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BOOK REVIEWS

Applied asymptotics; case studies in small-sample statistics, by A.R. Brazzale, A.C. Davison and N. Reid, Cambridge, Cambridge University Press, 2007, viii + 236 pp., £35.00 or US $65.00; ISBN 978-0-521-84703-2

This is a somewhat unorthodox book, but a welcome one. It is about the application – yes, the application – of the higher order asymptotics of likelihood theory. Everyone is familiar with the use of basic large-sample likelihood asymptotics (asymptotic normality, Fisher information, and all that) to provide approximate hypothesis tests and confidence intervals. Higher order asymptotics, which has seen much theoretical development over the last 20 years or so, extends the familiar 'first-order asymptotics' with a view to improving the quality of asymptotic inference. This endeavour is quite successful, but not entirely trivial to apply or understand.

The classic theoretical book on the subject is Barndorff-Nielsen and Cox [1]. I rather regret my exasperated public display of ignorance in my review of that book for this journal [2]. However, I also said 'If there is to be any serious influence of this kind of work on applied statistics, an introductory non-specialist book will have to emerge from somewhere' and cited a paper of the third author of the current book as 'more readably giv[ing] a small indication of the possibilities'. The book under review fits this bill. Ah, the power and influence of the book reviewer!!

After its Introduction, the book begins in earnest with a good overview of the main theoretical approximations. (Some of the required background mathematical expansions are provided in the Appendix, which seems incorrectly entitled 'Some numerical techniques'.) If your appetite is whetted for a fuller theoretical understanding then you will relish the more detailed underpinning of Chapter 8. However, the real heart of the book, its raison-d'être, is Chapters 3–7, which provide a series of examples/case-studies (both illustrative and substantial/substantive) of the use of higher order asymptotics in practice, covering a wide range of modelling situations, mostly of regression type, and emphasising taking proper account of nuisance parameters. One way to use this book might be as a 'handbook' of example analyses into which you can dip to find a similar problem to the one you have, and so start from there. I am not so sure of the value of Chapter 10, which contains a large number of problems, many substantial, many theoretical, interspersed with occasional further results. They 'serve as an extension' to the excellent bibliographic notes that complete each chapter.

Application of higher order asymptotics in complex modelling problems is not 'automatic', and provision of (and assistance with writing) suitable software is necessary. The authors are very helpful here too. The first author's 'R package bundle hoa' (obtainable from the book's webpage, the address of which has already changed) is appropriate to this task and is used and illustrated throughout (with some more discussion of numerical implementation in Chapter 9).

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This book is relatively rare for a modern one in being well produced with few typos. Indeed, the book is very well written. However, if it is serious about its target audience being applied statisticians, what is it doing in the 'Cambridge Series in Statistical and Probabilistic Mathematics'?

As I said at the beginning, I welcome this book and wish it well in achieving some inroads into practical use of a large area of theoretical developments. The authors are well aware of the obvious criticism 'that the gains from improved approximations are potentially outweighed by sensitivity to the modelling assumptions.' But if the methods are readily available, why not incorporate them, at least for some fairly standard and widespread modelling situations? I guess the next step on that road would be for higher order asymptotics to be less an add-on and more an integral part of future software packages.

References

[1] O.E. Barndorff-Nielsen and D.R. Cox, *Inference and Asymptotics*, Chapman & Hall, London, 1994.
[2] M.C. Jones, *Review of Inference and Asymptotics*, by Barndorff-Nielsen and Cox, Chapman & Hall, London. J. Appl. Stat. 24 (1997), pp. 125–126.

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DNA microarrays and related genomics techniques, by David B. Allison, Grier P. Page, T. Mark Beasley, and Jode W. Edwards (eds), Boca Raton, Chapman & Hall/CRC Press, 2006, xviii + 371 pp., £46.99 or US $89.95, ISBN 0-8247-5461-1

DNA gene expression microarrays are a fascinating and promising technology that allows biologists to study genome-wide patterns of gene expression in any given cell type, at any given time, and under any given set of conditions. A number of new microarray technologies have been developed over the last few years, and technological development in this area is likely to continue rapidly. In an attempt to keep up to date with such technological advances, the body of statistical methodology for the analysis of the data produced by microarray platforms has also been evolving and growing fast. *DNA Microarrays and Related Genomics Techniques* tries to consolidate and summarise the major statistical issues and methodologies of a typical microarray experiment – from the planning stage till the final step of making sense of the results – in 371 pages.

The 18 edited chapters of this book can be broadly structured into four major sections. The first four chapters provide a brief introduction to the existing microarray platforms and deal with issues related to pre-processing, quality and integrity of the data. A general framework in which to evaluate epistemological foundations of the available statistical methods for microarray data is also brought forward.

The three chapters that follow these describe some important aspects involved in the design and planning of an experiment: Chapter 5 discusses issues such as sample size and power, with an emphasis on approaches that consider distributions of p-values; Chapter 6 provides some guidance to the researcher who wonders under what circumstances she should pool biological samples together, including some results on the equivalence between pooled and non-pooled