Cyclists’ safety during interactions with AVs: A combined microscopic simulation and SSAM analysis

1. OBJECTIVES

- Define and simulate cyclists’ behavioural patterns.
- Evaluate AV-bicycle conflicts in a traffic simulation scenario through surrogate safety measures.

2. METHODOLOGY

a. Microsimulation via PTV Vissim software
   - Three defined behavioral patterns of cyclists: cautious, normal, and aggressive.
   - Two AV behaviours: cautious and normal.
   - Shared roads; uncontrolled T-intersection with low traffic volume (600 veh/h).
   - 24 model runs, 15 hours/run, 360 h of simulation.

b. Safety analysis via SSAM software
   - Safety indicators: TTC, PET, MaxSpeed, DeltaSpeed and MaxDeltaV were analyzed.

3. RESULTS

a. Distributions - Typical conflicts

   ![Chart showing conflict rates](image)

   - **CONFLICTS RATES**
     - Vehicle types involved in conflicts
     - Conflict settings: 600 m/s²
     - TTC value of typical conflicts

   ![Figure 4. Behavioural distributions of typical conflicts](image)

   - **Statistical significance of mean SSM**
     - TTC (s) PET (s) MaxS (m/s) DeltaS (m/s) DR MaxDeltaV (m/s)
     - Rear End (n=44) 0.91 0.84 4.48 1.88 0.50 2.5
     - Crossing (n=50) 0.93 0.72 10.88 11.74 0.43 10.44

   ![Figure 5. TTC values of typical conflicts](image)

b. Surrogate Safety Measures

   - **Modified Swedish traffic conflict technique**
     - Modified conflict risk diagram for motorcycle-car conflicts

   ![Figure 6. Severity levels comparison](image)

3. CONCLUSIONS

- The importance of the parameters: following and lateral parameters, and the priority parameters (gap acceptance and clearance).
- Rear-end conflict consists of the highest occurring conflict.
- The less involved behaviour of bikes is normal, while that of AVs is cautious.
- 50% of interactions have no risk while the remaining 50% are split in different levels of risk.
- Results cannot be generalized (only simulation based).
- A conflict diagram needs to be constructed to better understand the severity of conflicts between vehicles (incl. AVs) and bicycles.

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