INTEGRATION OF RESPONSIBILITY SENSITIVE SAFETY (RSS) INTO AUTOMATED DRIVING STACKS

Dr.-Ing. Bernd Gassmann

Autonomous Mobile Systems Research Lab
Intel Labs Europe
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RESPONSIBILITY SENSITIVE SAFETY (RSS)

Verifiable safety check for AV decision-making
Responsibility Sensitive Safety (RSS)

Mobileye proposed RSS

- Open, technology neutral and transparent method
- Formalizes human notions of safe driving
  1. Keep safe distance from the car in front of you
  2. Leave time and space for others in lateral maneuvers
  3. Exhibit caution in occluded areas
  4. Right-of-Way is given, not taken

RSS defines

- Safe distance: longitudinal & lateral
- Dangerous situation: if both lateral & longitudinal distances are not safe
- Appropriate response: how can the AV escape from a dangerous situation
AD RSS Library (Open Source)

- Current implementation covers the following situations
  - Longitudinal scenarios (same and opposite direction)
  - Lateral scenarios
  - Multilane roads
  - Intersections handling
AD RSS Library – Source code

- Standalone C++11 Open Source Library

- GitHub-pages are available under https://intel.github.io/ad-rss-lib/
  - GitHub sources
  - Doxygen docu
  - Background docu
  - Coverage report
INTEGRATION OF RSS INTO AD SYSTEMS...

...as an independent stand-alone checker
RSS Integration Example: Sense – Plan – Act

Sense
- Extract RSS World Model
- Receive Sensor Data

Plan
- Perception
- World Modeling
- Driving Behavior

Act
- Enforce RSS Restrictions
- Create Actuator Commands

Ad RSS Lib
- Extract Situations
- Check Situations
- Resolve Responses
- Transform Response

Real Vehicle / Simulation / …

User Implementation

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RSS Integration Example: Intel Labs AD Reference Stack

Real Vehicle / Simulation / ...

Sense
- World Modeling
- Perception
- Receive Sensor Data

Extract RSS World Model

Ad RSS Lib
- Extract Situations
- Check Situations
- Resolve Responses
- Transform Response

Plan
- Driving Behavior

Act
- Enforce RSS Restrictions
- Create Actuator Commands
INTEGRATION OF RSS INTO AD SYSTEMS...

...embedded as part of the planning function
RSS Integration Example: open source AD stack Apollo

- Integration with Baidu's Apollo Open Platform
  - Simple vehicle following scenario available
  - Code of Apollo RSS Decider is available under
    https://github.com/ApolloAuto/apollo/tree/master/modules/planning/tasks/rss
INTEGRATION OF RSS INTO AD SYSTEMS...

...entirely external as an assessment tool
RSS Integration Example: CARLA simulation platform

- Introduce RSS concepts into **CARLA simulator** (https://github.com/carla-simulator/carla)
  - CARLA sensor reporting RSS state of vehicles
    - Which vehicles have RSS conflicts?
    - Is overall situation dangerous?

- Outlook 2019
  - CARLA actor restricting vehicles acceleration
    - Enforcing RSS conform behavior
    - Statistics: How often the restrictor had to intervene?
  - Full AD RSS Lib support using a-priori map
AD RSS Library applied as CARLA „RSS Sensor“
CLOSING QUESTION: HOW TO INTEGRATE RSS IN AUTOWARE?