Nonparametric Tilted Additive Model

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Abstract:

In recent decades, nonparametric regression models have gained considerable attention in theoretical and applied statistics because they do not rely on a predetermined functional form of relationship between predictors and the outcome. In this work, we study a class of nonparametric regression estimator called linear smoother. We apply a tilting technique to improve the performance of the linear smoother by minimizing the distance between the linear smoother and a comparator. The tilted linear smoother takes advantage of both linear smoother and the comparator. We theorize the convergence rate of the tilted version of linear smoother, which is obtained by minimizing the distance to an infinite order flat-top trapezoidal kernel estimator (IO). We prove that the proposed estimator achieves a high level of accuracy. Moreover, it preserves the attractive properties of the infinite order flat-top kernel estimator. We also present an extensive numerical study for analysing the performance of two members of this class of estimators, named tilted Nadaraya-Watson (NW) and tilted local linear (LL), for finite samples. The simulation study shows that under some conditions the tilted estimators (tilted NW and tilted LL), are superior to conventional estimators (NW and LL) while under all conditions they perform better than the comparator, IO. We also extended the methodology for multiple predictors in an additive setting which, has led to the development of the Tilted Additive model (TAM). The TAM can be formulated by replacing the standard linear model combination of predictors, such $\sum \beta_j X_j$ with $\sum f_j(X_j)$, where f_j is a smooth nonlinear function of jth predictor X_j, respectively, which are estimated from the data. We use a tilted linear smoother to estimate f_j, which leads to the development of the TAM.