Markov Decision Processes with Parametric Uncertainty

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Talk will take place from 11:15AM - 12:05PM in Freeman Auditorium (also viewable through Zoom).

Abstract: Markov decision processes (MDPs) can model dynamic optimization problems in several applications such as inventory control, revenue management, pricing, supply chains, and logistics and transportation. Any MDP model requires two sets of critical input parameters - (i) rewards earned and (ii) system-state transition probabilities - both induced by a decision-maker's choice of actions. System-performance is sensitive to the estimated values of these parameters that were utilized while making decisions. Decision-makers are thus interested in developing models and corresponding solution methods that are explicitly cognizant of the uncertainty in these parameter values. I will present four approaches that attempt to tackle this challenge - inverse optimization to impute transition probabilities; robust optimization using data-driven distance-based ambiguity sets; information-theoretic methods for episodic Bayesian Reinforcement Learning; and percentile optimization in multi-armed bandit problems with extensions to weakly coupled MDPs. The talk will include rigorous theoretical analyses, convex programming (re)formulations, and modeling and computational examples. It will be based on joint work with three PhD students in my group.

Bio: Dr. Ghate is a Professor and Associate Chair of Industrial and Systems Engineering at the University of Washington (UW) in Seattle. He held a College of Engineering Endowed Professorship at UW from 2016-2021. He joined UW as an Assistant Professor after receiving a PhD in Industrial and Operations Engineering from the University of Michigan in 2006, and an MS in Management Science and Engineering from Stanford in 2003. He completed his undergraduate education at the Indian Institute of Technology, Bombay, in 2001. Archis is a recipient of the NSF

CAREER award, and the award for Excellence in Teaching Operations Research from the Institute of Industrial and Systems Engineers (IISE). He has served on the editorial boards of five journals and authored over 50 articles on optimization under uncertainty. He has supervised doctoral dissertations of 15 students. Several of these were funded in part by the NSF. Archis served as the General Chair of INFORMS 2019 and a Program Co-Chair of the 2021 IISE Annual Conference.