Using Time-to-React based on Naturalistic Traffic Object Behavior for Scenario-Based Risk Assessment of Automated Driving

Abstract—The steady improvement of advanced driving assistance systems (ADAS) and the leap towards automated driving (AD) require novel methods for assessing the safety of those, which is a major subject for current research. Different proposals cope with the massive testing effort to assure the safety of such systems. These proposals include virtualization of testing, usage of stochastic methods and reduction of the necessary real world driving tests. Despite these different approaches, they all rely on the same basis: The behavior assessment of the vehicle under test, which results in a measurement of risk. This paper presents a novel approach to measure the criticality of a given driving scenario fitted on the requirements of testing. A Monte-Carlo simulation, which uses the input of a motion prediction model as variation parameters, determines the possible evolutions of a scenario at every time step. The distributions of these parameters have been fitted to data obtained by a large-scale field tests. These evolutions are then analyzed individually by
considering the Time-To-React (TTR) measure. Finally a single value of accident risk between 0 and 1 can be assigned to the scenario.