DAIMLER

Overall Probabilistic Framework for Modeling and Analysis of Intersection Situations

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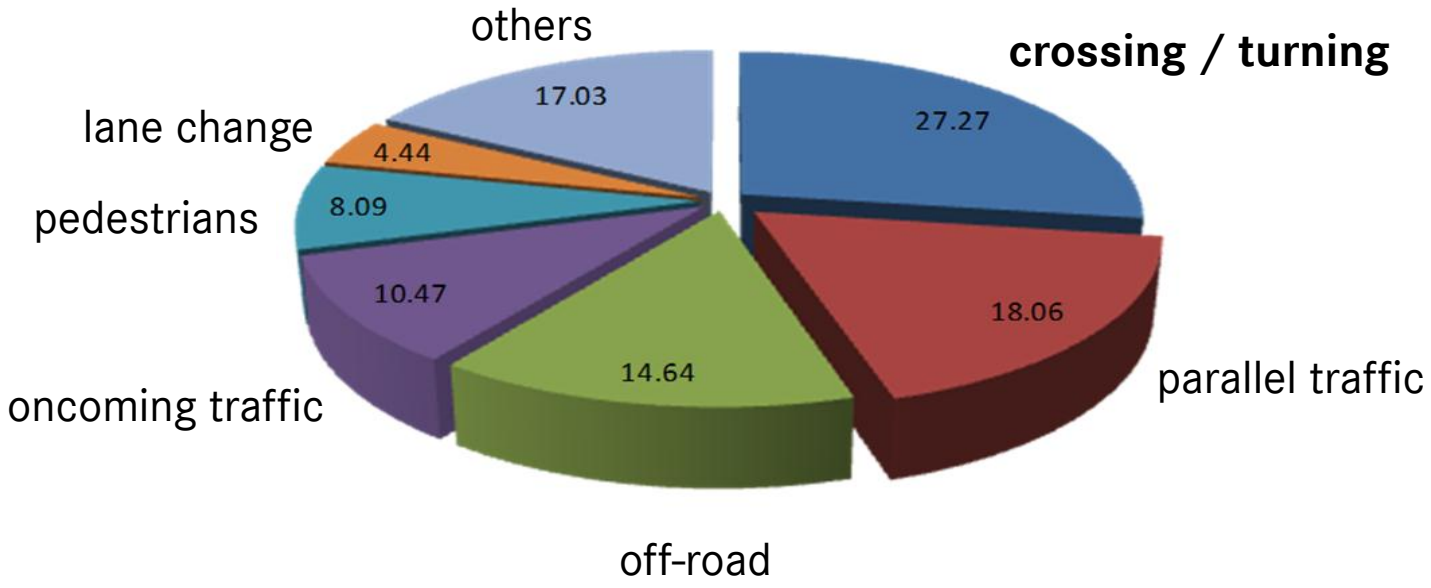
Motivation and Goals

Accidents Concentration on Intersections



Goals

- Recognition of behavior and intentions of all road users
- Risk assessment
- Driver assistance in critical situations

Cooperative Perception Architecture

Challenges in intersection situations:

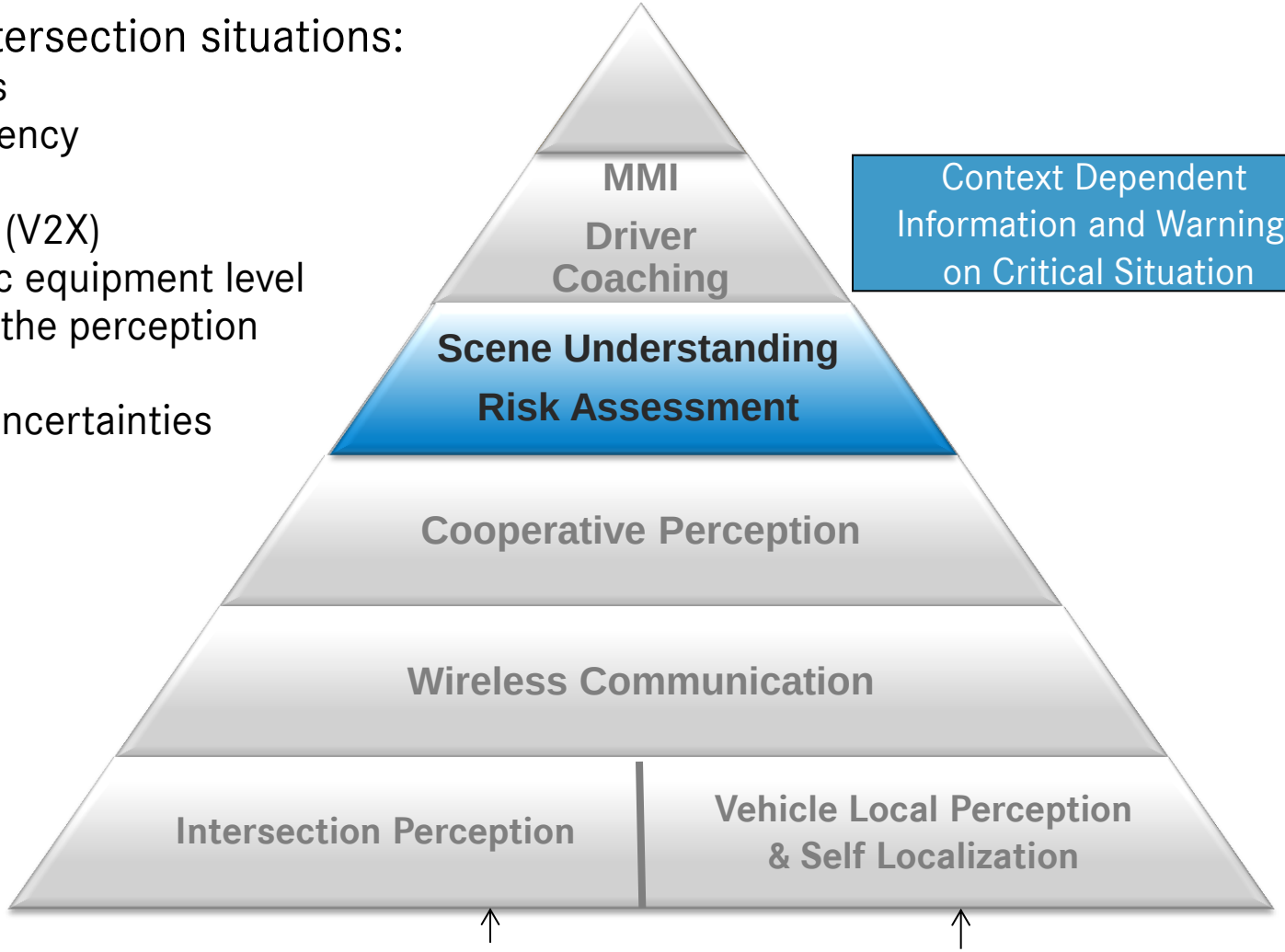
- Many road users
- Context dependency
- Occlusions

→ Communication (V2X)

→ Heterogenic equipment level

→ Socialize the perception

- Able to handle uncertainties



Assessment of Risks

Digital map for situation analysis:

- localization
- context information
  - topography & topology
  - priority context:
    - traffic lights
    - traffic signs
  - lane attributes + relations
    → maneuver-tracks options
  - conflict areas

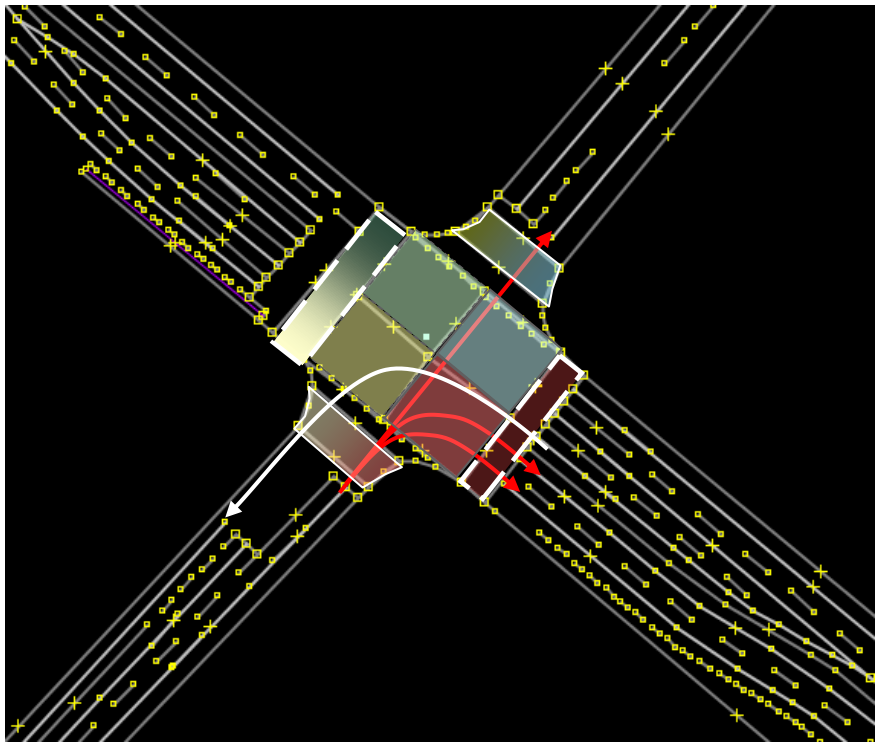
Objects (road users):

- position
- state of motion

⇨ Probabilistic maneuver-track options

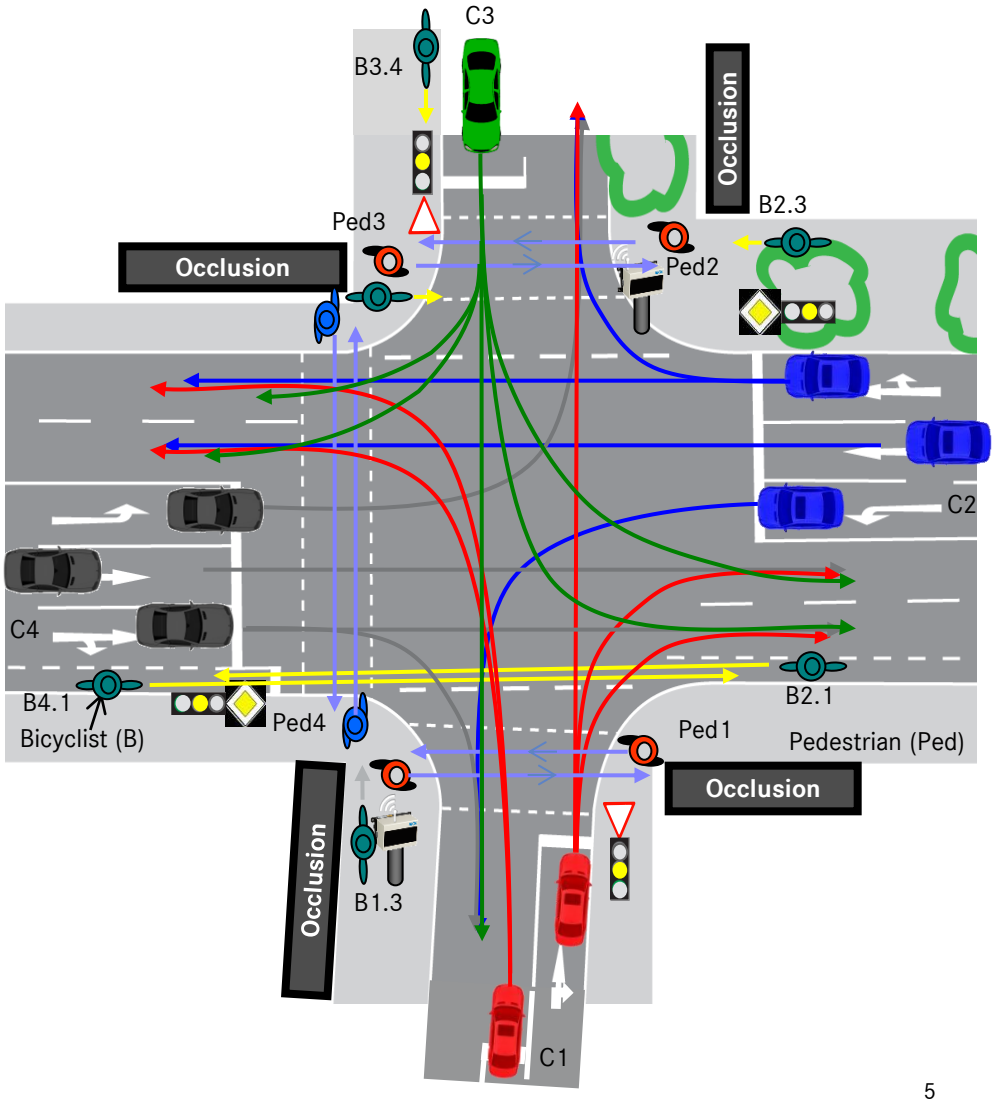
Risk assessment in space-time:

- potential conflicts (Object pairs)
- occupation of conflict areas
- time-to-enter/disappear



Intersection: Possible Conflict-Tracks

Assumption: The road users are selecting maneuver-tracks, conform with the lanes of their localization.



Method to Resolve the Challenges

Suitable method for probabilistic reasoning?

- Many networking road users with a number of maneuver options → combinatorial issue
- Handling of uncertainties in sensor measurements, digital map, localization and perception algorithms, modeling

Appropriate method for knowledge representation

- Qualitative
  - Express all maneuver options of all road users
  - Mimic the human reasoning for situation analysis
- Quantitative
  - Parameterize the models with acquired data

→ Bayesian Networks (BN)

Reduction of model complexity

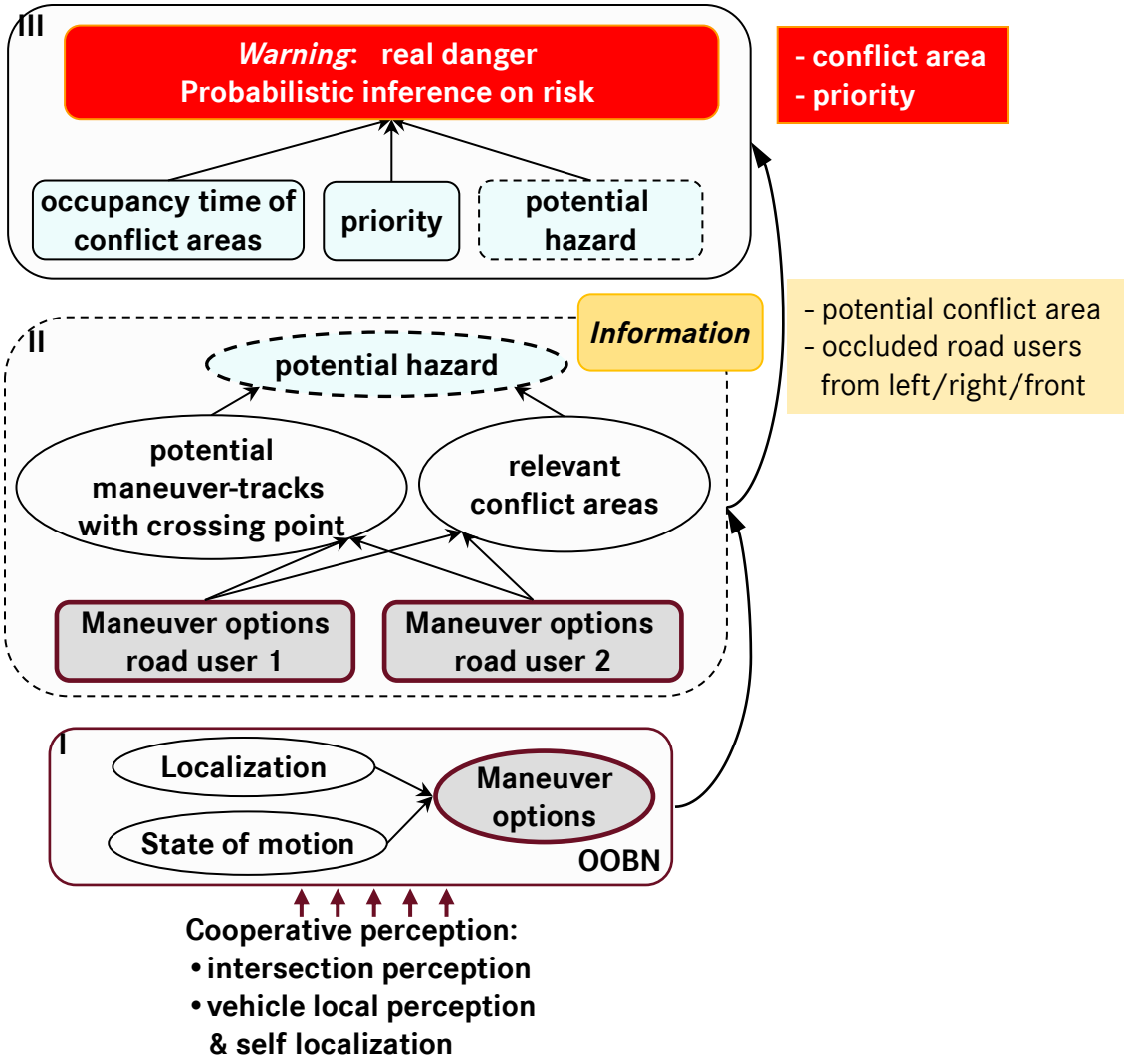
- Model library of BN-fragments → reuse or modify in similar situation context

→Object-oriented Bayesian Networks (OOBN)

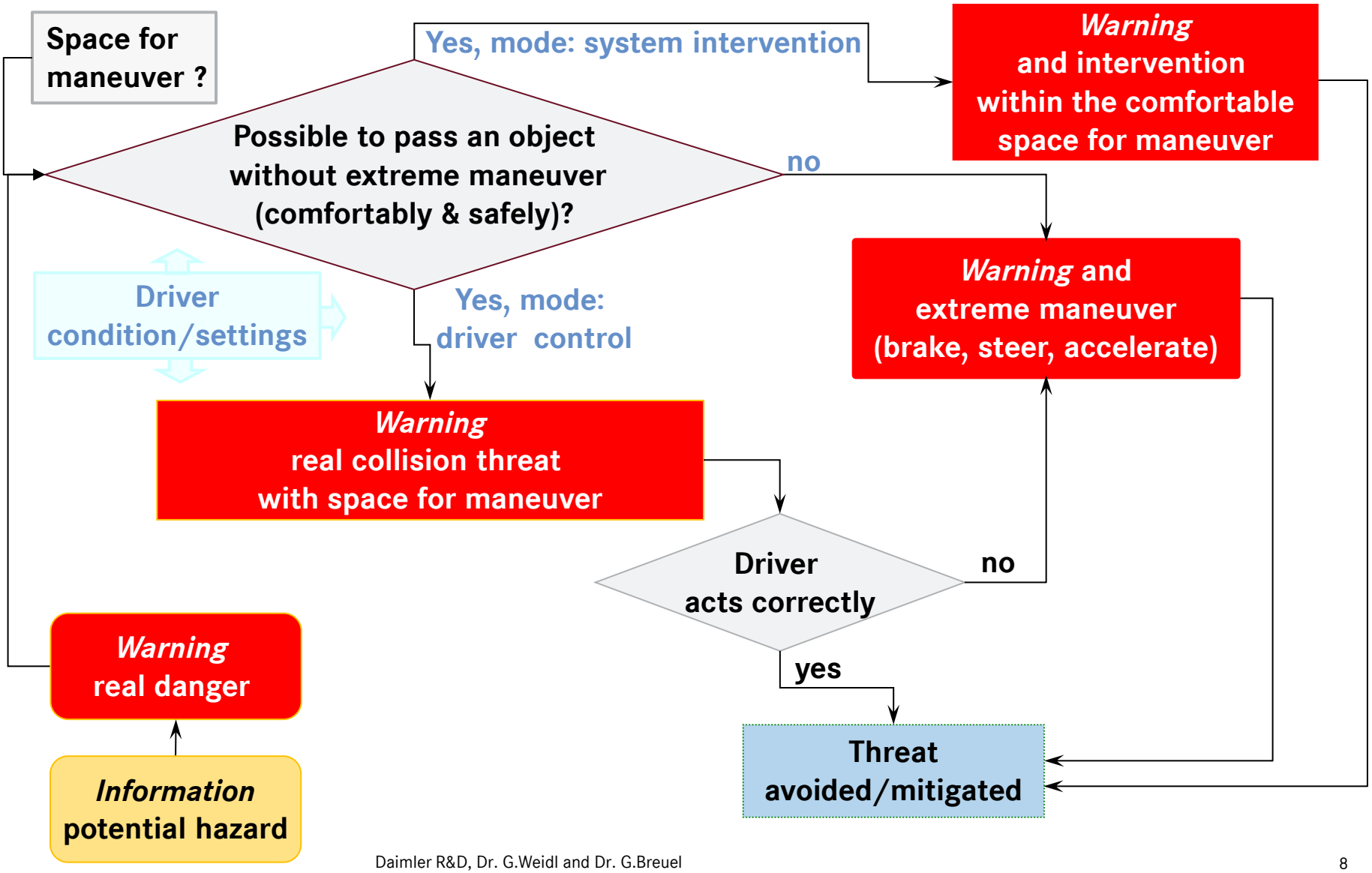
OOBN for Risk Assessment Between Networking Road Users

Knowledge Representation

- Qualitative (cognitive):
  - structure of the network
  - causality relations
- Quantitative (probabilistic):
  - strength of dependencies



Concept for Multistage Safety Assistance



References and Acknowledgments

"Feel-Safe Zone in Intersection Situations"

- a probabilistic algorithm estimating if „Space for maneuver" is available -

by E.Käfer, G.Weidl, V.Gomer, G.Breuel, C.Wöhler, H.Ritter

submitted to IEEE Intelligent Transportation Systems Transactions and Magazine

Acknowledgments

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