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Penalized estimation equation for an extended single-index model

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Abstract The single-index model is a useful extension of the linear regression model. Cui et al. (Ann Stat 39:1658–1688, 2011) proposed an estimating function method for the estimation of index vector in an extended single-index model (ESIM). Nevertheless, how to conduct variable selection for ESIM has not been studied. To solve this problem, we penalize the estimating equation with some types of penalty, such as smoothly clipped absolute deviation penalty and adaptive lasso penalty. Under some regularity conditions, the oracle property is established, i.e., the resulting estimator can be as efficient as the oracle estimator, thus we improve the explanatory ability and accuracy of estimator for the ESIM. A novel algorithm is proposed to solve the penalized estimating equation by combining quasi-Fisher scoring type algorithm and MM algorithm. Simulation study and real data application demonstrate the excellent performance of the proposed estimators.

Keywords Single-index model · Penalized estimating equations · Variable selection · Oracle property · Smoothly clipped absolute deviation · Adaptive lasso

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