

Fuzzy Database Modeling Of Imprecise And Uncertain Engineering Information Studies In Fuzziness And Soft Computing

[Fuzzy Database Modeling of Imprecise and Uncertain Engineering Information](#) [Fuzzy Database Modeling of Imprecise and Uncertain Engineering Information Dependability Modelling under Uncertainty](#) [The Combination of Paradoxical, Uncertain and Imprecise Sources of Information based on DSmT and Neutro-Fuzzy Inference](#) [Flexible Databases Supporting Imprecision and Uncertainty](#) [Soft Methods for Integrated Uncertainty Modelling](#) [Uncertainty Management in Information Systems](#) [The Geometry of Uncertainty](#) [Foundations of Reasoning under Uncertainty](#) [Aggregation and Fusion of Imperfect Information](#) [Uncertainty Modelling in Data Science](#) [Uncertainty and Imprecision in Decision Making and Decision Support: New Challenges, Solutions and Perspectives](#) [Query Processing over Uncertain Databases](#) [Uncertainty Approaches for Spatial Data Modeling and Processing](#) [Fuzzy Preference Ordering of Interval Numbers in Decision Problems](#) [Advances in Probabilistic Databases for Uncertain Information Management Interval / Probabilistic Uncertainty and Non-classical Logics](#) [Methods of Probability and Imprecise Probability for Uncertainty Quantification in Applied Problems](#) [Uncertainty in Engineering](#) [Principles of Imprecise-Information Processing](#) [Soft Methods for Handling Variability and Imprecision](#) [Quantified Representation of Uncertainty and Imprecision](#) [Modeling and Management of Fuzzy Semantic RDF Data](#) [Data Uncertainty and Important Measures](#) [Rough Sets and Data Mining](#) [Introduction to Imprecise Probabilities](#) [Modeling Uncertainty with Fuzzy Logic](#) [Combining Fuzzy Imprecision with Probabilistic Uncertainty in Decision Making](#) [Uncertainty and Imprecision in Decision Making and Decision Support](#) [Uncertainty and Intelligent Information Systems](#) [Imprecision and Uncertainty in Information Representation and Processing](#) [Quantified Representation of Uncertainty and Imprecision](#) [Combining Fuzzy Imprecision with Probabilistic Uncertainty in Decision Making](#) [Understanding and Using Rough Set Based Feature Selection: Concepts, Techniques and Applications](#) [Uncertain Judgements](#) [Software Engineering with Computational Intelligence](#) [Imprecision and Uncertainty in Information Representation and Processing](#) [Conference on Artificial Intelligence Applications](#) [Information Processing and Management of Uncertainty in Knowledge-Based Systems. Theory and Foundations](#) [Probabilistic Ranking Techniques in Relational Databases](#)

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Imprecision and Uncertainty in Information Representation and Processing Apr 05 2020 The book offers a comprehensive and timely overview of advanced mathematical tools for both uncertainty analysis and modeling of parallel processes, with a special emphasis on intuitionistic fuzzy sets and generalized nets. The different chapters, written by active researchers in their respective areas, are structured to provide a coherent picture of this interdisciplinary yet still evolving field of science. They describe key tools and give practical insights into and research perspectives on the use of Atanassov's intuitionistic fuzzy sets and logic, and generalized nets for describing and dealing with uncertainty in different areas of science, technology and business, in a single, to date unique book. Here, readers find theoretical chapters, dealing with intuitionistic fuzzy operators, membership functions and

algorithms, among other topics, as well as application-oriented chapters, reporting on the implementation of methods and relevant case studies in management science, the IT industry, medicine and/or education. With this book, the editors wish to pay homage to Professor Krassimir Todorov Atanassov for his pioneering work on both generalized nets and intuitionistic fuzzy set.

Quantified Representation of Uncertainty and Imprecision Mar 05 2020 We are happy to present the first volume of the Handbook of Defeasible Reasoning and Uncertainty Management Systems. Uncertainty pervades the real world and must therefore be addressed by every system that attempts to represent reality. The representation of uncertainty is a major concern of philosophers, logicians, artificial intelligence researchers and computer scientists, psychologists, statisticians, economists and engineers. The present Handbook volumes provide frontline coverage of this area. This Handbook was produced in the style of previous handbook series like the Handbook of Philosophical Logic, the Handbook of Logic in Computer Science, the Handbook of Logic in Artificial Intelligence and Logic Programming, and can be seen as a companion to them in covering the wide applications of logic and reasoning. We hope it will answer the needs for adequate representations of uncertainty. This Handbook series grew out of the ESPRIT Basic Research Project DRUMS II, where the acronym is made out of the Handbook series title. This project was financially supported by the European Union and regroups 20 major European research teams working in the general domain of uncertainty. As a fringe benefit of the DRUMS project, the research community was able to create this Handbook series, relying on the DRUMS participants as the core of the authors for the Handbook together with external international experts.

Introduction to Imprecise Probabilities Sep 10 2020 In recent years, the theory has become widely accepted and has been further developed, but a detailed introduction is needed in order to make the material available and accessible to a wide audience. This will be the first book providing such an introduction, covering core theory and recent developments which can be applied to many application areas. All authors of individual chapters are leading researchers on the specific topics, assuring high quality and up-to-date contents. An Introduction to Imprecise Probabilities provides a comprehensive introduction to imprecise probabilities, including theory and applications reflecting the current state of the art. Each chapter is written by experts on the respective topics, including: Sets of desirable gambles; Coherent lower (conditional) previsions; Special cases and links to literature; Decision making; Graphical models; Classification; Reliability and risk assessment; Statistical inference; Structural judgments; Aspects of implementation (including elicitation and computation); Models of inference; Game-theoretic probability; Stochastic processes (including Markov chains); Engineering applications. Essential reading for researchers in academia, research institutes and other organizations, as well as practitioners engaged in areas such as risk analysis and engineering.

Rough Sets and Data Mining Oct 12 2020 *Rough Sets and Data Mining: Analysis of Imprecise Data* is an edited collection of research chapters on the most recent developments in rough set theory and data mining. The chapters in this work cover a range of topics that focus on discovering dependencies among data, and reasoning about vague, uncertain and imprecise information. The authors of these chapters have been careful to include fundamental research with explanations as well as coverage of rough set tools that can be used for mining data bases. The contributing authors consist of some of the leading scholars in the fields of rough sets, data mining, machine learning and other areas of artificial intelligence. Among the list of contributors are Z. Pawlak, J. Grzymala-Busse, K. Slowinski, and others. *Rough Sets and Data Mining: Analysis of Imprecise Data* will be a useful reference work for rough set researchers, data base designers and developers, and for researchers new to the areas of data mining and rough sets.

Imprecision and Uncertainty in Information Representation and Processing Sep 30 2019 The book offers a comprehensive and timely overview of advanced mathematical tools for both uncertainty analysis and modeling of parallel processes, with a special emphasis on intuitionistic fuzzy sets and generalized nets. The different chapters, written by active researchers in their respective areas, are structured to provide a coherent picture of this interdisciplinary yet still evolving field of science. They describe key tools and give practical insights into and research perspectives on the use of Atanassov's intuitionistic fuzzy sets and logic, and generalized nets for describing and dealing with uncertainty in different areas of science, technology and business, in a single, to date unique book. Here, readers find theoretical chapters, dealing with intuitionistic fuzzy operators, membership functions and algorithms, among other topics, as well as application-oriented chapters, reporting on the implementation of methods and relevant case studies in management science, the IT industry, medicine and/or education. With this book, the editors wish to pay homage to Professor Krassimir Todorov Atanassov for his pioneering work on both generalized nets and intuitionistic fuzzy set.

Probabilistic Ranking Techniques in Relational Databases Jun 27 2019 Ranking queries are widely used in data exploration, data analysis and decision making scenarios. While most of the currently proposed ranking techniques focus on deterministic data, several emerging applications involve data that are imprecise or uncertain. Ranking uncertain data raises new challenges in query semantics and processing, making conventional methods inapplicable. Furthermore, the interplay between ranking and uncertainty models introduces new dimensions for ordering query

results that do not exist in the traditional settings. This lecture describes new formulations and processing techniques for ranking queries on uncertain data. The formulations are based on marriage of traditional ranking semantics with possible worlds semantics under widely-adopted uncertainty models. In particular, we focus on discussing the impact of tuple-level and attribute-level uncertainty on the semantics and processing techniques of ranking queries. Under the tuple-level uncertainty model, we describe new processing techniques leveraging the capabilities of relational database systems to recognize and handle data uncertainty in score-based ranking. Under the attribute-level uncertainty model, we describe new probabilistic ranking models and a set of query evaluation algorithms, including sampling-based techniques. We also discuss supporting rank join queries on uncertain data, and we show how to extend current rank join methods to handle uncertainty in scoring attributes. Table of Contents: Introduction / Uncertainty Models / Query Semantics / Methodologies / Uncertain Rank Join / Conclusion

Aggregation and Fusion of Imperfect Information Jan 27 2022 This book presents the main tools for aggregation of information given by several members of a group or expressed in multiple criteria, and for fusion of data provided by several sources. It focuses on the case where the availability knowledge is imperfect, which means that uncertainty and/or imprecision must be taken into account. The book contains both theoretical and applied studies of aggregation and fusion methods in the main frameworks: probability theory, evidence theory, fuzzy set and possibility theory. The latter is more developed because it allows to manage both imprecise and uncertain knowledge. Applications to decision-making, image processing, control and classification are described.

Flexible Databases Supporting Imprecision and Uncertainty Jul 01 2022 This volume offers the advice of selected expert contributors on the application of heterogeneous methods for managing uncertainty and imprecision in databases. It contains both survey chapters on classic topics such as "flexible querying in databases", and up to date information on "database models to represent imperfect data". Further, it includes specific contributions on uncertainty management in database integration, and in representing and querying semistructured and spatial data.

Dependability Modelling under Uncertainty Sep 03 2022 Mechatronic design processes have become shorter and more parallelized, induced by growing time-to-market pressure. Methods that enable quantitative analysis in early design stages are required, should dependability analyses aim to influence the design. Due to the limited amount of data in this phase, the level of uncertainty is high and explicit modeling of these uncertainties becomes necessary. This work introduces new uncertainty-preserving dependability methods for early design stages. These include the propagation of uncertainty through dependability models, the activation of data from similar components for analyses and the integration of uncertain dependability predictions into an optimization framework. It is shown that Dempster-Shafer theory can be an alternative to probability theory in early design stage dependability predictions. Expert estimates can be represented, input uncertainty is propagated through the system and prediction uncertainty can be measured and interpreted. The resulting coherent methodology can be applied to represent the uncertainty in dependability models.

Fuzzy Preference Ordering of Interval Numbers in Decision Problems Aug 22 2021 In conventional mathematical programming, coefficients of problems are usually determined by the experts as crisp values in terms of classical mathematical reasoning. But in reality, in an imprecise and uncertain environment, it will be utmost unrealistic to assume that the knowledge and representation of an expert can come in a precise way. The wider objective of the book is to study different real decision situations where problems are defined in inexact environment. Inexactness are mainly generated in two ways – (1) due to imprecise perception and knowledge of the human expert followed by vague representation of knowledge as a DM; (2) due to huge-ness and complexity of relations and data structure in the definition of the problem situation. We use interval numbers to specify inexact or imprecise or uncertain data. Consequently, the study of a decision problem requires answering the following initial questions: How should we compare and define preference ordering between two intervals?, interpret and deal inequality relations involving interval coefficients?, interpret and make way towards the goal of the decision problem? The present research work consists of two closely related fields: approaches towards defining a generalized preference ordering scheme for interval attributes and approaches to deal with some issues having application potential in many areas of decision making.

Quantified Representation of Uncertainty and Imprecision Jan 15 2021 We are happy to present the first volume of the Handbook of Defeasible Reasoning and Uncertainty Management Systems. Uncertainty pervades the real world and must therefore be addressed by every system that attempts to represent reality. The representation of uncertainty is a major concern of philosophers, logicians, artificial intelligence researchers and computer scientists, psychologists, statisticians, economists and engineers. The present Handbook volumes provide frontline coverage of this area. This Handbook was produced in the style of previous handbook series like the Handbook of Philosophical Logic, the Handbook of Logic in Computer Science, the Handbook of Logic in Artificial Intelligence and Logic Programming, and can be seen as a companion to them in covering the wide applications of logic and reasoning. We hope it will answer the needs for adequate representations of uncertainty. This Handbook series grew out of the ESPRIT Basic Research Project DRUMS II, where the acronym is made out of the Handbook series title. This project was financially supported by the European Union and regroups 20 major European research teams working

in the general domain of uncertainty. As a fringe benefit of the DRUMS project, the research community was able to create this Hand book series, relying on the DRUMS participants as the core of the authors for the Handbook together with external international experts.

Methods of Probability and Imprecise Probability for Uncertainty Quantification in Applied Problems May 19 2021

Principles of Imprecise-Information Processing Mar 17 2021 The book showcases cutting-edge concepts and methods, and presents the principle of imprecise-information processing. It also proposes a new theory and technology for imprecise-information processing that differs from fuzzy technology, thus providing a platform for related applications and laying the theoretical basis for further research. Imprecise-information processing – a type of processing based on flexible linguistic values and quantifiable rigid linguistic values – is an important component of intelligence science and technology. This book offers an easy-to-understand overview of the basic principles and methods of imprecise-information processing, allowing readers to develop related applications or pursue further research.

Uncertainty and Imprecision in Decision Making and Decision Support Jun 07 2020 This book is composed of selected papers from the Sixteenth National Conference on Operational and Systems Research, BOS-2020, held on December 14-15, 2020, one of premiere conferences in the field of operational and systems research. The second is the Nineteenth International Workshop on Intuitionistic Fuzzy Sets and Generalized Nets, IWIFSGN 2020, held on December 10-11, 2020, in Warsaw, Poland, in turn--one of premiere conferences on fuzzy logic, notably on extensions of the traditional fuzzy sets, also comprising a considerable part on the generalized nets (GNs), an important extension of the traditional Petri nets. A joint publication of selected papers from the two conferences follows a long tradition of such a joint organization and--from a substantial point of view--combines systems modeling, systems analysis, broadly perceived operational research, notably optimization, decision making, and decision support, with various aspects of uncertain and imprecise information and their related tools and techniques.

Information Processing and Management of Uncertainty in Knowledge-Based Systems. Theory and Foundations Jul 29 2019 This three volume set (CCIS 853-855) constitutes the proceedings of the 17th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2017, held in Cádiz, Spain, in June 2018. The 193 revised full papers were carefully reviewed and selected from 383 submissions. The papers are organized in topical sections on advances on explainable artificial intelligence; aggregation operators, fuzzy metrics and applications; belief function theory and its applications; current techniques to model, process and describe time series; discrete models and computational intelligence; formal concept analysis and uncertainty; fuzzy implication functions; fuzzy logic and artificial intelligence problems; fuzzy mathematical analysis and applications; fuzzy methods in data mining and knowledge discovery; fuzzy transforms: theory and applications to data analysis and image processing; imprecise probabilities: foundations and applications; mathematical fuzzy logic, mathematical morphology; measures of comparison and entropies for fuzzy sets and their extensions; new trends in data aggregation; pre-aggregation functions and generalized forms of monotonicity; rough and fuzzy similarity modelling tools; soft computing for decision making in uncertainty; soft computing in information retrieval and sentiment analysis; tri-partitions and uncertainty; decision making modeling and applications; logical methods in mining knowledge from big data; metaheuristics and machine learning; optimization models for modern analytics; uncertainty in medicine; uncertainty in Video/Image Processing (UVIP).

Software Engineering with Computational Intelligence Oct 31 2019 It is not an exaggeration to view Professor Lee's book, "Software Engineering with Computational Intelligence," or SECI for short, as a pioneering contribution to software engineering. Breaking with the tradition of treating uncertainty, imprecision, fuzziness and vagueness as issues of peripheral importance, SECI moves them much closer to the center of the stage. It is obvious, though still not widely accepted, that this is where these issues should be, since the real world is much too complex and much too ill-defined to lend itself to categorical analysis in the Cartesian spirit. As its title suggests, SECI employs the machineries of computational intelligence (CI) and, more or less equivalently, soft computing (SC), to deal with the foundations and principal issues in software engineering. Basically, CI and SC are consortia of methodologies which collectively provide a body of concepts and techniques for conception, design, construction and utilization of intelligent systems. The principal constituents of CI and SC are fuzzy logic, neurocomputing, evolutionary computing, probabilistic computing, chaotic computing and machine learning. The leitmotif of CI and SC is that, in general, better performance can be achieved by employing the constituent methodologies of CI and SC in combination rather than in a stand-alone mode. In what follows, I will take the liberty of focusing my attention on fuzzy logic and fuzzy set theory, and on their roles in software engineering. But first, a couple of points of semantics which are in need of clarification.

Uncertainty in Engineering Apr 17 2021 This open access book provides an introduction to uncertainty quantification in engineering. Starting with preliminaries on Bayesian statistics and Monte Carlo methods, followed by material on imprecise probabilities, it then focuses on reliability theory and simulation methods for complex systems. The final two chapters discuss various aspects of aerospace engineering, considering stochastic model

updating from an imprecise Bayesian perspective, and uncertainty quantification for aerospace flight modelling. Written by experts in the subject, and based on lectures given at the Second Training School of the European Research and Training Network UTOPIAE (Uncertainty Treatment and Optimization in Aerospace Engineering), which took place at Durham University (United Kingdom) from 2 to 6 July 2018, the book offers an essential resource for students as well as scientists and practitioners.

Foundations of Reasoning under Uncertainty Feb 25 2022 Uncertainty exists almost everywhere, except in the most idealized situations; it is not only an inevitable and ubiquitous phenomenon, but also a fundamental scientific principle. Furthermore, uncertainty is an attribute of information and, usually, decision-relevant information is uncertain and/or imprecise, therefore the abilities to handle uncertain information and to reason from incomplete knowledge are crucial features of intelligent behaviour in complex and dynamic environments. By carefully exploiting our tolerance for imprecision and approximation we can often achieve tractability, robustness, and better descriptions of reality than traditional inductive methods would allow us to obtain. In conclusion, as we move further into the age of machine intelligence, the problem of reasoning under uncertainty, in other words, drawing conclusions from partial knowledge, has become a major research theme. Not surprisingly, the rigorous treatment of uncertainty requires sophisticated machinery, and the present volume is conceived as a contribution to a better understanding of the foundations of information processing and decision-making in an environment of uncertainty, imprecision and partiality of truth. This volume draws on papers presented at the 2008 Conference on Information Processing and Management of Uncertainty (IPMU), held in Malaga, Spain, organized by the University of Malaga. The conference brought together some of the world's leading experts in the study of uncertainty.

Conference on Artificial Intelligence Applications Aug 29 2019

Uncertainty Modelling in Data Science Dec 26 2021 This book features 29 peer-reviewed papers presented at the 9th International Conference on Soft Methods in Probability and Statistics (SMPS 2018), which was held in conjunction with the 5th International Conference on Belief Functions (BELIEF 2018) in Compiègne, France on September 17–21, 2018. It includes foundational, methodological and applied contributions on topics as varied as imprecise data handling, linguistic summaries, model coherence, imprecise Markov chains, and robust optimisation. These proceedings were produced using EasyChair. Over recent decades, interest in extensions and alternatives to probability and statistics has increased significantly in diverse areas, including decision-making, data mining and machine learning, and optimisation. This interest stems from the need to enrich existing models, in order to include different facets of uncertainty, like ignorance, vagueness, randomness, conflict or imprecision. Frameworks such as rough sets, fuzzy sets, fuzzy random variables, random sets, belief functions, possibility theory, imprecise probabilities, lower previsions, and desirable gambles all share this goal, but have emerged from different needs. The advances, results and tools presented in this book are important in the ubiquitous and fast-growing fields of data science, machine learning and artificial intelligence. Indeed, an important aspect of some of the learned predictive models is the trust placed in them. Modelling the uncertainty associated with the data and the models carefully and with principled methods is one of the means of increasing this trust, as the model will then be able to distinguish between reliable and less reliable predictions. In addition, extensions such as fuzzy sets can be explicitly designed to provide interpretable predictive models, facilitating user interaction and increasing trust.

Fuzzy Database Modeling of Imprecise and Uncertain Engineering Information Nov 05 2022 This book presents recent advances for imprecise and uncertain engineering information from the point of view of fuzzy database modeling. The topics include fuzzy conceptual data modeling of engineering information, conversion of the fuzzy conceptual models, and database implementation of the fuzzy conceptual data models. Some major data and database models for engineering information modeling are investigated. The main novel aspect of this book is that the book focuses on imprecise and uncertain industrial information modeling viewed from databases and fuzzy database technologies viewed from industrial applications. This may be useful for people involved in theory research, design implementation, and application development of intelligent engineering databases.

Advances in Probabilistic Databases for Uncertain Information Management Jul 21 2021 This book covers a fast-growing topic in great depth and focuses on the technologies and applications of probabilistic data management. It aims to provide a single account of current studies in probabilistic data management. The objective of the book is to provide the state of the art information to researchers, practitioners, and graduate students of information technology of intelligent information processing, and at the same time serving the information technology professional faced with non-traditional applications that make the application of conventional approaches difficult or impossible.

Soft Methods for Integrated Uncertainty Modelling May 31 2022 The idea of soft computing emerged in the early 1990s from the fuzzy systems community, and refers to an understanding that the uncertainty, imprecision and ignorance present in a problem should be explicitly represented and possibly even exploited rather than either eliminated or ignored in computations. For instance, Zadeh defined 'Soft Computing' as follows: Soft computing differs from conventional (hard) computing in that, unlike hard computing, it is tolerant of imprecision, uncertainty and partial truth. In effect, the role model for soft computing is the human mind. Recently soft computing has, to

some extent, become synonymous with a hybrid approach combining AI techniques including fuzzy systems, neural networks, and biologically inspired methods such as genetic algorithms. Here, however, we adopt a more straightforward definition consistent with the original concept. Hence, soft methods are understood as those uncertainty formalisms not part of mainstream statistics and probability theory which have typically been developed within the AI and decision analysis community. These are mathematically sound uncertainty modelling methodologies which are complementary to conventional statistics and probability theory.

Uncertainty and Intelligent Information Systems May 07 2020 Intelligent systems are necessary to handle modern computer-based technologies managing information and knowledge. This book discusses the theories required to help provide solutions to difficult problems in the construction of intelligent systems. Particular attention is paid to situations in which the available information and data may be imprecise, uncertain, incomplete or of a linguistic nature. The main aspects of clustering, classification, summarization, decision making and systems modeling are also addressed. Topics covered in the book include fundamental issues in uncertainty, the rapidly emerging discipline of information aggregation, neural networks, Bayesian networks and other network methods, as well as logic-based systems.

Combining Fuzzy Imprecision with Probabilistic Uncertainty in Decision Making Jul 09 2020 In the literature of decision analysis it is traditional to rely on the tools provided by probability theory to deal with problems in which uncertainty plays a substantive role. In recent years, however, it has become increasingly clear that uncertainty is a multifaceted concept in which some of the important facets do not lend themselves to analysis by probability-based methods. One such facet is that of fuzzy imprecision, which is associated with the use of fuzzy predicates exemplified by small, large, fast, near, likely, etc. To be more specific, consider a proposition such as "It is very unlikely that the price of oil will decline sharply in the near future," in which the italicized words play the role of fuzzy predicates. The question is: How can one express the meaning of this proposition through the use of probability-based methods? If this cannot be done effectively in a probabilistic framework, then how can one employ the information provided by the proposition in question to bear on a decision relating to an investment in a company engaged in exploration and marketing of oil? As another example, consider a collection of rules of the form "If X is A_i then Y is B_j ," $j = 1, \dots, n$, in which X and Y are real-valued variables and A_i and B_j are fuzzy numbers exemplified by small, large, not very small, close to 5, etc.

Modeling Uncertainty with Fuzzy Logic Aug 10 2020 The world we live in is pervaded with uncertainty and imprecision. Is it likely to rain this afternoon? Should I take an umbrella with me? Will I be able to find parking near the campus? Should I go by bus? Such simple questions are a common occurrence in our daily lives. Less simple examples: What is the probability that the price of oil will rise sharply in the near future? Should I buy Chevron stock? What are the chances that a bailout of GM, Ford and Chrysler will not succeed? What will be the consequences? Note that the examples in question involve both uncertainty and imprecision. In the real world, this is the norm rather than the exception. There is a deep-seated tradition in science of employing probability theory, and only probability theory, to deal with uncertainty and imprecision. The monopoly of probability theory came to an end when fuzzy logic made its debut. However, this is by no means a widely accepted view. The belief persists, especially within the probability community, that probability theory is all that is needed to deal with uncertainty. To quote a prominent Bayesian, Professor Dennis Lindley, "The only satisfactory description of uncertainty is probability."

Uncertainty Approaches for Spatial Data Modeling and Processing Sep 22 2021 This volume is dedicated to the memory of Professor Ashley Morris who passed away some two years ago. Ashley was a close friend of all of us, the editors of this volume, and was also a Ph.D. student of one of us. We all had a chance to not only fully appreciate, and be inspired by his contributions, which have had a considerable impact on the entire research community. Due to our personal relations with Ashley, we also had an opportunity to get familiar with his deep thinking about the areas of his expertise and interests. Ashley has been involved since the very beginning of his professional career in database research and practice. Notably, he introduced first some novel solution in database management systems that could handle imprecise and uncertain data, and flexible queries based on imprecisely specified user interests. He proposed to use for that purpose fuzzy logic as an effective and efficient tool. Later the interests of Ashley moved to ways of how to represent and manipulate more complicated databases involving spatial or temporal objects. In this research he discovered and pursued the power of Geographic Information Systems (GISs). These two main lines of Ashley's research interests and contributions are reflected in the composition of this volume. Basically, we collected some significant papers by well known researchers and scholars on the above mentioned topics. The particular contributions will now be briefly summarized to help the reader get a view of the topics covered and the contents of the particular contributions.

Uncertain Judgements Dec 02 2019 Elicitation is the process of extracting expert knowledge about some unknown quantity or quantities, and formulating that information as a probability distribution. Elicitation is important in situations, such as modelling the safety of nuclear installations or assessing the risk of terrorist attacks, where expert knowledge is essentially the only source of good information. It also plays a major role in other contexts by augmenting scarce observational data, through the use of Bayesian statistical methods. However, elicitation is not a

simple task, and practitioners need to be aware of a wide range of research findings in order to elicit expert judgements accurately and reliably. *Uncertain Judgements* introduces the area, before guiding the reader through the study of appropriate elicitation methods, illustrated by a variety of multi-disciplinary examples. This is achieved by: Presenting a methodological framework for the elicitation of expert knowledge incorporating findings from both statistical and psychological research. Detailing techniques for the elicitation of a wide range of standard distributions, appropriate to the most common types of quantities. Providing a comprehensive review of the available literature and pointing to the best practice methods and future research needs. Using examples from many disciplines, including statistics, psychology, engineering and health sciences. Including an extensive glossary of statistical and psychological terms. An ideal source and guide for statisticians and psychologists with interests in expert judgement or practical applications of Bayesian analysis, *Uncertain Judgements* will also benefit decision-makers, risk analysts, engineers and researchers in the medical and social sciences.

The Combination of Paradoxical, Uncertain and Imprecise Sources of Information based on DS_mT and Neuro-Fuzzy Inference Aug 02 2022 The management and combination of uncertain, imprecise, fuzzy and even paradoxical or high conflicting sources of information has always been, and still remains today, of primal importance for the development of reliable modern information systems involving artificial reasoning.

Interval / Probabilistic Uncertainty and Non-classical Logics Jun 19 2021 This book contains the proceedings of the first International Workshop on Interval/Probabilistic Uncertainty and Non Classical Logics, Ishikawa, Japan, March 25-28, 2008. The workshop brought together researchers working on interval and probabilistic uncertainty and on non-classical logics. It is hoped this workshop will lead to a boost in the much-needed collaboration between the uncertainty analysis and non-classical logic communities, and thus, to better processing of uncertainty.

Fuzzy Database Modeling of Imprecise and Uncertain Engineering Information Oct 04 2022 Computer-based information technologies have been extensively used to help industries manage their processes and information systems hereby - come their nervous center. More specially, databases are designed to support the data storage, processing, and retrieval activities related to data management in information systems. Database management systems provide efficient task support and database systems are the key to implementing industrial data management. Industrial data management requires database technique support. Industrial applications, however, are typically data and knowledge intensive applications and have some unique characteristics that makes their management difficult. Besides, some new techniques such as Web, artificial intelligence, and etc. have been introduced into industrial applications. These unique characteristics and usage of new technologies have put many potential requirements on industrial data management, which challenge today's database systems and promote their evolvement. Viewed from database technology, information modeling in databases can be identified at two levels: (conceptual) data modeling and (logical) database modeling. This results in conceptual (semantic) data model and logical database model. Generally a conceptual data model is designed and then the designed conceptual data model will be transformed into a chosen logical database schema. Database systems based on logical database model are used to build information systems for data management. Much attention has been directed at conceptual data modeling of industrial information systems. Product data models, for example, can be viewed as a class of semantic data models (i. e.

The Geometry of Uncertainty Mar 29 2022 The principal aim of this book is to introduce to the widest possible audience an original view of belief calculus and uncertainty theory. In this geometric approach to uncertainty, uncertainty measures can be seen as points of a suitably complex geometric space, and manipulated in that space, for example, combined or conditioned. In the chapters in Part I, Theories of Uncertainty, the author offers an extensive recapitulation of the state of the art in the mathematics of uncertainty. This part of the book contains the most comprehensive summary to date of the whole of belief theory, with Chap. 4 outlining for the first time, and in a logical order, all the steps of the reasoning chain associated with modelling uncertainty using belief functions, in an attempt to provide a self-contained manual for the working scientist. In addition, the book proposes in Chap. 5 what is possibly the most detailed compendium available of all theories of uncertainty. Part II, The Geometry of Uncertainty, is the core of this book, as it introduces the author's own geometric approach to uncertainty theory, starting with the geometry of belief functions: Chap. 7 studies the geometry of the space of belief functions, or belief space, both in terms of a simplex and in terms of its recursive bundle structure; Chap. 8 extends the analysis to Dempster's rule of combination, introducing the notion of a conditional subspace and outlining a simple geometric construction for Dempster's sum; Chap. 9 delves into the combinatorial properties of plausibility and commonality functions, as equivalent representations of the evidence carried by a belief function; then Chap. 10 starts extending the applicability of the geometric approach to other uncertainty measures, focusing in particular on possibility measures (consonant belief functions) and the related notion of a consistent belief function. The chapters in Part III, Geometric Interplays, are concerned with the interplay of uncertainty measures of different kinds, and the geometry of their relationship, with a particular focus on the approximation problem. Part IV, Geometric Reasoning, examines the application of the geometric approach to the various elements of the reasoning chain illustrated in Chap. 4, in particular conditioning and decision making. Part V concludes the book by outlining a future, complete statistical theory of random sets, future extensions of the geometric approach, and identifying high-impact applications to

climate change, machine learning and artificial intelligence. The book is suitable for researchers in artificial intelligence, statistics, and applied science engaged with theories of uncertainty. The book is supported with the most comprehensive bibliography on belief and uncertainty theory.

Uncertainty and Imprecision in Decision Making and Decision Support: New Challenges, Solutions and Perspectives Nov 24 2021 This book gathers selected papers from two important conferences held on October 24–28, 2018, in Warsaw, Poland: the Fifteenth National Conference of Operational and Systems Research, BOS-2018, one of the leading conferences in the field of operational and systems research not only in Poland but also at the European level; and the Seventeenth International Workshop on Intuitionistic Fuzzy Sets and General Nets, IWIFSGN-2018, one of the premiere conferences on fuzzy logic. The papers presented here constitute a fair and comprehensive representation of the topics covered by both BOS-2018 and IWIFSGN-2018, including extensions of the traditional fuzzy sets, in particular on the intuitionistic fuzzy sets, as well as other topics in uncertainty and imprecision modeling, the Generalized Nets (GNs), a powerful extension of the traditional Petri net paradigm, and InterCriteria Analysis, a new method for feature selection and analyses in multicriteria and multi-attribute decision-making problems. The Workshop was dedicated to the memory of Professor Beloslav Riečan (1936–2018), a regular participant at the IWIFSGN workshops.

Understanding and Using Rough Set Based Feature Selection: Concepts, Techniques and Applications Jan 03 2020 This book provides a comprehensive introduction to rough set-based feature selection. Rough set theory, first proposed by Zdzisław Pawlak in 1982, continues to evolve. Concerned with the classification and analysis of imprecise or uncertain information and knowledge, it has become a prominent tool for data analysis, and enables the reader to systematically study all topics in rough set theory (RST) including preliminaries, advanced concepts, and feature selection using RST. The book is supplemented with an RST-based API library that can be used to implement several RST concepts and RST-based feature selection algorithms. The book provides an essential reference guide for students, researchers, and developers working in the areas of feature selection, knowledge discovery, and reasoning with uncertainty, especially those who are working in RST and granular computing. The primary audience of this book is the research community using rough set theory (RST) to perform feature selection (FS) on large-scale datasets in various domains. However, any community interested in feature selection such as medical, banking, and finance can also benefit from the book. This second edition also covers the dominance-based rough set approach and fuzzy rough sets. The dominance-based rough set approach (DRSA) is an extension of the conventional rough set approach and supports the preference order using the dominance principle. In turn, fuzzy rough sets are fuzzy generalizations of rough sets. An API library for the DRSA is also provided with the second edition of the book.

Modeling and Management of Fuzzy Semantic RDF Data Dec 14 2020 This book systemically presents the latest research findings in fuzzy RDF data modeling and management. Fuzziness widely exist in many data and knowledge intensive applications. With the increasing amount of metadata available, efficient and scalable management of massive semantic data with uncertainty is of crucial importance. This book goes to great depth concerning the fast-growing topic of technologies and approaches of modeling and managing fuzzy metadata with Resource Description Framework (RDF) format. Its major topics include representation of fuzzy RDF data, fuzzy RDF graph matching, query of fuzzy RDF data, and persistence of fuzzy RDF data in diverse databases. The objective of the book is to provide the state-of-the-art information to researchers, practitioners, and postgraduates students who work on the area of big data intelligence and at the same time serve as the uncertain data and knowledge engineering professional as a valuable real-world reference.

Query Processing over Uncertain Databases Oct 24 2021 Due to measurement errors, transmission lost, or injected noise for privacy protection, uncertainty exists in the data of many real applications. However, query processing techniques for deterministic data cannot be directly applied to uncertain data because they do not have mechanisms to handle data uncertainty. Therefore, efficient and effective manipulation of uncertain data is a practical yet challenging research topic. In this book, we start from the data models for imprecise and uncertain data, move on to defining different semantics for queries on uncertain data, and finally discuss the advanced query processing techniques for various probabilistic queries in uncertain databases. The book serves as a comprehensive guideline for query processing over uncertain databases. Table of Contents: Introduction / Uncertain Data Models / Spatial Query Semantics over Uncertain Data Models / Spatial Query Processing over Uncertain Databases / Conclusion

Data Uncertainty and Important Measures Nov 12 2020 The first part of the book defines the concept of uncertainties and the mathematical frameworks that will be used for uncertainty modeling. The application to system reliability assessment illustrates the concept. In the second part, evidential networks as a new tool to model uncertainty in reliability and risk analysis is proposed and described. Then it is applied on SIS performance assessment and in risk analysis of a heat sink. In the third part, Bayesian and evidential networks are used to deal with important measures evaluation in the context of uncertainties.

Soft Methods for Handling Variability and Imprecision Feb 13 2021 Probability theory has been the only well-

founded theory of uncertainty for a long time. It was viewed either as a powerful tool for modelling random phenomena, or as a rational approach to the notion of degree of belief. During the last thirty years, in areas centered around decision theory, artificial intelligence and information processing, numerous approaches extending or orthogonal to the existing theory of probability and mathematical statistics have come to the front. The common feature of those attempts is to allow for softer or wider frameworks for taking into account the incompleteness or imprecision of information. Many of these approaches come down to blending interval or fuzzy interval analysis with probabilistic methods. This book gathers contributions to the 4th International Conference on Soft methods in Probability and Statistics. Its aim is to present recent results illustrating such new trends that enlarge the statistical and uncertainty modeling traditions, towards the handling of incomplete or subjective information. It covers a broad scope ranging from philosophical and mathematical underpinnings of new uncertainty theories, with a stress on their impact in the area of statistics and data analysis, to numerical methods and applications to environmental risk analysis and mechanical engineering. A unique feature of this collection is to establish a dialogue between fuzzy random variables and imprecise probability theories.

Uncertainty Management in Information Systems Apr 29 2022 As its title suggests, "Uncertainty Management in Information Systems" is a book about how information systems can be made to manage information permeated with uncertainty. This subject is at the intersection of two areas of knowledge: information systems is an area that concentrates on the design of practical systems that can store and retrieve information; uncertainty modeling is an area in artificial intelligence concerned with accurate representation of uncertain information and with inference and decision-making under conditions infused with uncertainty. New applications of information systems require stronger capabilities in the area of uncertainty management. Our hope is that lasting interaction between these two areas would facilitate a new generation of information systems that will be capable of servicing these applications. Although there are researchers in information systems who have addressed themselves to issues of uncertainty, as well as researchers in uncertainty modeling who have considered the pragmatic demands and constraints of information systems, to a large extent there has been only limited interaction between these two areas. As the subtitle, "From Needs to Solutions," indicates, this book presents view points of information systems experts on the needs that challenge the uncertainty capabilities of present information systems, and it provides a forum to researchers in uncertainty modeling to describe models and systems that can address these needs.

Combining Fuzzy Imprecision with Probabilistic Uncertainty in Decision Making Feb 02 2020 In the literature of decision analysis it is traditional to rely on the tools provided by probability theory to deal with problems in which uncertainty plays a substantive role. In recent years, however, it has become increasingly clear that uncertainty is a multifaceted concept in which some of the important facets do not lend themselves to analysis by probability-based methods. One such facet is that of fuzzy imprecision, which is associated with the use of fuzzy predicates exemplified by small, large, fast, near, likely, etc. To be more specific, consider a proposition such as "It is very unlikely that the price of oil will decline sharply in the near future," in which the italicized words play the role of fuzzy predicates. The question is: How can one express the meaning of this proposition through the use of probability-based methods? If this cannot be done effectively in a probabilistic framework, then how can one employ the information provided by the proposition in question to bear on a decision relating to an investment in a company engaged in exploration and marketing of oil? As another example, consider a collection of rules of the form "If X is A_i then Y is B_j ," $j = 1, \dots, n$, in which X and Y are real-valued variables and A_i and B_j are fuzzy numbers exemplified by small, large, not very small, close to 5, etc.

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