Yale SCHOOL OF PUBLIC HEALTH

Biostatistics

Marginal Structural Models for Causal Inference with Continuous-Time Treatment and Censored Survival Outcomes

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ABSTRACT

Causal inference has traditionally focused on the estimation of causal effects of a number of treatments defined at baseline. In the case where treatment assignment is time-dependent, the treatment is often categorized in terms of time intervals for treatment initiation. This categorization can lead to coarsening of the information on treatment initiation and fails to answer the question of the causal effect of actual treatment timing. The marginal structural model, pioneered by Robins and colleagues, has been widely used for causal inference. It is easy to implement and provides a general infrastructure for weighting based methods to address confounding, particularly time-varying confounding. In this talk, I will show how the marginal structural model can be used to capture the causal effect of the continuous-time treatment when treatment initiation is either static or dynamic. I will derive estimation strategies amenable to marginal structural models to overcome complications frequently encountered in observational healthcare data, including incomplete treatment initiation time and censored survival outcomes. Theoretical justification of the developed approaches will be provided. A case study applying our approaches to a large-scale electronic health record data will estimate the optimal antiretroviral therapy initiating rules for patients presenting with HIV/TB coinfection and HIV-infected adolescents. New insights that can be gained relative to findings from randomized trials will be discussed.