Semiparametric Inference for the Functional Cox Model

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Abstract: This article studies penalized semiparametric maximum partial likelihood estimation and hypothesis testing for the functional Cox model in analyzing right-censored data with both functional and scalar predictors. Deriving the asymptotic joint distribution of finite-dimensional and infinite-dimensional estimators is a very challenging theoretical problem due to the complexity of semiparametric models. For the problem, we construct the Sobolev space equipped with a special inner product and discover a new joint Bahadur representation of estimators of unknown regression function and coefficients. Using this key tool, we establish the asymptotic joint normality of the proposed estimators and then con-struct a local confidence interval for an unknown slope function. Furthermore, we study a penalized partial likelihood ratio test, show that the test statistic enjoys the Wilks phenomenon, and also verify the optimality of the test. The theoretical results are examined through simulation studies, and a right-censored data example from the Improving Care of Acute Lung Injury Patients study is provided for illustration.