

Bayesian Decision Analysis: Principle and Practice, Jim Q. Smith (Warwick University, United Kingdom), Cambridge University Press, Boca Raton, ISBN 978-0521764544 (hardcover, \$65.00), x+348 pages, by Christian P. Robert, Université Paris-Dauphine, Institut Universitaire de France, and CREST, Paris.

Table of contents

- | | |
|---|------------------------------------|
| 1. Introduction | ysis |
| 2. Explanations of processes and trees | 6. Multivariate utility theory |
| 3. Utilities and rewards | 7. Bayesian networks |
| 4. Subjective probability and its elicitation | 8. Graphs, decisions and causality |
| 5. Bayesian inference for decision anal- | 9. Multidimensional learning |
| | 10. Conclusion |

Readership: Statistics graduate students and practitioners in Bayesian decision analysis and Bayesian networks

In 1989, I wrote a JASA review about *Decision Analysis: A Bayesian Approach*, by J.Q. Smith. In retrospect, this early review was far too critical! While acknowledging that the book developed “concepts not usually dealt with in Bayesian classics”, I bemoaned the lack of connections with classical Bayesian decision theory, as exemplified by Berger (1985), and missing entries. While I remain attached to the approach adopted in Berger’s book, I now see much more clearly the point made in Smith’s 1989 book.

If we now consider *Bayesian Decision Analysis*, the book somehow covers the same ground of Bayesian decision analysis, as opposed to Bayesian inference, but a deeper and more mature level. Jim Smith has been involved quite a lot in consulting experiences, in particular in connection with nuclear energy (hence the link on the unusual cover), and the expertise he gained from such experiences shows throughout the book. It mostly skips the traditional Bayesian inference with its use of parameterised models. Hence a logical lack of entry on computational aspects and on hierarchical models, except for Chapter 9, for Jim Smith considers tree models to be mostly superior to the later, both in terms of versatility and of symmetries. Before moving to a brief description of the chapters, let me stress that the design and the printing of the book are both of the highest quality, numerous tree graphs appearing seamlessly at the right place [making captions superfluous], different fonts making parts more coherent and so on. I spotted very few typos and I must only mention the one massacring Maurice Allais’ name into Allias: It looks as is the file was recomposed by CUP as otherwise a typo turning a β into a 3 (page 77) would not make sense. (I must also point

out that my own book is entitled *The Bayesian Choice*, not *The Bayesian Case!*)

The introduction of *Bayesian Decision Analysis* is very good if only because it avoids to jump into a mathematisation of the issues by sticking to a few coherent if classic examples. It stresses the fundamental difference with Bayesian inference from Section 1.0.2, namely that “Bayesian decision analysis is focused on solving a given problem.” The second chapter is a wonderful entry on trees, making their construction and the resulting optimal decision quite intuitive. This chapter also reminded me of the very enjoyable Raiffa (1968). Chapter 3 on utilities and rewards feels more traditional, in the spirit of DeGroot (1970), with a well-argued introduction of loss functions via a system of rational axioms. The following chapter on subjective probability and its elicitation actually steps away from classical textbooks by focussing on the finite universes covered by decision trees (an opportunity to point out the very nice distinction between analyst, decision maker, expert and auditor). The final chapter of the first part on Bayesian inference is maybe less necessary, even though I appreciate the part about mixtures, as well as the final section on the role of Bayesian inference in decision analysis, incl. counterfactuals.

The second part starts with a truly interesting chapter about multiple attribute utility theory, incl. an almost real-life Chernobyl illustration. The most developed case is obviously the additive type of utility function, but this seems almost unavoidable in real-life settings. Chapter 7 covers DAGs in a Lauritzen (1996) way, but also the elicitation of a Bayesian network in an almost-practical way (using a pipeline case as a reference example). The next chapter is about influence diagrams and causality, i.e. when prior modelling meets utility, connecting with earlier books by Shafer (1996) and Pearl (1988). Chapter 9 on multidimensional learning covers inference on probabilities in Bayesian networks, while the final chapter very nicely and honestly summarises the strengths and difficulties of Bayesian decision analysis. I thus hope it is obvious I strongly recommend reading the book to all involved in any level of decision management! Or teaching it.

References

- BERGER, J. (1985). *Statistical Decision Theory and Bayesian Analysis*. 2nd ed. Springer-Verlag, New York.
- DEGROOT, M. (1970). *Optimal Statistical Decisions*. McGraw-Hill, New York.

LAURITZEN, S. (1996). *Graphical Models*. Oxford University Press, Oxford.

PEARL, J. (1988). *Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference*. Morgan Kaufmann, San Mateo, CA.

RAIFFA, H. (1968). *Decision Analysis: Introductory Lectures on Choices under Uncertainty*. Addison-Wesley, Reading, Mass.

SHAFFER, G. (1996). *The Art of Causal Conjecture*. The MIT Press, Cambridge, Mass.