Lucerne University of
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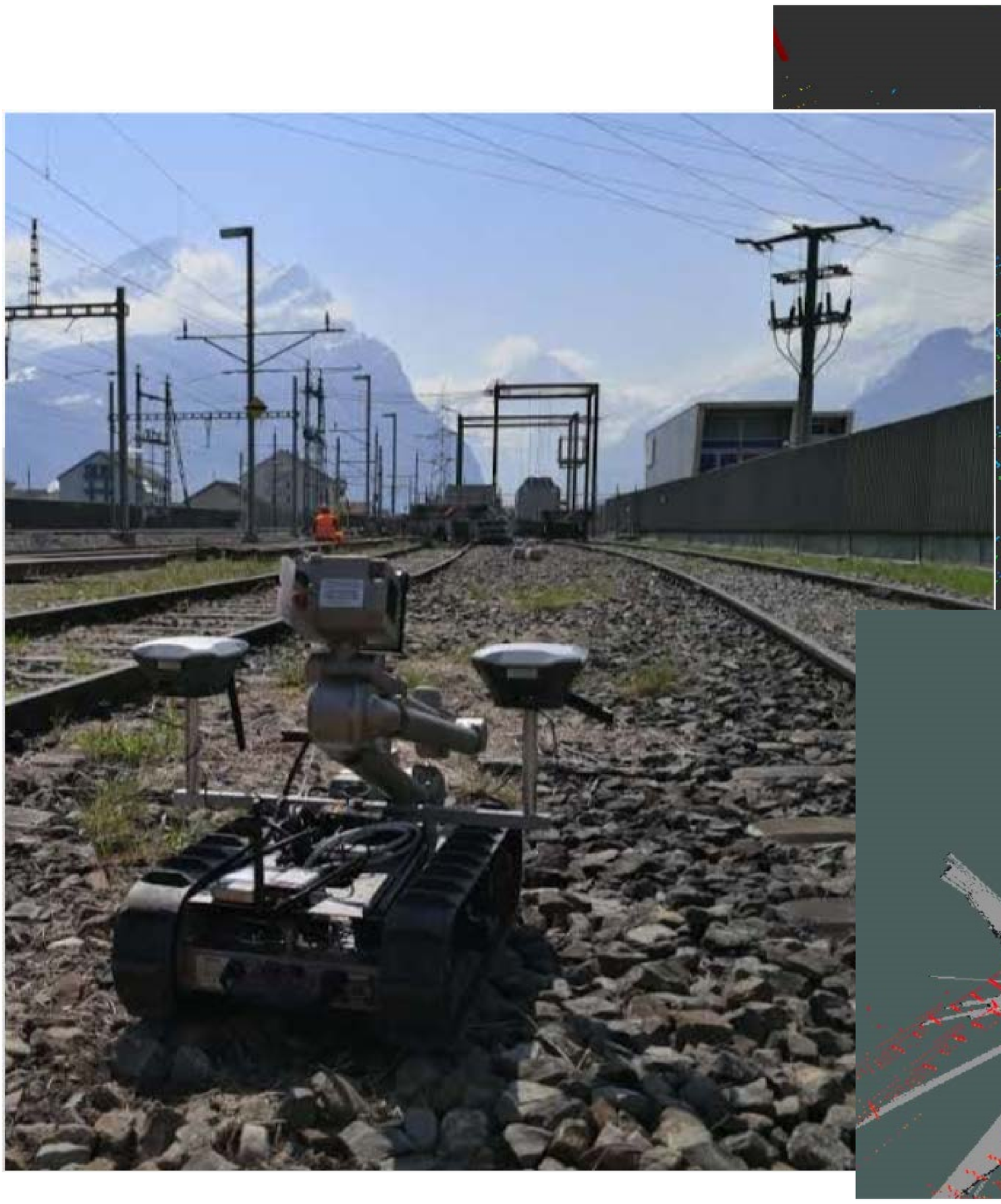
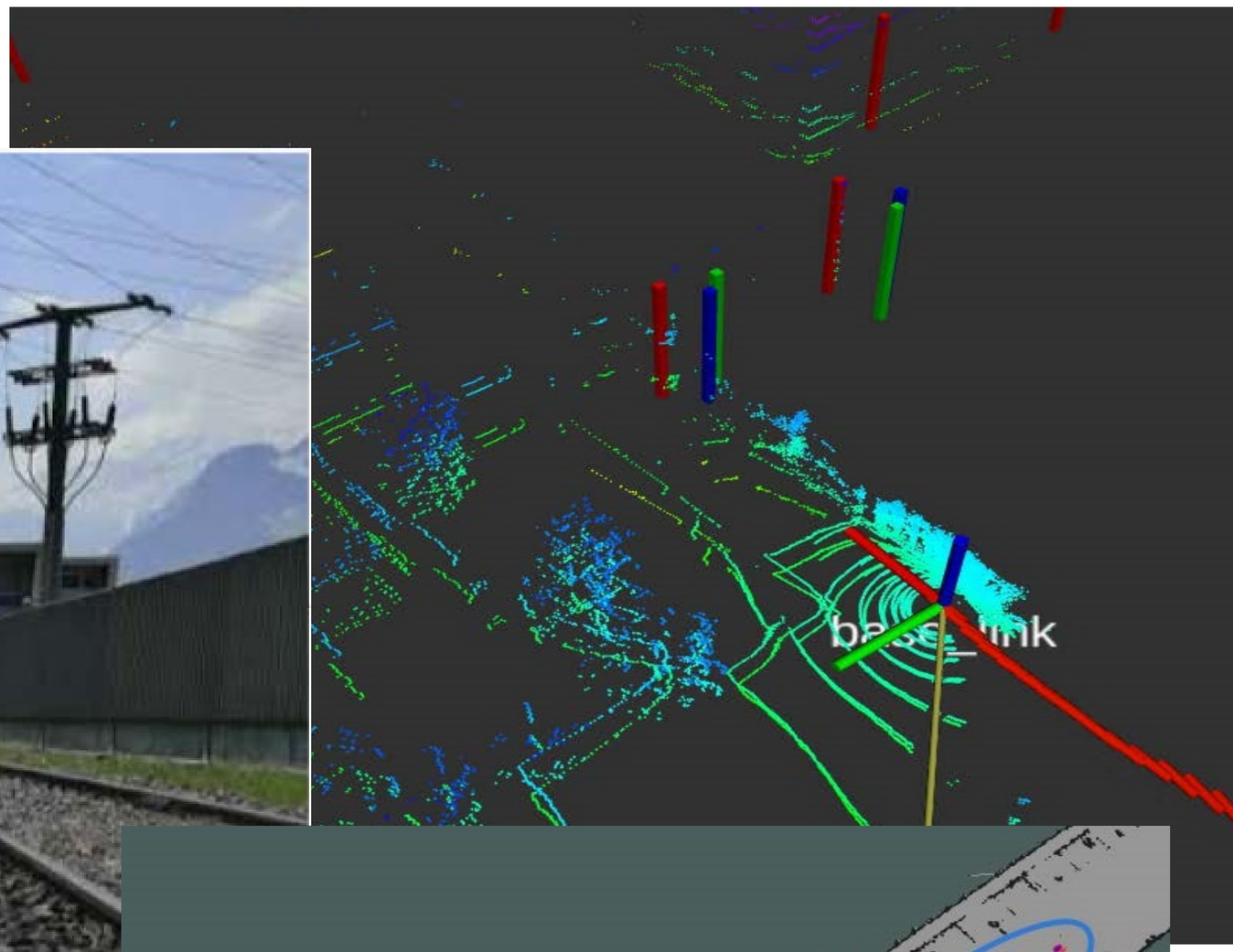
Technik & Architektur
FH Zentralschweiz

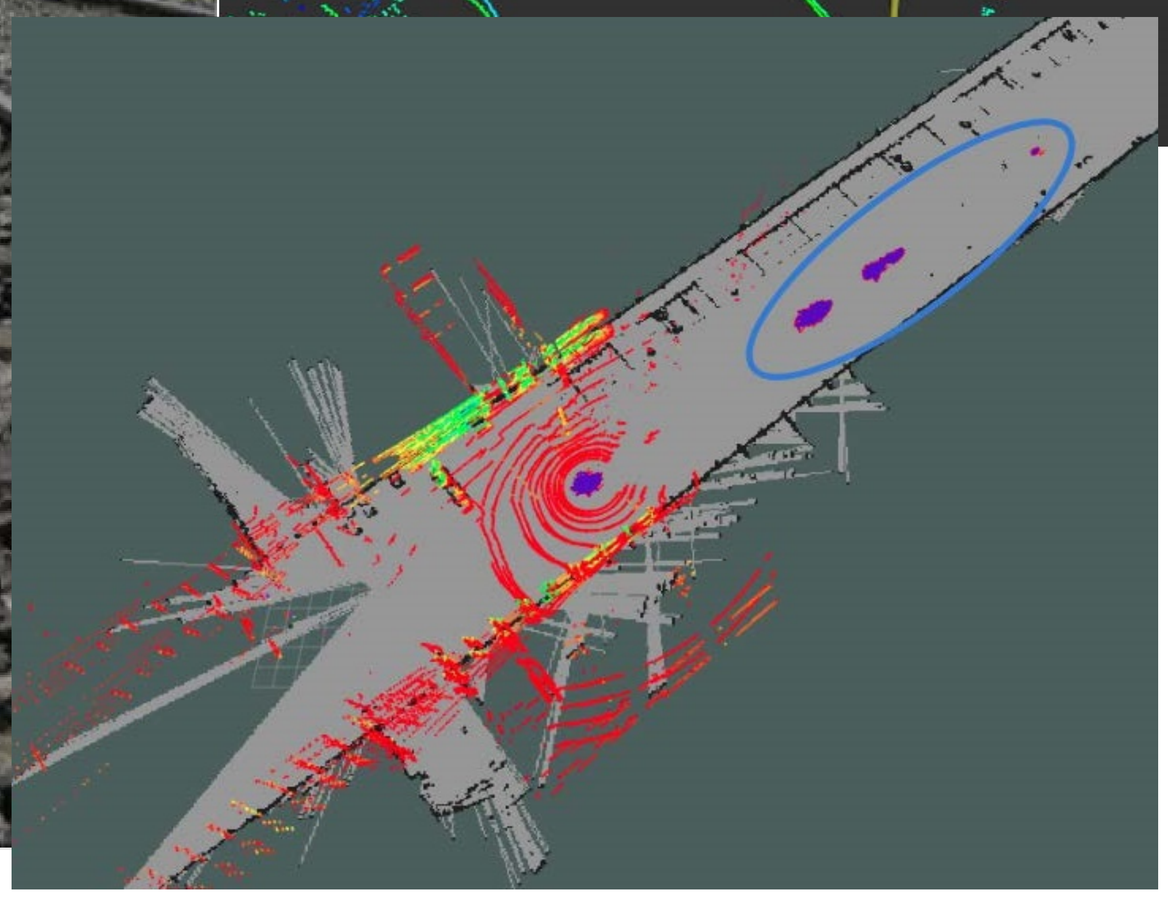
MSE | MASTER OF SCIENCE IN ENGINEERING

Master-Thesis Engineering, Fachgebiet Information and Communication Technologies

A Comparative Study of Localisation Methods for Large Scale Applications







Problem Statement

The primary question being "Where am I?". This question is answered by localization and is particular challenging in outdoor and large scale applications. The task is tackled by fusing multiple sensors with probabilistic algorithms. The scope of this work is the comparison of frameworks like Kalman filter and particle filters for applications in a large scale deployment of mobile robots for the industry partner SBB AG.

Multiple tasks in a train track environment e.g. monitoring, signalling and vegetation controll are repetitive. Mobile robots in general are good at repetitive tasks. By deploying a large scale application to conduct a task the safety on the train tracks is highly important. SBB AG have set strict requirements for mobile robots self-localization and navigation within train tracks to ensure safety of operations at all times.

Solution Concept

A mobile robot can be equiped with multiple sensors which providemeasurements like position, rotation, velocity, visual and a pointcloud. The sensors and combinations thereof are characterised to asses the benefits for self-localization.

Tests were conducted in HSLU campus in Horw and on train tracks in Flüelen, where sensor data was recorded for two mobile robot platforms. The real position of the mobile robot was continuously measured by a total station to evaluate the accuracy.

In retrospective the recorded sensor data was applied on localization methods to conduct an accuracy evaluation based on the total station measured data. This work focused on the localization by using a Kalman filter which fuses multiple sensors to gain the benefits of each sensors characteristics.

Particle filter localisation in an outdoor environment was evaluated by using an automatically generated map of the HSLU campus in Horw. The map was generated by querying object and infrastucture data from the SBB GIS databank to increase the precision and reliability of the map.

By extracting infrastructure features from the pointcloud, the mobile robot can match it to the queried data from the SBB GIS databank and self-localize by knowing the coordinates of the objects. The error analysis of the matching was conducted and the requirements for feature extraction were set.

Martins Lagzdins

Supervisor:
Prof. Dr. Björn Jensen

Industrial Partner:
SBB AG
Vulkanplatz 11
8048 Zürich, Schweiz