Autonomous Driving Examiner

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Autonomous driving is a major priority of our modern society with the great promise of dramatically reducing human fatalities and decreasing pollution. While many advances have already been achieved over the past decade, such as Tesla's cars driving in Autopilot mode on various roads within the US, the very accidents of some of these cars clearly expose the vulnerabilities of the current state-of-the-art. Will we ever be able to fully trust autonomous-driving controllers? What is needed so we can light-heartedly entrust our children to such highly automated vehicle, having them shuttled unattended across town? Human drivers have to prove their abilities to a driving examiner, before being allowed to drive autonomously. ADEX (Autonomous Driving Examiner) is an Austrian national project that, following this analogy, proposes a multidisciplinary approach to the design and synthesis of an autonomous-driving examination, which is agnostic to the particular design of an autonomous-driving controller, to expose its vulnerabilities or unknown flaws. The driving examination consists of a set of realistically simulated traffic situations, called scenarios, with various environment (other agents, weather, road, etc.) conditions. A special emphasis is put on edge cases rarely occurring in normal traffic, to allow uncovering hidden issues. For the autonomous-driver such edge cases might represent system limiting situations. Analysis of real-world traffic accidents is used to synthetically generate new, realistic and critical traffic scenarios for testing. Actions of the autonomous-driving controller are thoroughly quantified in form of rewards, that are then exploited by reinforcement-learning techniques, to more and more generate traffic situations in which the autonomous-driving controller would fail (towards safety, regulation and comfort criteria). As for the human-driving examination, if an autonomous-driving controller passes it, we as a society will achieve a greater confidence in the system's reliability and will be more inclined to accept it on our roads. In this talk, we present the outline of ADEX and show the preliminary results achieved in the first year of the project.