New validation approaches for automated driving safety

French views

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French approach: bird-eye view

Conception
- Functional descriptions
- OEM’s risk analysis, incl. tests and simulations

Audit
- Closed site tests
- Open road examination
- Perception / interpretation studies

Performance validation

Balanced + Complementary
French approach : main focuses (1/3)

- **Focus on functional descriptions**
  - ODD
  - Manœuvres : activation / de-activation, triggering conditions and logigrams
  - Safety rules : high level + (national) driving codes
- Risk analysis :
  - **Focus on scenarios management** *(cf. bellow)*
  - **Focus on simulation relevance** *(including calibration)*

**Transparent management of scenarios for validation**
- Combining systems’ failures and driving hazards
- Representing nominal and edge situations

Utilisation for tests

In-use reporting procedure to be adressed
French approach: main focuses (2/3): scenarios screening and scoring

1. Screening
   - Collection
     - Open road
     - Closed site
     - Experts' input
     - Accidents
     - In-use
   - Cleaning and labelling
   - Projection on parameters-space

2. Completing
   - Completeness analysis
     - Incl. external references (use cases, expertise)
   - Generation
     - Parameters variation
     - Additional inputs

3. Scoring
   - Quality, usability
   - Criticity
     - Exposure, Severity, Controlability (ISO26262)

4. Exploiting
   - Relevance analysis for:
     - Simulation
     - Closed site test
     - Open road test
     - Behavioral studies
     - Other?

- Possible criteriae:
  Best representative = exposure ≥ E4 and severity ≥ S1
  Worst case – edge = severity ≥ S3 and exposure ≥ E2

Link with 1a subgroup
French approach: main focuses (3/3)

- Closed sites tests
  - Unitary manoeuvres, including MRMs and limp-home
  - Edge-critical situations (pre-defined + randomly extracted from risk analysis / scenario screening)
- Open road evaluation / examination
  - Compliance with ODD
  - Compliance with (national) driving rules (e.g. signals)
  - Manoeuvres’ chains / logigrams
  - Interactions with other road users (etiquette, anticipation)
- Perception / interpretation studies
  - ODD definition
  - Manoeuvres’ triggering conditions / chains / logigrams
  - HMIs (internal and external)
  - Driver monitoring in real time to check well understanding of HMI

Link with 2b subgroup
### Technical
A single perception malfunction without failure should not induce a hazardous event. Consequently, the set of sensors used for the perception of a safety relevant environmental feature shall not be based on a single physical principle.

### ODD
The vehicle shall not be in AD mode out of its ODD.

### Driving
The vehicle shall manage risks according to the following rules:
- Vehicle shall not create accident by its own
- Vehicle shall be robust, as far as reasonably possible, to risks caused by others
- Vehicle shall comply with applicable driving rules (including those applicable to human drivers) unless it is the only way to avoid an accident

  This rule shall be fulfilled:
  - wherever the vehicle is driving (e.g. country, road, ...)
  - whenever the vehicle is driving (e.g. despite dynamic lane assignment; time dependent rule, introduction of a new type of traffic sign; rule change ...)

### Transitions
**AD ↔ Manual**
A deliberate driver action is required to activate AD mode.

### Scenarios
The OEMs shall set up a common process to create and maintain a common catalog of scenario, including misuses, to be used for safety argumentation during design and verification/validation phase.
Some open questions

- Learning systems and releases (in use performance monitoring and evaluation)
- AD systems where (dedicated) infrastructure provides a significant part of safety
- AD systems where connectivity (supervision) provides a significant part of safety
- Specific subsystems deserving specific validation focus (for learning systems ?)
  - Perception + recognition + positionning + mapping
  - Connectivity (cf. above)
  - HMIs
Thank you