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Decision Making with Spherical Fuzzy Sets-Cengiz Kahraman 2020-05-27 This book introduces readers to the novel concept of spherical fuzzy sets, showing how these sets can be applied in practice to solve various decision-making problems. It also demonstrates that these sets provide a larger preference volume in 3D space for decision-makers. Written by authoritative researchers, the various chapters cover a large amount of theoretical and

practical information, allowing readers to gain an extensive understanding of both the fundamentals and applications of spherical fuzzy sets in intelligent decision-making and mathematical programming.

Fuzzy Sets and Fuzzy Decision-Making-Hongxing Li 1995-07-03 The increasing number of applications of fuzzy mathematics has generated interest in widely ranging fields, from engineering and medicine to the humanities and management sciences. Fuzzy Sets and Fuzzy Decision-Making provides an introduction to fuzzy set theory and lays the foundation of fuzzy mathematics and its applications to decision-making. New concepts are simplified with the use of figures and diagrams, and methods are discussed in terms of their direct applications in obtaining solutions to real problems, particularly to decision-related problems. The first chapter presents the current state of knowledge of fuzzy set theory, using pan-Venn-diagrams to illustrate mathematical concepts. The second chapter clearly describes the theory of factor spaces, on which fuzzy decision-making is based. The remainder of the book is devoted to the methods, applications, techniques, and examples of this fuzzy decision-making, and includes methods for determining membership functions and for treating multifactorial and variable weights analyses.

Fuzzy Sets, Decision Making, and Expert Systems-Hans-Jürgen Zimmermann 2012-12-06 In the two decades since its inception by L. Zadeh, the theory of fuzzy sets has matured into a wide-ranging collection of concepts, models, and tech niques for dealing with complex phenomena which do not lend themselves to analysis by classical methods based on probability theory and bivalent logic. Nevertheless, a question which is frequently raised by the skeptics is: Are there, in fact, any significant problem areas in which the use of the theory of fuzzy sets leads to results which could not be obtained by classical methods? The approximately 5000 publications in this area, which are scattered over many areas such as artificial intelligence, computer science, control engineering, decision making, logic, operations research, pattern recognition, robotics and others, provide an affirmative answer to this question. In spite of the large number of publications, good and comprehensive textbooks which could facilitate the access of newcomers to this

area and support teaching were missing until recently. To help to close this gap and to provide a textbook for courses in fuzzy set theory which can also be used as an introduction to this field, the first volume ofthis book was published in 1985 [Zimmermann 1985 b]. This volume tried to cover fuzzy set theory and its applications as extensively as possible. Applications could, therefore, only be described to a limited extent and not very detailed.

Fuzzy Sets and Their Applications to Cognitive and Decision Processes-Lotfi A. Zadeh 2014-06-28 Fuzzy Sets and Their Applications to Cognitive and Decision Processes contains the proceedings of the U.S.-Japan Seminar on Fuzzy Sets and Their Applications, held at the University of California in Berkeley, California, on July 1-4, 1974. The seminar provided a forum for discussing a broad spectrum of topics related to the theory of fuzzy sets, ranging from its mathematical aspects to applications in human cognition, communication, decision making, and engineering systems analysis. Comprised of 19 chapters, this book begins with an introduction to the calculus of fuzzy restrictions, followed by a discussion on fuzzy programs and their execution. Subsequent chapters focus on fuzzy relations, fuzzy graphs, and their applications to clustering analysis; risk and decision making in a fuzzy environment; fractionally fuzzy grammars and their application to pattern recognition; and applications of fuzzy sets in psychology. An approach to pattern recognition and associative memories using fuzzy logic is also described. This monograph will be of interest to students and practitioners in the fields of computer science, engineering, psychology, and applied mathematics.

Multicriteria Decision-Making Under Conditions of Uncertainty-Petr Ekel 2019-12-12 A guide to the various models and methods to multicriteria decision-making in conditions of uncertainty presented in a systematic approach Multicriteria Decision-Making under Conditions of Uncertainty presents approaches that help to answer the fundamental questions at the center of all decision-making problems: "What to do?" and "How to do it?" The book explores methods of representing and handling diverse manifestations of the uncertainty factor and a multicriteria nature of problems that can arise in system design, planning, operation, and control. The authors—noted experts on the topic—and their book covers

essential questions, including notions and fundamental concepts of fuzzy sets, models and methods of multiobjective as well as multiattribute decision-making, the classical approach to dealing with uncertainty of information and its generalization for analyzing multicriteria problems in condition of uncertainty, and more. This comprehensive book contains information on "harmonious solutions" in multiobjective problem-solving (analyzing "i>X, F> models), construction and analysis of "i>X, R/i" models, results aimed at generating robust solutions in analyzing multicriteria problems under uncertainty, and more. In addition, the book includes illustrative examples of various applications, including real-world case studies related to the authors' various industrial projects. This important resource: Explains the design and processing aspect of fuzzy sets, including construction of membership functions, fuzzy numbers, fuzzy relations, aggregation operations, and fuzzy sets transformations Describes models of multiobjective decision-making ("i>X. M/i" models), their analysis on the basis of using the Bellman-Zadeh approach to decision-making in a fuzzy environment, and their diverse applications, including multicriteria allocation of resources Investigates models of multiattribute decision-making ("i>X, R/i" models) and their analysis on the basis of the construction and processing of fuzzy preference relations as well as demonstrating their applications to solve diverse classes of multiattribute problems Explores notions of payoff matrices and fuzzy-set-based generalization and modification of the classic approach to decision-making under conditions of uncertainty to generate robust solutions in analyzing multicriteria problems Written for students, researchers and practitioners in disciplines in which decision-making is of paramount relevance, Multicriteria Decision-Making under Conditions of Uncertainty presents a systematic and current approach that encompasses a range of models and methods as well as new applications.
Fuzzy Techniques for Decision Making 2018-José Carlos R. Alcantud 2020-12-02 Zadeh's fuzzy set theory incorporates the impreciseness of data and evaluations, by imputting the degrees by which each object belongs to a set. Its success fostered theories that codify the subjectivity, uncertainty, imprecision, or roughness of the evaluations. Their rationale is to produce new flexible

methodologies in order to model a variety of concrete decision problems more realistically. This Special Issue garners contributions addressing novel tools, techniques and methodologies for decision making (inclusive of both individual and group, single- or multi-criteria decision making) in the context of these theories. It contains 38 research articles that contribute to a variety of setups that combine fuzziness, hesitancy, roughness, covering sets, and linguistic approaches. Their ranges vary from fundamental or technical to applied approaches.

Fuzzy Logic for Planning and Decision Making-Freerk A. Lootsma 2013-03-14 This book starts with the basic concepts of Fuzzy Logic: the membership function, the intersection and the union of fuzzy sets, fuzzy numbers, and the extension principle underlying the algorithmic operations. Several chapters are devoted to applications of Fuzzy Logic in Operations Research: PERT planning with uncertain activity durations, Multi-Criteria Decision Analysis (MCDA) with vague preferential statements, and Multi-Objective Optimization (MOO) with weighted degrees of satisfaction. New items are: Fuzzy PERT using activity durations with triangular membership functions, Fuzzy SMART with a sensitivity analysis based upon Fuzzy Logic, the Additive and the Multiplicative AHP with a similar feature, ELECTRE using the ideas of the AHP and SMART, and a comparative study of the ideal-point methods for MOO. Finally, earlier studies of colour perception illustrate the attempts to find a physiological basis for the set-theoretical and the algorithmic operations in Fuzzy Logic. The last chapter also discusses some key issues in linguistic categorization and the prospects of Fuzzy Logic as a multi-disciplinary research activity. Audience: Researchers and students working in applied mathematics, operations research, management science, business administration, econometrics, industrial engineering, information systems, artificial intelligence, mathematical psychology, and psycho-physics.

Fuzzy Multi-Criteria Decision Making-Cengiz Kahraman 2008-08-09 This work examines all the fuzzy multicriteria methods recently developed, such as fuzzy AHP, fuzzy TOPSIS, interactive fuzzy multiobjective stochastic linear programming, fuzzy multiobjective dynamic programming, grey fuzzy multiobjective optimization, fuzzy

multiobjective geometric programming, and more. Each of the 22 chapters includes practical applications along with new developments/results. This book may be used as a textbook in graduate operations research, industrial engineering, and economics courses. It will also be an excellent resource, providing new suggestions and directions for further research, for computer programmers, mathematicians, and scientists in a variety of disciplines where multicriteria decision making is needed.

Fuzzy Sets in Decision Analysis, Operations Research and Statistics-Roman Slowiński 2012-12-06 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.

Fuzzy Sets, Decision Making, and Expert Systems-Hans-Jürgen Zimmermann 2012-12-06 In the two decades since its inception by L. Zadeh, the theory of fuzzy sets has matured into a wide-ranging collection of concepts, models, and tech niques for dealing with complex phenomena which do not lend themselves to analysis by classical methods based on probability theory and bivalent logic. Nevertheless, a question which is frequently raised by the skeptics

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Multiperson Decision Making Models Using Fuzzy Sets and Possibility Theory-J. Kacprzyk 2012-12-06 Decision making is certainly a very crucial component of many human activities. It is, therefore, not surprising that models of decisions play a very important role not only in decision theory but also in areas such as operations Research, Management science, social Psychology etc . . The basic model of a decision in classical normative decision theory has very little in common with real decision making: It portrays a decision as a clear-cut act of choice, performed by one individual decision maker and in which states of nature, possible actions, results and preferences are well and crisply defined. The only compo nent in which uncertainty is permitted is the occurence of the different states of nature, for which probabilistic descriptions are allowed. These probabilities are generally assumed to be known numerically, i. e. as single probabili ties or as probability distribution functions. Extensions of this basic model can primarily be conceived in three directions: 1. Rather than a single decision maker there are several decision makers involved. This has lead to the areas of game theory, team theory and group decision theory. 2. The preference or utility function is not single valued but rather vector valued. This extension is considered in multiattribute utility theory and in multicritieria analysis. 3.

Fuzzy Statistical Decision-Making-Cengiz Kahraman 2016-07-15 This book offers a comprehensive reference guide to fuzzy statistics and fuzzy decision-making techniques. It provides readers with all the necessary tools for making statistical inference in the case of incomplete information or insufficient data, where classical statistics cannot be applied. The respective chapters, written by prominent researchers, explain a wealth of both basic and advanced concepts including: fuzzy probability distributions, fuzzy frequency distributions, fuzzy Bayesian inference, fuzzy mean, mode and median, fuzzy dispersion, fuzzy p-value, and many others. To foster a better understanding, all the chapters include relevant numerical examples or case studies. Taken together, they form an excellent reference guide for researchers, lecturers and postgraduate students pursuing research on fuzzy statistics. Moreover, by extending all the main aspects of classical statistical decision-making to its fuzzy counterpart, the book presents a dynamic snapshot of the field that is expected to stimulate new directions, ideas and developments.

Intelligent and Fuzzy Techniques in Big Data Analytics and Decision Making-Cengiz Kahraman 2019-07-05 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.

Fuzzy Sets Theory and Applications-André Jones 1986-06-30 Problems in decision making and in other areas such as pattern recogni tion, control, structural engineering etc. involve numerous aspects of uncertainty. Additional vagueness is introduced as models become more complex but not necessarily more meaningful by the added details. During the last two decades one has become more and more aware of the fact that not all this uncertainty is of stochastic (random) cha racter and that, therefore, it can not be modelled appropriately by probability theory. This becomes the more obvious the more we want to represent formally human knowledge. As far as uncertain data are concerned, we have neither instru ments nor reasoning at our disposal as well defined and unquestionable as those used in the probability theory. This almost infallible do main is the result of a tremendous work by the whole scientific world. But when measures are dubious, bad or no longer possible and when we really have to make use of the richness of human reasoning in its variety, then the theories dealing with the treatment of uncertainty, some quite new and other ones older, provide the required complement, and fill in the gap left in the field of knowledge representation. Nowadays, various theories are widely used: fuzzy sets, belief function, the convenient associations between probability and fuzzines~ etc ••• We are more and more in need of a wide range of instruments and theories to build models that are more and more adapted to the most complex systems.

Fuzzy Set Theory—and Its Applications-Hans-Jürgen Zimmermann 2001-11-30 This introduction to fuzzy set theory and its multitude of applications seeks to balance the character of the book with the dynamic nature of the research. This edition includes new chapters on possibility theory, fuzzy logic and approximate reasoning, expert systems, fuzzy control, fuzzy data analysis, decision making and fuzzy set models in operations research. Existing material has been updated, and extended exercises are included.

Multi-objective Group Decision Making-Jie Lu 2007 This book proposes a set of models to describe fuzzy multi-objective decision making (MODM), fuzzy multi-criteria decision making (MCDM), fuzzy group decision making (GDM) and fuzzy multi-objective group

decision-making problems, respectively. It also gives a set of related methods (including algorithms) to solve these problems. One distinguishing feature of this book is that it provides two decision support systems software for readers to apply these proposed methods. A set of real-world applications and some new directions in this area are then described to further instruct readers how to use these methods and software in their practice.

Fundamentals of the Fuzzy Logic-Based Generalized Theory of Decisions-Rafik Aziz Aliev 2013-01-12 Every day decision making and decision making in complex human-centric systems are characterized by imperfect decision-relevant information. Main drawback of the existing decision theories is namely incapability to deal with imperfect information and modeling vague preferences. Actually, a paradigm of non-numerical probabilities in decision making has a long history and arose also in Keynes's analysis of uncertainty. There is a need for further generalization – a move to decision theories with perception-based imperfect information described in NL. The languages of new decision models for human-centric systems should be not languages based on binary logic but human-centric computational schemes able to operate on NL-described information. Development of new theories is now possible due to an increased computational power of information processing systems which allows for computations with imperfect information, particularly, imprecise and partially true information, which are much more complex than computations over numbers and probabilities. The monograph exposes the foundations of a new decision theory with imperfect decision-relevant information on environment and a decision maker's behavior. This theory is based on the synthesis of the fuzzy sets theory with perception-based information and the probability theory. The book is self containing and represents in a systematic way the decision theory with imperfect information into the educational systems. The book will be helpful for teachers and students of universities and colleges, for managers and specialists from various fields of business and economics, production and social sphere.

Fuzzy Sets and Decision Analysis-Hyman J. Zimmerman 1984
Fuzzy Sets, Fuzzy Logic, Applications-George Bojadziev 1996-01-09 Fuzzy sets and fuzzy logic are powerful mathematical tools for

modeling and controlling uncertain systems in industry, humanity, and nature; they are facilitators for approximate reasoning in decision making in the absence of complete and precise information. Their role is significant when applied to complex phenomena not easily described by traditional mathematics.The unique feature of the book is twofold: 1) It is the first introductory course (with examples and exercises) which brings in a systematic way fuzzy sets and fuzzy logic into the educational university and college system. 2) It is designed to serve as a basic text for introducing engineers and scientists from various fields to the theory of fuzzy sets and fuzzy logic, thus enabling them to initiate projects and make applications.

Multi-Objective Group Decision Making-Jie Lu 2007-05-10 This book proposes a set of models to describe fuzzy multi-objective decision making (MODM), fuzzy multi-criteria decision making (MCDM), fuzzy group decision making (GDM) and fuzzy multi-objective group decision-making problems, respectively. It also gives a set of related methods (including algorithms) to solve these problems. One distinguishing feature of this book is that it provides two decision support systems software for readers to apply these proposed methods. A set of real-world applications and some new directions in this area are then described to further instruct readers how to use these methods and software in their practice. Contents: Decision Making, Decision Support Systems, and Fuzzy Sets:Decision MakingMulti-Objective and Multi-Attribute Decision MakingGroup Decision MakingDecision Support SystemsFuzzy Sets and SystemsFuzzy Multi-Objective Decision Making:Fuzzy MODM ModelsFuzzy MODM MethodsFuzzy Multi-Objective DSSFuzzy Group Decision Making:Fuzzy MCDMFuzzy Group Decision MakingA Web-Based Fuzzy Group DSSFuzzy Multi-Objective Group Decision Making:Multi-Objective Group DSSFuzzy Multi-Objective Group DSSApplications:Environmental Economic Load DispatchTeam Situation AwarenessReverse Logistics Management Readership: Final year undergraduates, graduate and postgraduate students in business management, computer science, fuzzy logic, artificial intelligence and related areas. Keywords:Multi-Objective Decision Making;Group Decision Making;Multi-Criteria Decision Making;Decision Support Systems;Fuzzy SetKey Features:Describes

a complete set of models, methods and algorithms with fuzzy set techniques not only for solving fuzzy MODM, fuzzy MCDM and fuzzy GDM problems, but also for solving general MODM, MCDM and GDM problemsFeatures two decision support systems (DSSs) for a fuzzy multi-objective DSS and a fuzzy group DSS on how to apply, design and implement such kinds of DSSs in practiceHighlights various applications of proposed decision-making methods and DSS software including power markets, team situation awareness, and logistics management, from the practical point of viewReveals new directions of DSSs — online customer DSSs and perceptive DSSs INTRODUCTION TO FUZZY SETS AND FUZZY LOGIC-M. GANESH 2006-01-01 Reflecting the tremendous advances that have taken place in the study of fuzzy set theory and fuzzy logic, this book not only details the theoretical advances in these areas, but also considers a broad variety of applications of fuzzy sets and fuzzy logic. This comprehensive and up-to-date text is organized in three parts. The concepts pertaining to the "crisp" situation such as Set Theory, Logic, Switching Function Theory and Boolean Algebra are covered in Part I of the text. Part II is devoted to fuzzy Set Theory, Fuzzy Relations and Fuzzy Logic. The applications of fuzzy set theory and fuzzy logic to Control Theory and Decision Making are designated Part III of the text. Designed as a textbook for the undergraduate and postgraduate students of Science and Engineering, the book will also be immensely useful to practicing engineers and computer scientists.
Fuzzy Decision Making in Modeling and Control-Joao M. C. Sousa 2002 Decision making and control are two fields with distinct methods for solving problems, and yet they are closely related. This book bridges the gap between decision making and control in the field of fuzzy decisions and fuzzy control, and discusses various ways in which fuzzy decision making methods can be applied to systems modeling and control.Fuzzy decision making is a powerful paradigm for dealing with human expert knowledge when one is designing fuzzy model-based controllers. The combination of fuzzy decision making and fuzzy control in this book can lead to novel control schemes that improve the existing controllers in various ways. The following applications of fuzzy decision making methods for designing control systems are considered: OCo Fuzzy decision

making for enhancing fuzzy modeling. The values of important parameters in fuzzy modeling algorithms are selected by using fuzzy decision making.OCo Fuzzy decision making for designing signal-based fuzzy controllers. The controller mappings and the defuzzification steps can be obtained by decision making methods.OCo Fuzzy design and performance specifications in model-based control. Fuzzy constraints and fuzzy goals are used.OCo Design of model-based controllers combined with fuzzy decision modules. Human operator experience is incorporated for the performance specification in model-based control.The advantages of bringing together fuzzy control and fuzzy decision making are shown with multiple examples from real and simulated control systems."

Fuzzy Multiple Attribute Decision Making-Shu-Jen Chen 2012-12-06 This monograph is intended for an advanced undergraduate or graduate course as well as for researchers, who want a compilation of developments in this rapidly growing field of operations research. This is a sequel to our previous works: "Multiple Objective Decision Making--Methods and Applications: A state-of-the-Art Survey" (No.164 of the Lecture Notes); "Multiple Attribute Decision Making--Methods and Applications: A State-of-the-Art Survey" (No.186 of the Lecture Notes); and "Group Decision Making under Multiple Criteria--Methods and Applications" (No.281 of the Lecture Notes). In this monograph, the literature on methods of fuzzy Multiple Attribute Decision Making (MADM) has been reviewed thoroughly and critically, and classified systematically. This study provides readers with a capsule look into the existing methods, their characteristics, and applicability to the analysis of fuzzy MADM problems. The basic concepts and algorithms from the classical MADM methods have been used in the development of the fuzzy MADM methods. We give an overview of the classical MADM in Chapter II. Chapter III presents the basic concepts and mathematical operations of fuzzy set theory with simple numerical examples in a easy-to-read and easy-to-follow manner. Fuzzy MADM methods basically consist of two phases: (1) the aggregation of the performance scores with respect to all the attributes for each alternative, and (2) the rank ordering of the alternatives according to the aggregated scores.

Decision and Game Theory in Management With Intuitionistic Fuzzy Sets-Deng-Feng Li 2013-11-12 The focus of this book is on establishing theories and methods of both decision and game analysis in management using intuitionistic fuzzy sets. It proposes a series of innovative theories, models and methods such as the representation theorem and extension principle of intuitionistic fuzzy sets, ranking methods of intuitionistic fuzzy numbers, non-linear and linear programming methods for intuitionistic fuzzy multi-attribute decision making and (interval-valued) intuitionistic fuzzy matrix games. These theories and methods form the theory system of intuitionistic fuzzy decision making and games, which is not only remarkably different from those of the traditional, Bayes and/or fuzzy decision theory but can also provide an effective and efficient tool for solving complex management problems. Since there is a certain degree of inherent hesitancy in real-life management, which cannot always be described by the traditional mathematical methods and/or fuzzy set theory, this book offers an effective approach to using the intuitionistic fuzzy set expressed with membership and non-membership functions. This book is addressed to all those involved in theoretical research and practical applications from a variety of fields/disciplines: decision science, game theory, management science, fuzzy sets, operational research, applied mathematics, systems engineering, industrial engineering, economics, etc.

Fuzzy Multicriteria Decision-Making-Witold Pedrycz 2011-06-15 Fuzzy Multicriteria Decision-Making: Models, Algorithms and Applications addresses theoretical and practical gaps in considering uncertainty and multicriteria factors encountered in the design, planning, and control of complex systems. Including all prerequisite knowledge and augmenting some parts with a step-by-step explanation of more advanced concepts, the authors provide a systematic and comprehensive presentation of the concepts, design methodology, and detailed algorithms. These are supported by many numeric illustrations and a number of application scenarios to motivate the reader and make some abstract concepts more tangible. Fuzzy Multicriteria Decision-Making: Models, Algorithms and Applications will appeal to a wide audience of researchers and practitioners in disciplines where decision-making is paramount,

including various branches of engineering, operations research, economics and management; it will also be of interest to graduate students and senior undergraduate students in courses such as decision making, management, risk management, operations research, numerical methods, and knowledge-based systems.

Fuzzy Logic for Business, Finance, and Management-

Soft Computing for Business Intelligence-Rafael Espin 2013-12-30 The book Soft Computing for Business Intelligence is the remarkable output of a program based on the idea of joint transdisciplinary research as supported by the Eureka Iberoamerica Network and the University of Oldenburg. It contains twenty-seven papers allocated to three sections: Soft Computing, Business Intelligence and Knowledge Discovery, and Knowledge Management and Decision Making. Although the contents touch different domains they are similar in so far as they follow the BI principle "Observation and Analysis" while keeping a practical oriented theoretical eye on sound methodologies, like Fuzzy Logic, Compensatory Fuzzy Logic (CFL), Rough Sets and other soft computing elements. The book tears down the traditional focus on business, and extends Business Intelligence techniques in an impressive way to a broad range of fields like medicine, environment, wind farming, social collaboration and interaction, car sharing and sustainability.

Hesitant Fuzzy Decision Making Methodologies and Applications-Huchang Liao 2016-12-27 This book offers a comprehensive and systematic introduction to the latest research on hesitant fuzzy decision-making theory. It includes six parts: the hesitant fuzzy set and its extensions, novel hesitant fuzzy measures, hesitant fuzzy hybrid weighted aggregation operators, hesitant fuzzy multiple-criteria decision-making with incomplete weights, hesitant fuzzy multiple criteria decision-making with complete weights information, and the hesitant fuzzy preference relation based decision-making theory. These methodologies are implemented in various fields such as decision-making, medical diagnosis, cluster analysis, service quality management, e-learning management and environmental management. A valuable resource for engineers, technicians, and researchers in the fields of fuzzy mathematics, operations research, information science, management science and

engineering, it can also be used as a textbook for postgraduate and senior undergraduate students.

Fuzzy Logic in Its 50th Year-Cengiz Kahraman 2016-05-17 This book offers a multifaceted perspective on fuzzy set theory, discussing its developments over the last 50 years. It reports on all types of fuzzy sets, from ordinary to hesitant fuzzy sets, with each one explained by its own developers, authoritative scientists well known for their previous works. Highlighting recent theorems and proofs, the book also explores how fuzzy set theory has come to be extensively used in almost all branches of science, including the health sciences, decision science, earth science and the social sciences alike. It presents a wealth of real-world sample applications, from routing problem to robotics, and from agriculture to engineering. By offering a comprehensive, timely and detailed portrait of the field, the book represents an excellent reference guide for researchers, lecturers and postgraduate students pursuing research on new fuzzy set extensions.

Decision-making in a Fuzzy Environment-Richard Bellman 1970

An Introduction to Fuzzy Logic and Fuzzy Sets-James J. Buckley 2013-11-11 This book is an excellent starting point for any curriculum in fuzzy systems fields such as computer science, mathematics, business/economics and engineering. It covers the basics leading to: fuzzy clustering, fuzzy pattern recognition, fuzzy database, fuzzy image processing, soft computing, fuzzy applications in operations research, fuzzy decision making, fuzzy rule based systems, fuzzy systems modeling, fuzzy mathematics. It is not a book designed for researchers - it is where you really learn the "basics" needed for any of the above-mentioned applications. It includes many figures and problem sets at the end of sections.

Fuzzy Multiple Objective Decision Making-Gwo-Hshiung Tzeng 2016-04-19 Multi-objective programming (MOP) can simultaneously optimize multi-objectives in mathematical programming models, but the optimization of multi-objectives triggers the issue of Pareto solutions and complicates the derived answers. To address these problems, researchers often incorporate the concepts of fuzzy sets and evolutionary algorithms into MOP models. Focusing on the methodologies and applications of this field, Fuzzy Multiple Objective Decision Making presents mathematical tools for complex

decision making. The first part of the book introduces the most popular methods used to calculate the solution of MOP in the field of multiple objective decision making (MODM). The authors describe multi-objective evolutionary algorithms; expand de novo programming to changeable spaces, such as decision and objective spaces; and cover network data envelopment analysis. The second part focuses on various applications, giving readers a practical, in-depth understanding of MODM. A follow-up to the authors' Multiple Attribute Decision Making: Methods and Applications, this book guides practitioners in using MODM methods to make effective decisions. It also extends students' knowledge of the methods and provides researchers with the foundation to publish papers in operations research and management science journals.

Fuzzy Reasoning in Decision Making and Optimization-Christer Carlsson 2012-08-27 Many decision-making tasks are too complex to be understood quantitatively, however, humans succeed by using knowledge that is imprecise rather than precise. Fuzzy logic resembles human reasoning in its use of imprecise informa tion to generate decisions. Unlike classical logic which requires a deep under standing of a system, exact equations, and precise numeric values, fuzzy logic incorporates an alternative way of thinking, which allows modeling complex systems using a higher level of abstraction originating from our knowledge and experience. Fuzzy logic allows expressing this knowledge with subjective concepts such as very big and a long time which are mapped into exact numeric ranges. Since knowledge can be expressed in a more natural by using fuzzy sets, many decision (and engineering) problems can be greatly simplified. Fuzzy logic provides an inference morphology that enables approximate human reasoning capabilities to be applied to knowledge-based systems. The theory of fuzzy logic provides a mathematical strength to capture the un certainties associated with human cognitive processes, such as thinking and reasoning. The conventional approaches to knowledge representation lack the means for representating the meaning of fuzzy concepts. As a consequence, the approaches based on first order logic do not provide an appropriate con ceptual framework for dealing with the representation of commonsense knowl edge, since such knowledge is by its nature both lexically imprecise and non

categorical.

Hesitant Fuzzy Sets Theory-Zeshui Xu 2014-01-30 This book provides the readers with a thorough and systematic introduction to hesitant fuzzy theory. It presents the most recent research results and advanced methods in the field. These includes: hesitant fuzzy aggregation techniques, hesitant fuzzy preference relations, hesitant fuzzy measures, hesitant fuzzy clustering algorithms and hesitant fuzzy multi-attribute decision making methods. Since its introduction by Torra and Narukawa in 2009, hesitant fuzzy sets have become more and more popular and have been used for a wide range of applications, from decision-making problems to cluster analysis, from medical diagnosis to personnel appraisal and information retrieval. This book offers a comprehensive report on the state-of-the-art in hesitant fuzzy sets theory and applications, aiming at becoming a reference guide for both researchers and practitioners in the area of fuzzy mathematics and other applied research fields (e.g. operations research, information science, management science and engineering) characterized by uncertain ("hesitant") information. Because of its clarity and self contained explanations, the book can also be adopted as a textbook from graduate and advanced undergraduate students.

Fuzzy Sets and Interactive Multiobjective Optimization-Masatoshi Sakawa 2013-11-21 The main characteristics of the real-world decision-making problems facing humans today are multidimensional and have multiple objectives including eco nomic, environmental, social, and technical ones. Hence, it seems natural that the consideration of many objectives in the actual decision-making process re quires multiobjective approaches rather than single-objective. One ofthe major systems-analytic multiobjective approaches to decision-making under constraints is multiobjective optimization as a generalization of traditional single-objective optimization. Although multiobjective optimization problems differ from single objective optimization problems only in the plurality of objective functions, it is significant to realize that multiple objectives are often noncom mensurable and conflict with each other in multiobjective optimization problems. With this ob servation, in multiobjective optimization, the notion of Pareto optimality or effi ciency has been introduced instead of the

optimality concept for single-objective optimization. However, decisions with Pareto optimality or efficiency are not uniquely determined; the final decision must be selected from among the set of Pareto optimal or efficient solutions. Therefore, the question is, how does one find the preferred point as a compromise or satisficing solution with rational pro cedure? This is the starting point of multiobjective optimization. To be more specific, the aim is to determine how one derives a compromise or satisficing so lution of a decision maker (DM), which well represents the subjective judgments, from a Pareto optimal or an efficient solution set.

Intuitionistic Fuzzy Sets-Krassimir T. Atanassov 2013-03-20 In the beginning of 1983, I came across A. Kaufmann's book "Introduction to the theory of fuzzy sets" (Academic Press, New York, 1975). This was my first acquaintance with the fuzzy set theory. Then I tried to introduce a new component (which determines the degree of non-membership) in the definition of these sets and to study the properties of the new objects so defined. I defined ordinary operations as "n", "U", "+" and "." over the new sets, but I had began to look more seriously at them since April 1983, when I defined operators analogous to the modal operators of "necessity" and "possibility". The late George Gargov (7 April 1947 - 9 November 1996) is the "god father" of the sets I introduced - in fact, he has invented the name "intu itionistic fuzzy", motivated by the fact that the law of the excluded middle does not hold for them. Presently, intuitionistic fuzzy sets are an object of intensive research by scholars and scientists from over ten countries. This book is the first attempt for a more comprehensive and complete report on the intuitionistic fuzzy set theory and its more relevant applications in a variety of diverse fields. In this sense, it has also a referential character.

Fuzzy Sets and Fuzzy Decision-Making-Hongxing Li 1995-07-03 The increasing number of applications of fuzzy mathematics has generated interest in widely ranging fields, from engineering and medicine to the humanities and management sciences. Fuzzy Sets and Fuzzy Decision-Making provides an introduction to fuzzy set theory and lays the foundation of fuzzy mathematics and its applications to decision-making. New concepts are simplified with the use of figures and diagrams, and methods are discussed in

terms of their direct applications in obtaining solutions to real problems, particularly to decision-related problems. The first chapter presents the current state of knowledge of fuzzy set theory, using pan-Venn-diagrams to illustrate mathematical concepts. The second chapter clearly describes the theory of factor spaces, on which fuzzy decision-making is based. The remainder of the book is devoted to the methods, applications, techniques, and examples of this fuzzy decision-making, and includes methods for determining membership functions and for treating multifactorial and variable weights analyses.

Fuzzy Logic-F. Martin McNeill 2014-05-10 Fuzzy Logic: A Practical Approach focuses on the processes and approaches involved in fuzzy logic, including fuzzy sets, numbers, and decisions. The book first elaborates on fuzzy numbers and logic, fuzzy systems on the job, and Fuzzy Knowledge Builder. Discussions focus on formatting the knowledge base for an inference engine, personnel detection system, using a knowledge base in an inference engine, fuzzy business systems, industrial fuzzy systems, fuzzy sets and numbers, and quantifying word-based rules. The text then elaborates on designing a fuzzy decision and Fuzzy Thought Amplifier for complex situations. Topics include origins of cognitive maps, Fuzzy Thought Amplifier, training a map to predict the future, introducing the Fuzzy Decision Maker, and merging interests. The publication takes a look at fuzzy associative memory, fuzzy sets as hypercube points, and disk files and descriptions, including Fuzzy Thought Amplifier, Fuzzy Decision Maker, and composing and creating a memory. The text is a valuable source of data for researchers interested in fuzzy logic.

Interval-Valued Intuitionistic Fuzzy Sets-Krassimir T. Atanassov 2019-09-21 The book offers a comprehensive survey of interval-valued intuitionistic fuzzy sets. It reports on cutting-edge research carried out by the founder of the intuitionistic fuzzy sets, Prof. Krassimir Atanassov, giving a special emphasis to the practical applications of this extension. A few interesting case studies, such as in the area of data mining, decision making and pattern recognition, among others, are discussed in detail. The book offers the first comprehensive guide on interval-valued intuitionistic fuzzy sets. By providing the readers with a thorough survey and important

practical details, it is expected to support them in carrying out applied research and to encourage them to test the theory behind the sets for new advanced applications. The book is a valuable reference resource for graduate students and researchers alike. Fuzzy Sets in Decision Analysis, Operations Research and Statistics-Roman Slowiński 2012-12-06 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.

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