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Robust structure identification and variable selection in partial linear varying coefficient models

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Abstract

Partial linear varying coefficient models (PLVCM) are frequently used in statistical modelling, but most existing estimation and variable selection methods were built on the subset of variables having constant or varying effect on the response is known in advance. However, in application, this is unreasonable. This paper proposes a novel simultaneous model structure identification and variable selection method, which can do simultaneous coefficient estimation and three kinds of selections (constant or varying effects and relevant variables). It can be easily implemented in one step by employing a penalized exponential squared loss. Consistency in the three kinds of selections and oracle property in coefficient estimation are established. The outstanding merit of the proposed method is the resulting estimators are more efficient than the least squares (LS) based oracle estimators in the presence of outliers or heavy-tail error distributions. Moreover, we show that the proposed procedure is as asymptotically efficient as the LS method when there are no outliers and the errors follow normal distribution. Simulation studies and real data analysis also confirm our method.

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