

## Books on Bayesian data analysis and related topics

- [1] Y. Bard, *Nonlinear Parameter Estimation*, Academic, New York, 1974 (ISBN: 0-12-078250-2).  
One of the first books to lay out a full Bayesian approach to modeling, including issues of model checking, uncertainties in predictions, and design of experiments to achieve specified design criteria.
- [2] J. M. Bernardo and A. F. M. Smith, *Bayesian Theory*, John Wiley & Sons, New York, 1994 (ISBN: 0-471-92416-4).  
Bernardo and Smith have written a very thorough summary of the theory behind Bayesian analysis. The bibliography is unusually complete. However, because of its detailed mathematical treatment of the subject, many may find this book to be not very readable.
- [3] J. O. Berger, *Statistical Decision Theory and Bayesian Analysis*, Springer, New York, 1985.
- [4] D. A. Berry, *Statistics: A Bayesian Perspective*, Duxbury, Belmont, 1996 (ISBN: 0-534-23472-0).  
This book is meant to be used to teach introductory statistics. It combines the Bayesian viewpoint with traditional statistical methods. Ending up with regression analysis and a discussion of correlation coefficients, this book may not satisfy the needs of physicists who want to go beyond the standard techniques that they already know.
- [5] P. R. Bevington and D. K. Robinson, *Data Reduction and Error Analysis for the Physical Sciences*, McGraw-Hill, New York, 1992 (ISBN: 0-07-911243-9 pbk.).  
While not about Bayesian analysis, this updated edition of the classic textbook by Bevington presents a valuable introduction to the standard approach to treating experimental uncertainties and data analysis. Includes a diskette with source code for data-analysis routines in Pascal and FORTRAN.
- [6] G. E. P. Box and G. C. Tiao, *Bayesian Inference in Statistical Analysis*, John Wiley & Sons, New York, 1973 (reprinted in paperback 1992 ISBN: 0-471-57428-7 pbk.).
- [7] B. P. Carlin and T. A. Louis, *Bayes and Empirical Bayes Methods for Data Analysis*, Chapman & Hall, London, 1996 (ISBN: 0-412-05611-9).
- [8] M.-H. Chen, Q.-M. Shao, and J. G. Ibrahim, *Monte Carlo Methods in Bayesian Computation*, Springer, New York, 2000.
- [9] G. Cowan, *Statistical Data Analysis*, Clarendon (Oxford), Oxford, 1998 (ISBN: 0-19-850156-0 or 0-19-850155-2 in paperback).  
The data analysis described in this book not really Bayesian, ???.
- [10] G. d'Agostini, *Bayesian Reasoning in High Energy Physics - Principles and Applications*, 1998.  
These notes are for a course taught at CERN seem particularly relevant to physicists concerned with how to think about and treat uncertainties in experimental results. Available under the CERN web page [http://www.cern.ch/Training/ACAD/reglec\\_E.html](http://www.cern.ch/Training/ACAD/reglec_E.html) in PS or under <http://public.lanl.gov/kmh/course/bayesian.html> in PDF.

- [11] G. d'Agostini, *Bayesian Reasoning in Data Analysis - A Critical Introduction*, World Scientific, Singapore, 2003.  
Book based on the above CERN report. The author provides convincing arguments for the Bayesian approach with numerous simple examples, but does not get to substantive applications.
- [12] P. H. Garthwaite, I. T. Jolliffe, and B. Jones, *Statistical Inference*, Prentice Hall, London, 1996 (ISBN: 0-13-847260-2).
- [13] A. Gelman, J. B. Carlin, H. S. Stern, and D. B. Rubin, *Bayesian Data Analysis*, Chapman & Hall, London, 1995 (ISBN 0-412-03991-5).  
Gelman et al. summarize the full breadth of Bayesian analysis. A strong point of this presentation is its thoughtful and informative style, and avoidance of detailed mathematical derivations.
- [14] W. R. Gilks, S. Richardson, and D. J. Spiegelhalter, *Markov Chain Monte Carlo in Practice*, Chapman and Hall, London, 1996 (ISBN: 0-412-05551-1).  
This book thoroughly summarizes the uses of MCMC in Bayesian analysis. It is a core book for Bayesian studies.
- [15] P. C. Gregory, *Bayesian Logical Data Analysis for the Physical Sciences: A Comparative Approach with Mathematica Support*, Cambridge, Cambridge, 2005 (ISBN: 0-521-84150-X).  
Gregory has done an excellent job of presenting the logic of Bayesian analysis in physical sciences. The book revolves around a Mathematica tutorial, which includes many informative examples. The tutorial is available online at <http://www.cambridge.org/052184150X>.
- [16] A. Hald, *A History of Mathematical Statistics from 1750 to 1930*, John Wiley & Sons, New York, 1998 (ISBN: 0-471-17912-4).  
A complete history of modern statistics recounting the contributions of the founders of the field and their interrelationships. Includes derivations and proofs of theorems and properties of the well-known distributions.
- [17] C. Howson and P. Urbach, *Scientific Reasoning: The Bayesian Approach*, Open Court, La Salle, 1994 (ISBN: 0-8126-9085-0 pbk.).  
A comprehensive and eloquent presentation of the Bayesian approach to reasoning and its relation to the scientific method. This book explains how the Bayesian approach overcomes deficiencies of classical statistics for statistical inference. Its arguments are general and the presentation involves little mathematics.
- [18] K. B. Korb and A. E. Nicholson, *Bayesian Artificial Intelligence*, Chapman & Hall, Boca Raton, 2004 (ISBN: 1-58488-387-1).  
The authors develop an approach to artificial intelligence based on Bayesian networks with a full treatment of learning, knowledge engineering, and elicitation. Their web site at <http://www.csse.monash.edu.au/bai/> offers valuable supplementary material.
- [19] P. M. Lee, *Bayesian Statistics - An Introduction*, Arnold, London, 2004 (ISBN: 0-340-81405-5).
- [20] J. S. Liu, *Monte Carlo Strategies in Scientific Computing*, Springer, New York, 1994 (ISBN: 0-387-95230-6).  
A complete discussion of Monte Carlo and Markov Chain Monte Carlo methods with several biological applications. Written at a more advanced level than Gilks et al. with mathematical detail.

- [21] D. J. C. Mackay, *Information theory, inference, and learning algorithms*, Cambridge, Cambridge, 2003 (ISBN: 0-387-95230-6).  
A brilliant book on Bayesian inference applied to information theory. It has excellent chapters on MCMC, communication and coding theory, and neural networks. Unfortunately, the small font used is a challenge for some to read.
- [22] R. M. Neal, *Bayesian Learning for Neural Networks*, Springer, New York, 1996 (ISBN: 0-387-94724-8).  
This small volume contains a thorough presentation of the Hybrid (Hamiltonian) technique for MCMC and its use in Bayesian neural networks.
- [23] H. Neiderreiter, *Random Number Generation and Quasi-Monte Carlo Methods*, SIAM, Philadelphia, 1992.  
Quasi-Monte Carlo is a technique for generating sets of numbers that are more uniformly distributed than random sets. In typical Monte Carlo calculations, they often provide faster convergence than random numbers.
- [24] *Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing*, (New York), Springer, 1995.  
Many uses of Quasi-Monte Carlo number sets, and their benefits, are described in this proceedings.
- [25] S. J. Press, *Bayesian Statistics: Principles, Models, and Applications*, Wiley, New York, 1989.  
This book gives a terse and understandable introduction to the principles of Bayesian analysis. It provides numerous examples of the application of Bayesian inference to solving approachable problems along with useful approximations for evaluating results.
- [26] C. P. Robert, *The Bayesian Choice: a decision-theoretic motivation*, Springer, New York, 1994 (ISBN: 0-387-94629-3).  
Starting at an introductory level and progressing to a sophisticated level, this book provides a rigorous development of Bayesian analysis.
- [27] B. P. Roe, *Probability and Statistics in Experimental Physics*, Springer, New York, 2001 (ISBN: 0-387-95163-6).  
Intended as a practical introduction for advanced undergraduate students, this book presents a lot of interesting topics as well as some basic techniques such as curve fitting. However, it is not particularly useful to experimentalists seeking to understand how to assess uncertainties in their experimental results.
- [28] J. J. K. Ó Ruanaidh and W. J. Fitzgerald, *Numerical Bayesian Methods Applied to Signal Processing*, Springer, New York, 1996 (ISBN: 0-387-94629-2).
- [29] R. Y. Rubinstein, *Simulation and the Monte Carlo Method*, John Wiley and Sons, New York, 1981.
- [30] T. J. Santner, B. J. Williams, and W. I. Notz, *The Design and Analysis of Computer Experiments*, Springer, New York, 2003.
- [31] D. S. Sivia, *Data Analysis: A Bayesian Tutorial*, Clarendon (Oxford Univ. Press), Oxford, 1996 (ISBN: 0-19-851762-9 or 0-19-851889-7 in paperback).  
Divinder Sivia presents a very straightforward account of Bayesian analysis. Rather than going

for mathematical rigor and an axiomatic approach, he introduces concepts as they are needed to solve a sequence of increasingly complex analysis problems. Very readable and informative.

- [32] D. L. Smith, *Probability, Statistics, and Data Uncertainties in Nuclear Science and Technology*, American Nuclear Society, LaGrange Park, 1991 (ISBN: 0-89448-036-7). Well suited to scientists in nuclear physics, this book provides an introduction to Bayesian thinking, as well as numerous examples from the field.
- [33] J. R. Taylor, *An Introduction to Error Analysis*, University Science Books, Sausalito, 1997 (ISBN: 0-935702-42-3, 0-935702-75-X (pbk.)).  
A recently revised textbook on error (uncertainty) analysis of measurements acquired in physical experiments. This book has fewer formulas and is more elementary than Bevington and Robinson, so is a good introduction for undergraduate science students.

**The following series of proceedings from the Maximum Entropy and Bayesian Methods Workshops contain many important recent developments in Bayesian analysis.**

- [34] A. Mohammad-Djafari et al., ed., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, AIP Conf. Proc., Amer. Inst. Phys., Melville, NY, 2007 (to be published).
- [35] K. H. Knuth, A. E. Abbas, R. D. Morris, and J. P. Castle, eds., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 803 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2005 (ISBN: 0-7354-0292-2).
- [36] R. Fischer, R. Preuss, and U. von Toussaint, eds., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 735 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2004 (ISBN: 0-7354-0217-5).
- [37] G. J. Erickson and Y. Zhai, eds., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 707 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2004 (ISBN: 0-7354-0182-9).
- [38] C. J. Williams, ed., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 659 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2003 (ISBN: 0-7354-0119-5).
- [39] R. Fry, ed., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 617 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2002 (ISBN: 0-7354-0063-6).
- [40] A. Mohammad-Djafari, ed., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 568 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2001 (ISBN: 0-7354-0004-0).
- [41] J. T. Rychert, G. J. Erickson, and C. R. Smith, eds., *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*, vol. 567 of *AIP Conf. Proc.*, Amer. Inst. Phys., Melville, NY, 2001 (ISBN: 0-7354-0003-02).
- [42] W. von der Linden, V. Dose, R. Fischer, and R. Preuss, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1999 (ISBN: 0-7923-5766-3).

- [43] G. J. Erickson, J. T. Rychert, and C. R. Smith, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1998 (ISBN: 0-7923-5047-2).
- [44] M. Sears, V. Nedeljkovic, N. E. Pendock, and S. Sibisi, eds., *MAXENT 96: Proc. Maximum Entropy Conf.*, Univ. Witwatersrand, Johannesburg, South Africa, 1996.
- [45] K. M. Hanson and R. N. Silver, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1996 (ISBN: 0-7923-4311-5).
- [46] J. Skilling and S. Sibisi, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1996 (ISBN: 0-7923-3452-1).
- [47] G. Heidbreder, ed., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1996 (ISBN: 0-7923-2851-5).
- [48] A. Mohammad-Djafari and G. Demoment, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1993 (ISBN: 0-7923-2280-0).
- [49] C. R. Smith, G. J. Erickson, and P. O. Neudorfer, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1992 (ISBN: 0-7923-2031-X).
- [50] W. T. Grandy, Jr. and L. H. Schick, eds., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1991 (ISBN: 0-7923-1140-X).
- [51] P. F. Fourgère, ed., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1990 (ISBN: 0-7923-0928-6).
- [52] J. Skilling, ed., *Maximum Entropy and Bayesian Methods*, Kluwer Academic, Dordrecht, 1989 (ISBN: 0-7923-0224-9).
- [53] G. J. Erickson and C. R. Smith, eds., *Maximum Entropy and Bayesian Methods in Science and Engineering (Vol. 1)*, Kluwer Academic, Dordrecht, 1988 (ISBN: 90-277-2792-9).
- [54] G. J. Erickson and C. R. Smith, eds., *Maximum Entropy and Bayesian Methods in Science and Engineering (Vol. 2)*, Kluwer Academic, Dordrecht, 1988 (ISBN: 90-277-2792-9).
- [55] C. R. Smith and W. T. Grandy, Jr., eds., *Maximum Entropy and Bayesian Methods in Science and Engineering*, D. Reidel, Dordrecht, 1988 (ISBN: 90-277-2074-6).
- [56] R. D. Levine and M. Tribus, eds., *Maximum Entropy Formalism*, MIT, Cambridge, Mass., 1979 (ISBN: 0-262-12080-1).

Ken Hanson's e-mail address: [kmh@lanl.gov](mailto:kmh@lanl.gov)  
 Web home page: <http://home.lanl.gov/kmh/>

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