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成像技术与图像处理

多约束融合算法在多摄像机测量系统中的应用

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摘要： 为了提高大视场三维测量精度,克服传统束调整算法对大视场图像校正不理想(控制点集中在视场中心)的缺点,提出了基于多约束融合算法的多摄像机三维测量方法,其基本思想为:将空间控制点的三维坐标与其对应像素点坐标之间的共线方程作为约束条件,利用已知的距离、三点共线和四点共面等信息,建立测量视场中控制点与像点坐标间的约束关系,从而完成三维坐标测量,同时实现了系统参数的在线标定。实验中,通过RMS误差和测距相对精度对测量精度进行了定量分析,测距相对精度达到了1:7 000~1:15 000,相对传统的束调整算法,该算法测量精度提高了一个数量级,是一种可靠的高精度视觉测量方法。

关键词： 计算机视觉 束调整算法 条件约束 相机标定 三维测量

Multi-Camera Measurement System Based on Multi-Constraint Fusion Algorithm

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Abstract: In order to improve three-dimensional measurement accuracy in the large field and to overcome the shortcomings of the traditional bundle adjustment algorithm for image correction being not ideal for large field of view (the control points concentrated in the center of the view), this paper presented a multi-camera 3D measurement methods based on multi-constraint fusion algorithm. The basic idea is collinear equation of three-dimensional space coordinates of the control points and corresponding pixel coordinates is looked as constraints, using the known distance constraint, three-point collinear, four-point coplanar to establish the restriction between coordinates of the control points and pixel points, thus completing the three-dimensional coordinate measurement, at the same time, achieving the online calibration of the system parameters. In the experiment, the RMS error and relative accuracy of distance are used to analyses the measurement accuracy, the relative accuracy of distance reaches to 1:7 000~1:15 000, compared to the traditional bundle adjustment algorithm, the measurement accuracy of this algorithm is improved an order of magnitude, it is a reliable high-precision vision measurement method.

Keywords: computer vision bundle adjustment algorithm constraint camera calibration three-dimensional measurement

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