

A Study on the Integration of Visual, Inertial and Geolocalization Sensors for Autonomous Driving

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SLAM is the computational problem of simultaneously creating a map around a vehicle and localizing it in the said map. Implementations of SLAM algorithms are using different sets of sensors to compute their estimates. The state-of-the-art ones are often experimental, and their focus tends to be on visual and inertial sensors. In consequence, those methods produce drifting estimates as they integrate tiny errors that accumulate with time. ORB-SLAM3, a Real-Time Visual-Inertial SLAM algorithm that achieves excellent results in many conditions, is one of them. This thesis first presents the fundamental understanding needed to create a SLAM algorithm that relies on Maximum-a-Posteriori estimation like ORB-SLAM3. Then shows how we have developed a modified version of ORB-SLAM3 that tightly-couples the geolocalization measurements from a GNSS receiver with the existing solution. By doing so, our method corrects the drifting problem. Our experiments made using the KITTI dataset show that our method improves the accuracy of the original solution and does well compared to other methods that use geolocalization. As our method relies on an already robust Visual-Inertial solution, it still works for a short GNSS signal loss period, making it robust enough to be used in a real-world application like an autonomous vehicle.

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