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Sobotka, Fabian; Kneib, Thomas

Geoadditive expectile regression.

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Summary: Quantile regression has emerged as one of the standard tools for regression analysis that enables a proper assessment of the complete conditional distribution of responses even in the presence of heteroscedastic errors. Quantile regression estimates are obtained by minimising an asymmetrically weighted sum of absolute deviations from the regression line, a decision theoretic formulation of the estimation problem that avoids a full specification of the error term distribution. Recent advances in mean regression have concentrated on making the regression structure more flexible by including nonlinear effects of continuous covariates, random effects or spatial effects. These extensions often rely on penalised least squares or penalised likelihood estimation with quadratic penalties and may therefore be difficult to combine with the linear programming approaches often considered in quantile regression. As a consequence, geoadditive expectile regression based on minimising an asymmetrically weighted sum of squared residuals is introduced. Different estimation procedures are presented including least asymmetrically weighted squares, boosting and restricted expectile regression. The properties of these procedures are investigated in a simulation study and an analysis on rental fees in Munich is provided where the geoadditive specification allows for an analysis of nonlinear effects of the size of flats or the year of construction and the spatial distribution of rents simultaneously.

Keywords: boosting; least asymmetric weighted squares; Markov random fields; quantiles; P-splines; tensor product splines
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