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## 88C - CLARE HUDSON

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Geographical Information Systems (GIS) provide an enhanced environment for spatial data processing. The ability of geographic information systems to handle and analyse spatially referenced data may be seen as a major characteristic which distinguishes GIS from information systems developed to serve the needs of business data processing as well as from CAD systems or other systems whose primary objective is map production. This book, which contains contributions from a wide-ranging group of international scholars, demonstrates the progress which has been achieved so far at the interface of GIS technology and spatial analysis and planning. The various contributions bring together theoretical and conceptual, technical and applied issues. Topics covered include the design and use of GIS and spatial models, AI

tools for spatial modelling in GIS, spatial statistical analysis and GIS, GIS and dynamic modelling, GIS in urban planning and policy making, information systems for policy evaluation, and spatial decision support systems.

Statistics Analysis of Geographical Data: An Introduction provides a comprehensive and accessible introduction to the theory and practice of statistical analysis in geography. It covers a wide range of topics including graphical and numerical description of datasets, probability, calculation of confidence intervals, hypothesis testing, collection and analysis of data using analysis of variance and linear regression. Taking a clear and logical approach, this book examines real problems with real data from the geographical literature in order to illustrate the important role that statistics play in geographical investigations. Presented in a

clear and accessible manner the book includes recent, relevant examples, designed to enhance the reader's understanding.

The availability of spatial databases and widespread use of geographic information systems has stimulated increasing interest in the analysis and modelling of spatial data. Spatial data analysis focuses on detecting patterns, and on exploring and modelling relationships between them in order to understand the processes responsible for their emergence. In this way, the role of space is emphasised, and our understanding of the working and representation of space, spatial patterns, and processes is enhanced. In applied research, the recognition of the spatial dimension often yields different and more meaningful results and helps to avoid erroneous conclusions. This book aims to provide an introduction into spatial data analysis to graduates interested in applied statistical research. The text has been structured from a data-driven rather than a theory-based perspective, and focuses on those models, methods and techniques which are both accessible and of practical use for graduate students. Exploratory techniques as well as more formal model-based approaches are presented, and both area data and origin-destination flow data are considered.

Census workers need to capture and analyze information at the finest geographic level with mobile and geospatial-based technology. *GIS and the 2020 Census: Modernizing Official Statistics* provides statistical organizations with the most recent GIS methodologies and technological tools to support census workers' needs at all the stages of a census. Learn how to plan and carry out census work with GIS using new technologies for field data collection and operations management. After planning and collecting data, apply innovative solutions for performing statistical analysis, data

integration and dissemination. Additional topics cover cloud computing, big data, Location as a Service (LaaS), and emerging data sources. While *GIS and the 2020 Census* focuses on using GIS and other geospatial technology in support of census planning and operations, it also offers guidelines for building a statistical-geospatial information infrastructure in support of the 2020 Round of Censuses, evidence-based decision making, and sustainable development. Case studies illustrate concepts in practice.

The neighborhoods and the biophysical, political, and cultural environments all play a key role in affecting health outcomes of individuals. Unequal spatial distribution of resources such as clinics, hospitals, public transportation, fresh food markets, and schools could make some communities as a whole more vulnerable and less resilient to adverse health effects. This somber reality suggests that it is rather the question of "who you are depends upon where you are" and the fact that health inequality is both a people and a place concern. That is why health inequality needs to be investigated in a spatial setting to deepen our understanding of why and how some geographical areas experience poorer health than others. This book introduces how spatial context shapes health inequalities. *Spatial Health Inequalities: Adapting GIS Tools and Data Analysis* demonstrates the spatial health inequalities in six most important topics in environmental and public health, including food insecurity, birth health outcomes, infectious diseases, children's lead poisoning, chronic diseases, and health care access. These are the topics that the author has done extensive research on and provides a detailed description of the topic from a global perspective. Each chapter identifies relevant

data and data sources, discusses key literature on appropriate techniques, and then illustrates with real data with mapping and GIS techniques. This is a unique book for students, geographers, clinicians, health and research professionals and community members interested in applying GIS and spatial analysis to the study of health inequalities.

Spatial data analysis has seen explosive growth in recent years. Both in mainstream statistics and econometrics as well as in many applied fields, the attention to space, location, and interaction has become an important feature of scholarly work. The methods developed to deal with problems of spatial pattern recognition, spatial autocorrelation, and spatial heterogeneity have seen greatly increased adoption, in part due to the availability of user friendly desktop software. Through his theoretical and applied work, Arthur Getis has been a major contributing figure in this development. In this volume, we take both a retrospective and a prospective view of the field. We use the occasion of the retirement and move to emeritus status of Arthur Getis to highlight the contributions of his work. In addition, we aim to place it into perspective in light of the current state of the art and future directions in spatial data analysis. To this end, we elected to combine reprints of selected classic contributions by Getis with chapters written by key spatial scientists. These scholars were specifically invited to react to the earlier work by Getis with an eye toward assessing its impact, tracing out the evolution of related research, and to reflect on the future broadening of spatial analysis. The organization of the book follows four main themes in Getis' contributions: • Spatial analysis • Pattern analysis • Local statistics • Applications For each of these themes, the chapters provide a historical perspective on

early methodological developments and theoretical insights, assessments of these contributions in light of the current state of the art, as well as descriptions of new techniques and applications.

The contributors to this edited collection demonstrate that geographic information research is truly global in character, cutting across a wide range of disciplines and addressing conceptual, methodological, technical, ethical and political issues alike. Of the six themes, two are broadly concerned with data integration (geographic data infrastructures, GIS diffusion and implementation); two are more technical and conceptual in nature (generalisation, concepts and paradigms), and two reflect to a larger extent the application-driven nature of GIS technology (spatial analysis and multimedia). Each section is introduced by chapters highlighting the key research issues. Further chapters explore these issues in greater depth, and benefit from the international collaboration. Through the comparison of results included in this book, the prospects for advancing the field and addressing the challenges of GIS research are greatly improved.

The Handbook is written for academics, researchers, practitioners and advanced graduate students. It has been designed to be read by those new or starting out in the field of spatial analysis as well as by those who are already familiar with the field. The chapters have been written in such a way that readers who are new to the field will gain important overview and insight. At the same time, those readers who are already practitioners in the field will gain through the advanced and/or updated tools and new materials and state-of-the-art developments included. This volume provides an accounting of the diversity of current and emergent approaches, not available elsewhere despite the many excellent journals

and textbooks that exist. Most of the chapters are original, some few are reprints from the Journal of Geographical Systems, Geographical Analysis, The Review of Regional Studies and Letters of Spatial and Resource Sciences. We let our contributors develop, from their particular perspective and insights, their own strategies for mapping the part of terrain for which they were responsible. As the chapters were submitted, we became the first consumers of the project we had initiated. We gained from depth, breadth and distinctiveness of our contributors' insights and, in particular, the presence of links between them.

As political, economic, and environmental issues increasingly spread across the globe, the science of geography is being rediscovered by scientists, policymakers, and educators alike. Geography has been made a core subject in U.S. schools, and scientists from a variety of disciplines are using analytical tools originally developed by geographers. Rediscovering Geography presents a broad overview of geography's renewed importance in a changing world. Through discussions and highlighted case studies, this book illustrates geography's impact on international trade, environmental change, population growth, information infrastructure, the condition of cities, the spread of AIDS, and much more. The committee examines some of the more significant tools for data collection, storage, analysis, and display, with examples of major contributions made by geographers. Rediscovering Geography provides a blueprint for the future of the discipline, recommending how to strengthen its intellectual and institutional foundation and meet the demand for geographic expertise among professionals and the public.

An introductory overview of spatial analysis and statistics through GIS, including worked examples and critical analysis of results. The Definitive Volume on Cutting-Edge Exploratory Analysis of Massive Spatial and Spatiotemporal Databases Since the publication of the first edition of Geographic Data Mining and Knowledge Discovery, new techniques for geographic data warehousing (GDW), spatial data mining, and geovisualization (GVis) have been developed. In addition, there has been a CD-ROM that contains a complete set of ArcView Extensions used in text and accompanying datasets.

Backed by the collective knowledge and expertise of the world's leading Geographic Information Systems company, this volume presents the concepts and methods unleashing the full analytic power of GIS.

This is a hands-on book about ArcGIS that you work with as much as read. By the end, using Learn ArcGIS lessons, you'll be able to say you made a story map, conducted geographic analysis, edited geographic data, worked in a 3D web scene, built a 3D model of Venice, and more.

This is a book about how ecologists can integrate remote sensing and GIS in their research. It will allow readers to get started with the application of remote sensing and to understand its potential and limitations. Using practical examples, the book covers all necessary steps from planning field campaigns to deriving ecologically relevant information through remote sensing and modelling of species distributions. An Introduction to Spatial Data Analysis introduces spatial data handling using the open source software Quantum GIS (QGIS). In addition, readers will be guided through

their first steps in the R programming language. The authors explain the fundamentals of spatial data handling and analysis, empowering the reader to turn data acquired in the field into actual spatial data. Readers will learn to process and analyse spatial data of different types and interpret the data and results. After finishing this book, readers will be able to address questions such as “What is the distance to the border of the protected area?”, “Which points are located close to a road?”, “Which fraction of land cover types exist in my study area?” using different software and techniques. This book is for novice spatial data users and does not assume any prior knowledge of spatial data itself or practical experience working with such data sets. Readers will likely include student and professional ecologists, geographers and any environmental scientists or practitioners who need to collect, visualize and analyse spatial data. The software used is the widely applied open source scientific programs QGIS and R. All scripts and data sets used in the book will be provided online at [book.ecosens.org](http://book.ecosens.org). This book covers specific methods including: what to consider before collecting in situ data how to work with spatial data collected in situ the difference between raster and vector data how to acquire further vector and raster data how to create relevant environmental information how to combine and analyse in situ and remote sensing data how to create useful maps for field work and presentations how to use QGIS and R for spatial analysis how to develop analysis scripts

GEOGRAPHICAL INFORMATION SYSTEMS DATA STRUCTURES FOR THEMATIC MAPS DIGITAL ELEVATION MODELS DATA INPUT, VERIFICATION, STORAGE, AND OUTPUT METHODS OF DATA ANALYSIS AND SPATIAL MODELLING DATA QUALITY, ERRORS, AND NATURAL

#### VARIATION METHODS OF SPATIAL INTERPOLATION.

Clear, up-to-date coverage of methods for analyzing geographical information in a GIS context Geographic Information Analysis, Second Edition is fully updated to keep pace with the most recent developments of spatial analysis in a geographic information systems (GIS) environment. Still focusing on the universal aspects of this science, this revised edition includes new coverage on geovisualization and mapping as well as recent developments using local statistics. Building on the fundamentals, this book explores such key concepts as spatial processes, point patterns, and autocorrelation in area data, as well as in continuous fields. Also addressed are methods for combining maps and performing computationally intensive analysis. New chapters tackle mapping, geovisualization, and local statistics, including the Moran Scatterplot and Geographically Weighted Regression (GWR). An appendix provides a primer on linear algebra using matrices. Complete with chapter objectives, summaries, “thought exercises,” explanatory diagrams, and a chapter-by-chapter bibliography, Geographic Information Analysis is a practical book for students, as well as a valuable resource for researchers and professionals in the industry.

Addresses a range of analytical techniques that are provided within modern Geographic Information Systems and related geospatial software products. This guide covers: the principal concepts of geospatial analysis; core components of geospatial analysis; and, surface analysis, including surface form analysis, gridding and interpolation methods.

Geospatial information modeling and mapping has become an im-

important tool for the investigation and management of natural resources at the landscape scale. *Spatial Statistics: GeoSpatial Information Modeling and Thematic Mapping* reviews the types and applications of geospatial information data, such as remote sensing, geographic information systems

This volume presents methods for the analysis of quantitative and qualitative data, and for the processing and ordering of symbolic or linguistic information. The 45 papers combine methods from exploratory and inferential statistics with mathematical and numerical approaches, investigate conceptual classification and ordering structures and describe recent developments for knowledge-based information systems. The contributions are grouped into seven chapters: 1. Classification and Clustering, 2. Uncertainty and Fuzziness, 3. Methods of Data Analysis and Applications, 4. Statistical Models and Methods, 5. Bayesian Learning, 6. Conceptual Classification, Knowledge Ordering and Information Systems, 7. Linguistics and Dialectometry.

Learn how to get better answers in map analysis when you use spatial measurements and statistics. Spatial measurements and statistics give you a powerful way to analyze geospatial data, but you don't need to understand complex mathematical theories to apply statistical tools and get meaningful results in your projects. *The Esri Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics*, second edition, builds on Volume 1 by taking you to the next step of GIS analysis. Learn to answer such questions as, how are features distributed? What is the pattern created by a set of features? Where can clusters be found? This book introduces readers to basic statistical concepts and some of the most

common spatial statistics tasks: measuring distributions, identifying patterns and clusters, and analyzing relationships. Updated with the latest and most useful software tools and revised explanations, each chapter in *The Esri Guide to GIS Analysis, Volume 2* is organized to answer basic questions about the topic. Explore how spatial statistical tools can be applied in a range of disciplines, from public health to habitat conservation. Learn how to quantify patterns beyond visualizing them in maps. Examine spatial clusters through an updated chapter on identifying clusters. Use *The Esri Guide to GIS Analysis, Volume 2*, second edition, to understand the statistical methods and tools that can move your work past mapping and visualization to more quantitative statistical assessment.

*Statistical Methods for Geography* is the essential introduction for geography students looking to fully understand and apply key statistical concepts and techniques. Now in its fifth edition, this text is an accessible statistics '101' focused on student learning, and includes definitions, examples, and exercises throughout. Fully integrated with online self-assessment exercises and video overviews, it explains everything required to get full credits for any undergraduate statistics module. The fifth edition of this best-selling text includes:

- Coverage of descriptive statistics, probability, inferential statistics, hypothesis testing and sampling, variance, correlation, regression analysis, spatial patterns, spatial data reduction using factor analysis and cluster analysis.
- New examples from physical geography and additional real-world examples.
- Updated in-text and online exercises along with downloadable datasets.

This is the only text you'll need for undergraduate courses in statistical analysis, statistical methods, and quantita-

tive geography.

We are in an age of big data where all of our everyday interactions and transactions generate data. Much of this data is spatial - it is collected some-where - and identifying analytical insight from trends and patterns in these increasing rich digital footprints presents a number of challenges. Whilst other books describe different flavours of Data Analytics in R and other programming languages, there are none that consider Spatial Data (ie the location attached to data), or that consider issues of inference, linking Big Data, Geography, GIS, Mapping and Spatial Analytics. This is a 'learning by doing' text book, building on the previous book by the same authors, An Introduction to R for Spatial Analysis and Mapping. It details the theoretical issues in analyses of Big Spatial Data and developing practical skills in the reader for addressing these with confidence.

An integrated approach that combines essential GIS background with a practical workbook on applying the principles in ArcGIS 10.0 and 10.1 *Introducing Geographic Information Systems with ArcGIS* integrates a broad introduction to GIS with a software-specific workbook for Esri's ArcGIS. Where most courses make do using two separate texts, one covering GIS and another the software, this book enables students and instructors to use a single text with an integrated approach covering both in one volume with a common vocabulary and instructional style. This revised edition focuses on the latest software updates—ArcGIS 10.0 and 10.1. In addition to its already successful coverage, the book allows students to experience publishing maps on the Internet through new exercises, and introduces the idea of programming in the language Esri has chosen for applications (i.e., Python). A

DVD is packaged with the book, as in prior editions, containing data for working out all of the exercises. This complete, user-friendly coursebook: Is updated for the latest ArcGIS releases—ArcGIS 10.0 and 10.1 Introduces the central concepts of GIS and topics needed to understand spatial information analysis Provides a considerable ability to operate important tools in ArcGIS Demonstrates new capabilities of ArcGIS 10.0 and 10.1 Provides a basis for the advanced study of GIS and the study of the newly emerging field of GIScience *Introducing Geographic Information Systems with ArcGIS, Third Edition* is the ideal guide for undergraduate students taking courses such as Introduction to GIS, Fundamentals of GIS, and Introduction to ArcGIS Desktop. It is also an important guide for professionals looking to update their skills for ArcGIS 10.0 and 10.1.

This is the first book to provide sociologists, criminologists, political scientists, and other social scientists with the methodological logic and techniques for doing spatial analysis in their chosen fields of inquiry. The book contains a wealth of examples as to why these techniques are worth doing, over and above conventional statistical techniques using SPSS or other statistical packages. GIS is a methodological and conceptual approach that allows for the linking together of spatial data, or data that is based on a physical space, with non-spatial data, which can be thought of as any data that contains no direct reference to physical locations.

"Ideal for anyone who wishes to gain a practical understanding of spatial statistics and geostatistics. Difficult concepts are well explained and supported by excellent examples in R code, allowing readers to see how each of the methods is implemented in prac-

tice" - Professor Tao Cheng, University College London Focusing specifically on spatial statistics and including components for ArcGIS, R, SAS and WinBUGS, this book illustrates the use of basic spatial statistics and geostatistics, as well as the spatial filtering techniques used in all relevant programs and software. It explains and demonstrates techniques in: spatial sampling spatial autocorrelation local statistics spatial interpolation in two-dimensions advanced topics including Bayesian methods, Monte Carlo simulation, error and uncertainty. It is a systematic overview of the fundamental spatial statistical methods used by applied researchers in geography, environmental science, health and epidemiology, population and demography, and planning. A companion website includes digital R code for implementing the analyses in specific chapters and relevant data sets to run the R codes.

Quantitative Geography is a comprehensive and accessible discussion of the diversity of recent thinking on the use of quantitative methods in spatial data analysis.

Geographic information systems represent an exciting and rapidly expanding technology via which spatial data may be captured, stored, retrieved, displayed, manipulated and analysed. Applications of this technology include detailed inventories of land use parcels. Spatial patterns of disease, geodemographics, environmental management and macroscale inventories of global resources. The impetus for this book is the relative lack of research into the integration of spatial analysis and GIS, and the potential benefits in developing such an integration. From a GIS perspective, there is an increasing demand for systems that do something other than display and organize data. From a spatial analytical perspective, there are advantages to linking statistical meth-

ods and mathematical models to the database and display capabilities of a GIS. Although the GIS may not be absolutely necessary for spatial analysis, it can facilitate such an analysis and moreover provide insights that might otherwise have been missed. The contributions to the book tell us where we are and where we ought to be going. It suggests that the integration of spatial analysis and GIS will stimulate interest in quantitative spatial science, particularly exploratory and visual types of analysis and represents a unique statement of the state-of-the-art issues in integration and interface.

Spatial Data Analysis introduces key principles about spatial data and provides guidance on methods for their exploration; it provides a set of key ideas or frameworks that will give the reader knowledge of the kinds of problems that can be tackled using the tools that are widely available for the analysis of spatial data.

At the convergence of the land and sea, coastal environments are some of the most dynamic and populated places on Earth. This book explains how the many varied forms of spatial analysis, including mapping, monitoring and modelling, can be applied to a range of coastal environments such as estuaries, mangroves, seagrass beds and coral reefs. Presenting empirical geographical approaches to modelling, which draw on recent developments in remote sensing technology, geographical information science and spatial statistics, it provides the analytical tools to map, monitor and explain or predict coastal features. With detailed case studies and accompanying online practical exercises, it is an ideal resource for undergraduate courses in spatial science. Taking a broad view of spatial analysis and covering basic and advanced

analytical areas such as spatial data and geostatistics, it is also a useful reference for ecologists, geomorphologists, geographers and modellers interested in understanding coastal environments. Explains how to implement, interpret, and conduct diagnostics on the results of multivariate techniques. The book focuses on georeferenced data analysis applications, with explicit diagnostics for the role played by spatial autocorrelation in multivariate analyses. It also aims to establish specific connections between popular spatial analysis and multivariate procedures, and outlines methodology for implementing spatial auto, logistic, and Poisson regressions.

Applied Spatial Data Analysis with R, second edition, is divided into two basic parts, the first presenting R packages, functions, classes and methods for handling spatial data. This part is of interest to users who need to access and visualise spatial data. Data import and export for many file formats for spatial data are covered in detail, as is the interface between R and the open source GRASS GIS and the handling of spatio-temporal data. The second part showcases more specialised kinds of spatial data analysis, including spatial point pattern analysis, interpolation and geostatistics, areal data analysis and disease mapping. The coverage of methods of spatial data analysis ranges from standard techniques to new developments, and the examples used are largely taken from the spatial statistics literature. All the examples can be run using R contributed packages available from the CRAN website, with code and additional data sets from the book's own website. Compared to the first edition, the second edition covers the more systematic approach towards handling spatial data in R, as well as a number of important and widely used CRAN pack-

ages that have appeared since the first edition. This book will be of interest to researchers who intend to use R to handle, visualise, and analyse spatial data. It will also be of interest to spatial data analysts who do not use R, but who are interested in practical aspects of implementing software for spatial data analysis. It is a suitable companion book for introductory spatial statistics courses and for applied methods courses in a wide range of subjects using spatial data, including human and physical geography, geographical information science and geoinformatics, the environmental sciences, ecology, public health and disease control, economics, public administration and political science. The book has a website where complete code examples, data sets, and other support material may be found: <http://www.asdar-book.org>. The authors have taken part in writing and maintaining software for spatial data handling and analysis with R in concert since 2003.

Geocomputation with R is for people who want to analyze, visualize and model geographic data with open source software. It is based on R, a statistical programming language that has powerful data processing, visualization, and geospatial capabilities. The book equips you with the knowledge and skills to tackle a wide range of issues manifested in geographic data, including those with scientific, societal, and environmental implications. This book will interest people from many backgrounds, especially Geographic Information Systems (GIS) users interested in applying their domain-specific knowledge in a powerful open source language for data science, and R users interested in extending their skills to handle spatial data. The book is divided into three parts: (I) Foundations, aimed at getting you up-to-speed with geograph-

ic data in R, (II) extensions, which covers advanced techniques, and (III) applications to real-world problems. The chapters cover progressively more advanced topics, with early chapters providing strong foundations on which the later chapters build. Part I describes the nature of spatial datasets in R and methods for manipulating them. It also covers geographic data import/export and transforming coordinate reference systems. Part II represents methods that build on these foundations. It covers advanced map making (including web mapping), "bridges" to GIS, sharing reproducible code, and how to do cross-validation in the presence of spatial autocorrelation. Part III applies the knowledge gained to tackle real-world problems, including representing and modeling transport systems, finding optimal locations for stores or services, and ecological modeling. Exercises at the end of each chapter give you the skills needed to tackle a range of geospatial problems. Solutions for each chapter and supplementary materials providing extended examples are available at <https://geocompr.github.io/geocompkg/articles/>. Dr. Robin Lovelace is a University Academic Fellow at the University of Leeds, where he has taught R for geographic research over many years, with a focus on transport systems. Dr. Jakub Nowosad is an Assistant Professor in the Department of Geoinformation at the Adam Mickiewicz University in Poznan, where his focus is on the analysis of large datasets to understand environmental processes. Dr. Jannes Muenchow is a Postdoctoral Researcher in the GIScience Department at the University of Jena, where he develops and teaches a range of geographic methods, with a focus on ecological modeling, statistical geocomputing, and predictive mapping. All three are active developers and work on a number of R

packages, including `stplanr`, `sabre`, and `RQGIS`.

This is a new edition of the accessible and student-friendly 'how to' for anyone using R for the first time, for use in spatial statistical analysis, geocomputation and digital mapping. The authors, once again, take readers from 'zero to hero', updating the now standard text to further enable practical R applications in GIS, spatial analyses, spatial statistics, web-scraping and more. Revised and updated, each chapter includes: example data and commands to explore hands-on; scripts and coding to exemplify specific functionality; self-contained exercises for students to work through; embedded code within the descriptive text. The new edition includes detailed discussion of new and emerging packages within R like `sf`, `ggplot`, `tmap`, making it the go to introduction for all researchers collecting and using data with location attached. This is the introduction to the use of R for spatial statistical analysis, geocomputation, and GIS for all researchers - regardless of discipline - collecting and using data with location attached.

This book is a collection of papers on spatial statistics for remote sensing. The book emerges from a study day that was organized in 1996 at the International Institute for Aerospace Survey and Earth Sciences, ITC, in Enschede, The Netherlands. It was by several means a memorable event. The beautiful new building, according to a design by the famous modern Dutch architect Max van Huet was just opened, and this workshop was the first to take place there. Of course, much went wrong during the workshop, in particular as the newest electronic equipment regularly failed. But the workshop attracted more than hundred attendants, and was generally well received. The results of the workshop have been published in Stein et al. (1998). The aim of the workshop

