Open Source, Open Hardware Ground Truth for Visual Odometry and Simultaneous Localization and Mapping Applications

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Abstract : Ground-truth data is essential for VO (Visual Odometry) and SLAM (Simultaneous Localization and Mapping) quantitative evaluation using e.g. ATE (Absolute Trajectory Error) and RPE (Relative Pose Error). Many open-access data sets provide raw and ground-truth data for benchmark purposes. The issue appears when one would like to validate Visual Odometry and/or SLAM approaches on data captured using the device for which the algorithm is targeted for example mobile phone and disseminate data for other researchers. For this reason, we propose an open source, open hardware groundtruth system that provides an accurate and precise trajectory with a 3D point cloud. It is based on LiDAR Livox Mid-360 with a non-repetitive scanning pattern, on-board Raspberry Pi 4B computer, battery and software for off-line calculations (camera to LiDAR calibration, LiDAR odometry, SLAM, georeferencing). We show how this system can be used for the evaluation of various the state of the art algorithms (Stella SLAM, ORB SLAM3, DSO) in typical indoor monocular VO/SLAM.
Keywords : SLAM, ground truth, navigation, LiDAR, visual odometry, mapping
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