Estimating causal Effects from Complex Longitudinal Data via Point Effects of Treatments

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Abstract

Background and purpose: In many practices, one assigns a sequence of treatments to influence a certain outcome of interest. Between treatments, there exist the time-dependent covariates, which may have influences from earlier treatments and on subsequent treatments. From the complex longitudinal data, one aims to estimate the causal effect of a sequence of treatments on the outcome.
Challenges: Usually, one estimates the causal effect by modeling the standard parameters, i.e., the conditional mean of the outcome given all treatments and covariates. However, these parameters are essentially all different (null paradox). Furthermore, the dimension of the parameters is huge (curse of dimensionality).
Solutions: Instead of standard parameters, Wang and Yin estimated the causal effect by modeling the point effects of treatments in the sequence. The point effect is simply the effect of single-point treatment in single-point causal inference and its estimation is well studied.
Achievements: We have applied this method to a longitudinal study of COVID-19 progression during the first-wave pandemic and found that Swedish measure during the initial period have a long-term causal effect on the COVID-19 mortality as compared to the measures adopted by the other Nordic countries.

Keywords

long-term causal effect; short-term causal effect; point effect; COVID-19 progression

References:

Wang, X. and Yin, L. (2020). New G-Formula for the Sequential Causal Effect and Blip Effect of Treatment in Sequential Causal Inference. *Annals of Statistics*, 48: 138-160 .