Hi-Drive
FINAL EVENT
25 NOVEMBER 2025

TOPIC #2:
EFFECTS AND IMPACT ASSESSMENT
DRIVING SCENARIO DATABASE (DSDB)

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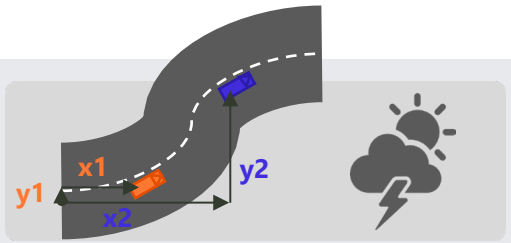
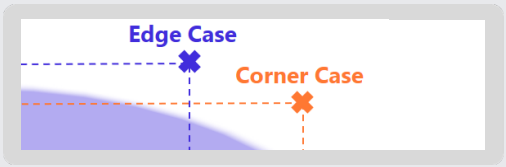
#Effects and Impact Assessment

Hi-Drive Driving Scenario Database (DSDB)

- Detailed **time series data** enriched by tags per scenario

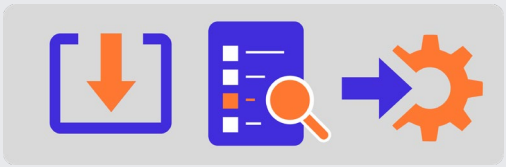


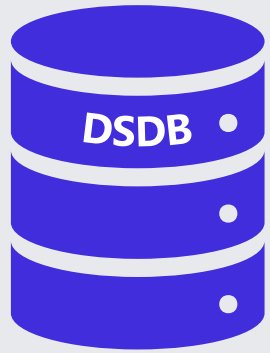
- Regular **driving scenario** instances and **edge cases**



- **Filtering, viewing,** and **analysing data**

- **Export** for different uses





The Hi-Drive Driving Scenario Concept

- The main **purpose** is to fulfil the needs of pilot data evaluation and impact assessment
- The **6-layer model** by Scholtes et al. (2021) was used as a reference
  - **Layer 4** (dynamic objects) defines the **36 distinct driving scenarios**
  - The **other layers define situational variables** (tags) to further specify the driving scenario instances

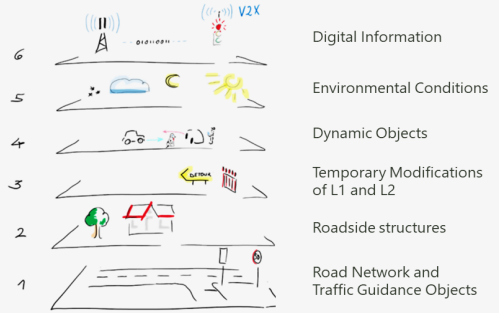
The full concept is published on Zenodo:
https://zenodo.org/record/8207762

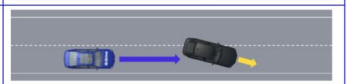
References:
1/ Scholtes, M. et al. (2021). 6-Layer Model for a Structured Description and Categorization of Urban Traffic and Environment. IEEE Access, 9, 59131–59147. https://doi.org/10.1109/access.2021.3072739
2/ illustration taken from Weber, H. et al. (2023). Holistic Driving Scenario Concept for Urban Traffic. 2023 IEEE Intelligent Vehicles Symposium (IV), Anchorage, AK, USA, 2023, pp. 1-8. https://doi.org/10.1109/IV55152.2023.10186385

Evaluation Needs

Use Cases

Gathered Data



Name	Label	Parent	Description	Pictogram
Approaching Longitudinally Moving Object	in_lane_approaching_long_moving	in_lane_approaching	The ego vehicle is following a lane and is approaching an object that is driving in the same lane.	
Approaching Laterally Moving Object	in_lane_approaching_lat_moving	in_lane_approaching	The ego vehicle is following a lane and is approaching a laterally moving object at a road section that is not near a crossing.	
Cut-in with a Rear-End Conflict	in_lane_cut_in_rear_end	in_lane_cut_in	The ego vehicle is following a lane and another object is doing a cut-in that results in a rear-end conflict.	

Edge Cases in Hi-Drive – Definition and Approaches

What is an Edge Case?

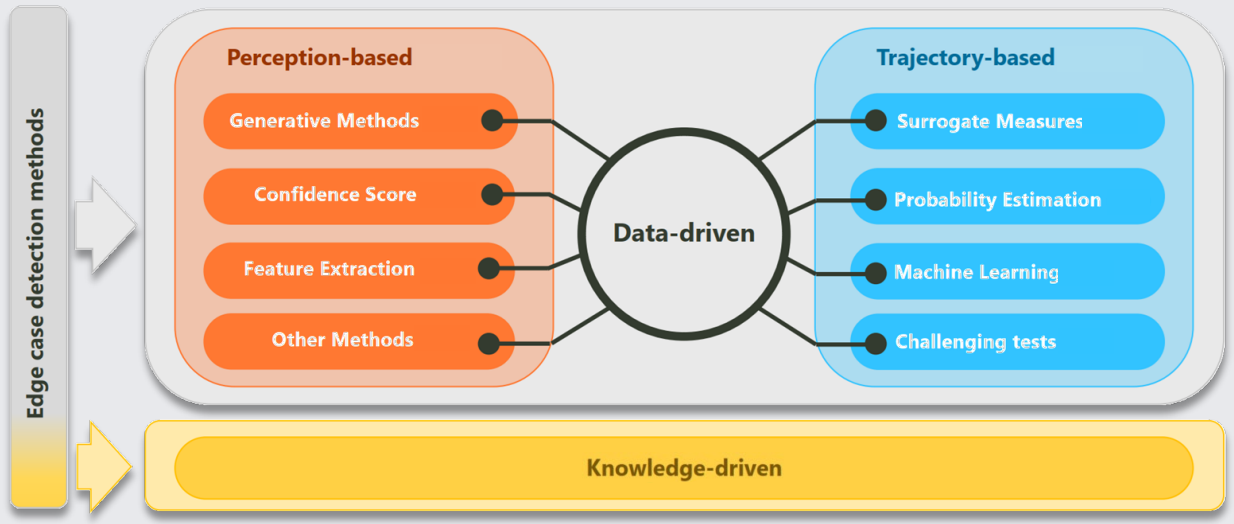
*"An **Edge Case** is a driving scenario instance that is **novel or rare** but still requires **specific design attention** for it to be dealt with by the AV in a reasonable and safe way. The quantification of "rare" is relative and generally refers to **situations or conditions that will occur often enough** in a full-scale deployed fleet to be a problem."*

(Adapted from Koopman et al., 2019)

The term "Corner Case" is often used as a **synonym!**

References: Rahmani, S. et al., "A Systematic Review of Edge Case Detection in Automated Driving: Methods, Challenges and Future Directions", arXiv preprint: arXiv:2410.08491, 2024

How to derive Edge Cases?



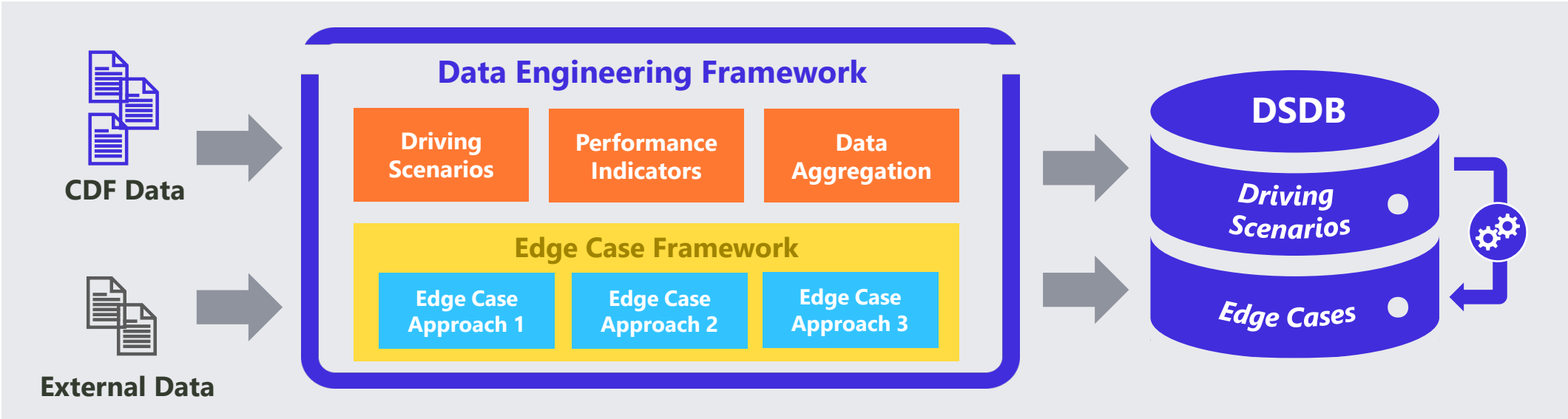
Multiple approaches identified in extensive literature survey

Driving Scenario and Edge Case Framework

Challenges

"We will probably not achieve one understanding of edge cases as there are different use cases and systems."

- The data engineering toolchain needed to host **different approaches** on how to get to **potential edge cases**



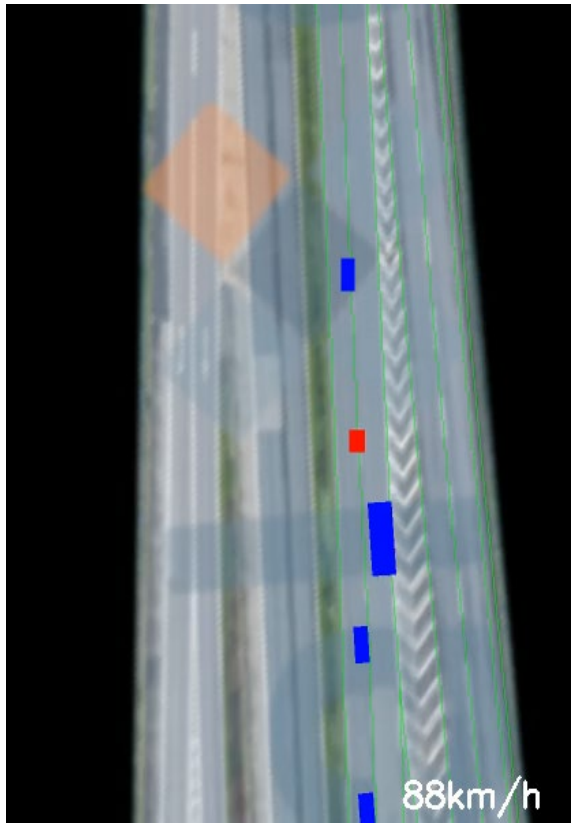
Edge Cases in Hi-Drive – Edge Case Derivation

Different EC approaches being developed

- Outlier detection (statistics and anomaly detection)
- Safety critical situations by metrics + accidents
- Manually labelled edge cases
- Unusual objects
- System limits
- Mismatch of planned and actual trajectory

Utilization of external data

- TASC
- GIDAS
- levelXdata
- Open datasets



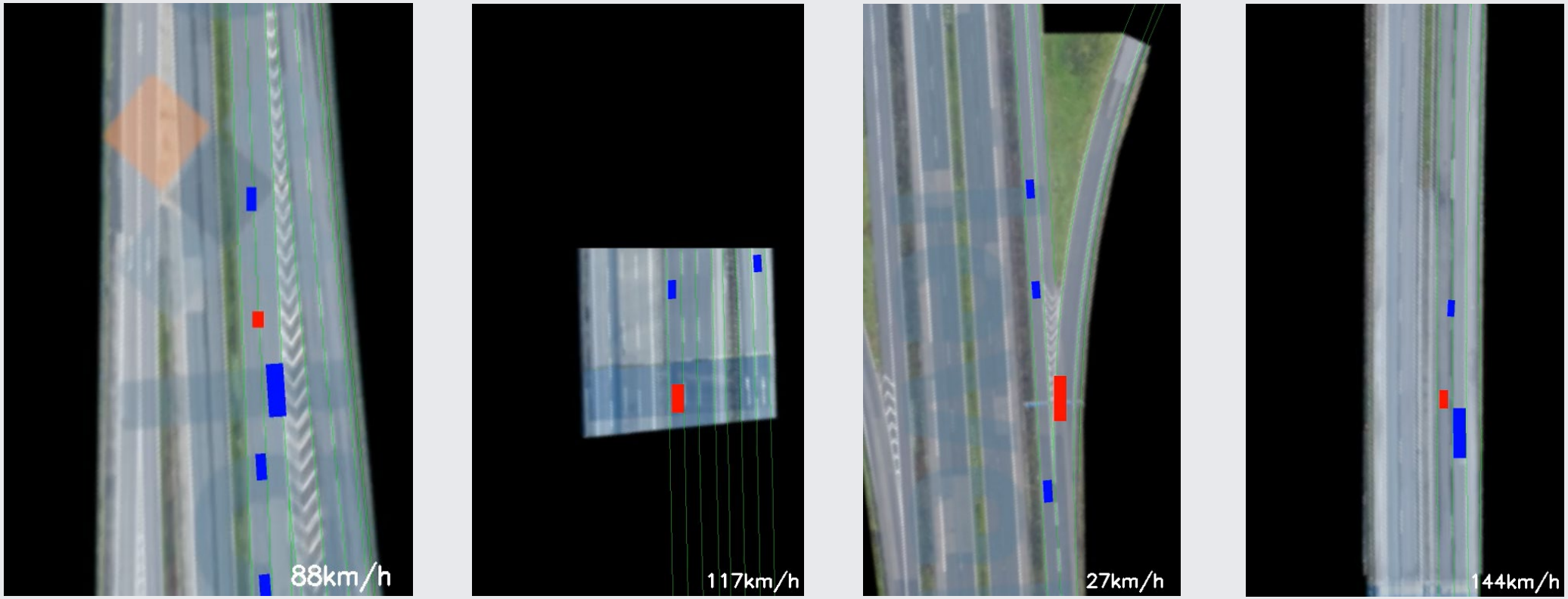
Potential Edge Cases for Urban Driving (1/2)

Potential Edge Cases for Urban Driving (2/2)

Potential Edge Cases for Motorway(-like) Driving (1/2)

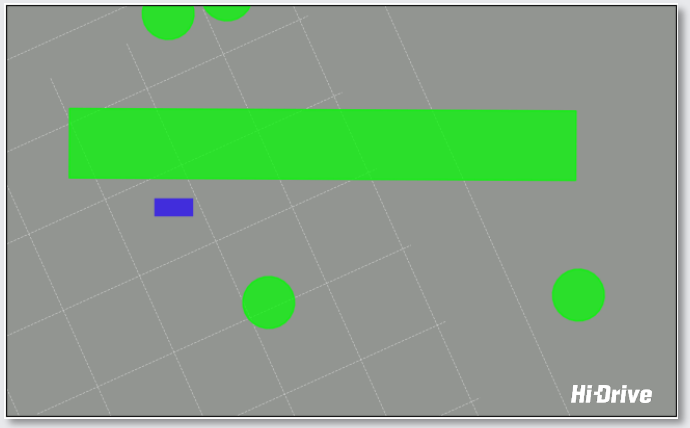
Other Potential Edge Cases from Hi-Drive Driving Data

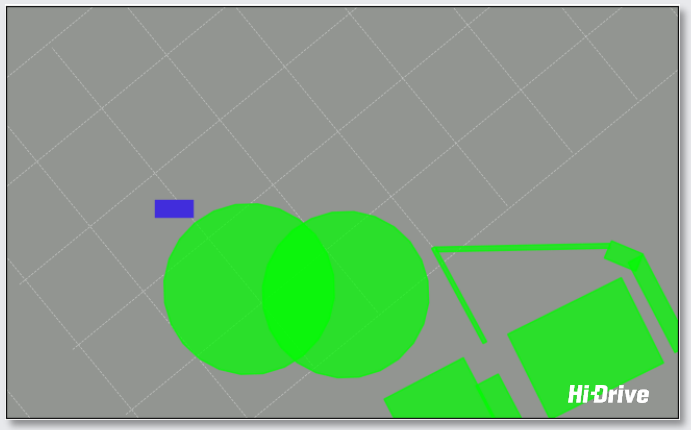
Potential Edge Cases from External Data – exiD Dataset

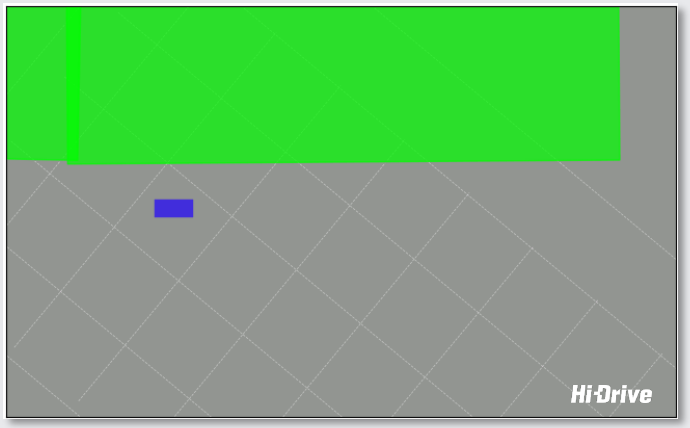


References: Moers, T. et al. "The exid dataset: A real-world trajectory dataset of highly interactive highway scenarios in Germany." 2022 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2022.

Potential Edge Cases from External Data – TASC Accident Data

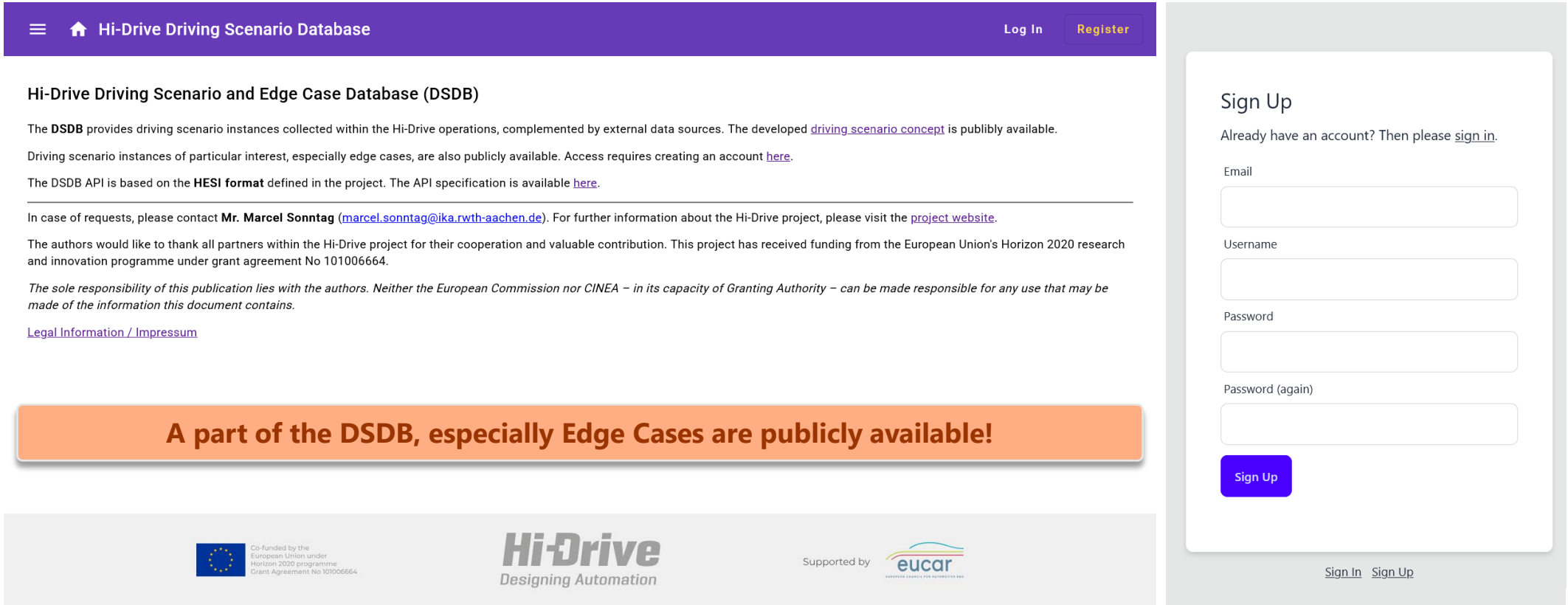




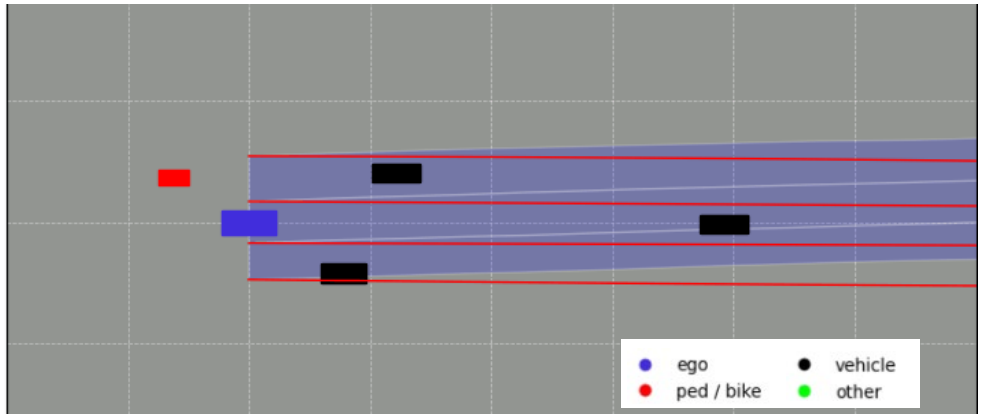


ego
vehicle
ped / bike
other

DSDB – Public Landing Page

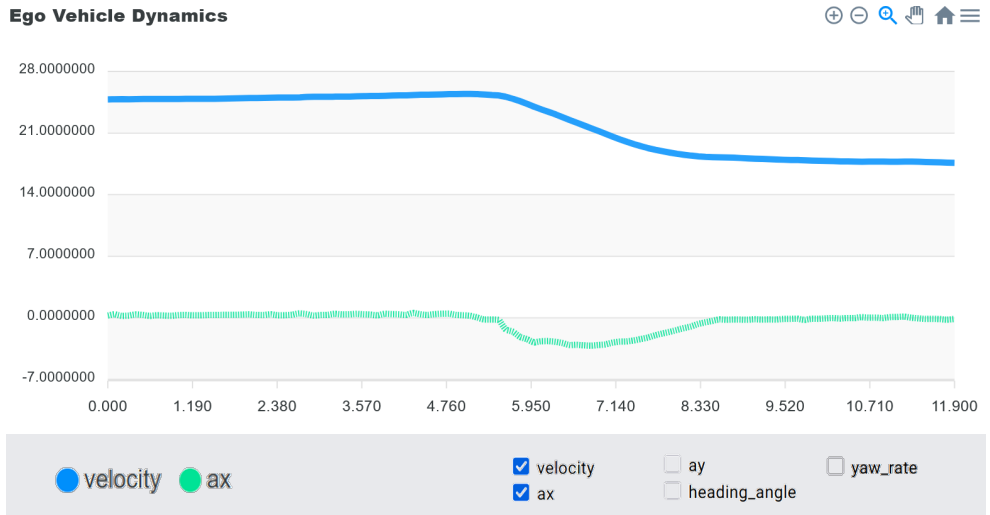


Driving Scenario Database Frontend – Scenario Assessment



Edge Case Tags

- Type: SAFETY METRICS
- Criterion: srs_L3Pilot.ForwardIncident.1.2, srs_SHRP2.LongAccBelow3_freeway,
- Description: This potential edge case was detected automatically. The following triggers led to being considered as potential edge case: Forward THW < 0.5s and v>20km/h, SHRP2 longitudinal acceleration < -3 m/s^2 on motorway,



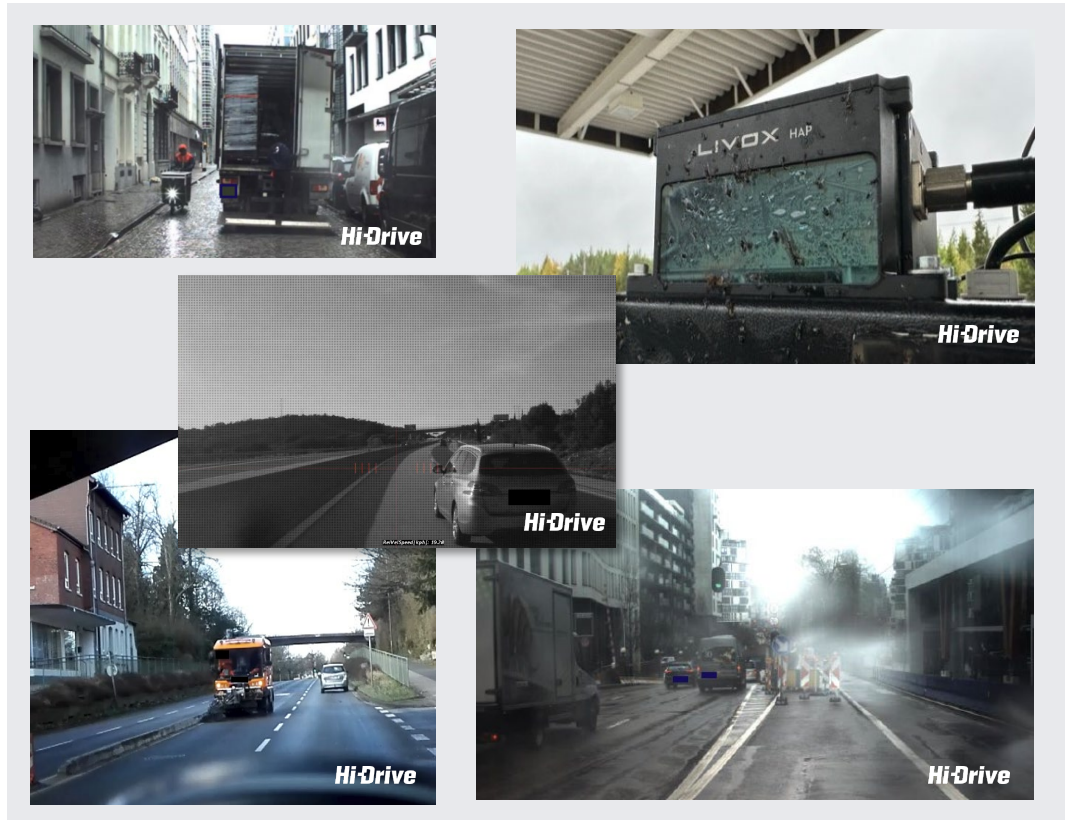
Tags overview and top view visualization for quick assessment of driving scenario instance

Detailed configurable plots of ego vehicle dynamics and object data

Visit us in the exhibition space!

Conclusion

- A **driving scenario database was built** in Hi-Drive to further utilize the operations data
- Edge cases are rare driving scenario instances of particular interest
  - They are **by definition very diverse**
  - **Multiple approaches** should be **applied** to derive them
- **Collection of edge cases** using complementary approaches as **joint effort**
  - **Hi-Drive is just a start!**
- **Check out the DSDB**



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...and many others!

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