מכון ויצמן למדע

THE WEIZMANN INSTITUTE OF SCIENCE

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Machine Learning and Statistics Seminar

Room 1 ,Ziskind Building
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Learning Linear-Quadratic Regulators Efficiently with only $\sqrt{T}$ Regret

Abstract:

The linear-quadratic regulator is a simple and ubiquitous model in optimal control. Classical results in control theory pertain to asymptotic convergence and stability of such systems. Recently, it has received renewed interest from a learning-theoretic perspective with a focus on computational tractability and finite-time convergence guarantees. Among the most challenging problems in LQ control is that of adaptive control: regulating a system with parameters that are initially unknown and have to be learned while incurring the associated costs. In its modern incarnation, this problem is approached through the lens of online learning with partial feedback (e.g., multi-armed bandits) and regret minimization. Still, recent results derive algorithms that are either computationally intractable or suffer from high regret. In this talk, I will present the first computationally-efficient algorithm with $\widetilde O(\sqrt{T})$ regret for learning in linear quadratic control systems with unknown dynamics. By that, this resolves an open question of Abbasi-Yadkori and Szepesvari (2011) and Dean, Mania, Matni, Recht, and Tu (2018). The key to the efficiency of our algorithm is in a novel reformulation of the LQ control problem as a convex semi-definite program. This is joint work with Tomer Koren and Yishay Mansour presented at ICML 2019.