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HIGH-DIMENSIONAL EMPIRICAL LIKELIHOOD

ABSTRACT

Statistical methods with empirical likelihood (EL) are appealing and effective especially in conjunction with estimating equations for flexibly and adaptively incorporating data information. It is known that EL approaches encounter difficulties when dealing with high-dimensional problems. To overcome the challenges, we propose a new penalized EL by applying two penalty functions respectively regularizing the model parameters and the associated Lagrange multiplier in the optimizations of EL. By penalizing the Lagrange multiplier to encourage its sparsity, a drastic dimension reduction in the number of estimating equations can be achieved. Most attractively, such a reduction in dimensionality of estimating equations can be viewed as a selection among those high-dimensional estimating equations, resulting in a highly parsimonious and effective device for estimating high-dimensional sparse model parameters. Allowing both the dimensionalities of model parameters and estimating equations growing exponentially with the sample size, our theory demonstrates that our new penalized EL estimator is sparse and consistent with asymptotically normally distributed nonzero components. We also study two inference problems: confidence set estimation for multiple components of the model parameters, and model specifications tests. For the first problem, we propose to construct a new set of estimating equations such that the impact from estimating the high-dimensional nuisance parameters becomes asymptotically negligible. The new construction enables us to estimate a valid confidence region by EL ratio. Second, we propose a test statistic as the maximum of the marginal EL ratios to quantify data evidence against the model specification.

BIOGRAPHY

Jinyuan Chang is Guanghua Distinguished Professor of Statistics and Econometrics at Southwestern University of Finance and Economics, and also professor at the Academy of Mathematics and Systems Science of the Chinese Academy of Sciences. His research interests include high-dimensional data analysis and high-frequency data analysis. He has received many awards, including the third prize of the 8th Outstanding Research Achievement Award in the Higher Education Institutions of China in 2020, and the National Science Fund for Distinguished Young Scholars of China in 2021.

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