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Estimation and inference for non-crossing multiple-index quantile regression. (Chinese. English summary) Zbl 07494964

Summary: Though the theoretical properties of quantile regression have been extensively studied in the past three decades, in practice it is not unusual to obtain crossing surfaces by estimating regression functions at different quantile levels with regular approaches. The crossing quantile surfaces are intrinsically uninterpretable. To address this issue, we consider the semiparametric multi-index quantile regression subject to the monotonicity restriction at different quantile levels. We first connect the semiparametric multi-index quantile regression with a dimension-reducible model. Such a relationship allows us to estimate the index coefficients consistently. The B-splines are then used to approximate the nonparametric function under the monotonicity restriction, which numerically corresponds to a constrained linear programming problem. To further improve the efficiency, we estimate the B-spline coefficients based on the dual of the constrained optimization problem. We assess the finite-sample performance of our proposed method through a comprehensive simulation study, and compare the prediction performance of different methods through a real case study.

MSC:
62G05 Nonparametric estimation
62G08 Nonparametric regression and quantile regression
62H12 Estimation in multivariate analysis

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