Computationally Efficient Safety Falsification of Adaptive Cruise Control Systems

Abstract: Falsification aims to disprove the safety of systems by providing counter-examples that lead to a violation of safety properties. In this work, we present two novel falsification methods to reveal safety flaws in adaptive cruise control (ACC) systems of automated vehicles. Our methods use rapidly-exploring random trees to generate motions for a leading vehicle such that the ACC under test causes a rear-end collision. By considering unsafe states and searching backward in time, we are able to drastically improve computation times and falsify even sophisticated ACC systems. The obtained collision scenarios reveal safety flaws of the ACC under test and can be directly used to improve the system’s design. We demonstrate the benefits of our methods by successfully falsifying the safety of state-of-the-art ACC systems and comparing the results to that of existing approaches.

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