Inference for generalized linear mixed models with sparse structure

Helen Ogden*
University of Warwick, Coventry, United Kingdom - h.ogden@warwick.ac.uk

Generalized linear mixed models are a natural and widely used class of models, but one in which the likelihood may involve an integral of very high dimension. Because of this intractability, several alternative approaches to inference have been proposed. Often, some approximation to the likelihood is used in place of the true likelihood, but such approximations often fail in models which have sparse structure, in that the data only provide a small amount of information on each random effect. An alternative is to use a pairwise likelihood for inference, but in some cases the resulting estimator may be much less efficient than the full likelihood estimator. Motivated by the poor performance of existing methods, we introduce a new approximation to the likelihood, which exploits the structure of the model to reduce the cost of computing the approximation. We give some examples in which the new method allows us to find an accurate approximation to the likelihood in a small fraction of the time required by existing methods. Some cases remain in which even the new approximation is too costly to compute, and we briefly discuss some ideas about how to do inference in these challenging situations.
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