Separating Borrowing Information and Forming Contrasts: Nonparametric Inference for Arbitrary Functionals of Survival

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The hazard ratio is commonly used for comparing survival distributions. While easily estimated in the presence of censored data, it does not allow physicians, patients, and regulatory agencies to easily judge the clinical relevance of any difference in survival across groups. We consider an approach for inference on clinically meaningful functionals of a survivor distribution (e.g., restricted mean, quantiles). In this approach we use different regression models to borrow information across sparse data than to form statistical contrasts of an estimated functional of interest. Three different statistical models are examined in three distinct scenarios where we demonstrate the ability to produce estimates of variable importance that have acceptable precision as well as the ability to produce valid confidence intervals. One model evaluated is recursive partitioning of a multivariate predictor space to derive groups based on differences in their survival distributions. The two semi-parametric approaches of Cox's proportional hazards and Buckley-James' linear regression with censored data are also included. First order linear contrasts across three estimated functionals of interest from each predictive model approach are then compared on root mean squared error and confidence interval coverage. In the examples covered we were able to demonstrate that an adaptive nonparametric predictive model could prove markedly superior to the use of semi-parametric predictive models. The approach is also demonstrated on a commonly used dataset from a clinical trial on primary biliary cirrhosis.