

Incorporating unobserved heterogeneity in Weibull survival models: A Bayesian approach

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Abstract

Outlying observations and other forms of unobserved heterogeneity can distort inference for survival datasets. The family of Rate Mixtures of Weibull distributions includes subject-level frailty terms as a solution to this issue. With a parametric mixing distribution assigned to the frailties, this family generates flexible hazard functions. Covariates are introduced via an Accelerated Failure Time specification for which the interpretation of the regression coefficients does not depend on the choice of mixing distribution. A weakly informative prior is proposed by combining the structure of the Jeffreys prior with a proper prior on some model parameters. This improper prior is shown to lead to a proper posterior distribution under easily satisfied conditions. By eliciting the proper component of the prior through the coefficient of variation of the survival times, prior information is matched for different mixing distributions. Posterior inference on subject-level frailty terms is exploited as a tool for outlier detection. Finally, the proposed methodology is illustrated using two real datasets, one concerning bone marrow transplants and another on cerebral palsy.