Open Invited Track at the IFAC World Congress 2020

Machine Learning and Model Predictive Control

Proposers:

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Description:

Model predictive control (MPC) is a popular optimization-based control strategy owing to its ability to handle systems with multivariable dynamics, nonlinearities, and constraints. Due to its versatility and the ability to provide robustness, safety guarantees and economics-oriented control, MPC has recently found increasing applications in unmanned vehicles, robotics for the control of quadrotors, humanoid robots, energy systems and biomedical systems. Yet, many MPC applications face important challenges related to the difficulty of modeling complex systems or the need for MPC strategies with provably safe and robust performance that have low online computational and memory requirements

The last years have witnessed an enormous interest in the use of machine learning techniques in different fields, including control systems, which is partly driven by the demonstrated success of machine learning methods in the field of computer science, but also by the increasing availability of data as well as new computation, sensing and communication capabilities.

The integration of machine learning in model predictive control, e.g., in the form of learning a system's model, the cost function or even the control law directly, raises fundamental challenges related to the controller properties, such as stability, convergence, constraint satisfaction and performance under uncertainty. The main motivation of this Open Invited Track is to encourage research at the interface between machine learning and model predictive control, which can provide important synergies and contribute to address the arising challenges.

This Open Invited Track will focus on how recent advances in machine learning can be leveraged to develop and deploy improved MPC schemes. The expected topics include, but are not limited to:

- Approximation of complex MPC laws using machine learning
- Machine learning for adaptive and learning-based MPC
- MPC based on machine learning models
- Reinforcement learning and MPC

We welcome contributions that focus on the development of theoretical guarantees, methods and software as well as challenging applications.