Universiteit Antwerpen

Progress Report Week 14

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Abstract

Optimisation of wireless networks is critical for the localisation of wireless devices. For this purpose, a wave propagation model of the environment can be created. Such a model contains a map of the environment combined with RF measurements that are obtained within that map. In this paper, we compare several visual SLAM algorithms such as LSD SLAM [1] and RGB-D SLAM [2] that can be used to render an accurate 3D map of an indoor environment. In order to test these algorithms, simulation software is used to navigate a drone around a room. A camera that is mounted on the drone provides necessary data for the algorithms. After finishing a SLAM algorithm, the resulting point cloud can be implemented in an OctoMap [3] to generate a volumetric representation. An initial guess of the environment is modelled and merged with the OctoMap that resulted from the SLAM algorithm. This way, an accurate probabilistic model of the environment can be created.

1 Progress

1.1 Final paper

My main focus for this week was writing my final paper and creating a portfolio.

1.2 LSD SLAM

With the new Genius WideCAM F100, I ran some more tests with LSD SLAM. The results are significantly better than previous tests. However, they are not as satisfactory as our RGB-D SLAM results. Therefore, I will mention LSD SLAM in my final paper, but I will not pursue it any further.

1.3 RGB-D SLAM Precision

In order to quantify precision of RGB-D SLAM, I ran the algorithm 11 times (1 reference + 10 test trajectories). Then, I exported the estimated trajectories from the RGB-D SLAM GUI and imported them in MatLab as .csv files. The timestamps of the trajectories were not always aligned with the timestamps of the reference estimate trajectory. Therefore, I had to write a function in MatLab that only keeps the valid rows of the trajectory by comparing their timestamps to the reference timestamps. Afterwards, I created boxplots for each trajectory that shows the error relative to the reference trajectory for the x-, y- and z-axis. The plots are shown in figure 1.

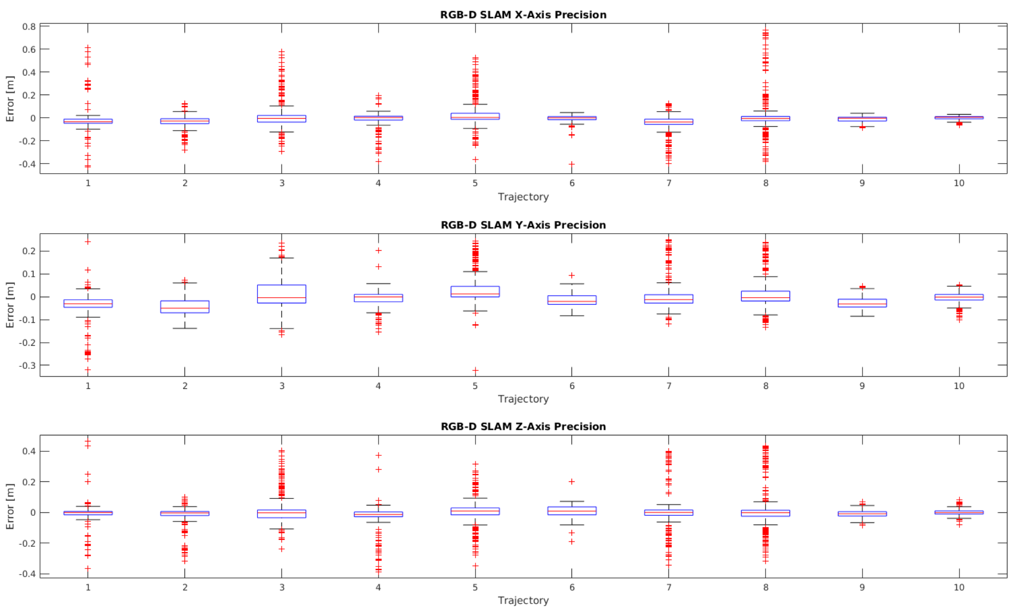

Figure 1: Boxplot on the precision of the RGB-D SLAM algorithm

Also, I plotted all trajectories relative to time in one plot, as shown in figure 2.

2 Planning week 15

- Finish paper and portfolio

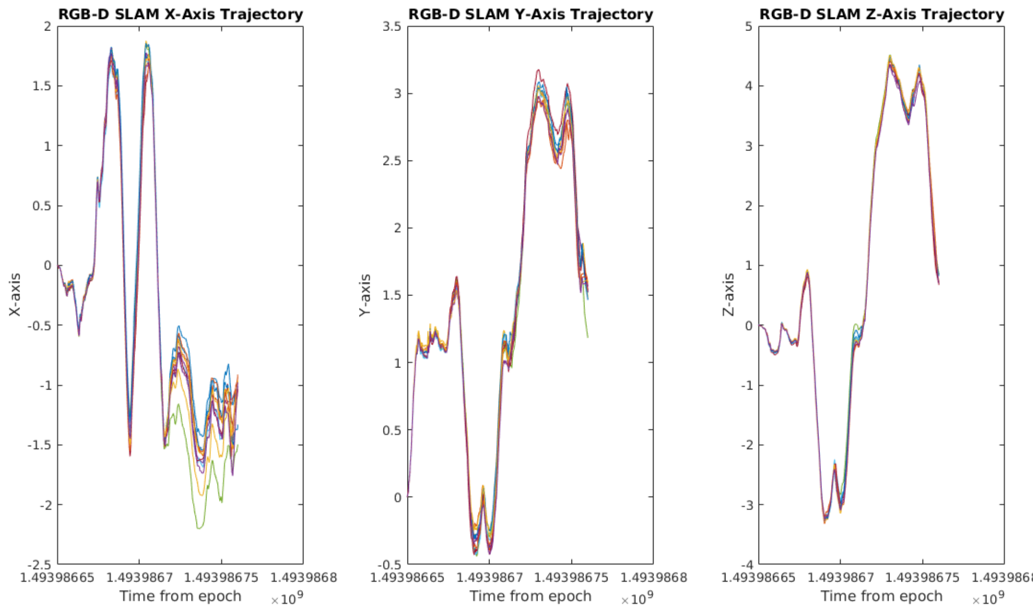

Figure 2: Boxplot on the precision of the RGB-D SLAM algorithm

References

[1] Jakob Engel, Thomas Schöps, and Daniel Cremers. LSD-SLAM: Large-Scale Direct Monocular SLAM. *Computer Vision ECCV 2014*, pages 834–849, 2014.

[2] Felix Endres, Jurgen Hess, Nikolas Engelhard, Jurgen Sturm, Daniel Cremers, and Wolfram Burgard. An evaluation of the {RGB}-D {SLAM} system. *2012 {IEEE} International Conference on Robotics and Automation*, 2012.

[3] Armin Hornung, Kai M Wurm, Maren Bennewitz, Cyrill Stachniss, and Wolfram Burgard. {OctoMap}: an efficient probabilistic {3D} mapping framework based on octrees. *Autonomous Robots*, 34(3):189–206, 2 2013.