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Masterarbeit / Bachelorarbeit / Studienarbeit

Machine Learning for Dynamic Transportation Processes

Machine learning offers some of today's most promising methods in data driven modeling of complex dynamic processes. It utilizes given data of a process to estimate mathematical models in order to make predictions of the process. To deal with nonlinear *dynamic* processes is the most challenging part of machine learning, since not only the nonlinearity of the process needs to be modeled but also the dynamics have to be part of the estimated model.
During the last decade, different model architectures have been developed to describe dynamic processes. Ranging from external dynamic to complex internal dynamic approaches, a wide range of different architectures exist to model dynamical processes. Dependent on the process, the choice of the model architecture is important to be able to model the process accurately but only marginally suffering from overfitting to the training data.

In this work the special class of transportation processes should be investigated. Transportation processes have the special property of containing pure time delays in its dynamics which need to be treated in a different way than other linear dynamics. Especially if the time delay cannot be compensated before learning, the model architecture needs to be capable of modelling pure time delays.

Figure 1: Block diagram of a nonlinear dynamic process with pure time delay in the transportation part

Therefore, in this task common dynamical model architectures should be investigated and evaluated regarding their possibility to capture the behavior of the described transportation processes. The focus should be placed on the capability of different model architectures to model internal pure time delays pre- and succeeded by nonlinear dynamics. Finally, one favored method should be applied to a real-world process.

Work Packages:

- Literature research
- Choice and implementation of a synthetic transportation example process
- Generation of synthetic data for training and testing purpose
- Training and comparison of different model architectures
- Application of chosen model architecture to a real-world process
- Documentation

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