

# Above and Below Ground

## Analyzing Multisensor Geospatial Data for Infrastructure Maintenance

### Background

Mobile mapping techniques are rapidly evolving and, in particular, become more and more common for infrastructure maintenance purposes. For example, municipalities, governments and private organizations capture geospatial data with multi-scanner systems for detailed modeling and analysis of urban environments, large facilities, and infrastructure networks such as by LiDAR scanners, which can generate high precision 3D scans of road surfaces, curbstones, and road space assets. Ground penetrating radar scanners measure material layers (e.g., asphalt, stone or sand) and corresponding properties several meters below ground, creating insights about the non-visible foundation of roads and pathways.

### Description

This master's project focuses on technological opportunities arising from the combination of above-ground 3D scans and below-ground 2D ground penetrating radar scans to derive information about the infrastructure. The key goal is to design and implement a number of algorithms that allow us to automatically analyze and detect anomalies in radar data based on deep-learning approaches, specialized to road space asset classification, such as detection of manholes and gullies. 3D scans, in a sense, belong to the most promising application fields for deep learning as they are characterized by a certain degree of fuzziness and interference phenomena – all of which can be handled perfectly by deep learning approaches. The project should investigate:

- Visual Analytics Techniques
  - Developing techniques for the combined visualization of multiple sensor data sources
  - Designing UIs for efficient data exploration
- 3D Scan Classification
  - Deep learning approaches for automated detection of road space assets (image matching)
- Anomaly Detection
  - Automated detection and highlighting of irregularities in radar data

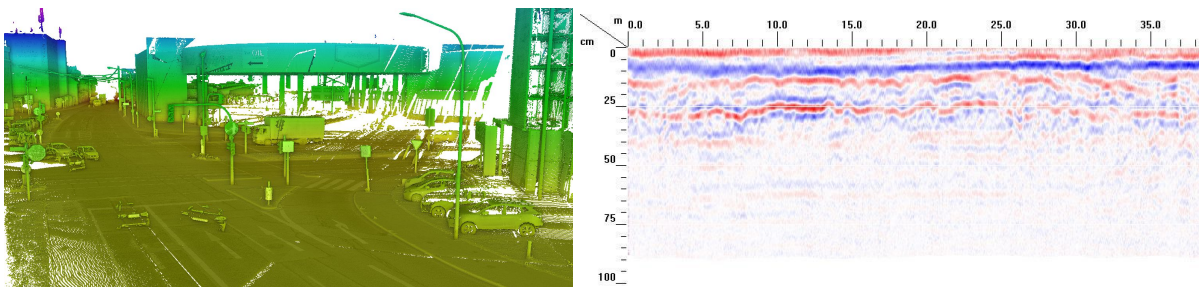


Figure: 3D scan of a road environment (left) and visualization of a ground penetrating radar profile (right).

The master's project refers to current research and software projects of the Computer Graphics Systems group. It is especially suited for further research in the context of a master's thesis or a future doctoral thesis. Further, the master's project can lay a foundation for working as a student assistant or software developer at our research partners.

### Contact

Rico Richter ([rico.richter@hpi.de](mailto:rico.richter@hpi.de)) and Johannes Wolf ([johannes.wolf@hpi.de](mailto:johannes.wolf@hpi.de))