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Book Reviews

Books for review are to be sent to the Book Review Editor Gösta Forsman, Department of Mathematics, University of Linköping, S-581 83 Linköping, Sweden.

Gruber, M.H.J., Regression Estimators: A Comparative Study. Academic Press, Boston, 1990. ISBN 0-12-304752-8. xi + 348pp., $49.95.

The ridge technique for the estimation of linear regression models was originally introduced by Hoerl and Kennard (1970a, b) and has since been extensively explored, discussed, and used in various applications. The ridge technique has been advocated particularly when multicollinearities exist among the regressor variables, causing unstable least squares estimates. Several interpretations of the ridge technique are possible, the most important ones are: as a particular class of estimators in the classical inference framework; as a least squares estimator when data are augmented with fictive observations; as a Bayesian estimator with a particular prior distribution; and as a minimax estimator in a decision theoretic framework. The aim of this book is "to present, compare, and contrast the development and properties of the ridge type estimators that result from these two [Bayesian and non-Bayesian] philosophically different points of view."

The material presented in the book is organized in four parts. The first part, consisting of the first two chapters, presents and discusses the linear regression model, the least squares estimator, and the ridge estimator. A survey of the ridge regression literature, matrix theory, some basic ideas in Bayesian estimation, and estimation in the framework of statistical decision theory are also presented. The second part, consisting of the two subsequent chapters, comprises the core of the book. Here the ridge estimators are presented from different viewpoints and their mathematical relationships are explored. With this as a basis, efficiencies and comparisons of efficiencies of the estimators are given in the third part, Chapters 5–8. In the final part, the last two chapters, applications to the Kalman filter and to analysis of variance are given.

Except for a few misprints, the presentation is usually clear and supported by a number of illustrative exercises; in other words, the book is easy to read. Perhaps this is also the danger with the book. The differences between the philosophical approaches considered are certainly not differences in mathematics. Nevertheless, the comparison presented is a mathematical comparison and is therefore of no, or very limited, value. Several excellent descriptions and comparisons of the different approaches to statistical inference are available in the statistical literature, including Barnett (1973) and

Cox and Hinkley (1974). For the discussion here it suffices to make some brief remarks on the basic ideas of the approaches.

In the classical inference ("the frequentist" point of view) observations are made on a random variable whose probability distribution is known except for the value of a parameter. The parameter has a fixed value and is estimated by an estimator, a particular function of the random variable. The probability distribution of the estimator, the sampling distribution, is solely interpretable in terms of the frequentist concept of probability. Choice between alternative estimators, and assessments of their individual properties (bias, variance, efficiency, etc.) are all derived from their sampling distributions, that is, in relation to repeated realizations of the current situation.

In Bayesian inference, on the other hand, the parameter is essentially regarded as a random variable in the sense that different values are possible with different probabilities, degrees of belief, or weights. After combining the prior information with sample information, the parameter's posterior distribution is obtained, reflecting our remaining uncertainty about the parameter in the current situation. The quantity that maximizes the posterior distribution is defined as the Bayesian estimate of the parameter and is interpreted as the most likely value for the parameter in the current situation.

Decision theory differs from both classical and Bayesian inference in a variety of fundamental respects. The first, and perhaps most important, difference is that decision theory is a theory for making decisions. The problem considered in decision theory is the selection of an action, belonging to a set of possible actions, such that certain optimality criteria are met. In order to apply decision theory for estimation, it is necessary to interpret the estimation problem as a decision problem, a requirement that is not always feasible. The second major distinction is that the success of the methods for choosing an action is not expressed in probability terms. This is in distinct contrast to, e.g., Bayesian inferences whose final inference is a probability distribution.

The different philosophical approaches to statistical inference can be compared with respect to the concepts and their consequences. This book, however, gives a comparison of the resulting mathematical formulae. The author then tries to compare different characteristics of sampling distributions in a repeated sampling framework with characteristics of distributions of degrees of believe and inferences not expressible in probability terms. This cannot be much more than an algebraic exercise, the purpose of which is still unknown to me.

In conclusion, it is important to compare different estimators and different philosophical approaches. Nevertheless, only comparable entities can be compared. In this book the author does not pay attention to this last requirement. The book therefore confuses more than it clarifies the different approaches to statistical inference, which is indeed of dubious value.

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Hinkley, D.V., Reid, N., and Snell, E.J. (Eds.), Statistical Theory and Modelling: In honour of Sir David Cox, FRS. Chapman and Hall, London, 1991. ISBN 0-412-30590-9, xxiv + 349pp., £30.00.

Sir David Cox is one of the most honoured and honourable statisticians of our time, and this book opens with a presentation of his academic career and his publications, which number over 200, including 14 books.

Twelve chapters written by as many distinguished contributors give a broad survey of much statistical theory and practice up to the present. Needless to say, Sir David Cox has contributed a great deal to most of these areas. The chapters are all well written and take up central issues in their fields. Each chapter ends with suggestions for further reading, and the book has a comprehensive list of almost 600 references. The book is useful for statisticians who want to broaden their views as well as for research students who can make good use of this collection of articles.

Chapter 1, Statistical Theory, D.V. Hinkley and N. Reid, 29pp.
A general survey of basic statistical concepts and modelling is given. After a short discussion of conditionality and prior information, the text focuses mainly on situations without external information. Likelihood theory, the exponential family of distributions, transformation families, tests, confidence intervals, point estimators, and influence functions are covered. Asymptotic theory is mentioned briefly. The text also links generalized linear models and bootstrap methods to the mainstream of general theoretical concepts. Some good examples in the spirit of Cox and Hinkley (1974) are also given. However, in the suggested reading, I missed Lehman's books and in particular, his *Theory of Point Estimation* (1983).

Chapter 2, Applied Statistics, E.J. Snell and D.V. Hinkley, 25pp.
This chapter discusses descriptive methods versus statistical modelling and simple random models versus more complicated ones. It stresses the need for a careful discussion of the purpose of the analysis as well as of the nature of the data. Eight data sets are given and two others are illustrated in figures. Most of them are published elsewhere, but their inclusion makes the text more useful. Based on examples, the authors discuss questions like stabilizing transformations, sources of variation, non-linear modelling, and reduction of multivariate dimension. A section on statistical inference illustrates, e.g., logistic modelling and inference conditional upon sufficient statistics for nuisance parameters. Exploratory and robust methods, such as kernel smoothing and data splitting, are also illustrated. The use of the residual bootstrap to test a kernel regression for non-linearity is put forward and illustrates how computer methods combine into useful analyses.

Chapter 3, Generalized Linear Models, D. Firth, 28pp.
This is one of the chapters I liked most. In one single chapter the author defines all the basic concepts such as link functions, the class of exponential dispersion models (a useful extension by Jörgensen 1987 of the exponential family), the variance function, sufficiency and canonical links, maximum likelihood estimation and their iterative solutions, quasi-likelihood, analysis of deviance, goodness of fit, etc. He also discusses and explains complications with the asymptotic distribution of deviance for the saturated model, the non-trivial definition of residuals and extensions into time series and multinomial responses (via the Poisson distribution). A data set illustrates many points in the text and conclusions are shown to depend heavily on possible overdispersion in the data.

I recommend reading this text before starting on more detailed texts such as the excellent reference work by McCullagh and Nelder (1989).

Chapter 4, Residuals and Diagnostics, A.C. Davison and E.J. Snell, 24pp.
Residuals have long been used in regression and time series analysis for model testing and as a modelling aid. Two new areas have extended their definitions and use dramatically. One is regression in generalized linear models, and the other is bootstrap resampling based on residuals. If $Y = g(\mathbf{x}, \beta, \varepsilon)$, then a rather general definition gives the residual R from $Y = g(\mathbf{x}, \hat{\beta}, \mathbf{R})$. Other definitions are deviance residuals, Anscombe residuals, and Pearson residuals in generalized linear models. Influence measures,

leverage, and Cook's distance are also discussed. This chapter thus gives a broad picture of definitions and use of residuals. However, strong use of residuals for modelling is an inference from data to our model set. It therefore has statistical effects which are usually left outside the formal analysis. The authors give a late, but motivated warning against "graphical overkill" in their further comments. Five examples are given.

Chapter 5, Life-Table Analysis, D. Oakes, 22pp.
The most interesting part of this chapter deals with the use of explanatory variables. This leads to accelerated life models and proportional hazards models introduced by Cox (1972). Often these models are only partially parametric, and inference is made via a partial likelihood function. This useful tradition is well reviewed in the chapter. Due to censoring and the special ways these data are treated, different kinds of residuals have been defined. The total integrated hazard is a useful approach and some definitions based on this concept are put forward.

Chapter 6, Sequential Methods, P. Armitage, 23pp.
Sequential methods were developed during the Second World War for quality control. The methods are still useful in quality and several standardized procedures exist. Clinical trials is another area of application where it can be important to reach an early decision, especially when the tendency seems clear. However, the methods also have some drawbacks in situations where several aspects are studied at the same time. This review deals mostly with the classical testing approach, but also covers results on sequential interval estimation and sequential design. The associated fields of recursive estimation and Bayesian methods are hardly mentioned.

Sequential methods are not taught much in basic statistical courses, and their industrial and clinical use seems somewhat limited. This can indicate a waste of resources. In any case, the methods belong to every well equipped statistical toolbox.

Chapter 7, Time Series Methods, P. Bloomfield, 25pp.
The basic theory of stationary time series in the time and frequency domains is reviewed. Inference for ARMA-models and nonparametric estimation is surveyed up to an example of confidence bounds for spectral estimates. The useful approach to estimate spectrum via high order AR or ARMA models could perhaps have been mentioned here. Gaussian likelihood methods both in time and frequency domains, regression with correlated errors, a stationarity test and a section on long term dependence conclude this clear and well written chapter.

Chapter 8, Modelling Stochastic Phenomena, V. Isham, 27pp.
Under this general title the author discusses Markov models, renewal processes, point processes, and some of their extensions. A set of such basic models is regarded as a "library of models", to be combined and applied to the modelling of real world phenomena. A section on spatial processes discusses extension of, e.g., Markov properties to processes with two- and three-dimensional parameters.

Traditional applications such as branching processes for population growth, birth and death processes for the spread of an epidemic, or for queuing models are extended into more general cluster point processes and epidemic models. An interesting review of recently published modelling for rainfall concludes the chapter.

Chapter 9, Optimum Design of Experiments, A.C. Atkinson, 28pp.
The British tradition in experimental design, from Fisher up to recent research including contributions by Cox, motivates this chapter. In a section on convex design theory, several optimality criteria are reviewed. It is indicated how a continuous approximation may often be optimized in an analytical way, while the exact discrete optimal design takes much more algebraical effort. Response surfaces, sequential design, and Bayesian designs are also covered.

Chapter 10, Likelihood Theory, O.E. Barndorff-Nielsen, 33pp.
This chapter outlines various likelihood and information concepts. Orthogonal parameters are defined in terms of information matrices, and their construction by partial differential equations is described. For score processes, i.e., differentiated log likelihoods under increasing information, the martingale property is shown and used for the central limit theory. Confidence sets based on likelihood ratios, and the corresponding results for profile, marginal, or conditional likelihoods are reviewed. Bartlett adjustments, saddlepoint approximations, and other asymptotic improvements are also included.

The review gives a good picture of how likelihood theory has been generalized a great deal in recent years. The chapter is more difficult than the others, and uses a very compact index notation which takes some effort for the non-specialist. But it reviews a vast and fascinating area of research.

Chapter 11, Quasi-Likelihood and Estimating Functions, P. McCullagh, 22pp.
Maximum likelihood estimates are often found by setting first derivatives (scores) to zero. More generally, an estimator can be defined by setting some other set of equations to zero. These equations are regarded as quasi-scores, and if a function Q exists such that the quasi-scores can be obtained as the first derivatives of Q with respect to the parameters, then Q is called a quasi-likelihood. The properties of quasi-likelihood estimates are discussed and compared to ordinary likelihood estimates. Also, the related theory of estimating functions, defined as having expected value zero at the true parameter point, is reviewed. A main point is that such estimates need less structure than the full maximum likelihood.

Chapter 12, Approximations and Asymptotics, N. Reid, 19pp.
Much recent and some traditional work on asymptotic theories and techniques is reviewed in this chapter. The emphasis is on asymptotic expansion beyond the first order approximation. The expansions may take place in the density functions, integrated density functions, or in the variables themselves. Edgeworth expansions, saddle point expansions, Laplace expansions, stochastic expansions, etc., are covered. Improved likelihood estimates and confidence levels are among the many possible applications.

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Marín, G. and Marín, B.V., Research with Hispanic Populations. Sage Publications, Inc., Applied Social Research Methods Series Volume 23, Newbury Park, California, 1991. ISBN 0-8039-3720-2(c) and ISBN 0-8039-3721-0(p). ix + 130pp., \$28.50(c)/\$13.95(p).

This book defines "Hispanics" as persons residing in the United States and tracing their family backgrounds to Spain or to a Latin American, Spanish-speaking country.

This definition is close to the one adopted by the U.S. government's Office of Management and Budget (OMB) in 1978. The OMB definition supported the government's attempts to enumerate the Hispanic population on a 100% sample basis in the 1980 and 1990 U.S. censuses. In both the 1980 and 1990 censuses, individuals were asked whether they were of "Spanish/Hispanic origin" and, if so, whether they were of Mexican, Puerto Rican, Cuban, or other Spanish/Hispanic origin. A similar Hispanic self-identification question had been introduced in a 1969 Current Population Survey and, on a 5% sample basis, in the 1970 census. Prior to 1969, the U.S. government sought to identify Hispanic persons strictly on the basis of presumably "objective" characteristics, including the respondent's and parents' places of birth, mother tongue, and Spanish surname.

The 1980 census found about 14.6 million Hispanics residing in the United States, about 6.4% of the total U.S. resident population. Of the Hispanics, about 60% were Mexican and highly concentrated near the Mexican border in the southwestern United States, 14% were Puerto Rican and highly concentrated in New York, and 5.5% were Cuban and highly concentrated in Florida. Given continuing high rates of Hispanic immigration to the United States, especially from Mexico, and Hispanic birth rates that are much higher than non-Hispanic birth rates, the 1990 census is likely to show that Hispanics comprise a greatly increased fraction of the total U.S. resident population, perhaps as high as 10%.

Hispanics, especially Mexican and Puerto Rican new immigrants, are economically disadvantaged relative to non-Hispanic whites. According to a 1987 survey, the median income for Hispanic families was $20,306, compared with $31,610 for non-Hispanic families. According to the 1980 census, 44% of Hispanics aged 25 and over had completed 12 years of formal education, compared with 68% of non-Hispanics (Marín and Marín, p. 6).

The important questions of the extent to which Hispanic immigrants will rise to higher levels of socio-economic status in the United States, following the examples of earlier European immigrant waves, and the extent to which any such mobility would require "acculturation", i.e., greater conformity by Hispanics to the cultural values of the non-Hispanic population, are not adequately treated in this book. These questions have been extensively debated, and a recent book by Bean and Tienda (1987), not cited by Marín and Marín, reviews and attempts to synthesize a number of alternative viewpoints.

Like Bean and Tienda, Marín and Marín recognize that Hispanics of different ancestries and different levels of acculturation have diverse demographic, geographic, socioeconomic, and cultural profiles, resulting partly from their unique histories in the United States. The Mexican and Puerto Rican groups can trace their origins to the United States conquests in the Mexican War (1848) and in the Spanish-American War (1898), respectively, whereas Cubans first immigrated to the United States in large numbers following the Cuban Revolution (1959). Given the heterogeneity of the Hispanic subgroups, it is understandable that the multi-ethnic label "Hispanic" is widely misunderstood and far from universally accepted. Based on their analysis of a 1987 survey, Marín and Marín (p. 30) report that the preferred ethnic label of Hispanics residing in the southwestern United States depends on the immigrant generation: 87% of first-generation respondents preferred "Mexican"; 81% of second-generation respondents preferred "Mexican-American."

Despite the limited acceptance of "Hispanic," Marín and Marín think this term can usefully serve as a "label of convenience" (p. 1). Indeed, to their minds, it is much more: "Hispanic" represents a "common background based on at least 500 years of shared cultural influences predicated on a common language, the historical influence of the colonizing nation (Spain), and the shaping of values and world views by Roman Catholicism" and "a supranational identity (as Latin Americans) that acknowledges the presence of common cultural threads among those individuals born in one of the 20 nations that make up Spanish-speaking Latin America" (p. 31). At the center of Hispanic identity, according to the authors, are seven "basic cultural values," including "Simpatía," the preference for smooth and pleasant social relations, and "allocentrism," the tendency to judge persons based on membership in the "ingroup" rather than on their individual merits.

Yet this book provides little basis for thinking that the basic cultural values are either especially typical of contemporary Hispanics or likely to endure in future generations. Moreover, by emphasizing common values, the authors pay insufficient heed to the difficult choices and value conflicts that confront immigrants who are trying to rise to higher socioeconomic positions in a host country. It is instructive to contrast Marín and Marín's viewpoint with Bean and Tienda's (1987, p. 34): ". . . an ethnic group is *created* by the entry of an immigrant group into American society, and its initial configuration depends on the characteristics of both the group and the society at the point of contact. Ethnicity is subsequently shaped by the social and economic experiences of the group in a changing society."

The main objective of the book is to show that both Hispanic heterogeneity and the common values of Hispanics have implications for research with Hispanic populations. This objective comprises five chapters: "Issues in Identifying Hispanics," "Enhancing Research Participation," "Development and Adaptation of Instruments," "Translation of Instruments," and "Data Interpretation Problems." Some of the conclusions of these chapters are the following:

1. Hispanic heterogeneity requires instruments to measure many aspects of Hispanic ethnicity, including countries of ancestors, Spanish language usage, and cultural values, if measurements are to be valid. Many aspects of ethnicity would be overlooked or obscured by an exclusive reliance upon self-identification.

2. Questions on the places of birth of ancestors often yield ambiguous results when the ancestors have mixed ethnicities, and there is some evidence that intermarriages among Hispanic subgroups and between Hispanics and non-Hispanics are increasing, especially in the second and later generations.

3. Educational level and "acculturation" level are key control variables in analyzing Hispanic ethnicity.

4. Hispanics generally participate in surveys at a higher level than non-Hispanics of similar socioeconomic statuses, but special efforts to elicit cooperation, such as obtaining community sponsorship and employing Spanish-language questions and Spanish-speaking data collectors, help to increase participation.

5. The development of survey questions for use with Hispanics should take into account that many concepts of the dominant culture have no exact equivalents in Spanish. Researchers should pretest questionnaire instruments to ensure their cultural appropriateness.

6. Since a majority of Hispanics in the United States either do not speak English (25%) or prefer to use Spanish (65%), the translation of survey questions is imperative. Comparing English and Spanish question versions can help in identifying questions that are culturally inappropriate for Hispanics.

7. There is some evidence that Hispanics use "extreme" response categories (e.g., "*definitely* agree") as well as "socially desirable" responses more frequently than non-Hispanics. The authors' own research (p. 104) suggests that less acculturated Hispanic respondents give "acquiescent" responses (i.e., consistently responding "yes" or "agree") more frequently than more acculturated Hispanic respondents. These findings suggest the need for careful interpretation of comparisons between Hispanics and non-Hispanics and between more and less acculturated Hispanics.

In summary, this book provides an introduction to many basic concerns in the design of research on human populations. Most of the authors' suggestions seem as important for research with non-Hispanics as for research with Hispanics. The writing is clear, and the examples, mainly drawn from the authors' own research, are compelling. The level of presentation seems appropriate for introductory courses in sociology or cross-cultural psychology. Yet the authors' portrayals of Hispanics in the United States do not fully reflect the complexity of contemporary theories. I would therefore recommend Bean and Tienda (1987) as a valuable supplement to this book.

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Topsøe, F., Spontaneous Phenomena: A Mathematical Analysis, Academic Press, San Diego, CA. 1990, ISBN 0-12-695175-6, 182 pp., $29.95.

This book discusses modelbuilding for phenomena encountered in practice from a mathematical, philosophical and historical point of view. The discussion is based on a problem raised by a physicist: Why do the observations of radioactivity exhibit a highly irregular character? Is it possible to make a mathematical model that takes account of these irregularities? Often irregularities are explained by some kind of randomness. The philosophical question is: Do spontaneous phenomena really exist or are all phenomena in fact deterministic? After the presentation of the problem some general thoughts on modelbuilding, especially stochastic models, are given with some basic facts on probabilities and random variables. Then by making certain assumptions concerning the nature of radioactivity, the Poisson model is derived. The model is confronted with reality, i.e., with the results of an experiment carried out by Rutherford and Geiger in 1910. Some critical aspects on the assumptions behind the Poisson model are given. The problem with the dead time of the counter is introduced. A new series of observations is investigated and a new model derived, which takes account of the dead time. By comparing the model with the observations the chi-square test is introduced as a tool for assessing the adequacy of the model. The main part of the text concludes with a chapter named The Historical Perspective which describes the development of probability theory leading to the Poisson distribution as well as the development of the theories concerning radioactivity. This chapter is followed by a section with exercises some of which entail proofs of theoretical results in the main text. The next section contains interesting examples from different fields of application, giving the reader opportunities to make his or her own models. Finally some useful computer programs are given.

Modelbuilding is a basic tool in all applied statistics. This book describes the development of mathematical models in an extremely pedagogical manner; the right thing is always said in the right place. Throughout the text important features of modelbuilding are formulated as instructive theses stimulating the reader to think more about mathematical models.

The author recommends the book for pre-college and early college levels. I think that it is an advantage for the reader to have some basic knowledge of probability and statistics. It is a very interesting book for students of mathematics, statistics and mathematical physics and also for teachers of these subjects.

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