Interval Valued Fuzzy Soft Sets and Fuzzy Connectives

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Abstract: The Article, We Learning A Few Operations Of Interval Valued Fuzzy Soft Sets Of Connectives And Give Elementary Properties Of Interval Valued Fuzzy Soft Sets Of Principal Disjunctive Normal Form And Principal Conjunctive Normal Form.

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Keyword: The Article, Fuzzy Soft Sets Of Principal Disjunctive Normal Form And Principal Conjunctive Normal Form.

I. INTRODUCTION

IVFSS gives the grouping of idea with the connectives "∧," "∨," "→, ''↔ ., are exacting overview of Boolean algebra forms. For any idea, form by the sets A and B, it is find that we are form 16 various idea as the mixture of the innovative idea A and B. then as well famous that their Boolean algebra Forms are as Principal Disjunction Normal Form and Principal Conjunction Normal Form, PDNF and PCNF, respectively. In this forms are constructing as the disjunction of valid major conjunction for the crate of PDNF and conjunction of valid main disjunctions in the crate of PCNF. It is well known that PDNF [·] = PCNF [·], if $x, y \in \{0,1\}\, for\ x \in A, y \in B$, and the connectives "∧,'' "∨,'' "→, ''↔., are denoted with the De Morgan law of minimum-maximum, that is , we are in use in the concept of Boolean algebra complete with its support condition which exist the law of "expelled center .'' $A \cup \overline{A}$ = 1, and its dual, the axiom of "opposition," $A \cup \overline{A}$ = 0, distributive, idem potency, absorbtion,etc. When the laws of "Abstain centre" and "Contradiction" are comfortable (and a, b ∈ [0, 1], as Zadeh planned in his determining paper [17]), it has been Shown that PDNF [·] ⊆ PCNF [·] (see [14], for the particular case of the De Morgan law of maximum-minimum and complement). Further it has been see, that, in general, PDNF [·] ⊆ PCNF[·], [13] for a certain class of normal forms T, and S (in intelligence of Schweizer and Sklar [6, 7, 8]), that satisfy the Following conditions:

$$x \le T(\,S[x,y], S[x,\overline{y}\,]),$$
$$x \ge T(\,S[x,y], S[x,\overline{y}\,]),$$
$$y \ge T(\,S[x,y], S[\overline{x}\,,y])$$

Where $x, y \in [0,1]\, for\ x \in A, y \in B, \overline{x} = 1 - x$, and $\overline{y} = 1 - y$, i.e., when we are in use below the consideration of boundary, associative, commutative of norms forms T and S. It should be recognized that the 3 clear states of relationships declared on top of in actuality reduce to one: certainly, since T and S are duals of each other, order one and two are also dual to each other. Order three is not something more than appositional variable modify due to regularity of norms T and S. With the recognition that PDNF ⊆ PCNF, Turksen [13] planned for IVFSS's by the PDNF and PCNF boundaries be predictable models to symbolize a joint ideas formed by the connective "∧ '', "∨,".

II. PRELIMINARIES:

DEFINITION: 1.1 FUZZY SET

A fuzzy set A of a set X can be defined as a set of ordered pairs $\{x, \mu_A(x)/x \in X\}$, the interval [0,1] we can define a mapping μ_A between element of the set X and value in the interval [0,1], (ie) $\mu_A: X \to [0,1]$, 0 denote complete non-membership value and 1 denote membership value and value in connecting are used to stand for in-between degree of membership value .

DEFINITION: 1.2. SOFT SET.

Let (U, E) be the soft universal, $A \subseteq E$. Let $F(U)$ be the set of all fuzzy subset in U. A ordered pair $(\overline{F}, A)$ is called a fuzzy soft set over U. where $\overline{F}$ is a function defined by $\overline{F}: A \to F(U)$

DEFINITION: 1.3. INTERVAL VALUED FUZZY SOFT SET.

Let X be any set. A mapping $[[F, A]]: X \to I[0,1]$ is called an interval valued subset [IVFSS] on X. when $I[0,1]$ denoted the group of all closed subintervals of [0,1]and $[[F, A]](x) = [[F, A] - (x), [F, A] + (x)]$ for all x in X.Where $[F, A] -$ and $[F, A] +$ are fuzzy soft subset of X such that $[[F, A] - (x) \le [F, A] + (x)]$ for all x in X that is $[[F, A]] + (x)](x)$ is an period (a closed subset of [0,1]) and not member in a interval [0,1] as in the holder of fuzzy soft set.

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DEFINITION: 1.4. PRINCIPAL DISJUNCTIVE NORMAL FORMS:

For a given statement formula an equivalent formula consisting of disjunction of minimum only is kwon as its Principal disjunctive normal form. (ie)

PDNF= [Minimum] ∨ [Mminimum] ∨ …∨ [Minimum]

DEFINITION:1.5.PRINCIPAL CONJUNCTIVE NORMAL FORMS:

For a given statement formula an equivalent formula consisting of conjunctive of maximum only is kwon as its Principal Conjunctive normal form. (ie)

PCNF= [Maximum] ∧ [Maximum] ∧ …∧ [Maximum]

A ∧ B ≙ [PDNF [A ∧ B], PCNF [A ∧ B]]

A ∨ B≙ [PDNF [A ∨ B], PCNF [A ∨ B]]

In this planned symbol, specific PDNF and PCNF language are 1st to be clearly identify for each joint ideas, and therefore the corresponding connective, in Tables 1 and 2.2nd they are to be find in the membership field with a select De Morgan law of normal form of T and S, and the remain that we write to ∧,∨, and Thus, for illustration, for the connectives "∧," "∨," we have:

$\mu_{PDNF}[A \wedge B] = T[x,y]$

$\mu_{PCNF}[A \wedge B] = T[T[S[x,y], S[x,\overline{y}\,], S[\overline{x},y]]$

$\mu_{PDNF}[A \wedge B] = [S[S[x,y], T[x,\overline{y}]\,, T[\overline{x},y]]$

$\mu_{PCNF}[A \vee B] = S[x,y]$

Where $x, y \in [0,1], \overline{x} = 1 - x, \overline{y} = 1 - y, x \in A$, and $y \in B$

It is to be experiential that $\mu_{PDNF}[A \wedge B] = T[x,y]$ corresponds to be the Ordinary crisp denote of "∧" in mainly present fuzzy journalism and its claim. But this is one and only the lower boundary of the IVFSS [A ∧ B], Where IVFSS [A ∧ B] instantly regarding but quite suitably denote the semantic imprecision of "∧ "that be supposed to be linked with its normal phrase use. In the same way, it is to be pragmatic that,

$$\mu_{PCNF}[A \vee B] = S[x,y]$$

In the same way to the general crisp representations of "∨ "in mostly present fuzzy immense effort and in this applications. But this crisp representations not well replicate the imprecision thus be linked in the common communication use of this connectives, and their unsure semantic meanings. While, as it will be explained in the next section, these IVFSS

Table 1: List of connective ideas of for A and B

S.No	Meaning	Combination
1	Disjunction	$A \vee B$
2	Conjunction	$A \wedge B$
3	Conjunctive Negation	$\sim A \wedge \sim B$
4	Disjunctive negation	$\sim A \vee \sim B$
5	Negation Biconditional	$\sim A \rightleftharpoons \sim B$
6	Contraction	$False$
7	Conditional (if then)	$A \rightarrow B$
8	Non-Conditional	$\sim A \rightarrow \sim B$
9	Inverse proposition	$A \wedge \sim B$
10	Not-inverse proposition	$\sim A \wedge B$
11	Biconditional	$A \rightleftharpoons B$
12	Exclusion	$A \uparrow B$
13	Statement	A
14	Cancellation A	$\sim A$
15	declaration B	B
16	Cancellation B	$\sim B$

Table 2: combined rule for A and B

S.No	PDNF	PCNF
1	$(A \wedge B) \vee (A \wedge \sim B) \vee (\sim A \wedge B) \vee (\sim A \wedge \sim B)$	U
2	φ	$(A \vee B) \wedge (A \vee \sim B) \wedge (\sim A \vee B) \wedge (\sim A \vee \sim B)$
3	$(A \wedge B) \vee (A \wedge \sim B) \wedge (\sim A \wedge B)$	$(A \vee B)$
4	$(\sim A \wedge \sim B)$	$(A \vee \sim) \wedge (\sim \wedge B) \wedge (A \sim \vee \sim B)$
5	$(A \wedge \sim B) \vee (\sim A \wedge B) \vee (\sim \wedge \sim B)$	$(\sim A \vee \sim B)$
6	$(A \wedge B)$	$(A \vee B) \wedge (A \vee \sim B) \wedge (\sim A \vee B)$
7	$(A \wedge B) \vee (\sim \wedge B) \vee (\sim \wedge \sim)$	$(\sim A \vee B)$
8	$(A \wedge \sim B)$	$(A \vee B) \wedge (A \vee \sim B) \wedge (\sim A \vee \sim B)$
9	$(A \wedge B) \vee (A \wedge \sim) \vee (\sim \wedge \sim)$	$(A \vee \sim B)$
10	$(\sim \wedge B)$	$(A \vee B) \wedge (\sim A \vee B) \wedge (\sim A \vee \sim B)$
11	$(A \wedge B) \vee (\sim A \wedge \sim)$	$(A \vee \sim B) \wedge (\sim A \vee B)$
12	$(A \wedge \sim) \vee (\sim \wedge B)$	$(A \vee B) \wedge (\sim A \vee \sim B)$

13	$(A\ \wedge B)\vee(A\wedge\sim)$	$(A\vee B)\wedge(A\vee\sim B\ )$
14	$(\sim\wedge B)\vee(\sim A\ \wedge\sim B)$	$(\sim A\vee B)\wedge(\sim A\vee\sim B\ )$
15	$(A\wedge B)\vee(\sim\wedge B)$	$(A\vee B)\wedge(\sim A\vee B)$
16	$(A\ \wedge\sim B\ )\vee(\sim A\ \wedge\sim B)$	$(A\ \vee\sim A\ )\wedge(\sim A\vee\sim B\ )$

Table 2: PDNF and PCNF equivalent to connectivity first table

Representations of connectives have a practical established efficient representativeness associated with them, minimum, for the connectives "∧'' and "∨''.

COMPENSATORY '∧'

It can basically find out by the normal character use of "∧," "∨" by individual organism experts do not communicate to T-norms T and t-co-norms S. They considered veiled connective in individual conclusion manufacture, identified as "Compensatory '∧' "which we can defined by

$$\mu_{A0B} = \mu_{A\wedge B}^{1-\lambda}\,\mu_{A\vee B}^{\lambda} \text{ ------ ---------------------------- (1)}$$

Also defined as $\mu_{A0B} = (1-\lambda)\mu_{A\wedge B} + \lambda\cdot\mu_{A\vee B}$ ------ ------ ------------------- (2)

Where zero is the "Compensatory '∧' " and A and B are fuzzy soft sets. The equation (1) is identified as the "exp Compensatory '∧'," and the Equation (2) is identified as the "Co -convex-Linear Compensatory '∨'." In a current analysis [10], it is shown that either:

$$\mu_{PDNF}[A\wedge B]\le\mu_{A0B}\le\mu_{PCNF}[A\wedge B]$$

And

$$\mu_{PDNF}[A\vee B]\le\mu_{A0B}\le\mu_{PCNF}[A\vee B]$$

And

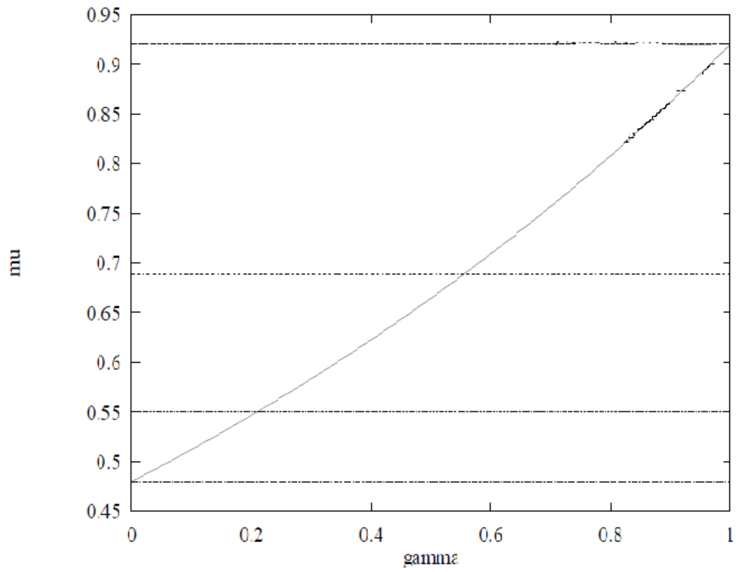
$$\mu_{PCNF}[A\wedge B]\le\mu_{A0B}\le\mu_{PDNF}[A\vee B]$$

For some values of [0, 1] and for together the "Exp" and " Co-convex linear" "Compensatory '∧'." we see in diagram 1, the world Amateur implication of the "∧" or "∨" and might be find out and then fixed each in "∨" interval area, that is , among $(\mu_{PDNF}[A\vee B],\mu_{PCNF}[A\wedge B])$ Where an individual concept, that is his scale of "∨" this can be denoted with a value within "∨" borders , or "∧" interval area, that is involving $\mu_{PDNF}[A\wedge B],\mu_{PCNF}[A\wedge B]$.where range of "∧ "ness this can be denoted within "∧" borders or as an appropriate grouping of "∧" or "∨" in the middle interval area connecting, $\mu_{PCNF}[A\wedge B],\mu_{PDNF}[A\vee B]$ corresponding the expert value located in the this sense of "∧" and "∨". Merely while an expert way absolutely "∧," then we can give

$$\mu_{PDNF}[A\wedge B] = T[x,y]$$

and only when a expert means absolutely "or" should we use

$$\mu_{PCNF}[ifA\vee B] = S[x,y]$$



Here
Comp ''∧''
PCNF for '∨'
PDNF for' ∨'
PCNF for '∧'
PCNF for '∧'

IVFSS "A ∧ B," "A ∨ B," oral in PDNF and PCNF and "Exp Compensatory ''∧ " with algebraic sum-product for thoughtful of normal forms for $\mu_A = 0.7, B = 0.8$, and $\in[0,1]$ or else we be supposed to defined them with appropriate IVFSS's as derived above. later than the estimate is received out in IVFSS to come back the semantic imprecision associated with these connectives, then a point-valued representative may be choose such as denote with the clear suggestion of the type 2 enlarge about it.

INTERVAL-VALUED FUZZY SOFT SET IMPLICATION

Immediately in the connectives "$\wedge$," "$\vee$," the proposition "$\to$" be able to be expressed in an interval-valued fuzzy soft set representation to return the vagueness associated with the humans use of "$\to$" in common literature . In this view, another time it is supposed to be well-known that "crisp implications," Bandler, such as:

$CS_1: x \to_5 y =$Minimum$(1, \overline{x} + y)$,

$C\,S_2: x \to_2 y = (\overline{x} + xy)$,

$CS_3: x \to_3 y = (\overline{x} \wedge y)$

$CS_4: x \to_4 y = (x \wedge y) \vee x$,

$CS_5: x \to_5 y = (x \to_4 y) \wedge (x \vee \overline{y})$,

Be the ones that are founded and helpful in a lot of additional of the present journalism. It has shown [11, 13], that the majority of these "crisp implications" terminology is enclosed inside the IVFSS representation of "$\to$" as follows:

$$\mu_{PDNF}\,[A \to B\,/\wedge,\vee,-] \le \{CS_4, CS_5, CS_6\} \le \mu_{PCNF}[A \to B\,/\wedge,\vee,-\,]$$

$$\mu_{PDNF}\,[A \to B\,/+,.,-\,] \le \{\,CS_2\} \le \mu_{PCNF}[A \to B/\,+,.,-]$$

$$\mu_{PCNF}\,([\,A \to B\,/\,,\wedge_+,\vee_+,+\,] \le \{CS_2, CS_6\} \le \mu_{PDNF}[A \to B/\wedge_+,\vee_+,-]$$

and

$$\wedge,\vee,-,+,.,-\,,\wedge_+,\vee_+,-$$

Be the maximum-minimum, arithmetic, sum and product and union, intersection, res. regrettably, for the cases of implications," we contain no new results to back up the continuation of "Compensatory 'implication' "in usual words uses.

NEW COMPENSATORY INTERVAL VALUED FUZZY SOFT SET CONNECTIVES

Obviously the Zimmermann and Zysno [20] definition of the "Compensatory '$\wedge$'."We derive the following properties: for this part, we classify and explore 4 probable recognition of "Compensatory '$\wedge$' " operators when A ''$\wedge$'' B and A '' $\vee$ '' B is interpreted as connectives in expressions of the PDNF and PCNF terms of normal forms [9]. It be supposed to be founded that compensatory connective are fundamentally interpreted as the grouping of normal forms [20] either exp or Co-convex. Therefore by substitute normal form with PDNF of '$\wedge$' and PCNF of '$\wedge$', and normal forms with PDNF of '' $\vee$ '' and PCNF of '' $\vee$ '', then we get 4 innovative "Compensatory '$\wedge$' "operators for moreover exp compensatory connectives or Co-convex compensatory connectives.

DEFINITION.1.6.

The PDNF of normal form based exponential "Compensatory ' $\wedge$ ' " operators are defined on the membership value as follows:

$$t_1^\lambda[x,y] = [\mu_{PCNF}\,[A \wedge B]]^{1-\lambda}[[\mu_{PCNF}\,[A \wedge B]]^\lambda\,;$$
$$t_2^\lambda[x,y] = [\mu_{PDNF}\,[A \wedge B]]^{1-\lambda}[[\mu_{PCNF}\,[A \vee B]]^\lambda\,;$$
$$t_3^\lambda[x,y] = [\mu_{PCNF}\,[A \wedge B]]^{1-\lambda}[[\mu_{PDNF}\,[A \vee B]]^\lambda;$$
$$t_1^\lambda[x,y] = [\mu_{PDNF}[A \wedge B]]^{1-\lambda}[[\mu_{PDNF}\,[A \vee B]]^\lambda\,.$$

Obviously

$$\rho_1^\lambda[x,y] = t_2^\lambda[x,y] = [\mu_{PDNF}\,[A \wedge B]]^{1-\lambda}[[\mu_{PCNF}\,[A \vee B]\lambda$$

the Zimmermann and Zysno [20] definition of the "Compensatory 'and ' ."We derive the following theorem:

THEOREM1.1: for $\alpha_1^\lambda[x,y]\ \beta_1^\lambda[x,y]\,,\beta_2^\lambda[x,y],\beta_3^\lambda[x,y],\beta_4^\lambda[x,y],\ \forall\, x,y \in [0,1]$ the following result holds

$$\alpha_1^\lambda[x,y] = \beta_2^\lambda[x,y] = [\mu_{PDNF}\,[A \wedge B])]^{1-\lambda}[\mu_{PCNF}\,[A \vee B]]^\lambda$$

$$\alpha_1^\lambda[x,y] \le \beta_1^\lambda[x,y] = [\mu_{PDNF}\,[A \wedge B]]^{1-\lambda}[\mu_{PCNF}\,[A \vee B]]^\lambda$$

$$\alpha_1^\lambda[x,y] \ge \beta_4^\lambda[x,y] = [\mu_{PDNF}\,[A \wedge B]]^{1-\lambda}[\mu_{PCNF}\,[A \vee B]]^\lambda$$

It is evident that the virtual among $\beta_3^\lambda[x,y], \beta_1^\lambda[x,y]$, and the relation between $\beta_3^\lambda[x,y]\ and\ \beta_4^\lambda[x,y]$, are quite obvious

$$\beta_3^\lambda[x,y] \ge \beta_1^\lambda[x,y]$$
$$\beta_3^\lambda[x,y] \ge \beta_3^\lambda[x,y]$$

Every in this property be able to be derivative from the properties for the PCNF and PDNF of fuzzy soft sets and the function $f(x,y) = s^{1-\lambda}t^\lambda$. Still the relation between $\beta_3^\lambda[x,y]$ and $\beta_1^\lambda[x,y]$ is not as clear as others. Then we can found the family members of a condition on your own as the family member mostly depends on the domain that it lies in. In order to study this family member, we build a new purpose as follows:

$$g(\lambda) = \alpha_1^\lambda[x,y] - \beta_3^\lambda[x,y] = \left[\mu_{PDNF}\,[A \wedge B]\right]^{1-\lambda}\left[\mu_{PCNF}\,[A \wedge B]\right]^\lambda - [\mu_{PDNF}\,[A \wedge B]]^{1-\lambda}[\mu_{PCNF}\,[A \vee B]]^\lambda.$$

Hence the theorem.

CONCLUSION

In this paper using fuzzy connectives ''AND'' and ''OR operator and some theorems and going to develop other connective'' NAND'' or'' NOR'' operator.

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