Institut für Systemtheorie und Regelungstechnik
Universität Stuttgart

Open Thesis (MA)

Multiple Thesis Opportunities on Guarantees for Learning-Based Control

Description:

As modern control systems become more complex and uncertain, traditional, purely model-based controller design approaches often fall short. This creates a need for techniques that tightly integrate (machine) learning and control. Addressing these challenges in stochastic environments involves concepts from diverse fields such as:

i) finite-sample statistics (for sample complexity analysis)
ii) system identification (for suitable estimators)
iii) theoretical machine learning (for performance measures such as regret).

Hereby, the core objectives are understanding how noisy data influences estimates and controller performance and designing learning algorithms that can reliably handle and reduce uncertainty.

Research questions that can be explored within a thesis include, but are not limited to:

- What are the fundamental limits and sample complexity of learning (to control) dynamical systems from finite data?
- How can linear approximations of nonlinear systems reliably be learned from noisy data and used in control?
- How should online learning/adaptive control algorithms act in time-varying environments to achieve performance guarantees?
- How can theoretical insights be used in practical applications?

Prerequisites:

- *Concepts of Automatic Control* or similar
- Interest in data-driven control, statistics, and theoretical machine learning

Supervisor:

Nicolas Chatzikiriakos
Room 3.244

Area:

Learning-based Control
Theoretical Machine Learning
Statistical Learning Theory

Properties:

Type: **MA**

25% literature
50% theory
25% programming

Distribution varies for the given RQ

Beginning:

anytime

Further information: http://www.ist.uni-stuttgart.de/teaching/bama