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On t-Conorm Operators of Interval-Valued Fuzzy Soft Matrix and its Application in MCDM

Research Article*

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Abstract: Fuzzy Soft Set theory is a newly emerging mathematical tool to deal with uncertain problems. In our daily life we often face some problems in which the correct decision making is essential. In this paper, to overcome this problem, the Multi-Criteria Decision Making (MCDM) approach based on t-Conorm operators of interval-valued fuzzy soft matrix have been discussed. Some relevant properties have also been studied. Finally the algorithm based on t-Conorm operators of interval-valued fuzzy soft matrix is proposed with an example to illustrate the new approach.

Keywords: Soft Set, Fuzzy Soft Set, Interval-Valued Fuzzy Soft Set, Interval-Valued Fuzzy Soft Matrix, Operators of t-Conorm, Decision Making Problem.

1. Introduction

Multiple criteria decision making (MCDM) problem is a well-known branch of decision theory. It has been found in real life decision situations. A MCDM problem consists of ranking the feasible alternatives and selecting the most desirable one(s) by considering multiple criteria, which are frequently in conflict with each other. A number of real life problems in engineering, medical sciences, social sciences economics etc. involves imprecise data and their solution involves the use of mathematical principle based on uncertainty and imprecision. Such uncertainties are being deal with the help of topics like probability, fuzzy set theory, intuitionistic fuzzy set, vague set, theory of interval mathematics, rough set theory etc. However, Molodtsov has shown that each of the above topics have some inherent difficulties due to the inadequacy of their parameterization tools. Then he initiated a different concept called soft set theory as a new mathematical tool for dealing with uncertainties which is free from the limitations of the above topics. Soft set theory has a rich potential for applications in several directions, few of which has been explained by Molodtsov in his pioneer work. Many scholars studied the properties and applications on the soft set theory. Xiao et al. [13] studied synthetically evaluating method for business competitive capacity and also Xiao et al. [12] gave a recognition for soft information based on the theory of soft sets. Pie and Miao [8] showed that the soft sets are a class of special information sytems. Mushrif et al. [7] presented a new algorithm based on the notions of soft set theory for classification of the natural textures. Kovkov et al. [3] considered the optimization problems in the framework of the theory of soft sets which is directed to formalize the concept of approximate object description.

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Zou and Xiao [14] presented data analysis approaches of soft sets under incomplete information. Majumdar and Samanta studied the similarity measure of soft sets. Ali et al. [1] introduced the analysis of several operations on soft sets. Maji et al. presented the concept of the fuzzy soft set [4] which is based on a combination of the fuzzy set and soft set models. Mitra Basu et al. [6] presented the concept of Matrices in Interval-valued fuzzy soft set theory and its application. Stephen Dinagar and Rajesh [10] presented a multi-criteria decision making approach based on complement of interval-valued fuzzy soft sets. Manash et al. [5] presented the concept of T-Product of fuzzy soft matrices in decision making. Md.Jalilul et al. [2] presented the theory of fuzzy soft matrix and its multi criteria in decision making based on three basic t-Norm operators. Stephen Dinagar and Rajesh [11] presented Basic t-Norm operators of interval-valued fuzzy soft matrix and its application in MCDM. Also in this work the concept of On t-Conorm operators of interval-valued fuzzy soft matrix and its application in multi criteria decision making have been studied. In this paper the sections are organized as follows: In section 2, we considered some formal definitions and important notations that are very useful to develop the concept of this article. In section 3, we presented some basic properties of t-Conorm operators of interval-valued fuzzy soft matrix. In section 4, we presented Algorithm based on t-Conorm operators of interval-valued fuzzy soft matrix. In section 5, application of a decision making problem is discussed. In section 6, we conclude the paper with a summary and outlook for further research.

2. Preliminaries

In this section, we recall the basic definition of Soft Set, Fuzzy Soft Set, Interval-Valued Fuzzy Soft Set, Interval-Valued Fuzzy Soft Matrix, t-Conorm, Three important Operator of t-Conorm, Arithmetic Mean of Interval-valued Fuzzy Soft Matrix and Associated real number of an interval number with example.

Definition 2.1 (Soft set [10])**.** *Let U be a universal set, E is a set of parameters and$A \subset E$. Then a pair (F, A) is called soft set over U, where F is a mapping from A to 2^U, the power set of U.*

Example 2.2. *Let $U = \{c_1, c_2, c_3\}$ be the set of three cars and $E = \{\cos tly(e_1), metallic\ colour(e_2), cheap(e_3)\}$ be the set of parameters, where $A = \{e_1, e_2\} \subset E$. Then $(F, A) = \{F(e_1) = \{c_1, c_2, c_3\}, F(e_2) = \{c_1, c_3\}\}$ is the crisp soft set over U which describes the " attractiveness of the cars" in which Mr.X (say) is going to buy.*

Definition 2.3 (Fuzzy Soft set [10])**.** *Let U be a universal set, E is a set of parameters and $A \subset E$. Let $F(U)$denotes the set of all fuzzy subsets of U. Then a pair (F, A) is called fuzzy soft set over U, where F is a mapping from A to $F(U)$.*

Example 2.4. *Let $U = \{c_1, c_2, c_3\}$ be the set of three cars and $E = \{\cos tly(e_1), metallic\ colour(e_2), getup(e_3)\}$ be the set of parameters, where $A = \{e_1, e_2\} \subset E$. Then $(G, A) = \{G(e_1) = \{c_1/.6, c_2/.4, c_3/.3\}, G(e_2) = \{c_1/.5, c_2/.7, c_3/.8\}\}$ is the fuzzy soft set over U which describes the "attractiveness of the cars" in which Mr.X (say) is going to buy.*

Definition 2.5 (Interval-Valued Fuzzy Soft Set [10])**.** *Let U be an initial universal set, E is a set of parameters, a pair $(\tilde{F}, E)$ is called an interval valued fuzzy soft set over $\tilde{P}(U)$, where $\tilde{F}$ is a mapping given by $\tilde{F} : E \to \tilde{P}(U)$.*

Remark 2.6. *An interval-valued fuzzy soft set is a parameterized family of interval-valued fuzzy subsets of U, thus its universe is the set of all interval-valued fuzzy sets of U, An interval-valued fuzzy soft set is also a special case of a soft set because it is still a mapping from parameters to $\tilde{P}(U)$.*

Definition 2.7 (Interval -Valued Fuzzy Soft Matrix [9])**.** *Let $U = \{h_1, h_2, h_3, \ldots, h_m\}$ be an universal set and E be the set of parameters given by $E = \{e_1, e_2, e_3, \ldots, e_n\}$. Let $A \subseteq E$ and (F, A) be a interval-valued fuzzy soft set over U, where F is a mapping given by $F : A \to I^U$, where I^U denotes the collection of all interval-valued fuzzy subsets of U. Then the interval-valued fuzzy soft set can be expressed in matrix form as $\tilde{A}_{m\times n} = [a_{ij}]_{m\times n}$ or $\tilde{A} = [a_{ij}]$, $i = 1, 2, 3, \ldots, m,\ j = 1, 2, 3, \ldots, n,$*

where

$$a_{ij} = \begin{cases} [\mu_{jL}(c_i), \mu_{jU}(c_i)] & if \quad e_j \in A \\ [0,0] & if \quad e_j \notin A \end{cases}$$

$[\mu_{jL}(c_i), \mu_{jU}(c_i)]$ *represents the membership of* c_i *in the interval-valued fuzzy soft set* $F(e_j)$.

Note that if $\mu_{jU}(c_i) = \mu_{jL}(c_i)$ then the interval-valued fuzzy soft matrix (IVFSM) reduces to an FSM.

Example 2.8. *Suppose* $U = \{h_1, h_2, h_3, h_4\}$ *be the set of four houses under consideration and* $E = \{e_1, e_2, e_3, e_4\} = \{beautiful, large, cheap, in\ green\ surroundings\}$ *be the set of parameters respectively. Consider the mapping* F *from parameter set* $A = \{e_1, e_2\} \subseteq E$ *to the set of all interval-valued soft set* (F, A) *which describes the "attractiveness of the houses" that is considering for purchase. Then interval-valued fuzzy soft set* (F, A) *is*

$$(F,A) = \{\, F(e_1) = \{h_1/(0.4, 0.7), h_2/(0.8, 1), h_3/(0.6, 0.9), h_4/(0.5, 0.8)\},$$
$$F(e_2) = \{h_1/(0.3, 0.5), h_2/(0.6, 0.8), h_3/(0.3, 0.7), h_4/(0.5, 0.9)\}\ \},$$

We would represent this interval-valued fuzzy soft set in matrix form as

$$[a_{ij}] = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.4, 0.7) & (0.3, 0.5) & (0, 0) & (0, 0) \\ (0.8, 1) & (0.6, 0.8) & (0, 0) & (0, 0) \\ (0.6, 0.9) & (0.3, 0.7) & (0, 0) & (0, 0) \\ (0.5, 0.8) & (0.5, 0.9) & (0, 0) & (0, 0) \end{bmatrix} \end{array}$$

Definition 2.9 (t- Conorm [2])**.** *Let* $S : [0, 1] \times [0, 1]$ *be a function satisfying the following axioms:*

(1). $S(a, 0) = a, \ \forall\ a \in [0, 1]$ *(Identity)*

(2). $S(a, b) = S(b, a), \ \forall\ a, b \in [0, 1]$ *(Commutativity)*

(3). if $b_1 \leq b_2$*, then* $S(a, b_1) \leq S(a, b_2), \ \forall\ a, b_1, b_2 \in [0, 1]$ *(Monotonicity)*

(4). $S(a, S(b, c)) = S(S(a, b), c), \ \forall\ a, b, c \in [0, 1]$ *(Associativity)*

Then S *is called t-Conorm. A t-Conorm is said to be continuous if* S *is continous function in* $[0, 1]$.

Example 2.10. *Continuous t-Conorm is* $a + b - a \cdot b$.

Remark 2.11. *The functions used for union of fuzzy sets are called t-Conorms.*

Definition 2.12 (Operators of t-Conorm [2])**.**

(1). Maximum Operator : $S_M\{\mu_1, \mu_2, \ldots, \mu_n\} = \max\{\mu_1, \mu_2, \ldots, \mu_n\}$.

(2). Product Operator : $S_P\{\mu_1, \mu_2, \ldots, \mu_n\} = 1 - \prod_{i=1}^{n} (1 - \mu_i)$.

(3). Operator Lukasiewicz t-Conorm (Bounded t-Conorm) : $S_L\{\mu_1, \mu_2, \ldots, \mu_n\} = \min\{\sum_{i=1}^{n} \mu_i, 1\}$.

Example 2.13. *Assume that* $[a_{ij}], [b_{ij}] \in IVFSM_{2\times 2}$ *are given as follows* $[a_{ij}] = \begin{bmatrix} (0.3, 0.5) & (0.4, 0.7) \\ (0.4, 0.6) & (0.3, 0.8) \end{bmatrix}$,

$[b_{ij}] = \begin{bmatrix} (0.1, 0.4) & (0.5, 0.8) \\ (0.2, 0.5) & (0.6, 0.9) \end{bmatrix}$. *Then*

$$S_M([a_{ij}], [b_{ij}]) = \begin{bmatrix} (0.3, 0.5) & (0.5, 0.8) \\ (0.4, 0.6) & (0.6, 0.9) \end{bmatrix},$$

$$S_P([a_{ij}], [b_{ij}]) = \begin{bmatrix} (0.37, 0.70) & (0.70, 0.94) \\ (0.52, 0.80) & (0.72, 0.98) \end{bmatrix} \quad and$$

$$S_L([a_{ij}], [b_{ij}]) = \begin{bmatrix} (0.4, 0.9) & (0.9, 1) \\ (0.6, 1) & (0.9, 1) \end{bmatrix}.$$

Definition 2.14 (Arithmetic Mean of IVFSM [11])**.** *Let* $\tilde{A} = [a_{ij}] \in IVFSM_{m\times n}$*, where* $a_{ij} = [\mu_{jL}(c_i), \mu_{jU}(c_i)]$. *Then Arithmetic Mean of Interval-Valued Fuzzy Soft Matrix of membership value denoted by* $\tilde{A}_{AM}$ *is defined as* $\tilde{A}_{AM} = \left[\frac{\sum_{j=1}^{n} \mu_{jL}(c_i)}{n}, \frac{\sum_{j=1}^{n} \mu_{jU}(c_i)}{n}\right]$.

Definition 2.15 (Associated real number of an interval number [11])**.** *The associated real number of an interval number* $A = (a, b)$ *is denoted by* $R(A)$ *and is defined as* $R(A) = \frac{a+b}{2}$.

Example 2.16. *An associated real number of the interval number* $A = (2, 3)$ *is* $R(A) = \frac{2+3}{2} = 2.5$.

3. Some Basic Properties of t-Conorm Operators of Interval-Valued Fuzzy Soft Matrix

Here we proposed some basic properties of t-Conorm operators of interval-valued fuzzy soft matrix which are useful in subsequent discussions.

Proposition 3.1. *Let* $[a_{ij}], [b_{ij}], [c_{ij}] \in IVFSM_{m\times n}$. *Where* $[a_{ij}] = [a_{ij}^-, a_{ij}^+]$, $[b_{ij}] = [b_{ij}^-, b_{ij}^+]$, $[c_{ij}] = [c_{ij}^-, c_{ij}^+]$. *Then*

(1). $[a_{ij}]\tilde{\bigcup}_{S_M}[0] = [a_{ij}]$.

(2). $[a_{ij}]\tilde{\bigcup}_{S_M}[1] = [1]$.

(3). $[a_{ij}]\tilde{\bigcup}_{S_M}[b_{ij}] = [b_{ij}]\tilde{\bigcup}_{S_M}[a_{ij}]$.

(4). $([a_{ij}]\tilde{\bigcup}_{S_M}[b_{ij}])\tilde{\bigcup}_{S_M}[c_{ij}] = [a_{ij}]\tilde{\bigcup}_{S_M}([b_{ij}]\tilde{\bigcup}_{S_M}[c_{ij}])$.

Proposition 3.2. *Let* $[a_{ij}], [b_{ij}], [c_{ij}] \in IVFSM_{m\times n}$. *Where* $[a_{ij}] = [a_{ij}^-, a_{ij}^+]$, $[b_{ij}] = [b_{ij}^-, b_{ij}^+]$, $[c_{ij}] = [c_{ij}^-, c_{ij}^+]$. *Then*

(1). $[a_{ij}]\tilde{\bigcup}_{S_P}[0] = [a_{ij}]$.

(2). $[a_{ij}]\tilde{\bigcup}_{S_P}[1] = [1]$.

(3). $[a_{ij}]\tilde{\bigcup}_{S_P}[b_{ij}] = [b_{ij}]\tilde{\bigcup}_{S_P}[a_{ij}]$.

(4). $([a_{ij}]\tilde{\bigcup}_{S_P}[b_{ij}])\tilde{\bigcup}_{S_P}[c_{ij}] = [a_{ij}]\tilde{\bigcup}_{S_P}([b_{ij}]\tilde{\bigcup}_{S_P}[c_{ij}])$.

Proposition 3.3. *Let* $[a_{ij}], [b_{ij}], [c_{ij}] \in IVFSM_{m\times n}$. *Where* $[a_{ij}] = [a_{ij}^-, a_{ij}^+]$, $[b_{ij}] = [b_{ij}^-, b_{ij}^+]$, $[c_{ij}] = [c_{ij}^-, c_{ij}^+]$. *Then*

(1). $[a_{ij}]\tilde{\bigcup}_{S_L}[0] = [a_{ij}]$.

(2). $[a_{ij}]\tilde{\bigcup}_{S_L}[1] = [1]$.

(3). $[a_{ij}]\tilde{\bigcup}_{S_L}[b_{ij}] = [b_{ij}]\tilde{\bigcup}_{S_L}[a_{ij}]$.

(4). $([a_{ij}]\tilde{\bigcup}_{S_L}[b_{ij}])\tilde{\bigcup}_{S_L}[c_{ij}] = [a_{ij}]\tilde{\bigcup}_{S_L}([b_{ij}]\tilde{\bigcup}_{S_L}[c_{ij}])$

4. Algorithm Based on t-Conorm Operators of Interval-Valued Fuzzy Soft Matrix

Step 1: Choose the interval-valued fuzzy soft sets (F, E), (G, E) and (H, E).

Step 2: Construct the interval-valued fuzzy soft matrices A, B and C of (F, E), (G, E) and (H, E).

Step 3: Compute S_M, S_P and S_L.

Step 4: Compute the arithmetic mean of membership value of interval-valued fuzzy soft matrix as $A_{AM}(S_M)$, $A_{AM}(S_P)$ and $A_{AM}(S_L)$.

Step 5: Find the decision with highest membership value.

Step 6: Select the house according to the maximum value of $R(h)$and verify that he will get the high interval value.

5. Application of a Decision Making Problem

Mr.X is facing the problem for choosing suitable house for his family, Suppose $U = \{h_1, h_2, h_3, h_4\}$ be the set of four houses under consideration and $E = \{e_1, e_2, e_3, e_4\} = \{Expensive, Near\ by\ city, Beautiful, Modern\ Construction\}$ be the set of parameters. Mr.X is interested in buying the house and seeks advice from the three experts Mr.A, Mr.B and Mr.C. On the basis of the parameters the three experts given their valuable comments about the houses and the following three interval-valued fuzzy soft sets (F, E), (G, E) and (H, E) are constructed as follows.

1. Let (F, E), (G, E) and (H, E) be three interval-valued fuzzy soft sets representing the 'attractiveness of the house' in which Mr.X is going to buy.

$$
\begin{aligned}
(F, E) = \{\, & F(e_1) = \{h_1/(0.3, 0.9), h_2/(0.2, 0.8), h_3/(0.1, 0.5), h_4/(0.2, 0.6)\},\\
& F(e_2) = \{h_1/(0.2, 0.8), h_2/(0.3, 0.9), h_3/(0, 0.5), h_4/(0.1, 0.6)\},\\
& F(e_3) = \{h_1/(0.3, 0.7), h_2/(0.4, 1), h_3/(0.1, 0.4), h_4/(0, 0.5)\},\\
& F(e_4) = \{h_1/(0.1, 0.5), h_2/(0.2, 0.7), h_3/(0.3, 0.6), h_4/(0.2, 0.8)\}\ \}.\\
(G, E) = \{\, & G(e_1) = \{h_1/(0.1, 0.5), h_2/(0.4, 0.9), h_3/(0.3, 0.7), h_4/(0.1, 0.5)\},\\
& G(e_2) = \{h_1/(0.4, 0.8), h_2/(0.1, 0.7), h_3/(0.2, 0.7), h_4/(0, 0.4)\},\\
& G(e_3) = \{h_1/(0.2, 0.5), h_2/(0.1, 0.6), h_3/(0, 0.4), h_4/(0.4, 0.9)\},\\
& G(e_4) = \{h_1/(0.3, 0.7), h_2/(0.2, 0.8), h_3/(0.1, 0.6), h_4/(0, 0.5)\}\ \} \quad \text{and}\\
(H, E) = \{\, & H(e_1) = \{h_1/(0.2, 0.9), h_2/(0.1, 0.6), h_3/(0.1, 0.4), h_4/(0.3, 0.8)\},\\
& H(e_2) = \{h_1/(0, 0.5), h_2/(0.4, 0.9), h_3/(0.1, 0.5), h_4/(0.3, 0.7)\},\\
& H(e_3) = \{h_1/(0.1, 0.4), h_2/(0.2, 0.7), h_3/(0.3, 0.8), h_4/(0.3, 0.8)\},\\
& H(e_4) = \{h_1/(0.2, 0.6), h_2/(0.3, 0.8), h_3/(0, 0.4), h_4/(0.4, 0.9)\}\ \}.
\end{aligned}
$$

2. Let the three interval-valued fuzzy soft sets (F, E), (G, E) and (H, E) representing by interval-valued fuzzy soft matrices A, B and C respectively.

$$A = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.3, 0.9) & (0.2, 0.8) & (0.3, 0.7) & (0.1, 0.5) \\ (0.2, 0.8) & (0.3, 0.9) & (0.4, 1) & (0.2, 0.7) \\ (0.1, 0.5) & (0, 0.5) & (0.1, 0.4) & (0.3, 0.6) \\ (0.2, 0.6) & (0.1, 0.6) & (0, 0.5) & (0.2, 0.8) \end{bmatrix} \end{array}$$

$$B = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.1, 0.5) & (0.4, 0.8) & (0.2, 0.5) & (0.3, 0.7) \\ (0.4, 0.9) & (0.1, 0.7) & (0.1, 0.6) & (0.2, 0.8) \\ (0.3, 0.7) & (0.2, 0.7) & (0, 0.4) & (0.1, 0.6) \\ (0.1, 0.5) & (0, 0.4) & (0.4, 0.9) & (0, 0.5) \end{bmatrix} \end{array} \text{ and}$$

$$C = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.2, 0.9) & (0, 0.5) & (0.1, 0.4) & (0.2, 0.6) \\ (0.1, 0.6) & (0.4, 0.9) & (0.2, 0.7) & (0.3, 0.8) \\ (0.1, 0.4) & (0.1, 0.5) & (0.3, 0.8) & (0, 0.4) \\ (0.3, 0.8) & (0.3, 0.7) & (0.3, 0.8) & (0.4, 0.9) \end{bmatrix} \end{array}$$

3 & 4. By using the three interval-valued fuzzy soft matrices A, B and C, we have constructed S_M, S_P, S_L operators of t-Conorm and the arithmetic mean (A.M) of membership value of interval-valued fuzzy soft matrices are given below.

$$S_M = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.3, 0.9) & (0.4, 0.8) & (0.3, 0.7) & (0.3, 0.7) \\ (0.4, 0.9) & (0.4, 0.9) & (0.4, 1) & (0.3, 0.8) \\ (0.3, 0.7) & (0.2, 0.7) & (0.3, 0.8) & (0.3, 0.6) \\ (0.3, 0.8) & (0.3, 0.7) & (0.4, 0.9) & (0.4, 0.9) \end{bmatrix} \end{array}$$

$$A_{AM}(S_M) = \begin{array}{c} h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{bmatrix} (0.325, 0.775) \\ (0.375, 0.900) \\ (0.275, 0.700) \\ (0.350, 0.825) \end{bmatrix} \text{ and} \tag{1}$$

$$S_P = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.496, 0.995) & (0.520, 0.980) & (0.496, 0.910) & (0.496, 0.940) \\ (0.568, 0.992) & (0.622, 0.997) & (0.568, 1.000) & (0.552, 0.988) \\ (0.433, 0.910) & (0.280, 0.925) & (0.370, 0.928) & (0.370, 0.904) \\ (0.496, 0.960) & (0.370, 0.928) & (0.580, 0.990) & (0.520, 0.990) \end{bmatrix} \end{array} \text{ and}$$

$$A_{AM}(S_P) = \begin{array}{c} h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{bmatrix} (0.502, 0.956) \\ (0.577, 0.994) \\ (0.363, 0.916) \\ (0.491, 0.967) \end{bmatrix} \tag{2}$$

$$S_L = \begin{array}{c} \\ h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{array}{c} \begin{array}{cccc} e_1 & e_2 & e_3 & e_4 \end{array} \\ \begin{bmatrix} (0.6, 1) & (0.6, 1) & (0.6, 1) & (0.6, 1) \\ (0.7, 1) & (0.8, 1) & (0.7, 1) & (0.7, 1) \\ (0.5, 1) & (0.3, 1) & (0.4, 1) & (0.4, 1) \\ (0.6, 1) & (0.4, 1) & (0.7, 1) & (0.6, 1) \end{bmatrix} \end{array} \text{ and}$$

$$A_{AM}(S_L) = \begin{array}{c} h_1 \\ h_2 \\ h_3 \\ h_4 \end{array} \begin{bmatrix} (0.600, 1) \\ (0.725, 1) \\ (0.400, 1) \\ (0.575, 1) \end{bmatrix} \tag{3}$$

5. From the above results (1), (2) and (3), it is obvious that h_2 house will be selected by Mr.X.
6. Finally by using the Definition 2.8, we verified that h_2 is the suitable house for Mr.X, as $R(h_2) > R(h_4) > R(h_1) > R(h_3)$.

6. Conclusion

In this paper, we have discussed the concept based on basic t-Conorm operators of interval-valued fuzzy soft matrix in decision making problem. Also we proposed an algorithm based on basic t-Conorm operators of interval-valued fuzzy soft matrix to solve the discussed notion with a new approach and relevant illustration is added to justify the above said concept.

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