BOOK REVIEWS

EDITOR:
THOMAS M. LOUGHIN

Laws of Small Numbers: Extremes and Rare Events, 2nd revised and extended edition
(M. Falk, J. Huesler, and R.-D. Reiss)  Arnold Janssen

Statistical Methods in Spatial Epidemiology, 2nd edition
(A. B. Lawson)  T. C. Bailey

Statistical Monitoring of Clinical Trials: A Unified Approach
(M. A. Proschan, K. K. G. Lan, and J. T. Wittes)  X. Joan Hu

Bioequivalence Studies in Drug Development, Methods and Applications
(D. Hauschke, V. Steinijans, and I. Pigeot)  S. Chung Chow

The Theory of Response-Adaptive Randomization in Clinical Trials
(F. Hu and W. F. Rosenberger)  Atanu Biswas

Finite Mixture and Markov Switching Models
(S. Frühwirth-Schnatter)  Dankmar Böhning

(T. E. Duncan, S. C. Duncan, and L. A. Strycker)  David B. Flora

Modern Experimental Design
(T. P. Ryan)  Robert G. McLeod

The Statistical Analysis of Interval-Censored Failure Time Data
(J. Sun)  Guadalupe Gómez

Data Analysis and Graphics using R, 2nd edition
(J. Maindonald and J. Braun)  Carl James Schwarz

Bayesian Core: A Practical Approach to Computational Bayesian Statistics
(J. M. Marin and C. P. Robert)  Lawrence Joseph

Brief Reports by the Editor

Bayesian Statistical Modelling, 2nd edition
(P. Congdon)

Structural Equation Modeling and Natural Systems
(J. B. Grace)

Principles of Statistical Inference
(D. R. Cox)

Modes of Parametric Statistical Inference
(S. Geisser)


The present monograph is the second edition of the early seminar book from 1994 with the same title. The main aim is the probabilistic modeling of rare events and their related processes given by extremes. This is well done via the truncated empirical point processes, which can be approximated by Poisson point processes. The book combines the mathematically oriented development of the theory of rare events with all kinds of underlying applications. The related statistical software XTREMES is available in the updated monograph with a CD.


In comparison with the first edition about 130 new pages are added. Much new material is added in Part II concerning multivariate extremes. The following comments focus mainly on these aspects. In Chapter 5, the reader finds a new spectral decomposition of multivariate extreme value distributions. Together with generalized Pareto models the statistical modeling of multivariate extremes is very fruitful. The question about efficient testing and estimation of extreme quantities is discussed in Section 7.3. The results are obtained via the powerful LAN theory of Le Cam for local asymptotically normal models. The program works for thinned empirical processes. Along these lines efficient procedures are established.

There are many new contributions in Part III for rare events in the non-i.i.d. case. Another section deals with maxima of processes. A highlight is certainly the application of
these results to the boundary crossing probability for Gaussian processes. Section 12 is devoted to applications and statistics for extremes.

The book can be used for a graduate-level course. It is an up-to-date monograph that is also of interest for research. The authors have contributed several papers and other books to extreme value theory.

The style of the book is very appealing with illustrations and practical examples. I appreciate it very much that the mathematical background is presented rigorously and new developments are taken into account. It is also a great advantage that now the statistical software system *xtremes* is available, which supports the second edition. In conclusion, the monograph can strongly be recommended.

REFERENCE


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Since the first edition of this book appeared in 2001, concerns about health and the environment have remained high on the public agenda. Fears about the spread of avian influenza, potential bioterrorism attacks, and the like, have fuelled renewed interest in surveillance systems for early detection of threats to animal or to human health. New issues have also emerged, such as the possible health impacts of climate change. Interest in spatial epidemiology therefore continues to grow, accompanied by significant new developments in associated statistical methodology. A second edition of this valuable and comprehensive review of the field is therefore both timely and welcome. The new edition not only updates the original, but also significantly expands on it. In total, over 100 pages have been added to what was already an impressive range of models and methods is discussed and more material remains devoted to disease mapping, but some 20 pages have been added to this in the new edition. Among other things, this contains new material on multivariate disease mapping, space–time modeling, spatial survival analysis, and the handling of longitudinal data. The final three chapters in Part 2 have been reordered with the previous Chapters 10 and 11 being brought forward to become Chapters 9 and 10. As in the original, the first deals with modeling relationships between spatial variations in disease incidence and environmental exposure, while the second considers infectious disease modeling. Again there is significant new material in both these chapters, particularly in the second, where survival analysis and censoring are now covered. The previous Chapter 9 on disease surveillance becomes the final Chapter 11 in the new edition. It has been approximately tripled in length and contains much new material particularly on “syndromic surveillance” (the use of surrogate information in the early detection of health events), but also on Bayesian approaches in disease surveillance and computational considerations. The decision to move this to the last chapter of the book is a good one, since surveillance techniques potentially apply to all of the previous problem areas considered in Part 2.

Practical application of methods is considered in more depth in the new edition through a much-enlarged appendix on “algorithms and code” and through an extended appendix discussing relevant software. These changes, along with additions to the book’s accompanying website, go some way towards countering a possible criticism of the original that it provided little real detailed help on how to go about implementing in practice many of the methods discussed throughout the book.

In conclusion, my overall impression is that the second edition is a substantial improvement on what was already a valuable, well-structured and comprehensive reference to
recent research on statistical techniques in spatial epidemiology. That said, the book remains, in places, a difficult read for those who do not have a fairly strong background in statistics. Some readers will need to work hard to truly understand the fine detail of certain models and how to implement them in practice.

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Statistical interim review has become essential in clinical trials. It is responsible for monitoring trials with respect to early benefit or harm. The task is conflicting and complex and often challenging to the Data Safety Monitoring Boards (DSMB) of the trials, who usually conduct the analyses and ultimately recommend whether or not to continue the trials as planned. There have been various methods proposed for statistical monitoring. This book stresses a mathematical unifying formulation, and shows when and how the framework can be used or needs to be modified to produce valid inference. It aims “to provide biostatisticians with tools not only to perform the necessary calculations but to be able to explain the methodology to our clinical colleagues,” as noted in the Preface. This reviewer regards the intention highly.

All three authors have substantial practical experience in interim monitoring. This grants them a privilege of having a variety of practical examples to motivate and to illustrate important issues related to statistical monitoring of ongoing clinical trials. The authors describe many practical projects and provide their illustrative analyses in the book. The examples, along with the extensive hypothetical ones used for illustration, are a major strength of the book. This reviewer particularly enjoyed the description in Chapter 1 of three trials: the Cardiac Arrhythmia Suppression Trial (CAST), the Multicenter Unsustained Tachycardia Trial (MUSTT), and the estrogen/progesterone replacement therapy trial (PERT) of the Women’s Health Initiative. The authors use these three completed trials to explain clearly the two sometimes conflicting considerations, “individual ethics” and “collective ethics,” that the DSMBs often encounter and struggle with. A newcomer’s interest in statistical monitoring can be well stimulated by the examples.

Formal interim reviews are usually formulated according to different outcomes. The authors emphasize the Brownian motion framework underlying many of the basic methods. This helps to provide insights into the complex decision processes. In addition, it gives a natural setting to present the Lan-DeMets spending function, which provides flexible alternatives to the classical Pocock and O’Brien-Fleming boundaries and is now well received and commonly used in practice.

The book covers most of the important topics in statistical monitoring of clinical trials, including monitoring boundary, conditional power, inference following a group-sequential trial, and adaptive sample size. It addresses practical survival monitoring, monitoring for safety, and Bayesian monitoring. It has a chapter on “Topics Not Covered,” which discusses briefly some other important topics in the area. Appendix II provides detailed information about the use of a program for computing necessary quantities in group sequential trails. This is a big plus, especially for many practitioners of statistical monitoring in clinical trials.

This book is valuable for anyone currently involved with or interested in monitoring clinical trials. For readers who intend to learn statistical monitoring from the beginning, the two recent books in the area, Group Sequential Methods with Applications to Clinical Trials by Jennison and Turnbull (2000) and Data Monitoring Committees in Clinical Trials, a Practical Perspective by Ellenberg, Fleming, and DeMets (2002), may be helpful to appreciate some discussions in this book.

REFERENCES


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It is my pleasure to review this book. Before we introduce the book, it will be helpful to provide some background for the role of bioavailability and bioequivalence in pharmaceutical research and development. In pharmaceutical research and development, bioavailability and bioequivalence studies usually serve as surrogates for clinical studies under the fundamental assumption that if a test product is bioequivalent to a reference product in terms of drug absorption (measured by pharmacokinetic parameters such as area under the blood- or plasma-concentration time curve, AUC, and maximum concentration, $C_{\text{max}}$), then it is assumed that the two drug products are therapeutically equivalent. In 1984, the United States Food and Drug Administration (FDA) was authorized to approve generic drug products based on evidence of average bioequivalence obtained through the conduct of bioequivalence studies. As a result, the FDA published the first guidance regarding design and analysis of bioequivalence under a two-sequence, two-period $(2 \times 2)$ crossover design in 1992. As more generic drug products become available, it is a concern that the generic drug products approved based on the average bioequivalence may not be bioequivalent to one another,
especially when significant subject-by-formulation (product) is observed. As a result, in early 1990, the FDA started an initiative to explore a new concept, criteria, design, and methodology for testing so-called population bioequivalence and individual bioequivalence. In 2003, the FDA published a guidance to conclude this initiative. The authors of this book actively participated in this initiative (by attending many workshops cosponsored by the FDA). Hence, it is very nice to see that the authors have developed this book along this line.

As indicated in the preface of the book, the focus of the book is to provide an up-to-date overview of available methods, via numerous examples using real data. This book consists of 10 chapters, which cover various topics regarding bioequivalence studies in drug development. As compared with other competitors, the uniqueness of this book is that it not only introduces a nonparametric approach for assessment of bioequivalence (although it is not widely used and accepted in the United States), but also provides methods for analysis of pharmacokinetic interactions. Moreover, it provides useful SAS programs for assessment of population and individual bioequivalence (Chapter 9). However, it is kind of strange to include the chapter on Therapeutic Equivalence (Chapter 10) in this book because the concept of bioequivalence is similar but different from that of therapeutic equivalence (see, e.g., Chow and Shao, 2002). For each chapter, the authors lay out basic concepts, statistical methods, and interpretations of the results well. It should, however, be noted that the US FDA’s current position regarding bioequivalence assessment in drug development is that “Average bioequivalence is required; individual bioequivalence may be used. Consultation with medical/statistical reviewers prior to the adoption of average bioequivalence or population/individual bioequivalence in drug development is strongly recommended.”

While the researchers and scientists who are engaged in the research area of bioequivalence would benefit from this book, there are still some important areas that are not included in this book. For example, the authors do not cover sample size calculation for assessment of population/individual bioequivalence under a higher-order or replicated crossover design, or the assessment of in vitro bioequivalence testing for local drug delivery drug products such as nasal aerosols and nasal sprays (see, e.g., Chow, Shao, and Wang, 2003a). In addition, it may be a good idea to discuss other related topics such as dose proportionality, steady state analysis, and population pharmacokinetic for completion. Moreover, the authors may want to update references by including the following references in future editions. These references include: (i) Lee, Shao, and Chow (2004), which provided a unified approach for modified large sample confidence intervals for linear combinations of variance components following the idea proposed by Hyslop, Hsuan, and Holder (2000). (ii) a review paper by Chow (1999) whose criticisms has led to the drop of the FDA (1997) draft guidance, (iii) Chow, Shao, and Wang (2002) and Chow, Shao, and Wang (2003b), which provided correct statistical methods for assessment of individual bioequivalence under a two-sequence, three-period \((2 \times 3)\) crossover design and population bioequivalence, respectively.

Pointing out areas for improvement does not discount the value of this book. This book would be beneficial to both pharmaceutical scientists/researchers and biostatisticians who are engaged in the area of bioequivalence studies in drug development. As an individual, I would like to add this book to my book collection of pharmaceutical research and development.

REFERENCES


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This well-written book is the first book-length representation of the theory of response-adaptive designs in phase III clinical trials, and it is indeed a remarkable addition in the literature of response-adaptive designs.

Response-adaptive designs has become more popular recently. A considerable number of research papers have been published in different statistical and biostatistical journals during the last 15 years or so. The present authors contributed a lot to the development of the process, and thus the current book was written by experts in this area.

The authors start with the introduction of response-adaptive designs. They briefly discuss the available urn
designs (which are very popular designs in terms of understanding and applications), but switch to the optimal response-adaptive designs and procedures based on sequential estimation. The very important aspects of sample-size calculation and inference (based on likelihood) following allocation are also discussed. The book also discusses important issues in response-adaptive trials like delayed response, time trend, continuous response case, situations with more than two treatments, and others. Significant attention is paid to design in the presence of covariates. The authors do a very good job by providing a detailed comprehensive theory under delayed responses and covariates.

The book discusses designs from one angle, mostly from the optimality viewpoint, and in the process does not discuss or even cite many ad hoc designs in the literature, which might be interesting to the readers of response-adaptive designs. The main focus of the book is the asymptotic results for the designs given in the book. Such asymptotic results will provide a theoretical basis for possible application of the design. This book is a must-read for researchers of the response-adaptive designs. More discussions on the continuous-response case and the stopping-rule approach could make the book more interesting.

Taking all these into account, I think the book is a milestone in the literature on response-adaptive designs in clinical trials.

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The author writes in the preface of her book:

“In the beginning, my intention was to write the book entirely from a Bayesian viewpoint, which has been the only way of statistical thinking that was able to satisfy my own intellectual needs. I was introduced into the Bayesian approach as a student during a course on reliability theory read by Reinhold Viertl in the winter term 1981/1982 at the University of Technology. I became a practical Bayesian a few months later when I had the incredible luck to start my scientific career on a project using Bayesian methods for flood design in hydrology (Kirnbauer et al., 1987).

“However, the more this book project progressed, the clearer it became that a lot would be said about finite mixture and Markov switching models, about their mathematical formulation, their properties, and their applications, that would have been said with the very same words by any non-Bayesian. Therefore, I decided to put the whole project on a broader basis as far as statistical inference is concerned.”

From my humble perspective, this was a wise decision. It impressively reflects the conflict of the author, present throughout the entire book, between her own preferences in statistical inference and competitive existing approaches. In my opinion the development of a solution for this conflict has lead to a magnificent book which, in almost 500 pages, gives a fair and, in my opinion, unbiased presentation of recent developments in mixture models, including Bayesian and non-Bayesian methods.

This also explains why this book was needed, considering the numerous existing books on mixtures, including Everitt and Hand (1981), Titterington, Smith, and Makov (1985), McLachlan and Basford (1988), and more recently Lindsay (1995), McLachlan and Peel (2000) (potentially in connection with McLachlan and Krishman, 1997), and Böhnning (2000). The book covers a lot of recent developments, with about 40 pages of references including a lot of the author’s own work (partly still under her maiden name).

Briefly stated, the first nine chapters of the book (about 300 pages) cover more classical aspects of mixtures including regression and nonnormal models. The remaining four chapters cover Markov switching models in about 100 pages. An appendix on probability distributions completes the book.

The book is impressive in its mathematical and formal correctness, in generality and in details. Already in the introduction the author shows her knowledge of recent literature when she discusses recent work on the number of modes in mixtures of univariate and multivariate normal densities due to Ray and Lindsay (2005). This section is a pleasure to read. Another pleasure to read—also in the introductory part of the book—is the discussion on lack of identifiability in mixture models, which is clearly separated into causes: invariance of relabeling the components, potential overfitting, and finally (and from my point of view most importantly) generic nonidentifiability. The lack of very recent references might indicate the difficulty in obtaining results in this area.

In addition to high quality in its technical level, the book contains numerous excellent graphs illustrating the mathematical ideas geometrically. So-called helicopter tours of likelihood surfaces of mixture models are another example of the author’s ability to produce good artwork.

I could not detect any errors in the book, apart from a small, quite excusable mistake in the references. The consistency result of the mixture maximum likelihood estimator is certainly due to the late Jack Kiefer (together with J. Wolfowitz) rather than N.M. Kiefer who worked on switching regression models.

I sometimes missed examples involving real data sets. This is unfortunate, because there are so many very interesting example data sets around that show the usefulness of mixtures (see McLachlan and Basford, 1988, Titterington, Smith, and Makov 1985, or Böhnning, 2000).

I also occasionally wished that some aspects had been discussed more extensively. Examples are the nonparametric likelihood approach (Lindsay, 1983), including algorithmic aspects different from the EM algorithmic concept (Böhnning, 1989), or the controversies associated with the distribution of the likelihood ratio statistic for mixture models, given the enormous impact for the application in the mixed model theory. The discussion of the latter aspect on page 115 is a bit scanty and misses important references.

Finally, I have difficulty in determining the potential readership of this book. The preface does not indicate for whom it is intended. On the back cover it says: “The aim of this..."
book is to impart the finite mixture and Markov switching approach to statistical modeling to a wide-ranging community. This includes not only statisticians, but also biologists, economists, engineers, financial agents, market researchers, medical researchers, or any other frequent user of statistical models. I am doubtful whether a biologist or medical researcher without a complete statistical education would be able to understand the book. I, myself, being involved in applied statistical education would hesitate to base a course on mixture models solely on this book. However, I imagine it would be helpful as an additional reference among a wider range of available textbooks in the area.

This does not take away any merit from this masterpiece of a book. I am supremely convinced that it will find many friends among experts and newcomers into the world of mixture models.

REFERENCES


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Latent growth curve modeling is an increasingly popular approach to analyzing longitudinal panel data in the social and behavioral sciences. *An Introduction to Latent Variable Growth Curve Modeling: Concepts, Issues, and Applications* (2nd ed.), by Duncan, Duncan, and Strycker, presents a broad overview of the use of structural equation modeling (SEM; e.g., Bollen, 1989) methodology for the specification of a variety of latent growth curve models (LGMs). Any reader with a solid background in applied statistics will find the book accessible, but familiarity with SEM would be of great benefit. The book focuses on the use of SEM software and application, with many examples from the authors’ research on substance use among adolescents.

There are 14 chapters. The first three consist primarily of introductory material and a description of the basic model and issues in latent growth curve modeling, while the remaining chapters describe more advanced extensions and applications (save for a final summary chapter). With the exception of the first and last chapters, each is organized around one or more applied examples illustrated with SEM path diagrams, with little technical detail given. For each example, data, code, and output from several SEM software packages is on an accompanying CD.

Chapter 1 gives a brief historical context for LGMs as an alternative to autoregressive panel models, then outlines the remaining chapters, describes the four software packages referenced throughout, and briefly discusses model fit statistics. Chapter 2 is probably the most important of the book, as it presents the basic LGM for linear change over time, focusing on interpretation of parameters. Next, the chapter describes a few relatively simple models for nonlinear change. Chapter 3 will be of interest to readers who are familiar with mixed linear models, as it first describes LGM as a generalization of fixed effects, repeated measures ANOVA, and then draws parallels between LGM and mixed models. Importantly, Chapter 3 also introduces the idea of adding predictors and outcomes related to the latent growth variables.

Chapter 4 describes higher-order LGMs, which draw on the factor analysis tradition of inferring second-order latent variables from the correlations among first-order latent variables. Chapter 5 covers models for multiple populations and Chapter 6 presents models for accelerated longitudinal designs, where two or more short-term designs are linked to describe change over a longer period of time. Chapter 7 describes approaches to handling nested data structures. SEM approaches to dealing with this type of data are not well developed, and as the authors show, specification and estimation of these models can be tedious. Researchers encountering this type of data might be better off using mixed models.

The Chapter 8 presentation of growth mixture models is new for the current edition of the book. These models are similar to those described in Chapter 5, except that population membership, rather than being observed, is inferred using mixture distributions which are conceptualized using a discrete latent variable. Growth mixture modeling represents a relatively new procedure, and the authors appropriately acknowledge that it has a number of limitations that are not yet resolved. Chapter 9 gives a brief presentation of piecewise and pooled interrupted time series models, while
Chapter 10, another new chapter, describes the estimation of LGMs from ordinal data using polychoric and polyserial correlations.

Missing data is a notorious problem in longitudinal research; thus Chapter 11 is of particular importance for the applied researcher. Three missing data methods are presented: An approach drawing on Chapter 5, where groups with different patterns of missingness are treated as multiple populations, direct maximum likelihood estimation, and, new to this edition, multiple imputation. Chapter 12 is also new, describing both analytical and Monte Carlo approaches to power analysis. Finally, Chapter 13 briefly presents an approach to modeling interactions among latent growth variables.

Despite its clear and conceptually focused presentation, my overall impression of this book is that such effort has been made to present a large variety of models and extensions that the statistical principles underlying LGMs are slighted. Indeed, it is unwise to attempt many of the procedures without a deeper understanding of the specification, estimation, and evaluation of the basic LGM than can be derived from the early chapters. For that purpose, a book such as Bollen and Curran (2006) might prove more useful (although many of the extensions given here are also discussed by Bollen and Curran). Thus, a more appropriate title for the book, rather than “An Introduction to...” would be “Topics in...” Nonetheless, a comprehensive set of references to which readers can turn is provided for each topic. In sum, this text offers an easily comprehensible and broad survey of concepts, issues, and applications in latent growth curve modeling with an eye toward software implementation.

REFERENCES


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The statistical design of experiments has been successfully applied across many research fields in the natural sciences. Generally speaking, such experiments are conducted by adhering to vital statistical tenets such as randomization, replication, and blocking. With these principles in mind, this book provides a refreshingly thorough treatment of experimental design concepts and techniques while focusing less upon data analysis.

If one were only apprised of the chapter headings one might be inclined to believe that this is “just another book” on experimental design. It is true that the “usual” design topics are covered—completely randomized designs, randomized block designs, two-, three-, and mixed-level fractional factorial designs, nested designs, split-plot designs, response surface designs, robust designs, and repeated measures designs. However, upon closer examination, the distinguishing feature between this text and others on experimental design is the statistical acumen with which the author illustrates each topic. Furthermore, each chapter provides arguably the most extensive literature review of all experimental design texts. For each design topic, one comes away feeling thoroughly briefed on all pertinent literature. Furthermore, unique case studies and recent advances in such varied topics as two-level split-plot designs, response surface designs, and space-filling designs are summarized. This book lives up to its advanced billing of “modern” experimental design.

A further distinguishing feature of this text is the author’s emphasis on analysis of means (ANOM) and conditional (simple) effects, which have been largely ignored in the applied literature. The author advocates increased use of ANOM, possibly as a supplement to the usual ANOVA techniques, since it has the attractive feature of being “inherently a graphical procedure and is in terms of the original unit(s) of measurement.” The reader should be forewarned that ANOM is not a full substitute for ANOVA because it can only be used for fixed factors. Further limitations for ANOM also exist, for example, in the presence of unequal variances and for analyzing data arising from response surface designs. The author also advocates computing conditional effects (for fixed factors) in factorial designs as a means for circumventing the possibility of extreme interactions resulting in “completely erroneous conclusions being drawn.” This topic, although moderately technical, is thoroughly treated.

It is somewhat paradoxical to say this, but the greatest strengths of this text could also be seen as its greatest flaws. First, the exhaustive treatment of the literature is such that undergraduate students may occasionally become lost in what they view as “trivialities.” For example, even in the Introduction one could argue that the author too quickly becomes bogged down in the technicalities of detectable effects and appropriate sample sizes. Second, although data analysis is not the stated emphasis of the text, the general absence of computational formulas limits one’s ability to confirm results by hand.

The text includes output from MINITAB®, JMP®, and Design-Expert® although step-by-step instructions for acquiring the output are not provided. There is also occasional discussion regarding the statistical capabilities of other software. One should also be aware that despite describing various design optimality criteria the author does not explicitly provide catalogs of optimal designs to which a practitioner may refer. Finally, a number of useful exercises, some with solutions provided, are included at the end of each chapter.

In summary, the author’s wealth of knowledge is immediately evident even as one reads through the Introduction. This depth of discussion continues throughout most of the text. Consequently, I view this text as providing an excellent exposé concerning the actual statistical planning or “design” of experiments. I would highly recommend this text for both
applied researchers and motivated students seeking thorough instruction in experimental design principles.

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Interval-censored data are an actively researched phenomenon that can be encountered nowadays in a large number of situations. These include the very early paper from Peto (1973) analyzing girls’ sexual maturity development from annual surveys; demographical studies, where the use of retrospective surveys and population registry data permits an estimate of the distribution of migrations or job changes (Courgeau and Najim, 1996); and the numerous applications found in AIDS studies. Interval censoring mechanisms arise when the event of interest cannot be directly observed and it is known only to have occurred during a random interval of time. This type of mechanism is quite common in longitudinal studies where subjects are not monitored continuously and hence the event of interest is detectable only at specific times of observation, such as at the time of a medical examination. The book’s author, Jianguo (Tony) Sun, is well known in the field, having published more than 30 papers that address statistical issues and develop statistical methods for the analysis of singly and doubly interval-censored survival data arising from AIDS, cancer, and other disease studies.

The book’s purpose is to collect and unify methods of analysis for lifetime data when part of the data is interval censored. The book is intended for a technical audience with a thorough background in statistics and in computational methods. The book is organized into 10 chapters and one appendix containing some sets of data. The first six chapters are the core of the book. They are devoted to statistical inference with one single random variable, which is interval censored. Chapters 7 and 8 cover, respectively, bivariate and doubly interval-censored random variables while Chapter 9 treats the case of panel count data. Chapter 10 gives a miscellanea of other approaches: regression diagnostics, Bayesian analysis, and interval-censored covariates, though each one could merit a chapter of its own.

The first chapter gives a short, but comprehensive, overview of the interval-censoring problem. Most of the notation and basic concepts are presented here. While the book is mathematically sound, the reader is not lost in an excess of technical details. It is fundamental, from my point of view, to think about the nature and the consequences of the censoring mechanism before an analysis of interval-censored data, and in particular about the assumptions on the inspection process so that the survival function is estimable. To this end issues such as independent, noninformative, and informative censoring models, which are briefly discussed in Chapter 10, could have been described in this first chapter. I would recommend reading Section 10.5 right after Section 1.3.

The book starts nicely with the parametric approach where methods and techniques are straightforward, and waits until the third and subsequent chapters to introduce special nonparametric and semiparametric inferences. It is a pity that we cannot find here the regularity conditions for the consistency of the maximum likelihood estimators because this is related to how the inspection process could preclude consistency.

It is a pleasure to go through the reading of the nonparametric methods undertaken in Chapters 3 and 4. The book gives a very good and unified presentation of the three possible methods to obtain nonparametric maximum likelihood survival estimates as well as a nice description about the speed of convergence of the algorithms.

Regression analysis is covered in Chapters 5 and 6, splitting the case of current status data and case II interval-censored data. The methods and theory behind these two situations are quite different, and it is indeed wise to treat them separately. Both chapters cover the proportional hazards and the proportional odds models.

The last four chapters cover different extensions, although from my point of view, these are not necessarily the most representative of the field. In particular the book falls short in the treatment of Bayesian models and multivariate interval-censored data. A major strength of the book is that the notation in this field is unified and the developments are rigorous without being too cumbersome. However, the readers would benefit from more detailed and hands-on examples with indications on how to use the available software to analyze interval-censored data.

In summary, this book is to be recommended to scientists in the field of survival analysis, and in particular to those researchers in interval-censored data, as an up-to-date reference in frequentist approaches. With more help on using the available software, the book might be also useful to practitioners from other disciplines who can find in this text the suitable methods to analyze interval-censored data.

REFERENCES

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This book is aimed at upper division students in statistics or practicing scientists in other disciplines who wish advice on using R in their analyses. It would not be suitable for students in introductory courses who do not have some basic statistical training. The best way to use this book is to first “skim” to
get a feel for the topics covered, and then to jump into the examples that match what you may want to do on a particular project.

The style of the book is a commendable “learn by example”—each of the many statistical techniques is centered on real-world examples (with all the attendant problems) showing snippets of R code for various phases of the analysis. According to the preface, the book is heavily based on the authors’ notes for a course in data analysis.

This book has a lot of good practical advice on the general practice of statistics, e.g., the preference of confidence intervals over formal p-values; the value of good exploratory data analysis with suitable graphics; the dangers of blindly applying analysis method without thinking about how the data are collected, and so forth. After each example, the authors give a good summary of what is important and references to other books for more information on some of the advanced topics.

The collection of topics is eclectic. After four chapters on introducing the R system, general advice on constructing graphs using R, and a cursory review of modeling and inference, the authors discuss simple linear regression in detail followed by a cursory overview of multiple regression. The second half of the book has a number of topics: generalized linear models, survival analysis, time series models, multilevel (mixed) models for analysis of variance, tree-based classification methods, some multivariate methods, and finally advice on using the R system.

The book also comes with extensive R code (the DAAG package) and sample datasets available at the author’s websites. These download easily and are straightforward to use. I had no problem with any of the codes that I tried. The book also has a very nice set of exercises that reinforce nicely the concepts from each chapter.

However, no book is perfect. The authors sometimes ignore their own advice to match the analysis to the design of the experiment when data that was clearly collected using a blocked design is analyzed ignoring the blocking. The level of detail is uneven in the book. For example, the book has a single page on matrix methods in regression but four pages on the detailed computations for t-tests; survival analysis is “covered” in five pages; there are many pages covering details on how sums of squares are computed, but only a few lines about maximum likelihood. Rather than spending time on the details of the construction of the t-test, it would have been better to discuss how to decide between the unpaired and paired versions of the test.

This is not a book to learn about programming in R—function writing is only covered cursorily. As well, there is little advice on the best way to structure analyses for posterity. For example, rather than saving material in workspaces, I prefer to maintain text files containing the function definitions and function calls which are loaded into workspaces using the source command of R. This book does not give advice on structuring your R session or debugging R functions.

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It is by now an overworked cliche (and even a cliche to call it a cliche!) that the rise in practical application of Bayesian methods was precipitated by the advent of fast computers and accompanying computational algorithms. While a number of books have presented Bayesian methods and the accompanying computational technology to a wider audience, these have often either been for beginners only (Berry, 1996; Lee, 1997; Woodworth, 2004), lacked sufficient computational details for real practice (Berry and Stangl, 1996; Gelman et al., 2003), focused on just one computational technique (Gilks, Richardson, and Spiegelhalter, 1996; Congdon, 2001, 2003), or lacked realistic examples of data analyses (Bernardo and Smith, 1994; O’Hagan, 1994; Chen, Shao, and Ibrahim, 2000; Evans and Swartz, 2000; Tanner, 2002). Therefore, despite the plethora of Bayesian materials now available, there remains room for a book aimed at exposing both the theory and practice of a variety of computational algorithms within the context of real examples.

According to the preface of “Bayesian Core,” the book provides a “self-contained entry into practical and computational Bayesian statistics” with “its primary audience consisting of graduate students who need to use (Bayesian) statistics as a tool to analyze their databases.” They also claim that the “book should appeal to scientists in all fields.” It is perhaps quixotic to hope to explain complex numerical algorithms to nonstatistician scientists in a book only 246 pages long, while also providing sufficient detail to satisfy graduate statistics students, so it is not surprising that the book is only partially successful in attaining its stated goals.

Structurally, the book consists of eight chapters: The introductory chapter explains the scope of the book, and introduces R as a programming language. Chapter 2 covers simple normal models, taking the opportunity to introduce basics of Bayesian analysis, including prior distributions, credible intervals (which the authors call confidence intervals, despite the Bayesian orientation of the book), testing, and simple Monte Carlo methods, including importance sampling. Linear regression with variable selection is covered in Chapter 3, followed by a chapter on generalized linear models. It is within these two chapters that MCMC methods are introduced. Chapter 5 is wholly devoted to capture-recapture models, and the next two chapters discuss mixture models (including label switching difficulties and reversible jump MCMC) and dynamic models (including AR, MA, ARMA, and hidden Markov models). The final chapter is on image analysis, including Markov random fields. Data sets and R programs are available on the book’s website.

The matching of each computational technique to a real data set allows readers to fully appreciate the Bayesian analysis process, from model formation to prior selection and practical implementation. The sections in Chapter 3 discussing the various types of priors (Jeffrey’s, G-priors) available for linear regression models are useful. The pitfalls of straightforward Gibbs sampling are well illustrated through examples,
and alternatives with better properties are given. The idea to mix R programs with the algorithms is a good one, but only partially realized. Past the very brief introduction in Chapter 1, no R programs are given in the text, and those on the website are largely uncommented and not that easy to follow. On the other hand, descriptions of some techniques such as the accept/reject algorithm in Chapter 5 are nice.

This book is not without its idiosyncrasies. It becomes clear early on that this is not an ideal book for self-study, nor would it be appropriate for scientists without an undergraduate degree in mathematical statistics. The minimal background is a course at the level of Casella and Berger (2001). For example, exercise 1.1 on page 3 requires an understanding of Lebesgue measure, and exercise 2.1 on page 15 suggests computing the first four moments of the normal density. Self-study is limited by crucial material being included only as exercises, with no solutions given, either in the book or on the website. This also severely restricts the book’s usefulness as a reference text. For example, the formula for the posterior confidence interval for a linear regression coefficient is given only as exercise 3.5.

There is an admittedly “rather sketchy” selection of topics. For example, a whole chapter is devoted to capture–recapture models, but no examples of simple binomial, difference between two normal means, or two by two table models. Loss functions are casually tossed into a paragraph on page 20 with no formal introduction or further discussion. On page 80, the authors express surprise that the “frequentist” BIC criterion provides similar model selection results compared to Bayes’ factors, never mentioning the close connection between these two criteria (Raftery, 1999). There are also some typographical errors. For example, the website given for downloading the R software on page 6 is incorrect, as is the definition of log odds on page 89.

Overall, a book such as Gelman et al. (2003) may be preferred for a first course in Bayesian data analysis, and Tanner (2002) is more comprehensive in its coverage of computational issues. Nevertheless, this book might be considered for a course that combines these two topics, especially with a good instructor to guide students through the rougher parts. A second edition that corrects typographical errors (the two listed above are not yet acknowledged on the book’s website), includes solutions to exercises at the back of the book, and provides better commented R programs to fully illustrate each algorithm may enable a wider audience.

REFERENCES


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BRIEF REPORTS BY THE EDITOR


The first edition of Bayesian Statistical Modelling was published in 2001 and reviewed by Joseph Ibrahim in Biometrics in 2002 (pp. 477–478). Ibrahim was very positive about the book, calling it, “an excellent introductory book on Bayesian modeling techniques and data analysis,” but made several suggestions for improvement. Congdon has evidently agreed with Ibrahim’s assessment, as the new edition incorporates practically everything Ibrahim suggested.

First, the introductory chapter has been expanded with a discussion of MCMC sampling and inference. The second chapter now covers methods for selecting, comparing, and assessing models (a somewhat shorter coverage of these topics had been the last chapter in the first edition). The third chapter introduces densities commonly used as likelihoods and priors. The remaining 12 chapters of the book each cover a particular class of problems: regression, time series, survival, and
so forth. In several cases, a single chapter from the old edition has been split to provide greater detail on specific subjects (e.g., “Correlated Data Models” is covered in separate chapters on time series and spatial dependency). Most chapters end with exercises and references; there is neither a global list of references nor an author index.

In the new material relating to general Bayesian approaches to modeling and MCMC methods, I found the writing style to be very terse. The material is often stated as a series of facts and equations, with little motivation or rationale behind them. There are few examples. The new material may well appeal to veteran Bayesians wanting a compact reference for model fitting, selection, and assessment. As a relative beginner to Bayesian analysis, however, I was frankly rather put off by this material, which unfortunately comes at the beginning of the book. Fortunately, the style of presentation of the rest of the book is much more transparent, and there are numerous examples and motivations to help carry readers along. The exercises seem to reflect a reasonable mix of practical and mathematical problems. Finally, there is a three-page introduction to WINBUGS at the end of the book.


Most natural systems are inherently complex, with many factors that interact to produce a set of responses. The author of this book, James Grace, is a research ecologist who has been using structural equation models (SEMs) to study natural systems. His goal in this book is to educate other researchers in the natural sciences about the potential for SEMs to attach useful and interesting interpretations to data measured on natural systems.

Definitions and descriptions of SEMs and their origins in path analysis are covered in the first half of the book. Different model structures are considered, as is the role of different types of variables, including latent variables. Grace stresses the general importance of letting the theory that underlies a system dictate what paths should be included in a model, while allowing that in exploratory studies the empirical evidence may suggest amendments to theory. Throughout these chapters, path diagrams are used very effectively to demonstrate various models and the features and problems associated with these models. Most important concepts are highlighted with one or more figures. Equations are rare, and when they are given, they are generally derived from the diagram.

This foundation is followed by several chapters’ worth of examples and applications, intended to demonstrate the use of different SEMs and to emphasize different difficulties practitioners face in the use of SEMs. This is followed by a chapter called “Cautions and Recommendations” detailing, in particular, likely errors that can be made in the application of SEMs. The main body of the book concludes with a pair of chapters offering Grace’s views on where and how SEMs might make the greatest contributions to the study of natural systems.

The strength of this book is its examples, both the small ones in the first half of the book, and the larger applications in the second half. Readers with higher levels of experience with statistics may find explanations to be verbose. Many concepts are explained in several different ways and in several places. This facet may be appreciated, on the other hand, by readers with less statistical experience. The table of contents is very sparse, listing only chapters and not sections, which are not even numbered. This limits the book’s use as a reference on SEMs; it seems that the book has been written to be read cover-to-cover.

The book’s low level of mathematics, combined with its rigor with regard to the application area, make it well suited to its intended readership. Readers with a solid background in linear regression and some cursory knowledge of multivariate statistics should be able to make use of this book.


These two books are not your typical theory books. Indeed, about the only thing that they have in common is the renown of their authors, and the fact that neither book is really intended to supplant more standard classroom texts in statistical inference. Their goals, and the approaches that are taken to achieve them, are about as diametrical as two books on the same subject could be.

Cox’s Principles aims to describe and discuss fundamental tenets of statistical inference without deriving or proving anything. The result, a no-math tour through all of the major results, clearly achieves this aim and does so without “dumbing down” the subject in the least. On the contrary, the arguments leading up to important results and the discussions of the role of these results in statistical theory and practice are thorough and sophisticated. There are equations, used when equations are naturally needed to explain something. There just aren’t any proofs. The point is not to show the reader how to do mathematical statistics, but rather to explain to the reader what principles are involved in the process and why they are important. The focus is on the thinking rather than the mathematics. By eschewing the purely mathematical results, Cox is able to bring depth and perspective to a variety of implications, special cases, and counter-examples.

On the other hand, Geisser’s Modes—published posthumously with Wesley Johnson selflessly taking up the task of completing the book following Geisser’s death in 2004—is deliberately mathematical. It aims to add depth and detail to the some of the interesting mathematical arguments behind statistical inference, without having to touch on every principle. Mathematical derivations and developments take up virtually entire sections at times, and examples are generally approached mathematically to highlight Geisser’s points. The
examples are usually something involving Bernoulli trials; the repetitiveness and limited scope are the price paid to keep the mathematics focused on the right issues.

The subjects covered in Cox’s *Principles* are more or less the same ones that would be found in any good book on inference, but the relative emphasis is greater on subjects for which there is greater controversy or diversity of opinion or philosophy. For example, the Bayesian versus frequentist debate is a recurring theme in the book, appearing as a part of the discussion of nearly every major topic. Cox handles this argument “from the middle,” discussing benefits and drawbacks on both sides whenever it arises. (In an appendix he describes his personal point of view on the matter.) Every subject is also accompanied by a variety of examples, representing some common, important, or novel problems in statistical inference.

Because the aim of Geisser’s *Modes* is to highlight certain features of statistical inference, the list of topics and coverage is not as complete as in *Principles*. There is not a strong linear flow from one topic to the next. Rather, much of the text reads like the “Notes” or “Remarks” segments often found at the end of other books’ chapters. The bulk of the book covers hypothesis testing, where Geisser is openly critical of frequentist approaches (specifically, Neyman–Pearson). Other modes of inference (Bayesian, likelihood, and fiducial) are covered to a considerably lesser degree than the frequentist mode.

Both books assume a solid knowledge of calculus—even without the derivations, *Principles* talks about derivatives, integrals, and so forth—as well as a fair amount of previous statistical experience. *Modes* further assumes that a reader is well versed in theoretical statistics. Neither book would be an appropriate text for a typical nonstatistical practitioner. I could easily see either book being used as a supplement for a standard class on statistical inference, with the choice made according to where the instructor wanted augmented coverage. *Principles* could probably be used as a stand-alone text for an alternative, less mathematical course. I would also suggest that the book is ideally suited for statisticians at all levels who want to refresh their own understanding of the theory of statistical inference without having to wade through theorems and proofs. *Modes* (and *Principles* as well, perhaps) would be a terrific resource for students preparing for comprehensive exams and wanting to expand their understanding of statistical inference.