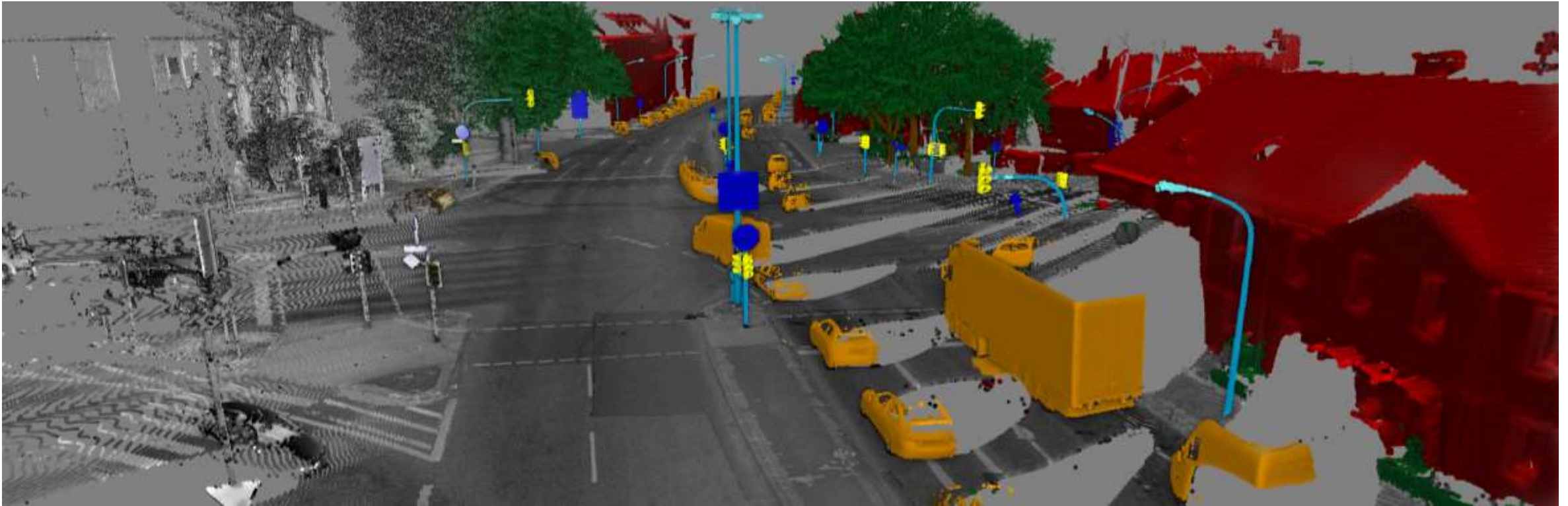


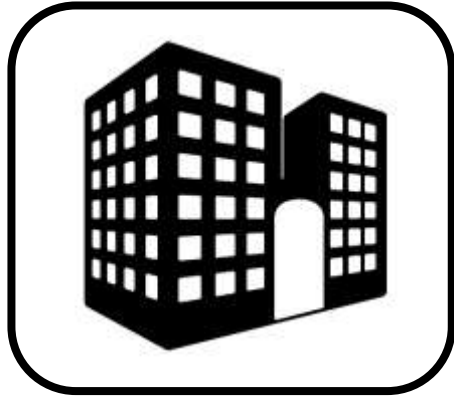
Künstliche Intelligenz für die Verarbeitung und Analyse von Punktwolken



Dr. Rico Richter

10. November 2023 – BauScan2023

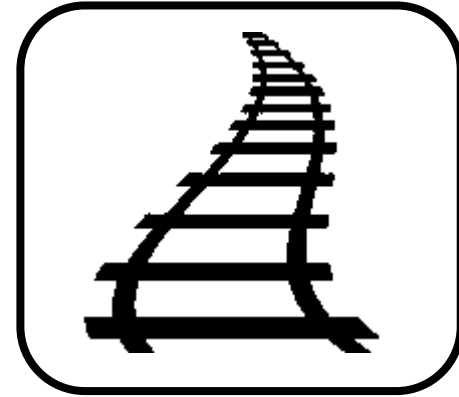
Structures, Objects and Assets Worldwide



1.7 billion¹



64 million kilometres⁴



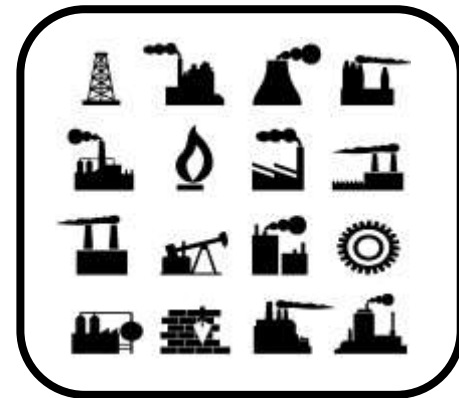
1 million kilometres³



400 billion²



100 million kilometres⁵



...and many more

Sources:
¹ Survey Sampling
² NASA
^{3,4} The World Bank
⁵ Siemens survey

3D Point Clouds – Data Acquisition

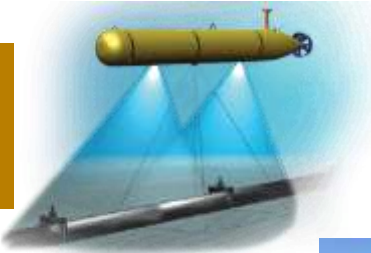
LiDAR

Image-based

Aerial



Mobile

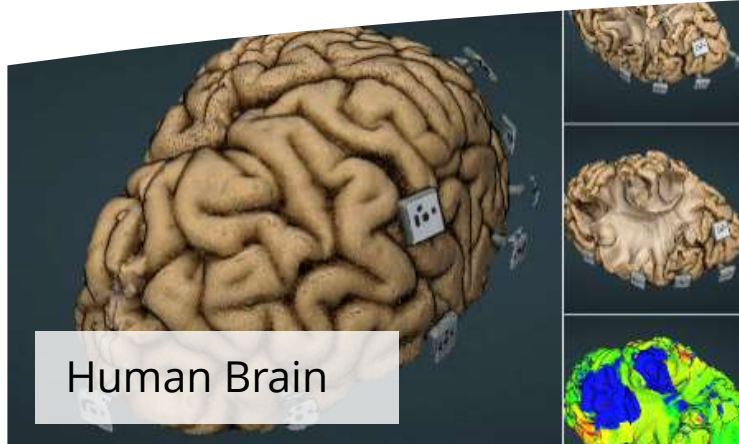
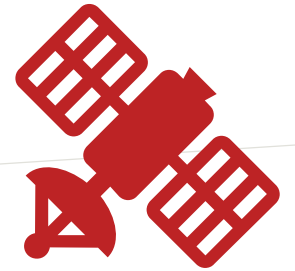


Terrestrial



Everything Can/Will Become a Point Cloud

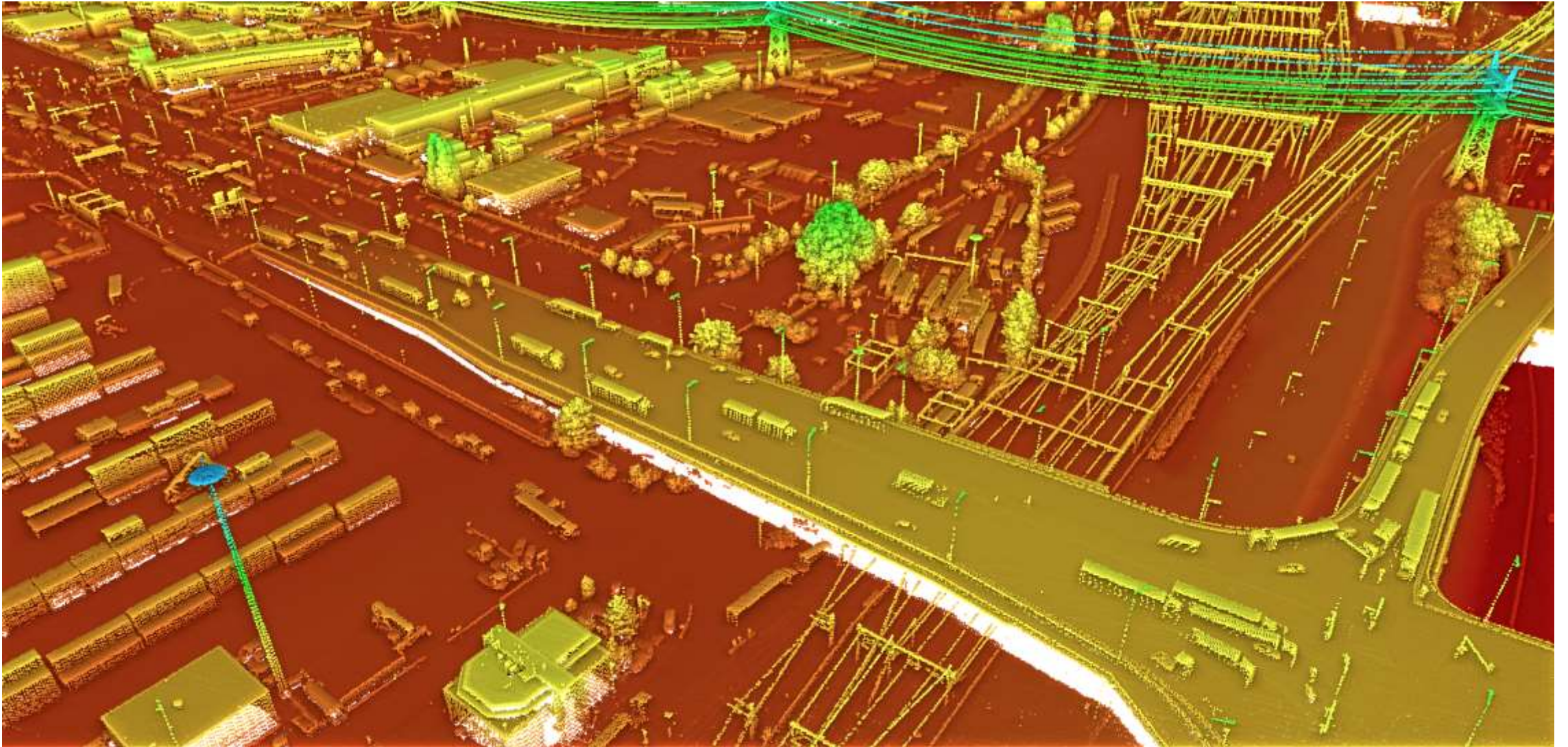
- Point clouds are the most essential category of geospatial data
- There is a strong need to extract information and create insights



Aerial Photogrammetry – UAV Scan



Aerial Laserscanning – Rotterdam, Netherlands



3D Point Clouds – Mobile Mapping



Acquisition Urban Area of Essen

Data acquisition

- 4.000 km road infrastructure
- ~ 40 GB raw data per km (images, point clouds, radar)
- 200 TB per year
- Annual data acquisition

Selected tasks:

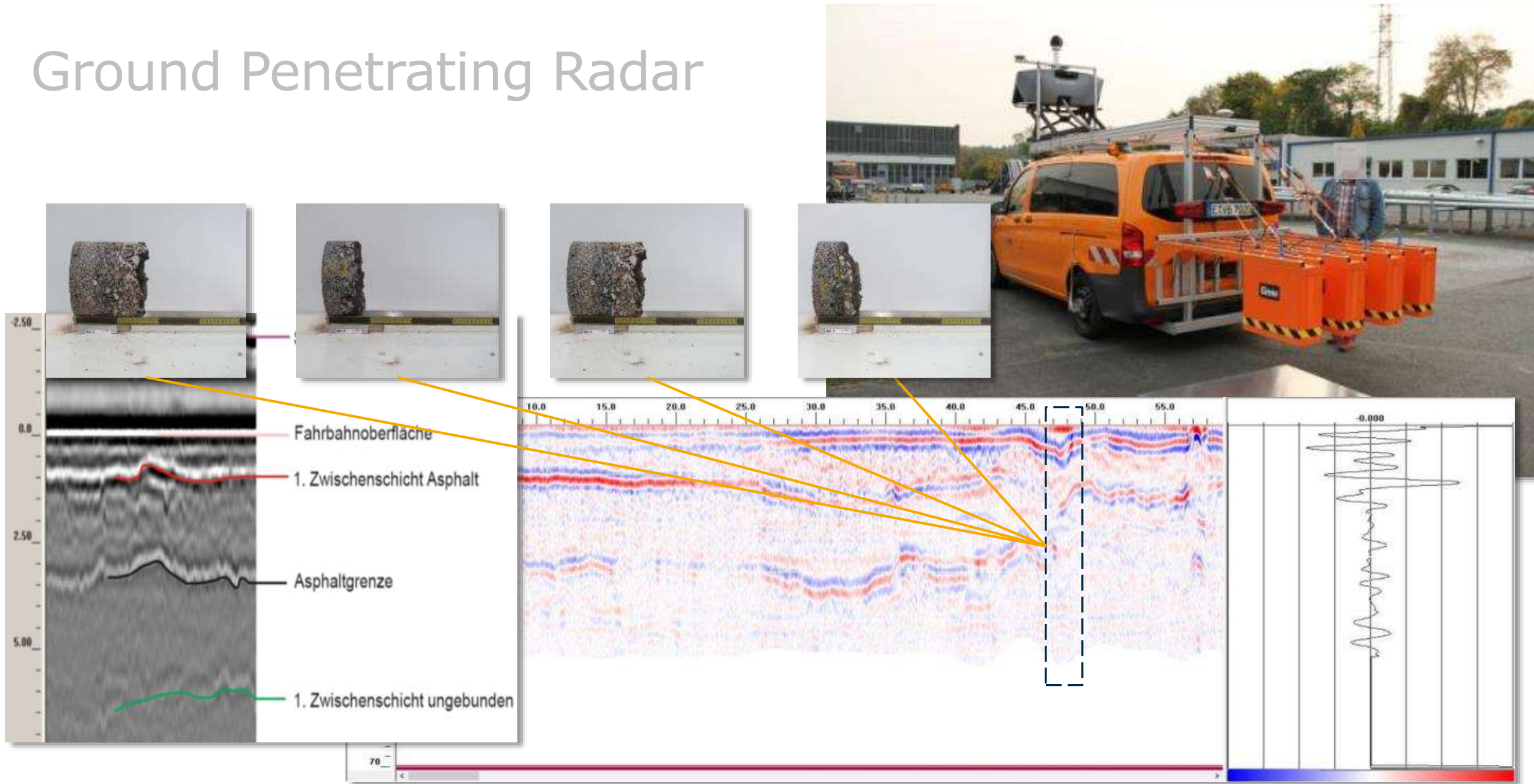
- Visualization & planning
- Inspection & maintenance
- Road condition evaluation & decision support
- Object and asset detection
- Data provision to all city departments
- ...



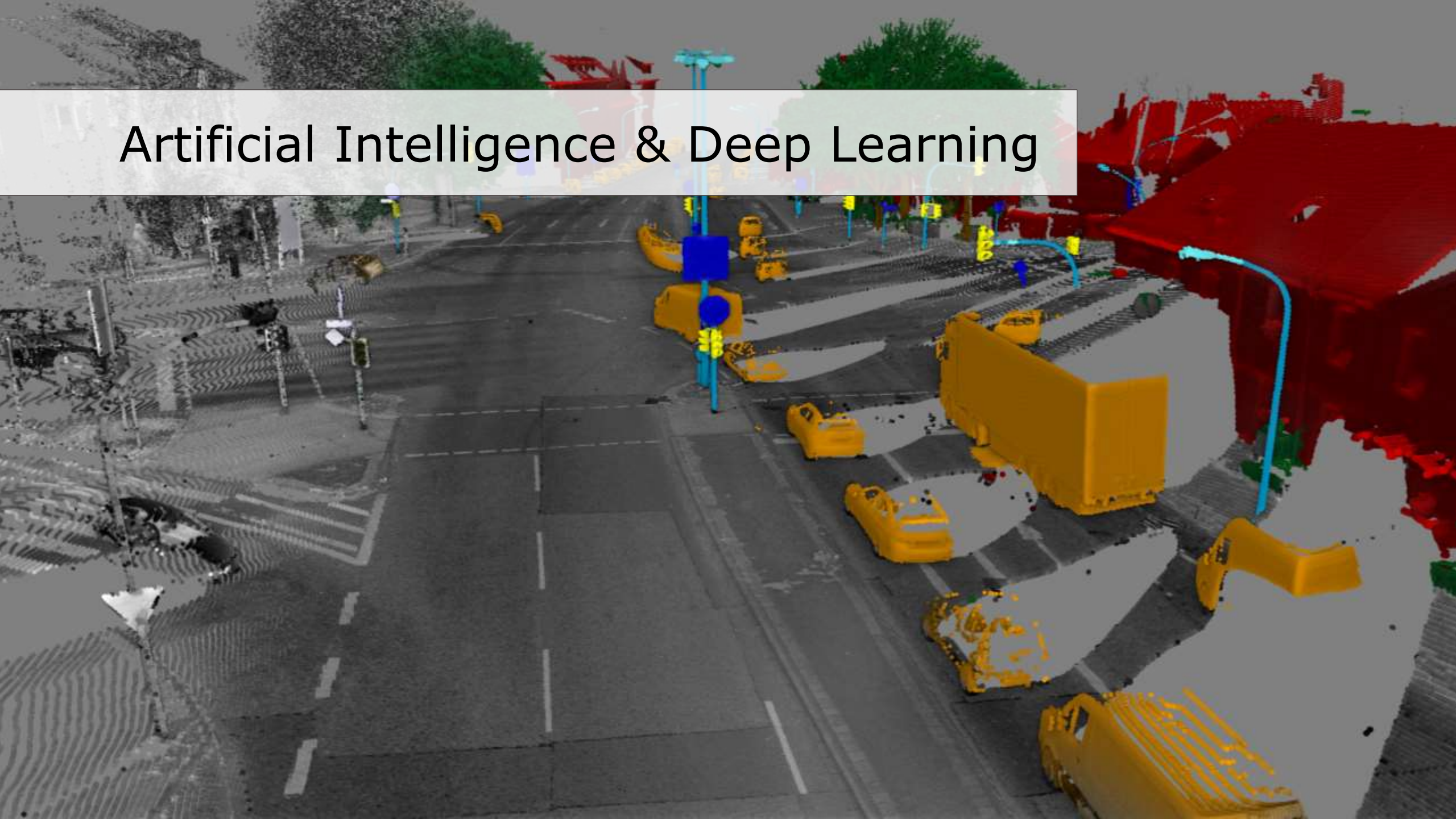
Panorama Images – Mobile Mapping



Ground Penetrating Radar



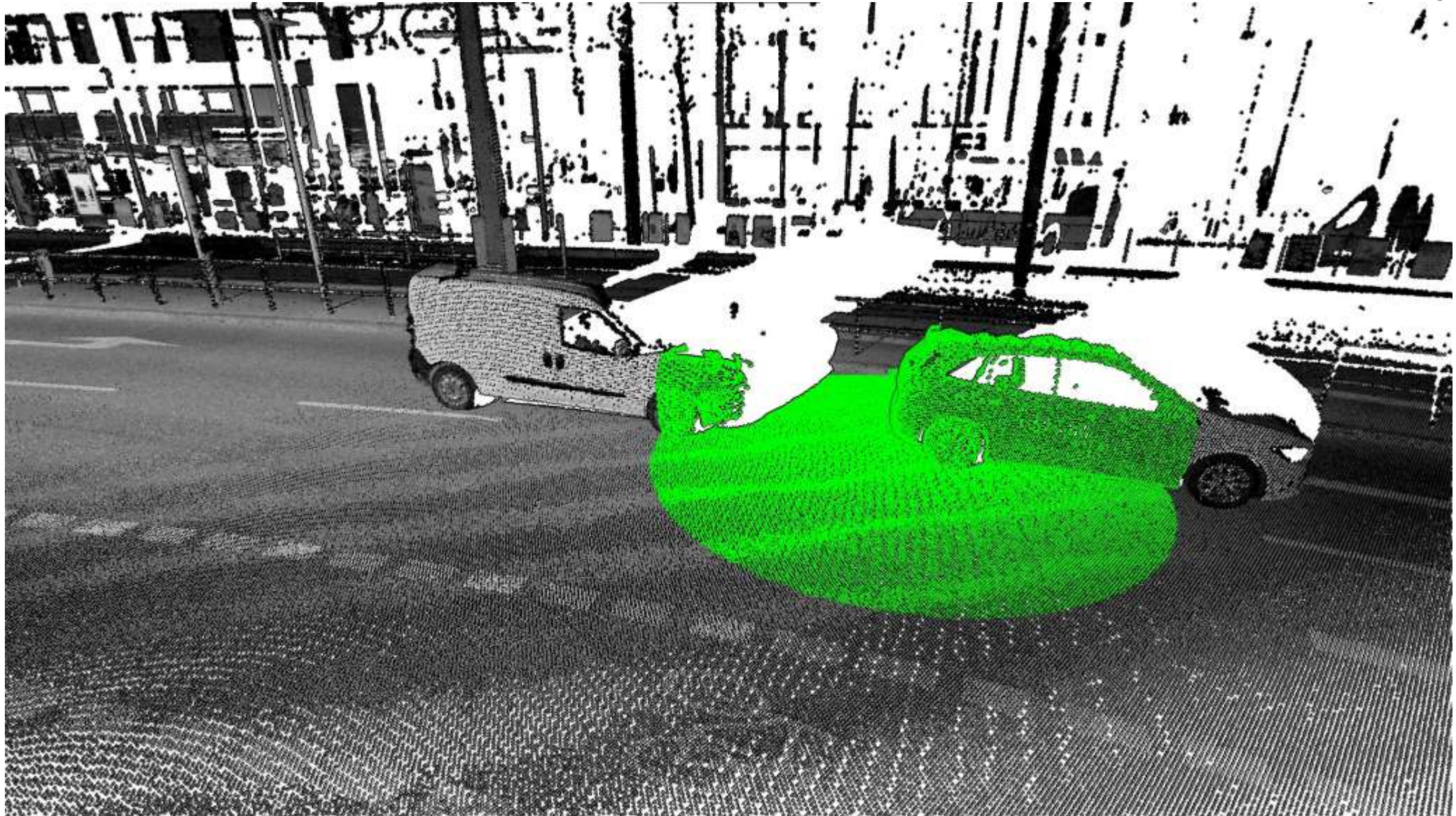
Artificial Intelligence & Deep Learning



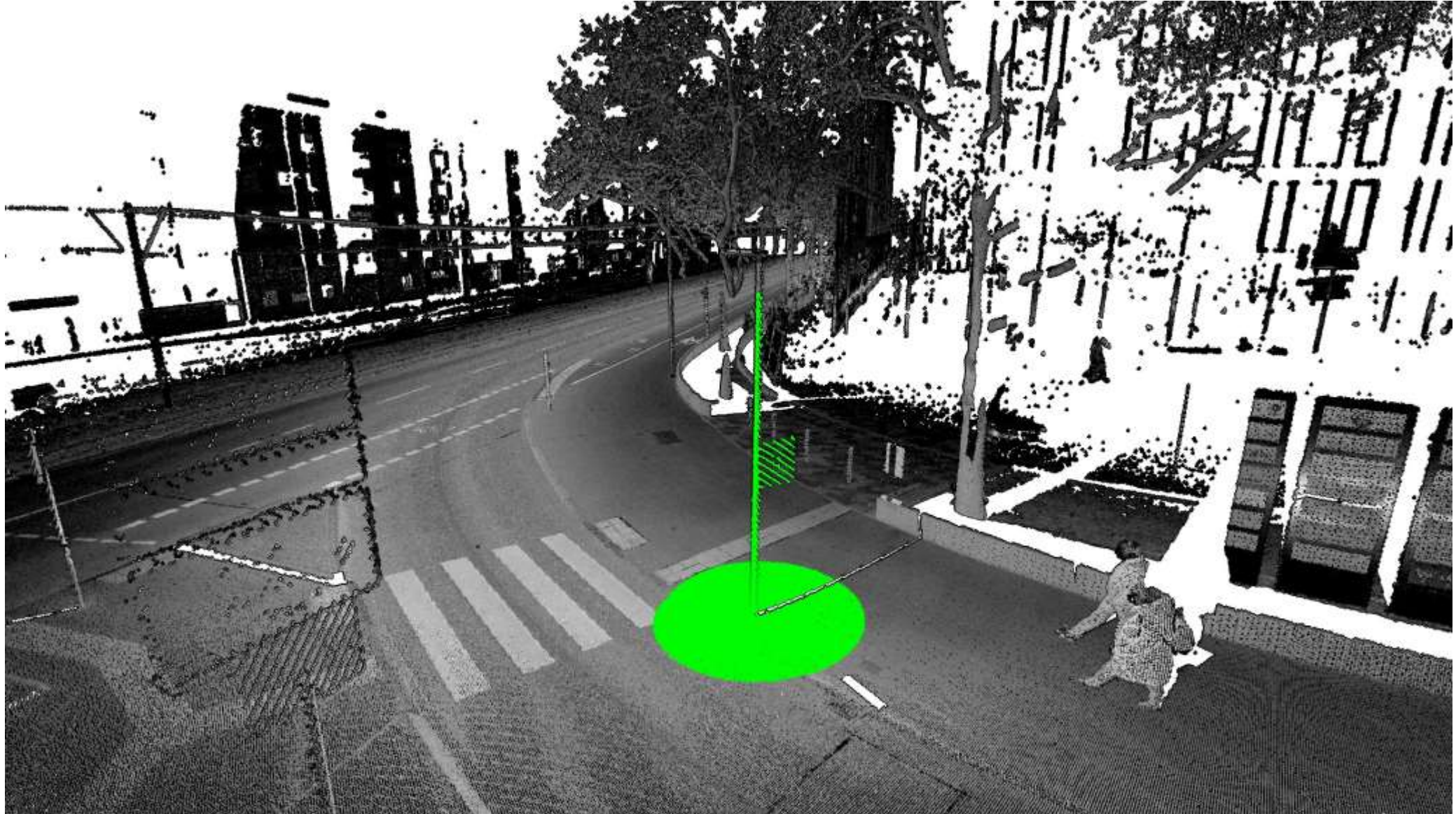
Deep Learning – Classification Results



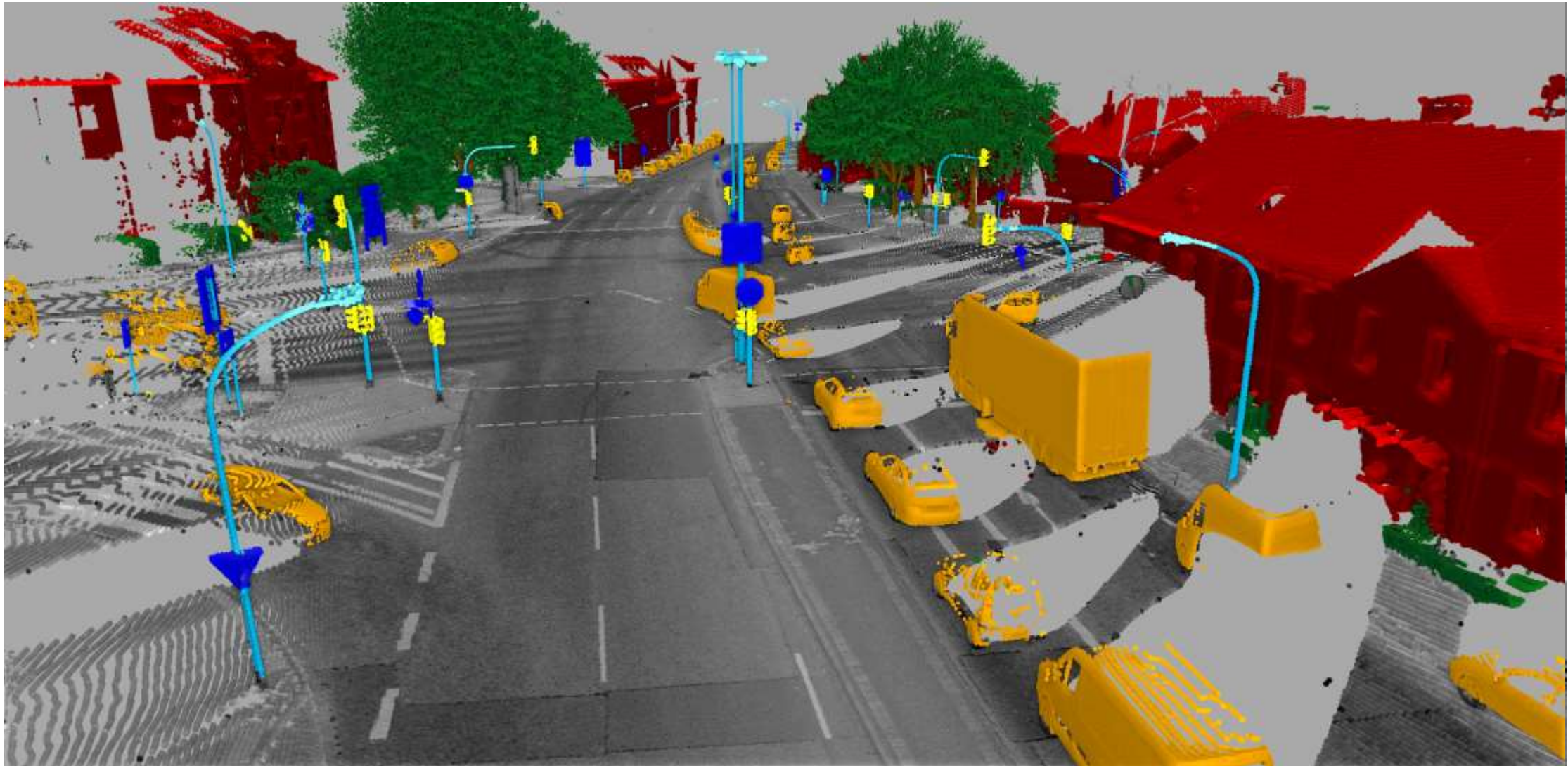
Local Point Environment



Local Point Environment



Deep Learning – Classification Results



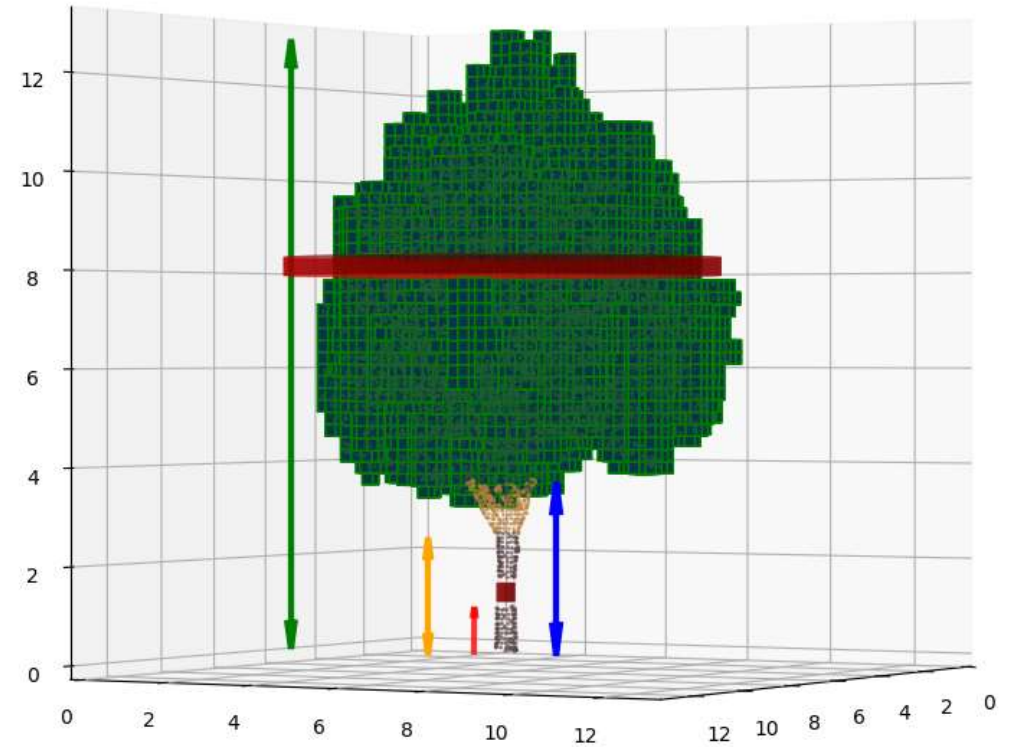
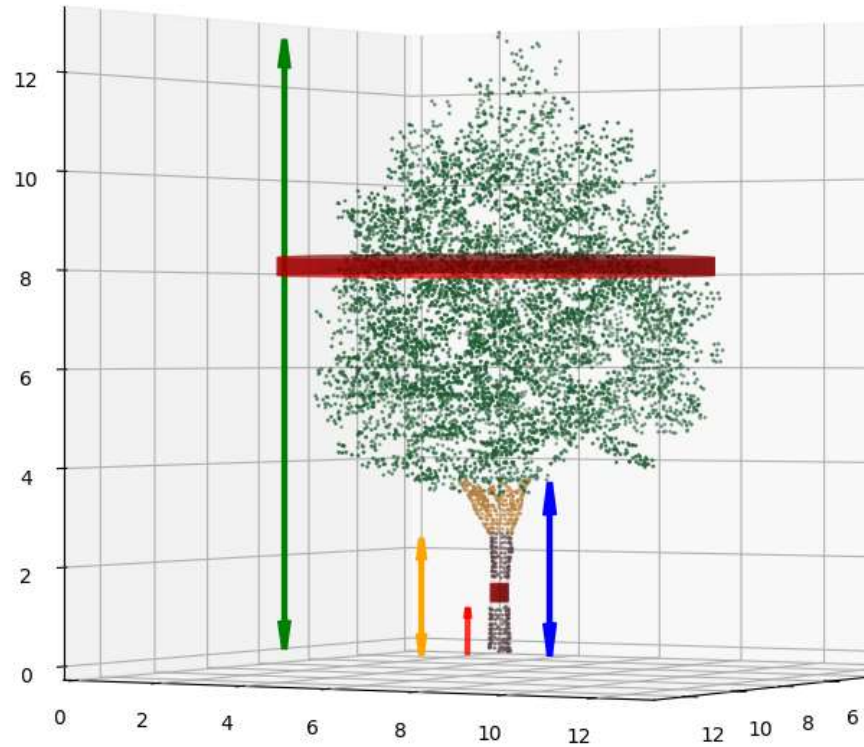
Tree Monitoring



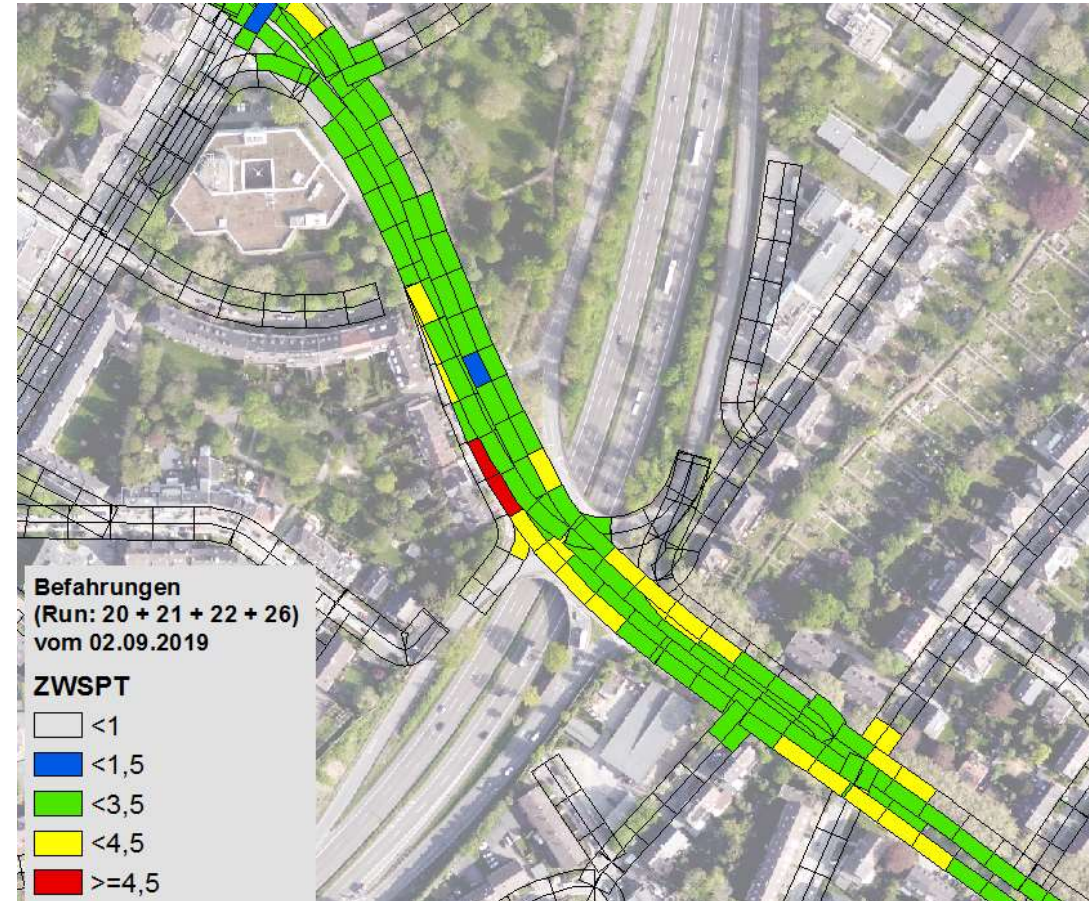
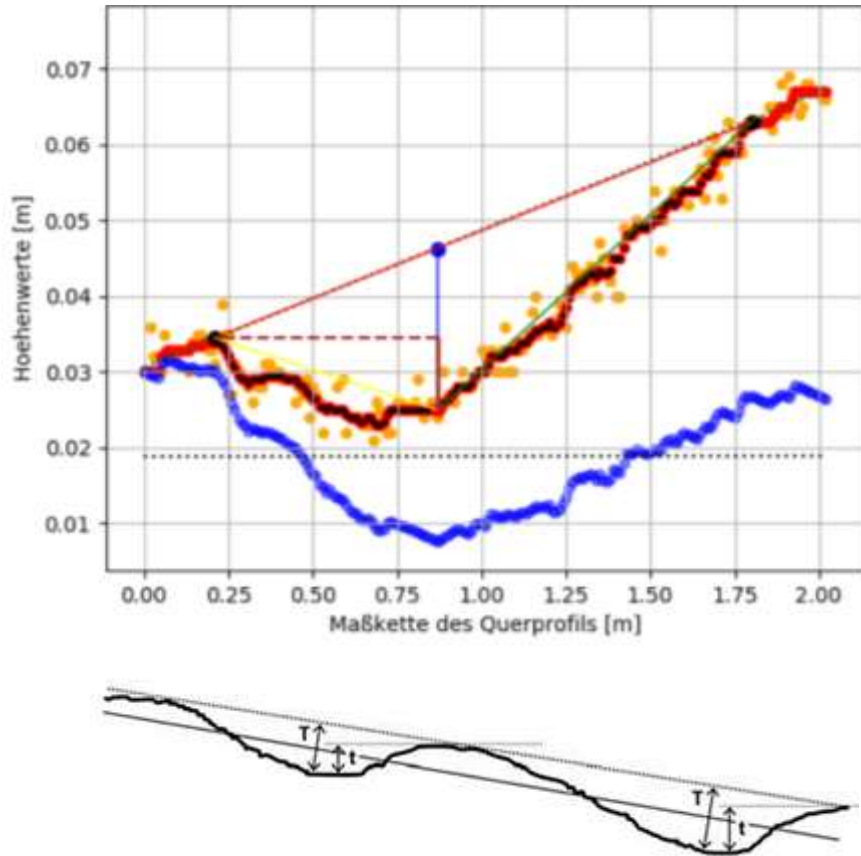
Tree Monitoring



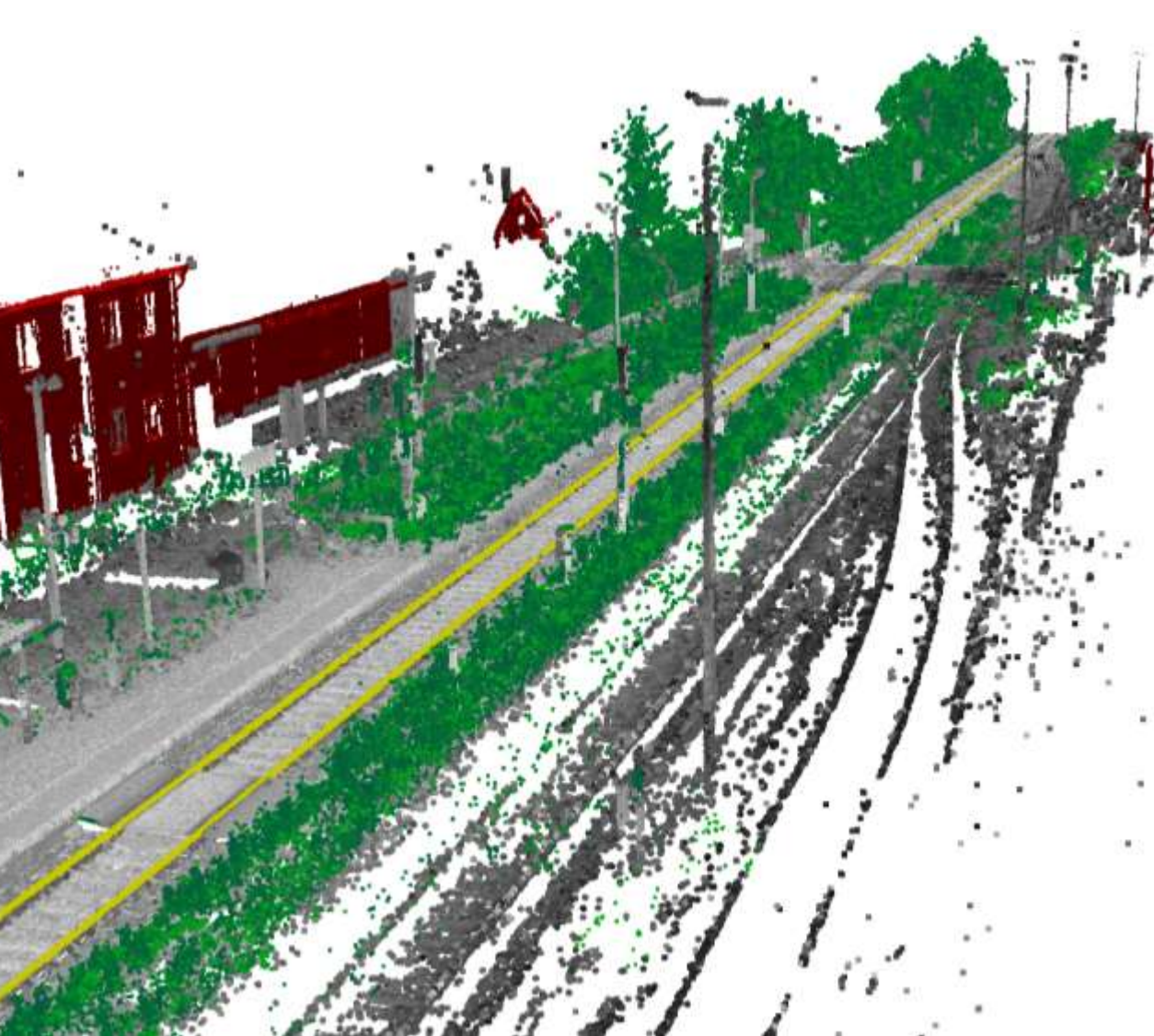
Tree Monitoring



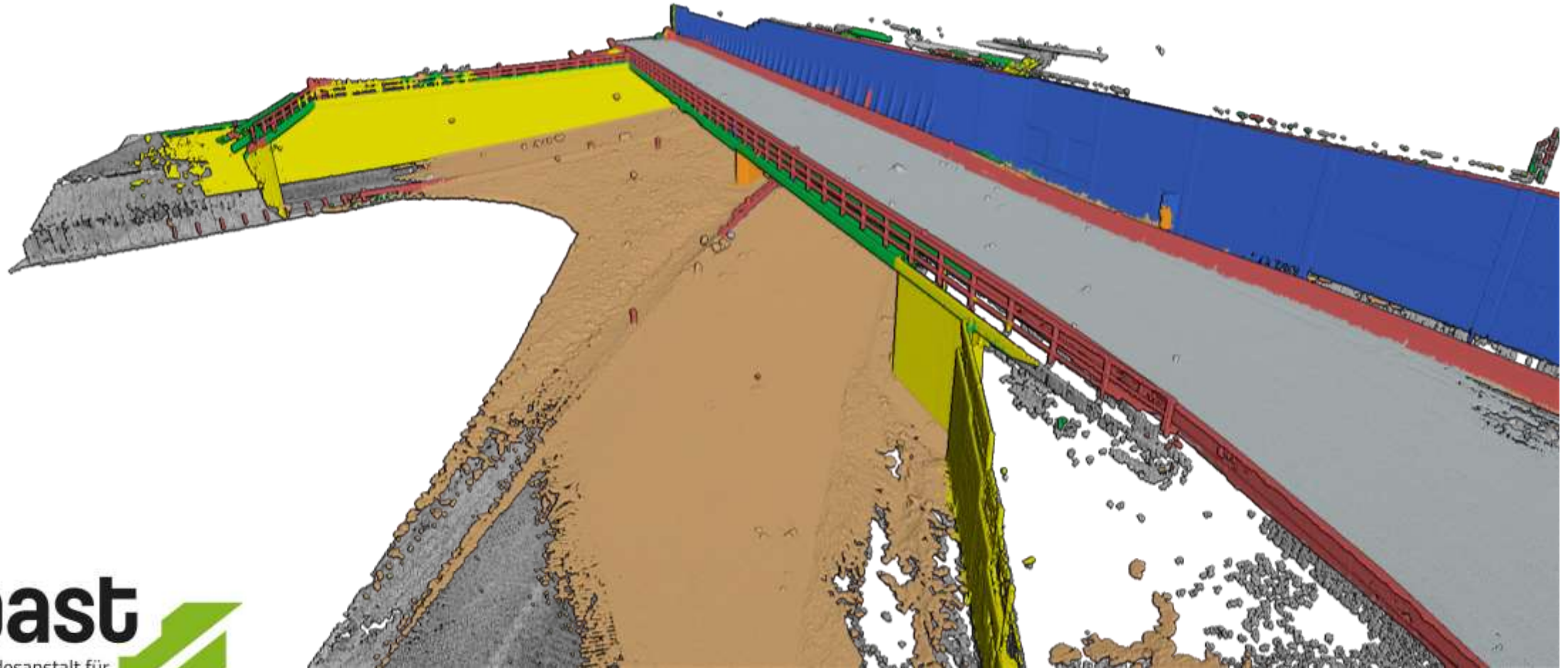
Road Quality Evaluation



Mobile Mapping Rail Infrastructure



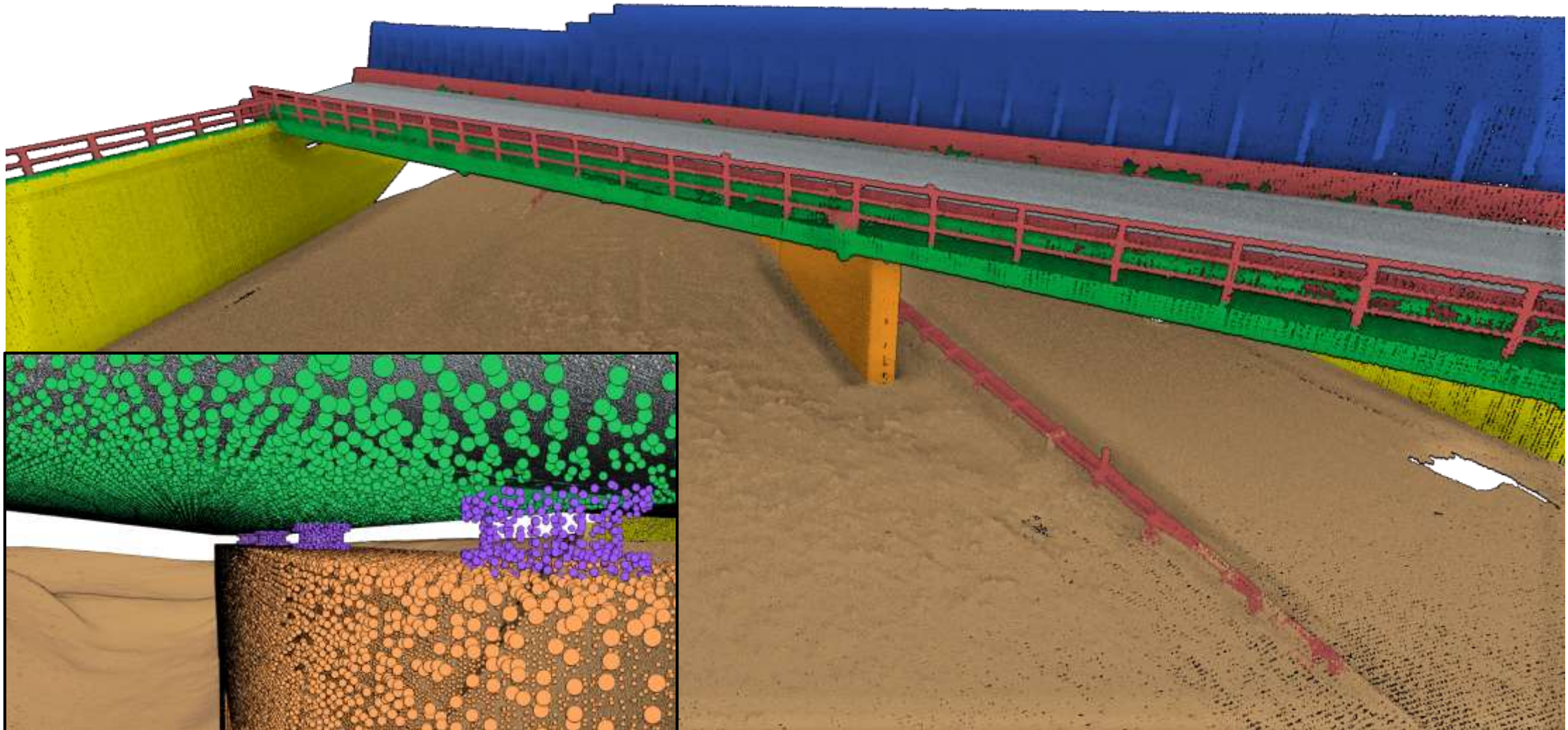
Scan2BIM for Bridges



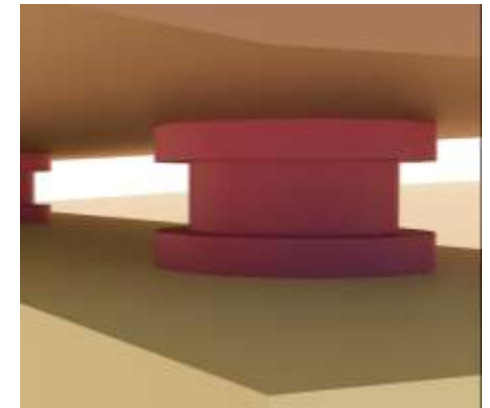
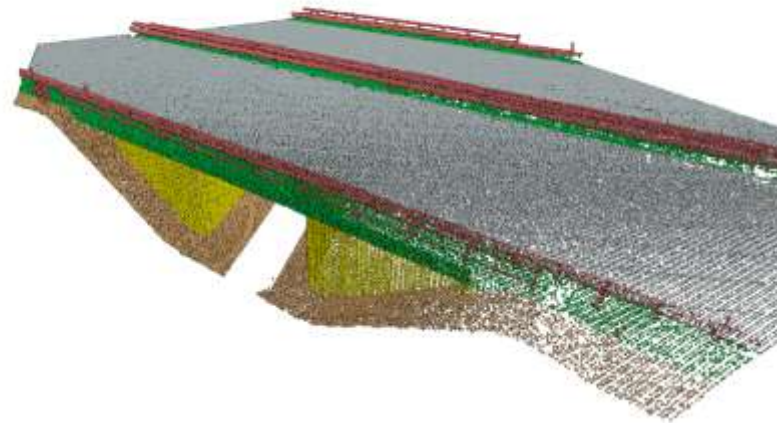
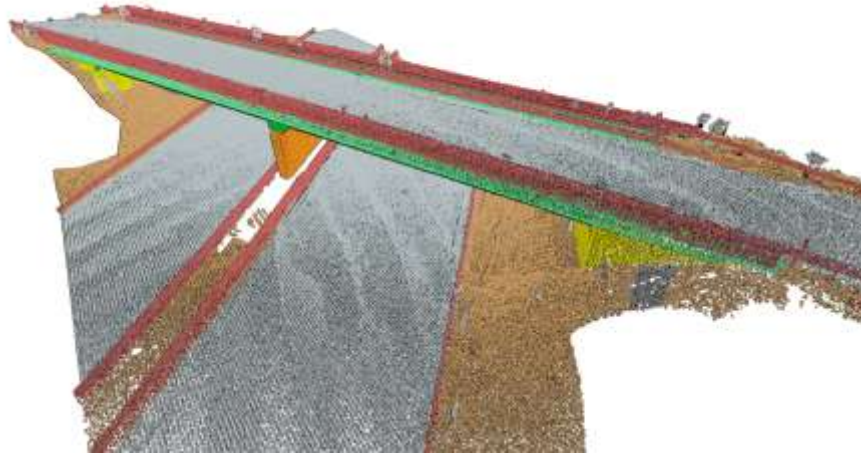
Widerlager Stützen Träger Geländer Straßenoberfläche Lärmschutzwand Lager Boden



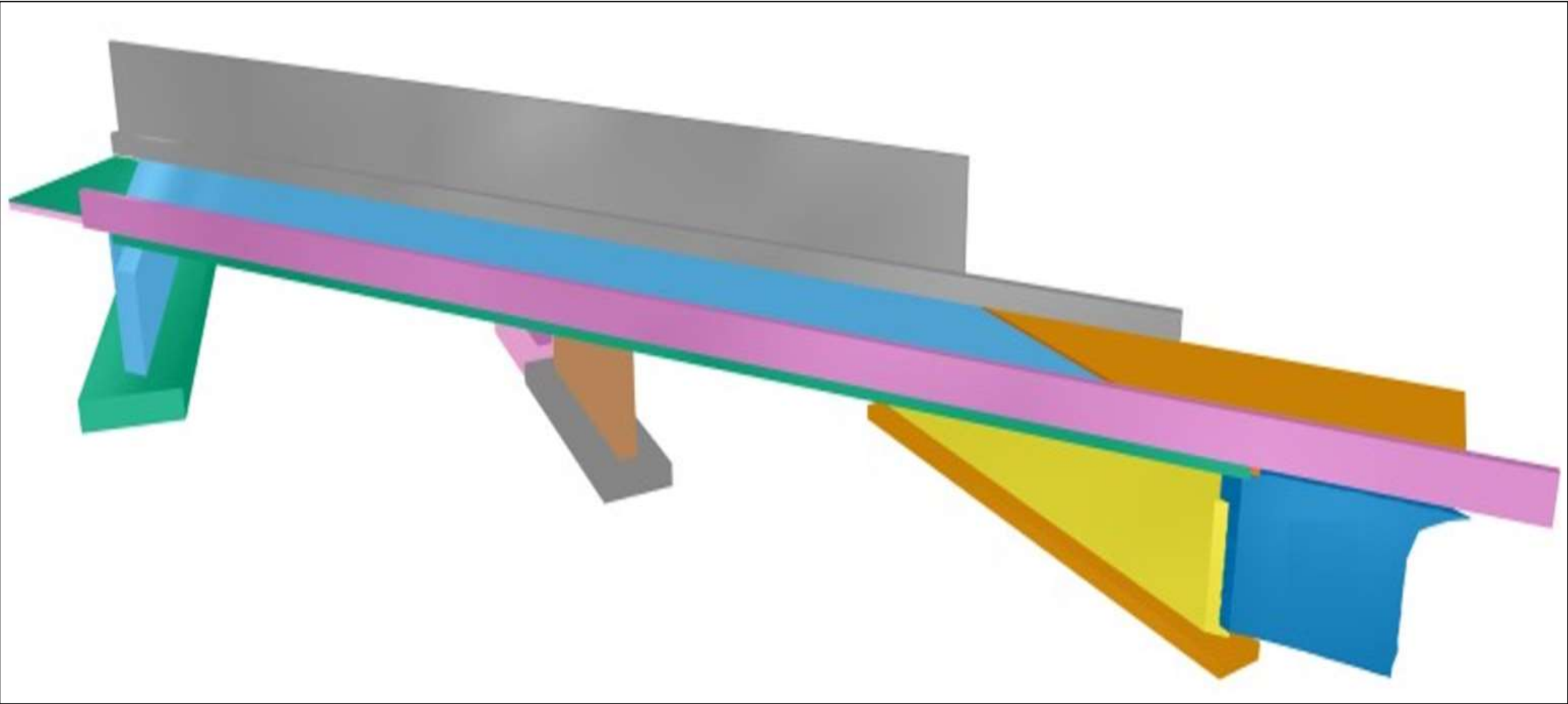
Scan2BIM: Result AI-based Classification



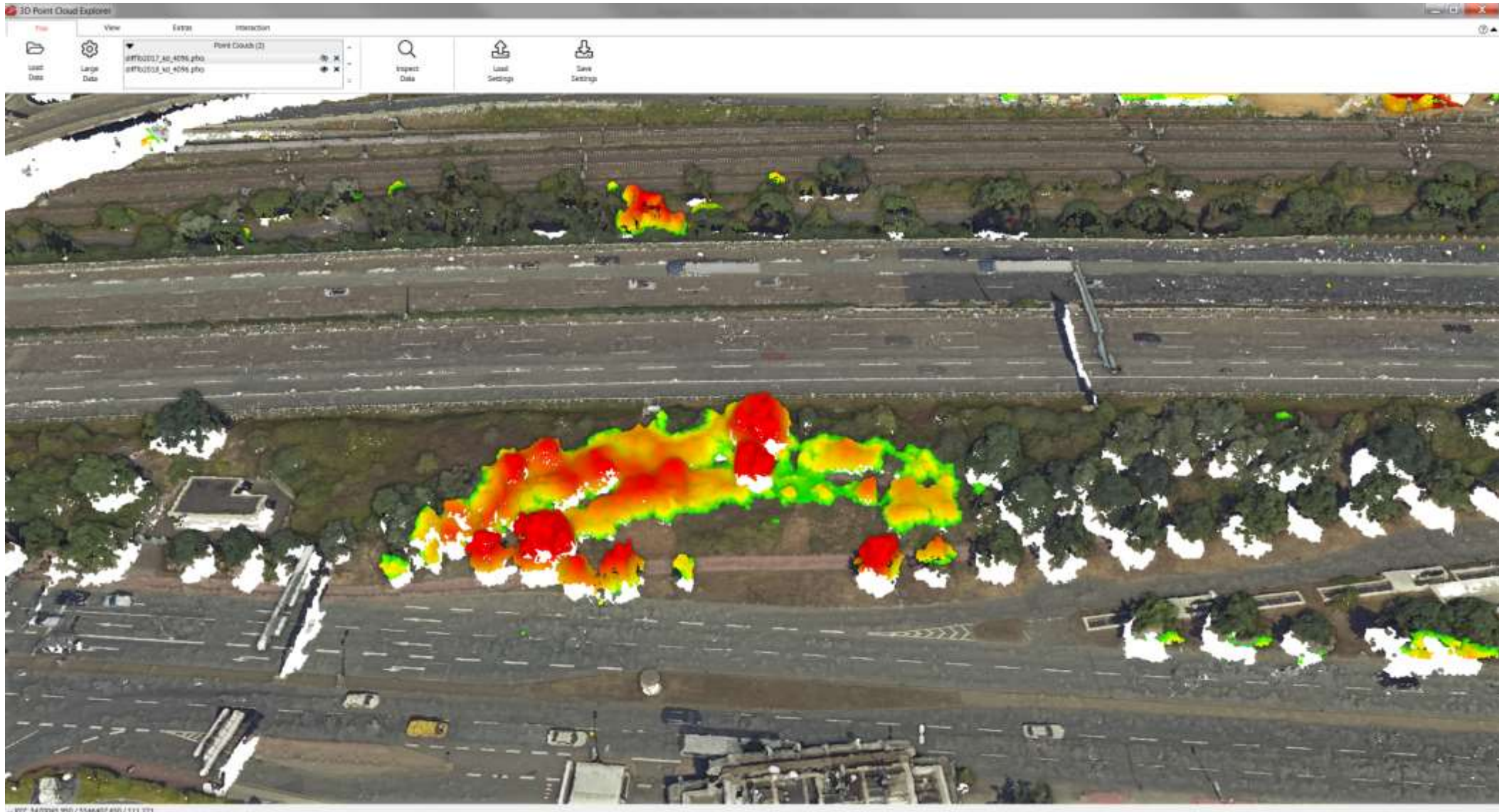
Scan2BIM for Bridges



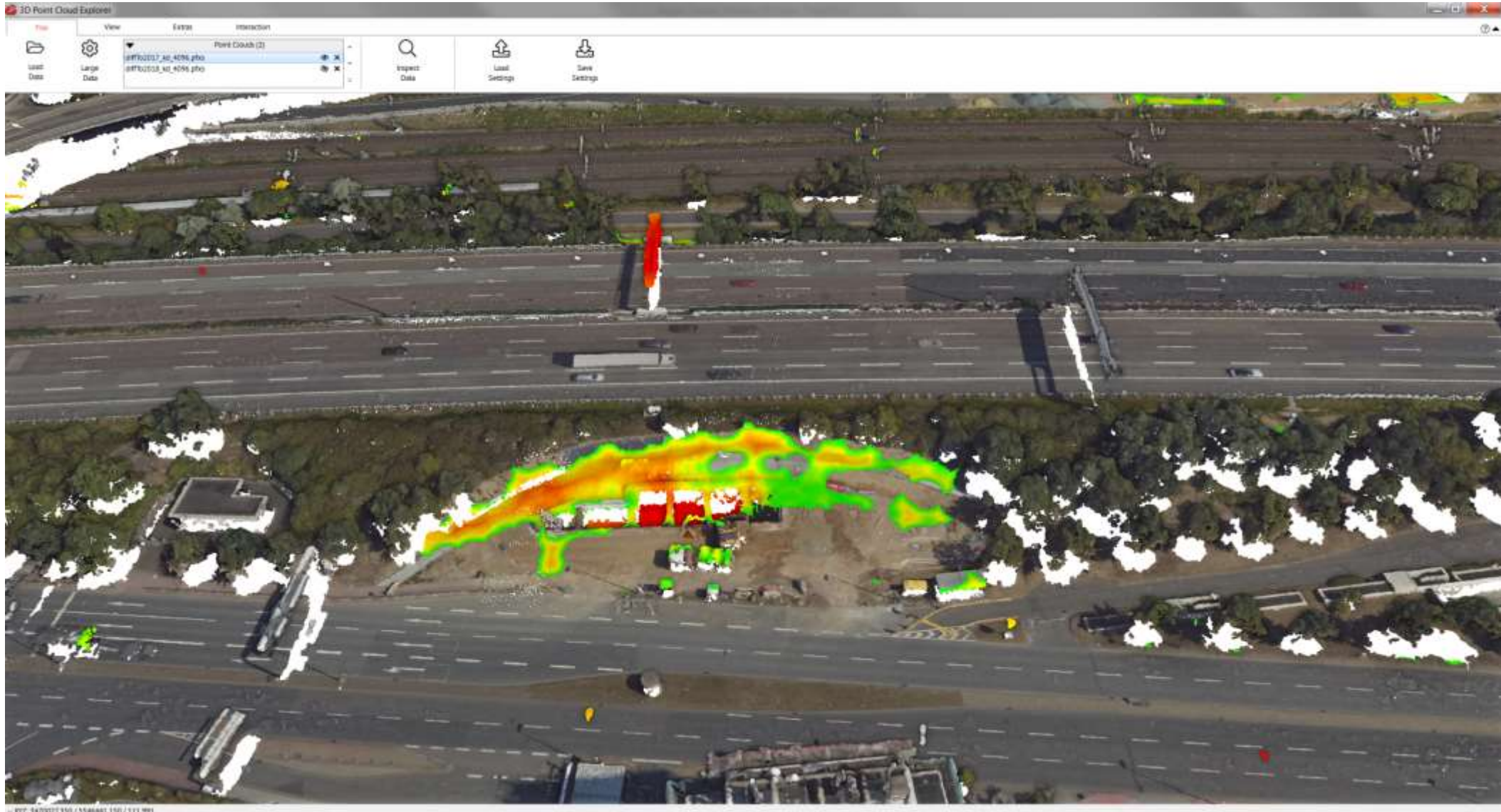
Scan2BIM for Bridges



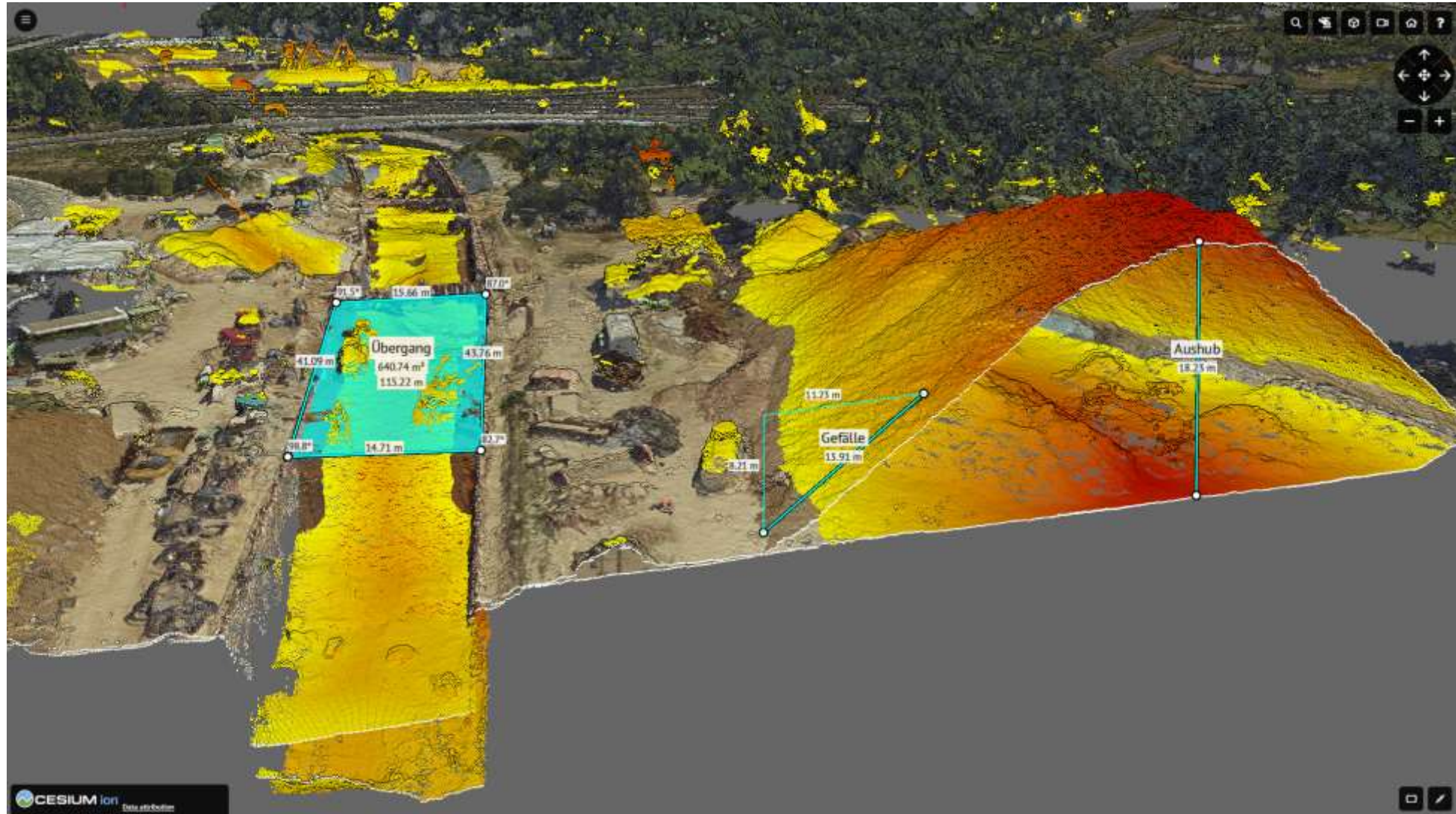
Change Detection Fraport – 2017 zu 2018



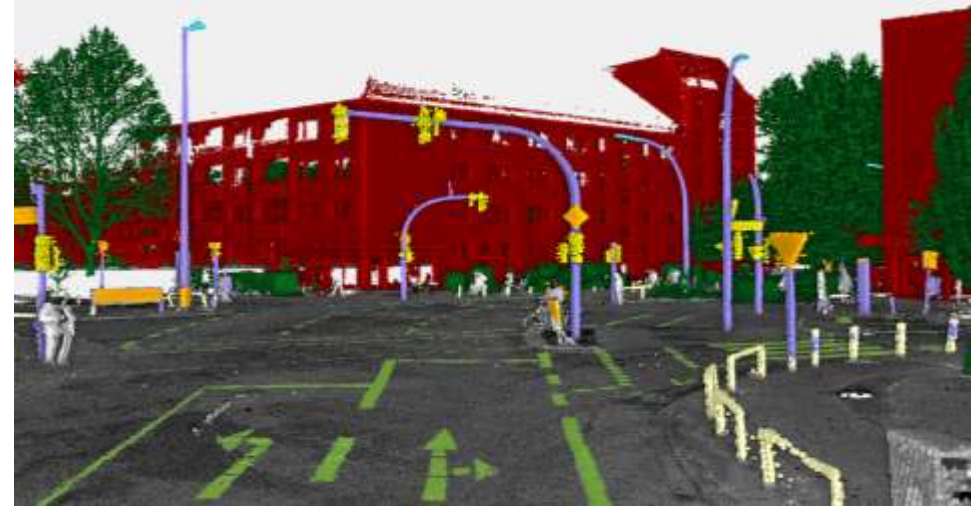
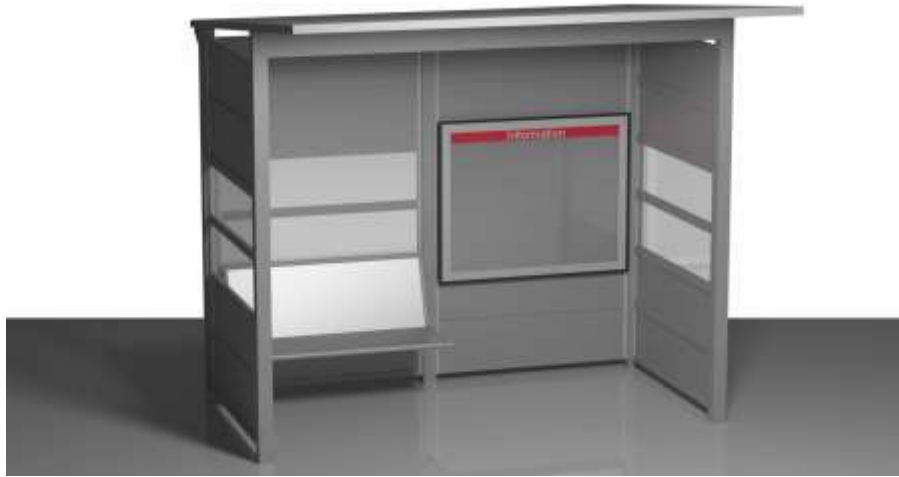
Change Detection Fraport – 2018 zu 2017



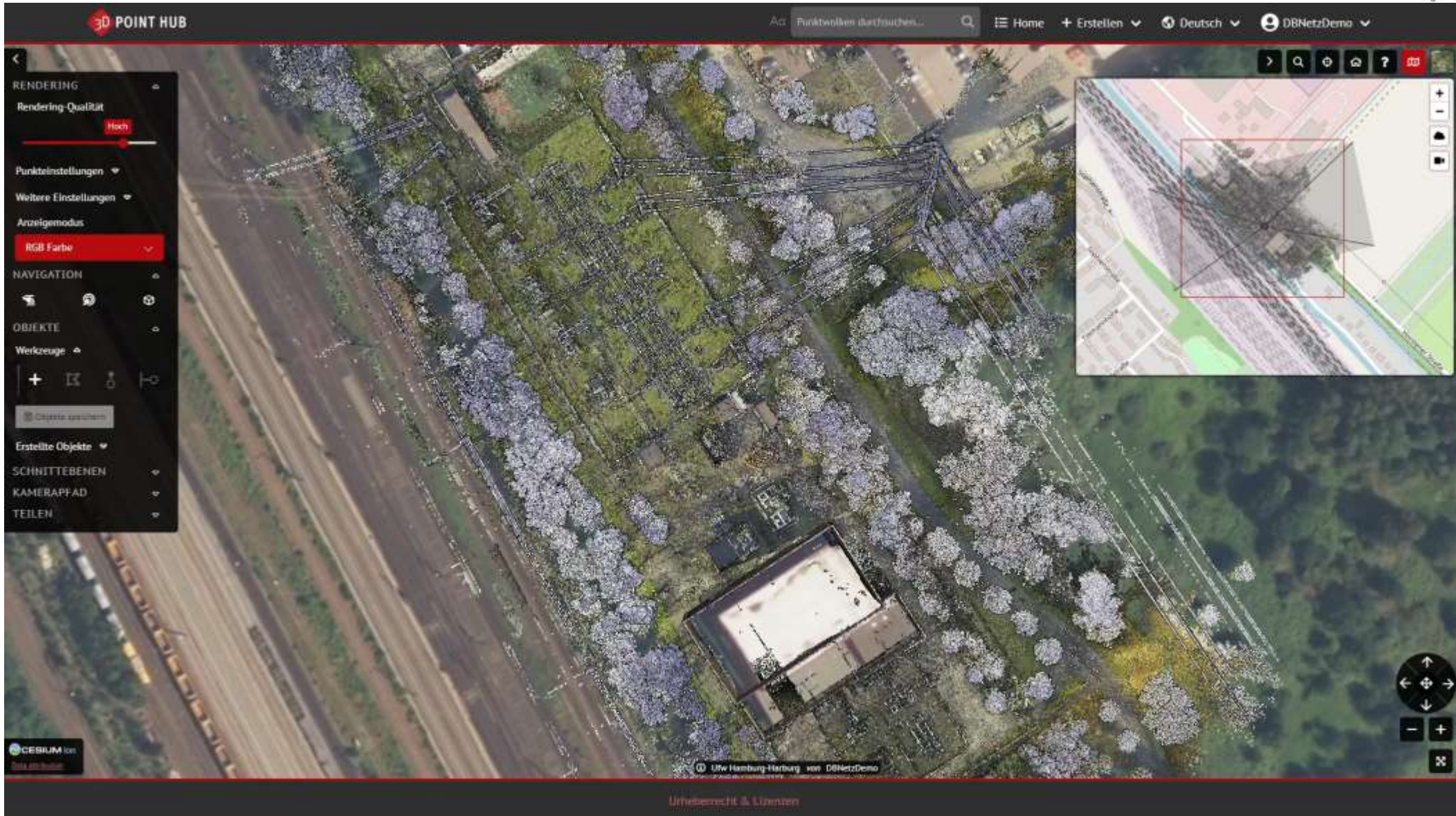
Change Detection – Construction Sites



Web Platform for Visualization & Collaboration



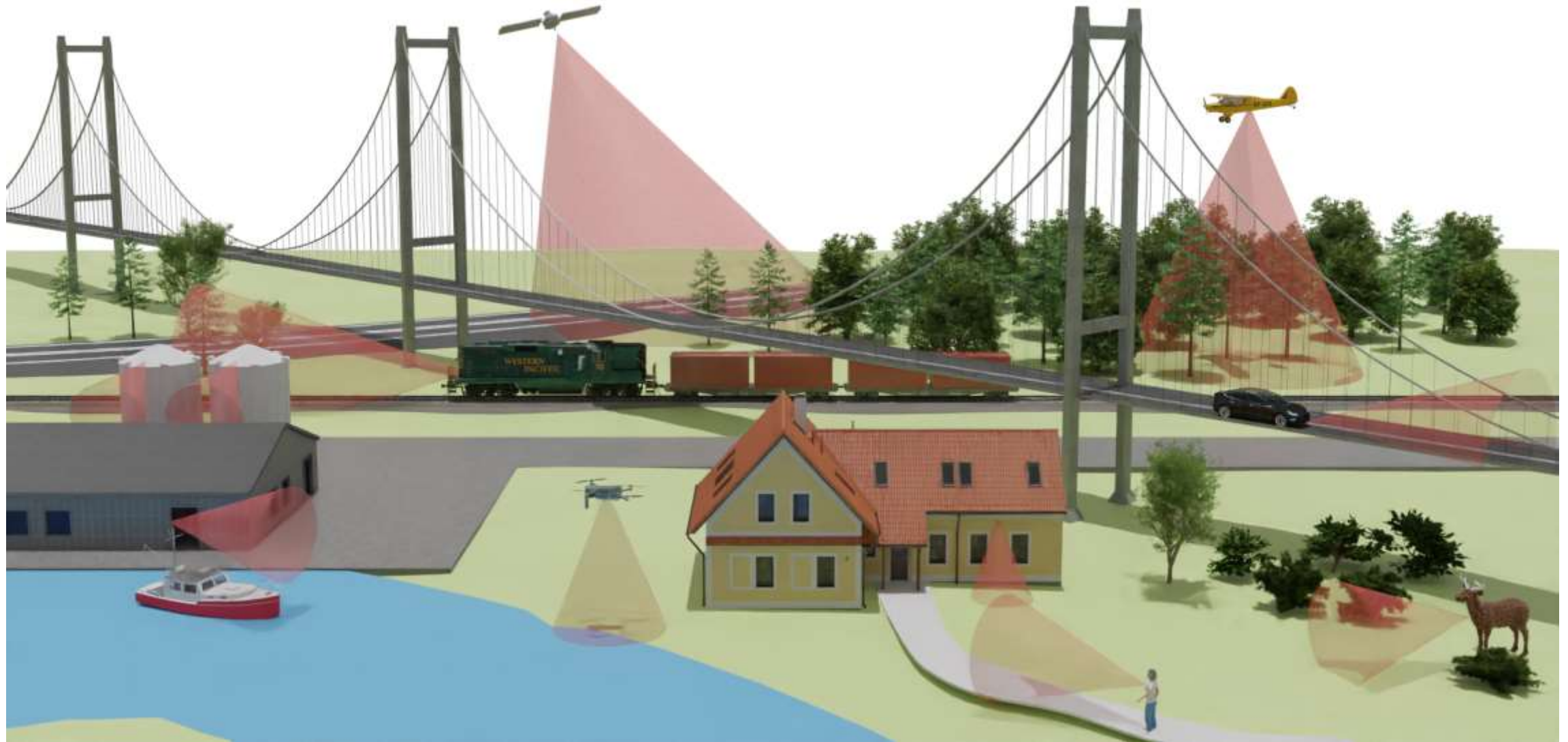
Web Platform for Visualization & Collaboration



Web-based Visualization



Future Data Acquisition



“Data availability, accuracy, density, and massivity of 3D/4D point clouds will vastly increase within the next years”

- **Point cloud analytics** is important for domain-specific applications.
- **Multi-temporal point clouds** enables selective updates and offer new insights.
- **Scalable infrastructures, GPU-based algorithms, AI-based processing strategies** are required to handle massive, dense, and large-scale point clouds.
- **Database** and **cloud infrastructures** are required to provide point clouds for different scales.
- **On-demand processing** and **analysis** with high-performance hardware is a key challenge.

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Demos:

www.3dpointhub.com

www.pointcloudtechnology.com/demos

Research: Hasso-Plattner-Institut

www.hpi3d.de

Data (among others) provided by:

