双边市场研讨会第一期

会议时间：2024.9.19（周四） 8:30-12:30

会议方式：腾讯会议 #197-410-492

08:30-12:30	双边市场研讨会第一期

08:30-09:10　【1】报告题目：**Responsible Bandit Learning for More Powerful Response-Adaptive Randomization Design via Mean-Volatility Statistics**

报告人：严晓东，西安交通大学

内容摘要：Equal Randomization and Response-Adaptive Randomization represent prevalent methodologies for allocating units across treatment arms in clinical trials. The conventional Wald statistical test, employed to assess treatment efficacy, elucidates a trade-off between statistical power and regret, stemming from the complexities in precisely estimating the variance of efficacy across divergent sample sizes. Generally, Equal Randomization is favored for augmenting statistical power, thereby facilitating the identification of a superior treatment arm during the trial. Conversely, Response-Adaptive Randomization is advantageous for minimizing regret within the trial by preferentially assigning a more significant number of participants to the more effective treatment arm.

To resolve this dilemma, we introduce a novel Mean-Volatility statistic that incorporates both the treatment effect's mean and volatility, suitable for strategy formulation and hypothesis testing. Utilizing this statistic, this work proposes an innovative clinical trial design Bandit process-based Response-Adaptive Randomization design (BRAR), which aims to integrate decision-making information into hypothesis testing, thereby striving to simultaneously enhance statistical power and reduce regret in comparison to existing methodologies. The efficacy of these approaches is substantiated by theoretical analysis and empirical numerical studies.

09:20-10:00　【2】报告题目：**A Two-armed Bandit Framework for Causal Inference**

报告人： 王晋娟，北京理工大学

内容摘要：Causal inference holds critical importance across a diverse spectrum of domains. Various methods have been proposed to infer the causal effect of a newly developed treatment relative to the control. This paper introduces a two-armed bandit framework for testing the average treatment effect.The proposed procedure initially leverages doubly robust estimation to generate pseudo outcomes. Subsequently, it employs a two-armed bandit strategy to construct the test

statistic,accompanied with a permutation-based method to enhance power.

The efficacy of the proposed method is demonstrated through asymptotic theories, numerical simulations and the application of real-world data, showcasing its superior performance in comparison to existing methods.

10：10−10：50　**【3】报告题目：Strategic Sequential Test for Qualitative Treatment Effects**
报告人：陈熙，科技部中信所

内容摘要：Internet and technology companies widely use A/B testing to evaluate the average treatment effect of strategies. However, in scenarios such as recommendation systems in internet companies, personalized medicine, and policy evaluations for specific regions, it is crucial to examine Qualitative Treatment Effects (QTE). Additionally, traditional A/B testing typically relies on the Central Limit Theorem under the assumption of independent and identically distributed (i.i.d.) samples, where the test statistic under the null hypothesis follows a standard normal distribution. Therefore, improving the testing power is also a significant issue that needs to be addressed. This paper develops a sequential testing algorithm for Qualitative Treatment Effects, with the main contributions as follows:

(i) Introducing two-armed bandit test statistics under the framework of strategy limits to the field of Casual Effects testing, which enhances testing power compared to traditional T-test based A/B testing;

(ii) Extending this method to online testing and proposing corresponding dual-optimal strategies to maximize the treatment effect received by experimental subjects while maintaining testing power;
(iii) Further improving testing efficiency through sequential testing and employing the bootstrap method to assist in determining boundaries.

11：00−11：40　**【4】报告题目：Utility-driven Bandit Learning for Matching Markets with Hypothesis Testing**
报告人：赵珊珊，山东大学

内容摘要：Bandit learning algorithms gradually optimize decision-making strategies by balancing exploration and exploitation and have been widely

applied in scenarios such as online ride-hailing, advertising recommendation, and personalized medicine. However, the optimization goal of most bandit algorithms is to maximize cumulative rewards, which means that the strategies fail to capture the uncertainty in the decision-making process, making them unreliable. This paper constructs a utility-driven strategy by incorporating the uncertainty of rewards as a new objective, as it aims to maximize the probability of achieving the anticipated goal c while considering the expected utility. This paper theoretically proves that the proposed utility-driven bandit learning achieves the fastest convergence rate among current bandit algorithms and generates stronger statistical power than classical tests based on normality. The conducted simulation studies further support the theoretical findings. Ultimately, the proposed strategy was applied to market matching scenarios, and it was found that our strategy can maximize the fairness of market matching.

11:50-12:10　　【5】报告题目:**多臂老虎机在工程中的应用与挑战**
报告人：张宇，山东大学