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Efficient Post-Shrinkage Estimation Strategies in High-Dimensional Cox's Proportional Hazards Models

Regularization methods such as LASSO, adaptive LASSO, Elastic-Net, and SCAD are widely used for variable selection in statistical modeling. However, these approaches primarily focus on variables with strong effects and often overlook weaker signals, which may lead to biased parameter estimates and reduced predictive performance. To address this limitation, corrected shrinkage strategies have been proposed to incorporate both strong and weak signals within the estimation process. Nevertheless, existing developments have largely been restricted to linear models, and their applicability to survival data has received limited attention, despite the common presence of both strong and weak covariate effects in biomedical survival studies.

To bridge this gap, we propose a novel class of post-selection shrinkage estimators within the Cox proportional hazards model framework. We establish the asymptotic properties of the proposed estimators and evaluate their performance through simulation studies that explicitly account for weak signals. The results demonstrate improvements in estimation accuracy and predictive performance. Finally, we illustrate the practical utility of the proposed approach using two real-world datasets, highlighting its advantages over existing methods.

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