



Applied Bayesian Hierarchical Methods

By Peter D. Congdon

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The use of Markov chain Monte Carlo (MCMC) methods for estimating hierarchical models involves complex data structures and is often described as a revolutionary development. An intermediate-level treatment of Bayesian hierarchical models and their applications, **Applied Bayesian Hierarchical Methods** demonstrates the advantages of a Bayesian approach to data sets involving inferences for collections of related units or variables and in methods where parameters can be treated as random collections.

Emphasizing computational issues, the book provides examples of the following application settings: meta-analysis, data structured in space or time, multilevel and longitudinal data, multivariate data, nonlinear regression, and survival time data. For the worked examples, the text mainly employs the WinBUGS package, allowing readers to explore alternative likelihood assumptions, regression structures, and assumptions on prior densities. It also incorporates BayesX code, which is particularly useful in nonlinear regression. To demonstrate MCMC sampling from first principles, the author includes worked examples using the R package.

Through illustrative data analysis and attention to statistical computing, this book focuses on the practical implementation of Bayesian hierarchical methods. It also discusses several issues that arise when applying Bayesian techniques in hierarchical and random effects models.

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Review

"...excellent ... for learning or applying [the Bayesian approach]. ... an excellent place for readers to learn and practice Bayesian concepts."

?*Journal of Statistical Computation and Simulation*, Vol. 84, 2014

"The overall presentation of concepts is logical and supported by detailed mathematical descriptions. ... the text provides a great reference for the underlying formalities of all of the methods discussed. Throughout each chapter, the author highlights methodological issues in relation to the topics presented with references to the literature, displaying his comprehensive and up-to-date knowledge of the material. The emphasis placed on computational issues related to the implementation of MCMC routines for model fitting (with BUGS code provided at the end of each chapter) is welcome, as this issue has the potential to cause a lot of headaches for practitioners trying to employ Bayesian methods. ... a comprehensive and valuable resource."

?Kris M. Jansen and Lyle C. Gurrin, *Australian and New Zealand Journal of Statistics*, 2012

"... a good reference for applied work in biometrics. It makes it easy to analyze models with the same type of data structures that are described in the book by supplying the companion code."

?Wolfgang Polasek, *Statistical Papers*, August 2012

"Many of the hierarchical modeling techniques in this book are recently proposed and new in the literature. The author provides very comprehensive references Even though many examples are related to health and social science, they also would be helpful to users in engineering and other fields. ... In summary, the book presents many excellent Bayesian hierarchical modeling techniques to tackle difficult and realistic modeling issues that many researchers may encounter in their scientific areas. ... an excellent collection and reference for researchers who are interested in applying the most recent Bayesian hierarchical modeling methods to their own areas."

?Zhaojun (Steven) Li, *Journal of Quality Technology*, Vol. 43, No. 4, October 2011

About the Author

Peter D. Congdon is a research professor of quantitative geography and health statistics in the Centre for Statistics and Department of Geography at the University of London, UK.

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