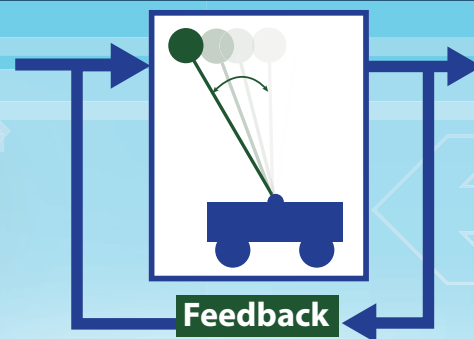


COLLEGE OF ENGINEERING

Control Seminar



Sponsored by: Bosch, Ford, and Toyota

Reinforcement Learning for Control of Unknown Autonomous Systems



RAHUL JAIN

Chair and Associate Professor
University of Southern California

Friday, February 1, 2019

3:30 – 4:30 pm 1500 EECS

ABSTRACT: System Identification followed by control synthesis has long been the dominant paradigm for control engineers. And yet, many autonomous systems must learn and control at the same time. Adaptive Control Theory has indeed been motivated by this need. But it has focused on asymptotic stability while many contemporary applications demand finite time (non-asymptotic) performance optimality. Practical algorithms for stochastic adaptive control are rare, if not unknown. In this talk, I will first propose Reinforcement Learning algorithms inspired by recent developments in Online (bandit) Learning. Two settings will be considered: Markov decision processes (MDPs) and Linear stochastic systems. We will introduce a posterior-sampling based regret-minimization learning algorithm that optimally trades off exploration v. exploitation and achieves order optimal regret. This is a practical algorithm that obviates the need for expensive computation and achieves non-asymptotic regret optimality. I will then talk about a general non-parametric stochastic system model on continuous state spaces. Designing universal control algorithms (that work for any problem) for such settings (even with a known model) that are provably (approximately) optimal has long been challenging problem in both Stochastic Control and Reinforcement Learning. I will propose a simple algorithm that combines randomized function approximation in universal function approximation spaces with Empirical Q-Value Learning which is not only universal but also approximately optimal with high probability.

BIO: Rahul Jain is the K.C. Dahlberg Early Career Chair and Associate Professor of Electrical Engineering, Computer Science* and ISE* (*by courtesy) at the University of Southern California (USC). He received a B.Tech from IIT Kanpur, an MA in Statistics and a PhD in EECS from the University of California, Berkeley. He has received numerous awards including the NSF CAREER award, the ONR Young Investigator award, an IBM Faculty award, the James H. Zumberge Faculty Research and Innovation Award, and is currently a US Fulbright Scholar. His interests span reinforcement learning, stochastic control, statistical learning, stochastic networks, and game theory, and power systems, transportation and healthcare on the applications side.

M | **ECE** ELECTRICAL &
COMPUTER ENGINEERING
UNIVERSITY OF MICHIGAN

BOSCH



Questions? Contact: Judi Jones asap@umich.edu