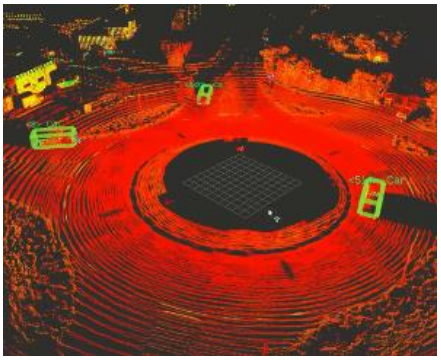
Chair of Cartography and Visual Analytics
TUM School of Engineering and Design
Technical University of Munich

Master Thesis

Sense-Making of Point Clouds for Easy Visual Interpretation



Classified LiDAR Point Clouds Challenging to Read © LiangDao GmbH

Point clouds are a collection of many single measurements in one dataset. LiDAR sensors contribute to high-precision reference maps on a centimeter level. Such LiDAR sensors are increasingly being employed in urban roadside sensing stations and serve as a valuable source to monitor real-time traffic volume. Basic traffic models can be built on raw traffic counts. However, detailed LiDAR dynamic point clouds can provide much more information than traffic counts, such as detailed traffic situations and vehicle type detection. However, raw point clouds prove to be difficult to read for city stakeholders, who could potentially use this information for traffic management guidance. Raw point clouds are very abstract due to the lack of semantic information, non-existent surfaces from objects, as well as the lack of an illumination model.

Digital Twin Architecture of a Road Area © Szalay (2021)

This thesis should find solutions for how to redesign station-based dynamic point clouds so that they become visually understandable to a wider target group. Therefore, the student should (1) apply generalization concepts to combat imperfections in the point cloud, (2) reconstruct surfaces from point clouds, (3) substitute classified bounding boxes with 3D models, and (4) stage design the fixed urban roadside settings. This thesis has no need to classify dynamic point clouds, as the given data from LiangDao GmbH (a system provider of LiDAR sensors) already provides classified vehicles and pedestrians as 3D bounding boxes. The classified LiDAR roadside-unit data of one street crossing will serve as study data.

The objective of this thesis is to introduce a semi-automated visualization pipeline for pre-classified point clouds to make visual representations of LiDAR data easily understandable. The proposed pipeline needs to be applicable to other LiDAR roadside units. This thesis is concluded by a systematic evaluation of the designed point cloud-based 3D model, possibly via a small user study. The student should have an interest in designing visual 3D models and handling point clouds.

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