Outlier Robust Block Bootstrap Fitting of Linear Mixed Models

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Abstract

Outliers are a well-known problem when fitting models with survey data. Estimates of the model parameters and also prediction of population quantities using the fitted model become unstable in presence of outliers in data. The main approaches that have been developed so far for this problem have focused on modifying the parameter estimating equations to make them less sensitive to sample outliers. When linear mixed models are used, this leads to the use of outlier robust versions of the ML and REML estimating equations for the mixed model parameters as well as outlier robust versions of the estimating equations for the random area effects. However, to the best of our knowledge, there has been no attempt to use outlier robust Monte Carlo methods to tackle this problem. Chambers and Chandra (2012) describe a random effect block bootstrap approach which is robust to failure of the dependence assumptions of the assumed mixed model. In this paper we propose an outlier robust extension of this idea that can be used to fit a linear mixed model in the presence of both group level as well as individual level outliers. We describe Monte Carlo simulation results that provide some evidence for our claim that the proposed robust block bootstrap method is robust to the influence of outliers and also leads to more reliable mixed model parameter estimates than comparable outlier robust approaches that have been proposed in the literature.

Key Words: Clustered data; Influence function; Outlier; Robustness; Variance components.