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Engineering Management, Information, and Systems
Seminar Series

Research Seminar

Dealing with Model Uncertainty in Markov Decision Processes for Chronic Diseases



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11:00 a.m. – 12:15 p.m.

Zoom link: <https://smu.zoom.us/j/95095343594>

Abstract: Optimization of sequential decision-making under uncertainty is important in many contexts, including chronic diseases, but ambiguity in the underlying models introduces significant challenges. In the context of chronic disease management, Markov decision processes (MDPs) have been used to optimize the delivery of medical interventions in a way that balances the immediate harms and costs with the uncertain future health benefits associated

with these interventions. Unfortunately, treatment recommendations that result from MDPs can depend heavily on the model of the chronic disease, and there are often multiple plausible models due to conflicting data sources or differing opinions among medical experts. To address this problem, we introduce a new framework in which a decision-maker can consider multiple models of the MDP's ambiguous parameters and seeks to find a strategy that maximizes the weighted performance with respect to each of these models of the MDP. We establish connections to other models in the stochastic optimization literature, derive complexity results, and establish solution methods for solving these problems. We illustrate our approach in the context of preventative treatment for cardiovascular disease, and end with a summary of the most important conclusions of our study. This is joint work with Lauren Steimle (University of Michigan), David Kauffman (University of Michigan – Dearborn).

Biography: Brian Denton's research interests are in data-driven sequential decision making and optimization under uncertainty with applications to medicine. He is Chair of the Department of Industrial and Operations Engineering and he has a cross-appointment in the School of Medicine at University of Michigan. Before joining the University of Michigan he worked at IBM, Mayo Clinic, and North Carolina State University. He has co-authored more than 100 journal articles, conference proceedings, book chapters, and patents. He is past Chair of the INFORMS Health Applications Section, past Secretary of INFORMS, and past President of INFORMS.