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BOOK REVIEW

Amanda B. Hepler,[1] *Ph.D.*

Review of: *Data Analysis in Forensic Science: A Bayesian Decision Perspective*

REFERENCE: Taroni F, Bozza S, Biederman A, Garbolino P, Aitken C. Data analysis in forensic science: a Bayesian decision perspective. Chichester, UK: John Wiley and Sons, Ltd., 2010, 388 pp.

This text is a welcome addition to the body of literature on forensic statistics. This volume adds to the existing literature as it not only tackles the applicability of the Bayesian approach itself but also the applicability of decision analysis approaches to the legal system.

The reader embarks upon their data analysis journey in Part I, exploring the "Foundations of Inference and Decision in Forensic Science." This section begins with an initial collection of desiderata in evidential assessment that is particularly useful and has, to my knowledge, not appeared elsewhere. This deceptively simple list—*balance, transparency, robustness, added value, flexibility,* and *logic*—are attributes to which the authors strive to adhere.

Another considerable contribution is made by the exhaustive set of references provided. The reader is often directed to further reading on topics of great complexity, which might take away from the exposition. In addition, where deemed appropriate, the authors defer to the eloquent musings of pioneers in their fields (Good, Jeffreys, Lindley, and de Finetti, among others).

The authors successfully emphasize that a Bayesian approach does not necessarily imply an imposition of a prior on the accused person's guilt, the "ultimate issue" (p. 60). This is a common misconception, and the detailed explanation provided in Section 2.4.1 is important to highlight. However, in this same Section, the authors glaze over the distinction between the "likelihood approach" (or "logical approach") and a "Bayesian approach." A likelihoodist often stops short of a fully Bayesian approach (by which I mean the deployment of subjective priors and use of resultant posteriors), see for example, *Interpreting DNA Evidence* (1). Likelihoodists provide a critical halfway-point between frequenstists and Bayesians, and unfortunately, this distinction is often ignored. For a notable exception, see *Forensic DNA Evidence Interpretation* (2, Chapter 2).

Overall, Part I is a whirlwind tour of Bayesian decision analysis concepts not for the faint of heart (or mathematically challenged). These sections contain material that will take considerable time and reflection to fully digest and appreciate, but are critical to understanding the analysis techniques provided in Part II, "Forensic Data Analysis."

The first chapter in Part II, "Point Estimation" provides several forensic examples, with R code, of performing parameter estimation from a Bayesian decision analysis perspective. This chapter is well rounded, notably including a Bayesian network designed to calculate Poisson probabilities for gunshot residue particle counts. Uncertainty in these parameter estimates is addressed in Chapter 5, via credible intervals.

In Chapter 6, an excellent conceptual discussion of hypothesis testing is followed by procedures and examples including allele mutation rate testing, detection of anabolic steroids, and blood alcohol concentration testing, among others. Disappointingly, conclusion statements are presented in statistical jargon, as opposed to something a layperson could understand. The text generally lacks suggestions on how an expert might present these results in court.

The topic of sampling is covered nicely in Chapter 7, which includes innovative Bayesian networks designed to evaluate sampling scenarios. Chapter 8 addresses classification problems that routinely occur, and includes previously published analysis methods for complex evidence types. This section is lacking a critical review of these methods, disappointing as these techniques present the greatest opportunities for advancement in the field.

The final chapter is presented in a Q&A format, and addresses a few of the burning questions the reader will have at this point, (e.g., Why should I conform to a Bayesian framework?). While other lingering questions are sure to exist, this section provides ample food for thought for the engaged reader.

In conclusion, this book will serve as a useful reference for the forensic statistician, providing comprehensive explanation of Bayesian analysis in the context of forensic science, and a comprehensible introduction to decision theory for the mathematically astute, but unfamiliar, reader. The R code is especially helpful for new researchers. However, I would hesitate to recommend it as a text for teaching forensic scientists. This fact seems to be understood by the authors, as review and exercise questions, designed to engage the reader, are noticeably absent.

David Kaye remarks in the Foreward, "not everyone will agree with the strong subjectivist perspective advanced here" (p. xiv) and I, for now, continue to fall firmly in that camp. However, I wholeheartedly agree with Professor Kaye's final assessment, "careful study of the chapters that follow will be an illuminating and valuable undertaking" (p. xiv).

References

1. Evett IW, Weir BS. Interpreting DNA evidence: statistical genetics for forensic scientists. Sunderland, MA: Sinauer Associates, 1998.
2. Buckleton J, Triggs CM, Walsh SJ editors. Forensic DNA evidence interpretation. Boca Raton, FL: CRC press, 2005.

[1]Innovative Decisions, Inc., 1945 Old Gallows Road, Suite 207, Vienna VA22182.