

MCMCpack: An Evolving R Package for Bayesian Inference

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MCMCpack Goals

- Free, open-source, easy-to-use software for Bayesian inference.
- Provide a development environment for easy implementation of non-standard statistical models.
- Provide a distribution mechanism for other researchers with a consistent user interface and documentation.



MCMCpack Design

- “R-like” user interface for Bayesian tools.
- Model-specific design.
- Estimation in compiled C++ (using the Scythe Statistical Library).
- coda `mcmc` objects for posterior density sample storage and summarization.
- Modular design and hidden functions to ease implementing additional models.



Why Not WinBUGS? Or JAGS?

- The BUGS language is good for many things, including quickly developing models. We see it as a complementary tool to MCMCpack. However . . .
- . . . as noted in the WinBUGS manual:

[P]otential users are reminded to be extremely careful if using this program for **serious statistical analysis**. . . If there is a problem, WinBUGS might just crash, which is not very good, but it might well carry on and produce answers that are wrong, which is even worse (p. 1).
- The BUGS language is slow (especially for large problems), and the WinBUGS engine does no work for certain problems.
- Platform and licensing issues.



Implemented Models To Date

Linear regression (with Gaussian errors), a general linear panel model, Wakefield's ecological inference model, Quinn's dynamic ecological inference model, Wakefield's hierarchical ecological inference model, a probit model, a logistic regression model, a one-dimensional item response theory model (identified through constraints on subject parameters), a K-dimensional item response theory model (identified through constraints on item parameters), a Normal theory factor analysis model, a mixed response factor analysis model, an ordinal item response theory model, a Poisson regression, and an ordered probit model.



Outline of Talk

- Demonstration of model-fitting in MCMCpack.
- The MCMCpack development environment.
- The generic Metropolis sampling engine MCMCmetrop1R.
- Parallel MCMC using MCMCpack.



Project Status

- We have been releasing alpha versions for about eighteen months. Our major 0.5 release will be on our website and CRAN “soon.”
- The development environment has been built and is fully documented in our specification.
- We will be adding additional models, including “toy” models for classroom instruction, over the next few years.
- Submit the software for peer-review.
- Extensions (more flexible prior specifications, real-time visualization of simulation progress, additional flexible estimation engines, etc.).



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