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Uniformed standard expression and applications of nonlinear mixed effects models

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Nonlinear mixed effect models (NLMEMs) are considered as powerful statistical tools and can not only reflect the overall variation of population, but also account for individual differences. During the past thirty years, single- and multi-level NLMEMs have been proposed and commonly used in various disciplines. The parameter estimation of NLMEMs has also been realized in the widely used statistical software packages such as SAS and S-Plus. However, NLMEMs currently lack the ability of explaining all types of random effects and their combinations, especially, the interactions between the factors or variables. There is also a lack of a uniformed standard expression. These impede the application of NLMEMs. In this study, a uniformed standard expression of NLNEMs was proposed and it can account for single- and nested multi-level random effects, and interactions between variables. A normal distribution based linearization approximation sequential quadratic programming algorithm was developed and implemented in ForStat to estimate the parameters of the uniformed standard expression. The evaluation of the expression was conducted using the data of tree height and diameter at breast height from larch (*Larix olgensis*) experimental stands and the data obtained by simulation with Richard, exponential and logistic models. The results showed that the linearization approximation sequential quadratic programming algorithm has fast converged and lead to high accuracy of estimation with small numbers of iterations. This standard expression was further expanded to those NLMEMs in which the variances of random effects are related to group variables.

Biography

Liyong Fu has completed his PhD at the age of 27 years from the Chinese Academy of Forestry (CAF) in 2012. He is a Research Associate in the Research Institute of Forest Resource Information Techniques, CAF, and is mainly interested in computational statistics studies. He is one of the core members for developing and maintaining the ForStat software which is a statistical software with specific forestry analytical tools as well as general statistical ones developed in the CAF. He has published more than 20 papers in reputed journals and has been serving as a reviewer for several international journals.

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