Inference for high-dimensional linear mixed-effects models: A quasi-likelihood approach

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Abstract: Linear mixed-effects models are widely used in analyzing clustered or repeated measures data.

We propose a quasi-likelihood approach for estimation and inference of the unknown parameters in linear mixed-effects models with high-dimensional fixed effects. The proposed method is applicable to general settings where the cluster sizes are possibly large or unbalanced. Regarding the fixed effects, we provide rate optimal estimators and valid inference procedures that are free of the assumptions on the specific structure of the variance components. Separately, rate optimal estimators of the variance components are derived under mild conditions. We prove that, under proper conditions, the convergence rate for estimating the variance components of the random effects does not depend on the accuracy of fixed effects estimation. Computationally, the algorithm involves convex optimization and is loop-free. The proposed method is assessed in various simulation settings and is applied to a real study regarding the associations between the body weight index and polymorphic markers in a heterogeneous stock mice population.