As per UGC guidelines an electronic bar code is provided to seure your paper

International Journal for Modern Trends in Science and Technology, 8(01): 210-213, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0801035
Available online at: http://www.ijmtst.com/vol8issue01.html

Applications of Interval-Valued Intuitioistic Fuzzy Soft Sets in Decision Making

Dr. Rajesh Kumar Pal

Associate Professor, Department of Mathematics, D.A.V. (PG) College, Dehradun-248001.

To Cite this Article
Dr. Rajesh Kumar Pal. Applications of Interval-Valued Intuitioistic Fuzzy Soft Sets in Decision Making. *International Journal for Modern Trends in Science and Technology* 2022, *8* pp. 210-213. https://doi.org/10.46501/IJMTST0801035

Article Info
Received: 09 December 2021; Accepted: 06 January 2022; Published: 12 January 2022.

ABSTRACT

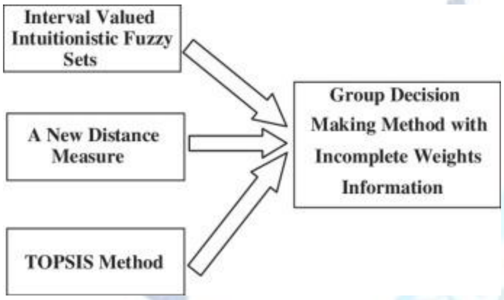
Soft set theory in combination with the interval-valued intuitionistic fuzzy set has been proposed as the concept of the interval-valued intuitionistic fuzzy soft set. However, up to the present, few documents have focused on practical applications of the interval-valued fuzzy intuitionistic soft sets. In this paper, Firstly, we present the algorithm to solve decision making problems based on interval-valued intuitionistic fuzzy soft sets, which can help decision maker obtain the optical choice. And then we propose a definition of normal parameter reduction of interval-valued intuitionistic fuzzy soft sets, which considers the problems of suboptimal choice and added parameter set, and give a heuristic algorithm to achieve the normal parameter reduction of interval-valued intuitionistic fuzzy soft sets. Finally, an illustrative example is employed to show our contribution.

Keywords: Soft sets , Interval-valued, intuitionistic, fuzzy , Decision, Reduction, Normal , parameter

1.INTRODUCTION

Molodtsov initiated the concept of soft set theory, which can be used as a generic mathematical tool for dealing with uncertainty. However, it has been pointed out that classical soft sets are not appropriate to deal with imprecise and fuzzy parameters. The notion of the interval-valued intuitionistic fuzzy soft set theory is proposed. Our interval-valued intuitionistic fuzzy soft set theory is a combination of an interval-valued intuitionistic fuzzy set theory and a soft set theory. In other words, our interval-valued intuitionistic fuzzy soft set theory is an interval-valued fuzzy extension of the intuitionistic fuzzy soft set theory or an intuitionistic fuzzy extension of the interval-valued fuzzy soft set theory. The complement, “and”, “or”, union, intersection, necessity and possibility operations are defined on the interval-valued intuitionistic fuzzy soft sets. The basic properties of the interval-valued intuitionistic fuzzy soft sets are discussed.[1,2]

Decision-making is a technique which all of us do every day in different contexts. In Decision-making several alternates are there from which the best one is to be selected. But the alternates may not be crisp many times. So, uncertainty based techniques are necessary to solve these problems. Among the different models of uncertainty, we have fuzzy sets, intuitionistic fuzzy sets and soft sets. There are other variations of fuzzy sets like the interval valued fuzzy sets. Also, we have hybrid models obtained by combining two or more of these models. Molodtsov introduced the notion of soft set in 1999, which has better parameterization capability than most of the other such models. The hybrid model of interval valued fuzzy set and soft set was introduced by Yang in 2009. We extend it to define interval valued intuitionistic fuzzy parameterized soft set (IVIFPSS) and establish their properties. Continuing the earlier works on using hybrid models in decision-making, we use IVIFPSS to put forth two algorithms on decision-making. Out of these two one is on individual decision-making and the other one is on group decision making.[3,4]



A new distance measure for interval valued intuitionistic fuzzy sets and its application to group decision making problems

2. OBSERVATIONS

We shall focus on the issue of MAGDM under interval-valued intuitionistic fuzzy environment where all the information provided by the DMs is characterized by IVIFNs, the information about DMs is completely unknown, and the information about attributes is partially known. The main contributions of this work can be summarized as follows:(i)A consensus-based method is developed to determine the weights of DMs.(ii)A multiobjective optimization model is proposed to determine the weights of attributes.(iii)A TOPSIS-based MAGDM model under interval-valued intuitionistic fuzzy environment is established via the aggregation operator, the weights of DMs, and the weights of attributes.Overall, in light of the above three aspects, the proposed method delivers a new vision of modeling uncertain group decision making problems from application fields.[5,6]

The remainder of this paper is organized as follows. We have proposed a method to solve the MAGDM problem in which all the information supplied by the decision makers is expressed as interval-valued intuitionistic fuzzy decision matrices where each of the elements is characterized by an interval-valued intuitionistic fuzzy number, and the information about the weights of both decision makers and attributes may be completely unknown or partially known. The main merits of this method cover three aspects. Firstly, the problem of determining the weights of DMs and attributes has been solved by the proposed consensus-based method and the proposed multiobjective model, respectively. Secondly, a complete mathematical formulation of MAGDM has been established, and its advantages have been proved by two examples. In addition, we have defined the correlation coefficient between two interval-valued intuitionistic fuzzy matrices which develops basic theories on IVIFSs.[7,8]

It should be noted that we just consider the situation where the information about DMs is completely unknown. In the future, we will consider the situations where the weights information about both DMs and attributes is expressed with various constraint conditions. Meanwhile, we will employ the proposed method to model some uncertain decision making problems from some concrete applied fields, such as medical decision making, social economic, and financial assessment.

TABLE 4 Decision Value

house	IVIFSWA		IVIFSDV max-min		IVIFSDV min-max	
	S	D	S	D	S	D
h_1	0.64	0.57	0.5	0.8	0.43	0.75
h_2	0.65	0.59	0.5	0.8	0.83	0.75
h_3	0.55	0.55	0.34	0.75	0.4	0.7
h_4	0.61	0.57	0.45	0.7	0.38	0.75
h_4	0.64	0.58	0.55	0.8	0.38	0.75

Step 5:

According to rule "weighted averaging", the result is:

$h_2 > h_1 > h_5 > h_4 > h_3$

According to rule "max-min", the result is:

$h_2 = h_1 > h_5 > h_4 > h_3$

According to rule "min-max", the result is:

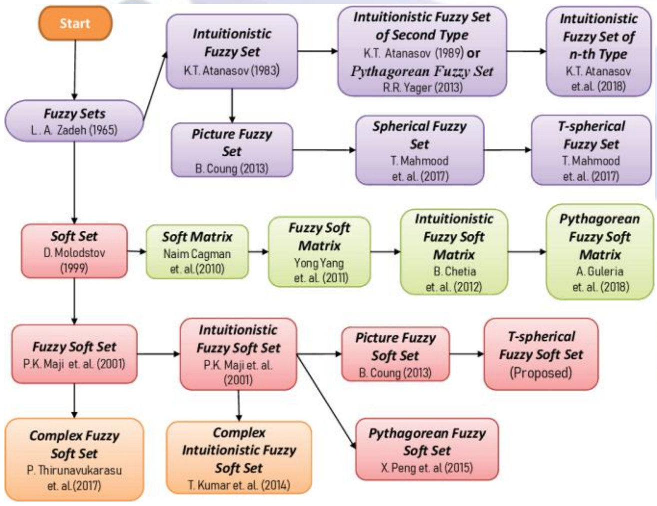
$h_2 > h_1 > h_3 > h_4 = h_5$

Thus the best alternative is the house h2.

3. DISCUSSION

If we identify a set A in X by its membership function μA : → [0, 1]. Then a set A is called an FS. Indeed, A = {(x, μA A(x) represents a grade ofμX}. A real number ∈(x)): x membership of a fuzzy set A defined over a universe. Definition 2.2 2 A pair (F, A) is called an SS over M if A is any subset of E, and there exists a mapping from A to P (M) is F, P (M) is the parameterized family of subsets of the M but not a set. Definition 2.3 6 Suppose X and E are universe set and set of attributes E. Let (fA, E) be a SS over X. Then a⊆respectively and A fA∈A, g∈E, uniquely defined as RA ={(g, t): t×subset RA of X (t)}, is called a relation form of the SS (fA, E). The characteristic function χRA of RA is defined as χRA : E→{0,1} where×X χRA (g, t) = { 1, (g,t) ∈ RA RA∉0, (g,t) Now if X= {$g1$, $g2$, $g3$,…., gm} and E={$t1$, $t2$, $t3$,…., tn} then the SS (fA, E) can be represented by a matrix $[aij]m\times n$ called a " SM" of SS (fA, E) over X as follows $[aij]m\times n$ = [$a11$ $a12$ ⋯ $a1n$ $a21$ $a22$ ⋯ $a2n$ ⋮ ⋮ ⋮ ⋮ $am1$ $am2$ ⋯ amn] Where aij = χRA (gi , ti) In other words, an SS is uniquely represented by its corresponding SM. So, we can define a function ρ which maps SS to SM i.e. ρ: RA⟶ [aij] Where aij = χRA (gi , ti) [9]

A pair (F, A) is called FSS over M, and there exists a mapping from A to P (M) is F, P (M) is the collection of fuzzy subsets of M. Definition 2.5 35 A pair (F, A) is called FSS in the fuzzy soft class (M, E). Then (F, A) is represented in a matrix form such as $Am\times n$ = $[aij]m\times n$ or A = [aij] (i = 1→ m), (j = 1 → n) Where aij = { $\mu j(bj)$ if bj ∈ A 0 if bj ∉ A Definition 2.6 22 Let A be a set and U be a universal set than IVFS in A over U is defined as A = {(p, [$\mu AL(p)$, μAU (p)]): p ∈ U}, Where $\mu AL(p)$ and μAU (p) are a fuzzy subset of U and $\mu AL(p) \le \mu AU(p)$ for all i, j. Definition 2.7 22 Let A = [$\mu AL(p)$, μAU (p)] and B = [$\mu BL(p)$, μBU (p)] are two IVFS over U, then A is said to be IVF-subset of B if $\mu AL(p) \le \mu BL(p)$ and μAU (□) ≤ □□□ (□) for all p ∈ U., it is represented as A ⊆ B.



The concepts of fuzzy sets, soft sets, fuzzy soft sets, and interval-valued fuzzy soft sets are presented in this work with some properties and operations. By using the IVFSMmDM function we develop a graphical model known as the IVFSMmDM method. Finally, we use the proposed model for the selection of patients who need medical treatment on urgent bases according to given symptoms.[10,11]

4. RESULTS

We focused on handling complex data sets using the properties of interval-valued complex fuzzy sets (IVCFSs). We extend the IV-CFS model to include a generalization parameter that reflects the opinion of experts to validate the information provided by the users. Our proposed generalized interval-valued complex fuzzy soft set model allows users to indicate their confidence in the data through the interval-based membership structure. The built-in validation mechanism in the model provides a robust framework that allows experts to ratify the individual hesitancy of the users supplying data to the system. To further enhance the utility of the proposed model, we introduce a weighted geometric aggregation operator and an accompanying score function. This aggregation operator reduces the multiple components in the proposed model into a single component with the aim of analyzing the decision-making process in a precise manner. An application of the aggregation operator and score function is demonstrated via a MADM problem related to measuring the effects of the implementation of TPPA by the Malaysian government on selected sectors of the Malaysian economy, and the time taken for these effects to manifest itself on the economic sectors that are considered. The results derived from this method is then corroborated using the interval-valued complex fuzzy concept lattice method.[12,13]

Inference method	*Definition*	*Area of inferred output fuzzy set,* $A(\hat{\mu})$
Mamdani minimum, R_{MM}	min($\hat{\mu}$, μ (output))	$\hat{\mu}(a_{m+1}-b_{m-1})\left[2-\hat{\mu}(1-\theta_m)\right]/2$
Larsen product, R_{LP}	$\hat{\mu}.\mu$ (output)	$\hat{\mu}(a_{m+1}-b_{m-1})(1+\theta_m)/2$
Drastic product, R_{DP}	Case 1 : $\hat{\mu}$, if μ (output) = 1	$\hat{\mu}\theta_m(a_{m+1}-b_{m-1})$
	Case 2 : μ (output), if $\hat{\mu}=1$	$(a_{m+1}-b_{m-1})(1+\theta_m)/2$
	Case 3 : 0, if $\hat{\mu}$, μ (output) < 1	0

5. CONCLUSION

There are many mathematical constructions similar to or more general than fuzzy sets. Since fuzzy sets were introduced in 1965, many new mathematical constructions and theories treating imprecision, inexactness, ambiguity, and uncertainty have been developed. Some of these constructions and theories are extensions of fuzzy set theory, while others try to mathematically model imprecision and uncertainty in a different way[14,15]

REFERENCES

[1] L. A. Zadeh (1965) "Fuzzy sets" Archived 2015-08-13 at the Wayback Machine. Information and Control 8 (3) 338–353.

[2] Klaua, D. (1965) Über einen Ansatz zur mehrwertigen Mengenlehre. Monatsb. Deutsch. Akad. Wiss. Berlin 7, 859–876. A recent in-depth analysis of this paper has been provided by Gottwald, S. (2010). "An early approach toward graded identity and graded membership in set theory". Fuzzy Sets and Systems. 161 (18): 2369–2379. doi:10.1016/j.fss.2009.12.005.

[3] D. Dubois and H. Prade (1988) Fuzzy Sets and Systems. Academic Press, New York.

[4] Liang, Lily R.; Lu, Shiyong; Wang, Xuena; Lu, Yi; Mandal, Vinay; Patacsil, Dorrelyn; Kumar, Deepak (2006). "FM-test: A fuzzy-set-theory-based approach to differential gene expression data analysis". BMC Bioinformatics. 7: S7. doi:10.1186/1471-2105-7-S4-S7. PMC 1780132. PMID 1721752 5.

[5] "AAAI". Archived from the original on August 5, 2008.

[6] Jump up to:a b c Ismat Beg, Samina Ashraf: Similarity measures for fuzzy sets, at: Applied and Computational Mathematics, March 2009, available on Research Gate since November 23rd, 2016

[7] Jump up to:a b c d N.R. Vemuri, A.S. Hareesh, M.S. Srinath: Set Difference and Symmetric Difference of Fuzzy Sets, in: Fuzzy Sets Theory and Applications 2014, Liptovský Ján, Slovak Republic

[8] Goguen, Joseph A., 196, "L-fuzzy sets". Journal of Mathematical Analysis and Applications 18: 145–174

[9] Bui Cong Cuong, Vladik Kreinovich, Roan Thi Ngan: A classification of representable t-norm operators for picture fuzzy sets, in: Departmental Technical Reports (CS). Paper 1047, 2016

[10] Tridiv Jyoti Neog, Dusmanta Kumar Sut: Complement of an Extended Fuzzy Set, in: International Journal of Computer Applications (097 5–8887), Volume 29 No.3, September 2011

[11] Jump up to:a b c Yanase J, Triantaphyllou E (2019). "A Systematic Survey of Computer-Aided Diagnosis in Medicine: Past and Present Developments". Expert Systems with Applications. 138: 112821. doi:10.1016/j.eswa.2019.112821.

[12] Smarandache, Florentin (1998). Neutrosophy: Neutrosophic Probability, Set, and Logic: Analytic Synthesis & Synthetic Analysis. American Research Press. ISBN 978-1879585638.

[13] Jump up to:a b Yanase J, Triantaphyllou E (2019). "The Seven Key Challenges for the Future of Computer-Aided Diagnosis in Medicine". International Journal of Medical Informatics. 129: 413–422. doi:10.1016/j.ijmedinf.2019.06.017. PMID 31445285.

[14] Yager, Ronald R. (June 2013). "Pythagorean fuzzy subsets". 2013 Joint IFSA World Congress and NAFIPS Annual Meeting (IFSA/NAFIPS). IEEE: 57–61. doi:10.1109/IFSA-NAFIPS.2013.6608375. ISBN 978-1-4799 -0348-1. S2CID 36286152.

[15] Yager, Ronald R (2013). "Pythagorean membership grades in multicriteria decision making". IEEE Transactions on Fuzzy Systems. 22 (4): 958–965. doi:10.1109/TFUZZ.2013.2278989. S2CID 37195356.