Applying LO-RANSAC to Camera Calibration

The goal of camera calibration is to estimate a set of model parameters which describes the properties of a particular camera. These parameters include the intrinsic camera parameters as well as variable number of parameters which are used to model the camera's lens. A widely used method has been proposed Zhang [Zha00]. However, when using complex lens models consisting of multiple parameters the present algorithm often computes only sub-optimal estimates. Furthermore, by adding additional model parameters the dimensionality of the non-linear optimization problem increases and therefore also the runtime.

In this thesis the coupling between the intrinsic parameters and the corresponding lens model parameters should be investigated and ideally be reduced. The second task of this thesis consists of developing a new calibration algorithm which is based on the original work of Zhang and more recent work presented by Goshen et al. [Gos08]. In this work the authors present BEEM, a fast and robust method for estimating the fundamental matrix of a stereo camera setup, which is a related problem. BEEM reduces the runtime of the estimation by using a variation of RANSAC to find a close-to-optimal solution which is then refined by regular non-linear optimization.

In detail, the thesis consists of these tasks:

- Presentation of the state-of-the-art in a literature and patent research
- Investigation of the coupling between intrinsic parameters and lens model parameters
- Development of a new calibation method based on [Zha00]
- Evaluation of the new method with different monochrome and 3D cameras
- Comparison to current methods

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Start:
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References

[Gos08] L. Goshen, I. Shimshoni: *Balanced Exploration and Exploitation Model Search for Efficient Epipolar Geometry Estimation*, *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, Bd. 30, Nr. 7, July 2008, S. 1230–1242.

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