Long-Term Autonomy in Forest Environment using Self-Corrective SLAM

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Abstract Vehicles with prolonged autonomous missions have to maintain environment awareness by simultaneous localization and mapping (SLAM). Closed loop correction is substituted by interpolation in rigid body transformation space in order to systematically reduce the accumulated error over different scales. The computation is divided to an edge computed lightweight SLAM and iterative corrections in the cloud environment. Tree locations in the forest environment are sent via a potentially limited communication bandwidths. Data from a real forest site is used in the verification of the proposed algorithm. The algorithm adds new iterative closest point (ICP) cases to the initial SLAM and measures the resulting map quality by the mean of the root mean squared error (RMSE) of individual tree clusters. Adding 4 % more match cases yields the mean RMSE 0.15 m on a large site with 180 m odometric distance.

Keywords: Odometry; SLAM; Sparse Point Clouds; Lidar; Laser Scanning; Forest Localization; Autonomous Navigation

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