

Cox Regression with Survival-Dependent Missing Covariate Values

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Abstract: Analysis with time-to-event data in clinical and epidemiological studies often encounters missing covariate values and the missing at random assumption is commonly adopted, which assumes that missingness depends on the observed data, including the observed outcome which is the minimum of survival and censoring time. However, it is conceivable that in certain settings, missingness of covariate values is related to the survival time but not to the censoring time. This is especially so when covariate missingness is related with an unmeasured variable affected by patient's illness and prognosis factors at baseline. If this is the case, then the covariate missingness is not at random as the survival time is censored, and it creates a challenge in data analysis. In this article, we propose an approach to deal with such survival-time-dependent covariate missingness based on the well known Cox proportional hazard model. Our method is based on inverse propensity weighting with the propensity estimated by nonparametric kernel regression. Our estimators are consistent and asymptotically normal, and their finite-sample performance is examined through simulation. An application to a real-data example is included for illustration.