



IVORY – AI for Vision Zero in Road Safety

From Prediction to Intervention: Personalised Driver Profiling and AI-Enabled Driver Assistance

Personalised profiling, coaching and driver assistance

Qiu, S., Tsoutsanis, A., Lourenço, A., Ziakopoulos, A., Brijs, T., Yannis, G.

IVORY Conference

15 April 2026



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101119590





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DC4. Road user profiling using multimodal data of naturalistic driving databases

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Research Objectives

- ❖ To automatically extract safety features and risk factors from dashcam video data
- ❖ To automatically create macro-level analysis reports of fleet drivers for fleet managers to provide intervention
- ❖ To automatically create micro-level analysis reports of each driver from naturalistic driving data for analyzing their personalized driving safety.



Starting point

❖ A Practical Method for Lane Change Detection of Surrounding Vehicles in Dashcam Videos

- identify cut-in, cut-out, and self-lane-change maneuvers directly from continuous driving videos, without requiring prior information.
- Achieves over 95% precision and recall on a public benchmark.
- Distinguish real tailgating risks from false positives triggered by surrounding vehicles' cut-in maneuvers on a new and challenging dataset from the EU Horizon i-DREAMS project.



Current Research

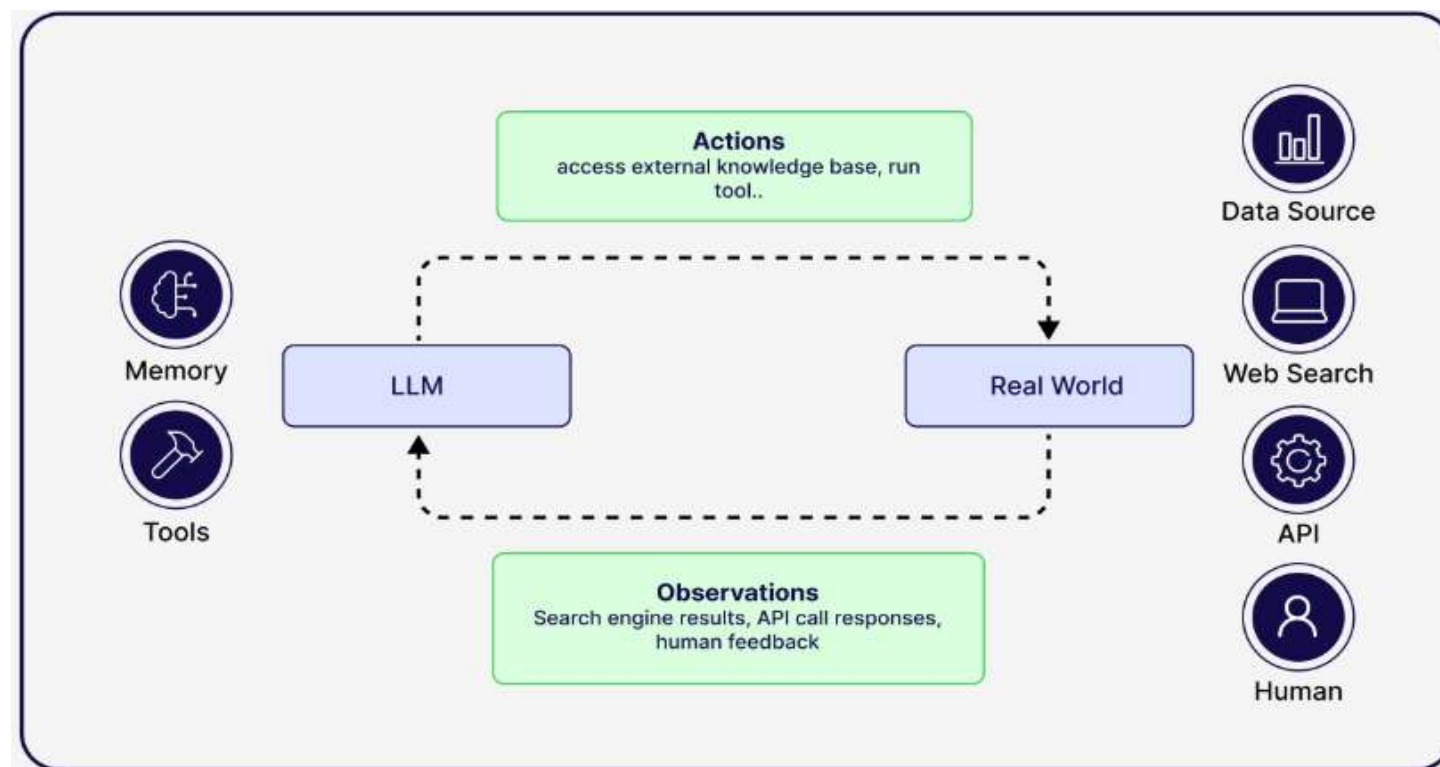
- ❖ Automatic fleet analysis and report generation from naturalistic driving data
- ❖ Data
 - Drivers
 - Trips
 - Scores for various safety and Eco factors (vehicle control, speed management, road sharing, Fuel consumption, and so on)
 - Risk indicators (speeding, tailgating, harsh movement, fatigue, and so on)
 - Speed, GPS and so on



Current Research

- ❖ A large amount of data, beyond the fleet manager's capability

- ❖ LLM-based AI agents



Current Research

❖ Current report outline:

- Executive Fleet Intelligence Summary
- Fleet Overview Metrics
- Driver Performance Metrics
- High-Risk Driver Analysis
- Elite Driver Identification
- Advanced Statistical Analysis of Performance Cliffs
- Driver Growth & Transformation Analysis
- Severe Event Evidence



Next Research

- ❖ Generate micro-level analysis reports for each driver to analyze their personalized driving behavior progress.
 - Daily, weekly, and monthly behavior tracking and report generation
 - Provide feedback based on their personalized data analysis
 - Profiling their personalized risky driving habits
 - Compare with other elite drivers





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DC 7: Data fusion of traffic, behaviour & infrastructure for holistic driver assistance

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DC7 - Intro

- ❖ Developed a solution for detecting harsh cornering events using smartphone telematics data
 - Presented to TRB, Washington, DC, USA
- ❖ Currently doing a secondment in Haskoning, Amersfoort, NL
 - Multi-modal driver behavior analysis (Vision & IMU)
 - Lane keeping
 - Harsh events



Agenda



From data collection to personalised driver feedback



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Telematics Data for Driver Assistance (1/2)

❖ Smartphone Telematics

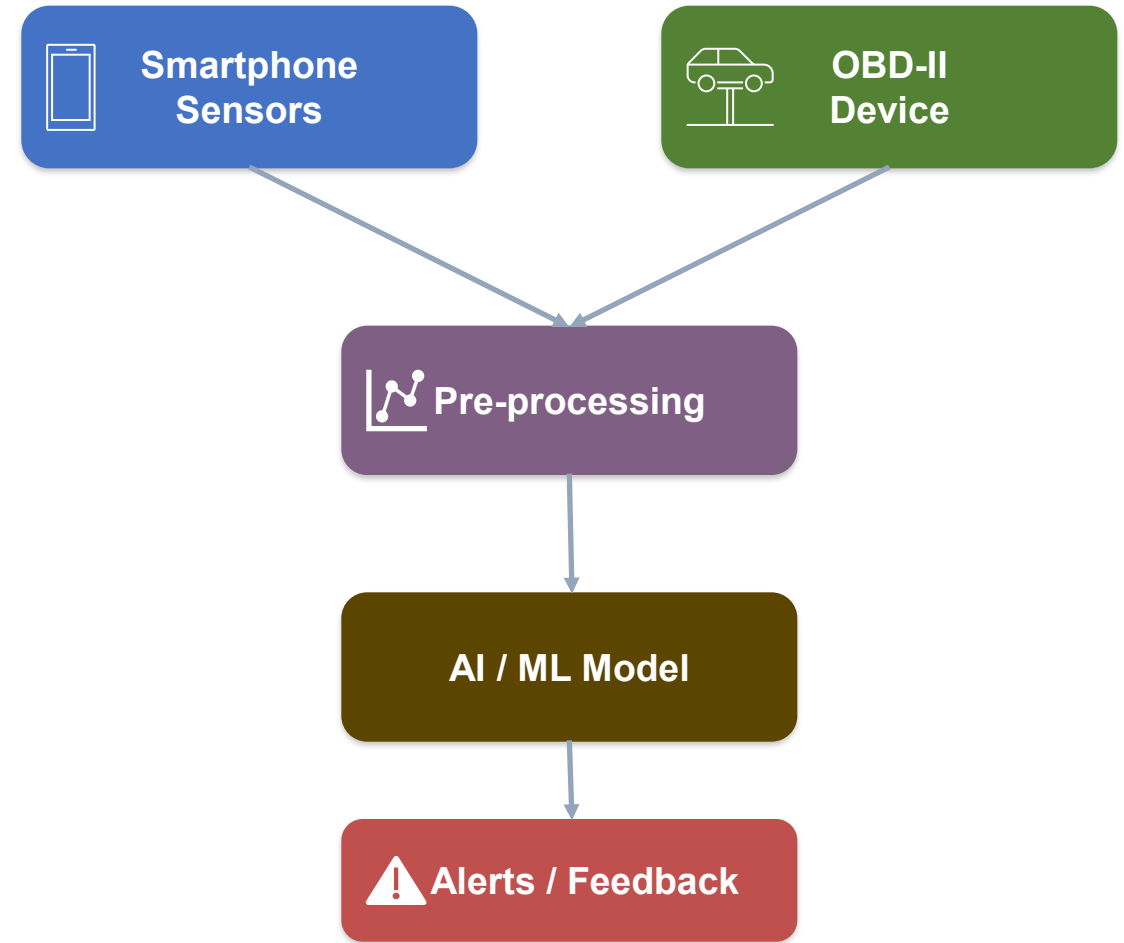
- GPS, accelerometer & gyroscope
- Detects harsh braking, cornering & acceleration events

❖ OBD (On-Board Diagnostics)

- Vehicle speed, RPM & engine load
- Real-time vehicle diagnostics via CAN bus

❖ Data Fusion & AI Processing

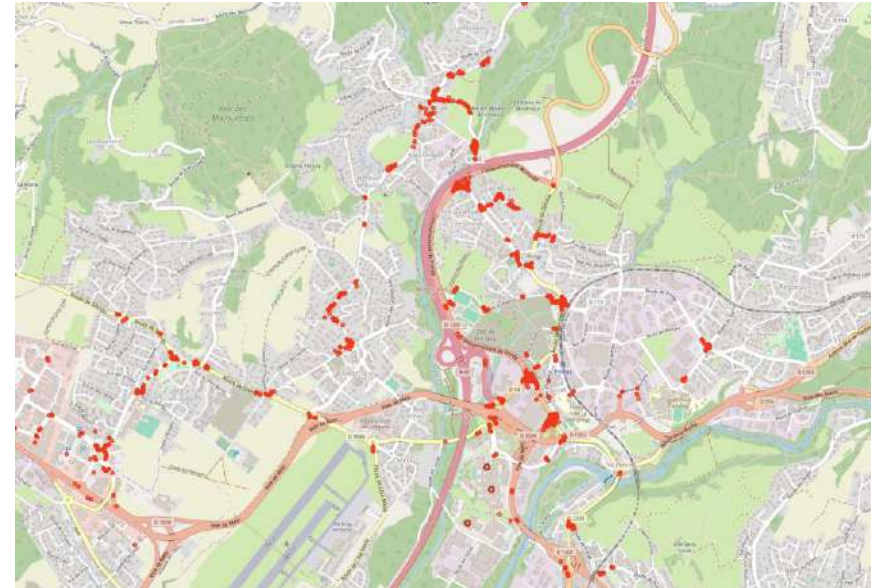
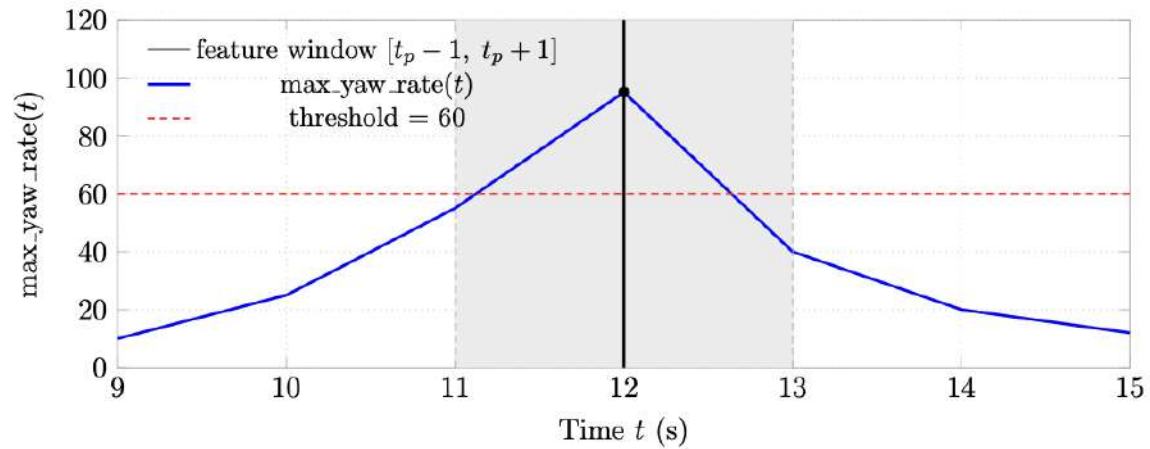
- Multi-sensor fusion for driver profiling & real-time alerts



Telematics Data for Driver Assistance (2/2)

❖ Time series creation

- Select a time interval and create 3 seconds multi-variate time-series events



Vision & IMU

❖ Dataset

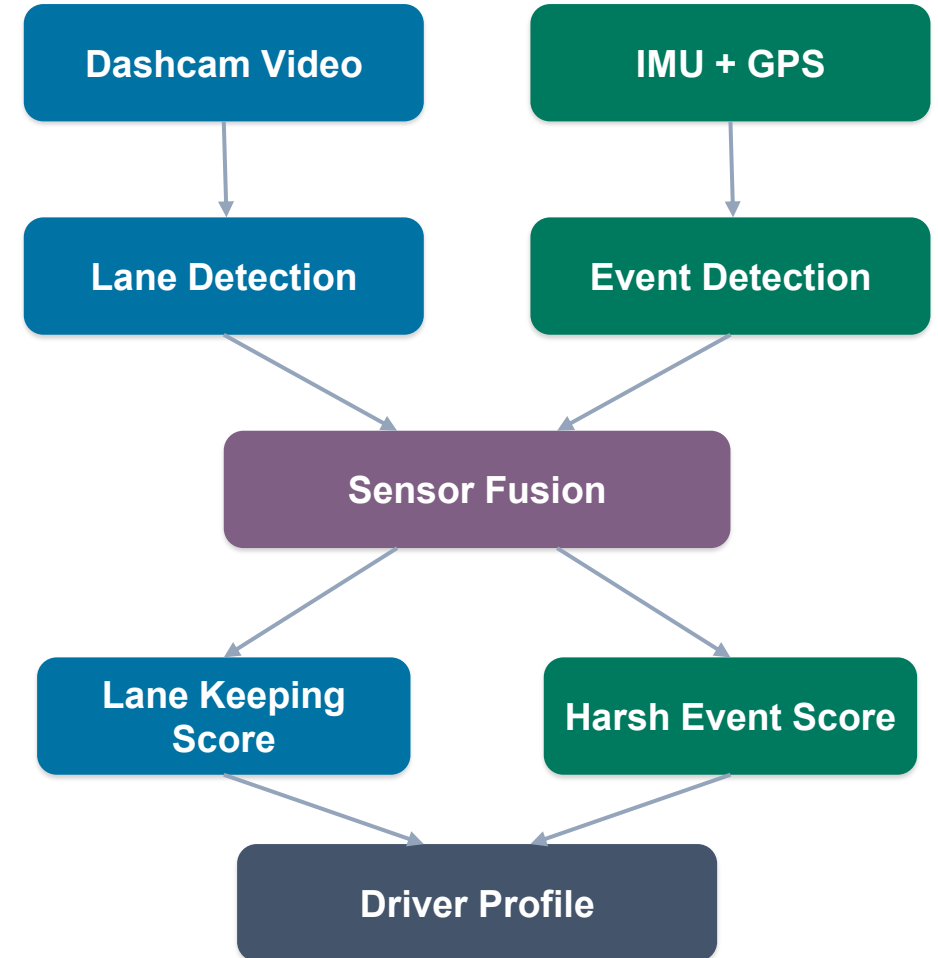
- ~4 hrs naturalistic driving in the Netherlands
- Front-view dashcam (road-view video)
- IMU (accelerometer 200 Hz) + GPS (18 Hz)

❖ Lane Detection for Lane Keeping

- Vision model detects lane boundaries from dashcam frames
- Measures lateral offset from lane centre over time
- Fused with IMU lateral acceleration for lane keeping scoring

❖ Harsh Event Detection

- Accelerometer to flag braking and acceleration
- GPS corroboration adds geolocation context to each event





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Driver Assistance & Evaluation

❖ Lane Keeping Score

- Vision-based lane detection combined with IMU lateral acceleration
- Measures deviation from lane centre over time
- Normalised score (0–100): higher = better lane discipline

❖ Harsh Event Score

- Aggregates **BRAKE**, **ACCEL** & cornering events per trip
- Penalises frequency & severity (peak g-force weighted)

❖ Overall Driver Profile

- Weighted composite: lane keeping + harsh events + speed compliance
- Real-time coaching alerts & post-trip summary for personalised feedback





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Thank you!

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