

# Simultaneous estimation for semi-parametric multi-index models

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**Abstract:** Estimation of a general multi-index model comprises determining the number of linear combinations of predictors (structural dimension) that are related to the response, estimating the loadings of each index vector, selecting the active predictors and estimating the underlying link function. These objectives are often achieved sequentially at different stages of the estimation process. In this study, we propose a unified estimation approach under a semi-parametric model framework to attain these estimation goals simultaneously. The proposed estimation method is more efficient and stable than many existing methods where the estimation error in the structural dimension may propagate to the estimation of the index vectors and variable selection stages. A detailed algorithm is provided to implement the proposed method. Comprehensive simulations and a real data analysis illustrate the effectiveness of the proposed method.