

needed for nonadditive and more complex models. Chapter 2 describes five additional examples that provide the foundation for more detailed explanations in later chapters. The chapter also includes some of properties of sensitivity analysis and expands on the various settings in which sensitivity analysis is applicable. Chapter 3 presents the examples in greater detail by showing some practical problems in which sensitivity analysis has demonstrated usefulness. The chapter includes a variance estimation problem, the method of Morris, Monte Carlo filtering, and estimation/calibration problems. Chapter 4 concerns the identification of a subset of the most important factors when working with a complex model involving numerous input factors. Chapter 5 presents methods that illustrate the approach of variance decomposition relative to the output factor. Both orthogonal and nonorthogonal sets of input factors are discussed. Chapter 6 presents methods suitable for sensitivity analysis of diagnostic models. A Monte Carlo approach termed "regionalized sensitivity analysis" is presented in detail, and Bayesian methods and global sensitivity analysis are covered. Chapter 7 illustrates use of the SIMLAB software (the authors' software, available for free download at through the authors' webpage) to implement many of the methods described in the text. There are step-by-step instructions that explain how to use SIMLAB to analyze the investor's portfolio example in Chapter 1. The last chapter is a short but entertaining presentation of the importance of sensitivity analysis in model validation that includes some quotations on the role of sensitivity analysis to confirm numerical based scientific findings.

I found this to be an interesting and informative book; however, some of the technical material seemed overly complicated and lacking sufficient explanation. I was left with the impression that to fully grasp some of the more complex aspects of sensitivity analysis, additional references are needed to supplement this text. Perhaps that is part of the authors' purpose, to whet the appetite for more information. If so, they have succeeded.

James T. WASSELL
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Generalized Latent Variable Modeling: Multilevel, Longitudinal, and Structural Equation Models, Anders SKRONDAL and Sophia RABE-HESKETH, Boca Raton, FL: Chapman & Hall/CRC, 2004, ISBN 1-58488-000-7, xi + 508 pp., \$80.96.

This book presents the achievements in the generalization and development of various statistical concepts, methods, and tools belonging to a wide span of so-called "latent variable" models. The monograph appeared in the publisher's Interdisciplinary Statistics Series, and it actually achieves the goal of unification of different approaches for operating with the random variables that are not observed or measured, or the latent variables. Elaborated in various fields for different needs of statistical modeling, analysis, and prediction, the latent models are known by dissimilar names and have their specifics in each particular area of application. Comparison and integration across these models yields a significantly better understanding of their properties, and serves to mutually enhance all of the cross-cultured fields of science and technology. The book describes and synthesizes numerous recent innovations obtained in the advancement of modern multivariate statistical analysis with latent variables. Written by well-known experts in biostatistics and educational statistics, it presents a uniform approach to enriching both theoretical and applied latent variables modeling that also can be used in any branch of natural science or technical and engineering application.

The book contains two parts—Methodology (about 280 pages) and Applications (about 160 pages), along with a comprehensive list of more than 1,000 references. The Methodology part comprises eight chapters presenting path diagrams; generalized linear models with binary and polytomous responses; ordinal, cumulative, survival, and other kinds of regression; and multilevel, nested, hierarchical, mixed, and random-effects models. A reader can find here confirmatory and exploratory factor analyses, item and nominal response models, structural equations, and longitudinal, lagged, and autoregressive models. The authors introduce a general framework that incorporates multilevel, structural equation, latent class, and longitudinal models with various responses, covariance structures, and distributions. The random response and factor models are unified in a generalized factor description, and predictors are defined in a generalized random coefficient formulation. Problems of parameter identification for complex models are considered, and various estimation methods are presented. Maximum likelihood (ML) criteria are used, including nonparametric,

joint, conditional, and restricted ML; penalized quasi-likelihood; marginal likelihood; EM algorithm; gradient and quasi-Newton techniques; and simulators. Among the other methods covered are the limited information technique, iterative generalized least squares, generalized estimating equations, hierarchical Bayesian methods, and Markov chain Monte Carlo approaches. Problems of assigning values or scoring the latent variables, including classification, calibration, and empirical Bayes prediction, are discussed. Statistical inference by likelihood, score tests, criteria of deviance information, global and local absolute fit, goodness of fit, cross-validation, and other questions of model specification and diagnostics are considered.

The Applications part comprises six chapters with solutions of various real-life problems from biological, social, and economic sciences. Numerous interesting examples of the models with responses of dichotomous, ordinal, count, censored, comparative, mixed, and multiple process types are considered, with "know-how" applications of the models, graphical illustrations, and explanation of the results. The software and documentation can be downloaded from <http://www.gllamm.org>; datasets for some applications are available at <http://www.gllamm.org/books> and at several other sites given in the book.

Written in a very friendly and mathematically clear language, rigorous but not overloaded with redundant pure statistical derivations, the book could be exceptionally useful for practitioners. Although illustrations are given using examples from medical or social sciences, most of the statistical methods and methodologies described have universal application. They can successfully be used in the physical, chemical, and engineering sciences, for instance, in the modeling of quantum, stochastic, and phase transition behavior, abrupt catastrophic changes, and other kind of switches among qualitatively diverse levels or states. This book is a really enjoyable and useful reading for graduate students and researchers along with the readers of *Technometrics* from any field who wish to use modern statistical techniques to solve practical problems.

Stan LIPOVETSKY
GfK Custom Research Inc.

Kernel Methods for Pattern Analysis, John SHAWE-TAYLOR and Nello CRISTIANINI, Cambridge, U.K.: Cambridge University Press, 2004, ISBN 0-521-81397-2, xiv + 462 pp., \$75.00.

As the authors state in their Preface, this book illustrates the stage of pattern analysis that enables researchers to analyze nonlinear relations with the same efficiency as linear algorithms. The authors show how kernel methods have bridged the gaps between different subdisciplines of pattern recognition. They present algorithms in this book for identifying a wide variety of relations, ranging from the traditional tasks of classification and regression; to ranking and clustering, and to advanced techniques, including principal components analysis and canonical correlation analysis.

Generally speaking, this book deals with data and ways to exploit that data through the identification of valuable knowledge. This valuable knowledge is *pattern analysis*. These patterns are relations that make a dataset redundant, that is, the patterns are the laws we extract from the data. The patterns may be exact or approximate. The authors emphasize that all algorithms in the book are (1) computationally efficient and that the degree of any polynomial involved will render the algorithm practical for large datasets; (2) robust, that is, able to handle noisy data and identify approximate patterns; (3) statistically stable (or statistically robust), that is, that patterns identified are true patterns and not anomalies in the data.

Up front, the authors claim they present "a novel, principled and unified approach to pattern analysis." They present a generalization of prediction methods across such diverse areas as regression modeling, time series modeling, optical character recognition, general data mining, cryptography, bioinformatics, signal processing, data mining, and others.

The general approach to "kernel methods" consists of embedding the data in a "feature" space and then using algorithms based on linear algebra, statistics, and geometry to analyze the data. So every kernel method has two parts. Part 1 embeds the data in a feature space, and part 2 is a learning algorithm that detects linear relationships in the embedded data.

Chapters 1 and 2 give the general introduction as outlined briefly earlier. The remaining chapters are divided by the authors into three parts: