Fuzzy Data Analysis

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evaluation of functional relationship e g in order to specify diagnostic or control systems the modelling presented uses ideas from fuzzy set theory and the suggested methods solve problems usually tackled by data analysis if the data are real numbers fuzzy data analysis is self contained and is addressed to mathematicians oriented towards applications and to practitioners in any field of application who have some background in mathematics and statistics

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statistical data are not always precise numbers or vectors or categories real data are frequently what is called fuzzy examples where this fuzziness is obvious are quality of life data environmental biological medical sociological and economics data also the results of measurements can be best described by using fuzzy numbers and fuzzy vectors respectively statistical analysis methods have to be adapted for the analysis of fuzzy data in this book the foundations of the description of fuzzy data are explained including methods on how to obtain the characterizing function of fuzzy measurement results furthermore statistical methods are then generalized to the analysis of fuzzy data and fuzzy a priori information key features provides basic methods for the mathematical description of fuzzy data as well as statistical methods that can be used to analyze fuzzy data describes methods of increasing importance with applications in areas such as environmental statistics and social science complements the theory with exercises and solutions and is illustrated throughout with diagrams and examples explores areas such quantitative description of data uncertainty and mathematical description of fuzzy data this work is aimed at statisticians working with fuzzy logic engineering statisticians finance researchers and environmental statisticians it is written for readers who are familiar with elementary stochastic models and basic statistical methods

this book presents basic aspects for a theory of statistics with fuzzy data together with a set of practical applications theories of fuzzy logic and of random closed sets are used as basic ingredients in building statistical concepts and procedures in the context of imprecise data including coarse data analysis the book aims at motivating

statisticians to examine fuzzy statistics to enlarge the domain of applicability of statistics in general

this book gathers contributions presented at the 7th international conference on soft methods in probability and statistics smps 2014 held in warsaw poland on september 22 24 2014 its aim is to present recent results illustrating new trends in intelligent data analysis it gives a comprehensive overview of current research into the fusion of soft computing methods with probability and statistics synergies of both fields might improve intelligent data analysis methods in terms of robustness to noise and applicability to larger datasets while being able to efficiently obtain understandable solutions of real world problems

in recent years there has been a growing interest to extend classical methods for data analysis the aim is to allow a more flexible modeling of phenomena such as uncertainty imprecision or ignorance such extensions of classical probability theory and statistics are useful in many real life situations since uncertainties in data are not only present in the form of randomness various types of incomplete or subjective information have to be handled about twelve years ago the idea of strengthening the dialogue between the various research communities in the field of data analysis was born and resulted in the international conference series on soft methods in probability and statistics smps this book gathers contributions presented at the smps 2012 held in konstanz germany its aim is to present recent results illustrating new trends in intelligent data analysis it gives a comprehensive overview of current research into the fusion of soft computing methods with probability and statistics synergies of both fields might improve intelligent data analysis methods in terms of robustness to noise and applicability to larger datasets while being able to efficiently obtain understandable solutions of real world problems

complex systems and their phenomena are ubiquitous as they can be found in biology finance the humanities management sciences medicine physics and similar fields for many problems in these fields there are no conventional ways to mathematically or analytically solve them completely at low cost on the other hand nature already solved many optimization problems efficiently computational intelligence attempts to mimic nature inspired problem solving strategies and methods these strategies can be used to study model and analyze complex systems such that it becomes feasible to handle them key areas of computational intelligence are artificial neural networks evolutionary computation and fuzzy systems as only a few researchers in that field rudolf kruse has contributed in many important ways to the understanding modeling and application of computational intelligence methods on occasion of his 60th birthday a collection of original papers of leading researchers in the field of computational intelligence has been collected in this volume

soft computing as an engineering science and statistics as a classical branch of mathematics emphasize different aspects of data analysis soft computing focuses on obtaining working solutions quickly accepting approximations and unconventional approaches its strength lies in its flexibility to create models that suit the needs arising in applications in addition it emphasizes the need for intuitive and interpretable models which are tolerant to imprecision and uncertainty statistics is more rigorous and focuses on establishing objective conclusions based on experimental data by analyzing the possible situations and their relative likelihood it emphasizes the need for mathematical methods and tools to assess solutions and guarantee performance combining the two fields enhances the robustness and generalizability of data analysis methods while preserving the flexibility to solve real world problems efficiently and intuitively

fuzzy sets in decision analysis operations research and statistics includes chapters on fuzzy preference modeling multiple criteria analysis ranking and sorting methods group decision making and fuzzy game theory it also presents optimization techniques such as fuzzy linear and non linear programming applications to graph problems and fuzzy combinatorial methods such as fuzzy dynamic programming in addition the book also accounts for advances in fuzzy data analysis fuzzy statistics and applications to reliability analysis these topics are covered within four parts decision making mathematical programming statistics and data analysis and reliability maintenance and replacement the scope and content of the book has resulted from multiple interactions between the editor of the volume the series editors the series advisory board and experts in each chapter area each chapter was written by a well known researcher on the topic and reviewed by other experts in the area these expert reviewers sometimes became co authors because of the extent of their contribution to the chapter as a result twenty five authors from twelve countries and four continents were involved in the creation of the 13 chapters which enhances the international character of the project and gives an idea of how carefully the handbook has been developed

data warehousing and mining dwm is the science of managing and analyzing large datasets and discovering novel patterns and in recent years has emerged as a particularly exciting and industrially relevant area of research prodigious amounts of data are now being generated in domains as diverse as market research functional genomics and pharmaceuticals intelligently analyzing these data with the aim of answering crucial questions and helping make informed decisions is the challenge that lies ahead the encyclopedia of data warehousing and mining provides a comprehensive critical and descriptive examination of concepts issues trends and challenges in this rapidly expanding field of data warehousing and mining dwm this

encyclopedia consists of more than 350 contributors from 32 countries 1 800 terms and definitions and more than 4 400 references this authoritative publication offers in depth coverage of evolutions theories methodologies functionalities and applications of dwm in such interdisciplinary industries as healthcare informatics artificial intelligence financial modeling and applied statistics making it a single source of knowledge and latest discoveries in the field of dwm

computational intelligence is a component of encyclopedia of technology information and systems management resources in the global encyclopedia of life support systems eolss which is an integrated compendium of twenty one encyclopedias computational intelligence is a rapidly growing research field including a wide variety of problem solving techniques inspired by nature traditionally computational intelligence consists of three major research areas neural networks fuzzy systems and evolutionary computation neural networks are mathematical models inspired by brains neural networks have massively parallel network structures with many neurons and weighted connections whereas each neuron has a simple input output relation a neural network with many neurons can realize a highly non linear complicated mapping connection weights between neurons can be adjusted in an automated manner by a learning algorithm to realize a non linear mapping required in a particular application task fuzzy systems are mathematical models proposed to handle inherent fuzziness in natural language for example it is very difficult to mathematically define the meaning of cold in everyday conversations such as it is cold today and can i have cold water the meaning of cold may be different in a different situation even in the same situation a different person may have a different meaning fuzzy systems offer a mathematical mechanism to handle inherent fuzziness in natural language as a result fuzzy systems have been successfully applied to real world problems by extracting linguistic knowledge from human experts in the form of fuzzy if then rules evolutionary computation includes various population based search algorithms inspired by evolution in nature those algorithms usually have the following three mechanisms fitness evaluation to measure the quality of each solution selection to choose good solutions from the current population and variation operators to generate offspring from parents evolutionary computation has high applicability to a wide range of optimization problems with different characteristics since it does not need any explicit mathematical formulations of objective functions for example simulation based fitness evaluation is often used in evolutionary design subjective fitness evaluation by a human user is also often used in evolutionary art and music these volumes are aimed at the following five major target audiences university and college students educators professional practitioners research personnel and policy analysts managers and decision makers

this book analyzes techniques that use the direct and inverse fuzzy transform for image processing and data analysis the book is divided into two parts the first of which describes methods and techniques that use the bi dimensional fuzzy transform method in image analysis in turn the second describes approaches that use the multidimensional fuzzy transform method in data analysis an f transform in one variable is defined as an operator which transforms a continuous function f on the real interval a b in an n dimensional vector by using n assigned fuzzy sets a1 an which constitute a fuzzy partition of a b then an inverse f transform is defined in order to convert the n dimensional vector output in a continuous function that equals f up to an arbitrary quantity ε we may limit this concept to the finite case by defining the discrete f transform of a function f in one variable even if it is not known a priori a simple extension of this concept to functions in two variables allows it to be used for the coding decoding and processing of images moreover an extended version with multidimensional functions can be used to address a host of topics in data analysis including the analysis of large and very large datasets over the past decade many researchers have proposed applications of fuzzy transform techniques for various image processing topics such as image coding decoding image reduction image segmentation image watermarking and image fusion and for such data analysis problems as regression analysis classification association rule extraction time series analysis forecasting and spatial data analysis the robustness ease of use and low computational complexity of fuzzy transforms make them a powerful fuzzy approximation tool suitable for many computer science applications this book presents methods and techniques based on the use of fuzzy transforms in various applications of image processing and data analysis including image segmentation image tamper detection forecasting and classification highlighting the benefits they offer compared with traditional methods emphasis is placed on applications of fuzzy transforms to innovative problems such as massive data mining and image and video security in social networks based on the application of advanced fragile watermarking systems this book is aimed at researchers students computer scientists and it developers to acquire the knowledge and skills necessary to apply and implement fuzzy transforms based techniques in image and data analysis applications

provides a timely and important introduction to fuzzy cluster analysis its methods and areas of application systematically describing different fuzzy clustering techniques so the user may choose methods appropriate for his problem it provides a very thorough overview of the subject and covers classification image recognition data analysis and rule generation the application examples are highly relevant and illustrative and the use of the techniques are justified and well thought out features include sections on inducing fuzzy if then rules by fuzzy clustering and non alternating optimization fuzzy clustering algorithms discussion of solid fuzzy clustering

techniques like the fuzzy c means the gustafson kessel and the gath and geva algorithm for classification problems focus on linear and shell clustering techniques used for detecting contours in image analysis accompanying software and data sets pertaining to the examples presented enabling the reader to learn through experimentation examination of the difficulties involved in evaluating the results of fuzzy cluster analysis and of determining the number of clusters with analysis of global and local validity measures this is one of the most comprehensive books on fuzzy clustering and will be welcomed by computer scientists engineers and mathematicians in industry and research who are concerned with different methods data analysis pattern recognition or image processing it will also give graduate students in computer science mathematics or statistics a valuable overview

statistical modeling analysis and management of fuzzy data or smfd for short is an important contribution to a better understanding of a basic issue an issue which has been controversial and still is though to a lesser degree in substance the issue is are fuzziness and randomness distinct or coextensive facets of uncertainty are the theories of fuzziness and random ness competitive or complementary in smfd these and related issues are addressed with rigor authority and insight by prominent contributors drawn in the main from probability theory fuzzy set theory and data analysis com munities first a historical perspective the almost simultaneous births close to half a century ago of statistically based information theory and cybernetics were two major events which marked the beginning of the steep ascent of probability theory and statistics in visibility influence and importance i was a student when information theory and cybernetics were born and what is etched in my memory are the fascinating lectures by shannon and wiener in which they sketched their visions of the coming era of machine intelligence and automation of reasoning and decision processes what i heard in those lectures inspired one of my first papers 1950 an extension of wiener s theory of prediction and led to my life long interest in probability theory and its applications to information processing decision analysis and control

this book includes the proceedings of the intelligent and fuzzy techniques infus 2019 conference held in istanbul turkey on july 23 25 2019 big data analytics refers to the strategy of analyzing large volumes of data or big data gathered from a wide variety of sources including social networks videos digital images sensors and sales transaction records big data analytics allows data scientists and various other users to evaluate large volumes of transaction data and other data sources that traditional business systems would be unable to tackle data driven and knowledge driven approaches and techniques have been widely used in intelligent decision making and they are increasingly attracting attention due to their importance and effectiveness in

addressing uncertainty and incompleteness infus 2019 focused on intelligent and fuzzy systems with applications in big data analytics and decision making providing an international forum that brought together those actively involved in areas of interest to data science and knowledge engineering these proceeding feature about 150 peer reviewed papers from countries such as china iran turkey malaysia india usa spain france poland mexico bulgaria algeria pakistan australia lebanon and czech republic

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