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Tactical decision-making for autonomous driving: A reinforcement learning approach

Date and location of defense: The seminar will be held in lecture hall FB, Fysikgården 4, Chalmers University of Technology, at 10.00 on June 5, 2019.

Abstract
The tactical decision-making task of an autonomous vehicle is challenging, due to the diversity of the environments the vehicle operates in, the uncertainty in the sensor information, and the complex interaction with other road users. This thesis introduces and compares three general approaches, based on reinforcement learning, to creating a tactical decision-making agent. The first method uses a genetic algorithm to automatically generate a rule based decision-making agent, whereas the second method is based on a Deep QNetwork agent. The third method combines the concepts of planning and learning, in the form of Monte Carlo tree search and deep reinforcement learning. The three approaches are applied to several highway driving cases in a simulated environment and outperform a commonly used baseline model by taking decisions that allow the vehicle to navigate 5% to 10% faster through dense traffic. However, the main advantage of the methods is their generality, which is indicated by applying them to conceptually different driving cases. Furthermore, this thesis introduces a novel way of applying a convolutional neural network architecture to a high level state description of interchangeable objects, which speeds up the learning process and eliminates all collisions in the test cases.