# Machine Learning-supported Embedded Model Predictive Control

Proposal for a Master's Thesis Topic

Model predictive control (MPC) is an optimization- and model-based control technique. It is simultaneously the most adopted advanced control technique in the industry and a very active research field in academia. MPC allows to directly include constraints and prior knowledge about the controlled system and uses the resulting model for predicting into the future. It then determines an optimal control sequence for the whole prediction horizon. However, this comes at a high computational cost, since in general case it requires to iteratively solve nonlinear optimal control problems online.
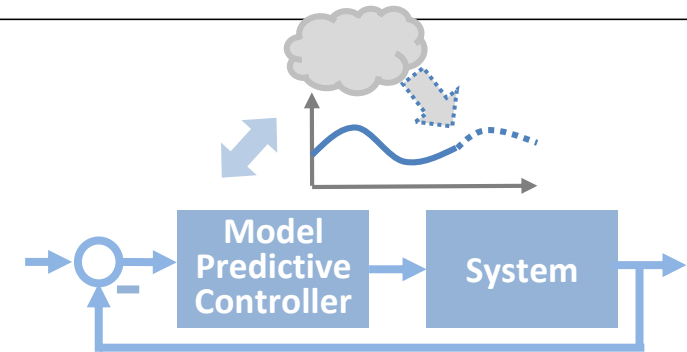
The goal of this thesis is to determine the viability of deploying MPC controllers on embedded platforms. Research directions can include investigation of efficiency of modern optimization toolboxes (acados, NeuroMANCER, etc.), as well as Machine Learning frameworks (PyTorch, TensorFlow) with the emphasis on low-power computing hardware. The thesis should include generation of an optimal control problem and a simulation study employing the aforementioned frameworks.
The following prerequisites will be useful for the project

$$\Xi := \min_u \int F(x(\tau, u(\tau)) \mathrm{d}\tau$$

Experience with / knowledge about:	Model predictive control, Optimization and Optimal Control, differential equations
Programming skills:	Matlab or Python
Language:	German or English

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