Single Axis Rotation Angle Measurement Toolbox Using a Camera and a Checkboard

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Introduction

This is a MATLAB toolbox (**download**) for angle measurement. The toolbox can be used to measure single axis rotation angles from an image sequence of the checkboard (see Fig. 2). The angle measurement method consists of two steps: calibration of single axis motion and angle measurement. In the first step, intrinsic parameters and the geometry relation of thecheckboard, the camera and the rotation axis are calibrated by several images without occlusion. Then, the rotation angle of a certain image is measured. For more details, please refer to our paper : Hongxin Dong, Qiang Fu, Xu Zhao, Quan Quan, RuifengZhang. "A Practical Rotation Angle Measurement Method by Monocular Vision," Applied Optics, 2015, 54(3): 425–435. [**PDF**].

Installation

Copy all the files into a directory. MATLAB 2011a or higher version is required.

Usage

1. Run "anglemeasurement.m". The main interface of this toolbox is shown in Fig. 1.

2. Click "Read reference image" to choose a reference image, which should be without occlusion.

3. Click "Calibration" and choose several images without occlusion to calibrate the single axis.

4. Click "Read current image" to choose an image. The image can be with or without occlusion.

5. Click "Calculate angle" to measure the angle of current image.
If you have any questions, then please feel free to contract Hongxin Dong (**dhx_buaa@buaa.edu.cn**) or Quan Quan(**qq_buaa@buaa.edu.cn**).

Main Functions

TOOLBOX_CALIB

This file contains a general camera calibration toolbox [1].

VISION

This file contains the point detection algorithm of checkboard[2].

ANGLEMEASUREMENT

This fuction is the main function of the angle measurement toolbox.

TWOVIEWGEOMETRY

This function computes the initial values of intrinsic parameters and the parameters describing the geometry relation of thecheckboard, the camera and the rotation axis using two view geometry of single axis motion from the general calibration results.

POINTMATCHING

This function achieves the point matching and angle measurement algorithm mentioned in our paper.

Demo

In the toolbox file, several images of an experiment are given. These images consists of a reference image, 61 images without occlusion, and 5 images with occlusion. They are named after their rotation angles from the reference image. Namely, if the rotation angle of a certain image is 30 deg, then it is named after 30.bmp. A demonstration video is available in supplementary materials.

Reference

[1] J. Y. Bouguet, Camera calibration toolbox for matlab(2004)[online].Available: http://www.vision.caltech.edu/bouguetj/calib_doc/.

[2] A. Geiger, F. Moosmann, O. Car, and B. Schuster,Automatic camera and range sensor calibration using a singleshot," in IEEE International Conference on Robotics and Automation(IEEE, 2012), pp. 3936-3943.
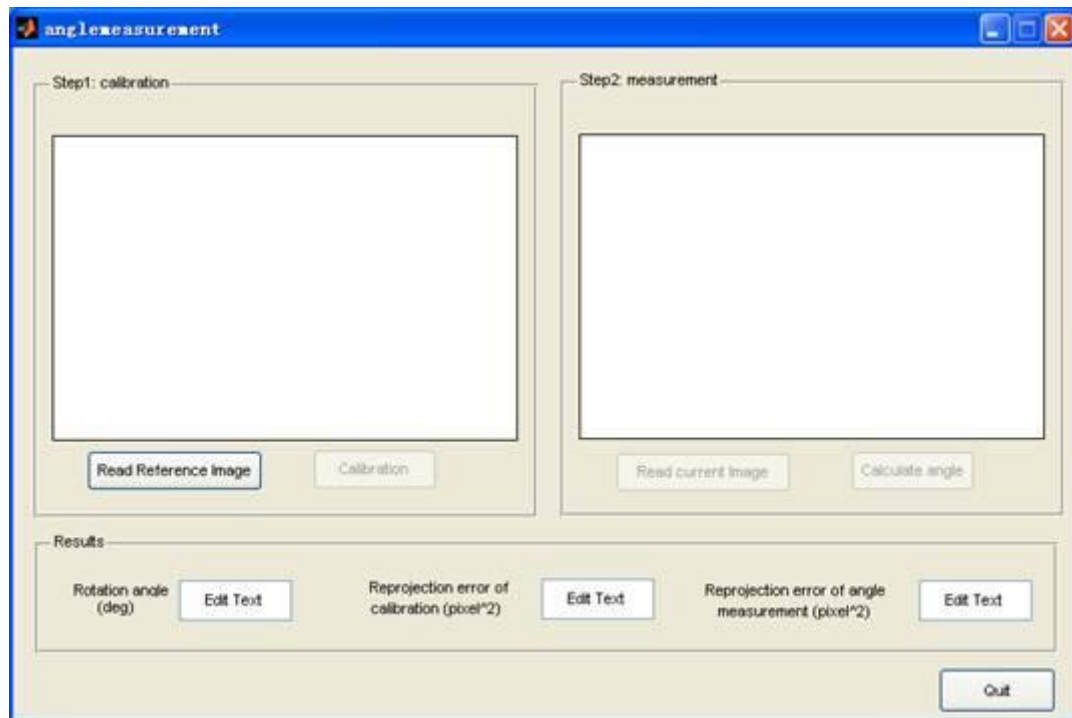
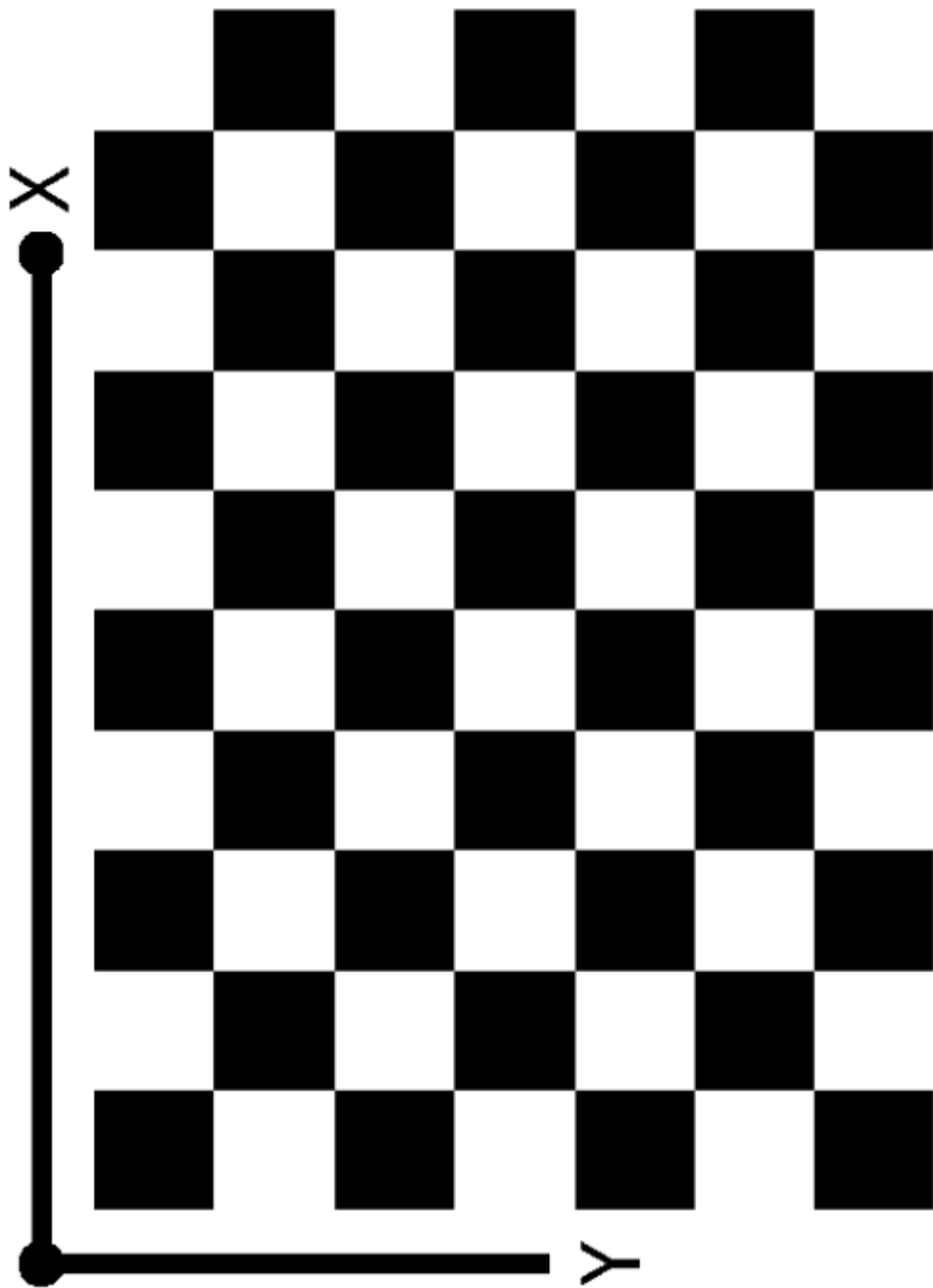Fig. 1 The main interface of this angle measurement toolbox.

Fig.2 A sample checkboard for angle measurement toolbox. The number of interesting points of this checkboard is 54.