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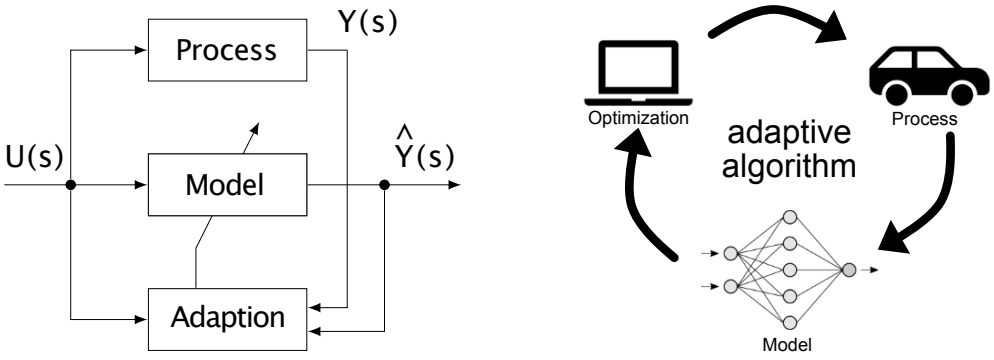
Adaptive Model Identification with Evolving Local Model Networks

Learning systems are often a key feature in automatization of complex processes. Learning of the process behavior is mostly done by utilizing measured data of the process. With machine learning a powerful tool for automatic learning from data is available. It uses the information contained in the data to model the system behavior. Normally this is done offline from previously collected datasets. A special case in which such an approach does not work is represented by temporarily changing operation conditions or processes. Adaptive identification methods show superior behavior in these cases, because they can handle measured data straight from collecting. This enables adaptive methods to change their models over time while new data are collected. If working conditions or the process itself changes during operation the adaptive method can track these changes an incorporate them direct into the model. For example, an adaptive system is able to learn the driving style of a car driver. Based on the learned behavior, forecasts can be calculated, e.g., about possible travel times. If a new driver enters the car, the system learns the new driving style and is able to adapt the forecast to the new conditions.



Block diagram and principal work flow of adaptive model identification

In this work the goal is to find different possibilities to utilize local model networks for adaptive system identification. Local model networks have shown good behavior in approximation of nonlinear processes. Normally the collected data are used to find a good partition of the input space in order to model the nonlinearity. An adaptive approach hasn't got all the data at the beginning, so a solution has to be found either to start with a good initial partition or to find this partition while operating and measuring the process. To track temporarily changing processes the parameter of the local models as well as the partition of the network can be adapted. Therefore, a robust way for changing these parameters should be found and investigated in this work. Finally, an example scenario is chosen to simulate and investigate the behavior of the implemented algorithms.

Work packages:

- Literature research on evolving local model networks
- MATLAB Implementation of different approaches for evolving local model networks
- Investigation and comparison of the different approaches regarding their learning behavior
- Application to an example scenario

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