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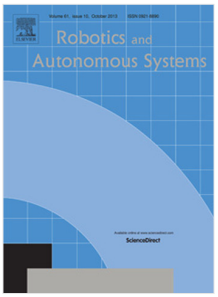

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Pose estimation by Omnidirectional Visual-Inertial Odometry

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Abstract

In this paper, a novel approach to ego-motion estimation is proposed based on visual and inertial sensors, named Omnidirectional Visual-Inertial Odometry (OVIO). The proposed approach combines omnidirectional visual features with inertial measurements within the Multi-State Constraint Kalman Filter (MSCKF). In contrast with other visual inertial odometry methods that use visual features captured by perspective cameras, the proposed approach utilizes spherical images obtained by an omnidirectional camera to obtain more accurate estimates of the position and orientation of the camera. Because the standard perspective model is unsuitable for omnidirectional cameras, a measurement model on a plane tangent to the unit sphere rather than on the image plane is defined. The key hypothesis of OVIO is that a wider field of view allows the incorporation of more visual features from the surrounding environment, thereby improving the accuracy and robustness of the ego-motion estimation. Moreover, by using an omnidirectional camera, a situation where there is not enough texture is less likely to arise. Experimental evaluation of OVIO using synthetic and real video sequences captured by a fish-eye camera in both indoor and outdoor environments shows the superior performance of the proposed OVIO as compared to the MSCKF using a perspective camera in both positioning and attitude estimation.

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