Estimation and diagnostics for heteroscedastic nonlinear regression models based on scale mixtures of skew-normal distributions

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Abstract: An extension of some standard likelihood based procedures to heteroscedastic nonlinear regression models under scale mixtures of skew-normal (SMSN) distributions is developed. This novel class of models provides a useful generalization of the heteroscedastic symmetrical nonlinear regression models, since the random terms distributions cover both symmetric as well as asymmetric and heavy-tailed distributions such as skew-t, skew-slash, skew-contaminated normal, among others. A simple EM-type algorithm for iteratively computing maximum likelihood estimates of the parameters is presented and the observed information matrix is derived analytically. In order to examine the performance of the proposed methods, some simulation studies are presented to show the robust aspect of this flexible class against outlying and influential observations and that the maximum likelihood estimates based on the EM-type algorithm do provide good asymptotic properties. Furthermore, local influence measures and the one-step approximations of the estimates in the case-deletion model are obtained. Finally, an illustration of the methodology is given considering a data set previously analyzed under the homoscedastic skew-t nonlinear regression model.

Keywords: Case-deletion model, EM algorithm, Homogeneity, Local influence, Nonlinear regression models, Scale mixtures of skew-normal distributions.