PHD DISSERTATION DEFENSE ANNOUNCEMENT

Methods for Two-Sample Comparisons from Censored Time-to-Event Data

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ABSTRACT

In the analysis of censored survival data it is frequently of interest to determine the efficacy of a treatment or new method over a control or existing method. For this purpose, one may report estimates of the two survival functions or, more specifically, their difference, accompanied by simultaneous confidence bands (SCBs). Alternatively, or in addition, one may conduct hypothesis testing for the difference of the two survival functions.

The first project exploits two bootstrap methods to develop new Wald-type SCBs for the difference of survival functions. The censored data bootstrap is employed to obtain nonparametric SCBs for the difference of two survival curves. Furthermore, a recently developed two-stage bootstrap is exploited to obtain semiparametric SCBs for the difference. The two-stage bootstrap combines classical bootstrap with a model-based regeneration of censoring indicators. Simulation studies are presented to show that the new SCBs are superior to a currently existing one, in the sense of producing empirical coverage closer to the nominal level. The model-based approach produces tighter and, hence, more informative SCBs. Specifically, for censoring rates between 10% and 40%, the semiparametric SCBs provide a relative reduction in enclosed area amounting to between 2% and 7% over their nonparametric counterparts, with the increase in reduction being directly proportional to the censoring rate. In particular, the reduction is expected to be even higher for high censoring rates. The methods are illustrated using real data sets from cancer and other biomedical studies.

The second project develops semiparametric SCBs for the difference using the method of empirical likelihood. Simulation studies are presented to show that the semiparametric approach is superior to the nonparametric counterpart, with the new SCBs producing empirical coverage closer to the nominal level. Further comparisons reveal that the semiparametric confidence bands are tighter and, hence, more informative. For censoring rates between 10% and 40%, the semiparametric confidence bands provide a relative reduction in enclosed area amounting to between 2% and 7% over their nonparametric bands, with increased reduction attained for higher censoring rates. The methods are illustrated using a University of Massachusetts AIDS data set.

Finally, the third project develops two test procedures for the null hypothesis of no difference between the survival functions. The test statistics are based on the group-specific nonparametric or semiparametric survival function estimators. The censored data and two-stage bootstrap procedures are again deployed to obtain critical values for the testing. Numerical simulations show that the new test procedures outperform an existing one, in terms of producing the correct empirical significance level. Furthermore, power studies reinforce the superiority of the proposed method. A real example illustration is given to demonstrate the proposed method.