

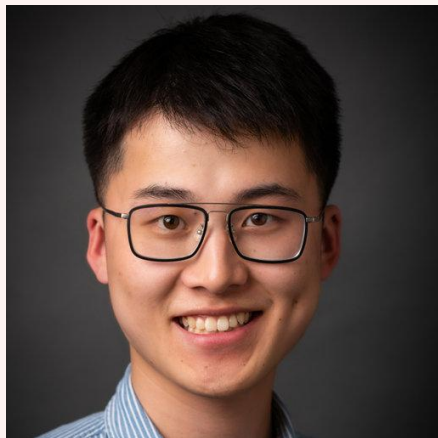
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Traffic-Rule-Compliant Motion Planning for Autonomous Vehicles Using Signal Temporal Logic

Dr. Yuanfei Lin
Technical University of Munich



摘要:

To enable autonomous vehicles to safely participate in traffic and avoid liability claims for car manufacturers, it is crucial that they obey traffic rules. We formalize traffic rules for interstates and intersections based on the German Road Traffic Regulation, the Vienna Convention on Road Traffic, and legal decisions from courts. This approach allows for the automatic and unambiguous verification of whether autonomous vehicles comply with traffic rules. We use Signal Temporal Logic (STL) to mathematically express these rules. Additionally, we demonstrate how to compute the quantitative measures of the STL formula, specifically robustness, in both a model-free and model predictive manner. This enables the integration of these rules into rule-compliant motion planning for autonomous vehicles. Furthermore, if there are numerous rules to consider and the nominal planner plans a trajectory that violates several of them, we propose repairing the trajectory instead of replanning it from scratch.

简介:

Yuanfei Lin is a fourth-year PhD student in the Cyber Physical Systems Group at the Technical University of Munich, under the supervision of Prof. Dr.-Ing. Matthias Althoff. He graduated with a Master of Science degree in Mechanical Engineering from the same university in 2020 and received a Bachelor of Engineering degree in Automotive Engineering from Tongji University, Shanghai, China, in 2018. From August 2023 to February 2024, he was a visiting research scholar at the University of California, Berkeley, working with Prof. Masayoshi Tomizuka. His research focuses on safe motion planning for autonomous vehicles, safe cooperative motion planning, and formal methods.