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一种地形轮廓特征的立体视觉三维重建方法

魏振忠, 李苏祺, 张广军

北京航空航天大学 仪器科学与光电工程学院

3D Reconstruction Method of Terrain Contour Features Based on Stereo Vision

Wei Zhenzhong, Li Suqi, Zhang Guangjun

School of Instrument Science and Opto-electronics Engineering, Beijing University of Aeronautics and Astronautics

摘要

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摘要 针对自然地形轮廓特征的三维数据测量问题, 提出了一种基于区域分割的立体视觉三维重建方法。先通过分水岭变换进行图像分割, 根据分割区域边界确定图像中场景的轮廓边缘。轮廓边缘按所属区域分组进行立体匹配, 根据分割区域相互邻接的全局特征和各区域的位置、尺寸、灰度值局部特征建立区域约束, 并根据区域边缘像素点梯度分布特点建立梯度方向约束, 以减小立体匹配的搜索空间、优化匹配顺序、提高匹配精度。进而根据双目立体视觉的成像模型计算匹配边缘点的三维坐标, 实现地形轮廓边缘的三维重建。实验结果表明, 该方法能够快速有效地重建出体现地形三维结构特征的轮廓边缘, 并具有较高的立体匹配正确率和重建精度。

关键词: 立体视觉 三维重建 边缘匹配 区域约束 梯度方向

Abstract: To realize the 3D measurement of natural terrain contour features, a stereo vision 3D reconstruction method based on region segmentation was proposed. First, on the basis of image segmentation by using the watershed transformation method, the contour edges were detected according to the boundaries of the segmented regions. Then the contour edges were grouped according to their corresponding regions for stereo matching. On the basis of a region's global adjacency characteristics and its local position, area and gray characteristics, the region constraint was established. In addition, the gradient direction constraint of an edge point was established according to the gradient distribution. The new constraints effectively reduced the search area, optimized the matching order and increased the correct matching ratio. By using the stereo matching edge point pairs, their 3D coordinates were estimated according to the binocular stereo vision imaging model. Experimental results show that the proposed method can reconstruct the terrain contour edges denoting the terrain 3D structure characteristics quickly and effectively, and it can yield high stereo matching ratio and 3D reconstruction precision.

Keywords: stereo vision 3D reconstruction edge matching region constraint gradient direction

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Corresponding Authors: 张广军

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