The Double Helix and the Law of Evidence.

David H. KAYE. Cambridge, MA: Harvard University Press, 2010. ISBN 978-0-674-03588-1. xvi + 330 pp. $45.00 (H).

This monograph describes the introduction and subsequent use of forensic DNA analysis in U.S. courts, with a focus on important statistical aspects that have been much debated over the past years. The author, a law professor, is an authority in this field. He provides a balanced summary of the main arguments of lawyers and scientists in court cases, in literature, and in reports of the National Research Council, along with his personal critical view.

The book is organized chronologically and discusses the presentation of small probabilities in court, the calculation of DNA profile random match probabilities with the product rule, and the impact of relatives, laboratory errors, and structured populations. Autosomal ('normal') DNA is considered, along with Y-chromosomal DNA, which is restricted to males and inherits from father to son, and mitochondrial DNA, which inherits from mother to son or daughter. Mixed DNA profiles and hairs are considered as well. The book ends with a section 'Learning from DNA,' focusing on the role of experts in court.

This book's main attractions are the numerous cases in which arguments were put forward and the author's critical view and comments on these arguments. Some of the cases are well known, such as the O. J. Simpson case, others have been described in the scattered literature, and some are new to me. The cited discussions in court between experts and lawyers, along with inside information about their motives and opinions, are very entertaining and illustrate the communication gap between the two groups. For me, this is the distinctive feature of this monograph compared with the many other publications on forensic DNA.

The book is written for nonexperts in the field and explains the biology and statistics lucidly, but at a basic level. Consequently, the amount of statistics in the book is kept at a minimum; this is not a technical text on forensic DNA statistics. Furthermore, the author does not discuss current controversial topics, like database search, Y-STR match probability calculation, and reporting on transfer of DNA.

In conclusion, this well-documented book makes excellent reading for those interested in the interaction between experts and lawyers, in the presentation of statistics and probabilities in court, and in the history of forensic DNA statistics.

Marjan J. SJERPS
Netherlands Forensic Institute (NFI) and University of Amsterdam (UvA)

From Finite Sample to Asymptotic Methods in Statistics.

Pranab K. SEN, Julio M. SINGER, and Antonio C. Pedroso de LIMA. New York, NY: Cambridge University Press, 2010. ISBN 978-0-521-87722-0. xii + 386 pp. $70.00 (H).

This book is a revision and update of the 1993 text, *Large Sample Methods in Statistics: An Introduction With Applications,* with Antonio C. Pedroso de Lima added as a coauthor. (The earlier book is referred to as "SS93" in the rest of this review.) The revision apparently resulted from experience in using SS93 as a textbook for courses at the University of North Carolina at Chapel Hill and University of Sao Paulo. As the authors state in their Preface,

"we came across a new hiatus originated in the apparent distinction between the theory covered in the exact statistical inference and the approximate approach adopted in the (1993) book. While realizing that the foundations of the large-sample statistical methods we proposed to address stem from the basic concepts and principles that underlie finite sample statistical setups, we decided to integrate both approaches in the present text. In summary, our intent is to provide a broad view of finite-sample statistical methods, to examine their merits and caveats, and to judge how far asymptotic results eliminate some of the detected impasses, providing the basis for sound application of approximate statistical inference in large samples."

The main differences between the current book and SS93 are as follows:

(a) Four chapters have been added: Chapters 2–5, on "Estimation Theory," "Hypothesis Testing," "Elements of Statistical Decision Theory," and "Stochastic Processes: An Overview." Roughly speaking, Chapter 6 corresponds to Chapter 2 of SS93, Chapter 7 corresponds to Chapters 3 and 4 of SS93, and Chapters 8–11 correspond to Chapters 5–8 of SS93.

(b) Some exercises have been added: The book contains a total of 213 problems, considerably more than the 124 problems in SS93.

(c) A few references, mostly in connection with the new chapters, have been added, and quite a few references in SS93 have been removed, including such seminal works as Wald's (1949) paper on consistency of the MLE, Huber's (1967) Fifth Berkeley Symposium paper on M- and Z-estimators, and Hájek's (1972) Sixth Berkeley Symposium paper on local asymptotic minimax and admissibility in estimation.

(d) Material removed: Occasionally the authors seem to have deleted some notation or material from SS93, but continue to use the notation without explanation. One instance of this occurs in Section 9.3.

The result is a book of 386 pages, just a bit longer than the 382 pages of SS93.

The authors write clearly and concisely, and have continued the philosophy espoused in SS93 of writing a book that attempts to bridge the gap between a readership without "a high level of mathematical knowledge" and the "need for more profound mathematical theory in statistical large-sample theory."

When SS93 appeared, there were few, if any, textbooks attempting to fill the niche of providing basic asymptotic theory for statistics at an introductory level; the text by Serfling (1980) might be the exception proving the rule. Today, that situation has changed significantly; the books by Ferguson (1996), Lehmann (1999), Wasserman (2004, 2006), and, at a more advanced level, van der Vaart (1998) provide alternative treatments and perspectives. I have used Ferguson's book repeatedly in my teaching at the University of Washington, and probably will continue to use it rather than switching to the present book, because of the former's inclusion of Wald's proof of consistency of MLEs, the related development of uniform strong laws of large numbers (or Glivenko–Cantelli theorems), and its many nice exercises and examples.

I spotted only a few typographical errors (some of which seem to be changes from the revision that went undetected), and fewer technical errors. I did note two technical problems. First, the discussion of the behavior of the Wald statistic under alternatives on pages 262 and 263 contains a number of wobbles and incorrect assertions. For example, when sampling under $\theta = \theta_0 + \delta \neq \theta_0$, the statement on page 263, line 2, that $\sqrt{n}(\widehat{\theta}_n - \theta_0)$ converges in distribution to $\mathrm{N}(0, I(\theta_0 + \delta)^{-1})$ should be that $\sqrt{n}(\widehat{\theta}_n - \theta)$ converges to $\mathrm{N}(0, I(\theta)^{-1})$. Similarly, in line 3 of the proof of Theorem 2.6.2, the statement that under $H_{1,n}$ $\sqrt{n}(\widehat{\theta}_n - \theta_0)$ converges in distribution to $\mathrm{N}(0, I(\theta_0)^{-1})$ is not proved, and should be replaced by the statement that $\sqrt{n}(\widehat{\theta}_n - \theta_n)$ converges in distribution to $\mathrm{N}(0, I(\theta_0)^{-1})$. (This is easily proved with no additional hypotheses using standard contiguity theory, but these tools are not provided here or elsewhere in this book.) In Section 2.2, the authors go back and forth between densities and likelihoods in a way that is common in the applied literature, but which I believe to be a major conceptual difficulty for students. For example, in (2.2.9) on page 44, the authors refer to $p(X_1, \dots, X_n | T_n; \theta)$ as the "conditional density of $X_1, \dots, X_n$ given T_n," whereas I would prefer to call this the conditional likelihood given T_n, because it is the density evaluated at a set of observations from the (or some) density or distribution.

Does the revision work? That probably depends on the audience or reader. For me, the inclusion of the foundational theory material in Chapters 2–5 gives the book a heavier and somewhat more old-fashioned feel. The added material harks back to an earlier age of statistical theory, without introducing any of the excitement of more current developments covered by some of the alternative texts mentioned earlier. For example, the book provides a very sketchy treatment of the bootstrap and resampling methods more generally on pages 268–271, whereas this material is treated at length in Section 6.5 of the text of Lehmann (1999). Other topics amenable to large-sample methods given only minimal or no treatment include empirical likelihood, permutation tests, Bernstein–von Mises theorems, Stein's method, model misspecification, multiple testing and false discovery rates, and nonparametric estimation with censored data.

The book's somewhat old-fashioned feel is reinforced by a somewhat negative or pessimistic tone in some of the subsections titled "Concluding Notes" (which seem to be carried over verbatim from SS93). For example, on page 336, in the Concluding Notes for Chapter 10, the authors state that

"We are also somewhat skeptical about the genuine prospects of the semiparametric models in applied research. As with parametric models, in semiparametrics robustness although currently in use without any reservation, may be a main issue, in the sense that even a small departure from an assumed semiparametric model may lead to a serious bias in the large sample context."

Although there is always room for skepticism in statistical research, and robustness issues are important (however one parses the second sentence above), there is also a need to understand models as approximations of reality and to be optimistic about the possibility of using models to define meaningful and useful parameters, even when they are incorrect.

In conclusion, *From Finite Sample to Asymptotic Methods in Statistics* provides a solid introduction to basic asymptotic theory in statistics with only modest mathematical prerequisites, and will be useful as a textbook for beginning graduate students and as a reference book for statistical scientists and researchers more generally. I find it disappointingly lacking in connections to much of the current research directions in statistics in general and asymptotic theory in particular. The reader will need to look elsewhere for these connections.

Jon A. WELLNER
University of Washington

REFERENCES

Ferguson, T. S. (1996), *A Course in Large Sample Theory. Texts in Statistical Science Series*, London: Chapman & Hall. [769]

Hájek, J. (1972), "Local Asymptotic Minimax and Admissibility in Estimation," in *Proceedings of the Sixth Berkeley Symposium on Mathematical Statistics and Probability*, Vol. I, Berkeley: University of California Press, pp. 175–194. [769]

Huber, P. (1967), "The Behavior of the Maximum Likelihood Estimator Under Nonstandard Conditions," in *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, Vol. I, Berkeley: University of California Press, pp. 221–233. [769]

Lehmann, E. L. (1999), *Elements of Large-Sample Theory. Springer Texts in Statistics*, New York: Springer-Verlag. [769]

Serfling, R. J. (1980), *Approximation Theorems of Mathematical Statistics. Wiley Series in Probability and Mathematical Statistics*, New York: Wiley. [769]

van der Vaart, A. W. (1998), *Asymptotic Statistics. Cambridge Series in Statistical and Probabilistic Mathematics*, Vol. 3, Cambridge: Cambridge University Press. [769]

Wald, A. (1949), "Note on the Consistency of the Maximum Likelihood Estimate," *Annals of Mathematical Statistics*, 20, 595–601. [769]

Wasserman, L. (2004), *All of Statistics. Springer Texts in Statistics. A Concise Course in Statistical Inference*, New York: Springer-Verlag. [769]

——— (2006), *All of Nonparametric Statistics. Springer Texts in Statistics*, New York: Springer. [769]

Non-Equilibrium Statistical Mechanics and Turbulence.

John CARDY, Gregory FALKOVICH, and Krzysztof GAWEDZKI. New York, NY: Cambridge University Press, 2008. ISBN 978-0-521-71514-0. x + 161 pp. $52.00 (P).

This book comprises the authors' lecture notes from the LMS 2006 Summer School organized by the editors at the University of Warwick and held in conjunction with the Warwick Turbulence Symposium/Workshop. The authors have correctly identified a significant gap in the physics literature. Despite the substantial body of work that has accumulated on using a diverse range of advanced nonequilibrium statistical mechanics tools to attack problems in turbulence research, there is no single comprehensive text or reference on the subject. This volume of lecture notes is offered as an attempt to begin addressing that need.

The subject matter is partitioned into three sections, each presented by one of the authors. Gregory Falkovich leads with turbulence from the statistical mechanics perspective, followed by Krzysztof Gawędzki on applying statistical mechanics approaches to passive advection. John Cardy closes with a section on field-theoretic methods for addressing nonequilibrium critical phenomena. Each author provides a set of problems to accompany the notes, along with highly detailed solutions and copious references to both previous and state-of-the-art research for additional reading.

Of the three collections of notes, Gawędzki's is perhaps the most successful in structuring the material in a way that can serve as a stand-alone teaching text for advanced graduate students or researchers in turbulence theory/statistical physics who would like to expand their horizons. In 44 tightly structured pages, he establishes the context for modern turbulence transport theory and then takes the reader smoothly from the Navier–Stokes equations through transport of particles and fields, to multiplicative ergodic theory, and finally to a clear and illuminating discussion of the Kraichnan model—the last in an astonishingly concise 24 pages. Problems are integrated into the discussion to provide food for thought along the way. I especially appreciated the italicized remarks that guide the reader through the material with brief milepost summaries of important points, supplementary material, and cautionary notes. It is as if the author is standing beside the reader offering a gentle nudge when the going gets tough. The bibliography is also the most extensive of the three sections and delves the most deeply into the current literature.

The Falkovich section, which introduces the reader to turbulence theory in the context of nonequilibrium statistical mechanics, is similarly comprehensive and concise but flows less smoothly. Transitions between the topics are sometimes hard to follow for a reader not already familiar with the subject.

The final section by Cardy, tackling turbulence theory via field-theoretic methods, is the roughest of the three sections. It is more a compilation of lecture notes rather than a complete text. The introductory notes establish only a minimal context for the material, and little overarching vision is provided for what the author expects the reader to be able to take away from the discussion. This is partly a matter of organization and editing—for example, the summary of a general strategy for attacking reaction-diffusion processes would be better included in the introduction than as a bridge into Section 3.6. The range of topics is impressive, but more work on capturing the broader context that the author likely provided in the course itself as he taught the material would have been helpful.

In sum, this volume in its current lecture notes form is likely to be most useful as a review of the leading-edge theoretical work on turbulent systems to researchers with in-depth understanding of statistical physics who are already reasonably familiar with and want to expand their understanding of turbulence theory (or vice versa). The final field theoretic section would be particularly heavy sailing for anyone not already quite familiar with the subject. The collected notes also would serve as a good outline for an advanced topics course or seminar series in turbulence theory and nonequilibrium statistical physics for graduate students, postdoctoral students, and professors with good backgrounds in the basics of those fields, and their guidance, pointers and references for further study can provide an excellent resource for new researchers.

Mary Z. FUKA
TriplePoint Physics, LLC

Sparse Image and Signal Processing: Wavelets, Curvelets, Morphological Diversity.

Jean-Luc STARCK, Fionn MURTAGH, and Jalal M. FADILI. New York, NY: Cambridge University Press, 2010. ISBN 978-0-521-11913-9. xvii + 316 pp. $70.00 (H).

This book delivers a wide and up-to-date review of multiscale methods and their applications in signal and image processing using wavelets and their variants. Multiscale methods have been applied to various problems, including denoising, sparse signal decomposition, compression, and feature detection. Areas of application include medicine, biology, physics, seismology, geology, metrology, mechanical and civil engineering, astronomy, digital media, and forensics. As can be seen in recent statistical journals (see, e.g., Cai et al. 2009), multiscale methods provide important tools for theoretical and applied statistical problems. A major theme of the book is the sparse representation of a signal or image using regularization. Regularization methods provide techniques for significantly reducing the actual complexity involved in the model estimation procedure. In this book, regularization is identified with penalty-based methods, such as hard and soft thresholding.

As the authors point out in the Preface, few books in this area aim to fill the gap between mathematical approaches and application-oriented experiments. This book is the authors' attempt to bridge this gap. This is a much-needed work whose value is clear, and I applaud the authors' effort in tackling this topic. On the other hand, if one is looking for a book that is mathematically rigorous and self-contained, this would not be the best choice, because its wide coverage comes at the expense of deep discussion. Mathematical derivations of the formulas are omitted, leaving the reader to consult the reference lists for more detailed information. Thus, this book is most suitable for readers who already have some knowledge of signal and image processing and are interested in learning multiscale methods. In addition, statisticians with experience in both