

Statistics and Data Science Seminar

Stage-Aware Learning for Dynamic Treatments

Annie Qu (University of California at Irvine)

Abstract: Recent advances in dynamic treatment regimes (DTRs) provide powerful optimal treatment searching algorithms, which are tailored to individuals' specific needs and able to maximize their expected clinical benefits. However, existing algorithms could suffer from insufficient sample size under optimal treatments, especially for chronic diseases involving long stages of decision-making. To address these challenges, we propose a novel individualized learning method which estimates the DTR with a focus on prioritizing alignment between the observed treatment trajectory and the one obtained by the optimal regime across decision stages. By relaxing the restriction that the observed trajectory must be fully aligned with the optimal treatments, our approach substantially improves the sample efficiency and stability of inverse probability weighted based methods. In particular, the proposed learning scheme builds a more general framework which includes the popular outcome weighted learning framework as a special case of ours. Moreover, we introduce the notion of stage importance scores along with an attention mechanism to explicitly account for heterogeneity among decision stages. We establish the theoretical properties of the proposed approach, including the Fisher consistency and finite-sample performance bound. Empirically, we evaluate the proposed method in extensive simulated environments and a real case study for COVID-19 pandemic.

Wednesday, November 20 at 4:00 PM in 636 SEO