Online Fusion of Vehicle Sensor and Safety Server Backend Map Data
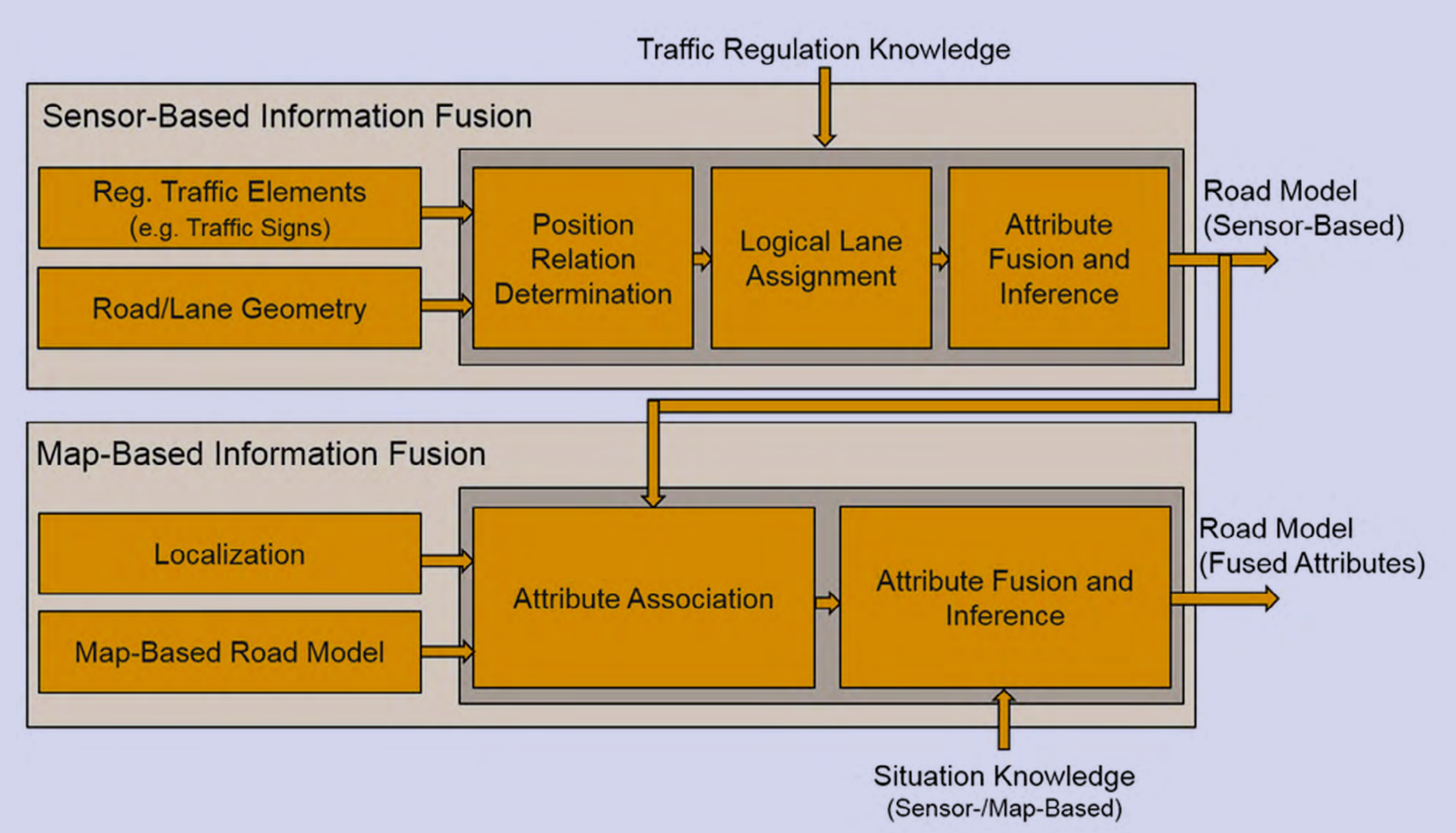
BACKGROUND AND MOTIVATION

- Automated driving functions need a consistent representation of the **road** and its **lanes** with associated **traffic rule-related lane attributes** for proper behavior planning and decision making, a so-called **road model.**

- The road model can either be derived from **sensor data** or from **digital map data** provided by the safety server backend.
- Online road model fusion to increase **robustness** and **quality** of the road/lane representation for the driving functions.
- Road model fusion involves fusion of **lane geometry, topology,** and **attributes.**

FUSION CHALLENGES

- Adequate integration of traffic regulation, situation, sensor, and digital map knowledge.
- Proper dealings with incomplete, uncertain, and inconsistent information sources.

MAIN CONTRIBUTIONS

- General high-level road model fusion framework to infer **lane-specific traffic rules** by combining.

- i) regulatory traffic elements:

- ii) lane geometry:

- iii) digital map infos:

- Full considerations of **spatial, existence,** and **attribute uncertainties** without intermediate hard decisions.
- Additional incorporation of **uncertain situation knowledge** within a Dempster-Shafer-based attribute fusion.
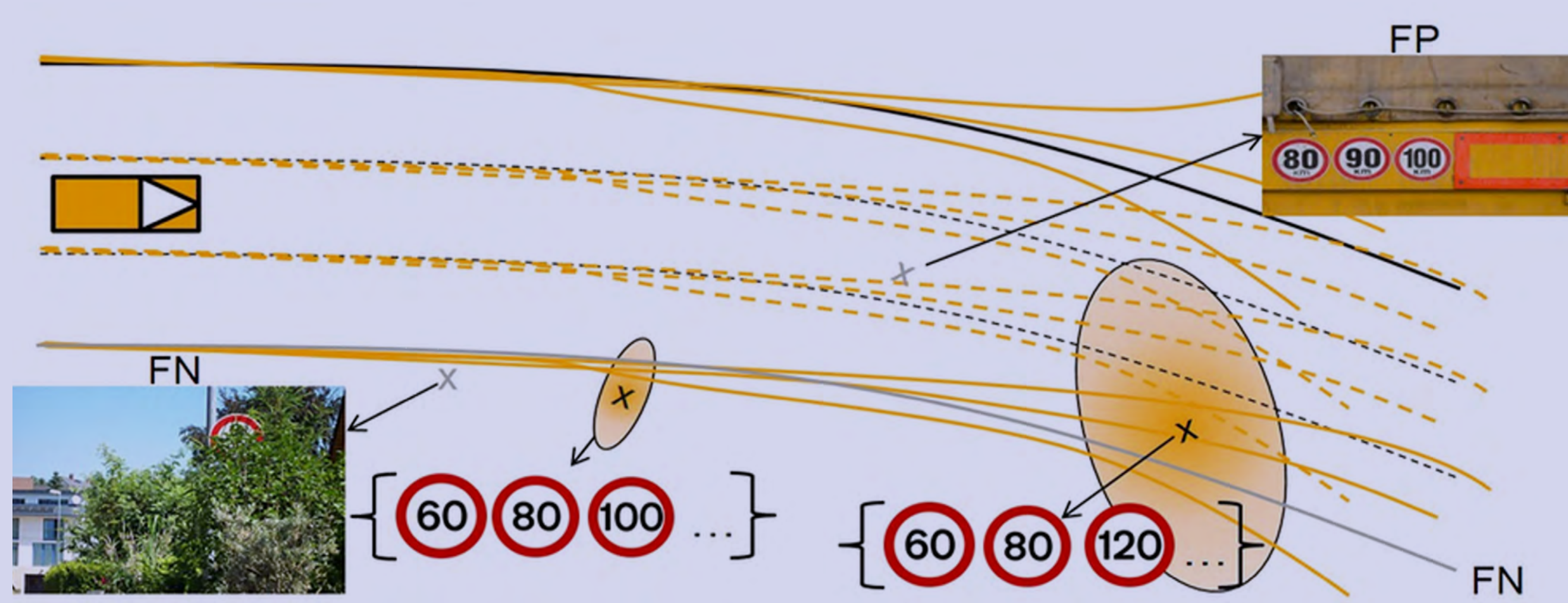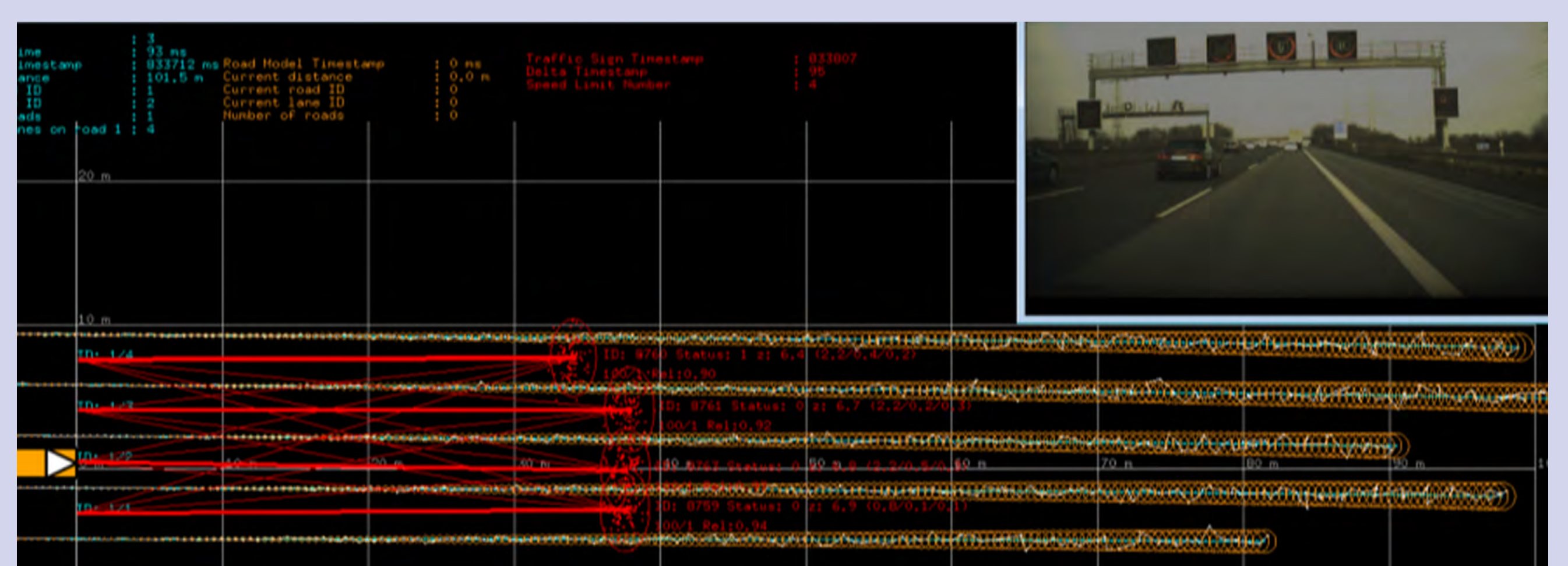
FUSION FRAMEWORK OVERVIEW

- **Sensor-based information fusion** to generate a sensor-based road model with traffic rule-related attributes.
- **Map-based information fusion** to include digital map attributes.
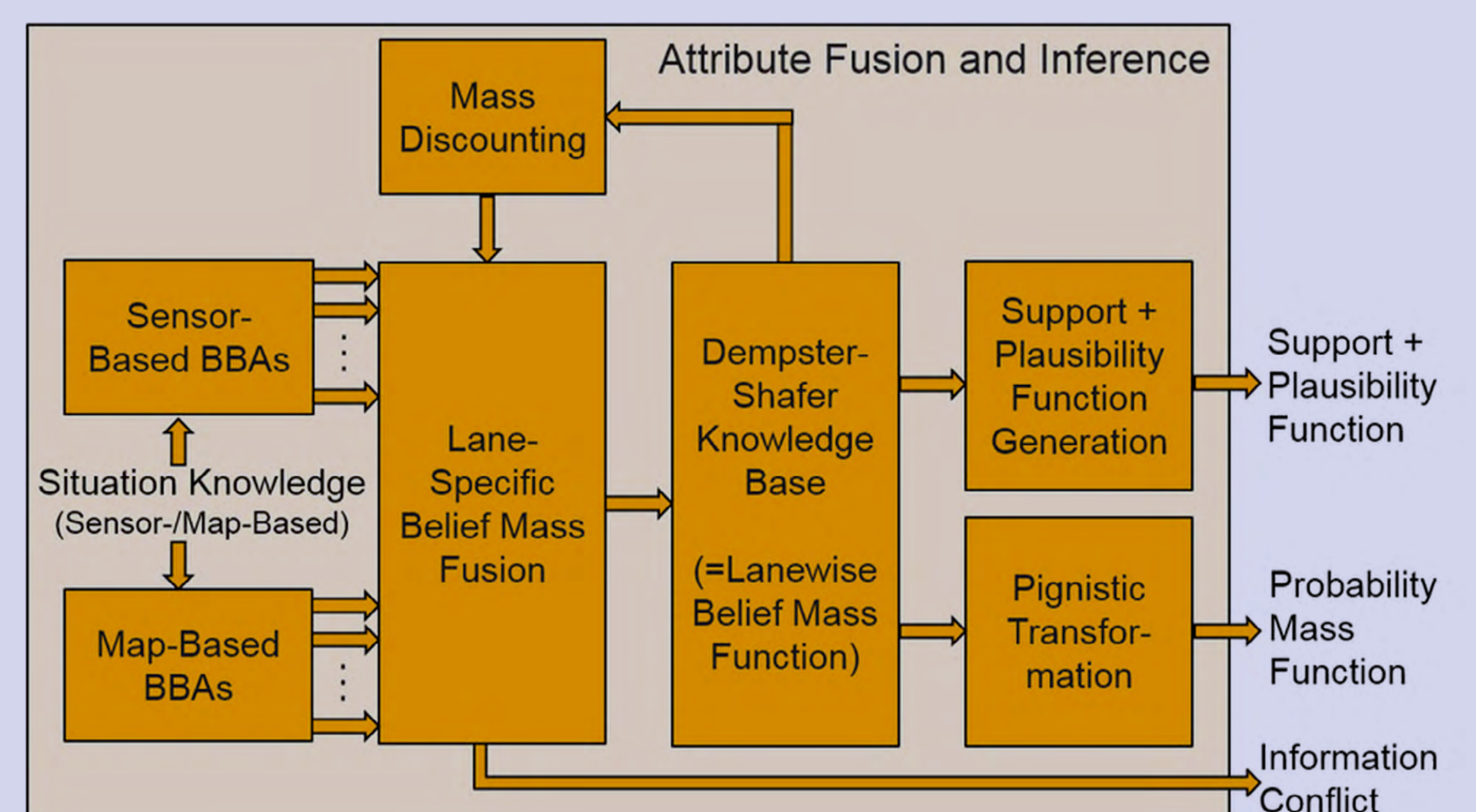

KEY METHODS

- **Monte Carlo** simulations for the estimation of position relations between regulatory traffic elements and lanes.

- **Bayesian networks** for logical lane assignment of traffic elements under incorporation of traffic regulation knowledge and position relations.
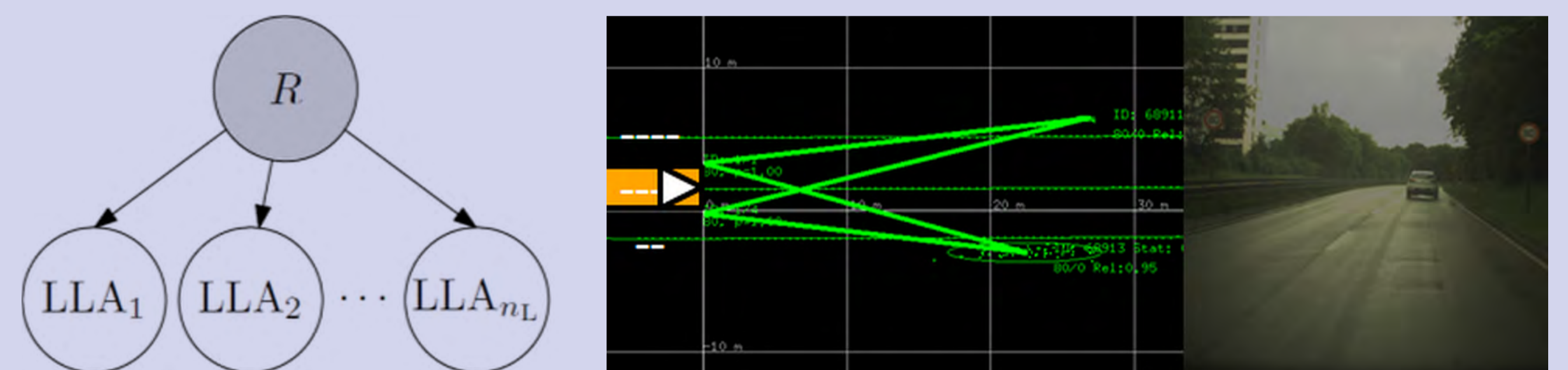
- **Dempster-Shafer** theory for
i) fusing multiple simultaneously sensor-detected traffic signs and
ii) traffic situation-dependent fusion of digital map attributes with sensor-inferred attributes.

EXEMPLARY FUSION RESULT

- Situation-dependent speed limit fusion and inference within a construction site.

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