

## Diagnostic and treatment for linear mixed models

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We consider residual, local influence and leverage analyses to identify violations of the assumptions underlying Gaussian linear mixed models. In particular, we propose different diagnostic measures to analyze marginal, conditional and random-effects residuals and develop R-based software to implement such tools in a graphical setup. We propose remedial measures that range from fine-tuning of the model to the adoption of more robust elliptically symmetric distributions as well as generalized linear mixed models or GEE-based models and comment on the available diagnostic tools for such alternatives. We consider practical examples where some of the underlying assumptions are invalid, show how such violations are detected with the proposed tools and redefine the models to accommodate them. Finally, we suggest directions for further research.

**Key Words:** local influence, global influence, residual analysis, remedial measures