Smoothing Methods in Statistics. By Jeffrey S. Simonoff. New York: Springer-Verlag. 1996. xii+338 pages. AUD 87.50 (hardcover). ISBN 0-387-94716-7.

This book surveys the use of smoothing methods in statistics, covering density estimation, nonparametric regression and smoothing ordered categorical data. Some other topics are also covered briefly. Its stated purpose is 'to provide a general discussion of smoothing methods in statistics, with particular emphasis on the actual application of such methods to real data problems' (p.10). Its coverage is broad and the theoretical connections between methods are exploited. There are many interesting applications throughout, illuminating the methodology and motivating some of the ideas.

The intended readers are data analysts with a good background in statistics. A second audience is 'statisticians who are interested in studying the area of smoothing methods' (p.viii). I fall into both categories, and have found the book very useful, both for data analysis ideas and for its brief surveys of smoothing research, with many bibliographic references.

The book is structured as follows:

1. **Introduction**. This chapter uses three examples to motivate the idea of using smooth nonparametric methods rather than parametric models for data analysis.
2. **Simple univariate density estimation**. The ideas of density estimation are introduced using the histogram and frequency polygon. The required trade-off between bias and variance is demonstrated, and some asymptotic properties of histograms and frequency polygons are derived.
3. **Smoother univariate density estimation**. The well-known kernel estimator is discussed first including its asymptotic properties, the problem of bandwidth selection, and some variations on the simple estimator. Other density estimators are compared including local likelihood estimation and spline-based methods.
4. **Multivariate density estimation**. Multivariate versions of histograms, frequency polygons and kernel estimators are discussed.
5. **Nonparametric regression**. This chapter begins with the Nadaraya–Watson kernel estimator and goes on to local polynomial estimation, spline smoothing and additive models. Local polynomial estimation receives the most attention, and there is detailed discussion on its properties near the boundary of the predictor space and in the interior of the predictor space. Bandwidth selection is covered in only two and a half pages. Other issues such as outliers, robust smoothing, and the effects of autocorrelation are discussed.
6. **Smoothing ordered categorical data**. This chapter covers an area rarely mentioned in other books on smoothing, namely smoothing sparse multinomials and the higher dimensional problem of smoothing space contingency tables. Section 6.4 provides an interesting discussion of the link between categorical data smoothing, nonparametric regression and density estimation.
7. **Further applications of smoothing**. Brief examples are given of the application of smoothing to other areas of statistics including discriminant analysis, goodness-of-fit tests, smoothing-based parametric estimation, and the smoothed bootstrap.

Each chapter contains a section called 'Background material' which contains extensive bibliographic references, fills in some gaps and mentions related approaches which are not discussed in the main text. These sections are extremely helpful to anyone wanting to explore the subject further. There are over 750 references in the bibliography, the vast majority to papers which have appeared in the past 10 or 15 years.

Another common feature of each chapter is the section on computational issues. This lists the computer packages which offer the methods discussed. Any publicly available code is also mentioned. S-Plus functions to implement the methods are described in detail, including Internet addresses from which to download them.

Finally, there are exercises at the end of each chapter which cover both theoretical issues and applications to real data.

Appendix A contains a description of the 37 datasets which are used in the book. These can be obtained from the book's web site at `http://www.stern.nyu.edu/SOR/SmoothMeth/`. This site also contains S-Plus code for producing the figures in the book, updated information on computational issues, a list of errata and updated and corrected references.

This text is very well written and interesting to read. The production quality is excellent, as you would expect from Springer-Verlag. The graphics are mostly excellent, although some of the axis labels are missing (an annoying quirk of S-Plus). One particularly poor graphic is Figure 4.8, a three-dimensional contour shell of a multivariate density. Unfortunately, the polygon shading chosen did not match the grey-scales on the printer so that the appearance of a smooth surface is lost.

I teach a Masters course in Nonparametric Methods which covers density estimation and nonparametric regression amongst other things. This book is an ideal reference for those parts of the course. Students appreciate the many interesting applications and the clear explanations. My graduate research students also like the bibliographic surveys at the end of each chapter.

The most glaring omission in Simonoff is a discussion of important issues of inferences such as obtaining confidence intervals for the underlying density when doing density estimation, or obtaining confidence intervals for the conditional mean when doing nonparametric regression, or testing whether a fitted regression line is significantly different from linear, and so on. For a book with a strong data analytic emphasis, this is an unfortunate omission.

A number of excellent smoothing books have appeared in the past few years including Scott (1992), Wand & Jones (1995), Fan & Gijbels (1996) and Bowman & Azzalini (1997). They have different purposes and intended audiences, so it is hard to make direct comparisons with Simonoff. The most similar of these to Simonoff is the recent book by Bowman & Azzalini, although they concentrate on kernel methods and have a greater emphasis on inference. The books by Wand & Jones, and Fan & Gijbels contain few realistic data analyses, but their theoretical treatment of the subject is much more detailed than Simonoff's. Scott contains a mixture of theory and applications but focuses more on density estimation than Simonoff does.

For any statisticians interested in expanding their toolboxes to include smoothing methods, or who would like a helpful guide into the smoothing research literature, Simonoff is highly recommended.

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References

BOWMAN, A.W. & AZZALINI, A. (1997). *Applied Smoothing Techniques for Data Analysis: The Kernel Approach with Applications.* Oxford University Press.

FAN, J. & GIJBELS, I. (1996). *Local Polynomial Modeling and Its Applications.* London: Chapman and Hall.

SCOTT, D.W. (1992). *Multivariate Density Estimation: Theory, Practice, and Visualization.* New York: Wiley.

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Statistics for Environmental Biology and Toxicology. By Walter W. Piegorsch & A. John Bailer. Chapman and Hall. 1998. xvi+579 pages. Price AUD 111.50 (softcover) ISBN 0-412-04731-4

This book is intended as a text for environmental data analysis, the target audience being intermediate graduate students and advanced undergraduates in statistics, and also postgraduate applied researchers in statistics, toxicology and biology.

The book is divided into 11 chapters. The first chapter covers some introductory concepts in probability, and introduces a wide range of continuous and discrete univariate and multivariate distributions. Chapter 2 continues the introductory material with a review of statistical inference, including confidence intervals, hypothesis testing, methods of estimation and introductory likelihood theory. The chapter also introduces some advanced topics, namely maximum quasi-likelihood estimation and generalized estimating equations. Both chapters are well written and succinct, forming the basis for topics covered in the rest of the book.

Chapter 3 discusses issues in experimental design as it is applied in environmental biology and toxicology. This chapter is intended to introduce some basic terminology, and gives a brief discussion of some fundamental aspects of experimental design. Local control, sample sizes and blocking are discussed. However, anyone requiring an in-depth treatment of experimental design issues would