Special issue in honor of Kathryn Chaloner

We are honored to be guest editors for this special issue of *Applied Stochastic Models in Business and Industry*, dedicated to Kathryn Chaloner’s life and achievements. Contributions from her colleagues and friends in this volume are devoted to Kathryn’s early research interest in Bayesian optimal design. She was a pioneer in this field and had a broad impact on the subsequent literature on experimental design. Kathryn was internationally known for her research in Bayesian Statistics, which included design of experiments, outlier detection, prior elicitation, and clinical trials, and for her advancements in the study of HIV/AIDS. She was an accomplished researcher, teacher, and mentor. She actively encouraged women and under-represented minority students to join the field of biostatistics and provided mentorship, support, and encouragement.

The special issue contains seven papers. The first three papers present some of the recent work in Bayesian optimal designs for nonlinear models, binary responses, and experiments with adversarial components. This is followed by two articles on Bayesian designs in clinical trials. The last two articles of the special issue involve engineering design problems.

The paper by Giovagnoli considers the binary response models of Chaloner and Larntz (1989, *Journal of Statistical Planning and Inference*, 21:191–208) and develops an adaptive version of $A$-optimal Bayesian designs that are revised as additional data become available during the experiment. Adaptive Bayesian compound designs is also discussed as another extension.

Konstantinou and Dette develop approximate Bayesian $D$-optimal designs for nonlinear regression models that involve covariates that cannot be observed directly. Applications to specific nonlinear models including the exponential regression model are considered and characterizations of the $D$-optimal saturated designs are presented.

Optimal sample size selection for experiments is considered by De Santis and Gubbiotti in an adversarial setting where the decision makers have different prior opinions while having common utility functions and data. Using a Bayesian decision approach with a quadratic loss function, the authors present results for the one-parameter exponential family and investigate effect of the priors on the optimal sample size.

Müller, Xu, and Thall discuss advantages and limitations of Bayesian decision theoretic approach in design of clinical trials. In doing so, the authors present a specific case study and point out the limitations such as the computational difficulties involved in solving sequential problems as well as selection of utility functions capturing different stakeholder interests.

The article by Ventz, Parmigiani, and Trippa also consider limitations of the Bayesian framework in design of clinical trials and propose a strategy to alleviate these. The proposed strategy involves combining Bayesian designs with frequentist metrics such as error rates, confidence intervals, etc. that are commonly used by medical community and regulatory agencies. The authors show that this can be achieved by an inclusion of frequentist constraints into the Bayesian formulation. The constrained decision theoretic framework is illustrated via several applications and computational algorithms are presented for implementing the proposed approach.

Nakamura, Seepaul, Kadane, and Reeeja-Jayan discuss design of experiments in materials science. The authors consider use of a batch-sequential experiment and a regression model to determine optimal levels of input variables for synthesis of ceramic materials. It is illustrated that the optimal settings produce more reliable results than other experiments.

The final article by Polson and Soyer considers Bayesian design of accelerated life tests for reliability assessment. An augmented probability simulation (APS) approach using Lindley’s (1976, *Annals of Statistics*, 4:1–10) conjugate utility functions is proposed to compute optimal designs in an efficient manner. The proposed approach is illustrated using single and multiple point designs. Use of particle based methods for APS is also discussed as an alternative to Markov chain Monte Carlo methods.

Refik Soyer
Department of Decision Sciences,
George Washington University, USA
E-mail: soyer@gwu.edu

Isabella Verdinelli*
Department of Statistics,
Carnegie Mellon University, USA

*Isabella Verdinelli knew Kathryn for over forty years, since they were both MSc students of Statistics at University College in London. They were colleagues, co-authors and friends.