab assignment. To reduce the mean reprojection error we could remove from the set the images for which the calibration performs worst. This procedure though, introduces some lack of generality on the estimating intrinsic parameters. The worst images indeed, considering the reprojection error, are the ones where the chessboard pattern appears on the edges, that is where the lens distortion is more observable. This is why in the code all the images of the set were considered. The best RMS reprojection error value obtained was 0.123744 and on average 0.48371, that are acceptable results for calibration since they are below 1.2.