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Nonparametric Independence Screening in Sparse Ultra-High Dimensional Varying Coefficient Models

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The varying-coefficient model is an important nonparametric statistical model that allows us to examine how the effects of covariates vary with exposure variables. When the number of covariates is big, the issue of variable selection arrives. In this paper, we propose and investigate marginal nonparametric screening methods to screen variables in ultra-high dimensional sparse varying-coefficient models. The proposed nonparametric independence screening (NIS) selects variables by ranking a measure of the nonparametric marginal contributions of each covariate given the exposure variable. The sure independent screening property is established under some mild technical conditions when the dimensionality is of nonpolynomial order, and the dimensionality reduction of NIS is quantified. To enhance practical utility and the finite sample performance, two data-driven iterative NIS methods are proposed for selecting thresholding parameters and variables: conditional permutation and greedy methods, resulting in Conditional-INIS and Greedy-INIS. The effectiveness and flexibility of the proposed methods are further illustrated by simulation studies and real data applications.

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