

# SCENARIO EXTRACTION AT URBAN CROSSINGS

## Exploiting the Topology of a Road Network for Maneuver Annotation and Scenario Extraction

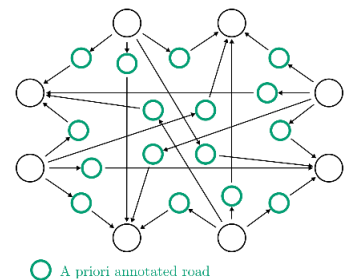
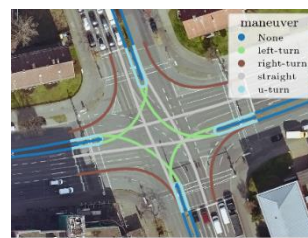
Lars Klitzke, DLR

Real-world drivings reveal valuable information about traffic in general and the behavior of traffic participants in particular. The DLR AIM Research Intersection in Braunschweig enables the analysis of urban traffic in a manifold and complex environment by microscopic detection of motorized and non-motorized traffic participants.

A challenge is, however, representing the collected trajectory data on a semantic level for in-depth scenario driven analysis, e.g. in terms of situation criticality or behavior normativity. Routing scenarios on intersections in the urban domain are of special interest since they describe how road users cross the intersection.

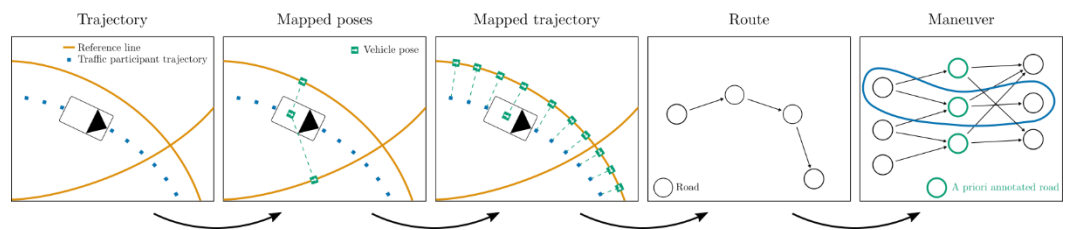
### Annotation of Road Networks with primitive maneuver

Annotating roads of intersections *a priori* with *driving maneuvers* allows inferring the maneuver a road user will perform solely based on the association to a road.



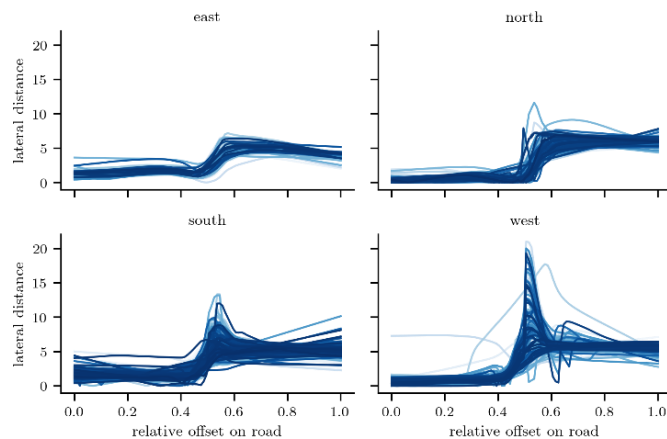
### Route Backtracking for Scenario Extraction

- Map the trajectory of a road user on the digital map
- Backtrack the route of a road user using the projected poses and the road network topology



- Given the *a priori* annotated road network, routing scenarios can be extracted to compile a knowledge base of driving scenarios.

### Example Scenarios: U-Turns



For trajectory comparison and in-depth analysis, the trajectories are transformed into the Frenét reference system defined by the annotated road. This allows analysing trajectories independent of time.

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A project developed by the  
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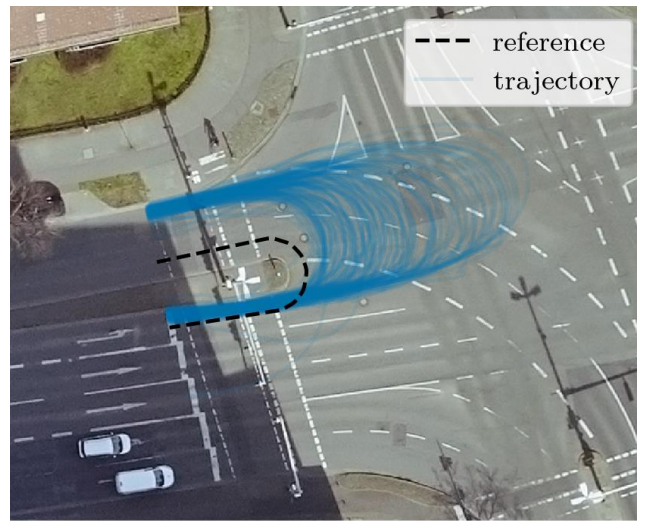
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### U-turns in Region West

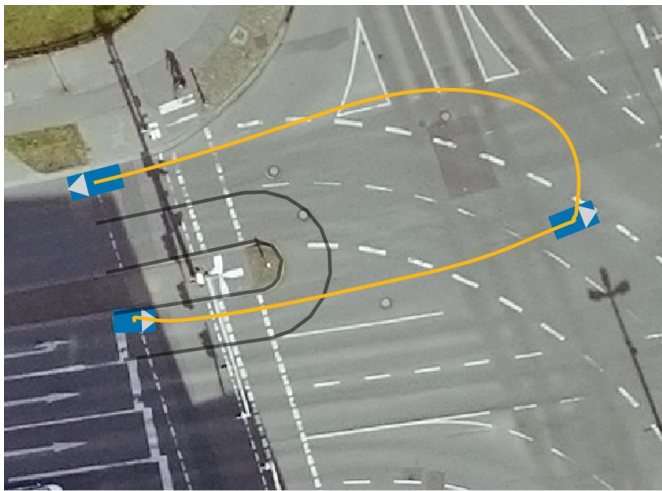
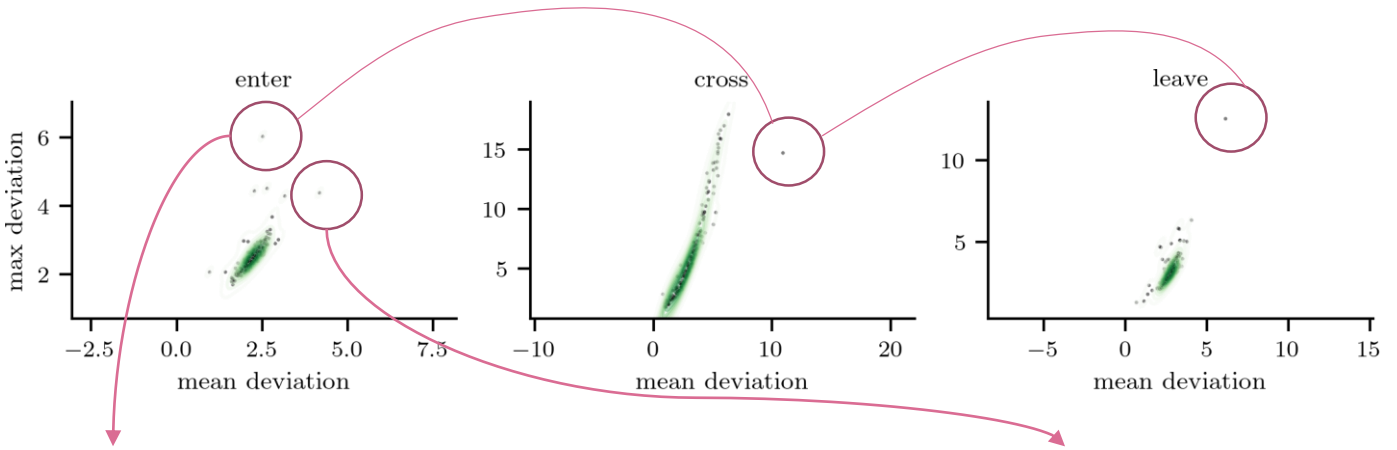
The transformation of a trajectory into the Frenét reference system allows assessing a maneuver w.r.t the displacement to the assumed optimal trajectory given by the digital map of the road network.



(c) Stadt Braunschweig | Abteilung Geoinformation

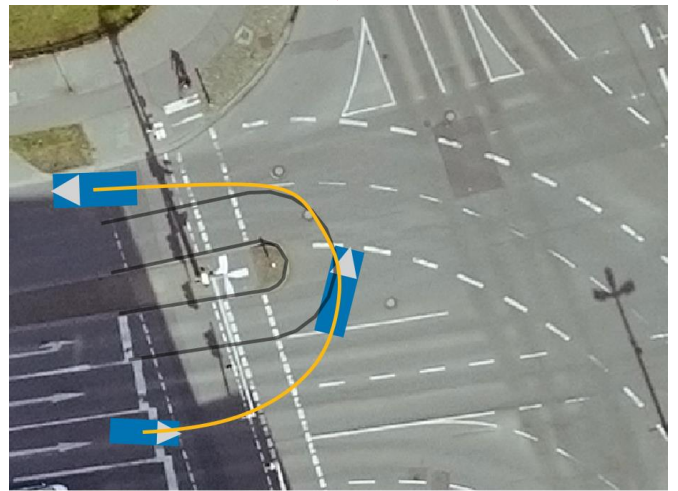
### Finding irregularities

Dividing the optimal trajectory into three parts enables to take a closer look on how road users *enter*, *cross* and *leave* the intersection, i.e., *characterizing* the maneuver. Assuming that the average maneuver represents the *normal* behavior, outliers might indicate road users with a *typical* behavior.



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The road user moves far into the intersection before performing the u-turn maneuver.



(c) Stadt Braunschweig | Abteilung Geoinformation

A truck enters the intersection on the straight-ahead lane but performs a u-turn maneuver.

### Outlook

The approach also allows extracting scenarios with multiple road users, such as unprotected left-turns, thus enabling the identification and characterization of, e.g., critical scenarios in a real-world environment for in-depth simulation-based testing.

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