Machine Perception: How Robots Navigate and Map the World

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There are several open-source software VIO algorithms that can be deployed on an end-user's system to solve a specific problem. In the literature, the majority of those pipelines are tested in machines with abundant computational resources, so they don't represent the real performance of those methods for the deployment in drones. Furthermore, due to the fact that papers usually present only the best results in a particular dataset with fine-tuned parameters, it is not clear how robust the algorithm is in other conditions (e.g. low illumination, few texture, dynamic scene) and consequently how generalizable the solutions are. The problem is that is not clear from existing results in the literature which VO algorithms perform well under the accuracy, latency and computational constrains of a flying robot with onboard state estimation. This project provides a framework to evaluate State of the Art VO pipelines on different hardware configurations in order to provide valid insights to the folks of the robotics research community and tech world. The framework has been developed using the following stack: Python, C++, ROS and Docker. Using ROS and de-facto software framework for robotics development, is possible to store the data in a systematic, organized and memory efficient way. The experiments are then automatized with Python and bash scripts. The results of those experimentations suggest that there is no free lunch in visual state estimation. Both robustness and accuracy can be improved clearly with additional resources, but on systems like those with few resources, is challenging to find the right trade-off. With this framework, the hope is that will help other passionate about robotics in finding the appropriate compromise depending on their application.

Awards Won:

Innopolis University : Full tuition scholarships for the Bachelor program in Computer Science