Chapter 6 Maximum Likelihood Analysis Of Dynamic

The application of estimation theory renders the processing of experimental results both rational and effective, and thus helps not only to make our knowledge more precise but to determine the measure of its reliability. As a consequence, estimation theory is indispensable in the analysis of the measuring processes and of experiments in general. The knowledge necessary for studying this book encompasses the disciplines of probability and mathematical statistics as studied in the third or fourth year at university. For readers interested in applications, comparatively detailed chapters on linear and quadratic estimations, and normality of observation vectors have been included. Chapter 2 includes selected items of information from algebra, functional analysis and the theory of probability, intended to facilitate the reading of the text proper and to save the reader looking up individual theorems in various textbooks and papers; it is mainly devoted to the reproducing kernel Hilbert spaces, helpful in solving many estimation problems. The text proper of the book begins with Chapter 3. This is divided into two parts: the first deals with sufficient statistics, complete sufficient statistics, minimal sufficient statistics and relations between them; the second contains the mostimportant inequalities of estimation theory for scalar and vector valued parameters and presents properties of the exponential family of distributions. The fourth chapter is an introduction to asymptotic methods of estimation. The method of statistical moments and the maximum-likelihood method are investigated. The sufficient conditions for asymptotical normality of the estimators are given for both methods. The linear and quadratic methods of estimation are dealt with in the fifth chapter. The method of least squares estimation is treated. Five basic regular versions of the regression model and the unified linear model of estimation are described. Unbiased estimators for unit dispersion (factor of the covariance matrix) are given for all mentioned cases. The equivalence of the least-squares method to the method of generalized minimum norm inversion of the design matrix of the regression model is studied in detail. The problem of estimating the covariance components in the mixed model is mentioned as well. Statistical properties of linear and quadratic estimators developed in the fifth chapter in the case of normally distributed errors of measurement are given in Chapter 6. Further, the application of tensor products of Hilbert spaces generated by the covariance matrix of random error vector of observations is demonstrated. Chapter 7 reviews some further important methods of estimation theory. In the first part Wald's method of decision functions is applied to the construction of estimators. The method of contracted estimators and the method of Hoerl and Kennard are presented in the second part. The basic ideas of robustness and Bahadur's approach to estimation theory are presented in the third and fourth parts of this last chapter.

This book is unique in its focus on showing students in the behavioral sciences how to analyze longitudinal data using R software. The book focuses on application, making it practical and accessible to students in psychology, education, and related fields, who have a basic foundation in statistics. It provides explicit instructions in R computer programming throughout the book, showing students exactly how a specific analysis is carried out and how output is interpreted.

Since the pioneering work of Shannon in the late 1940's on the development of the theory of entropy and the landmark contributions of Jaynes a decade later leading to

the development of the principle of maximum entropy (POME), the concept of entropy has been increasingly applied in a wide spectrum of areas, including chemistry, electronics and communications engineering, data acquisition and storage and retreival, data monitoring network design, ecology, economics, environmental engineering, earth sciences, fluid mechanics, genetics, geology, geomorphology, geophysics, geotechnical engineering, hydraulics, hydrology, image processing, management sciences, operations research, pattern recognition and identification, photogrammetry, psychology, physics and quantum mechanics, reliability analysis, reservoir engineering, statistical mechanics, thermodynamics, topology, transportation engineering, turbulence modeling, and so on. New areas finding application of entropy have since continued to unfold. The entropy concept is indeed versatile and its applicability widespread. In the area of hydrology and water resources, a range of applications of entropy have been reported during the past three decades or so. This book focuses on parameter estimation using entropy for a number of distributions frequently used in hydrology. In the entropy-based parameter estimation the distribution parameters are expressed in terms of the given information, called constraints. Thus, the method lends itself to a physical interpretation of the parameters. Because the information to be specified usually constitutes sufficient statistics for the distribution under consideration, the entropy method provides a quantitative way to express the information contained in the distribution.

Full of biological applications, exercises, and interactive graphical examples, Foundational and Applied Statistics for Biologists Using R presents comprehensive coverage of both modern analytical methods and statistical foundations. The author harnesses the inherent properties of the R environment to enable students to examine the code of complica

A self-contained, contemporary treatment of the analysis of long-range dependent data Long-Memory Time Series: Theory and Methods provides an overview of the theory and methods developed to deal with long-range dependent data and describes the applications of these methodologies to real-life time series. Systematically organized, it begins with the foundational essentials, proceeds to the analysis of methodological aspects (Estimation Methods, Asymptotic Theory, Heteroskedastic Models, Transformations, Bayesian Methods, and Prediction), and then extends these techniques to more complex data structures. To facilitate understanding, the book: Assumes a basic knowledge of calculus and linear algebra and explains the more advanced statistical and mathematical concepts Features numerous examples that accelerate understanding and illustrate various consequences of the theoretical results Proves all theoretical results (theorems, lemmas, corollaries, etc.) or refers readers to resources with further demonstration Includes detailed analyses of computational aspects related to the implementation of the methodologies described, including algorithm efficiency, arithmetic complexity, CPU times, and more Includes proposed problems at the end of each chapter to help readers solidify their understanding and practice their skills A valuable real-world reference for researchers and practitioners in time series analysis, economerics, finance, and related fields, this book is also excellent for a beginning graduate-level course in long-memory processes or as a supplemental textbook for those studying advanced statistics, mathematics, economics, finance, engineering, or physics. A companion Web site is available for readers to access the S-

Plus and R data sets used within the text.

The Wiley-Interscience Paperback Series consists of selected books that have been made more accessible to consumers in an effort to increase global appeal and general circulation. With these new unabridged softcover volumes, Wiley hopes to extend the lives of these works by making them available to future generations of statisticians, mathematicians, and scientists. "For both applied and theoretical statisticians as well as investigators working in the many areas in which relevant use can be made of discriminant techniques, this monograph provides a modern, comprehensive, and systematic account of discriminant analysis, with the focus on the more recent advances in the field." –SciTech Book News ". . . a very useful source of information for any researcher working in discriminant analysis and pattern recognition." –Computational Statistics Discriminant Analysis and Statistical Pattern Recognition provides a systematic account of the subject. While the focus is on practical considerations, both theoretical and practical issues are explored. Among the advances covered are regularized discriminant analysis and bootstrap-based assessment of the performance of a sample-based discriminant rule, and extensions of discriminant analysis motivated by problems in statistical image analysis. The accompanying bibliography contains over 1,200 references.

The Wiley Classics Library consists of selected books that havebecome recognized classics in their respective fields. With thesenew unabridged and inexpensive editions, Wiley hopes to extend thelife of these important works by making them available to futuregenerations of mathematicians and scientists. Currently availablein the Series: T. W. Anderson Statistical Analysis of Time SeriesT. S. Arthanari & Yadolah Dodge Mathematical Programming inStatistics Emil Artin Geometric Algebra Norman T. J. Bailey TheElements of Stochastic Processes with Applications to the NaturalSciences George E. P. Box & George C. Tiao Bayesian Inferencein Statistical Analysis R. W. Carter Simple Groups of Lie TypeWilliam G. Cochran & Gertrude M. Cox Experimental Designs,Second Edition Richard Courant Differential and Integral Calculus,Volume I Richard Courant Differential and Integral Calculus, VolumeII Richard Courant & D. Hilbert Methods of MathematicalPhysics, Volume I Richard Courant & D. Hilbert Methods ofMathematical Physics, Volume II D. R. Cox Planning of ExperimentsHarold M. S. Coxeter Introduction to Modern Geometry, SecondEdition Charles W. Curtis & Irving Reiner Representation Theoryof Finite Groups and Associative Algebras Charles W. Curtis &Irving Reiner Methods of Representation Theory with Applications toFinite Groups and Orders, Volume I Charles W. Curtis & IrvingReiner Methods of Representation Theory with Applications to FiniteGroups and Orders, Volume II Bruno de Finetti Theory ofProbability, Volume 1 Bruno de Finetti Theory of Probability,Volume 2 W. Edwards Deming Sample Design in Business Research Amosde Shalit & Herman Feshbach Theoretical Nuclear Physics, Volume1 --Nuclear Structure J. L. Doob Stochastic Processes NelsonDunford & Jacob T. Schwartz Linear Operators, Part One, GeneralTheory Nelson Dunford & Jacob T. Schwartz Linear Operators,Part Two, Spectral Theory--Self Adjoint Operators in Hilbert SpaceNelson Dunford & Jacob T. Schwartz Linear Operators, PartThree, Spectral Operators Herman Fsehbach Theoretical NuclearPhysics: Nuclear Reactions Bernard Friedman Lectures onApplications-Oriented Mathematics Gerald d. Hahn & Samuel S.Shapiro Statistical Models in Engineering Morris H. Hansen, WilliamN. Hurwitz & William G. Madow

Sample Survey Methods and Theory,Volume I--Methods and Applications Morris H. Hansen, William N.Hurwitz & William G. Madow Sample Survey Methods and Theory,Volume II--Theory Peter Henrici Applied and Computational ComplexAnalysis, Volume 1--Power Series--Integration--ConformalMapping--Location of Zeros Peter Henrici Applied and ComputationalComplex Analysis, Volume 2--Special Functions--IntegralTransforms--Asymptotics--Continued Fractions Peter Henrici Appliedand Computational Complex Analysis, Volume 3--Discrete FourierAnalysis--Cauchy Integrals--Construction of ConformalMaps--Univalent Functions Peter Hilton & Yel-Chiang Wu A Coursein Modern Algebra Harry Hochetadt Integral Equations Erwin O.Kreyezig Introductory Functional Analysis with Applications WilliamH. Louisell Quantum Statistical Properties of Radiation All HasanNayfeh Introduction to Perturbation Techniques Emanuel ParzenModern Probability Theory and Its Applications P.M. Prenter Splinesand Variational Methods Walter Rudin Fourier Analysis on Groups C.L. Siegel Topics in Complex Function Theory, Volume I--EllipticFunctions and Uniformization Theory C. L. Siegel Topics in ComplexFunction Theory, Volume II--Automorphic and Abelian integrals C. LSiegel Topics in Complex Function Theory, Volume III--AbelianFunctions & Modular Functions of Several Variables J. J. StokerDifferential Geometry J. J. Stoker Water Waves: The MathematicalTheory with Applications J. J. Stoker Nonlinear Vibrations inMechanical and Electrical Systems

This book takes a fresh look at the popular and well-established method of maximum likelihood for statistical estimation and inference. It begins with an intuitive introduction to the concepts and background of likelihood, and moves through to the latest developments in maximum likelihood methodology, including general latent variable models and new material for the practical implementation of integrated likelihood using the free ADMB software. Fundamental issues of statistical inference are also examined, with a presentation of some of the philosophical debates underlying the choice of statistical paradigm. Key features: Provides an accessible introduction to pragmatic maximum likelihood modelling. Covers more advanced topics, including general forms of latent variable models (including non-linear and non-normal mixed-effects and state-space models) and the use of maximum likelihood variants, such as estimating equations, conditional likelihood, restricted likelihood and integrated likelihood. Adopts a practical approach, with a focus on providing the relevant tools required by researchers and practitioners who collect and analyze real data. Presents numerous examples and case studies across a wide range of applications including medicine, biology and ecology. Features applications from a range of disciplines, with implementation in R, SAS and/or ADMB. Provides all program code and software extensions on a supporting website. Confines supporting theory to the final chapters to maintain a readable and pragmatic focus of the preceding chapters. This book is not just an accessible and practical text about maximum likelihood, it is a comprehensive guide to modern maximum likelihood estimation and inference. It will be of interest to readers of all levels, from novice to expert. It will be of great benefit to researchers, and to students of statistics from senior undergraduate to graduate level. For use as a course text, exercises are provided at the end of each chapter.

An Easy Guide to Factor AnalysisRoutledge

Sample surveys provide data used by researchers in a large range of disciplines

to analyze important relationships using well-established and widely used likelihood methods. The methods used to select samples often result in the sample differing in important ways from the target population and standard application of likelihood methods can lead to

An up-to-date, comprehensive treatment of a classic text on missing data in statistics The topic of missing data has gained considerable attention in recent decades. This new edition by two acknowledged experts on the subject offers an up-to-date account of practical methodology for handling missing data problems. Blending theory and application, authors Roderick Little and Donald Rubin review historical approaches to the subject and describe simple methods for multivariate analysis with missing values. They then provide a coherent theory for analysis of problems based on likelihoods derived from statistical models for the data and the missing data mechanism, and then they apply the theory to a wide range of important missing data problems. Statistical Analysis with Missing Data, Third Edition starts by introducing readers to the subject and approaches toward solving it. It looks at the patterns and mechanisms that create the missing data, as well as a taxonomy of missing data. It then goes on to examine missing data in experiments, before discussing complete-case and available-case analysis, including weighting methods. The new edition expands its coverage to include recent work on topics such as nonresponse in sample surveys, causal inference, diagnostic methods, and sensitivity analysis, among a host of other topics. An updated "classic" written by renowned authorities on the subject Features over 150 exercises (including many new ones) Covers recent work on important methods like multiple imputation, robust alternatives to weighting, and Bayesian methods Revises previous topics based on past student feedback and class experience Contains an updated and expanded bibliography Statistical Analysis with Missing Data, Third Edition is an ideal textbook for upper undergraduate and/or beginning graduate level students of the subject. It is also an excellent source of information for applied statisticians and practitioners in government and industry.

This book provides a review of methods for obtaining and analysing data from stage-structured biological populations. The topics covered are sam pling designs (Chapter 2), the estimation of parameters by maximum likelihood (Chapter 3), the analysis of sample counts of the numbers cif individuals in different stages at different times (Chapters 4 and 5), the analysis of data using Leslie matrix types of model (Chapter 6) and key factor analysis (Chapter 7). There is also some discussion of the approaches to modelling and estimation that have been used in five studies of particular populations (Chapter 8). There is a large literature on the modelling of biological populations, and a multitude of different approaches have been used in this area. The various approaches can be classified in different ways (Southwood, 1978, ch. 12), but for the purposes of this book it is convenient to think of the three categories mathematical, statistical and predictive modelling. Mathematical modelling is concerned largely with

developing models that capture the most important qualitative features of population dynamics. In this case, the models that are developed do not have to be compared with data from natural populations. As representations of idealized systems, they can be quite informative in showing the effects of changing parameters, indicating what factors are most important in promoting stability, and so on.

WILEY-INTERSCIENCE PAPERBACK SERIES The Wiley-Interscience Paperback Series consists of selected books that have been made more accessible to consumers in an effort to increase global appeal and general circulation. With these new unabridged softcover volumes, Wiley hopes to extend the lives of these works by making them available to future generations of statisticians, mathematicians, and scientists. ". . .Variance Components is an excellent book. It is organized and well written, and provides many references to a variety of topics. I recommend it to anyone with interest in linear models." —Journal of the American Statistical Association "This book provides a broad coverage of methods for estimating variance components which appeal to students and research workers . . . The authors make an outstanding contribution to teaching and research in the field of variance component estimation." —Mathematical Reviews "The authors have done an excellent job in collecting materials on a broad range of topics. Readers will indeed gain from using this book . . . I must say that the authors have done a commendable job in their scholarly presentation." —Technometrics This book focuses on summarizing the variability of statistical data known as the analysis of variance table. Penned in a readable style, it provides an up-to-date treatment of research in the area. The book begins with the history of analysis of variance and continues with discussions of balanced data, analysis of variance for unbalanced data, predictions of random variables, hierarchical models and Bayesian estimation, binary and discrete data, and the dispersion mean model.

This book introduces the reader to the main quantitative concepts, methods, and computational techniques needed for the development, evaluation, and application of tests in the behavioral/social sciences, including educational tests. Two empirical examples are carried throughout to illustrate alternative methods. Other data sets are used for special illustrations. Self-contained programs for confirmatory and exploratory factor analysis are available on the Web. Intended for students of psychology, particularly educational psychology, as well as social science students interested in how tests are constructed and used, prerequisites include a course on statistics. The programs and data files for this book can be downloaded from www.psypress.com/test-theory/

This book presents and standardizes statistical models and methods that can be directly applied to both reliability and survival analysis. These two types of analysis are widely used in many fields, including engineering, management, medicine, actuarial science, the environmental sciences, and the life sciences. Though there are a number of books on reliability analysis and a handful on

survival analysis, there are virtually no books on both topics and their overlapping concepts. Offering an essential textbook, this book will benefit students, researchers, and practitioners in reliability and survival analysis, reliability engineering, biostatistics, and the biomedical sciences.

Quantitative Trait Loci (QTL) is a topic of major agricultural significance for efficient livestock production. This advanced-level textbook covers all the statistical methods that have been used or proposed for detection and analysis of QTL and marker- and gene- assisted selection in animal genetics and breeding, as well as new advances that have revolutionized the field since the first edition. This book contributes to re cent developments on the statistical analysis of multiple time series in the presence of regime shifts. Markov-switching models have become popular for modelling non-linearities and regime shifts, mainly, in univariate eco nomic time series. This study is intended to provide a systematic and operational ap proach to the econometric modelling of dynamic systems subject to shifts in regime, based on the Markov-switching vector autoregressive model. The study presents a comprehensive analysis of the theoretical properties of Markov-switching vector autoregressive processes and the related statistical methods. The statistical concepts are illustrated with applications to empirical business cyde research. This monograph is a revised version of my dissertation which has been accepted by the Economics Department of the Humboldt-University of Berlin in 1996. It con sists mainly of unpublished material which has been presented during the last years at conferences and in seminars. The major parts of this study were written while I was supported by the Deutsche Forschungsgemeinschajt (DFG), Berliner Graduier tenkolleg Angewandte Mikroökonomik and Sondeiforschungsbereich 373 at the Free University and Humboldt-University of Berlin. Work was finally completed in the project The Econometrics of Macroeconomic Forecasting founded by the Economic and Social Research Council (ESRC) at the Institute of Economies and Statistics, University of Oxford. It is a pleasure to record my thanks to these institutions for their support of my research embodied in this study.

Hyperspectral Data Processing: Algorithm Design andAnalysis is a culmination of the research conducted in theRemote Sensing Signal and Image Processing Laboratory (RSSIPL) atthe University of Maryland, Baltimore County. Specifically, ittreats hyperspectral image processing and hyperspectral signalprocessing as separate subjects in two different categories. Mostmaterials covered in this book can be used in conjunction with theauthor's first book, Hyperspectral Imaging: Techniques forSpectral Detection and Classification, without muchoverlap. Many results in this book are either new or have not beenexplored, presented, or published in the public domain. Theseinclude various aspects of endmember extraction, unsupervisedlinear spectral mixture analysis, hyperspectral informationcompression, hyperspectral signal coding and characterization, aswell as applications to conceal target detection, multispectralimaging, and magnetic resonance imaging. Hyperspectral DataProcessing contains eight major sections: Part I: provides fundamentals of hyperspectral dataprocessing Part II: offers various algorithm designs for endmemberextraction Part III: derives theory for supervised linear spectral mixtureanalysis Part IV: designs unsupervised methods for hyperspectral imageanalysis Part V: explores new concepts

on hyperspectral informationcompression Parts VI & VII: develops techniques for hyperspectralsignal coding and characterization Part VIII: presents applications in multispectral imaging andmagnetic resonance imaging Hyperspectral Data Processing compiles an algorithmcompendium with MATLAB codes in an appendix to help readersimplement many important algorithms developed in this book andwrite their own program codes without relying on softwarepackages. Hyperspectral Data Processing is a valuable reference forthose who have been involved with hyperspectral imaging and itstechniques, as well those who are new to the subject.

Walking readers step by step through complex concepts, this book translates missing data techniques into something that applied researchers and graduate students can understand and utilize in their own research. Enders explains the rationale and procedural details for maximum likelihood estimation, Bayesian estimation, multiple imputation, and models for handling missing not at random (MNAR) data. Easy-to-follow examples and small simulated data sets illustrate the techniques and clarify the underlying principles. The companion website (www.appliedmissingdata.com) includes data files and syntax for the examples in the book as well as up-to-date information on software. The book is accessible to substantive researchers while providing a level of detail that will satisfy quantitative specialists.

Multiple regression analysis has been widely used by researchers to analyze complex social problems since the 1950s. A specialization in economics, known as econometrics, developed out of a recognition that multiple regression is based upon a large number of assumptions--many of which are commonly violated in specific applications, as well as a variety of corrective measures for estimating regression models in the presence of many of the violations. Unfortunately, the mathematical sophistication required to understand the econometrics literature started out high and has continued to rise over the years. As a consequence, an understanding of the assumptions of the regression model, tests for violations, and corrective estimation approaches have failed to permeate widely many other policy-related disciplines such as political science, social work, public administration, and sociology. This book should help to ameliorate this situation by presenting a detailed and accessible discussion of multiple regression and limited-dependent variable models in the context of policy analysis.

Linear models, normally presented in a highly theoretical and mathematical style, are brought down to earth in this comprehensive textbook. Linear Models examines the subject from a mean model perspective, defining simple and easy-to-learn rules for building mean models, regression models, mean vectors, covariance matrices and sums of squares matrices for balanced and unbalanced data sets. The author includes both applied and theoretical discussions of the multivariate normal distribution, quadratic forms, maximum likelihood estimation, less than full rank models, and general mixed models. The mean model is used to bring all of these topics together in a coherent presentation of linear model theory. Provides a versatile format for investigating linear model theory, using the mean model Uses examples that are familiar to the student: Design of experiments, analysis of variance, regression, and normal distribution theory Includes a review of relevant linear algebra concepts Contains fully worked examples which follow the theorem/proof presentation Practical, example-driven introduction to maximum likelihood for the social sciences.

Emphasizes computation in R, model selection and interpretation.

The aerospace community has long recognized and repeatedly emphasizes the importance of reliability for space systems. Despite this, little has been published in book form on the topic. Spacecraft Reliability and Multi-state Failures addresses this gap in the literature, offering a unique focus on spacecraft reliability based on extensive statistical analysis of system and subsystem anomalies and failures. The authors provide new results pertaining to spacecraft reliability based on extensive statistical analysis of on-orbit anomaly and failure data that will be particularly useful to spacecraft manufacturers and designers, for example in guiding satellite (and subsystem) test and screening programs and providing an empirical basis for subsystem redundancy and reliability growth plans. The authors develop nonparametric results and parametric models of spacecraft and spacecraft subsystem reliability and multi-state failures, quantify the relative contribution of each subsystem to the failure of the satellites thus identifying the subsystems that drive spacecraft unreliability, and propose advanced stochastic modeling and analysis tools for the reliability and survivability of spacecraft and space-based networks. Spacecraft Reliability and Multi-state Failures provides new nonparametric results pertaining to spacecraft reliability based on extensive statistical analysis of on-orbit anomaly and failure data; develops parametric models of spacecraft and spacecraft subsystem reliability and multi-state failures quantifies the relative contribution of each subsystem to the failure of the satellites proposes advanced stochastic modeling and analysis tools for the reliability and survivability of spacecraft and space-based networks. provides a dedicated treatment of the reliability and subsystem anomalies of communication spacecraft in geostationary orbit.

Methods of Statistical Model Estimation examines the most important and popular methods used to estimate parameters for statistical models and provide informative model summary statistics. Designed for R users, the book is also ideal for anyone wanting to better understand the algorithms used for statistical model fitting. The text presents algorith

The field of whole genome selection has quickly developed into the breeding methodology of the future. As efforts to map a wide variety of animal genomes have matured and full animal genomes are now available for many animal scientists and breeders are looking to apply these techniques to livestock production. Providing a comprehensive, forward-looking review of animal genomics, Genomic Selection in Animals provides coverage of genomic selection in a variety of economically important species including cattle, swine, and poultry. The historical foundations of genomic selection are followed by chapters that review and assess current techniques. The final chapter looks toward the future and what lies ahead for field as application of genomic selection becomes more widespread. A concise, useful summary of the field by one of the world's leading researchers, Genomic Selection in Animals fills an important gap in the literature of animal breeding and genomics.

Factor analysis is a statistical technique widely used in psychology and the social sciences. With the advent of powerful computers, factor analysis and other multivariate methods are now available to many more people. An Easy Guide to Factor Analysis presents and explains factor analysis as clearly and simply as possible. The author, Paul Kline, carefully defines all statistical terms and demonstrates step-by-step how to work out a simple example of principal components analysis and rotation. He further explains other methods of factor analysis, including confirmatory and path analysis, and concludes with a discussion of the use of the technique with various examples. An Easy Guide to Factor Analysis is the clearest, most comprehensible introduction to factor analysis for students. All those who need to use statistics

in psychology and the social sciences will find it invaluable. Paul Kline is Professor of Psychometrics at the University of Exeter. He has been using and teaching factor analysis for thirty years. His previous books include Intelligence: the psychometric view (Routledge 1990) and The Handbook of Psychological Testing (Routledge 1992).

Providing probability and statistical concepts developed using pseudorandom numbers, this book covers enumeration-, simulation-, and randomization-based statistical analyses for comparison of the test performance of alternative designs, as well as simulation- and randomization-based tests for examination of the credibility of statistical presumptions. the book discusses centroid and moment of inertia analogies for mean and variance and the organization structure of completely randomized, randomized complete block, and split spot experiment test programs. Purchase of the text provides access to 200 microcomputer programs illustrating a wide range of reliability and statistical analyses.

The widespread use of Geographical Information Systems (GIS) has significantly increased the demand for knowledge about spatial analytical techniques across a range of disciplines. As growing numbers of researchers realise they are dealing with spatial data, the demand for specialised statistical and mathematical methods designed to deal with spatial data is undergoing a rapid increase. Responding to this demand, The Handbook of Spatial Analysis is a comprehensive and authoritative discussion of issues and techniques in the field of Spatial Data Analysis. Its principal focus is on: • why the analysis of spatial data needs separate treatment • the main areas of spatial analysis • the key debates within spatial analysis • examples of the application of various spatial analytical techniques • problems in spatial analysis • areas for future research Aimed at an international audience of academics, The Handbook of Spatial Analysis will also prove essential to graduate level students and researchers in government agencies and the private sector.

WILEY-INTERSCIENCE PAPERBACK SERIES The Wiley-Interscience Paperback Series consists of selectedbooks that have been made more accessible to consumers in an effortto increase global appeal and general circulation. With these newunabridged softcover volumes, Wiley hopes to extend the lives ofthese works by making them available to future generations ofstatisticians, mathematicians, and scientists. "Many examples drawn from the author's experience ofengineering applications are used to illustrate the theoreticalresults, which are presented in a cookbook fashion...it provides anexcellent practical guide to the analysis of product-lifedata." –T.M.M. Farley Special Programme of Research in Human Reproduction World Health Organization Geneva, Switzerland Review in Biometrics, September 1983 Now a classic, Applied Life Data Analysis has been widelyused by thousands of engineers and industrial statisticians toobtain information from life data on consumer, industrial, andmilitary products. Organized to serve practitioners, this bookstarts with basic models and simple informative probability plotsof life data. Then it progresses through advanced analyticalmethods, including maximum likelihood fitting of advanced models tolife data. All data analysis methods are illustrated with numerousclients' applications from the author's consulting experience.

Statistical analyses of the numbers, lengths, and orientations of fission tracks etched in minerals yield dating and thermal history information valuable in geological and geoscience applications, particularly in oil exploration. Fission tracks can be represented mathematically by a stochastic process of randomly oriented line segments in three dimensions, and this "line segment" model can describe and explain the essential statistical features of the data, providing a rigorous foundation for quantitative modelling and simulation studies. Statistics for Fission Track Analysis explores the line segment model and its consequences for the analysis and interpretation of data. The author derives the equations for fission track data and the theoretical probability distributions for the number, orientation, and length measurements of the tracks. He sets out the theory of fission track dating and through numerical examples, presents

methods for analyzing and interpreting fission track counts. Later chapters address statistical models for situations in which samples contain mixtures of fission track ages. These methods, along with observation features of the various measurements, are illustrated by real examples. Finally, the author brings together the theoretical and observation aspects to formulate a joint likelihood function of counts, lengths, and angles as a basis for parametric thermal history modelling. An appendix provides general notes on statistical concepts and methods. Designed for broad accessibility, this is the first book to fully cover the statistical foundations of fission track analysis. Whether you work in a fission track lab, in archaeological, geological, or geochronological research, or in geological applications of statistics, you will find the background material and practical tools you need to optimize the use of fission track analysis in your work and to make further advances in the field.

Sample Text

When some useful information is hidden behind a mass of unwanted information we often resort to information processing used in its broad sense or specifically to signal processing when the useful information is a waveform. In geophysical surveys, in particular in aeromagnetic and gravity surveys, from the measured field it is often difficult to say much about any one specific target unless it is close to the surface and well isolated from the rest. The digital signal processing approach would enable us to bring out the underlying model of the source, that is, the geological structure. Some of the tools of dsp such as digital filtering, spectrum estimation, inversion, etc., have found extensive applications in aeromagnetic and gravity map analysis. There are other emerging applications of dsp in the area of inverse filtering, three dimensional visualization, etc. The purpose of this book is to bring numerous tools of dsp to the geophysical community, in particular, to those who are entering the geophysical profession. Also the practicing geophysicists, involved in the aeromagnetic and gravity data analysis, using the commercially available software packages, will find this book useful in answering their questions on "why and how?". It is hoped that such a background would enable the practising geophysicists to appreciate the prospects and limitations of the dsp in extracting useful information from the potential field maps. The topics covered are: potential field signals and models, digital filtering in two dimensions, spectrum estimation and application, parameter estimation with error bounds.

This book provides a comprehensive introduction to methods and models for categorical data analysis and their applications in social science research. Companion website also available, at https://webspace.utexas.edu/dpowers/www/

This book examines the consequences of misspecifications for the interpretation of likelihood-based methods of statistical estimation and interference. The analysis concludes with an examination of methods by which the possibility of misspecification can be empirically investigated.

BOOK DESCRIPTION: Written by two leading statisticians, this applied introduction to the mathematics of probability and statistics emphasizes the existence of variation in almost every process, and how the study of probability and statistics helps us understand this variation. Designed for students with a background in calculus, this book continues to reinforce basic mathematical concepts with numerous real-world examples and applications to illustrate the relevance of key concepts. NEW TO THIS EDITION: The included CD-ROM contains all of the data sets in a variety of formats for use with most statistical software packages. This disc also includes several applications of Minitab® and Maple(tm). Historical vignettes at the end of each chapter outline the origin of the greatest accomplishments in the field of statistics, adding enrichment to the course. Content updates The first five chapters have been reorganized to cover a standard probability course with more real examples and exercises. These chapters are important for students wishing to pass the first actuarial exam, and cover the necessary material needed for students taking this course at the junior level. Chapters 6 and 7 on

estimation and tests of statistical hypotheses tie together confidence intervals and tests, including one-sided ones. There are separate chapters on nonparametric methods, Bayesian methods, and Quality Improvement. Chapters 4 and 5 include a strong discussion on conditional distributions and functions of random variables, including Jacobians of transformations and the moment-generating technique. Approximations of distributions like the binomial and the Poisson with the normal can be found using the central limit theorem. Chapter 8 (Nonparametric Methods) includes most of the standards tests such as those by Wilcoxon and also the use of order statistics in some distribution-free inferences. Chapter 9 (Bayesian Methods) explains the use of the "Dutch book" to prove certain probability theorems. Chapter 11 (Quality Improvement) stresses how important W. Edwards Deming's ideas are in understanding variation and how they apply to everyday life. TABLE OF CONTENTS: Preface Prologue 1. Probability 1.1 Basic Concepts 1.2 Properties of Probability 1.3 Methods of Enumeration 1.4 Conditional Probability 1.5 Independent Events 1.6 Bayes's Theorem 2. Discrete Distributions 2.1 Random Variables of the Discrete Type 2.2 Mathematical Expectation 2.3 The Mean, Variance, and Standard Deviation 2.4 Bernoulli Trials and the Binomial Distribution 2.5 The Moment-Generating Function 2.6 The Poisson Distribution 3. Continuous Distributions 3.1 Continuous-Type Data 3.2 Exploratory Data Analysis 3.3 Random Variables of the Continuous Type 3.4 The Uniform and Exponential Distributions 3.5 The Gamma and Chi-Square Distributions 3.6 The Normal Distribution 3.7 Additional Models 4. Bivariate Distributions 4.1 Distributions of Two Random Variables 4.2 The Correlation Coefficient 4.3 Conditional Distributions 4.4 The Bivariate Normal Distribution 5. Distributions of Functions of Random Variables 5.1 Functions of One Random Variable 5.2 Transformations of Two Random Variables 5.3 Several Independent Random Variables 5.4 The Moment-Generating Function Technique 5.5 Random Functions Associated with Normal Distributions 5.6 The Central Limit Theorem 5.7 Approximations for Discrete Distributions 6. Estimation 6.1 Point Estimation 6.2 Confidence Intervals for Means 6.3 Confidence Intervals for Difference of Two Means 6.4 Confidence Intervals for Variances 6.5 Confidence Intervals for Proportions 6.6 Sample Size. 6.7 A Simple Regression Problem 6.8 More Regression 7. Tests of Statistical Hypotheses 7.1 Tests about Proportions 7.2 Tests about One Mean 7.3 Tests of the Equality of Two Means 7.4 Tests for Variances 7.5 One-Factor Analysis of Variance 7.6 Two-Factor Analysis of Variance 7.7 Tests Concerning Regression and Correlation 8. Nonparametric Methods 8.1 Chi-Square Goodness of Fit Tests 8.2 Contingency Tables 8.3 Order Statistics 8.4 Distribution-Free Confidence Intervals for Percentiles 8.5 The Wilcoxon Tests 8.6 Run Test and Test for Randomness 8.7 Kolmogorov-Smirnov Goodness of Fit Test 8.8 Resampling Methods 9. Bayesian Methods 9.1 Subjective Probability 9.2 Bayesian Estimation 9.3 More Bayesian Concepts 10. Some Theory 10.1 Sufficient Statistics 10.2 Power of a Statistical Test 10.3 Best Critical Regions 10.4 Likelihood Ratio Tests 10.5 Chebyshev's Inequality and Convergence in Probability 10.6 Limiting Moment-Generating Functions 10.7 Asymptotic Distributions of Maximum Likelihood Estimators 11. Quality Improvement Through Statistical Methods 11.1 Time Sequences 11.2 Statistical Quality Control 11.3 General Factorial and 2k Factorial Designs 11.4 Understanding Variation A. Review of Selected Mathematical Techniques A.1 Algebra of Sets A.2 Mathematical Tools for the Hypergeometric Distribution A.3 Limits A.4 Infinite Series A.5 Integration A.6 Multivariate Calculus B. References C. Tables D. Answers to Odd-Numbered Exercises

There has been a surge of interest in methods of analysing data that typically arise from surveys of various kinds of experiments in which the number of people, animals, places or objects occupying various categories are counted. In this textbook, first published in 1984, Dr Fingleton describes some techniques centred on the log-linear model from the perspective of the social, behavioural and environmental scientist.

Provides a simple exposition of the basic time series material, and insights into underlying

technical aspects and methods of proof Long memory time series are characterized by a strong dependence between distant events. This book introduces readers to the theory and foundations of univariate time series analysis with a focus on long memory and fractional integration, which are embedded into the general framework. It presents the general theory of time series, including some issues that are not treated in other books on time series, such as ergodicity, persistence versus memory, asymptotic properties of the periodogram, and Whittle estimation. Further chapters address the general functional central limit theory, parametric and semiparametric estimation of the long memory parameter, and locally optimal tests. Intuitive and easy to read, Time Series Analysis with Long Memory in View offers chapters that cover: Stationary Processes; Moving Averages and Linear Processes; Frequency Domain Analysis; Differencing and Integration; Fractionally Integrated Processes; Sample Means; Parametric Estimators; Semiparametric Estimators; and Testing. It also discusses further topics. This book: Offers beginning-of-chapter examples as well as end-of-chapter technical arguments and proofs Contains many new results on long memory processes which have not appeared in previous and existing textbooks Takes a basic mathematics (Calculus) approach to the topic of time series analysis with long memory Contains 25 illustrative figures as well as lists of notations and acronyms Time Series Analysis with Long Memory in View is an ideal text for first year PhD students, researchers, and practitioners in statistics, econometrics, and any application area that uses time series over a long period. It would also benefit researchers, undergraduates, and practitioners in those areas who require a rigorous introduction to time series analysis.

Hyperspectral Imaging: Techniques for Spectral Detection and Classification is an outgrowth of the research conducted over the years in the Remote Sensing Signal and Image Processing Laboratory (RSSIPL) at the University of Maryland, Baltimore County. It explores applications of statistical signal processing to hyperspectral imaging and further develops non-literal (spectral) techniques for subpixel detection and mixed pixel classification. This text is the first of its kind on the topic and can be considered a recipe book offering various techniques for hyperspectral data exploitation. In particular, some known techniques, such as OSP (Orthogonal Subspace Projection) and CEM (Constrained Energy Minimization) that were previously developed in the RSSIPL, are discussed in great detail. This book is self-contained and can serve as a valuable and useful reference for researchers in academia and practitioners in government and industry.

Digital Spectral Analysis offers a broad perspective of spectral estimation techniques and their implementation. Coverage includes spectral estimation of discrete-time or discrete-space sequences derived by sampling continuous-time or continuous-space signals. The treatment emphasizes the behavior of each spectral estimator for short data records and provides over 40 techniques described and available as implemented MATLAB functions. In addition to summarizing classical spectral estimation, this text provides theoretical background and review material in linear systems, Fourier transforms, matrix algebra, random processes, and statistics. Topics include Prony's method, parametric methods, the minimum variance method, eigenanalysis-based estimators, multichannel methods, and two-dimensional methods. Suitable for advanced undergraduates and graduate students of electrical engineering — and for scientific use in the signal processing application community outside of universities — the treatment's prerequisites include some knowledge of discrete-time linear system and transform theory, introductory probability and statistics, and linear algebra. 1987 edition.

Economists can rarely perform controlled experiments to generate data. Existing information in the form of real-life observations simply has to be utilized in the best possible way. Given this, it is advantageous to make use of the increasing availability and accessibility of combinations of time-series and cross-sectional data in the estimation of economic models. But such data call for a new methodology of estimation and hence for the development of new econometric

models. This book proposes one such new model which introduces error components in a system of simultaneous equations to take into account the temporal and cross-sectional heterogeneity of panel data. After a substantial survey of panel data models, the newly proposed model is presented in detail and indirect estimations, full information and limited information estimations, and estimations with and without the assumption of normal distribution errors. These estimation methods are then applied using a computer to estimate a model of residential electricity demand using data on American households. The results are analysed both from an economic and from a statistical point of view.

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