Intuitionistic Fuzzy Sets Spherical Representation And

Keeping in view the importance of new defined and well growing spherical fuzzy sets, in this study, we proposed a novel method to handle the spherical fuzzy multi-criteria group decision-making (MCGDM) problems. Firstly, we presented some novel logarithmic operations of spherical fuzzy sets (SFSs). Then, we proposed series of novel logarithmic operators, namely spherical fuzzy weighted average operators and spherical fuzzy weighted geometric operators.
In this book, we approach different topics related to neutrosophics, such as: Neutrosophic Set, Intuitionistic Fuzzy Set, Inconsistent Intuitionistic Fuzzy Set, Picture Fuzzy Set, Ternary Fuzzy Set, Pythagorean Fuzzy Set, Atanassov's Intuitionistic Fuzzy Set of second type, Spherical Fuzzy Set, n-HyperSpherical Neutrosophic Set, q-Rung Orthopair Fuzzy Set, truth-membership, indeterminacy-membership, falsehood-nonmembership, Regret Theory, Grey System Theory, Three-Ways Decision, n-Ways Decision, Neutrosophy, Neutrosophication, Neutrosophic Probability, Refined Neutrosophy, Refined Neutrosophication, Nonstandard Analysis;

Extended Nonstandard Analysis; Open and Closed Monads to the Left/Right; Pierced and Unpierced Binads; MoBiNad Set; infinitesimals; infinities; nonstandard reals; standard reals; Nonstandard Neutrosophic Lattices of First Type (as poset) and Second Type (as algebraic structure); Nonstandard Neutrosophic Logic; Extended Nonstandard Neutrosophic Logic; Nonstandard Arithmetic Operations; Nonstandard Unit Interval; Nonstandard Neutrosophic Infimum; and so on.

This book is a collection of papers devoted to the emergence and development in Bulgarian Academy of Sciences of some of the areas of informatics, including artificial intelligence. The papers are prepared by specialists from the Academy, some of whom are among the founders of these scientific and application areas in Bulgaria and in some cases – in the world. The book is interesting for specialists in informatics and computer science and researchers in history of sciences.

This book offers a comprehensive reference guide for modeling humanoid robots using intelligent and fuzzy systems. It provides readers with the necessary intelligent and fuzzy tools for controlling humanoid robots by incomplete, vague, and imprecise information or insufficient data, where

classical modeling approaches cannot be applied. The respective chapters, written by prominent researchers, explain a wealth of both basic and advanced concepts including fuzzy control, metaheuristic-based control, neutrosophic control, etc. To foster reader comprehension, all 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 humanoid robots. Moreover, by extending all the main aspects of humanoid robots to its intelligent and fuzzy counterparts, the book presents a dynamic snapshot of the field that is expected to stimulate new directions, ideas, and developments.

Advances of Standard and Nonstandard Neutrosophic Theories

A Handbook on Theory and Applications

Theory and Applications

13th International Conference, IPMU 2010, Dortmund, Germany, June 28–July 2, 2010. Proceedings

Plithogenic Subjective Hyper-Super-Soft Matrices with New Definitions & Local, Global, Universal Subjective Ranking Model

Neutrosophic Set is a Generalization of Intuitionistic Fuzzy Set, Inconsistent Intuitionistic Fuzzy Set (Picture Fuzzy Set,

Ternary Fuzzy Set), Pythagorean Fuzzy Set, Spherical Fuzzy Set, and q-Rung Orthopair Fuzzy Set, while Neutrosophication is a Generalization of Regret Theory, Grey System Theory, and Three-Ways Decision (revisited)

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.

This book offers a comprehensive reference guide to customer-oriented product design and intelligence. It provides readers with the necessary intelligent tools for designing customer-oriented products in contexts characterized by incomplete information or insufficient data, where classical product design

approaches cannot be applied. The respective chapters, written by prominent researchers, explain a wealth of both basic and advanced concepts including fuzzy QFD, fuzzy FMEA, the fuzzy Kano model, fuzzy axiomatic design, fuzzy heuristics-based design, conjoint analysis-based design, and many others. To foster reader comprehension, all 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 customer-oriented product design. Moreover, by extending all the main aspects of classical customer-oriented product design to its intelligent and fuzzy counterparts, the book presents a dynamic snapshot of the field that is expected to stimulate new directions, ideas, and developments.
This book presents recent research in intelligent and fuzzy techniques. Emerging conditions such as pandemic, wars, natural disasters and various high technologies force people for significant changes in business and social life. The adoption of digital technologies to transform services or businesses, through replacing non-digital or manual processes with digital processes or replacing older digital technology with newer digital technologies through intelligent systems is the main scope of this book. It focuses on revealing the reflection of digital transformation in our business and social life under emerging conditions through intelligent and fuzzy systems. The latest intelligent and fuzzy methods

and techniques on digital transformation are introduced by theory and applications. The intended readers are intelligent and fuzzy systems researchers, lecturers, M.Sc. and Ph.D. students studying digital transformation. Usage of ordinary fuzzy sets and their extensions, heuristics and metaheuristics from optimization to machine learning, from quality management to risk management makes the book an excellent source for researchers.

This book gathers the most recent developments in fuzzy & intelligence systems and real complex systems presented at INFUS 2020, held in Istanbul on July 21–23, 2020. The INFUS conferences are a well-established international research forum to advance the foundations and applications of intelligent and fuzzy systems, computational intelligence, and soft computing, highlighting studies on fuzzy & intelligence systems and real complex systems at universities and international research institutions. Covering a range of topics, including the theory and applications of fuzzy set extensions such as intuitionistic fuzzy sets, hesitant fuzzy sets, spherical fuzzy sets, and fuzzy decision-making; machine learning; risk assessment; heuristics; and clustering, the book is a valuable resource for academics, M.Sc. and Ph.D. students, as well as managers and engineers in industry and the service sectors.

Neutrosophic Set is a Generalization of Intuitionistic Fuzzy Set, Inconsistent Intuitionistic Fuzzy Set

(Picture Fuzzy Set, Ternary Fuzzy Set), Pythagorean Fuzzy Set (Atanassov's Intuitionistic Fuzzy Set of second type), q-Rung Orthopair Fuzzy Set, Spherical Fuzzy Set, and n-HyperSpherical Fuzzy Set, while Neutrosophication is a Generalization of Regret Theory, Grey System Theory, and Three-Ways Decision (revisited)

On Intuitionistic Fuzzy Sets Theory

Proceedings of the INFUS 2021 Conference, held August 24-26, 2021. Volume 2

Developments Of Artificial Intelligence Technologies In Computation And Robotics - Proceedings Of The 14th International Flins Conference (Flins 2020)

Methods and Applications

Quadruple Neutrosophic Theory And Applications, Volume I

Contributors to current issue (listed in papers' order): Ibrahim Yasser, Abeer Twakol, A. A. Abd El-Khalek, A. A. Salama, Ahmed Sharaf Al-Din, Issam Abu Al-Qasim, Rafif Alhabib, Magdy Badran, Remya P. B, Francina Shalini, Masoud Ghods, Zahra Rostami, A. Sahaya Sudha, Luiz Flavio Autran Monteiro Gomes, K.R. Vijayalakshmi, Prakasam Muralikrishna, Surya Manokaran, Nidhi Singh, Avishek Chakraborty, Soma Bose Biswas, Malini Majumdar, Rakhal Das, Binod Chandra Tripathy, Nidhi Singh, Avishek Chakraborty, Nilabhra Paul, Deepshikha Sarma, Akash Singh, Uttam Kumar Bera, Fatimah M. Mohammed, Sarah W. Raheem, Muhammad Riaz, Florentin Smarandache, Faruk Karaaslan, Masooma Raza Hashmi, Iqra Nawaz, Kousik Das, Sovan Samanta, Kajal De, Xavier Encarnacion, Nivetha Martin, I. Pradeepa, N. Ramila Gandhi, P. Pandiammal, Aiman Muzaffar, Md Tabrez Nafis, Shahab Saquib Sohail,

Abhijit Saha, Jhulaneswar Baidya, Debjit Dutta, Irfan Deli, Said Broumi, Mohsin Khalid, Neha Andaleeb Khalid, Md. Hanif Page, Qays Hatem Imran, Shilpi Pal, S. Satham Hussain, Saeid Jafari, N. Durga, Hanieh Shambayati, Mohsen Shafiei Nikabadi, Seyed Mohammad, Ali Khatami Firouzabadi, Mohammad Rahmanimanesh, Mujahid Abbas, Ghulam Murtaza, K. Porselvi, B. Elavarasan, Y. B. Jun, Chinnadurai V, Sindhu M P, K.Radhika, K. Arun Prakash, Malayalan Lathamaheswari, Ruipu Tan, Deivanayagampillai Nagarajan, Talea Mohamed, Assia Bakali, Nivetha Martin, R. Dhavaseelan, Ali Hussein Mahmood Al-Obaidi, Suman Das, Surapati Pramanik, Madad Khan, Muhammad Zeeshan, Saima Anis, Abdul Sami Awan, M. Sarwar Sindhu, Tabasam Rashid, Agha Kashif, Rajesh Kumar Saini, Atul Sangal, Manisha.

In this paper, we initially introduce a novel type of matrix representation of Plithogenic Crisp/Fuzzy/Intuitionistic/Neutrosophic Hypersoft Set named as Plithogenic Crisp/Fuzzy/Intuitionistic/Neutrosophic Hypersoft Matrix, which is generated by multiple parallel sheets of matrices. Furthermore, these parallel sheets are representing parallel universes or parallel realities (a combination of attributes and sub-attributes w.r.t. subjects). We represent cross-sectional cuts of these hyper-soft matrices as parallel sheets (images of the expanded universe).

Although the single valued neutrosophic sets (SVNSs) are effective tool to express uncertain information and are superior to the fuzzy sets, intuitionistic fuzzy sets, Pythagorean fuzzy sets and q-rung orthopair fuzzy sets, there is not yet reported an operation which can provide desirable generality and flexibility under single valued neutrosophic environment, although many operations have been developed earlier to meet above such eventualities.

The purpose of this study is to evaluate risks which are frequently encountered in the engine room on-board. In this context, twenty common risks are assessed using the neutrosophic analytic hierarchy process (N-AHP) and trapezoidal fuzzy technique for order preference by similarity to ideal solution (TrF-TOPSIS).

Intelligent and Fuzzy Techniques for Emerging Conditions and Digital Transformation

Research in Computer Science in the Bulgarian Academy of Sciences

New Developments, Directions and Challenges

Neutrosophic Sets and Systems, Book Series, Vol. 35, 2020. An International Book Series in Information Science and Engineering

MADM Using m-Generalized q-Neutrosophic Sets

Spherical Fuzzy Logarithmic Aggregation Operators Based on Entropy and Their Application in Decision Support Systems

In this paper, we first develop a new Hamming distance between single-valued neutrosophic numbers and then present an extension of the TOPSIS method for multi-attribute group decision-making (MAGDM) based on single-valued neutrosophic sets, where the information about attribute values and attribute weights are expressed by decision-makers based on neutrosophic numbers. Climate change is one of the most challenging problems for the world, which leads researchers to study on the decrease of its impact to the environment at several disciplines. One of the most adverse effects on environment can be observed in transportation area. Hence, in this paper,

the impact of bridge maintenance on the environment is inquired in the bridge maintenance prioritization perspective. The aim of this paper is to rank the bridge maintenance projects using type-2 neutrosophic number (T2NN) based fuzzy WASPAS (Weighted Aggregated Sum Product Assessment) and TOPSIS (Technique For Order Preference By Similarity To An Ideal Solution) to test five alternative bridges, where a critical environmental criterion is introduced in this model, which addresses to additional CO_2 emission because of truck detours in the event of a bridge closures. The applicability of the proposed model is demonstrated in a case study in Turkey. The evaluation findings show that the ranking results are robust and the CO_2 emission criterion is found to be the dominant criterion in the multicriteria decision-making model proposed in this paper. This book aims to be a comprehensive and accurate survey of state-of-art research on intuitionistic fuzzy sets theory and could be considered a continuation and extension of the author ?s previous book on Intuitionistic Fuzzy Sets, published by Springer in 1999 (Atanassov, Krassimir T., Intuitionistic Fuzzy Sets, Studies in Fuzziness and soft computing, ISBN 978-3-79O8-1228-2, 1999). Since the aforementioned book has appeared, the research activity of the author within the area of intuitionistic fuzzy sets has been expanding into many directions. The results of the author ?s most recent work

covering the past 12 years as well as the newest general ideas and open problems in this field have been therefore collected in this new book.

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.

Technique for Reducing Dimensionality of Data in Decision-Making Utilizing Neutrosophic Soft Matrices

Essays in Honor of Fusun Ulengin

Research on the Shortest Path Solution Method of Interval Valued Neutrosophic Graphs Based on the Ant Colony Algorithm

New types of Neutrosophic Set/Logic/Probability, Neutrosophic Over-/Under-/Off-Set, Neutrosophic Refined Set, and their Extension to Plithogenic Set/Logic/Probability, with Applications

CO_2 Emission based prioritization of bridge maintenance projects using neutrosophic fuzzy sets based decision making approach

Intelligent and Fuzzy Techniques

International Journal of Neutrosophic Science (IJNS) is peer-review journal publishing high quality experimenta and theoretical research in all areas of Neutrosophic ar its Applications. Papers concern with neutrosophic logi and mathematical structures in the neutrosophic settin Besides providing emphasis on topics like artificial intelligence, pattern recognition, image processing, robotics, decision making, data analysis, data mining, applications of neutrosophic mathematical theories contributions to economics, finance, management, industries, electronics, and communications are promoted.

This book addresses new concepts, methods, algorithm modeling, and applications of green supply chain, inventory control problems, assignment problems, transportation problem, linear problems and new information related to optimization for the topic from theoretical and applied viewpoints of neutrosophic sets and logic. The book is an innovatory of new tools and procedures, such as: Neutrosophic Statistical Tests and Dependent State Samplings, Neutrosophic Probabilistic Expert Systems, Neutrosophic HyperSoft Set, Quadripartitioned Neutrosophic Cross-Entropy, Octagonal and Spherical and Cubic Neutrosophic Numbers used in machine learning. It highlights the process of neutrosofication {which means to split the universe into three parts, two opposite ones (Truth an Falsehood), and an Indeterminate or neutral one (I) in between them}. It explains Three-Ways Decision, how t

universe set is split into three different distinct areas, regard to the decision process, representing: Acceptan Noncommitment, and Rejection, respectively. The Three Way Decision is used in the Neutrosophic Linguistic Rough Set, which has never been done before.

The problem of energy crisis and environmental polluti has been mitigated by the generation and use of solar power; however, the choice of locations for solar powe plants is a difficult task because the decision-making process includes political, socioeconomic, and environmental aspects.Thus, several adverse consequences have been created by the choice of suboptimal locations. The objective of this paper is to address the integrated qualitative and quantitative multicriteria decision-making framework for the selecti of solar power plant locations. Neutrosophic sets (NSs are the latest extension of the ordinary fuzzy sets. The main characteristic of the neutrosophic sets is satisfyi the condition that the sum of the truth, indeterminacy falsity grades must be at least zero and at most three this research, we establish novel operational laws base on the Yager t-norm and t-conorm under neutrosophic environments (NE).

Fuzzy logic, which is based on the concept of fuzzy set has enabled scientists to create models under conditio of imprecision, vagueness, or both at once. As a result, has now found many important applications in almost a sectors of human activity, becoming a complementary feature and supporter of probability theory, which is

suitable for modelling situations of uncertainty derived from randomness. Fuzzy mathematics has also significantly developed at the theoretical level, providing important insights into branches of traditional mathematics like algebra, analysis, geometry, topology, and more. With such widespread applications, fuzzy sets and logic are an important area of focus in mathematics. The Handbook of Research on Advances and Applications of Fuzzy Sets and Logic studies recent theoretical advances of fuzzy sets and numbers, fuzzy systems, fuzzy logic and their generalizations, extensions, and more. This book also explores the applications of fuzzy sets and logic applied to science, technology, and everyday life to further provide research on the subject. This book is ideal for mathematicians, physicists, computer specialists, engineers, practitioners, researchers, academicians, and students who are looking to learn more about fuzzy sets, fuzzy logic, and their applications.

Decision Support Technique Based on Neutrosophic Yager Aggregation Operators: Application in Solar Power Plant Locations - Case Study of Bahawalpur, Pakistan

Digital Acceleration and The New Normal - Proceedings of the INFUS 2022 Conference, Volume 1

Toward Humanoid Robots: The Role of Fuzzy Sets

Information Processing and Management of Uncertainty in Knowledge-Based Systems

International Journal of Neutrosophic Science (IJNS) Volume 9, 2020

Neutrosophic Sets and Systems, Vol. 35, 2O2O

"Neutrosophic Sets and Systems" has been created for publications on advanced studies in neutrosophy, neutrosophic set, neutrosophic logic, neutrosophic probability, neutrosophic statistics that started in 1995 and their applications in any field, such as the neutrosophic structures developed in algebra, geometry, topology, etc.

The International Conference on Information Processing and Management of - certainty in Knowledge-Based Systems, IPMU, is organized every two years with the aim of bringing together scientists working on methods for the management of uncertainty and aggregation of information in intelligent systems. Since 1986, this conference has been providing a forum for the exchange of ideas between th theoreticians and practitioners working in these areas and related ?elds. The 13 IPMU conference took place in Dortmund, Germany, June 28–July 2, 2010. This volume contains 79 papers selected through a rigorous reviewing process. The contributions re?ect the richness of research on topics within the scope of the conference and represent several important developments, speci?cally focused on theoretical foundations and methods for information processing and management of uncertainty in knowledge-based systems. We were delighted that Melanie Mitchell (Portland State University, USA), Nihkil R. Pal (Indian

Statistical Institute), Bernhard Sch¨ olkopf (Max Planck I- titute for Biological Cybernetics, Tubing¨ en, Germany) and Wolfgang Wahlster (German Research Center for Arti?cial Intelligence, Saarbruc¨ ken) accepted our invitations to present keynote lectures. Jim Bezdek received the Kamp ´ede F´ eriet Award, granted every two years on the occasion of the IPMU conference, in view of his eminent research contributions to the handling of uncertainty in clustering, data analysis and pattern recognition.

FLINS, an acronym introduced in 1994 and originally for Fuzzy Logic and Intelligent Technologies in Nuclear Science, is now extended into a well-established international research forum to advance the foundations and applications of computational intelligence for applied research in general and for complex engineering and decision support systems.The principal mission of FLINS is bridging the gap between machine intelligence and real complex systems via joint research between universities and international research institutions, encouraging interdisciplinary research and bringing multidiscipline researchers together.FLINS 2020 is the fourteenth in a series of conferences on computational intelligence systems.

"Neutrosophic Sets and Systems" has been created for publications on advanced studies in neutrosophy, neutrosophic set, neutrosophic

logic, neutrosophic probability, neutrosophic
statistics that started in 1995 and their
applications in any field, such as the neutrosophic
structures developed in algebra, geometry,
topology, etc. Some articles in this issue:
Neutrosophic Soft Fixed Points, Selection of
Alternative under the Framework of Single-Valued
Neutrosophic Sets, Application of Single Valued
Trapezoidal Neutrosophic Numbers in
Transportation Problem.

Decision Making with Spherical Fuzzy Sets
Proceedings of the INFUS 2020 Conference,
Istanbul, Turkey, July 21-23, 2020
Multi-Attribute Multi-Perception Decision-Making
Based on Generalized T-Spherical Fuzzy Weighted
Aggregation Operators on Neutrosophic Sets
AN EXTENSION OF THE TOPSIS FOR MULTI-
ATTRIBUTE GROUP DECISION MAKING UNDER
NEUTROSOPHIC ENVIRONMENT
Intelligent and Fuzzy Techniques in Big Data
Analytics and Decision Making
Proceedings of the INFUS 2019 Conference,
Istanbul, Turkey, July 23-25, 2019
This book offers a comprehensive reference
guide for the theory and practice of
intelligent and fuzzy techniques in
Aviation 4.0. It provides readers with the
necessary intelligent and fuzzy tools for
Aviation 4.0 when incomplete, vague, and
imprecise information or insufficient data
exist in hand, where classical modeling

approaches cannot be applied. The respective chapters, written by prominent researchers, explain a wealth of both basic and advanced concepts including baggage services, catering services, check-in and boarding services, maintenance and cargo management, security, etc. To foster reader comprehension, all 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 Aviation 4.0. Moreover, by extending all the main aspects of Aviation 4.0 to its intelligent and fuzzy counterparts, the book presents a dynamic snapshot of the field that is expected to stimulate new directions, ideas, and developments.

Interval neutrosophic sets (INSs) provide us with a more flexible and effective way to express incomplete, indeterminate, and inconsistent information..epurpose of this paper is to introduce the new multicriteria decision-making (MCDM) method based on the improved projection model under the interval neutrosophic environment. In this paper, we investigated the basic concepts and operational rules of interval neutrosophic numbers (INNs), then proposed the

projection of two INNs and improved the entropy formula of the INNs. Furthermore, this paper took account into the decision maker's attitude towards the indeterminacy and risk and proposed two different methods to determine the ideal solutions. Based on this, we presented an improved MCDM method based on the projection model under the interval neutrosophic environment. Finally, the practicability and reliability of the proposed method were explained by the example of software quality-in-use evaluation.

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.

International Journal of Neutrosophic Science (IJNS) is a peer-review journal publishing high quality experimental and theoretical research in all areas of Neutrosophic and its Applications. IJNS is published quarterly. IJNS is devoted to the publication of peer-reviewed original research papers lying in the domain of neutrosophic sets and systems. Papers submitted for possible publication may concern with foundations, neutrosophic logic and mathematical structures in the neutrosophic setting. Besides providing emphasis on topics like artificial intelligence, pattern recognition, image processing, robotics, decision making,

data analysis, data mining, applications
of neutrosophic mathematical theories
contributing to economics, finance,
management, industries, electronics, and
communications are promoted.
Logarithmic Hybrid Aggregation Operators
Based on Single Valued Neutrosophic Sets
and Their Applications in Decision Support
Systems
Neutrosophic Operational Research
Handbook of Research on Advances and
Applications of Fuzzy Sets and Logic
The Projection Model with Unknown Weight
Information under Interval Neutrosophic
Environment and Its Application to
Software Quality-in-Use Evaluation
New Perspectives in Operations Research
and Management Science
Neutrosophic Sets and Systems, Vol. 29,
2019

**This book presents some recent specialized works of
theoretical study in the domain of fuzzy systems. Over
eight sections and fifteen chapters, the volume addresses
fuzzy systems concepts and promotes them in practical
applications in the following thematic areas: fuzzy
mathematics, decision making, clustering, adaptive neural
fuzzy inference systems, control systems, process
monitoring, green infrastructure, and medicine. The
studies published in the book develop new theoretical
concepts that improve the properties and performances of
fuzzy systems. This book is a useful resource for specialists,**

engineers, professors, and students.
This book presents innovative operations research
applications in business, specifically industrial engineering
and its sub-disciplines. It investigates new perspectives in
operations research and management science with regard
to research methods, the research context, and industrial
engineering, offering readers a broad range of new
approaches to management problems. The book features
the latest work of researchers who have worked with
Professor Fusun Ulengin or built upon her work in their
academic careers. Written in honor of Prof. Ulengin, this
book was edited by her former Ph.D. students, who are
now experts in operations research, multiple criteria
decision making, competitiveness, logistics, and supply
chain management. Prof. Ulengin's impact in academia is
visible in the range of topics and methodologies featured in
this book: Location and transportation problems,
competitiveness of nations, food supply chains, debt
collection, mathematical modelling, multiple criteria
decision making, data envelopment analysis, random
forests, and Bayesian networks.
This book contains 37 papers by 73 renowned experts from
13 countries around the world, on following topics:
neutrosophic set; neutrosophic rings; neutrosophic
quadruple rings; idempotents; neutrosophic extended
triplet group; hypergroup; semihypergroup; neutrosophic
extended triplet group; neutrosophic extended triplet
semihypergroup and hypergroup; neutrosophic offset;
uninorm; neutrosophic offuninorm and offnorm;
neutrosophic offconorm; implicator; prospector; n-person
cooperative game; ordinary single-valued neutrosophic

(co)topology; ordinary single-valued neutrosophic subspace; ?-level; ordinary single-valued neutrosophic neighborhood system; ordinary single-valued neutrosophic base and subbase; fuzzy numbers; neutrosophic numbers; neutrosophic symmetric scenarios; performance indicators; financial assets; neutrosophic extended triplet group; neutrosophic quadruple numbers; refined neutrosophic numbers; refined neutrosophic quadruple numbers; multigranulation neutrosophic rough set; nondual; two universes; multiattribute group decision making; nonstandard analysis; extended nonstandard analysis; monad; binad; left monad closed to the right; right monad closed to the left; pierced binad; unpierced binad; nonstandard neutrosophic mobinad set; neutrosophic topology; nonstandard neutrosophic topology; visual tracking; neutrosophic weight; objectness; weighted multiple instance learning; neutrosophic triangular norms; residuated lattices; representable neutrosophic t-norms; De Morgan neutrosophic triples; neutrosophic residual implications; infinitely ?-distributive; probabilistic neutrosophic hesitant fuzzy set; decision-making; Choquet integral; e-marketing; Internet of Things; neutrosophic set; multicriteria decision making techniques; uncertainty modeling; neutrosophic goal programming approach; shale gas water management system.

The shortest path problem (SPP) is considerably important in several fields. After typhoons, the resulting damage leads to uncertainty regarding the path weight that can be expressed accurately. A neutrosophic set is a collection of the truth membership, indeterminacy membership, and

falsity membership degrees of the elements. In an uncertain environment, neutrosophic numbers can express the edge distance more effectively.

Intelligent and Fuzzy Techniques: Smart and Innovative Solutions

Uncertain Fuzzy Preference Relations and Their Applications

A Novel Risk Evaluation Approach For Frequently Encountered Risks In Ship Engine Rooms

Fuzzy Systems

Intelligent and Fuzzy Systems

Intelligent and Fuzzy Techniques in Aviation 4.0

In this paper we prove that Neutrosophic Set (NS) is an extension of Intuitionistic Fuzzy Set (IFS) no matter if the sum of single-valued neutrosophic components is 1, or = 1. For the case when the sum of components is 1 (as in IFS), after applying the neutrosophic aggregation operators one gets a different result from that of applying the intuitionistic fuzzy operators, since the intuitionistic fuzzy operators ignore the indeterminacy, while the neutrosophic aggregation operators take into consideration the indeterminacy at the same level as truth-membership and falsehood-nonmembership are taken. NS is also more flexible and effective because it handles, besides independent components, also partially independent and partially dependent components, while IFS cannot deal with these. Since there are many types of indeterminacies in our world, we can construct different approaches to various neutrosophic concepts.

On the basis of fuzzy sets and some of their relevant generalizations, this book systematically presents the fundamental principles and applications of group decision making under different scenarios of preference relations. By

using intuitionistic knowledge as the field of discourse, this work investigates by utilizing innovative research means the fundamental principles and methods of group decision making with various different intuitionistic preferences: Mathematical reasoning is employed to study the consistency of group decision making; Methods of fusing information are applied to look at the aggregation of multiple preferences; Techniques of soft computing and optimization are utilized to search for satisfactory decision alternatives. Each chapter follows the following structurally clear format of presentation: literature review, development of basic theory, verification and reasoning of principles , construction of models and computational schemes, and numerical examples, which cover such areas as technology, enterprise competitiveness, selection of airlines, experts decision making in weather-sensitive enterprises, etc. In terms of theoretical principles, this book can be used as a reference for researchers in the areas of management science, information science, systems engineering, operations research, and other relevant fields. It can also be employed as textbook for upper level undergraduate students and graduate students. In terms of applications, this book will be a good companion for all those decision makers in government, business, and technology areas.
The decision-making problems in which there are large numbers of qualitative and quantitative factors involved, the technique of dimensionality reduction plays an important role for simplicity and wider applicability.
This book presents recent research in intelligent and fuzzy techniques on digital transformation and the new normal, the state to which economies, societies, etc. settle following a crisis bringing us to a new environment. Digital transformation and the new normal-appearing in many areas such as digital economy, digital finance, digital government,

digital health, and digital education are the main scope of this book. The readers can benefit from this book for preparing for a digital "new normal" and maintaining a leadership position among competitors in both manufacturing and service companies. Digitizing an industrial company is a challenging process, which involves rethinking established structures, processes, and steering mechanisms presented in this book. The intended readers are intelligent and fuzzy systems researchers, lecturers, M.Sc., and Ph.D. students studying digital transformation and new normal. The book covers fuzzy logic theory and applications, heuristics, and metaheuristics from optimization to machine learning, from quality management to risk management, making the book an excellent source for researchers.

Fuzzy Logic in Its 50th Year
Customer Oriented Product Design
International Journal of Neutrosophic Science (IJNS) Volume 6, 2020
The purpose of this paper is to introduce new aggregation operators based on logarithmic operations and to develop a multi-criteria decision-making approach to study the interaction between the input argument under the single valued neutrosophic (SVN) environment. The main advantage of the proposed operator is that it can deal with the situations of the positive interaction, negative interaction or non-interaction among the criteria, during decision-making process.
In this paper, we prove that Neutrosophic Set (NS) is an extension of Intuitionistic Fuzzy Set (IFS) no matter if the sum of neutrosophic components is 1, or $=1$. For the case

when the sum of components is 1 (as in IFS), after applying the neutrosophic aggregation operators, one gets a different result than applying the intuitionistic fuzzy operators, since the intuitionistic fuzzy operators ignore the indeterminacy, while the neutrosophic aggregation operators take into consideration the indeterminacy at the same level as truth-membership and falsehood-nonmembership are taken.

The framework of the T-spherical fuzzy set is a recent development in fuzzy set theory that can describe imprecise events using four types of membership grades with no restrictions. The purpose of this manuscript is to point out the limitations of the existing intuitionistic fuzzy Einstein averaging and geometric operators and to develop some improved Einstein aggregation operators.