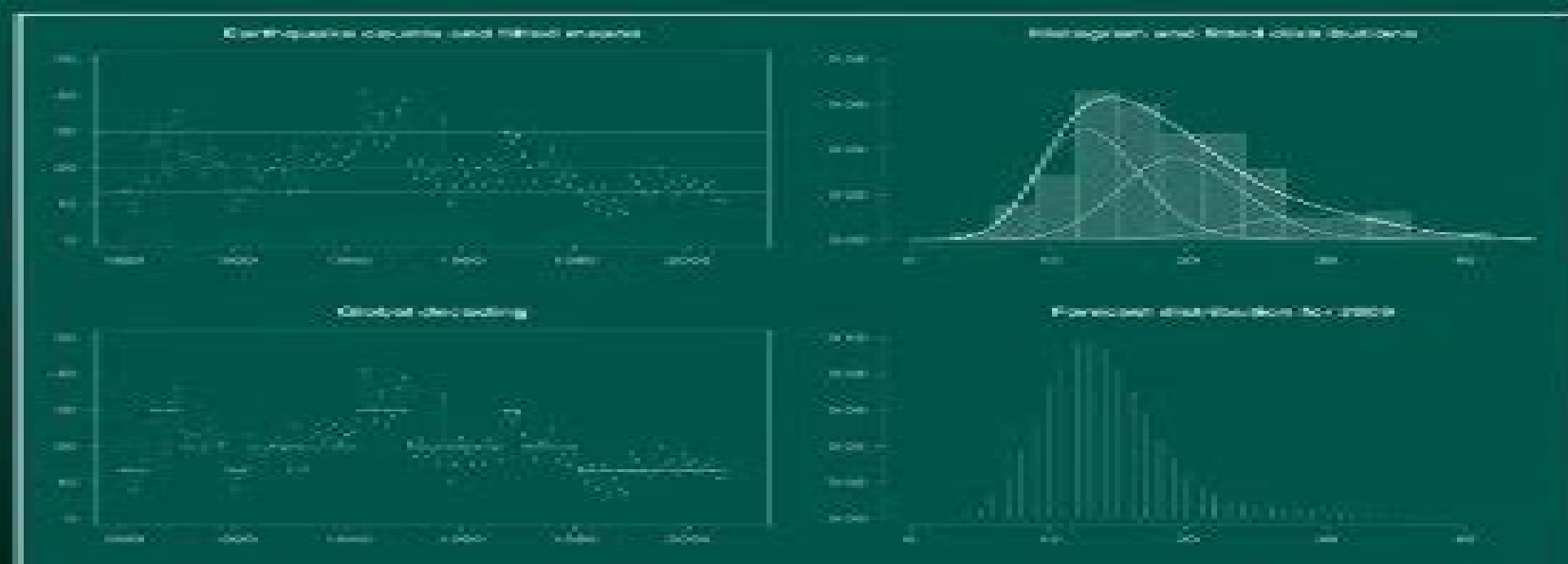


Hidden Markov Models for Time Series

An Introduction Using R



Walter Zucchini
Iain L. MacDonald



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old and this book presents the first broad introductory treatment of the subject Along with background material in probability algebra and statistics this book covers a range of topics in algebraic statistics including algebraic exponential families likelihood inference Fisher s exact test bounds on entries of contingency tables design of experiments identifiability of hidden variable models phylogenetic models and model selection With numerous examples references and over 150 exercises this book is suitable for both classroom use and independent study

Multistate Models for the Analysis of Life History Data Richard J Cook,Jerald F. Lawless,2018-05-15 Multistate Models for the Analysis of Life History Data provides the first comprehensive treatment of multistate modeling and analysis including parametric nonparametric and semiparametric methods applicable to many types of life history data Special models such as illness death competing risks and progressive processes are considered as well as more complex models The book provides both theoretical development and illustrations of analysis based on data from randomized trials and observational cohort studies in health research It features Discusses a wide range of applications of multistate models Presents methods for both continuously and intermittently observed life history processes Gives a thorough discussion of conditionally independent censoring and observation processes Discusses models with random effects and joint models for two or more multistate processes Discusses and illustrates software for multistate analysis that is available in R Target audience includes those engaged in research and applications involving multistate models

Nonparametric Models for Longitudinal Data Colin O. Wu,Xin Tian,2018-05-23 Nonparametric Models for Longitudinal Data with Implementations in R presents a comprehensive summary of major advances in nonparametric models and smoothing methods with longitudinal data It covers methods theories and applications that are particularly useful for biomedical studies in the era of big data and precision medicine It also provides flexible tools to describe the temporal trends covariate effects and correlation structures of repeated measurements in longitudinal data This book is intended for graduate students in statistics data scientists and statisticians in biomedical sciences and public health As experts in this area the authors present extensive materials that are balanced between theoretical and practical topics The statistical applications in real life examples lead into meaningful interpretations and inferences Features Provides an overview of parametric and semiparametric methods Shows smoothing methods for unstructured nonparametric models Covers structured nonparametric models with time varying coefficients Discusses nonparametric shared parameter and mixed effects models Presents nonparametric models for conditional distributions and functionals Illustrates implementations using R software packages Includes datasets and code in the authors website Contains asymptotic results and theoretical derivations

Time Series Analysis and Its Applications Robert H. Shumway,David S. Stoffer,2025-01-27 This 5th edition of this popular graduate textbook presents a balanced and comprehensive treatment of both time and frequency domain methods with accompanying theory It includes numerous examples using nontrivial data illustrate solutions to problems such as discovering natural and anthropogenic climate change evaluating pain perception experiments using functional magnetic

resonance imaging and monitoring a nuclear test ban treaty The R package *astsa* has had major updates and the text will reflect those updates In general the graphics have been improved New topics include random number generation modeling and fitting predator prey interactions more emphasis on structural models testing for linearity discussion of EM algorithm is more extensive Bayesian analysis of state space models and MCMC is more extensive including new scripts in *astsa* particle methods are introduced stochastic volatility coverage is expanded changepoint detection is introduced new topic The book is designed as a textbook for graduate level students in the physical biological and social sciences and as a graduate level text in statistics Some parts may also serve as an undergraduate introductory course Theory and methodology are separated to allow presentations on different levels In addition to coverage of classical methods of time series regression ARIMA models spectral analysis and state space models the text includes modern developments including categorical time series analysis multivariate spectral methods long memory series nonlinear models resampling techniques GARCH models ARMAX models stochastic volatility and Markov chain Monte Carlo integration methods This edition includes R code for each numerical example

The British National Bibliography Arthur James Wells, 2009 *Subject Guide to Books in Print*, 1996

Hidden Markov and Other Models for Discrete-valued Time Series Iain L. MacDonald, Walter Zucchini, 1997-01-01

Discrete valued time series are common in practice but methods for their analysis are not well known In recent years methods have been developed which are specifically designed for the analysis of discrete valued time series Hidden Markov and Other Models for Discrete Valued Time Series introduces a new versatile and computationally tractable class of models the hidden Markov models It presents a detailed account of these models then applies them to data from a wide range of diverse subject areas including medicine climatology and geophysics This book will be invaluable to researchers and postgraduate and senior undergraduate students in statistics Researchers and applied statisticians who analyze time series data in medicine animal behavior hydrology and sociology will also find this information useful

Joyce in the Belly of the Big Truck; Workbook Joyce A. Cascio, 2005-05 *Inference in Hidden Markov Models* Olivier Cappé, Eric Moulines, Tobias Ryden, 2006-04-12

Hidden Markov models have become a widely used class of statistical models with applications in diverse areas such as communications engineering bioinformatics finance and many more This book is a comprehensive treatment of inference for hidden Markov models including both algorithms and statistical theory Topics range from filtering and smoothing of the hidden Markov chain to parameter estimation Bayesian methods and estimation of the number of states In a unified way the book covers both models with finite state spaces which allow for exact algorithms for filtering estimation etc and models with continuous state spaces also called state space models requiring approximate simulation based algorithms that are also described in detail Simulation in hidden Markov models is addressed in five different chapters that cover both Markov chain Monte Carlo and sequential Monte Carlo approaches Many examples illustrate the algorithms and theory The book also carefully treats Gaussian linear state space models and their extensions and it contains a chapter on general

Markov chain theory and probabilistic aspects of hidden Markov models This volume will suit anybody with an interest in inference for stochastic processes and it will be useful for researchers and practitioners in areas such as statistics signal processing communications engineering control theory econometrics finance and more The algorithmic parts of the book do not require an advanced mathematical background while the more theoretical parts require knowledge of probability theory at the measure theoretical level From the reviews By providing an overall survey of results obtained so far in a very readable manner and also presenting some new ideas this well written book will appeal to academic researchers in the field of HMMs with PhD students working on related topics included It will also appeal to practitioners and researchers from other fields by guiding them through the computational steps needed for making inference HMMs and or by providing them with the relevant underlying statistical theory In the reviewer's opinion this book will shortly become a reference work in its field MathSciNet This monograph is a valuable resource It provides a good literature review an excellent account of the state of the art research on the necessary theory and algorithms and ample illustrations of numerous applications of HMM It goes much beyond the earlier resources on HMM I anticipate this work to serve well many Technometrics readers in the coming years Haikady N Nagaraja for Technometrics November 2006 Hidden Markov Models and Dynamical Systems Andrew M. Fraser, 2008-01-01 Presents algorithms for using HMMs and explains the derivation of those algorithms for the dynamical systems community Complex Stochastic Systems O.E. Barndorff-Nielsen, Claudia Kluppelberg, 2000-08-09 Complex stochastic systems comprises a vast area of research from modelling specific applications to model fitting estimation procedures and computing issues The exponential growth in computing power over the last two decades has revolutionized statistical analysis and led to rapid developments and great progress in this emerging field In Complex Stochastic Systems leading researchers address various statistical aspects of the field illustrated by some very concrete applications A Primer on Markov Chain Monte Carlo by Peter J Green provides a wide ranging mixture of the mathematical and statistical ideas enriched with concrete examples and more than 100 references Causal Inference from Graphical Models by Steffen L Lauritzen explores causal concepts in connection with modelling complex stochastic systems with focus on the effect of interventions in a given system State Space and Hidden Markov Models by Hans R K nschshows the variety of applications of this concept to time series in engineering biology finance and geophysics Monte Carlo Methods on Genetic Structures by Elizabeth A Thompson investigates special complex systems and gives a concise introduction to the relevant biological methodology Renormalization of Interacting Diffusions by Frank den Hollander presents recent results on the large space time behavior of infinite systems of interacting diffusions Stein's Method for Epidemic Processes by Gesine Reinert investigates the mean field behavior of a general stochastic epidemic with explicit bounds Individually these articles provide authoritative tutorial style exposition and recent results from various subjects related to complex stochastic systems Collectively they link these separate areas of study to form the first comprehensive overview of this rapidly developing field

Mixture and Hidden Markov Models with R Ingmar Visser, Maarten Speekenbrink, 2022-06-28 This book discusses mixture and hidden Markov models for modeling behavioral data. Mixture and hidden Markov models are statistical models which are useful when an observed system occupies a number of distinct regimes or unobserved hidden states. These models are widely used in a variety of fields including artificial intelligence, biology, finance, and psychology. Hidden Markov models can be viewed as an extension of mixture models to model transitions between states over time. Covering both mixture and hidden Markov models in a single book allows main concepts and issues to be introduced in the relatively simpler context of mixture models. After a thorough treatment of the theory and practice of mixture modeling, the conceptual leap towards hidden Markov models is relatively straightforward. This book provides many practical examples illustrating the wide variety of uses of the models. These examples are drawn from our own work in psychology as well as other areas such as financial time series and climate data. Most examples illustrate the use of the authors' depmixS4 package which provides a flexible framework to construct and estimate mixture and hidden Markov models. All examples are fully reproducible and the accompanying hmmR package provides all the datasets used as well as additional functionality. This book is suitable for advanced students and researchers with an applied background.

Markov Models Joshua Chappman, 2017-10-29 What is a MEMORYLESS predictive model? Markov models are a powerful predictive technique used to model stochastic systems using time series data. They are centered around the fundamental property of memorylessness, stating that the outcome of a problem depends only on the current state of the system; historical data must be ignored. This model construction may sound overly simplistic. After all, if you have historical data, why not use it to develop more complete and well-informed models? Surely it would lead to more accurate predictions. However, when modelling time series data where previous results are of limited relevance, a memoryless model delivers vast performance advantages. By considering only the present state, algorithms become highly scalable, stable, fast, and above all else, extremely versatile. Speech recognition is a perfect example: nearly all of today's speech recognition algorithms are built using Markov Models. In this book, we will explore why a Memoryless predictive model can be so advantageous to the modern tech industry. We will take a look at fundamental mathematics and high-level concepts alike, extending our understanding of the subject beyond the simple Markov Model. You will learn: Foundations of Markov Models, Markov Chains, Case Study: Google PageRank, Hidden Markov Models, Bayesian Networks, Inference Tasks.

Markov Models and Optimization M.H.A. Davis, 1993

Introduction to Hidden Semi-Markov Models John Van der Hoeek, Robert J. Elliott, 2018 Markov chains and hidden Markov chains have applications in many areas of engineering and genomics. This book provides a basic introduction to the subject by first developing the theory of Markov processes in an elementary discrete-time finite-state framework, suitable for senior undergraduates and graduates. The authors then introduce semi-Markov chains and hidden semi-Markov chains before developing related estimation and filtering results. Genomics applications are modelled by discrete observations of these hidden semi-Markov

chains This book contains new results and previously unpublished material not available elsewhere The approach is rigorous and focused on applications

Hidden Markov Models Robert J Elliott, Lakhdar Aggoun, John B. Moore, 2008-09-27 As more applications are found interest in Hidden Markov Models continues to grow Following comments and feedback from colleagues students and other working with Hidden Markov Models the corrected 3rd printing of this volume contains clarifications improvements and some new material including results on smoothing for linear Gaussian dynamics In Chapter 2 the derivation of the basic filters related to the Markov chain are each presented explicitly rather than as special cases of one general filter Furthermore equations for smoothed estimates are given The dynamics for the Kalman filter are derived as special cases of the authors general results and new expressions for a Kalman smoother are given The Chapters on the control of Hidden Markov Chains are expanded and clarified The revised Chapter 4 includes state estimation for discrete time Markov processes and Chapter 12 has a new section on robust control

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