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# 2D PATTERN VS. SURROUNDING 3D PATTERN FOR FISHEYE CAMERA CALIBRATION

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Abstract. *For a fisheye camera with wider FOV (field of view) than hemisphere, a 2D plane pattern cannot cover the whole FOV. Intuitively, a surrounding 3D pattern covering the whole FOV of a fisheye camera may acquire a better parameters estimation of the fisheye camera than a 2D plant pattern. However, it seems there is no result available concerning quantitative evaluation on this expectation until now. In this paper we give a case study result on the comparison between 2D pattern and surrounding 3D pattern for fisheye camera calibration. Control points are extracted from circles painted on the calibration patterns. A better estimate of projection curve of fisheye camera and smaller standard deviations of the back-projection of the control points on the fisheye image are obtained in our simulation experiments.*
**Keywords:** Surrounding 3D pattern, Fisheye camera, Calibration

1. **Introduction.** The conventional calibration methods based upon the pinhole camera model have been studied extensively in computer vision [2-6], and the proposed calibration techniques in literature can be classified into two categories: reference object based calibration and self-calibration. Self-calibration does not use any calibration object and image point correspondences are only required [4]. According to the dimensions of the reference objects, we can further classify the pattern-based camera calibration techniques as follows:

(1) 3D pattern based calibration. This calibration method needs to view a calibration object whose geometry in 3D space is known with very good precision. The usual 3D calibration pattern is a cube with grid points plotted on its surface and the camera to be calibrated observes the cube to acquire the image with grid point for calibration [3,4], as shown in Figure 1. The calibrated result of this method is accurate but the 3D pattern made precisely is very difficult.
(2) 2D pattern based calibration. The technique requires view a planar pattern shown at a few different orientations [5]. The knowledge of the plane motion is not necessary. Because a calibration pattern is very simple, the setup is easier for camera calibration.