TECHNISCHE UNIVERSITÄT MÜNCHEN
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B A C H E L O R T H E S I S
for
N.N.
Student ID XXXXXXX, Degree XX-XX

Learning Control for Gaussian Process Models

Problem description:

Research at the intersection of machine learning and control made impressive advances over the past years. Data-driven identification using Gaussian processes have been successfully employed in various control tasks [2]. However, many approaches separate the learning phase (data measuring and model training) and the control phase [3].
Learning control techniques allow to improve the model during the execution of the control law [1]. However, this comes with various theoretical and practical challenges e.g. stability analysis of hybrid systems or high demand on processing and storing the constantly growing data set.
The goal of this thesis is to investigate the limits of data-driven learning control and to improve and generalize existing methods. Particular focus is set on the efficient management of the stored data and the frequency at which measurements are taken. A theoretic analysis and an evaluation in simulation of the proposed approach is performed.

Tasks:

- Literature research on Gaussian processes and learning control
- Enhancement of existing learning-based control methods
- Implementation and evaluation of the proposed concept.

Bibliography:

[1] G. Chowdhary, H. A. Kingravi, J. P. How, and P. A. Vela. Bayesian nonparametric adaptive control using Gaussian processes. *IEEE Transactions on Neural Networks and Learning Systems*, 26(3):537–550, March 2015.
[2] Carl Edward Rasmussen and Christopher KI Williams. *Gaussian Processes for Machine Learning*. MIT Press, Cambridge, MA, USA, January 2006.
[3] J. Umlauft, T. Beckers, M. Kimmel, and S. Hirche. Feedback linearization using Gaussian processes. In *Conference on Decision and Control (CDC)*, pages 5249–5255. IEEE, Dec 2017.

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