MARGINAL STRUCTURAL MEAN MODELS FOR OPTIMAL DYNAMIC-REGIMES

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Dynamic treatment regimes are set rules for the treatment sequential decision making based on patient covariate history. Two recently developed statistical methods are specifically tailored to the investigation of optimal treatment regimes from observational data (Murphy, 2003; Robins, 2004). However, these methods can only estimate the optimal regime out of the set of regimes in which the decision maker has access to a high dimensional vector of covariates comprised by the set of all confounding variables. Suppose that the set of enforceable regimes comprises simple rules based on a subset of past information and is indexed by a Euclidean vector z. The substantive goal is to estimate the regime z_{opt} that maximizes the expected counterfactual utility over all enforceable regimes. Murphy et al. (2001) developed efficient augmented inverse probability weighted estimators of the expected utility for each fixed regime. We extend this approach for the case in which the expected utility is assumed to follow a parametric model on z indexed by an unknown Euclidean parameter β_0. Under this model, the optimal treatment z_{opt} is a function of β_0, so efficient estimation of the optimal regime depends on the efficient estimation of β_0. We derive a class of consistent and asymptotically normal estimators of β_0 under the proposed model and derive a locally efficient estimator in the class. We present simulations to evaluate the finite sample behavior of the estimators.