

**Title: The Wolf Will Live with the Lamb: Combining Conformal Prediction with Bayesian Approaches to Enhance Heterogeneity Detection in Clinical Trials**

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**Abstract:**

In clinical trials, understanding and assessing heterogeneity is crucial for personalized medicine and optimizing treatment strategies. This presentation introduces a novel ensemble approach that leverages causal machine learning methods to enhance the detection and assessment of heterogeneity in clinical trials.

Causal machine learning excels at identifying and interpreting the relationships between variables, enabling a more nuanced understanding of how different patient subgroups respond to treatments. However, selecting the optimal causal ml method is challenging due to frequent disagreements among algorithms, each offering unique advantages and limitations.

In addition, many of the causal ML methods still lack well understood uncertainty estimates, especially in finite samples that are common in clinical trials. We have developed a framework for estimating uncertainty for finite samples using Conformal prediction.

Our methodology addresses this challenge by integrating a weighted combination of different algorithms through a Bayesian approach taking the model uncertainty into account thereby capitalizing on the strengths of multiple models. This fusion results in robust performance across a wide range of different data generation processes.

We will present a simulation study demonstrating the application of our approach in clinical trial scenarios, highlighting its ability to uncover nuanced insights into patient subgroups and treatment effects. This work represents a significant step forward in the use of machine learning for improving clinical trial design and personalized medicine, providing a practical and powerful tool for researchers and clinicians alike.