

Multiple Objective Decision Analysis

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Springer Science & Business Media

This research investigated value and utility functions in multiobjective decision analysis to examine the relationship between them in a military decision making context. The impact of these differences was examined to improve implementation efficiency. The robustness of the decision model was examined with respect to the preference functions to reduce the time burden imposed on the decision maker. Data for decision making in a military context supports the distinction between value and utility functions.

Relationships between value and utility functions and risk attitudes were found to be complex. Elicitation error was significantly smaller than the difference between value and utility functions. Risk attitudes were generally neither constant across the domain of the evaluation measure nor consistent between evaluation measures. An improved measure of differences between preference functions, the weighted root means square, is introduced and a goodness of fit criterion established. An improved measure of risk attitudes employing utility functions is developed. Response Surface Methodology was applied to improve the efficiency of decision analysis utility model applications through establishing the robustness of decision models to the preference functions. An algorithm was developed and employs this information to provide a hybrid value-utility model that offers increased elicitation efficiency.

Multicriteria Analysis for Environmental Decision-Making CRC Press

Multicriteria analysis is a rapidly growing aspect of operations research and management science, with numerous practical applications in a wide range of fields. This book presents all the recent advances in multicriteria analysis, including multicriteria optimization, goal programming, outranking methods, and disaggregation techniques. The latest developments on robustness analysis, preference elicitation, and decision making when faced with incomplete

information, are also discussed, together with applications in business performance evaluation, finance, and marketing. Finally, the interactions of multicriteria analysis with other disciplines are also explored, including among others data mining, artificial intelligence, and evolutionary methods.

Multi-Criteria Decision Analysis via Ratio and Difference Judgement CRC Press

A ONE-OF-A-KIND GUIDE TO THE BEST PRACTICES IN DECISION ANALYSIS Decision analysis provides powerful tools for addressing complex decisions that involve uncertainty and multiple objectives, yet most training materials on the subject overlook the soft skills that are essential for success in the field. This unique resource fills this gap in the decision analysis literature and features both soft personal/interpersonal skills and the hard technical skills involving mathematics and modeling. Readers will learn how to identify and overcome the numerous challenges of decision making, choose the appropriate decision process, lead and manage teams, and create value for their organization. Performing modeling analysis, assessing risk, and implementing decisions are also addressed throughout. Additional features include: Key insights gleaned from decision analysis applications and behavioral decision analysis research Integrated coverage of the techniques of single- and multiple-objective decision analysis Multiple qualitative and quantitative techniques presented for each key decision analysis task Three substantive real-world case studies illustrating diverse strategies for dealing with the challenges of decision making Extensive references for mathematical proofs and advanced topics The Handbook of Decision Analysis is an essential reference for academics and practitioners in various fields including business, operations research, engineering, and science. The book also serves as a supplement for courses at the upper-undergraduate and graduate levels.

Multiple Criteria Decision Analysis Morgan & Claypool Publishers

The point of departure in the present book is that the decision makers, involved in the evaluation of alternatives under conflicting criteria, express their preferential judgement by estimating ratios of subjective values or differences of the corresponding logarithms, the so-called grades. Three MCDA methods are studied in detail: the Simple Multi-Attribute Rating Technique SMART, as well as the Additive and the Multiplicative AHP, both pairwise-comparison methods which do not suffer from the well-known shortcomings of the original Analytic Hierarchy Process. Context-related preference modelling on the basis of psycho-physical research in visual perception and motor skills is extensively discussed in the introductory chapters. Thereafter many extensions of the ideas are presented via case studies in university administration, health care, environmental assessment, budget allocation, and energy planning at the national and the European level. The issues under consideration are: group decision making with inhomogeneous power distributions, the search for a compromise solution, resource allocation and fair distributions, scenario analysis in long-term planning, conflict analysis via the pairwise comparison of concessions, and multi-objective optimization. The final chapters are devoted to the fortunes of MCDA in the hands of its designers.

The research started in the late seventies, when I got involved in three different problems: the nomination procedures in a university, the evaluation of alternative energy-research proposals, and the evaluation of non-linear programming software.

Using Multiple Objective Decision Analysis Methods to Improve Signalized Intersections Multi-objective Decision Analysis

Multi-objective Decision Analysis Business Expert Press

Multi-Objective Decision Making Springer Science & Business Media

When people or computers need to make a decision, typically multiple conflicting criteria need to be evaluated; for example, when we buy a car, we need to consider safety, cost and comfort. Multiple criteria decision making (MCDM) has been researched for decades. Now as the rising trend of big-data analytics in supporting decision making, MCDM can be more powerful when combined with state-of-the-art analytics and machine learning. In this book, the authors introduce a new framework of MCDM, which can lead to more accurate decision making. Several real-world cases will be included to illustrate the new hybrid approaches.

Multiple Criteria Decision Analysis in Regional Planning Cambridge University Press

The book discusses state-of-the-art applications and methodologies of the Multiple Criteria Decision Making (MCDM) techniques and approaches. The book focuses on critical literature, underlying principles of methods and models, solution approaches, testing and validation, real-world applications, case studies, etc. The book helps evaluate strategic decision-making through advanced MCDM and integrated approaches of AI, big data, and IoT to provide realistic and robust solutions to the current problems. The book will be a guideline to the potential MCDM researchers about the choice of approaches for dealing with the complexities and modalities. The contributions of the book help readers to explore new avenues leading towards multidisciplinary research discussions. This book will be interesting for engineers, scientists, and students studying/working in the related areas.

Multi-criteria Decision Analysis for Supporting the Selection of Engineering Materials in Product Design Springer Science & Business Media

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.

Multiple Criteria Decision Analysis for Industrial Engineering Springer

Whether managing strategy, operations or products, knowing how to make the best decision in a complex, uncertain business environment is difficult. You might be faced with multiple, competing objectives, which means making trade-offs. To complicate matters, any uncertainty makes it hard to explicitly understand how different objectives will impact potential outcomes. This book will help you face these problems. It provides a decision analysis framework implemented as a simple spreadsheet tool. This multi-objective decision analysis framework helps you to measure trade-offs among objectives and incorporate uncertainties and risk preferences. With this book, you will be able to identify what information is needed to make a decision, define how that information should be combined, and, finally, provide quantifiable evidence to clearly communicate and justify the decision. The process involves minimal overhead and is perfect for busy professionals who need a simple, structured

process for making, tracking, and communicating decisions. This process makes decision making more efficient by focusing only on information and factors that are well-defined, measureable, and relevant to the decision at hand. The framework requires clear characterization of a decision, ensuring that it can be traced and is consistent with the intended objectives and organizational values. Using this structured decision-making framework, anyone can consistently make better decisions to gain competitive and strategic advantage.

Multiple Criteria Decision Analysis: State of the Art Surveys CRC Press

At a practical level, mathematical programming under multiple objectives has emerged as a powerful tool to assist in the process of searching for decisions which best satisfy a multitude of conflicting objectives, and there are a number of distinct methodologies for multicriteria decision-making problems that exist. These methodologies can be categorized in a variety of ways, such as form of model (e.g. linear, non-linear, stochastic), characteristics of the decision space (e.g. finite or infinite), or solution process (e.g. prior specification of preferences or interactive). Scientists from a variety of disciplines (mathematics, economics and psychology) have contributed to the development of the field of Multicriteria Decision Making (MCDM) (or Multicriteria Decision Analysis (MCDA), Multiattribute Decision Making (MADM), Multiobjective Decision Making (MODM), etc.) over the past 30 years, helping to establish MCDM as an important part of management science. MCDM has become a central component of studies in management science, economics and industrial engineering in many universities worldwide. Multicriteria Decision Making: Advances in MCDM Models, Algorithms, Theory and Applications aims to bring together 'state-of-the-art' reviews and the most recent advances by leading experts on the fundamental theories, methodologies and applications of MCDM. This is aimed at graduate students and researchers in mathematics, economics, management and engineering, as well as at practicing management scientists who wish to better understand the principles of this new and fast developing field.

GIS and Multicriteria Decision Analysis Springer

Multi-criteria decision making (MCDM) has been extensively used in diverse disciplines, with a variety of MCDM techniques used to solve complex problems. A primary challenge faced by research scholars is to decode these techniques using detailed step-by-step analysis with case studies and data sets. The scope of such work would help decision makers to understand the process of using MCDM techniques appropriately to solve complex issues without making mistakes. Multi-Criteria Decision Analysis in Management provides innovative insights into the rationale behind using MCDM techniques to solve decision-making problems and provides comprehensive discussions on these techniques from their inception, development, and growth to their advancements and applications. The content within this publication examines hybrid multicriteria models, value theory, and data envelopment. Ideal for researchers, management professionals, students, operations scholars, and academicians, this scholarly work supports and enhances the decision-making process.

Preference Disaggregation in Multiple Criteria Decision Analysis Anthem Press

Multiple Criteria Decision Analysis: State of the Art Surveys provides survey articles and references of the seminal or state-of-the-art research on MCDA. The material covered ranges from the foundations of MCDA, over various MCDA methodologies (outranking methods, multiattribute utility and value theories, non-classical approaches) to multiobjective mathematical programming, MCDA applications, and software. This vast amount of material is organized in 8 parts, with a total of 25 chapters. More than 2000 references are listed.

Trends in Multiple Criteria Decision Analysis Springer

Ports are essential for maritime transportation and global supply chains since they are nodes that connect the sea- and land-based modes of transportation. With containerization and supply

chains stimulating global trade, ports are challenged to adjust to changes in the market to create value to their customers. Therefore, this dissertation research focuses on the container port selection decision analysis to provide information to help shipping lines select the best port for their shipping networks. Since the problem is complex, dynamic, and involves multiple and conflicting criteria, the research proposes to use the multi-objective decision analysis with Value-Focused Thinking approach. The first chapter analyzes the port selection literature by timeline, journals, geographical location, and focus of the studies. Also, the research identifies the multiple criteria used in the port selection literature, as well as the models and approaches used for the analysis of the port selection decision problem. The second chapter develops a container port selection decision model for shipping lines using ports in West Africa. This model uses a multi-attribute value theory with valued-focused thinking and Alternative-Focused Thinking methodologies. The third chapter develops a port selection decision support system for shipping lines to select the best port in the U.S. Gulf Coast considering the impact of the Panama Canal's expansion. The decision support system uses the multi-objective decision analysis with Value-Focused Thinking approach, incorporating the opinion of an industry expert for the development of the value model. It also includes a cost model to quantify the cost of the alternatives. A Monte Carlo simulation is used to help decision makers understand the value and cost risks of the decision. The contribution of this research is that it provides a tool to decision makers of the shipping lines industry to improve the decision making process to select the port that will add the most affordable value to the global supply chains of their customers. In addition, researchers can use the proposed methodology for future port selection studies in other regions and from the perspectives of other stakeholders.

Multicriteria and Multiobjective Models for Risk, Reliability and Maintenance Decision Analysis John Wiley & Sons

Multicriteria analysis, or MCA, has been increasingly used in environmental decision-making to support the identification of suitable courses of action by integrating factual information with value-based information collected through stakeholder engagement. *Multicriteria Analysis for Environmental Decision-Making* provides an introduction to the key concepts of MCA and includes a series of case studies that illustrate the application of MCA to a variety of environmental decision-making problems ranging from protected area zoning to landfill siting, and from forest restoration to environmental impact assessment of tourism infrastructures. A compact reference that can be used by researchers, practitioners and planners/decision makers, *Multicriteria Analysis for Environmental Decision-Making* can also serve as a textbook for undergraduate and postgraduate courses in a broad range of curricula.

Multi-Criteria Decision Analysis Springer Science & Business Media

This book presents the main principles of preference disaggregation analysis and covers theoretical advances in preference modelling, group decision making, classification methods, robustness analysis, process mining, and decision support systems. In addition, it highlights several applications of the preference disaggregation analysis in a wide range of areas, such as customer satisfaction analysis, consumer behavior, energy and environmental policy, strategy development, and agricultural marketing. This book was published in honor of Yannis Siskos on the occasion of his retirement from the University of Piraeus, Greece. It offers a unique snapshot of the preference disaggregation philosophy in multiple criteria decision analysis and presents a range of research ideas, many of which were significantly influenced by Professor Siskos work.

Multiple-Objective Decision Analysis Applied to Chemical Engineering Butterworth-Heinemann
This work on strategic decision making focuses on multi-objective decision analysis with spreadsheets

Multiple Criteria Decision Analysis Springer

Decision analysis has become widely recognized as an important process for translating science into management actions. With climate change and other systemic threats as driving forces in creating environmental and engineering problems, there is a great need for understanding decision making frameworks through a case-study based approach. Management of environmental and engineering projects is often complicated and multidisciplinary in scope and nature, thus issues that arise can be difficult to solve analytically. *Multi-Criteria Decision Analysis: Case Studies in Engineering and the Environment* provides detailed description of MCDA methods and tools and illustrates their applications through case studies focused on sustainability and system engineering applications. New in the Second Edition: Addresses current and emerging environmental and engineering problems Includes seven new case studies to illustrate different management situations applicable at the international level Builds on real case studies from recent and relevant environmental and engineering management experience Describes advanced MCDA techniques and extensions used by practitioners Provides corresponding decision models implemented using the DECERNS software package Gives a more holistic approach to teaching MCDA methodology with a focus on sustainable solutions and adoption of new technologies, including nanotechnology and synthetic biology Given the novelty and inherent applicability of this decision-making framework to the environmental and engineering fields, a greater number of teaching tools for this topic need to be made available. This book provides those teaching tools, covering the breadth of the applications of MCDA methodologies with clear explanations of the MCDA process. The case studies are implemented in the DECERNS software package, allowing readers to experiment and explore and to understand the full process by which environmental managers assess these problems. This book is a great resource for professionals and students seeking to learn decision analysis techniques and apply similar frameworks to environmental and engineering projects

Decisions with Multiple Objectives Springer

This book describes how a confused decision maker, who wishes to make a reasonable and responsible choice among alternatives, can systematically probe their thoughts and feelings in order to make the critically important trade-offs between incommensurable objectives.

Multi-Criteria Decision Analysis in Management Springer Science & Business Media

This book is devoted to presenting theoretical fundamentals for the methods of multiple criteria decision making (MCDM) in the social sciences with particular intent to their applicability to real-world decision making. The main characteristics of the complex problems facing humans in the world today are multidimensional and have multiple objectives; they are large-scale, and have noncommensurate and conflicting objectives, such as economic, environmental, societal, technical, and aesthetic ones. The authors intend to establish basic concepts for treating these complex problems and to present methodological discussions for MCDM with some applications to administrative, or regional, planning. MCDM is composed of two phases: analytical and judgmental. In this book, we intend to consolidate these two phases and to present integrated methodologies for manipulating them with particular interest in managerial decision making, which has not yet been properly treated in spite of its urgent necessity. Although a number of books in MCDM fields have already been published in recent years, most of them have mainly treated one aspect of MCDM. Our work specifically intends to treat the methodology in unified systems and to construct a conceptual structure with special regards to the intrinsic properties of MCDM and its "economic meanings" from the social scientific point of view.

Multicriteria Decision Analysis in Geographic Information Science CRC Press

Many real-world decision problems have multiple objectives. For example, when choosing a medical treatment plan, we want to maximize the efficacy of the treatment, but also minimize the side effects. These objectives typically conflict, e.g., we can often increase the efficacy of the treatment, but at the cost

of more severe side effects. In this book, we outline how to deal with multiple objectives in decision-theoretic planning and reinforcement learning algorithms. To illustrate this, we employ the popular problem classes of multi-objective Markov decision processes (MOMDPs) and multi-objective coordination graphs (MO-CoGs). First, we discuss different use cases for multi-objective decision making, and why they often necessitate explicitly multi-objective algorithms. We advocate a utility-based approach to multi-objective decision making, i.e., that what constitutes an optimal solution to a multi-objective decision problem should be derived from the available information about user utility. We show how different assumptions about user utility and what types of policies are allowed lead to different solution concepts, which we outline in a taxonomy of multi-objective decision problems. Second, we show how to create new methods for multi-objective decision making using existing single-objective methods as a basis. Focusing on planning, we describe two ways to creating multi-objective algorithms: in the inner loop approach, the inner workings of a single-objective method are adapted to work with multi-objective solution concepts; in the outer loop approach, a wrapper is created around a single-objective method that solves the multi-objective problem as a series of single-objective problems. After discussing the creation of such methods for the planning setting, we discuss how these approaches apply to the learning setting. Next, we discuss three promising application domains for multi-objective decision making algorithms: energy, health, and infrastructure and transportation. Finally, we conclude by outlining important open problems and promising future directions.