Technometrics
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/utch20

Applied Bayesian Modelling
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Published online: 01 Jan 2012.

To cite this article: Thomas H Short (2004) Applied Bayesian Modelling, Technometrics, 46:2, 249-250, DOI: 10.1198/004017004000000293
To link to this article: http://dx.doi.org/10.1198/004017004000000293

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Forthcoming Reviews

Applied Bayesian Modelling by Peter Congdon, West Sussex, U.K.: Wiley, 2003, ISBN 0-471-48695-7, xii + 457 pp., $85.00.

Congdon’s new book follows his 2001 volume titled Bayesian Statistical Modelling. The new text is certainly more focused on specific areas of application, rather than on general background information about Bayesian inference. The initial chapter of Applied Bayesian Modelling carries the wandering title “The Basis for, and Advantages of, Bayesian Model Estimation via Repeated Sampling.” This chapter sets the stage for a computational approach to applied Bayesian techniques built on the foundation Markov Chain Monte Carlo methods and the WinBugs software package.

The book goes on to explore such topics as ‘Hierarchical Mixture Models,’ ‘Regression Models,’ and then even more specific areas including multilevel data, time series, panel (longitudinal) data, spatial data, structural equation models, survival models, and causal inference in the context of epidemiology. Congdon admits to the “ambitiousness” of this list of topics, but the list certainly does convey a sense of the broad applicability and flexibility of computational Bayesian methods.

The narrative is dense but clear, and the examples are engaging and sample from historical favorites and challenging recent problems. Most of the exercises in the text request that analyses initiated in examples be extended. I would have preferred more “start from scratch” datasets for students to explore on their own. Also, Congdon’s approach is decidedly algebraic. The book’s first graph does not appear until page 64. More frequent use of visual displays might help break up the density of the narrative. Snippets of WinBugs code are sprinkled through the text, and the author will happily supply code and datasets on request.

I’ll admit to becoming nervous about the examples and contexts presented in the book after I read Example 2.2 in the chapter titled “Hierarchical Mixture Models.” The example is on “hot hand” data shared by Kass and Raftery (1995). The original dataset concerns “Vinnie Johnson” and the sport of “basketball,” but Congdon refers to “Vinnie Jones” and “baseball.” After I found this confusion I searched for other egregious distortions of context in the examples and exercises, but I could not find any others.

I find it a bit irritating that the references are listed at the end of each chapter instead of at the end of the entire book. Although I suggest moving the references to the end of the text, an alternative solution would be to add a list of authors cited to the index.

Applied Bayesian Modelling would be an appropriate choice for the primary textbook in a graduate-level applied Bayesian methods course for students who have already been introduced to Bayesian statistics. It is certainly a fine choice as a supporting reference in either a first or second Bayesian methods course even if it is not the primary textbook, and I also recommend it as an informative reference for researchers who practice applied Bayesian methods.

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Congdon, P. (2001), Bayesian Statistical Modelling, West Sussex, U.K.: Wiley. Kass, R., and Raftery, A. (1995), “Bayes Factors,” Journal of the American Statistical Association, 90, 773–795.

Bayesian Inference: Parameter Estimation and Decisions, by H. L. Harney, Berlin: Springer-Verlag, 2003, ISBN 3-540-00397-5, xiii + 263 pp., $79.95.

I believe this text can find a niche for its intended audience: upper undergraduate physics/science/engineering majors and early graduate students or researchers new to the area of drawing conclusions from “random events.” Statisticians are ‘enjoying’ an explosion of Bayesian articles and textbooks, with Markov chain Monte Carlo (MCMC) methods leading the way. Problems can now be treated using realistic priors, likelihoods, and assumptions with the help of MCMC. However, there are already many fine texts on the application of MCMC, so in a way it is refreshing that Harney’s text does not even mention MCMC. Neither does the text deal with “sensitivity to the prior” issues that are typical (and useful). Instead, the primary focus is on the non-informative (Jeffreys’) prior and the development as form invariance, which informally means that the data x and parameters η can be transformed simultaneously without changing the posterior p(η|x).

There is no treatment of the topic of “informative” prior construction. The development of form invariance includes elementary group theory in a highly readable presentation. However, after a brief technical struggle in Chapter 9, it is revealed that the well-known Jeffreys’ rule provides a form-invariance probability model using the determinant of the Fisher information matrix. The absence of references to the Dirichlet prior as a useful noninformative prior makes me wonder whether Harney is aware of the Dirichlet process prior.

I caution the mathematically inclined reader that Harney’s treatment opts more for simplicity than for rigor. For example, exchanging the order of differentiation and infinite sums is assumed to be valid without question, and the existence of probability densities of transformed variables is assumed (dispensing with the calculus theorem regarding change of variables in definite integrals) by stating that after transformation probabilities remain the same, so g(y)dy = f(x)dx, where g(y) is the pdf of y and f(x) is the pdf of x. And “the absolute values are necessary because pdfs are nonnegative.” So, frankly, this text is written in the style of a physics professor teaching statistical methods to other physicists. It is perhaps better to not imagine such a scene, but the statistical community should be aware that “self-taught” scientists are quite capable of performing competent statistical analyses. As an example, in the treatment of the Poisson distribution in Chapter 5, the “trick” that x = ∑ n=1 y n is used to calculate moments of the Poisson. Exploiting the trick requires exchanging the order of differentiation and an infinite sum that I was taught in an undergraduate physics course. I have never seen the trick written down until this text, although I suspect it is common in certain types of texts.

My impression is that the text arose from a gnawing at Harney brain concerning the foundational question of noninformative prior construction. The text implies that some of the material on form invariance is new. However, appropriate reference to left and right Haar measure is made ( Chap. 6), which clearly indicates that no new foundational results are provided. A simple way to improve the text is readily available: devote a new chapter to the general discussion of “informative” priors, sensitivity to the prior analyses, and “richer” statistical inferences than inferring the mean and standard deviation. That is, the intended audience would likely benefit from at least lip service to the broad topic of Bayesian inference before devoting virtually the entire monograph to noninformative priors.

Topics include:

1 Knowledge and Logic, where the frequentist/Bayes debate is “settled” by taking it for granted that it is acceptable to consider probability as the “value of truth” assigned to a statement. This is too emphatic for my taste and omits the important issues of sensitivities to the prior and model misspecifications that are inevitable when models are applied to real data. That is, rarely can Bayesian posterior probabilities be regarded as “true probabilities” but are at best “approximate probabilities.”

2 Bayes Theorem, Transformations, and Improper Distributions. Eventually it is stated that all conditional probabilities must be proper (integrate to 1) but that priors can be improper.