Geometric Calibration of Rotational Vision System for Dynamic Exterior Orientation

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Abstract

Rotational vision system (RVS) is a common type of active vision with only rotational freedom. Typically, the rotational freedom is provided by turntable and pan-tilt-zoom (PTZ). Or eye in hand (EIH) structure in an articulated arm robot. The ideal assumption that rotation axes are perfectly aligned with the coordinate axes of the local camera is mostly violated due to assembling deviations and limitations of manufacturing accuracy. To solve this problem, we propose a generalized deviation model for a specified rotation axis that relates the rotation motion of the platform to the exterior orientation (EO) of the camera. Based on it we put heuristic estimation algorithms through minimizing global reprojection error and fitting a circle in space respectively for rotating platform with or without accurate angle measurements with constrained global optimization. Implemented experiments on a servo pan-tilt turntable validate the accuracy and efficiency of the above models and calibration technique.

Full Text

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Figures

Figure 1

"Please see the Manuscript PDF file for the complete figure caption".

Figure 2

"Please see the Manuscript PDF file for the complete figure caption".

Figure 3

Image of actual experimental apparatus.

Figure 4

(a) Captured image sequence from the tilt motion. (b) Captured image sequence from the pan motion.

(a)

(b)

Figure 5

The obtained mean reprojection error after EO reconstruction with the estimated parameters, corresponding to captured images shown in Fig. 4. The red dashed line represents total mean reprojection error of all the images except the referenced frame.