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Spatial Linear Models for Environmental Data

2024-04-17

many applied researchers equate spatial statistics with prediction or mapping but this book naturally extends linear models which includes regression and anova as pillars of applied statistics to achieve a more comprehensive treatment of the analysis of spatially autocorrelated data spatial linear models for environmental data aimed at students and professionals with a master s level training in statistics presents a unique applied and thorough treatment of spatial linear models within a statistics framework two subfields one called geostatistics and the other called areal or lattice models are extensively covered zimmerman and ver hoef present topics clearly using many examples and simulation studies to illustrate ideas by mimicking their examples and r code readers will be able to fit spatial linear models to their data and draw proper scientific conclusions topics covered include exploratory methods for spatial data including outlier detection semi variograms moran s i and geary s c ordinary and generalized least squares regression methods and their application to spatial data suitable parametric models for the mean and covariance structure of geostatistical and areal data model fitting including inference methods for explanatory variables and likelihood based methods for covariance parameters practical use of spatial linear models including prediction kriging spatial sampling and spatial design of experiments for solving real world problems all concepts are introduced in a natural order and illustrated throughout the book using four datasets all analyses tables and figures are completely reproducible using open source r code provided at a github site exercises are given at the end of each chapter with full solutions provided on an instructor s ftp site supplied by the publisher

Bayesian Applications in Environmental and Ecological Studies with R and Stan

2022-08-29

modern ecological and environmental sciences are dominated by observational data as a result traditional statistical training often leaves scientists ill prepared for the data analysis tasks they encounter in their work bayesian methods provide a more robust and flexible tool for data analysis as they enable information from different sources to be brought into the modelling process bayesian applications in environmental and ecological studies with r and stan provides a bayesian framework for model formulation parameter estimation and model evaluation in the context of analyzing environmental and ecological data features an accessible overview of bayesian methods in environmental and ecological studies emphasizes the hypothetical deductive process particularly model formulation necessary background material on bayesian inference and monte carlo simulation detailed case studies covering water quality monitoring and assessment ecosystem response to urbanization fisheries ecology and more advanced chapter on bayesian applications including bayesian networks and a change point model complete code for all examples along with the data used in the book are available via github the book is primarily aimed at graduate students and researchers in the environmental and ecological sciences as well as environmental management professionals this is a group of people representing diverse subject matter fields who could benefit from the potential power and flexibility of bayesian methods

Spatio-Temporal Models for Ecologists

2024-02-27

ecological dynamics are tremendously complicated and are studied at a variety of spatial and temporal scales ecologists often simplify analysis by describing changes in density of individuals across a landscape and statistical methods are advancing rapidly for studying spatio temporal dynamics however spatio temporal statistics is often presented using a set of principles that may seem very distant from ecological theory or practice this book seeks to introduce a minimal set of principles and numerical techniques for spatio temporal statistics that can be used to implement a wide range of real world ecological analyses regarding animal movement population dynamics community composition causal attribution and spatial dynamics we provide a step by step illustration of techniques that combine core spatial analysis packages in r with low level computation using template model builder techniques are showcased using real world data from varied ecological systems providing a toolset for hierarchical modelling of spatio temporal processes spatio temporal models for ecologists is meant for graduate level students alongside applied and academic ecologists key features foundational ecological principles and analyses thoughtful and thorough ecological examples analyses conducted using a minimal toolbox and fast computation code using r and tmb included in the book and available online

Bringing Bayesian Models to Life

2019-05-15

bringing bayesian models to life empowers the reader to extend enhance and implement statistical models for ecological and environmental data analysis we open the black box and show the reader how to connect modern

statistical models to computer algorithms these algorithms allow the user to fit models that answer their scientific questions without needing to rely on automated bayesian software we show how to handcraft statistical models that are useful in ecological and environmental science including linear and generalized linear models spatial and time series models occupancy and capture recapture models animal movement models spatio temporal models and integrated population models features r code implementing algorithms to fit bayesian models using real and simulated data examples a comprehensive review of statistical models commonly used in ecological and environmental science overview of bayesian computational methods such as importance sampling mcmc and hmc derivations of the necessary components to construct statistical algorithms from scratch bringing bayesian models to life contains a comprehensive treatment of models and associated algorithms for fitting the models to data we provide detailed and annotated r code in each chapter and apply it to fit each model we present to either real or simulated data for instructional purposes our code shows how to create every result and figure in the book so that readers can use and modify it for their own analyses we provide all code and data in an organized set of directories available at the authors websites

Biometry for Forestry and Environmental Data

2020-05-27

biometry for forestry and environmental data with examples in r focuses on statistical methods that are widely applicable in forestry and environmental sciences but it also includes material that is of wider interest features describes the theory and applications of selected statistical methods and illustrates their use and basic concepts through examples with forestry and environmental data in r rigorous but easily accessible presentation of the linear nonlinear generalized linear and multivariate models and their mixed effects counterparts chapters on tree size tree taper measurement errors and forest experiments are also included necessary statistical theory about random variables estimation and prediction is included the wide applicability of the linear prediction theory is emphasized the hands on examples with implementations using r make it easier for non statisticians to understand the concepts and apply the methods with their own data lot of additional material is available at biobook org the book is aimed at students and researchers in forestry and environmental studies but it will also be of interest to statisticians and researchers in other fields as well

Spatio-Temporal Methods in Environmental Epidemiology with R

2023-12-12

spatio temporal methods in environmental epidemiology with r like its first edition explores the interface between environmental epidemiology and spatio temporal modeling it links recent developments in spatio temporal theory with epidemiological applications drawing on real life problems it shows how recent advances in methodology can assess the health risks associated with environmental hazards the book s clear guidelines enable the implementation of the methodology and estimation of risks in practice new additions to the second edition include a thorough exploration of the underlying concepts behind knowledge discovery through data a new chapter on extracting information from data using r and the tidyverse additional material on methods for bayesian computation including the use of nimble and stan new methods for performing spatio temporal analysis and an updated chapter containing further topics throughout the book there are new examples and the presentation of r code for examples has been extended along with these additions the book now has a github site spacetime environ github io stepi2 that contains data code and further worked examples features explores the interface between environmental epidemiology and spatio temporal modeling incorporates examples that show how spatio temporal methodology can inform societal concerns about the effects of environmental hazards on health uses a bayesian foundation on which to build an integrated approach to spatio temporal modeling and environmental epidemiology discusses data analysis and topics such as data visualization mapping wrangling and analysis shows how to design networks for monitoring hazardous environmental processes and the ill effects of preferential sampling through the listing and application of code shows the power of r tidyverse nimble and stan and other modern tools in performing complex data analysis and modeling representing a continuing important direction in environmental epidemiology this book in full color throughout underscores the increasing need to consider dependencies in both space and time when modeling epidemiological data readers will learn how to identify and model patterns in spatio temporal data and how to exploit dependencies over space and time to reduce bias and inefficiency when estimating risks to health

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alternative formulation developed by lecam but requires a minimum of mathematical prerequisites

Nonparametric Statistical Methods Using R

2024-05-20

praise for the first edition this book would be especially good for the shelf of anyone who already knows nonparametrics but wants a reference for how to apply those techniques in r the american statistician this thoroughly updated and expanded second edition of nonparametric statistical methods using r covers traditional nonparametric methods and rank based analyses two new chapters covering multivariate analyses and big data have been added core classical nonparametrics chapters on one and two sample problems have been expanded to include discussions on ties as well as power and sample size determination common machine learning topics including k nearest neighbors and trees have also been included in this new edition key features covers a wide range of models including location linear regression anova type mixed models for cluster correlated data nonlinear and gee type includes robust methods for linear model analyses big data time to event analyses timeseries and multivariate numerous examples illustrate the methods and their computation r packages are available for computation and datasets contains two completely new chapters on big data and multivariate analysis the book is suitable for advanced undergraduate and graduate students in statistics and data science and students of other majors with a solid background in statistical methods including regression and anova it will also be of use to researchers working with nonparametric and rank based methods in practice

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