Refitted Dimension-reduced tests for Cox's models based on regularization

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Abstract

lassical likelihood ratio (LR) tests underpin parametric inference, but modern studies often face parameters p greatly exceed sample size n. In such settings, naive LR/PLR is miscalibrated and underpowered: sensitivity to model specification and selection-induced randomness dilute power and distort type-I error. We therefore propose a dimension-reduced partial likelihood ratio (DR-PLR) test: penalized partial likelihood screens the nuisance block to define a low-dimensional, data-adaptive working alternative, after which inference proceeds with an unpenalized PLR in that reduced space. To mitigate overselection and shrinkage bias, we introduce a refitted DR-PLR that re-estimates coefficients on the selected support (optionally with sample splitting) before testing. In Cox models under non-polynomial (NP) dimensional growth, we derive Bahadur-type linearizations for estimators in randomly sized post-screening models, establish Wilks-type null limits, and characterize local-alternative power gains from removing inactive nuisance effects. The procedure is computationally light and, once the screened set stabilizes, largely tuning-insensitive, making it well suited to survival analyses in genomics, clinical trials, and other high-dimensional biomedical applications.

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