Statistics Seminar

Department of Mathematics and Statistics

DATE:	Thursday, March 26, 2026
TIME:	1:30pm – 2:30pm
LOCATION:	WH 100E
SPEAKER:	Roman Semenko, Binghamton University
TITLE:	Reasoning under uncertainty: Dempster–Shafer theory and algorithmic approaches to belief updating

Abstract

Dempster–Shafer (D–S) theory of evidence is a mathematical framework for reasoning under uncertainty that extends classical probability by allowing belief to be assigned to sets of hypotheses and explicitly modeling ignorance. Unlike Bayesian approaches, D–S theory does not require complete prior information and instead represents uncertainty through belief and plausibility functions defined over a frame of discernment. Evidence from multiple sources is combined using Dempster's or other rules, which aggregates agreement while accounting for conflict between sources.

Building on this theoretical foundation, the paper introduces algorithmic methods that operationalize D–S theory for practical applications in complex systems. In particular, the Implication Induction Algorithm is used to extract relationships and infer rules from uncertain or incomplete data, while the Belief Revision Algorithm provides a mechanism for dynamically updating beliefs as new evidence becomes available. These algorithms address key limitations of traditional D–S theory, including handling dependent evidence and improving robustness in the presence of conflicting information.

Together, the integration of belief-based theory with algorithmic techniques provides a flexible and powerful framework for modeling uncertainty, supporting reliable inference and decision-making in domains such as software reliability prediction and data-driven systems.