Covariate-Adaptive Randomization in Clinical Trials: New Procedures and Their Statistical Inference

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Covariate balance is one of the most important concerns for successful comparative studies (about causal effects), such as causal inference, online A/B testing and clinical trials. However, chance imbalance may still exist in traditional randomized experiments, and are substantial increasing in big data. In this talk, we discuss several new adaptive designs and their advantages. The proposed methods show substantial advantages over the traditional methods in terms of the covariate balance and computational time.

Since the randomization inevitably uses the covariate information when forming balanced treatment assignments, the validity of classical statistical inference following such randomization is often unclear in literature. We derived the theoretical properties of statistical inference post general covariate-adjusted randomization under the linear model framework. More important, we explicitly unveil the relationship between covariate-adjusted designs and inference properties. We apply the proposed general theory to commonly used procedures and compare their performance analytically. These results open a new door to understand and analyze comparative studies based on covariate-adjusted randomization.