# Statistics Seminar

Department of Mathematics and Statistics

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| **DATE:** | Thursday, December 05, 2024 |
| **TIME:** | 1:15pm – 2:15pm |
| **LOCATION:** | WH 100E |
| **SPEAKER:** | Baozhen Wang, Binghamton University |
| **TITLE:** | Conformal Prediction Methods for Distribution Shifts and Causal Effect Estimation |


**Abstract**

Conformal prediction is a distribution-free framework to quantify uncertainty by generating prediction sets that contain the true response with a user-specified probability. Conformal prediction is highly valuable across domains, as it does not rely on assumptions about the underlying data distribution, ensuring reliable predictions even in complex, real-world applications. Despite its strengths, conformal prediction faces several limitations that restrict its utility in practical settings: it relies on the exchangeability between training and test data, which limits its effectiveness under distribution shifts; the prediction efficiency depends on the choice of score functions, and current methods can yield conservative prediction intervals that hinder practical usability. We aim to address these limitations from three aspects, extending conformal prediction to broader settings with enhanced efficiency and reliability.

In the first work, we develop a weighted conformal classification method for covariate shift with posterior drift (CSPD), where both feature distributions and conditional distribution of labels given features differ between the source and the target data. The second work studies conformal prediction for causal inference. By choosing the conditional densities as the score function, we utilize a reference distribution technique to produce valid, narrower prediction intervals for individual treatment effects (ITE), improving state-of-the-art methods. Finally, the third work introduces a penalized approach to conformal prediction in regression, optimizing interval length while maintaining coverage guarantees.