Abstract

The main purpose of this work is to determine the camera mapping for optical measurement objectives. The standard approach models the camera mapping as a pinhole camera with distortion. We formulate different error functions for the pinhole camera model. Minimizing all error functions introduces a non-linear optimization. Therefore, we present initial values for the intrinsic and extrinsic camera parameters including distortion. In particular, the distortion can be determined by a linear least squares problem. This yields a semi-linear approach to camera calibration.

Stereo camera calibration introduces an additional constraint, which is used as epipolar line constraint in the literature. We extend this constraint to epipolar curves and present some calibration approaches for a stereo camera setup. These include the epipolar curve constraint.

When modelling the camera as a pinhole with distortion, we observe a residual error. We show that this error depends on the depth of the observed object. Thus, we present two approaches to introduce a depth-dependent distortion model: First, we propose a spline correction of the residual error, second, we suggest a two-plane distortion model. Several experimental results support both approaches.