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Learning from Data for Traffic Control

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Data-driven methods are a promising approach for optimizing traffic control systems. Today's vehicle technology allows to collect an increasing amount of data to improve the vehicles'performance, reliability and safety. Concerning mobility infrastructure and communication technology, larger and larger datasets can be transmitted faster every year. Our goal is to use (real-time) data, communicated between cars and infrastructure, to improve traffic flow in the future and to support holistic, efficient and sustainable mobility solutions.

We therefore model different networks using a microscopic traffic simulation where Reinforcement Learning (RL) methods are used to let agents (vehicles) learn to drive more fluently through typical traffic situations. The agents obtain real-time information from other vehicles and learn to improve the traffic flow by repetitive observation and algorithmic optimization. Accordingly, we use RL to control traffic guidance systems, such as traffic lights. In [1], an illustrating example is given, where the traffic light system of the "Opel roundabout", Kaiserslautern's largest roundabout, is considered in a model –it has been set up and improved by Reinforcement Learning. As underlying model structures for all RL approaches, we use, e.g., linear models, radial-basis function networks and neural nets. In the future we plan to investigate the performance of other model variants, such as Gaussian Processes, and we will enhance this model-free approach with physics-based microscopic traffic models to improve the mathematical description of the underlying dynamical system.

[1] U. Baumgart. *Reinforcement Learning for Traffic Control.* Master's Thesis, University of Mannheim, 2019.

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