中央研究院統計科學研究所

學 術 演 講

講 題：Nonparametric Inference on Dose-Response Curves Without the Positivity Condition

演 講 人：Prof. Yen-Chi Chen

Department of Statistics, University of Washington

時 間： 2024-08-26(Mon.) 10:30-12:00

地 點：Auditorium, B1F, Institute of Statistical Science；The tea reception will be held at 10:10.

備 註： Online live streaming through Cisco Webex will be available.

Abstract

Existing statistical methods in causal inference often rely on the assumption that every individual has some chance of receiving any treatment level regardless of its associated covariates, which is known as the positivity condition. This assumption could be violated in observational studies with continuous treatments. In this paper, we present a novel integral estimator of the causal effects with continuous treatments (i.e., dose-response curves) without requiring the positivity condition. Our approach involves estimating the derivative function of the treatment effect on each observed data sample and integrating it to the treatment level of interest so as to address the bias resulting from the lack of positivity condition. The validity of our approach relies on an alternative weaker assumption that can be satisfied by additive confounding models. We provide a fast and reliable numerical recipe for computing our estimator in practice and derive its related asymptotic theory. To conduct valid inference on the dose-response curve and its derivative, we propose using the nonparametric bootstrap and establish its consistency. The practical performances of our proposed estimators are validated through simulation studies and an analysis of the effect of air pollution exposure (PM2.5) on cardiovascular mortality rates.

Link: https://arxiv.org/pdf/2405.09003

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