CPS: GOALI: Synergy: Maneuver and Data Optimization for High Confidence Testing of Future Automotive Cyber-Physical Systems

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The development of a toolchain for high confidence testing, validation, and verification of advanced, connected, and autonomous vehicles is required to support the introduction of such vehicles into mass production.

The development of such tools is pursued based on research into maneuver and data optimization using game theory, model-free trajectory optimization, data-driven anomaly detection, and Smart Black Box approaches to determine test trajectories and scenarios for vehicle testing.

$10^9$ vehicle operational hours of (conventional) testing would be needed to assure the same rate of reliability as existing human-driven cars[1].

Representative Finding

- In-traffic vehicle interactions can be modeled with Level-k game theory\cite{2}.

- Driving safety and performance can be assessed using game theoretic traffic simulation.
Representative Finding

- Autonomous driving algorithms that do not account for interactions between traffic participants may lead to significant amount of faults.

Rate of safety violations (percentage of 200-[s] simulation runs that has safety violations)

- Game theoretic traffic simulation highlights fault scenarios due to traffic interactions to inform testing

Safety violation scenarios due to traffic interactions.


Interactions may happen beyond perception.