Department of Applied and Computational Mathematics and Statistics Colloquium

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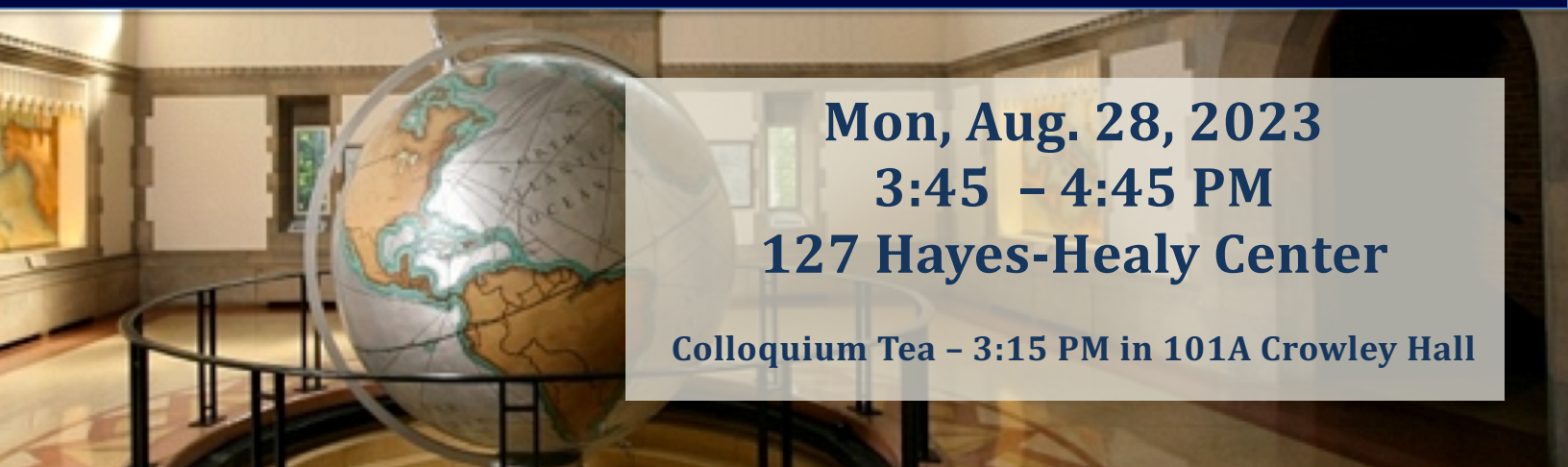
Repro Samples Method for Irregular Inference Problems and for Unraveling Machine Learning Blackboxes

Rapid data science developments require us to have innovative frameworks to tackle often seen but highly non-trivial ``irregular inference problems,'' e.g., those involving discrete or non-numerical parameters and those involving non-numerical data, etc. This talk presents a novel, effective, and wide-reaching framework, called repro samples method, to conduct statistical inference for the irregular problems plus more. We develop both theories to support the development and provide effective computing algorithms for problems in which explicit solutions are not available. The method is likelihood-free and is particularly effective for irregular inference problems. For commonly encountered irregular inference problems that involve both discrete (or nonnumerical) and continuous parameters, we propose an effective three-step procedure to make inference for all parameters and develop a unique matching scheme that turns the disadvantage of lacking tools to handle discrete/nonnumerical parameters into an advantage of improving computational efficiency. The effectiveness of the proposed method is illustrated through case studies by solving two open inference problems in statistics: a) how to make inference for the unknown number of components in a normal mixture model; b) how to construct confidence sets for the unknown true model, the regression coefficients, or both true model and coefficients jointly in a high dimensional regression model. Although the two case studies pertain to the traditional statistics models, the method also has direct extensions to complex machine learning models, e.g., (ensemble) tree models, neural networks, graphical models, etc. It provides a new toolbox to develop interpretable AI and unravel machine learning blackboxes.



Mon, Aug. 28, 2023
3:45 – 4:45 PM
127 Hayes-Healy Center

Colloquium Tea – 3:15 PM in 101A Crowley Hall