University of California, Irvine
Statistics Seminar

Causal Inference and Machine Learning in Mobile Health

Tianchen Qian
Assistant Professor
UCI

4 p.m., Thursday, Oct. 24, 2024
6011 Donald Bren Hall

Mobile health (mHealth) interventions, such as text messages and push notifications targeting behavior change, are a promising alternative to in-person healthcare. Understanding how the effect of an mHealth intervention varies over time and with contextual information is critical for optimizing the intervention and advancing domain knowledge. We discuss two projects that showcase the use of causal inference and machine learning in answering such questions. In the first project, we assess how a push notification suggesting physical activity influences individuals' step counts using data from a micro-randomized trial. We propose the first semiparametric causal excursion effect model with varying coefficients to model the time-varying effects within a decision point and across decision points. Our analysis reveals new insights into individuals' change in response profiles due to the activity suggestions. In the second project, we study the theoretical limit of efficient estimation (i.e., semiparametric efficiency) for the causal effects of mHealth interventions. We propose a class of two-stage estimators that achieve the efficiency bound. Through real data applications and numerical experiments, we show how supervised learning and cross-fitting lead to substantial variance reduction and robustness against misspecified working models.