

Synthesizing Independent Stagewise Trials for Optimal Dynamic Treatment Regimes

Yuan Chen

Columbia University

E-mail: yc3281@cumc.columbia.edu

Abstract: Dynamic treatment regimes (DTRs) adaptively prescribe treatments based on patient's intermediate responses and evolving health status over multiple treatment stages. Data from sequential multiple assignment randomization trials (SMARTs) are recommended to be used for learning DTRs. However, due to re-randomization of the same patients over multiple treatment stages and a prolonged follow-up period, SMARTs are often difficult to implement and costly to manage, and patient adherence is always a concern in practice. To lessen such practical challenges, we propose an alternative approach to learn optimal DTRs by synthesizing independent trials over different stages. Specifically, at each stage, data from a single randomized trial along with patient's natural medical history and health status in previous stages are used. We use a backward learning method to estimate optimal treatment decisions at a particular stage, where patient's future optimal outcome increment is estimated using data observed from independent trials with future stages' information. Under some conditions, we show that the proposed method yields consistent estimation of the optimal DTRs and we obtain the same learning rates as those from SMARTs. We conduct simulation studies to demonstrate the advantage of the proposed method. Finally, we apply the developed method to learn optimal DTRs by stagewise synthesis of two randomized trials of therapies for major depressive disorder (MDD). The advantage of the proposed synthesis is validated on an independent trial of MDD.