Robust nonnegative garrote variable selection in linear regression

Irène Gijbels\textsuperscript{a} and Inge Vrinssen\textsuperscript{a}

\textsuperscript{a} Department of Mathematics and Leuven Statistics Research Centre (LStat), KU Leuven, Belgium

We consider a multiple linear regression model with \( p \) covariates. Often there are only a few coefficients that are different from zero. Therefore Breiman proposed in [1] the nonnegative garrote method. This is a variable selection method that shrinks the least squares estimates and puts some of these coefficients equal to zero. The method has been successfully used in variable selection in additive regression models and varying coefficient models in [2] and [3].

In this work we aim at robustifying the nonnegative garrote method to make it less sensitive to outliers, while keeping the good efficiency properties. We can use existing robust methods such as the S-estimator [4], the \( \tau \)-estimator, \ldots, to compute initial estimates of the coefficients to rely on. The main goal is thus to find robust methods to estimate the shrinkage factors and robust selection criteria to determine the value of the regularization parameter. Several robust estimation methods for the shrinkage factors and robust selection criteria for the regularization parameter are discussed. The performances of the different methods are investigated and compared via a simulation study. The methods are also illustrated on a real data example.

References