BAYESIAN STATISTICS 8

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PREFACE

The Eighth Valencia International Meeting on Bayesian Statistics was held in Benidorm (Alicante, Spain), 150 kilometres south of Valencia, from June 2nd to June 6th 2006. The meeting was convened with the Eighth World Meeting of the International Society for Bayesian Analysis (ISBA). Valencia/ISBA 8 continued the tradition of this premier conference series – established in 1979 with the first Valencia International Meeting – as the forum for a definitive overview of current concerns and activities in Bayesian statistics.* In this tradition, Valencia/ISBA 8 encompassed a wide range of theoretical and applied research, and also notably highlighted the breadth, vitality and impact of Bayesian thinking in interdisciplinary research.

The Valencia organising committee invited 20 leading experts to present papers, each of which was followed by discussion led by an invited discussant. ISBA selected 32 contributed papers for plenary oral presentation, and a further 326 papers were presented in three poster sessions. The conference was preceded by a day of expository tutorials on Bayesian statistics.

These *Proceedings* contain the 20 invited papers with their discussions, and synopses of 19 contributed papers (of which five were presented orally and 14 as posters) that were selected by a rigorous refereeing process. The full versions of these contributed papers appear in the *Bayesian Analysis* electronic journal.

The papers cover a broad range of topics.

Foundational issues in statistics are addressed by several authors. At the inferential interfaces, **Mira and Baddeley** are interested in the potential for estimating equation methods to provide unifying opportunities in deriving statistical estimators, while **Rousseau** explores theoretical relationships between null and interval testing from both Bayesian and non-Bayesian viewpoints. Objective Bayesian foundations are addressed by **Wallstrom**, who revisits marginalization paradoxes and proposes resolutions in countably additive settings.

Disciplinary interface foundations are investigated in two papers. **Bishop and Lasserre** discuss discriminative and generative approaches to learning, representing interface statistics-machine learning perspectives in classification problems. The foundations of Bayesian statistics intersect the foundations of quantum theory, and **Schäck** provides an overview of recent and emergent

* 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, sixth and seventh by Clarendon Press, Oxford (1988, 1992, 1996, 1999, 2003). The editors in each case were the members of the organizing committee.

advances in interpreting and defining quantum mechanical probabilities from a subjective Bayesian viewpoint.

Research in Bayesian non-parametrics percolates through the proceedings. Several papers focus on extending and applying variants of Dirichlet process models and mixtures. **Gelfand, Guindani and Petrone** provide a synthesis of Bayesian spatial modelling with Dirichlet processes to generate a new class of non-parametric spatial models, while **Ghahramani, Griffiths and Sollich** discuss Dirichlet process and related models for binary latent variables applications. Theoretical developments are discussed by **Kokolakis and Kouvaris**, who construct classes of continuous random measures by mixing Dirichlet process building blocks.

Flexible models for Bayesian non-parametric regression and function fitting are the primary focus of two papers. **Clyde and Wolpert** develop a class of Bayesian non-parametric regression models, and associated computational methodology, based on Lévy process priors, while **Mertens** develops semi-parametric, basis-function approaches to regression with a proteomic application.

The growth and development of objective Bayesian methods in the last several years is reflected in a number of papers. Among these, **Sun and Berger** develop and explore classes of objective priors in multilinear/normal contexts, **Bernardo and Pérez** inject objective Bayesian decision theory using information-theoretic loss functions in the normal means problem, while **Cano, Kessler and Salmerón** discuss objective prior specification and testing in the related one-way random effects model.

Theory and methods for model assessment and testing are the primary focus of a number of papers. **Almeida and Mouchart** discuss model specification testing of a parametric null model embedded in an encompassing class of non-parametric alternatives, while **Chakrabarti and Ghosh** develop theoretical studies of cross-validatory Bayes factors and related methods in model selection for prediction. Developments in Bayesian decision theory linked to 'large p' multiple testing problems are addressed by **Müller, Parmigiani and Rice**, motivated by genomic applications. **Peruggia** develops Bayesian analysis for checking a linear hierarchical model by embedding in models with correlated error structures, while **Spitzner** develops theoretical investigation of testing under both objective and smoothness priors in the 'large p' normal means problem.

In time series and forecasting, **Carvalho and West** introduce and develop a synthesis of matrix-variate dynamic models with graphical modelling, illustrated in applications to Bayesian portfolio decision-making in finance.

The growth of structured probabilistic modelling for challenging problems in molecular biology, genetics and genomics is seen in several papers.

Among these, **Brooks, Manolopoulou and Emerson** develop highly structured mixture models, and associated computational methods, in problems of evolutionary molecular genetics with ecological/phylogeographic applications, while **Cowell, Lauritzen and Mortera** discuss Bayesian mixture modelling in DNA forensic analysis. **Merl and Prado** introduce, develop and apply structured Bayesian models of DNA sequence data in challenging problems of detecting natural selection, while **Xing and Sohn** develop hidden Markov Dirichlet process models in studies that aim to jointly model recombination and coalescence events in molecular population genetics.

While computational research is evident in many papers, several authors are concerned primarily with computational questions. The evaluation of marginal likelihood values in Bayesian analysis is addressed in two papers. **Raftery, Newton, Satagopan and Pavel** develop new computational approaches to this problem based on the harmonic mean identity, while **Skilling** introduces a new 'nested sampling' approach inspired by methods in statistical physics. Sequential computation using sequential Monte Carlo methods is broadly reviewed and developed theoretically by **Del Moral, Doucet and Jasra**, while **Holmes and Pintore** explore sequential "relaxation" approaches for iterative development of regression and distributional models. In the MCMC domain, **Möller and Mengersen** provide theoretical development of a method for estimation of posterior expectations of monotone functions using theory of dominating processes.

Biomedical applications of Bayesian methods continue to represent a major area of success and growth of more realistic, complex statistical modelling. **Dukíc and Dignam** develop flexible multiresolution models for survival hazard functions applied to breast cancer recurrence, while **Jirsa, Quinn and Varga** discuss sensitive prior modelling of response curves in radiotherapy studies.

Bayesian research and applications in spatial statistics have expanded substantially over the last decade, and several authors address aspects of this broad field. Practical questions of prior elicitation are developed in **Denham and Mengersen** in spatial/ecological contexts. **Gamerman, Salazar and Reis** overview a range of recent methodological developments and introduce new spatio-temporal systems using classes of dynamic Gaussian process models, while **Ma and Carlin** develop hierarchical spatial models utilizing multivariate conditional autoregressions.

Bayesian methods in social and policy sciences are evident in several papers. **Little and Zheng** discuss and overview Bayesian thinking and methods in finite population survey sampling studies, while **Madrigal** extends influence diagrams to incorporate experimental design intervention nodes motivated by policy decision assessment studies.

The growth and success of complex Bayesian modelling for applications in challenging scientific areas is reflected in several papers. Among these, **Schmidler** introduces novel Bayesian models for geometric shapes, and efficient computational approaches to shape matching, with applications to problems of protein structure alignment and classification, while **Short, Higdon and Kronberg** develop Bayesian process convolution and smoothing spline models in a study of estimation of galactic magnetic fields.

Estimation of multi-regime models, including change-point problems, are considered by several authors. **Girón, Moreno and Casella** revisit change-point problems in regression from an objective Bayesian viewpoint, while **Hutter** discusses MCMC and model selection questions for piecewise constant response functions.

We are most grateful to a number of organizations that provided support for the meeting. These include the *Universitat de València*, the *International Society for Bayesian Analysis*, *Microsoft Corporation*, and the *National Science Foundation of the USA*.

The review and selection of contributed papers for parallel publication in this volume and *Bayesian Analysis* (`http://ba.stat.cmu.edu`) was handled by the editorial staff of the journal. We are most grateful for the efforts of founding editor-in-chief Rob Kass, current editor-in-chief Brad Carlin, managing editor Herbie Lee, system managing editor Pantelis Vlachos, editors Alicia Carriquiry, Phil Dawid, David Dunson, David Heckerman, Michael Jordan, Fabrizio Ruggeri, and Dalene Stangl, and of course numerous anonymous associate editors and referees. The papers accepted and appearing in Bayesian Analysis are represented here by their extended synopses.

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We look forward to the Ninth Valencia International Meeting on Bayesian Statistics, which will again be convened jointly with ISBA and is planned to take place in the early summer of 2010.

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