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A Robust Visual Simultaneous Localization and Mapping for Indoor Dynamic Environment

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Abstract : Visual Simultaneous Localization and Mapping (VSLAM) uses cameras to collect information in unknown environments to realize simultaneous localization and environment map construction, which has a wide range of applications in autonomous driving, virtual reality and other related fields. At present, the related research achievements about VSLAM can maintain high accuracy in static environment. But in dynamic environment, due to the presence of moving objects in the scene, the movement of these objects will reduce the stability of VSLAM system, resulting in inaccurate localization and mapping, or even failure. In this paper, a robust VSLAM method was proposed to effectively deal with the problem in dynamic environment. We proposed a dynamic region removal scheme based on semantic segmentation neural networks and geometric constraints. Firstly, semantic extraction neural network is used to extract prior active motion region, prior static region and prior passive motion region in the environment. Then, the light weight frame tracking module initializes the transform pose between the previous frame and the current frame on the prior static region. A motion consistency detection module based on multi-view geometry and scene flow is used to divide the environment into static region and dynamic region. Thus, the dynamic object region was successfully eliminated. Finally, only the static region is used for tracking thread. Our research is based on the ORBSLAM3 system, which is one of the most effective VSLAM systems available. We evaluated our method on the TUM RGB-D benchmark and the results demonstrate that the proposed VSLAM method improves the accuracy of the original ORBSLAM3 by 70%˜98.5% under high dynamic environment.

Keywords : dynamic scene, dynamic visual SLAM, semantic segmentation, scene flow, VSLAM
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