

WILLIAM W. BOYER LECTURE SERIES

Discrete Choice Enhanced with Machine Learning Capabilities

Moshe Ben-Akiva

Edmund K. Turner Professor of Civil and
Environmental Engineering
Director, Intelligent Transportation Systems Lab
Massachusetts Institute of Technology



This presentation introduces a novel framework for integrating data-driven flexibility into the specification and selection in Discrete Choice Analysis (DCA) models. Traditional DCA often relies on restrictive and sometimes arbitrary specification assumptions, which undermine credibility and overstate predictive certainty.

Building on well-established DCA models, such as multivariate extreme value and logit mixture models, our framework relaxes functional and distributional assumptions while explicitly incorporating behavioral theory constraints (e.g. sign, regularity, shape). These constraints preserve interpretability and trust, ensuring the resulting models remain consistent with foundational economic and behavioral principles. This expanded scope of inference enhances predictive accuracy and overall model credibility. Hypothesis tests are developed to validate the consistency of the imposed constraints with observed data.

The added flexibility comes at the expense of increased complexity, both computational and algorithmic. Specialized solutions are developed for each application of the framework leveraging recent advances in mixed-integer and conic optimization (for classical estimation) and Markov Chain Monte Carlo (for Bayesian inference). Ongoing research focuses on scalable and generalized algorithms for broader applications.

This framework well-positions DCA to realize synergies between the data-driven and theory-based paradigms.

Friday, May 2, 2025 • 2:30pm

Bernie Dallas Room, Goodell Building,
University of Massachusetts Amherst

Reception to immediately follow



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*Professor William W. Boyer was instrumental in the development of the
UMass Transportation Program in the 1950s, 60s and 70s.*

