Head:	Dr. A. Kouvelas / Dr. M. Makridis
Topic:	**Machine Learning against Urban Network Disturbances**
Assistant:	Linghang Sun
Registration:	www.ivt.ethz.ch/en/studies/downloads/assignments.html#registration

Description:

Data-driven machine learning algorithms have been proven to be very powerful in multiple application scenarios in various disciplines. And for sure the same trend is also taking place in the field of transportation. Reinforcement learning (RL) is a type of advanced machine learning technique, which involves training agent(s) to implement control under a predefined environment. The agent interacts with such an environment to gain experience and learn from it. In comparison with the traditional methods based on control theory, the benefits of reinforcement learning lie in its model-agonistic characteristic and great flexibility to deal with nonlinearity under complex environments. Also, with proper setups, it can be empowered to anticipate disturbances with merely early signs.

Traffic networks are susceptible to disturbances and uncertainties, not only from the demand side but may also come from the model side. One common example could be, many researchers study an urban network based on the concept of a “well-defined” Macroscopic Fundamental Diagram (MFD). However, based on some other findings, the MFD model itself can be affected by disturbances and thus cannot remain “well-defined” anymore. Although traditional control-based methods are able to yield accurate results under no disturbances, they may fail hard with their precisely optimized results when things start to change and are off expectation.

This assignment aims to design and test RL-based methods when disturbances are taking place in a predefined scenario and observe whether they would be capable of making the smart choices, which lead to more resilient or even antifragile networks.

Links:	-
Additional remarks:	Individual work recommended
Minimum credits:	8-11 ECTS based on the study program and the type of thesis
Recommended lectures:	101-0416-10L Road Transport Systems 103-0849-00L Multivariate Statistik und Machine Learning
Additional remarks:	Programming skills in Python are required A basic understanding of transportation models and metrics is needed A basic understanding of machine learning is of necessity Knowledge of reinforcement learning is recommended but not required Interested students may contact linghang.sun@ivt.baug.ethz.ch