The Intuitionistic Fuzzy FlowSort Method for Multicriteria Group Decision Making

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ABSTRACT

The real-life problems are multidimensional in nature and may involve some ambiguity when it comes to decision making. It is, therefore, difficult to design the evaluation criteria precisely and determine the exact value of the attributes in the multicriteria analysis. The intuitionistic fuzzy set (IFS) achieved great success in treating this kind of ambiguity in a great deal of research. The study of sorting problems is an active research issue in the multiple criteria decision aid (MCDA) area. This paper investigated one of the sorting methods, FLOWSORT, and extended it to the multicriteria group decision making based on the output aggregation of the individual sorting results. The rating of each alternative was described through linguistic terms that can be expressed in triangular intuitionistic fuzzy numbers. An illustrative example as well as an empirical comparison with other multi-criteria decision-making methods were carried out to validate the extension.

KEYWORDS

FlowSort Method, Intuitionistic Fuzzy Set, Multicriteria Group Decision Making, Sorting Problematic

1. INTRODUCTION

Multi-criteria decision making (MCDM) is considered as an essential part of modern decision science and operational research. It is the process of finding the best compromise among the feasible alternatives. It provides a wide variety of methodologies and techniques that enable the systematic treatment of decision problems under multiple criteria. The MCDA methods can be applied to four different kinds of analyses that can be performed in order to provide significant support to decision-makers (Remadi and Frikha, 2019). These are: (1) the choice of the best alternative, (2) the ranking of the set of the alternatives from the best to the worst, (3) the description of the features of the alternatives and (4) the classification of the alternatives into predefined homogenous groups.

In this paper, we studied the ordinal classification problem, also called sorting problem. It consists to orienting the decision problem to an assignment of alternatives to one of the predefined, ordered and homogenous categories or classes. The class is a set of alternatives with similar properties or even values for the same properties, when compared to the alternatives of the other classes. Multiple methods have been proposed during the previous decades. Among these, we can mention the well-known sorting methods, the ELECTRE-TRI (Shen et al. 2016), the THESEUS (Fernandez and Avarro, 2011), etc. Relying on the PROMETHEE (Brans et al. 1984) methodology, several authors proposed

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Intuitionistic Fuzzy Multicriteria Group Decision Making

Shuping Wan, Jiuying Dong

Intuitionistic Fuzzy Multicriteria Group Decision Making:

Algebraic Structures of Neutrosophic Triplets, Neutrosophic Duplets, or Neutrosophic Multisets Florentin Smarandache, Xiaohong Zhang, Mumtaz Ali, 2019-04-04 Neutrosophy 1995 is a new branch of philosophy that studies triads of the form where is an entity i e element concept idea theory logical proposition etc is the opposite of while is the neutral or indeterminate between them i e neither nor Based on neutrosophy the neutrosophic triplets were founded which have a similar form x neut x anti x that satisfy several axioms for each element x in a given set This collective book presents original research papers by many neutrosophic researchers from around the world that report on the state of the art and recent advancements of neutrosophic triplets neutrosophic duplets neutrosophic multisets and their algebraic structures that have been defined recently in 2016 but have gained interest from world researchers Connections between classical algebraic structures and neutrosophic triplet duplet multiset structures are also studied And numerous neutrosophic applications in various fields such as multi criteria decision making image segmentation medical diagnosis fault diagnosis clustering data neutrosophic probability human resource management strategic planning forecasting model multi granulation supplier selection problems typhoon disaster evaluation skin lesson detection mining algorithm for big data analysis etc

Algebraic Structures of Neutrosophic Triplets, Neutrosophic Duplets, or Neutrosophic Multisets, Volume II Florentin Smarandache, Xiaohong Zhang, Mumtaz Ali, Neutrosophy 1995 is a new branch of philosophy that studies triads of the form where is an entity i e element concept idea theory logical proposition etc is the opposite of while is the neutral or indeterminate between them i e neither nor Based on neutrosophy the neutrosophic triplets were founded they have a similar form x neut x anti x that satisfy some axioms for each element x in a given set This book contains the successful invited submissions to a special issue of Symmetry reporting on state of the art and recent advancements of neutrosophic triplets neutrosophic duplets neutrosophic multisets and their algebraic structures that have been defined recently in 2016 but have gained interest from world researchers and several papers have been published in first rank international journals

Neutrosophic Sets and Systems, vol. 19/2018 Florentin Smarandache, Surapati Pramanik, 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 Neutrosophic Operational Research, 2nd volume Florentin Smarandache, Mohamed Abdel-Basset, Victor Chang, 2017 This book treats all kind of data in neutrosophic environment with real life applications approaching topics as linear programming problem linear fractional programming integer programming triangular neutrosophic numbers single valued triangular neutrosophic number neutrosophic optimization goal programming problem Taylor series multi objective programming problem neutrosophic geometric programming neutrosophic topology neutrosophic open set neutrosophic semi open set neutrosophic continuous function cylindrical skin plate design

neutrosophic MULTIMOORA alternative solutions decision matrix ratio system reference point method full multiplicative form ordinal dominance standard error market research and so on The selected papers deal with the alleviation of world changes including changing demographics accelerating globalization rising environmental concerns evolving societal relationships growing ethical and governance concern expanding the impact of technology some of these changes have impacted negatively the economic growth of private firms governments communities and the whole society Sets and Systems, Book Series, Vol. 35, 2020. An International Book Series in Information Science and Engineering Florentin Smarandache, Mohamed Abdel-Basset, 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 Igra 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

Different Forms of Triangular Neutrosophic Numbers, De-Neutrosophication Techniques, and their Applications Avishek Chakraborty, Sankar Prasad Mondal, Ali Ahmadian, Norazak Senu, Shariful Alam, Soheil Salahshour, In this paper we introduce the concept of neutrosophic number from different viewpoints We define different types of linear and non linear generalized triangular neutrosophic numbers which are very important for uncertainty theory We introduced the de neutrosophication concept for neutrosophic number for triangular neutrosophic numbers. This concept helps us to convert a neutrosophic number into a crisp number. The concepts are followed by two application namely in imprecise project evaluation review technique and route selection problem. Neutrosophic Sets and Systems, Vol. 35, 2020 Florentin Smarandache, Mohamed Abdel-Basset, 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

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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
MULTI-CRITERIA GROUP DECISION MAKING MODEL USING SINGLE-VALUED NEUTROSOPHIC SET Suman Das,Rakhal Das,Binod Chandra Tripathy, In this article we introduce some approaches for decision making in the neutrosophic set The purpose of this study is to develop a neutrosophic multi criteria group decision making MCGDM model based on hybrid score accuracy functions for approving a tender for construction under a simplified neutrosophic environment Five criteria have been selected from experts opinions to be considered for the distribution of tender In this paper we use the score functions the accuracy functions and the hybrid score accuracy functions of single valued neutrosophic numbers SVNNs and ranking method for SVNNs those will help for making a decision
Journal of Zhejiang University ,2007
Prosiding Seminar Bidang Kepakaran Jabatan Matematik, 2010 ,2011 Proceedings of a seminar on study and teaching of mathematics in Malaysia
The Journal of Fuzzy Mathematics ,1998

Multiple Criteria Decision Making with Fuzzy Sets Babek Erdebilli, Gerhard-Wilhelm Mathematical Reviews .2004 Weber, 2022-06-28 Using numerical examples to illustrate their concepts and results this book examines recently developed fuzzy multi criteria methods such as Intuitionistic Fuzzy TOPSIS Intuitionistic Fuzzy TOPSIS DEA AHP Intuitionistic VIKOR Pythagorean WASPAS Pythagorean ENTROPI Hesitant CBD Hesitant MABAC Triangular EDAS Triangular PROMETHEE g Rung Orthopair COPRAS and Fuzzy Type 2 ELECTRE Each chapter covers practical applications in addition to fresh developments and results Given its structure and scope the book can be used as a textbook in graduate courses on operations research and industrial engineering It also offers a valuable resource for scientists working in a range of disciplines that require multi criteria decision making Simplified neutrosophic sets and their applications in multi-criteria group decision-making problems Juan-juan Peng, Jian-giang Wang, Jing Wang, Hong-yu Zhang, Xiao-hong Chen, As a variation of fuzzy sets and intuitionistic fuzzy sets neutrosophic sets have been developed to represent uncertain imprecise incomplete and inconsistent information that exists in the real world Simplified neutrosophic sets SNSs have been proposed for the main purpose of addressing issues with a set of specific numbers However there are certain problems regarding the existing operations of SNSs as well as their aggregation operators and the comparison methods Therefore this paper defines the novel operations of simplified neutrosophic numbers SNNs and develops a comparison method based on the related research of intuitionistic fuzzy numbers On the basis of these operations and the comparison method some SNN aggregation operators are proposed Additionally an approach for multi criteria group decision making MCGDM problems is explored by applying

these aggregation operators Finally an example to illustrate the applicability of the proposed method is provided and a comparison with some other methods is made **Real Life Applications of Multiple Criteria Decision Making** Techniques in Fuzzy Domain Laxminarayan Sahoo, Tapan Senapati, Ronald R. Yager, 2022-12-01 This edited book discusses creative and recent developments of fuzzy systems and its real life applications of multiple criteria decision making Keeping on the existing fuzzy sets and recent developed fuzzy sets viz intuitionistic fuzzy Pythagorean fuzzy Fermatean fuzzy Hesitant fuzzy and multiple criteria decision approaches this book is committed to probing the soft computing techniques and fuzzy multiple criteria decision making in favour of fuzzy intelligent system and business analytics It also addresses novel development of fuzzy set theory as well as real life applications of fuzzy systems It presents challenging and useful real world applications based on problems of decision making in various fields The modelling and solution procedures of such real world problems will be provided concisely although all topics start with a more developed resolution. The contributory chapters will be based on the vast research experiences of the authors in real world decision making problems This book provides readers with a valuable conspectus of several decision making problems as a reference for researchers and industrial practitioners in this field This book will broadly cover recent development of fuzzy systems and its applications of multiple criteria decision making in the areas of management and production manufacturing management selections problems group decision making transportation and logistics inventory control systems and interval technique fuzzy technique uncertainty of the above mentioned areas Decision Making Theories and Methods Based on Interval-Valued Intuitionistic Fuzzy Sets Shuping Wan, Jiuying Dong, 2020-02-03 This is the first book to provide a comprehensive and systematic introduction to the ranking methods for interval valued intuitionistic fuzzy sets multi criteria decision making methods with interval valued intuitionistic fuzzy sets and group decision making methods with interval valued intuitionistic fuzzy preference relations Including numerous application examples and illustrations with tables and figures and presenting the authors latest research developments it is a valuable resource for researchers and professionals in the fields of fuzzy mathematics operations research information science management science and decision analysis Mathematics in practice and theory ,2006

Multi Criteria Decision Making Via Intuitionistic Fuzzy Set Pranjal Talukdar,2023-01-04 The characteristic function of a crisp set assigns a value either 1 or 0 to each object in a set and thereby distinguishesthe members and non members of crisp set under consideration The function can be generalized such that the values assigned to the elements of a set fall within a specific range from 0 to 1 and indicate the membership grade of these elements in the set in question Larger values denote higher degree of set membership Such function is called a membership function and the set defined by it is known as fuzzy set In short it can be opinedthat the crisp set and logic divide the world of yes or no true or false but nothing in between On the other hand fuzzy sets and logic deal with objects that are of degree with all possible grades between yes or no Thus fuzzy set represents the vague or ill defined not well defined concept like good very good poor intelligent large and medium large

etc and hence it can be extensively applied in a wide range of area Zadeh developed this novel concept of fuzzy sets that created a new branch of Mathematics which is used to characterize the uncertainty A lot of significant developments have been made by the researchers in the last five decades and applied it in a large variety of fields It is observed that in fuzzy set theory FST the non membership function is the complement of the membership function But in many situations complement of membership function may not reflect the exact non membership grades of an element to a set Later Atanassov defined both the membership function and nonmembership function which also characterized some hesitation degree between them This newly defined set is called Intuitionistic fuzzy set IFS As IFS can represent the incomplete ill defined information in a more specific manner than FST therefore IFS become more popular among the researchers in uncertainty modeling problems Furthermore Atanassov and Gargov introduced the notion of Interval valued intuitionistic fuzzy sets IVIFSs extending the concept IFS in which the membership and non membership grades are represented by intervals Starting from our many daily life situations up to very complex system making decision is undoubtedly one of the most necessary activities of human being It is a logical judgment process to identifying and choosing the right alternatives based on the preferences and values of the decision maker with respect to its criteria In mathematical point of view there should be some methodology and algorithm through which one can make a logical and proper decision Recently decision making processes have become popular in industries in different managerial level of the concerned department of many organizations because of their global competitiveness making good planning and to survive successfully in respective marketplace Therefore decision making plays a vital role especially in purchase department for reducing material costs minimizing production time as well as improving the quality of product or service Fuzzy Techniques for Decision Making José Carlos R. Alcantud, 2018-05-18 This book is a printed edition of the Special Issue Fuzzy Techniques for Decision Making that was published in Symmetry

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