KIDELTA LEARNING
Scalable AI for Automated Driving

Final Event | March 09, 2023

Data – The Basis for Delta Learning

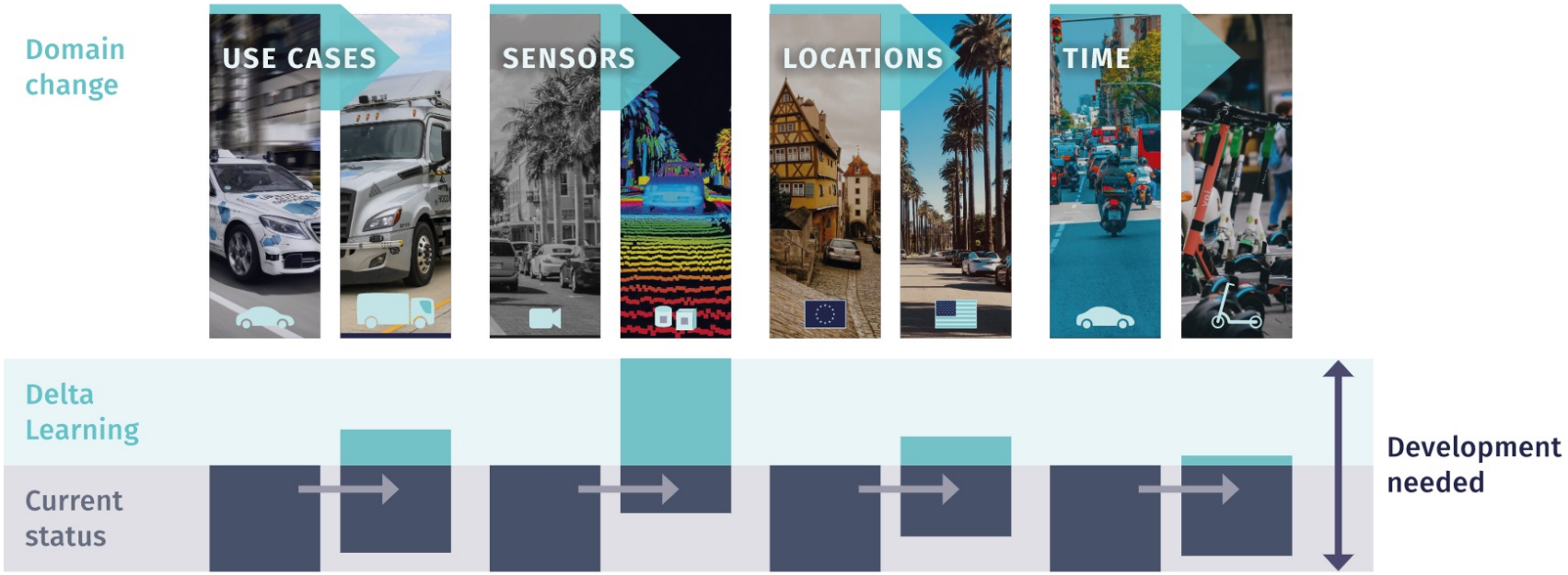
Christian Witt

Deltas

Problem: complex situations & changing domains

Focus of projects: step by step extensions (= deltas)

- **delta sensors**
- **delta traffic areas**
- **delta countries**
- **delta environment**
- **delta time**
- **(delta networks)**



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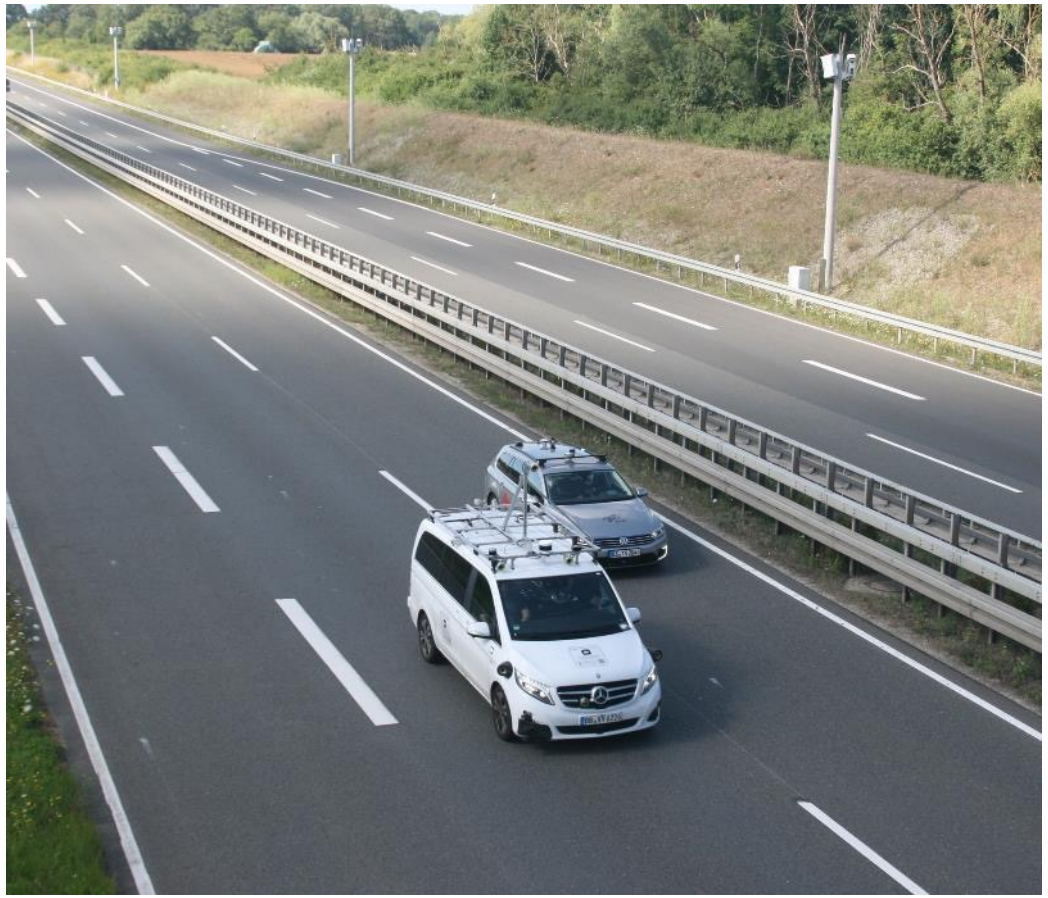
Artificial Neural Networks require data!

What do we need?

- real world recordings & simulation
- sensors: reference + serial sensors
- environment:
  - multiple towns & another country
  - different weather and lightning conditions
  - …
- 2D & 3D Annotations
- easy workflow for data management
- compliant to data protection (GDPR)



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Creating Data for Deltas

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Delta Sensors

Sensor Overview

12 Cameras

- 1x **Reference Camera** 120° 8.9MP
- 1x **Wide FoV Camera** 130° 2.3MP
- 9x **Protocol Cameras** 90° 2.3MP
- 1x **Serial Camera** (Bosch MPC3) 100° 2MP

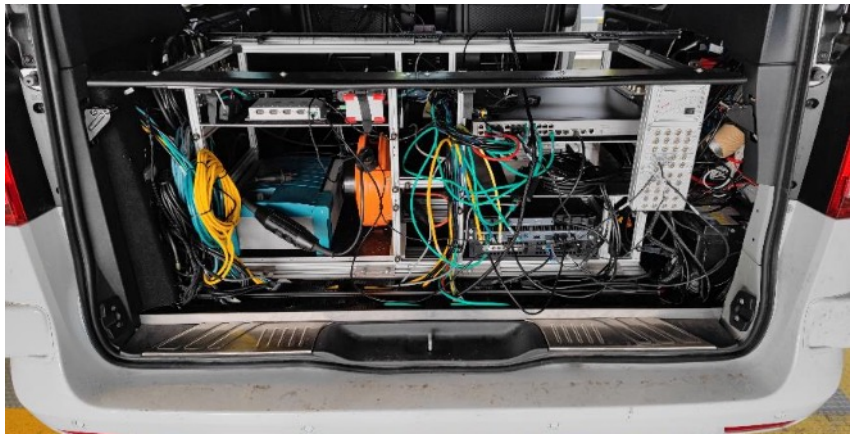
5 LiDARs

- 1x **Reference LiDAR** 128 Layer
- 2x **Protocol LiDAR** 32 Layer
- 2x **Serial LiDAR** (Valeo Scala Mobility Kit & Innoviz One)

Other

- 2x **Radar** (InnoSenT 5G3)
- 1x **IMU**

Recording Vehicle



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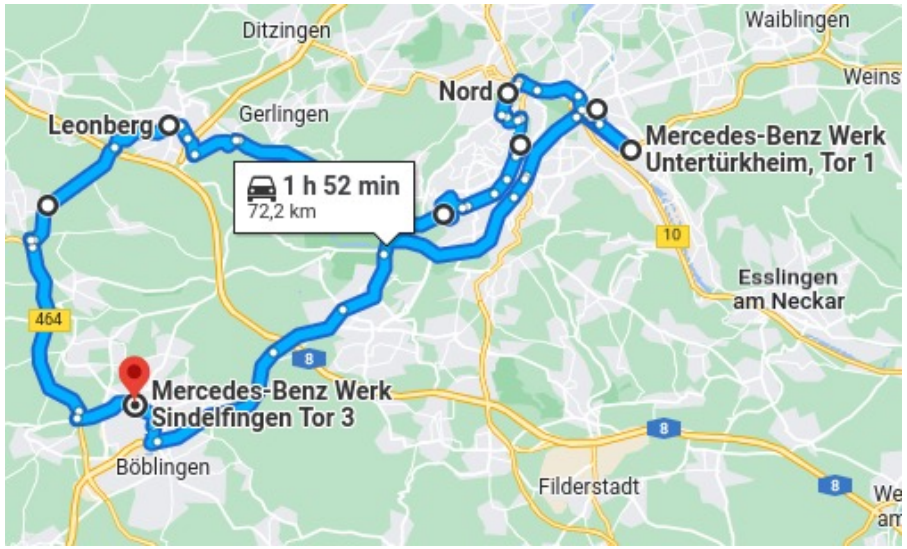
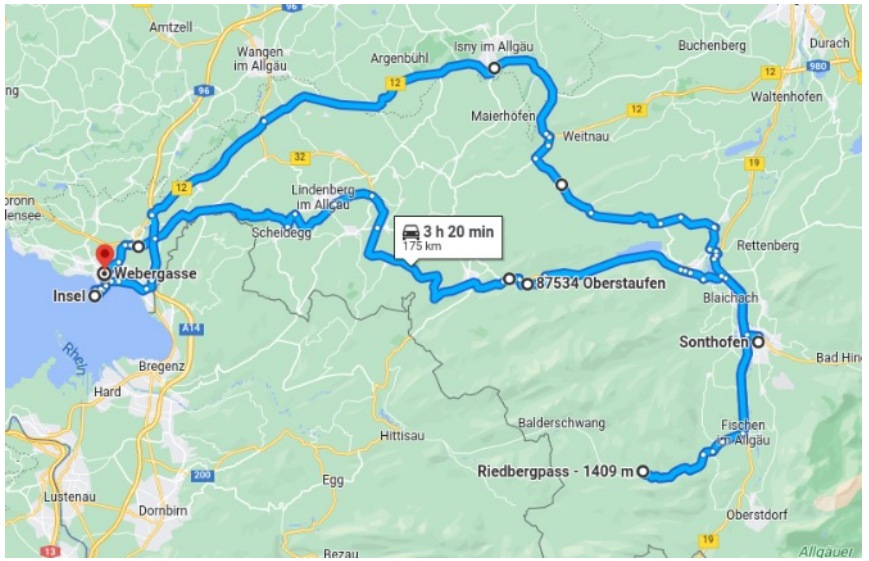
Delta Traffic Areas

Routes





Local Drive (80km, 2:00h)

Sindelfingen → Stuttgart → Leonberg

Local Drive 2 (175km, 03:20h)

Lindau → Oberstaufen → Oberstaufen → Füssen → Riedbergpass → Isny

Routes

Day Drive (430km, 6:30h)

Sindelfingen → Lindau → Friedrichshafen → Jungnau → Reutlingen

Multi Day Drive (1500km, 16:30h)

Sindelfingen → Nürnberg → Leipzig → Berlin → Braunschweig → Würzburg

DLR Infrastructure

DLR Infrastructure - Impressions

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Delta Countries

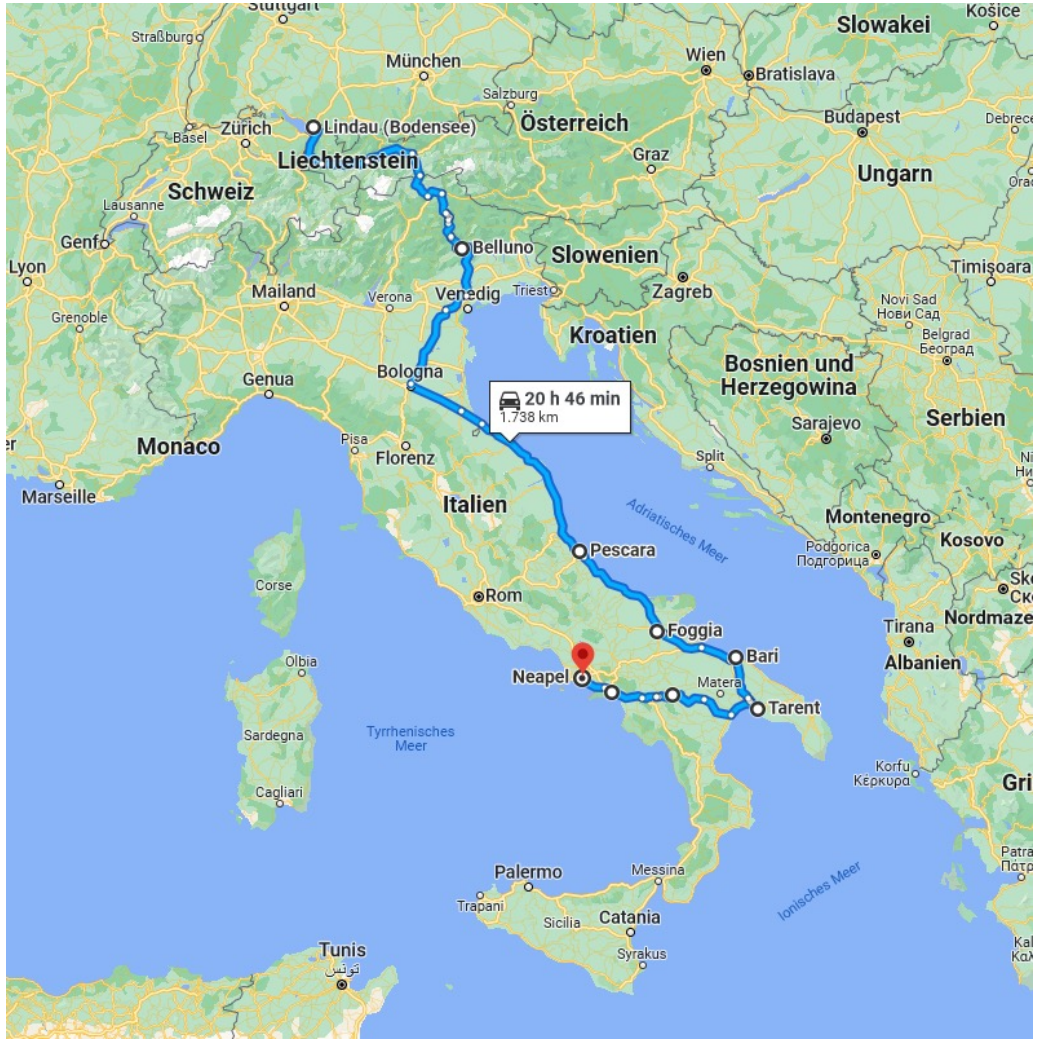
Italy - Route

Italy Drive (2880 km, 32:46h)

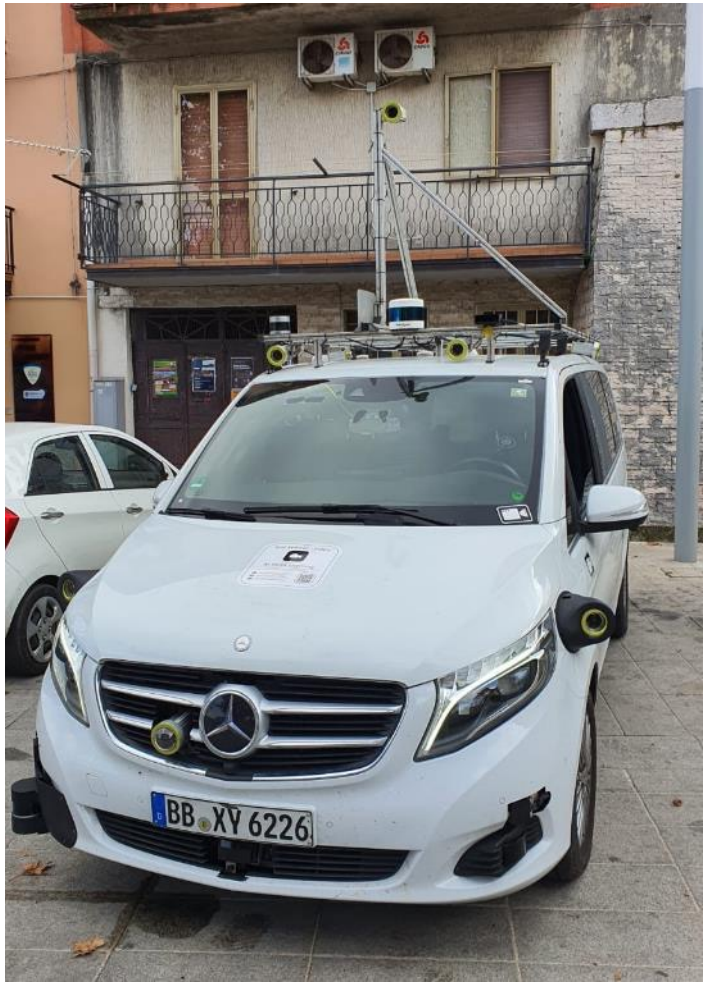
Sterzing → Belluno → Bologna → Pescara

→ Foggia → Bari → Tarent → Salerno → Neapel

11 days



Italy - Impressions



Germany vs. Italy

Germany

Italy

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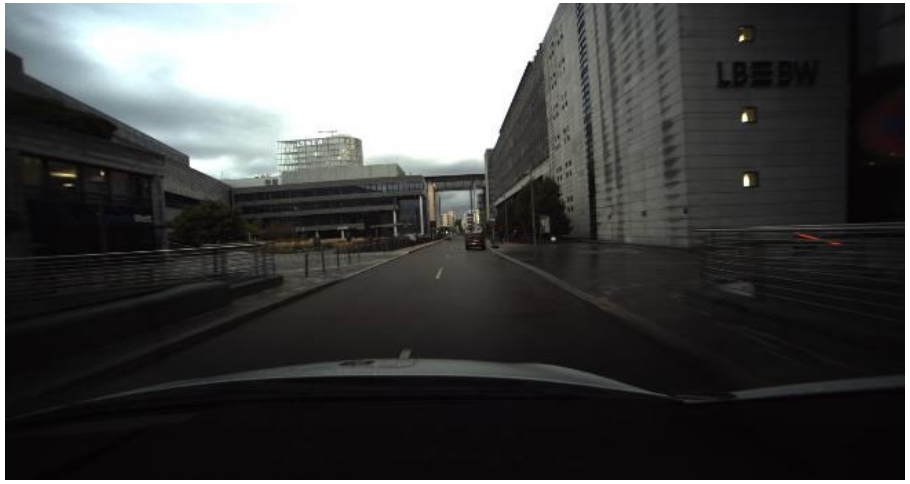
Delta Environment & Delta Time

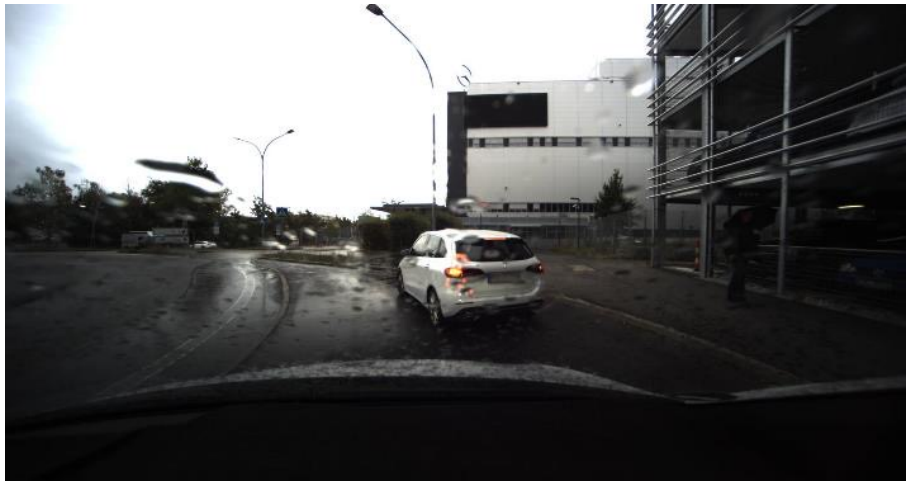
Type: Urban, Interurban & Rural

Lighting Condition: Dawn, Day, Twilight & Night



Cloudiness: Sunny, Partly Cloudy & Dull

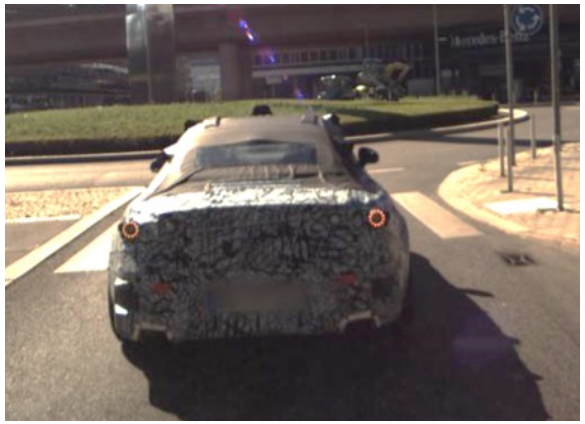
Humidity: Dry, Rain & Snow



Street Surface: Asphalt, Cobblestone & Dirt Road

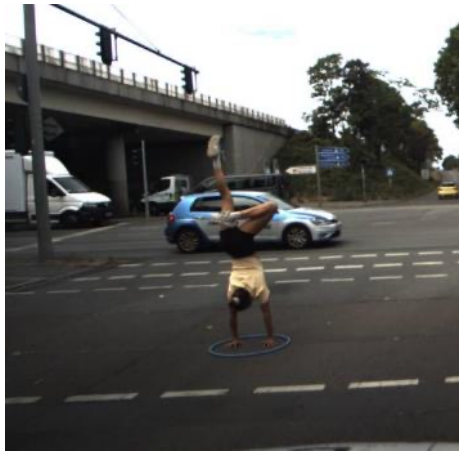
Special Ways: Intersections, Tunnel & Bridges

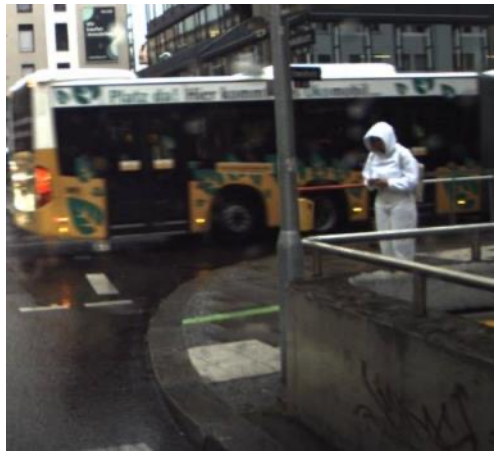
Special Cars



Pedestrians

Highlights





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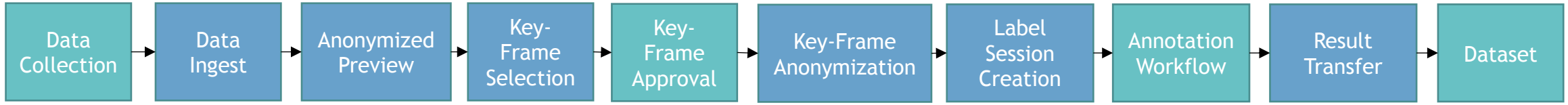
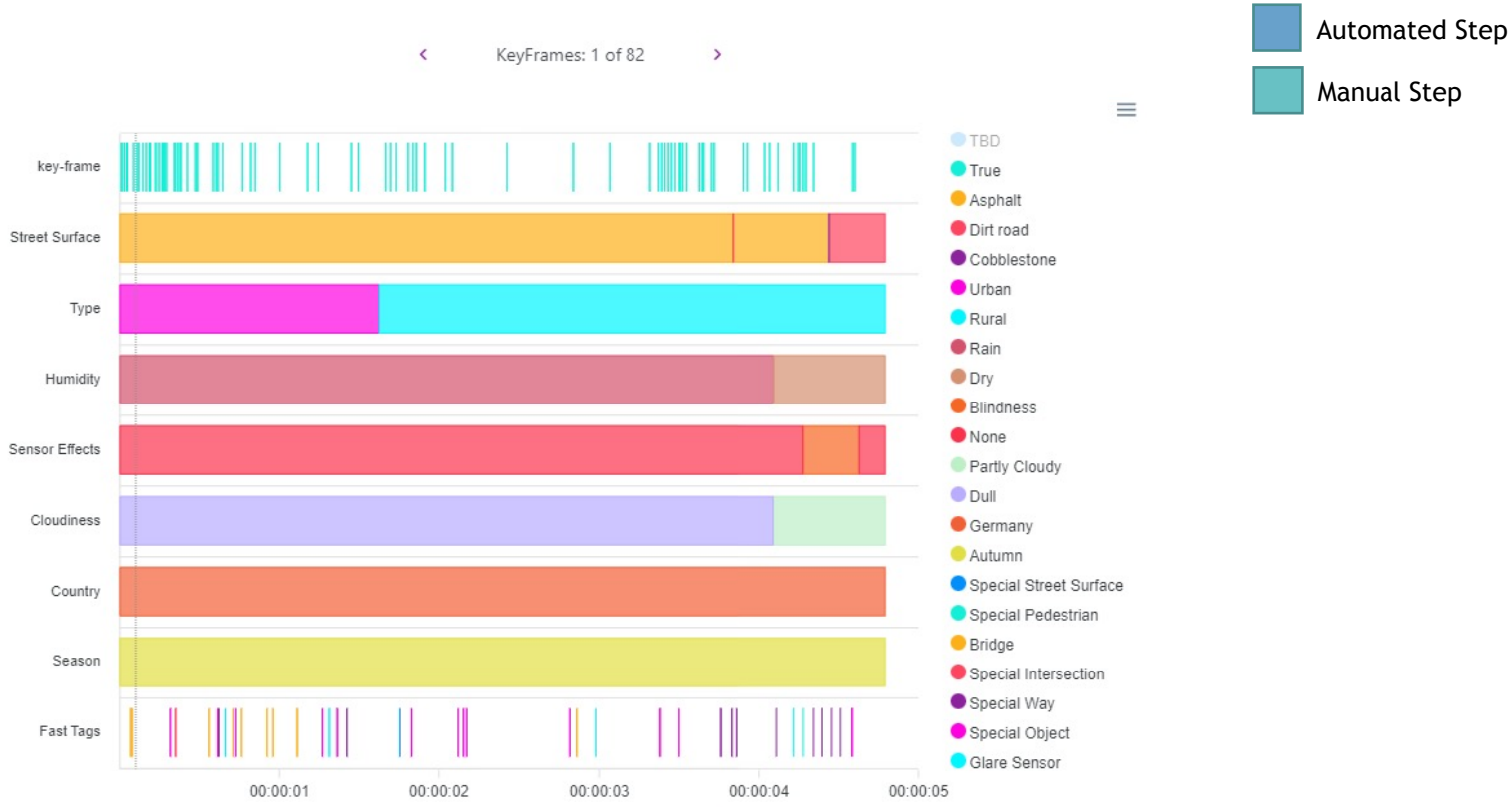
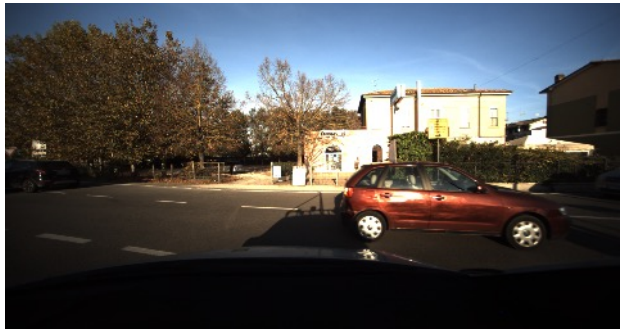
Annotations

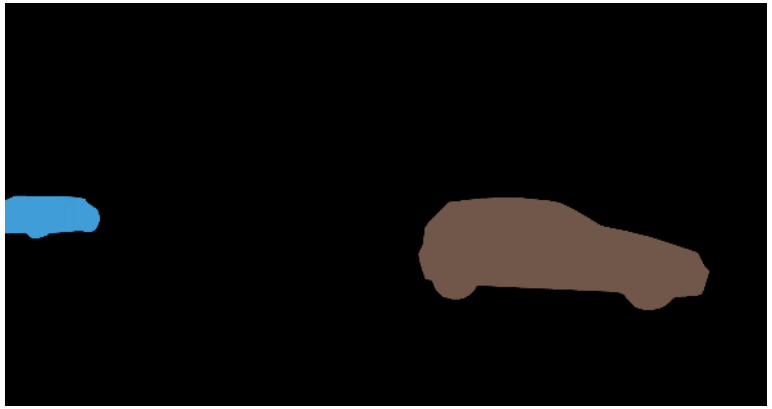
Data Management & Key Frame Selection

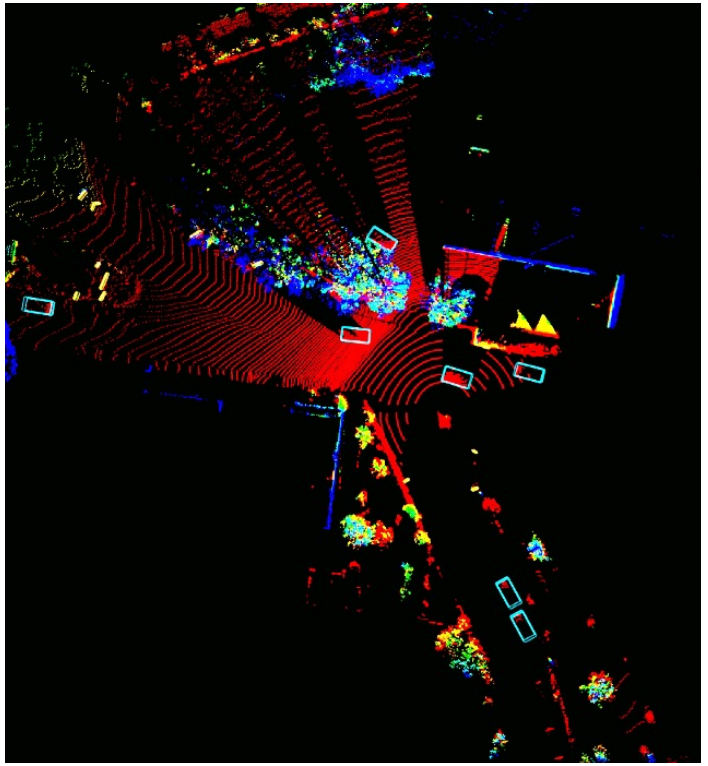




Annotation







2D Semantic Segmentation

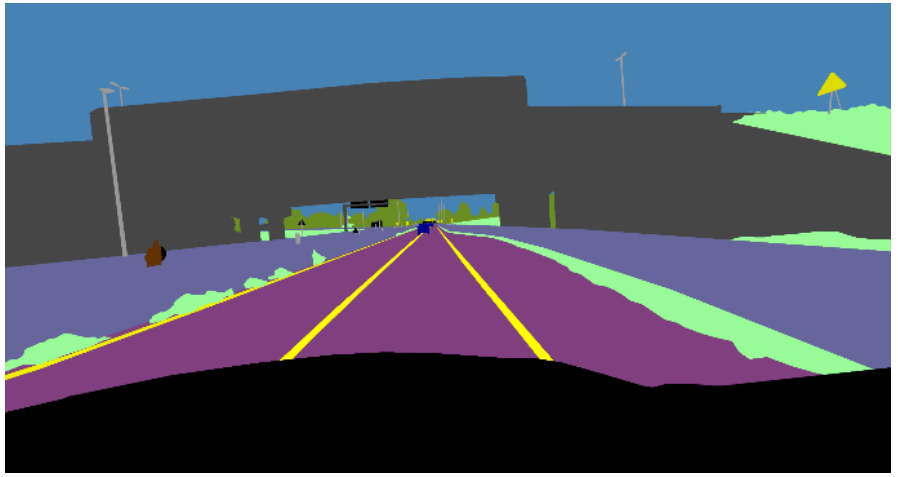
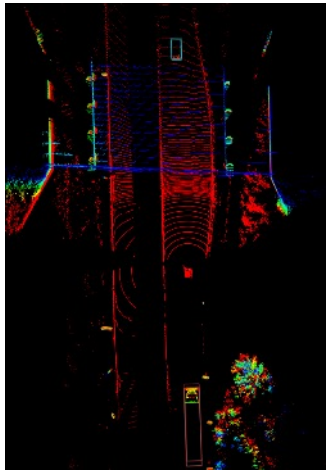
- *reference: 8.9MP 120° Front-Camera*

2D Instance Segmentation

3D Bounding Box

- *reference: Velodyne 128L 360°*
- including velocity

Annotation

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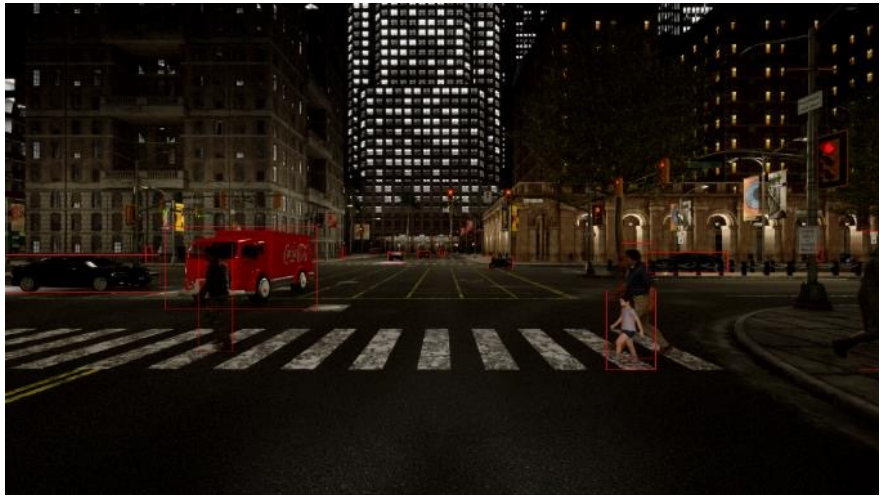
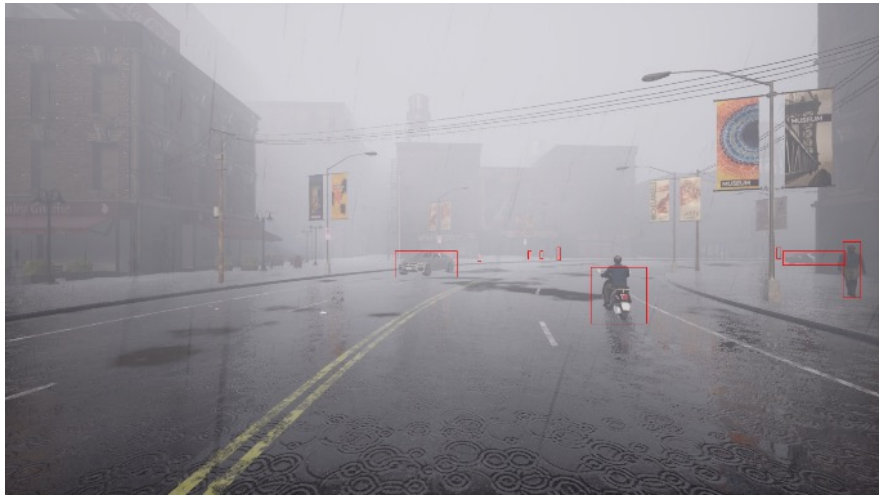
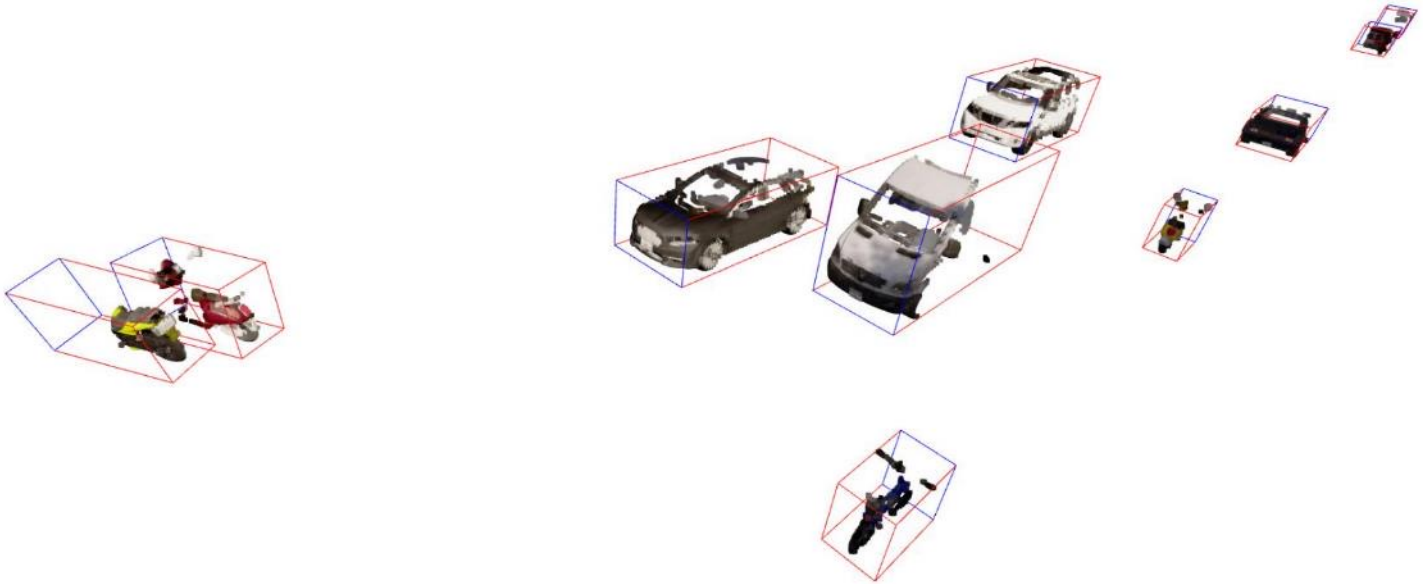
Synthetic Data Generation

Data Generation in Carla

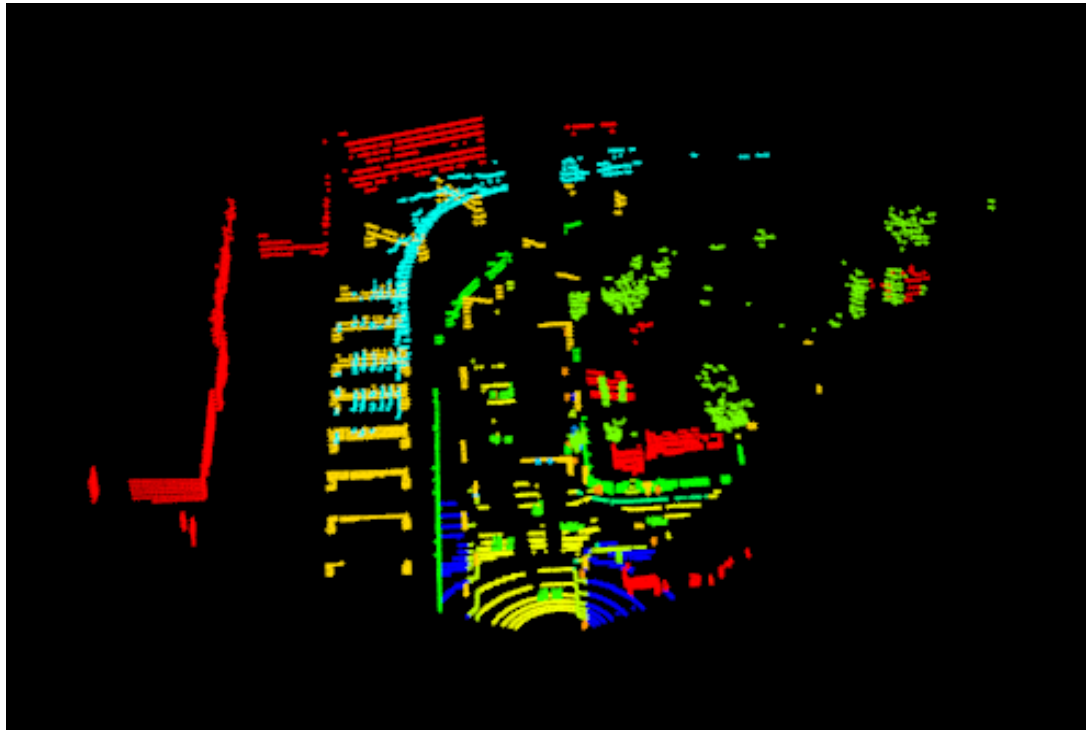


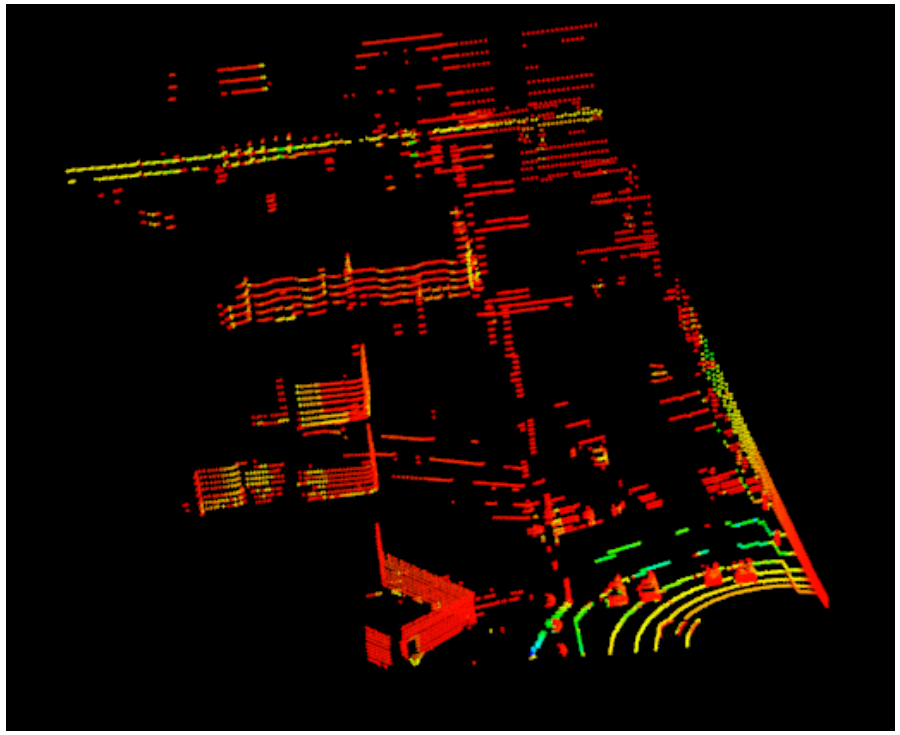


Improving Instance Segmentation in CARLA

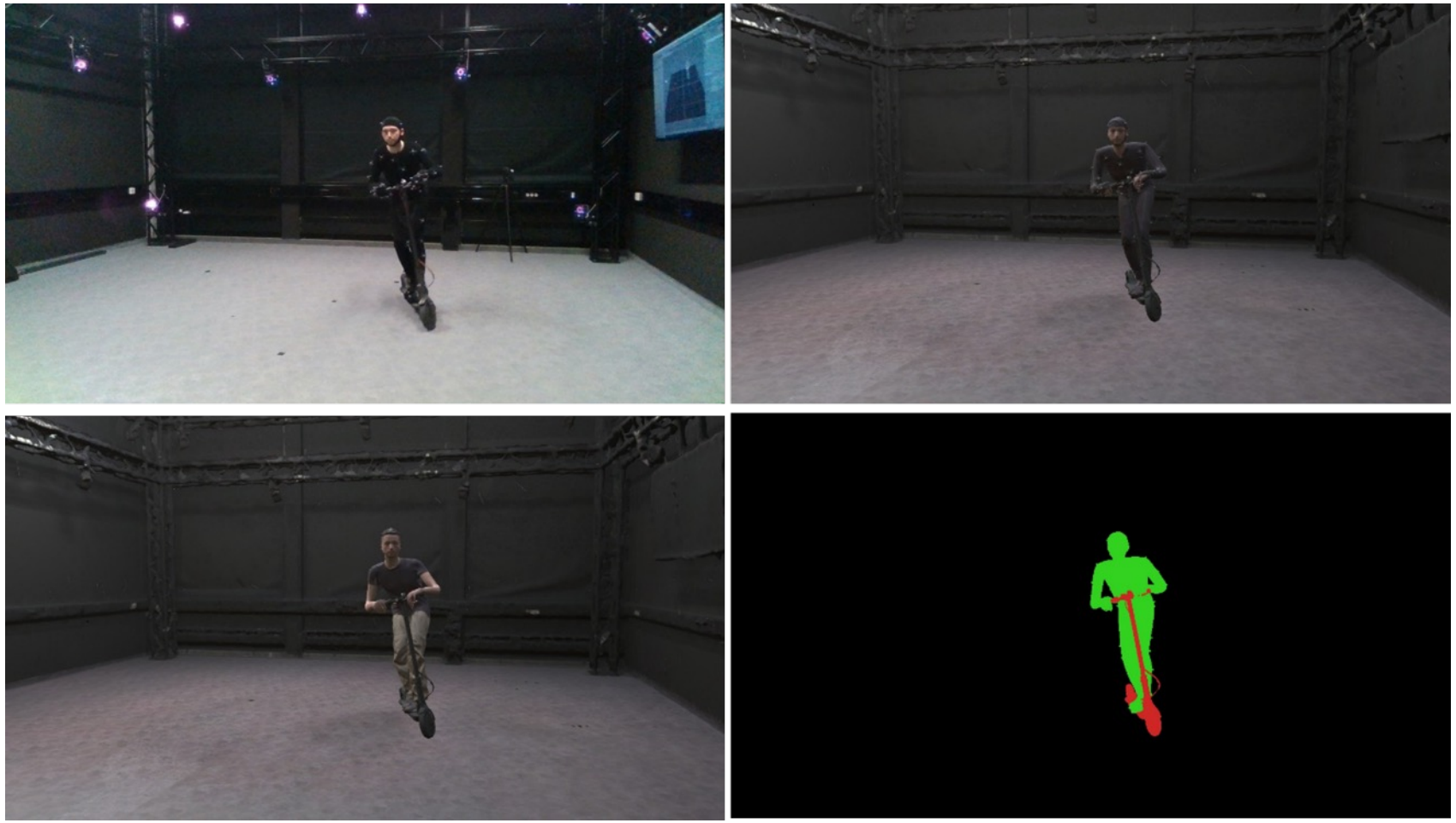


Simulation of Rotating Pulsed Lidar





Motion Capture



4

What did we get?

What did we get?

193 hours

calibrated and timestamped raw data recordings

18,000

annotated real world single frames

50,000

simulated labeled frames from CARLA

Outlook

- partners can use the data after the project ends
- huge interest to publish the dataset

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Christian Witt | Valeo

christian.witt@valeo.com

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KI FAMILIE

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