BAYESIAN STATISTICS 7

Proceedings of the Seventh Valencia International Meeting

Dedicated to Dennis V. Lindley

June 2–6, 2002

Edited by

J. M. Bernardo
M. J. Bayarri
J. O. Berger
A. P. Dawid
D. Heckerman
A. F. M. Smith
and
M. West

CLARENDON PRESS · OXFORD
2003

PREFACE

The four-yearly Valencia International Meetings on Bayesian Statistics meetings are firmly established as the premier conferences for the exchange and advancement of Bayesian ideas.* By a quirk of Bayesian geography, the Seventh Valencia Meeting was held in the Spanish Canary Islands, at the Mare Nostrum Resort, Tenerife, from 2 to 6 June 2002. Over 440 delegates, from 35 different countries, were present. The meeting was dedicated to Professor Dennis V. Lindley, pioneer and champion of modern Bayesian Statistics, a founding member of the Valencia organizing committee and former Conference President.

For this meeting the organizing committee invited 25 leading experts in the field to present papers, followed by discussion. The International Society for Bayesian Analysis selected another 50 contributed papers for oral presentation. A further 290 papers were presented in three poster sessions.

These Proceedings contain 23 invited papers with their discussions, as well as 31 contributed papers (of which 10 were presented orally and 21 as posters), selected after a rigorous refereeing process. Together they provide a definitive overview of current concerns and activity in Bayesian Statistics, encompassing a wide range of theoretical and applied research.

Three papers treat topics related to the fundamental concept of exchangeability. **Lauritzen** characterizes random Rasch-type models for binary data in terms of sufficiency and row-column exchangeability; **Arellano-Valle, Iglesias and Vidal** study elliptical symmetry and its implications for inference; while **Esteves, Wechsler, Iglesias and Pereira** introduce a mixture extension of Polyá's urn scheme and discuss its predictive properties.

Problems in nonparametric Bayesian inference are considered by **Salinetti**, who describes the use of the hypo-strong law of large numbers to show consistency; and **Gutiérrez-Peña and Nieto-Barajas**, who analyze a nonparametric mixed Poisson process using an independent increment process prior for the mean function.

Other theoretical topics are treated by **Fraser, Reid, Wong and Yi**, who construct a third-order accurate likelihood function free of nuisance parameters; and by **Pettit and Sugden**, who consider estimation of a finite population total while allowing for outliers.

The objective Bayesian school is represented by **Bernardo and Juárez**, who treat the problem of point estimation in invariant fashion; **Rodríguez, Álvarez and Sansó**, who develop Bayesian reference analyses and intrinsic Bayes factors for a model motivated by a problem in oil exploration; and **Girón, Martínez, Moreno and Torres**, who provide a default model choice perspective on the analysis of matched pairs in the presence of covariates.

Two papers deal with Bayesian approaches to inverse problems. **Wolpert, Ickstadt and Hansen** develop a nonparametric analysis for ill-posed problems, given the values of certain integrals with respect to an unknown measure; while **Higdon, Lee and Holloman** construct methodology for estimating spatially dependent inputs from outputs generated by a complex physical or computational model.

The growing interest in causal inference is represented by three papers. **Chib** presents a Bayesian analysis, within the "potential outcomes" framework, for estimating treatment effects in the presence of unobserved confounders; **Daneshkhah and Smith** relate independence and consistency properties of prior distributions for a causal Bayesian network; while **Leucari and Consonni** apply reference conditioning to define and study compatibility of priors across a collection of such networks.

* The Proceedings of previous meetings have been published: the first by the University Press, Valencia (1980); the second by North-Holland, Amsterdam (1985); and the third, fourth, fifth and sixth by Clarendon Press, Oxford (1988, 1992, 1996, 1999). The editors in each case were the members of the organizing committee.

Simulation-based Bayesian computation is both a practically important and a theoretically challenging topic. **Mengersen and Robert** introduce the "pinball sampler" for generating Monte Carlo samples with an exact target distribution; **Papaspiliopoulos, Roberts and Sköld** compare the effects of centered and non-centered hierarchical model parametrizations on the convergence of MCMC routines; **Lavine** supplies a theorem allowing the identification of an ergodic chain for a subvector within a non-convergent Markov chain; and **Rasmussen** reduces the computational demands of hybrid Monte Carlo methods by incorporating a Gaussian process model.

Variational approximations are a useful fast alternative to simulation. **Beal and Ghahramani** develop variational bounds on marginal model likelihoods in the presence of incomplete data; while **Blei, Jordan and Ng** apply variational methods to a hierarchical model of a large-scale text collection.

Bayesian approaches to multivariate and regression analysis form a popular topic. **Liu, Zhang, Palumbo and Lawrence** apply Markov chain Monte Carlo methods to select and transform variables for cluster analysis; **Chipman, George and McCulloch** develop Bayesian analyses of treed generalized linear models, allowing local specification of the response model; **Neal** introduces "Dirichlet diffusion trees," combining exchangeability with hierarchical clustering, to structure multivariate prior distributions; **Peña, Rodríguez and Tiao** apply the SAR procedure to identify data heterogeneity and fit piecewise regression models; and **Smith and Walshaw** take some bivariate steps towards a Bayesian analysis of multivariate extreme values.

Three paper deal with gambling and finance. **Schervish, Seidenfeld and Kadane** use the gambling set-up of de Finetti's "dutch book" coherence argument to introduce measures of incoherence; **Quintana, Lourdes, Aguilar and Liu** consider the relevance of dynamic Bayesian modelling to investment in financial markets; and **Polson and Stroud** develop Bayesian methodology for combining data on financial derivatives and on their underlying assets.

A number of papers treat various aspects of temporal and spatial modelling and analysis. **Virto, Martín, Ríos-Insua and Moreno-Díaz** explore the applicability of MCMC methods to dynamic programming; **Zohar and Geiger** discuss problems of tracking groups of moving objects; **Scott and Smyth** use a hidden Markov model representation to analyze a Markov modulated Poisson process; **Lefebvre, Gadeyne, Bruyninckx and de Schutter** extend Kalman filter methods to online estimation of nonlinear systems; **Dethlefsen** applies state-space models and Kalman smoothing to analyze spatial Markov random fields; **Garside and Wilkinson** develop computational estimation tools for a lattice model with a latent spatio-temporal process; **Tamminen and Lampinen** use hierarchical modelling to aid feature location in computer vision; and **Carlin and Banerjee** develop a hierarchical spatio-temporal model for multivariate survival data.

In other fruitful applications of hierarchical modelling, **Davy and Godsill** analyze harmonic musical sounds; **Johnson, Graves, Hamada and Reese** consider the reliability of multi-component systems; and **Ferreira, West, Lee, Higdon and Bi** use multi-scale time-series models to estimate hydrological permeability fields.

Several papers are motivated by genetic microarray technology, where many variables may be measured on few individuals. In this context, **Genovese and Wasserman** compare Bayesian and frequentist approaches to multiple testing; while **West** discusses Bayesian factor regression models. **Mertens** applies Bayesian logistic regression models to microarray discrimination problems; while **Wakefield, Zhou and Self** use a hierarchical model to cluster temporally ordered gene expression data.

Other applied and methodological contributions include: **Newton, Yang, Gorman, Tomlinson and Roylance**, who describe a modelling strategy for analyzing genomic aberrations;

Gebouský, Kárný and Quinn, who exploit prior information to make inferences from sparse medical diagnostic data; **Choy, Chan and Yam**, who analyze salamanders with heavy tails; **Jamieson and Brooks**, who investigate density dependence in duck dynamics; and **Ausín, Lillo, Ruggeri and Wiper**, who attempt to optimize hospital bed provision. **Vehtari and Lampinen** use cross-validation to estimate the predictive utility of a model; **Erosheva** develops a Bayesian analysis of the "grade of membership" model; **van der Linde and Osius** consider uses of the odds ratio parametrization; **Zheng and Marriott** analyze a linear trend model with smooth transitions in intercept and slope; and **Dobra, Fienberg and Trottini** present a Bayesian framework for thinking about the confidentiality of individual data in a contingency table.

The task of deciding which of the many excellent conference papers should be included in the limited space of this volume was not an easy one. The organizers would like to express their deep appreciation for the assistance and advice of the associate editors: Bradley P. Carlin, Siddhartha Chib, Stephen Fienberg, Edward George, Simon Godsill, Eduardo Gutiérrez-Peña, David Higdon, Valen Johnson, Steffen Lauritzen, Jun Liu, Angelika van der Linde, Kerrie Mengersen, Michael Newton, Daniel Peña, Gareth O. Roberts, Gabriella Salinetti and Mark J. Schervish.

We are indebted to the Conference sponsors, the *Universitat de València* and the *International Society for Bayesian Analysis*, as well as to *Iberia Airlines*, *Microsoft Corporation*, the *Universidad de La Laguna, Canarias* and the *United States National Science Foundation*, for their generous financial support.

We are also most grateful to Mailo Albiach, Miguel Juárez, Carlos Perez and Dolores Tortajada for their invaluable administrative and technical assistance, and in particular to Dolores Tortajada for preparing the final TEXversion of these Proceedings. The Eighth Valencia International Meeting on Bayesian Statistics is planned to take place in the early summer of 2008.

M. J. Bayarri
J. O. Berger
J. M. Bernardo
A. P. Dawid
D. Heckerman
A. F. M. Smith
M. West

CONTENTS

I. INVITED PAPERS (with discussion)

II. CONTRIBUTED PAPERS