Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 1, January-2023, ISSN 2230-7540

Measuring Intuitionistic Fuzzy Set Relative membership: An analytical approach

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Abstract - The interesting IFS (Intuitionistic Fuzzy Set) theory, introduced by K. T. Atanassov, is a tool for problem-solving. The IFS effectively broadens Zadeh's imprecise set. Recently, the IFS theory has been applied to many different domains, such as logic programming, decision making problems, and medical diagnoses.Fuzzy sets can be defined as For any space S, there exists a fuzzy set F specified as a non-empty collection of 2-tuple members. Each constituent of an IFS is a 4-tuple consisting of a membership degree, reluctance degree, and non-membership degree, and the collection is defined in a domain of speech where u_r:S[0,1]. The degree of hesitation u_r (g)[0,1] can play a role in participation, in non-membership, or in both. The following illustrations illustrate the aforementioned three levels.

Keywords - Intuitionistic Fuzzy Set, logic programming, and decision making problems

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INTRODUCTION

The author of [1] argues that the intuitive fuzzy set (IFS) is a valuable resource because it offers a versatile paradigm for making sense of the uncertainty and fuzziness inherent in decision-making. Using the normalised Euclidean distance method to measure how far each student is from each career path, we explored the concept of integrated field studies (IFS) and argued for its use in career selection. Finding the quickest route between each learner and their potential career paths may be the answer. This novel application of intuitionistic fuzzy sets to the problem of job choice is extremely important because it facilitates the making of a sound decision based on scholastic achievement. It's not easy to choose a career because that choice can have far-reaching consequences for one's productivity and competence if it's managed poorly. In the demonstrated application, we calculated the gap between each student's chosen field of study and the given subjects using the normalised Euclidean distance.

In [2], it is demonstrated that fuzzy set theory is a useful method for characterising scenarios where exact or clear facts are lacking. Fuzzy sets, which evaluate the degree to which an object corresponds to a collection, can be useful in these situations. However, in real life, a person might assume that an object x does, in some sense, belong to a group A, but he might not be entirely sure of this assertion. The extent to which x belongs to group A may be questioned or uncertain, to put it another way. As it stands, fuzzy set theory cannot be used to incorporate such uncertainty into the membership degrees. Two varieties of fuzzy sets, interval-valued fuzzy sets and intuitionistic fuzzy sets, allow us to represent doubt and ambiguity by adding an additional dimension. In the context of a particular lattice L*, both of these are similar to L-fuzzy sets in the meaning of Goguen. Deschrijver, Cornelis, and Kerre respectively expanded the notions of triangular norm, triangle conorm, negator, and implicator to the lattice L*. We summarise recent algebraic results on these operators in this paper. We begin by giving you the lattice L*. Then we check some baseline properties after defining the different operators. Some properties of implicators generated by t-norms, t-conorms, and uninorms are investigated here. The residuation concept for t-norms and t-conorms on L* is also discussed. The final step is to construct the cardinal total of t-norms on L*.

INTUITIONISTIC FUZZY SET THEORY

Problem-solving is aided by the intriguing IFS (Intuitionistic Fuzzy Set) theory that K. T. Atanassov proposed. The fuzzy set described by Zadeh is really extended by the IFS. The IFS theory has recently been used in a variety of fields, including logic programming, decision-making issues, and medical diagnostics.The meaning of a fuzzy set is A non-empty set of 2-tuple elements is a fuzzy set F defined in a space S.

$$\Rightarrow F = \{g, u_r(g)\}, g \in S\}, \forall g \in S$$

An intuitionistic fuzzy set (IFS) is a fuzzy set defined in a domain of discourse where $u_r: S \rightarrow [0,1]$ each element is a 4-tuple comprising membership degree, hesitation degree, and non-membership degree. The degree $u_r(g) \in [0,1]$ of reluctance is either a component of membership, a component of non-membership, or both. The three degrees listed above are shown by the examples below.

Example 1: Let's examine the group of persons in the 18 and older age range as a discourse domain. The intuitionistic fuzzy set's membership, hesitation, and non-membership degrees are characterized as follows:

If we use membership degrees to identify young persons between the ages of 18 and 40, we may use non-membership degrees to identify older people 50 years and older. People between the ages of 40 and 50 may be categorized as either youthful, elderly, or both. As a result, we may use degrees of reluctance to portray these folks (aged between 40 and 50).

Example 2: Let's think about a day's worth of 24 hours. The intuitionistic fuzzy set's membership, hesitation, and non-membership degrees are characterized as follows:

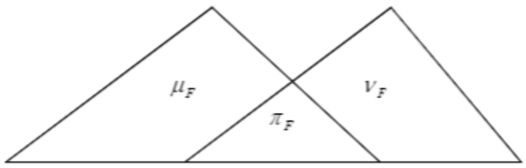
If we use membership degrees to indicate the day between 7 AM and 6 PM, we may use non-membership degrees to indicate the night between 7 PM and 5 AM. You may classify the hours between 5 and 6 in the morning and 6 and 7 in the evening as either day or night. As a result, we may indicate these times (5 AM – 6 AM and 6 PM – 7 PM) by the degree of reluctance.

DEFINITION

In a discourse domain, an intuitionistic fuzzy set F is defined. A non-empty set of four-tuple elements, or SSF, is what is meant by this.

$$\Rightarrow F = \{(g, u_F(g)\}, \Pi_F(g), v_F(g)) | g \in S\}, \forall g \in S$$

where the symbols u_F, Π_F, and v_F stand for the corresponding membership function v_F :S $\rightarrow [0,1]$ hesitation function u_F :S $\rightarrow [0,1]$., and non-membership function Π_F :S $\rightarrow [0,1]$.The expressions $u_F(g)$, $\Pi_F(g)$, and $v_F(g)$ measure the IFS F's relative membership, hesitation, and non-membership degrees of $g \in S$. We are able to depict, u_G, Π_G, and v_G visually.



For every $g \in S$, $u_F(g)$+ $\Pi_F(g)$+ $v_F(g)$=1

And $0 \leq u_F(g), \Pi_F(g), v_F(g) \leq 1$

In case, if we have the degree of $u_F(g)$, and $v_F(g)$, then we can easily calculate $\Pi_F(g)$, i.e.

$\Pi_F(g)$ = 1- $u_F(g)$-$v_F(g)$, $(g \in S)$

Each component of the IFS F can be written as a 3-tuple element for simplicity's sake:

$(u_F(g), \Pi_F(g), v_F(g))$ And also IFS is as follow:

$F = \{ t_i | t_j = (u_F(g), \Pi_F(g), v_F(g))$ *and* $gi \in S$ *or*

$F = \{ t_i | t_j = (u_i, \Pi_i, v_i)\ \pi_j$

Where $u_i = u_F(g)$

$\Pi_i = \Pi_F(g)$

$v_i = v_F(g)$

$\forall t_i, t_i \in F\ (l \neq j),$

$t_i \leq t_j$ *if* $[u_i \leq u_j, \pi i \circ \pi j$ and $v_i \geq v_j$

Or $u_i \leq u_j$ *if* and $v_i \geq v_j$

Where $\circ \in \{<, =, >\}$

$t_i = t_j$ *if* $[u_i = u_j, \pi i = \pi j$ and $v_i = v_j$

Or $u_i = u_j$ *if* and $v_i = v_j$

If $P = \{ p_i | p_j = (u_p(g), \Pi_p(g), v_p(g))$ *and* $gi \in S, \forall gi \in S$

$Q = \{ q_i | q_j = (u_q(g), \Pi_q(g), v_q(g))$ *and* $gi \in S, \forall gi \in S,$

if there are two IFSs that are specified within the sphere of conversation S, then there is a

1- $P \subset Q, iff\ [pi \leq qi], \forall\ pi \in P, \&\ \forall\ q_i\ \in Q$
2- $P = Q, iff\ [pi = qi], \forall\ pi \in P, \&\ \forall\ q_i\ \in Q$

Where Does the T1FS Theory Fall Short and How Does It Differ From the IFS Hypothesis?

The following will provide definitions of the fundamental ideas, as well as the fundamental operations, relations, and operators that are applicable to IFSs. We will next explore which of these fundamental concepts have parallels in T1FS theory and which do not.

Let us assume that there is a constant universe E and that its subset A exists. The ensemble

$A^* = \{[x, \mu_A(x), \nu_A(x)]|x \in E$

Gentele

Where

$\Rightarrow 0 \leq\ \mu_A(x) + \nu_A(x) \leq 1$ ....(2)

Equation (2) is called IFS function

$\mu_A : E \rightarrow [0,1]$.................(3)

And

$\nu_A : E \rightarrow [0,1]$.....................(4)

Equation 3 and 4 denote the degree of membership (validity is one example) and non- membership which includes non- validity respectively.

Moreover, in IFS, it can be also defined as the function $\pi_A : E \rightarrow [0,1]$ by

$\pi(x) = 1 - \mu(x) - \nu(x)$

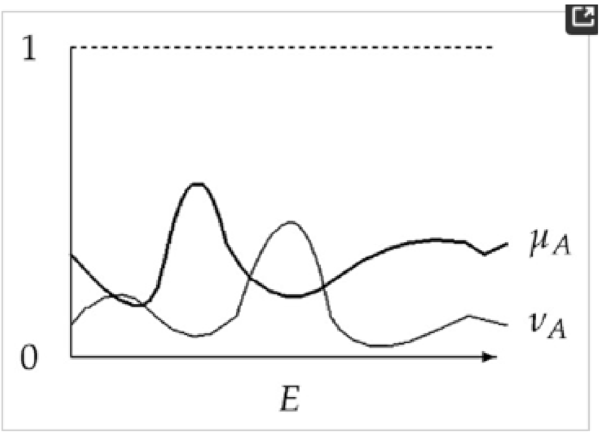
This is directly proportional to the amount of uncertainty (uncertainty, etc.).

Where it is feasible to do so, we will write below A instead of A for the sake of brevity.

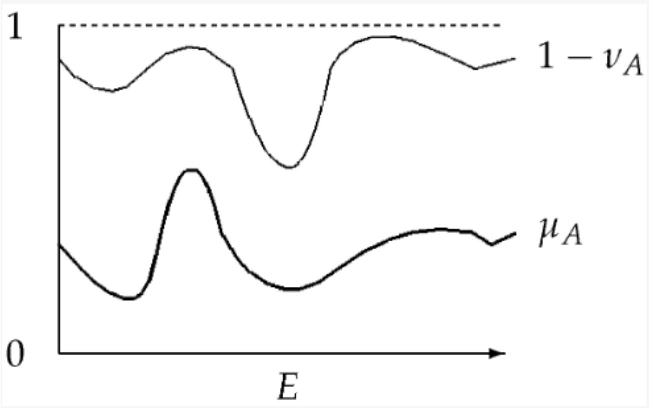
Obviously, for every $T_1\ FS\ A: \pi_A(x) = 0\ for\ each\ x \in E, and\ this\ set\ has\ the\ form$

$\{[x, \mu_A(x), 1 - \mu_A(x)]\}|x \in E.$

Where it is feasible to do so, we will write below A instead of A for the sake of brevity.



First geometrical interpretation—first form.



First geometrical interpretation—second form

In the T1FS situation, the line depicting v is absent from both images, and as a result, they are identical. The IFSs may also be interpreted geometrically in a different way, which, in a similar fashion, allows them to be turned into the T1FS case by omitting the line for. It is the first interpretation in circular geometry based on geometric principles.

CONCLUSION

In such cases, it may be helpful to use fuzzy sets, which assess how closely an item matches a group. However, in practice, one may presume that an entity x does, in some sense, belong to a group A, without being absolutely certain of this claim. To put it another way, it is possible that x's membership in group A is questionable or unclear. As it stands, such degrees of membership ambiguity cannot be accounted for using fuzzy set theory. Interval-valued fuzzy sets and intuitionistic fuzzy sets are two types of fuzzy sets that can be used to express uncertainty and misunderstanding.Both pictures are indistinguishable in the T1FS case because neither contains the line denoting v. In a similar vein, the IFSs can be transformed into the T1FS case by removing the line for if one adopts an alternative geometry interpretation of the symbols. This theory is the first to use math concepts in the study of circles.

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