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Geostatistical Functional Data Analysis Explore the intersection between geostatistics and functional data analysis with this insightful new reference Geostatistical Functional Data Analysis presents a unified approach to

modelling functional data when spatial and spatio-temporal correlations are present. The Editors link together the wide research areas of geostatistics and functional data analysis to provide the reader with a new area called geostatistical functional data analysis that will bring new insights and new open questions to researchers coming from both scientific fields. This book provides a complete and up-to-date account to deal with functional data that is spatially correlated, but also includes the most innovative developments in different open avenues in this field. Containing contributions from leading experts in the field, this practical guide provides readers with the necessary tools to employ and adapt classic statistical techniques to handle spatial regression. The book also includes: A thorough introduction to the spatial kriging methodology when working with functions A detailed exposition of more classical statistical techniques adapted to the functional case and extended to handle spatial correlations Practical discussions of ANOVA, regression, and clustering methods to explore spatial correlation in a collection of curves sampled in a region In-depth explorations of the similarities and differences between spatio-temporal data analysis and functional data analysis Aimed at mathematicians, statisticians, postgraduate students, and researchers involved in the analysis of functional and spatial data, Geostatistical Functional Data Analysis will also prove to be a powerful addition to the libraries of geoscientists, environmental scientists, and economists seeking insightful new knowledge and questions at the interface of geostatistics and functional data analysis. This book covers the main mining issues where geostatistics, a discipline founded in the 1960s to study regionalized variables measured at a limited number of points in space, is expected to play a role. Each chapter of the book is associated with a stage of the mining sequence, including the interpretation and geological modeling of

mineral deposits, evaluation of in-situ and recoverable resources, long-term mine planning, short-term planning and ore control, geotechnics, geometallurgy and sampling. This work, featuring more than 150 illustrations, avoids the traditional laborious and crippling theoretical treatment of geostatistics and is systematically oriented toward a practical exhibition of the problems and proposed solutions. The writing is fluid and intended to involve the reader. The book is the fruit of more than 35 cumulative years of applied research by the authors, a professor at the University of Chile and a researcher at Mines ParisTech, carried out in collaboration with the Chilean company Codelco since the late 1990s. Despite focusing on copper porphyry deposits, the generalization of the methods presented to the entire mining industry is straightforward. The broad range of problems addressed, including generally neglected disciplines such as geotechnics, geometallurgy and sampling, and their practical presentation make this book unique and usable by a very wide audience – students, researchers, geologists, engineers, geotechnicians and metallurgists. The Stanford Geostatistical Modeling Software (SGeMS) is an open-source computer package for solving problems involving spatially related variables. It provides geostatistics practitioners with a user-friendly interface, an interactive 3-D visualization, and a wide selection of algorithms. This practical book provides a step-by-step guide to using SGeMS algorithms. It explains the underlying theory, demonstrates their implementation, discusses their potential limitations, and helps the user make an informed decision about the choice of one algorithm over another. Users can complete complex tasks using the embedded scripting language, and new algorithms can be developed and integrated through the SGeMS plug-in mechanism. SGeMS was the first software to provide algorithms for multiple-point statistics, and the book presents a discussion of the corresponding theory and applications. Incorporating the full SGeMS software (now available from www.cambridge.org/9781107403246), this book is a useful user-guide for Earth Science graduates and researchers, as well as practitioners of environmental mining and

petroleum engineering. The contributions in this book were presented at the Fourth International Geostatistics Congress held in Tróia, Portugal, in September 1992. They provide a comprehensive account of the current state of the art of geostatistics, including recent theoretical developments and new applications. In particular, readers will find descriptions and applications of the more recent methods of stochastic simulation together with data integration techniques applied to the modelling of hydrocarbon reservoirs. In other fields there are stationary and non-stationary geostatistical applications to geology, climatology, pollution control, soil science, hydrology and human sciences. The papers also provide an insight into new trends in geostatistics particularly the increasing interaction with many other scientific disciplines. This book is a significant reference work for practitioners of geostatistics both in academia and industry. Model-based Geostatistics for Global Public Health: Methods and Applications provides an introductory account of model-based geostatistics, its implementation in open-source software and its application in public health research. In the public health problems that are the focus of this book, the authors describe and explain the pattern of spatial variation in a health outcome or exposure measurement of interest. Model-based geostatistics uses explicit probability models and established principles of statistical inference to address questions of this kind. Features: Presents state-of-the-art methods in model-based geostatistics. Discusses the application these methods some of the most challenging global public health problems including disease mapping, exposure mapping and environmental epidemiology. Describes exploratory methods for analysing geostatistical data, including: diagnostic checking of residuals standard linear and generalized linear models; variogram analysis; Gaussian process models and geostatistical design issues. Includes a range of more complex geostatistical problems where research is ongoing. All of the results in the book are reproducible using publicly available R code and data-sets, as well as a dedicated R package. This book has been written to be accessible not only to statisticians but also to students and researchers in the public health

sciences. The Authors Peter Diggle is Distinguished University Professor of Statistics in the Faculty of Health and Medicine, Lancaster University. He also holds honorary positions at the Johns Hopkins University School of Public Health, Columbia University International Research Institute for Climate and Society, and Yale University School of Public Health. His research involves the development of statistical methods for analyzing spatial and longitudinal data and their applications in the biomedical and health sciences. Dr Emanuele Giorgi is a Lecturer in Biostatistics and member of the CHICAS research group at Lancaster University, where he formerly obtained a PhD in Statistics and Epidemiology in 2015. His research interests involve the development of novel geostatistical methods for disease mapping, with a special focus on malaria and other tropical diseases. In 2018, Dr Giorgi was awarded the Royal Statistical Society Research Prize "for outstanding published contribution at the interface of statistics and epidemiology." He is also the lead developer of PrevMap, an R package where all the methodology found in this book has been implemented. This book provides a guided approach to the geostatistical modelling of compositional spatial data. These data are data in proportions, percentages or concentrations distributed in space which exhibit spatial correlation. The book can be divided into four blocks. The first block sets the framework and provides some background on compositional data analysis. Block two introduces compositional exploratory tools for both non-spatial and spatial aspects. Block three covers all necessary facets of multivariate spatial prediction for compositional data: variogram modelling, cokriging and validation. Finally, block four details strategies for simulation of compositional data, including transformations to multivariate normality, Gaussian cosimulation, multipoint simulation of compositional data, and common postprocessing techniques, valid for both Gaussian and multipoint methods. All methods are illustrated via applications to two types of data sets: one a large-scale geochemical survey, comprised of a full suite of geochemical variables, and the other from a mining context, where only the elements of greatest importance are considered. R codes

are included for all aspects of the methodology, encapsulated in the R package "gmGeostats", available in CRAN. A novel, practical approach to modeling spatial uncertainty. This book deals with statistical models used to describe natural variables distributed in space or in time and space. It takes a practical, unified approach to geostatistics-integrating statistical data with physical equations and geological concepts while stressing the importance of an objective description based on empirical evidence. This unique approach facilitates realistic modeling that accounts for the complexity of natural phenomena and helps solve economic and development problems-in mining, oil exploration, environmental engineering, and other real-world situations involving spatial uncertainty. Up-to-date, comprehensive, and well-written, *Geostatistics: Modeling Spatial Uncertainty* explains both theory and applications, covers many useful topics, and offers a wealth of new insights for nonstatisticians and seasoned professionals alike. This volume: * Reviews the most up-to-date geostatistical methods and the types of problems they address. * Emphasizes the statistical methodologies employed in spatial estimation. * Presents simulation techniques and digital models of uncertainty. * Features more than 150 figures and many concrete examples throughout the text. * Includes extensive footnoting as well as a thorough bibliography. *Geostatistics: Modeling Spatial Uncertainty* is the only geostatistical book to address a broad audience in both industry and academia. An invaluable resource for geostatisticians, physicists, mining engineers, and earth science professionals such as petroleum geologists, geophysicists, and hydrogeologists, it is also an excellent supplementary text for graduate-level courses in related subjects. This book presents a geostatistical framework for data integration into subsurface Earth modeling. It offers extensive geostatistical background information, including detailed descriptions of the main geostatistical tools traditionally used in Earth related sciences to infer the spatial distribution of a given property of interest. This framework is then directly linked with applications in the oil and gas industry and how it can be used as the basis to simultaneously integrate geophysical data (e.g. seismic reflection data) and well-log

data into reservoir modeling and characterization. All of the cutting-edge methodologies presented here are first approached from a theoretical point of view and then supplemented by sample applications from real case studies involving different geological scenarios and different challenges. The book offers a valuable resource for students who are interested in learning more about the fascinating world of geostatistics and reservoir modeling and characterization. It offers them a deeper understanding of the main geostatistical concepts and how geostatistics can be used to achieve better data integration and reservoir modeling. Geostatistics is expanding very fast: concept- and technique-wise. Keeping in view the importance of the subject, it was thought appropriate to bring out the second edition of this book. In this process, Chapter I has been expanded In Chapter 2, incorporating more details on sampling and sampling designs. a section on simulation has been introduced with emphasis on Monte-Carlo simulation with worked out examples. In Chapter 5, a procedure to compute variogram in the case of irregular grid has been outlined. Minor modifications have been made in all other chapters. A new chapter on Introduction to Advanced Geostatistics has been introduced with discussions on universal kriging, disjunctive kriging, conditional simulation and median polish kriging. Review Questions are given at the end of each chapter to facilitate a better understanding of the subject by the student/practitioner. The software codes are put in a CD for convenience of the students/practitioner of geostatistics. A few additions have been made in the bibliography making it more exhaustive. This contains references to the concepts and methods presented, in-depth treatment of related topics and possible extensions. My grateful thanks are due to Dr. B.S. Saini, Principal, Guru Nanak Engg. College, Hyderabad for very helpful support. I hope that this edition will be a welcome one. This book provides a comprehensive introduction to multiple-point geostatistics, where spatial continuity is described using training images. Multiple-point geostatistics aims at bridging the gap between physical modelling/realism and spatio-temporal stochastic modelling. The book provides an

overview of this new field in three parts. Part I presents a conceptual comparison between traditional random function theory and stochastic modelling based on training images, where random function theory is not always used. Part II covers in detail various algorithms and methodologies starting from basic building blocks in statistical science and computer science. Concepts such as non-stationary and multi-variate modeling, consistency between data and model, the construction of training images and inverse modelling are treated. Part III covers three example application areas, namely, reservoir modelling, mineral resources modelling and climate model downscaling. This book will be an invaluable reference for students, researchers and practitioners of all areas of the Earth Sciences where forecasting based on spatio-temporal data is performed. The aim of this book is to bring together a series of contributions from experts in the field to cover the major aspects of the application of geostatistics in precision agriculture. The focus will not be on theory, although there is a need for some theory to set the methods in their appropriate context. The subject areas identified and the authors selected have applied the methods in a precision agriculture framework. The papers will reflect the wide range of methods available and how they can be applied practically in the context of precision agriculture. This book is likely to have more impact as it becomes increasingly possible to obtain data cheaply and more farmers use onboard digital maps of soil and crops to manage their land. It might also stimulate more software development for geostatistics in PA. Geostatistics is essential for environmental scientists. Weather and climate vary from place to place, soil varies at every scale at which it is examined, and even man-made attributes - such as the distribution of pollution - vary. The techniques used in geostatistics are ideally suited to the needs of environmental scientists, who use them to make the best of sparse data for prediction, and to plan future surveys when resources are limited. Geostatistical technology has advanced much in the last few years and many of these developments are being incorporated into the practitioner's repertoire. This second edition describes these techniques

for environmental scientists. Topics such as stochastic simulation, sampling, data screening, spatial covariances, the variogram and its modeling, and spatial prediction by kriging are described in rich detail. At each stage the underlying theory is fully explained, and the rationale behind the choices given, allowing the reader to appreciate the assumptions and constraints involved. This is the sixth contribution to the Computer Methods in the Geosciences series and it continues the tradition of being practical, germane, and easy to read. Michael Hohn in his presentation, *Geostatistics and Petroleum Geology*, nicely compliments the other books in the series and brings to the readers some new techniques by which to analyze their data. New approaches always result in new ideas or enhancement of old ones. The French School of Geostatistics (Fontainebleau, France) was founded and developed by Georges Matheron in response to problems in mining exploration and exploitation. This approach has been used successfully in that industry since the mid-1960s, but only recently applied to similar problems in petroleum. Likewise, these applications have been successful in this applied field as well and here Hohn gives examples. Standard subjects of the field of geostatistics are explored and discussed—the semivariogram, kriging, cokriging, nonlinear and parametric estimation, and conditional simulation. These may be unrecognizable terms to the readers now, but upon completion of reading the book, they will be familiar ones. Each subject is discussed in detail with appropriate and pertinent case studies, taken from the author's own research or from the literature. The author notes the book is for working geologists in the petroleum industry. This book explains the integration of data of different support in Geostatistics. There is a common misconception in the mining industry that the data used for estimation/simulation should have the same size or support. However, *Geostatistics* provides the tools to integrate several types of information that may have different support. This book aims to explain these geostatistical tools and provides several examples of applications. The book is directed for a broad audience, including engineers, geologists, and students in the area

of Geostatistics. An introduction to geostatistics stressing the multivariate aspects for scientists, engineers and statisticians. The book presents a brief review of statistical concepts, a detailed introduction to linear geostatistics, and an account of three basic methods of multivariate analysis. Applications from very different areas of science, as well as exercises with solutions, are provided to help convey the general ideas. In this second edition, the chapters regarding normal kriging and cokriging have been restructured and the section on non-stationary geostatistics has been entirely rewritten. Praise for the First Edition ". . . a readable, comprehensive volume that . . . belongs on the desk, close at hand, of any serious researcher or practitioner." —*Mathematical Geosciences* The state of the art in geostatistics Geostatistical models and techniques such as kriging and stochastic multi-realizations exploit spatial correlations to evaluate natural resources, help optimize their development, and address environmental issues related to air and water quality, soil pollution, and forestry. *Geostatistics: Modeling Spatial Uncertainty, Second Edition* presents a comprehensive, up-to-date reference on the topic, now featuring the latest developments in the field. The authors explain both the theory and applications of geostatistics through a unified treatment that emphasizes methodology. Key topics that are the foundation of geostatistics are explored in-depth, including stationary and nonstationary models; linear and nonlinear methods; change of support; multivariate approaches; and conditional simulations. The Second Edition highlights the growing number of applications of geostatistical methods and discusses three key areas of growth in the field: New results and methods, including kriging very large datasets; kriging with outliers; nonseparable space-time covariances; multipoint simulations; pluri-gaussian simulations; gradual deformation; and extreme value geostatistics Newly formed connections between geostatistics and other approaches such as radial basis functions, Gaussian Markov random fields, and data assimilation New perspectives on topics such as collocated cokriging, kriging with an external drift, discrete Gaussian change-of-support models, and simulation algorithms *Geostatistics,*

Second Edition is an excellent book for courses on the topic at the graduate level. It also serves as an invaluable reference for earth scientists, mining and petroleum engineers, geophysicists, and environmental statisticians who collect and analyze data in their everyday work. Geostatistics for Engineers and Earth Scientists Geostatistics is a branch of mathematics that deals with the sampling, analysis, interpretation and display of phenomena that fluctuate in space. Although not all geostatistical methods are probabilistic in nature, the most important accomplishments in the field have been in estimation and forecasting, extending probabilistic methods of stochastic processes and time series analysis to the spatial domain. This book gives the only available comprehensive collection of definitions of geostatistical terms. It lists more than 600 entries selected from the book and journal literature through the end of 1989. Where appropriate, multiple meanings have been included for specific terms. Cross-references abound to help the reader when the definitions of a word leads to the search for other terms. Although all the definitions are in English, equivalent terms are provided in alphabetized lists in Chinese, French, German, Greek, Portuguese, Russian and Spanish. This volume will provide a useful reference for students, scientists, engineers, and others concerned with the meaning of terms found in the geostatistical literature and heard in professional practice. Definitions and entries have been prepared with multiple levels of rigor and complexity, in order to provide help to a readership that may range from inexperienced practitioners to advanced researchers. The ideas in this book have been developed over the past three or four years while I was working at the Institute of Geological Sciences and later for Golder Associates. During that time all of the geological modelling and resource estimation studies I participated in had data that were non-ideal in one respect or another (or just plain 'dirty'): the standard ways of handling the data with kriging or with simpler parametric methods gave reasonable results, but always there were nagging doubts and some lack of confidence because of the corners that had to be cut in generating a model. The bimodal distribution that was assumed to be

'close enough' to normal; the pattern of rich and poor zones that was not quite a trend yet made the data very non-stationary; and the many plotted variograms that would not fit any standard model variogram: these all contributed to the feeling that there should be something that statistics could say about the cases where hardly any assumptions could be made about the properties of the parent population. This volume brings together selected contributions from geoENV 2008, the 7th International Conference on Geostatistics for Environmental Applications, held in Southampton, UK. It presents the state-of-the-art in geostatistics for the environmental sciences. Engineers and applied geophysicists routinely encounter interpolation and estimation problems when analysing data from field observations. Introduction to Geostatistics presents practical techniques for the estimation of spatial functions from sparse data. The author's unique approach is a synthesis of classic and geostatistical methods with a focus on the most practical linear minimum-variance estimation methods, and includes suggestions on how to test and extend the applicability of such methods. The author includes many useful methods (often not covered in other geostatistics books) such as estimating variogram parameters, evaluating the need for a variable mean, parameter estimation and model testing in complex cases (e.g. anisotropy, variable mean, and multiple variables), and using information from deterministic mathematical models. Well illustrated with exercises and worked examples taken from hydrogeology, Introduction to Geostatistics assumes no background in statistics and is suitable for graduate-level courses in earth sciences, hydrology, and environmental engineering, and also for self-study. This scholarly introductory treatment explores the fundamentals of modern geostatistics, viewing them as the product of the advancement of the epistemic status of stochastic data analysis. The book's main focus is the Bayesian maximum entropy approach for studying spatiotemporal distributions of natural variables, an approach that offers readers a deeper understanding of the role of geostatistics in improved mathematical models of scientific mapping. Starting with an overview of the uses of spatiotemporal mapping in the natural sciences,

the text explores spatiotemporal geometry, the epistemic paradigm, the mathematical formulation of the Bayesian maximum entropy method, and analytical expressions of the posterior operator. Additional topics include uncertainty assessment, single- and multi-point analytical formulations, and popular methods. An innovative contribution to the field of space and time analysis, this volume offers many potential applications in epidemiology, geography, biology, and other fields. Linear geostatistics is a fast developing field of research and its principles are extended over other fields of activity. Tools such as the variogram and kriging are now in everyday use for estimating the mean grade of material in an area from values achieved from measured samples. Non-linear geostatistics is at the forefront of statistical development, it has a potential application over a wide range of practical problems and is likely to occupy an important place in the statutory monitoring and control of air, water, and land pollution. This book provides a comprehensive introduction to the field for geographers and engineers. Presents a set of linked HTML documents on the application of geostatistical theory, designed to be viewed and navigated with an Internet browser. This reader-friendly introduction to geostatistics demystifies complex concepts and makes formulas and statistical tests easy to apply. With wide-ranging examples from topics across the Earth and environmental sciences, and worked examples at the end of each chapter, this book can be used for undergraduate courses or for self-study and reference. This brief will provide a bridge in succinct form between the geostatistics textbooks and the computer manuals for 'push-button' practice. It is becoming increasingly important for practitioners, especially neophytes, to understand what underlies modern geostatistics and the currently available software so that they can choose sensibly and draw correct conclusions from their analysis and mapping. The brief will contain some theory, but only that needed for practitioners to understand the essential steps in analyses. It will guide readers sequentially through the stages of properly designed sampling, exploratory data analysis, variography (computing the variogram

and modelling it), followed by ordinary kriging and finally mapping kriged estimates and their errors. There will be short section on trend and universal kriging. Other types of kriging will be mentioned so that readers can delve further in the substantive literature to tackle more complex tasks. Statistical Methods for Spatial and Spatio-Temporal Data Analysis provides a complete range of spatio-temporal covariance functions and discusses ways of constructing them. This book is a unified approach to modeling spatial and spatio-temporal data together with significant developments in statistical methodology with applications in R. This book includes: Methods for selecting valid covariance functions from the empirical counterparts that overcome the existing limitations of the traditional methods. The most innovative developments in the different steps of the kriging process. An up-to-date account of strategies for dealing with data evolving in space and time. An accompanying website featuring R code and examples Praise for the First Edition ". . . a readable, comprehensive volume that . . . belongs on the desk, close at hand, of any serious researcher or practitioner."

—Mathematical Geosciences The state of the art in geostatistics Geostatistical models and techniques such as kriging and stochastic multi-realizations exploit spatial correlations to evaluate natural resources, help optimize their development, and address environmental issues related to air and water quality, soil pollution, and forestry. Geostatistics: Modeling Spatial Uncertainty, Second Edition presents a comprehensive, up-to-date reference on the topic, now featuring the latest developments in the field. The authors explain both the theory and applications of geostatistics through a unified treatment that emphasizes methodology. Key topics that are the foundation of geostatistics are explored in-depth, including stationary and nonstationary models; linear and nonlinear methods; change of support; multivariate approaches; and conditional simulations. The Second Edition highlights the growing number of applications of geostatistical methods and discusses three key areas of growth in the field: New results and methods, including kriging very large datasets; kriging with outliers; nonseparable space-time

covariances; multipoint simulations; pluri-gaussian simulations; gradual deformation; and extreme value geostatistics Newly formed connections between geostatistics and other approaches such as radial basis functions, Gaussian Markov random fields, and data assimilation New perspectives on topics such as collocated cokriging, kriging with an external drift, discrete Gaussian change-of-support models, and simulation algorithms Geostatistics, Second Edition is an excellent book for courses on the topic at the graduate level. It also serves as an invaluable reference for earth scientists, mining and petroleum engineers, geophysicists, and environmental statisticians who collect and analyze data in their everyday work. This unique book presents a learn-by-doing introduction to geostatistics. Geostatistics provides the essential numerical tools for addressing research problems that are encountered in fields of study such as geology, engineering, and the earth sciences. Illustrating key methods through both theoretical and practical exercises, Solved Problems in Geostatistics is a valuable and well-organized collection of worked-out problems that allow the reader to master the statistical techniques for modeling data in the geological sciences. The book's scope of coverage begins with the elements from statistics and probability that form the foundation of most geostatistical methodologies, such as declustering, debiasing methods, and Monte Carlo simulation. Next, the authors delve into three fundamental areas in conventional geostatistics: covariance and variogram functions; kriging; and Gaussian simulation. Finally, special topics are introduced through problems involving utility theory, loss functions, and multiple-point geostatistics. Each topic is treated in the same clearly organized format. First, an objective presents the main concepts that will be established in the section. Next, the background and assumptions are outlined, supplying the comprehensive foundation that is necessary to begin work on the problem. A solution plan demonstrates the steps and considerations that have to be taken when working with the exercise, and the solution allows the reader to check their work. Finally, a remarks section highlights the overarching principles and noteworthy aspects of the

problem. Additional exercises are available via a related Web site, which also includes data related to the book problems and software programs that facilitate their resolution. Enforcing a truly hands-on approach to the topic, Solved Problems in Geostatistics is an indispensable supplement for courses on geostatistics and spatial statistics at the upper-undergraduate and graduate levels. It also serves as an applied reference for practicing professionals in the geosciences. To honour the remarkable contribution of Michel David in the inception, establishment and development of Geostatistics, and to promote the essence of his work, an international Forum entitled Geostatistics for the Next Century was convened in Montreal in June 1993. In order to enhance communication and stimulate geostatistical innovation, research and development, the Forum brought together world leading researchers and practitioners from five continents, who discussed-debated current problems, new technologies and futuristic ideas. This volume contains selected peer-reviewed papers from the Forum, together with comments by participants and replies by authors. Although difficult to capture the spontaneity and range of a debate, comments and replies should further assist in the promotion of ideas, dialogue and criticism, and are consistent with the spirit of the Forum. The contents of this volume are organized following the Forum's thematic sessions. The role of theme sessions was not only to stress important topics of today but in addition, to emphasize common ground held among diverse areas of geostatistical work and the need to strengthen communication between these areas. For this reason, any given section of this book may include papers from theory to applications, in mining, petroleum, environment, geohydrology, image processing. This text fulfills a need for an advanced-level work covering both the theory and application of geostatistics. It covers the most important areas of geostatistical methodology, introducing tools for description, quantitative modeling of spatial continuity, spatial prediction, and assessment of local uncertainty and stochastic simulation. It also details the theoretical background underlying most GSLIB programs. The tools are applied to an environmental data set, but the book includes

a general presentation of algorithms intended for students and practitioners in such diverse fields as soil science, mining, petroleum, remote sensing, hydrogeology, and the environmental sciences. Geostatistical Functional Data Analysis Explore the intersection between geostatistics and functional data analysis with this insightful new reference Geostatistical Functional Data Analysis presents a unified approach to modelling functional data when spatial and spatio-temporal correlations are present. The Editors link together the wide research areas of geostatistics and functional data analysis to provide the reader with a new area called geostatistical functional data analysis that will bring new insights and new open questions to researchers coming from both scientific fields. This book provides a complete and up-to-date account to deal with functional data that is spatially correlated, but also includes the most innovative developments in different open avenues in this field. Containing contributions from leading experts in the field, this practical guide provides readers with the necessary tools to employ and adapt classic statistical techniques to handle spatial regression. The book also includes: A thorough introduction to the spatial kriging methodology when working with functions A detailed exposition of more classical statistical techniques adapted to the functional case and extended to handle spatial correlations Practical discussions of ANOVA, regression, and clustering methods to explore spatial correlation in a collection of curves sampled in a region In-depth explorations of the similarities and differences between spatio-temporal data analysis and functional data analysis Aimed at mathematicians, statisticians, postgraduate students, and researchers involved in the analysis of functional and spatial data, Geostatistical Functional Data Analysis will also prove to be a powerful addition to the libraries of geoscientists, environmental scientists, and economists seeking insightful new knowledge and questions at the interface of geostatistics and functional data analysis. Univariate description. Bivariate description. Spatial description. Data sets. Estimation. Random function models. Global estimation. Point estimation. Ordinary kriging. Block kriging. Search strategy. Cross validation. Cokriging.

Estimating a distribution. Change of support. Assessing uncertainty. Final thoughts. "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 practice" - 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. This volume is the first book-length treatment of model-based geostatistics. The text is expository, emphasizing statistical methods and applications rather than the underlying mathematical theory. Analyses of datasets from a range of scientific contexts feature prominently, and simulations are used to illustrate theoretical results. Readers can reproduce most of the computational results in the book by using the authors' software package, geoR, whose usage is illustrated in a computation section at the end of each chapter. The book assumes a working knowledge of classical and Bayesian methods of inference, linear models, and generalized linear models. First published in 1978, this complete reference work on mining geostatistics attempts to synthesize the practical experience gained by researchers from the Centre de Morphologie Mathématique in France and by mining engineers and geologists all over the world who contributed their ideas. (Technology & Industrial)

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