

## MASTER'S THESIS

### Learning control using Gaussian Processes

#### Problem description:

Recent times have seen considerable advances in the field of machine learning, which have led to remarkable results when applied to complex settings [3]. As such, machine learning has recently seen increased usage in the field of control, particularly when the task at hand is too intricate to be modeled solely by employing first-principles. However, attaining good results via machine learning is often difficult in settings where simultaneously safety constraints have to be guaranteed. To mitigate this, recent research efforts have merged tools from control theory and machine learning to guarantee system safety during the learning procedure [1, 2].

Given a setting where system knowledge is limited, the goal of this thesis is to employ state-of-the-art tools from control theory and machine learning to safely learn and solve control tasks.

#### Tasks:

#### Bibliography:

- [1] Berkenkamp, F., M. Turchetta, A. Schoellig, and A. Krause (2017). Safe model-based reinforcement learning with stability guarantees. In I. Guyon, U. V. Luxburg, S. Bengio, H. Wallach, R. Fergus, S. Vishwanathan, and R. Garnett (Eds.), *Advances in Neural Information Processing Systems 30*, pp. 908–918. Curran Associates, Inc.
- [2] Koller, T., F. Berkenkamp, M. Turchetta, and A. Krause (2018). Learning-based model predictive control for safe exploration and reinforcement learning. *arXiv preprint arXiv:1803.08287*.
- [3] Silver, D., A. Huang, C. J. Maddison, A. Guez, L. Sifre, G. Van Den Driessche, J. Schrittwieser, I. Antonoglou, V. Panneershelvam, M. Lanctot, et al. (2016). Mastering the game of go with deep neural networks and tree search. *Nature 529*(7587), 484–489.

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Start: XX.XX.XX  
Intermediate Report: XX.XX.XX  
Delivery: XX.XX.XX

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