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A Comparative Study of Additive and Nonparametric Regression Estimators and Variable Selection Procedures

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Abstract : One of the biggest challenges in nonparametric regression is the curse of dimensionality. Additive models are known to overcome this problem by estimating only the individual additive effects of each covariate. However, if the model is misspecified, the accuracy of the estimator compared to the fully nonparametric one is unknown. In this work the efficiency of completely nonparametric regression estimators such as the Loess is compared to the estimators that assume additivity in several situations, including additive and non-additive regression scenarios. The comparison is done by computing the oracle mean square error of the estimators with regards to the true nonparametric regression function. Then, a backward elimination selection procedure based on the Akaike Information Criteria is proposed, which is computed from either the additive or the nonparametric model. Simulations show that if the additive model is misspecified, the percentage of time it fails to select important variables can be higher than that of the fully nonparametric approach. A dimension reduction step is included when nonparametric estimator cannot be computed due to the curse of dimensionality. Finally, the Boston housing dataset is analyzed using the proposed backward elimination procedure and the selected variables are identified.

Keywords : additive model, nonparametric regression, variable selection, Akaike Information Criteria
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