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Using Fuzzy Soft Matrix in Medical Analysis for Human's Illness

J.Venketsan, N.Anitha, V.Lambodharan, K.Geetha, M.Latha

Abstract: *Nowadays the human being of in this world with faced many troubles that can manage by theory of soft set. We can develop the analysis of medical field using fuzzy soft matrices (FSM). And apply IFSM. Here we establish the characterization of intersection and union of IIVFSM with examples. And the end, we can study about how to develop medical analysis using IIVFSM.*

Keywords: *Fuzzy set, SS, FSS, IVFSM, Union and intersection of IIVFSM, IVFSM for medical analysis, Fuzzy relation..*

I. INTRODUCTION

This In most of our real life situations, we are going to face many medical dishes, that's only we establish the idea of IIVFSM, This concept is one of the modern subject to develop for trade with the uncertainties, paramedic instruments for IIVFSM Introduced, for all application, very deeply our everyday life problem engineering, environment, medical, science, frequently occupy the data which are not essentially crisp. With these problem associated different reservations of the character deterministic. Like that uncertainties we are going to apply with the probability , fuzzy logic set theory ,IVFS , IIVFS etc.In this idea developed for pal and shymal [8] , GFM , this can be extended for Interval valued fuzzy matrix also develop max.min.operation. For any two elements in fuzzy algebra $\mathcal{F} = [0,1]$, and defined by addition and product as follows, let $a, b \in \mathcal{F}$ then $a + b = \max\{a, b\}$ and $a.b = \min\{a, b\}$. Let $m \times n \in [0,1]$ be the fuzzy matrix, it is denoted by the symbol $\mathcal{F}_{m\times n}$. All the elements of the matrices are subinterval of the interval $[0,1]$. The procedure of medical analysis apply IFS , in this study and develop Sanchez's [5],[6] and De et.al.[2].This concept also extended by Saikia et.al[7] apply soft set theory using IFS. Das Chetia study Sanchez's applies medical analysis along IVFSS finding development of the similar idea in De et. Al.[2], [7] . And then pervious study of [3] presented an IVFM $A = (aij) = ([aij-, aij+])$ by applying this concept, now we are going to extended for IIVFSM. We can define IIFSM represented by $= (a_{ij}) = ([a_{ij-}, a_{ij+}], [b_{ij-}, b_{ij+}])$, where a_{ij}, b_{ij} be the subinterval of the closed interval $[0,1]$. where a_{ij-} , b_{ij-} bounded below limit, and a_{ij+}, b_{ij+} bounded above limit of the closed interval $[0,1]$.After we develop Sanchez's concept for medical analysis applying IIVFSM . we switch the intersection and union of IIVFSM , also give some example , at the end of this paper medical analysis using soft matrices.

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* Correspondence Author
J.Venketsan*, Department of Mathematics , Sri vidya Mandir Arts and Science college ,Uthangarai. Email: venji86@gmail.com
N.Anitha, Department of Mathematics, Periyar University PG Extension centre Email: anithaarenu@gmail.com
V.Lambodharan, Department of Mathematics, Periyar University PG Extension centre .Email: mathslambo@gmail.com
K.Geetha ,Department of Mathematics ,Periyar university PG Extension cenntre ,Dharmapuri .
M.Latha, Department of Mathematics ,Periyar university PG Extension cenntre ,Dharmapuri

II. BASIC CONCEPTS

Definition 2.1. Let them take U be the Global set and let G be the parameter of the Global set , Let $P(U)$ be the Global set U.and we consider a pair (F, G) is said to be SS over Global set U here F is the mapping from $F: G \to P(U)$. It is evidently soft set is a preserving from parameters to $P(U)$ and not in set, except family of parameterized subset of the U.

Definition 2.2. Let them take U be the Global set and G be the parameter set , and take $A \subseteq G$, A FSS (F, A) over the Global set U and define the mapping $F: A \to I_U$, Here I_U Be the all subset of Global set U.

Definition2.3. Let U be the Global set therefore $U = \{s_1, s_2, s_3, \dots s_m\}$, and parameter set E therefore $G = \{g_1, g_2, g_3, \dots g_n\}$, Let them take $A \subseteq G$,a fuzzy soft set is (F, A) , in the fuzzy soft class (U, G), a pair (F, A) be the fuzzy soft matrix we can define as follows $A_{m\times n} = [a_{ij}]_{m\times n}$, where $i = 1,2,3 \dots m, j = 1,2,3, \dots n$.

$F(g_i) = \mu_i(s_j)$, $g_i \in A$, *here* $a_{ij} = \mu_i(s_j)$, s_j be the membership value of fuzzy set and 0 , $g_i \notin A$.

Definition 2.2. The Global set U and parameters set G, then $A \subseteq G$. Then the interval valued fuzzy soft set (F, A) over the Global set U. And define the mapping $F: A \to I_U$, here I_U denotes all IIVFSS of Global set U.

Definition 2.3. IIVFS: The Global set U and parameters set G, then $A \subseteq G$. Then the IIVFSS $[(F, (A, B)]$ over the Global set U.

And define the mapping $F:[A,B] \to [I_U, I_U]$, here $[I_U, I_U]$, denotes all IIVFSS of Global set U.

Definition 2.4. IVFSM: Let U be the set therefore $U = \{s_1, s_2, s_3, \dots s_m\}$, and set of parameter G .therefore$G = \{g_1, g_2, g_3, \dots g_n\}$, Let them take $A \subseteq G$, is IVFS set is over U, then the mapping defined by $F: A \to I_U$, here set of all IVF subset of U denoted by I_U , the expression of the IVFSM formed by

$A_{m\times n} = [a_{ij}]_{m\times n}$, where $i = 1,2,3 \dots m, j = 1,2,3, \dots n$.

Where $a_{ij} = \begin{cases} ([\mu_{i-}(s_j), \mu_{i+}(s_j)]), & g_i \in A \\ ([0,0]), & g_i \notin A \end{cases}$,here $([\mu_{i-}(s_j), \mu_{i+}(s_j)])$ membership value of s_j, $[0,0]$ be the non membership values of IVF soft set.

Definition 2.5. IIVFSM: Let U be the Global set therefore $U = \{s_1, s_2, s_3, \dots s_m\}$, and parameter set E therefore$G = \{g_1, g_2, g_3, \dots g_n\}$, Let them take $A \subseteq G$, is IIVFSS is over U, then the mapping defined by $F: A \to I_U$, here set of all IIVFS subset of U denoted by I_U , the expression of the IIFSM matrix is formed by

$A_{m\times n} = [a_{ij}]_{m\times n}$, $B_{m\times n} = [b_{ij}]_{m\times n}$ where $i = 1,2,3 \dots m, j = 1,2,3, \dots n$. Where

$([a_{ij}, b_{ij})] = \begin{cases} ([\mu_{i-}(s_j), \mu_{i+}(s_j)], [\lambda_{i-}(s_j), \lambda_{i+}(s_j)]), & g_i \in A \\ ([0,0],[0,0]) , & g_i \notin A \end{cases}$, Here $(([\mu_{i-}(s_j), \mu_{i+}(s_j)], [\lambda_{i-}(s_j), \lambda_{i+}(s_j)]))$ membership value of s_j , $([0,0],[0,0])$ be the non membership values of interval valued fuzzy soft set.

Example: 2.1. Let them consider four apartment, specifically the Global set $U = \{a_1, a_2, a_3, a_4\}$, and $G = \{g_1, g_2, g_3, g_4\}$ be the parameter set here we assign ''big'', "attractive", "economical", "in sea green surroundings", rep.Then the mapping F from the parameter set $A = \{g_1, g_2\}$ which contained in G for all Instinutostic $P(U)$ and consider IIVFSS $(F,[A,B])$ which assigned by ''big apartments''for buying. Then IVFSS $(F,[A,B])$ is

$(F,[A,B]) = \{F(g_1$)=

$\{a_1, ([0.51,0.71],[0.71,0.81]), (a_2, ([0.51,0.71],[0.71,0.81])), (a_3, ([041..,0.61],[0.61,0.71])), , (a_4, ([0.61,0.71],[0.61,0.81])\}$

$(F,[A,B]) = \{F(g_2$)=

$\{a_1, ([0.41,0.51],[0.61,0.71]), (a_2, ([0.41,0.61],[0.61,0.71])), (a_3, ([0.51,0.61],[0.41,0.61])), (a_4, ([0.71,0.81],[0.81,0.91])\}$

After the IIVFSS in the matrix representation as follows

$$\begin{bmatrix} ([0.51,0.71],[0.71,0.81]) & ([0.41,0.51],[0.61,0.71]) & ([0,0],[0,0]) & ([0,0],[0,0]) \\ ([0.51,0.71],[0.71,0.81]) & ([0.41,0.61],[0.61,0.71]) & ([0,0],[0,0]) & ([0,0],[0,0]) \\ ([041..,0.61],[0.61,0.71]) & ([0.51,0.61],[0.41,0.61]) & ([0,0],[0,0]) & ([0,0],[0,0]) \\ ([0.61,0.71],[0.61,0.81]) & ([0.71,0.81],[0.81,0.91]) & ([0,0],[0,0]) & ([0,0],[0,0]) \end{bmatrix}$$

Definition 2.6 Sum of IIVFSS in matrix

Consider two matrixes

$A_{m\times n} = [a_{ij}]_{m\times n}$, $B_{m\times n} = [b_{ij}]_{m\times n}$

where$i = 1,2,3 \dots m, j = 1,2,3, \dots n$ then the sum define

$A + B = [c_{ij}]_{2\times 2}$ =max $([\mu_{Aij-}, \mu_{Bij-}], [\mu_{Aij+}, \mu_{Bij+}])\ \forall i,j$

Example 2.2 Let they take two matrixes A and B

Where

$A = \begin{bmatrix} ([0.51,0.71],[0.71,0.81]) & ([0.41,0.51],[0.61,0.71]) \\ ([0.41,0.61],[0.61,0.71]) & ([0.51,0.61],[0.41,0.61]) \end{bmatrix}$

,

$B = \begin{bmatrix} ([0.41,0.61],[0.61,0.71]) & ([0.51,0.61],[0.41,0.61]) \\ ([0.71,0.81],[0.81,0.91]) & ([0.61,0.71],[0.61,0.81] \end{bmatrix}$

, Then the sum of two IIVFSM is given by

$A + B = \begin{bmatrix} ([0.51,0.71][0.71,0.81]) & ([0.51,0.61],[0.61,0.71]) \\ ([0.71,0.81],[0.81,0.9]) & ([0.62,0.71],[0.62,0.82]) \end{bmatrix}$

Product of two IIVFSM

$A_{m\times n} = [a_{ij}]_{m\times n}$, $B_{m\times n} = [b_{ij}]_{m\times n}$

where$i = 1,2,3 \dots m, j = 1,2,3, \dots n$ then the sum define

$A \times B = [c_{ij}]_{2\times 2}$ = [max

$min[\mu_{Aij-}, \mu_{Bij-}]$, max $min\ [\mu_{Aij+}, \mu_{Bij+}]\ \forall i,j$

Where

$A = \begin{bmatrix} ([0.51,0.71],[0.71,0.81]) & ([0.41,0.51],[0.61,0.71]) \\ ([0.41,0.61],[0.61,0.71]) & ([0.51,0.61],[0.41,0.61]) \end{bmatrix}$

,

$B = \begin{bmatrix} ([0.41,0.61],[0.61,0.73]) & ([0.52,0.64],[0.41,0.62]) \\ ([0.71,0.82],[0.83,0.94]) & ([0.62,0.74],[0.63,0.84] \end{bmatrix}$

, Then the product of two IIVFSM is given by

$A \times B = \begin{bmatrix} ([042,0.63],[0.61,0.72]) & ([0.41,0.53],[0.43,0.64]) \\ ([041,0.62],[0.62,0.73]) & ([0.53,0.64],[0.41,0.63]) \end{bmatrix}$

.

are two IIVFSM then product of these two matrices.

Note:$A \times B \neq B \times A$

Definition: 2.7. Complement of two matrix of IIVFSM

Let $A_{m\times n} = [a_{ij}]_{m\times n}$, $B_{m\times n} = [b_{ij}]_{m\times n}$

where $i = 1,2,3 \dots m, j = 1,2,3, \dots n$.the complement of the IIVFSM is defined as $A^c = 1 - ([\mu_{i-}(s_j), \mu_{i+}(s_j)])$,

$B^c = 1 - ([\lambda_{i-}(s_j), \lambda_{i+}(s_j)]$

III. USING SOFT MATRIX IN MEDICAL ANALYSIS FOR HUMAN'S ILLNESS

Aassume X is a set of identification of some illness , I be the set of illness and H be the set of Human's . Create an ISM (F,(I,I)) over X, here F is function $F: H \to F(X, Y)$. A matrix relation say, R_1 is formed from IVFSS (F, H) and say the identification of illness matrix. Likewise its complement (F,(I,I) gives next matrix relation ,say R_2 , that is no identification illness matrix. Corresponding to sanchez"s notion of Knowledge of medical analysis for Human's illness we have submit to every relation matrix R_1 and R_2as IIVFS set of Knowledge Medical analysis for illness. Another time we create a different IIVFS set (F_1,(X, Y) over H, H_1, Where F_1 is a function from given by $F1: XY \to \overline{F}(HH_1)$. In this IIVFS gives different matrix relation GG_1 called Human's – identification matrix. After we find two another matrices relation T_1=GR_1 and T_2=GR_2, called identification Human's relation matrix and no identification Human's relation matrix, for the membership degrees are defined by

$\mu T_1(Hi, Ie)$ = [max {min

$([\mu_{G-}(Hi, s_j), \mu_{G-}(Hi, s_j), \mu R_{1-}(Hi, Ie)], [\lambda_{G-}(Hi\, s_j), \lambda_{G-}(Hi\, s_j), \mu R_{1-}(Hi, Ie)])\}$

{max {min

$[\mu_{G+}(Hi\, s_j), \mu_{G+}(s_j), \mu R_{1+}(Hi, Ie)], [\lambda_{G+}(Hi\, s_j), \mu R_{1+}(Hi, Ie)]$

$\mu T_2(Hi, \sim Ie)$ = [max {min

$([\mu_{G-}(Hi, s_j), \mu_{G-}(Hi, s_j), \mu R_{2-}(Hi, Ie)], [\lambda_{G-}(Hi, s_j), \lambda_{G-}(Hi, s_j), \mu R_{2-}(Hi, Ie)])\}$

{max{min

$[\mu_{G+}(Hi, s_j), \mu_{G+}(Hi, s_j), \mu R_{2+}(Hi, Ie)], [\lambda_{G+}(Hi, s_j), \mu R_{2+}(Hi, Ie)]\}$

,We find

$X\,TT_1 = max_{ij}\{\mu\_T(Hi, Ij), \mu\_T(Hj, Ii), \mu\_T_1(Hi, Ij), \mu\_T_1(Hj, Ii)$

$\{\mu_+T(Hi, Ij), \mu_+T(Hj, Ii), \mu_+T_1(Hi, Ij), \mu_+T_1(Hj, Ii\}$

$X\,TT_2 = max_{ij}\{\mu\_T(Hi, Ij), \mu\_T(Hj, Ii), \mu\_T_2(Hi, Ij), \mu\_T_2(Hj, Ii)$

, $\{\mu_+T(Hi, Ij), \mu_+T(Hj, Ii), \mu_+T_2(Hi, Ij), \mu_+T_2(Hj, Ii\}$

For the above is called analysis range for beside for the illness. Now max$\{XT_1(Hi, Ij) - XT_2(Hi, \sim Ij)\}$ give for right (Hi, Ie) single, after the end the suitable analysis of assumption for Human's Hi is the illness Ie. If there exist tie, the procedure has frequently apply for the Human's Hi by applying the identification.

IV. CONDITION FOR MEDICAL ANALYSIS FOR ILLNESS FIGURES AND TABLES

The sets (F, I) and $(F, I)^c$ more than the sets X of identification, here I is illness set, as well we write the soft medical information R_1 , R_2 be the matrices relation of the IIVFSS (F, I) and $(F, I)^C$. Enter the IIVFSS (F_1, X) follow the set H of Human's and the matrix relation Q. Calculate the matrix relation $T_1 = G.R_1$ and $T_2 = G.R_2$. Also calculate the analysis ranges T_1, T_2 .Calculate $X_k = max\{XT_1(Hi, Ij) - XT_2(Hi, \sim Ij)\}$ at the end the Human's Hi pain for the illnessI_k. If X_k has additional value, then go to begin and do the same process by the identification for the Human's. Assume that three Human's H_1, H_2 and H_3 in a infirmary with identification ulcer, stomach pain, generalized hand pain and pimples problem. Let the probable illness involving to the above identification be malarias and brain fever. we take the set X = $\{g_1, g_2, g_3, g_4\}$ as global set, here g_1, g_2, g_3 and $g_4$represent the identification of stomach pain , generalized hand pain and pimples problem fever, headache, generalized body pain and the set I =$\{I_1, I_2\}$where I_1,and I_2 be the parameterized malarias and brain fever respectively. Suppose that F (I_1) $\{g_1, ([0.51, 0.61], [0.61, 0.72]), (g_2, ([0.41, 0.53], [0.61, 0.73]),$

$(g_3, ([041., 0.52], [0.65, 0.71])), (g_3, ([051., 0.62], [0.51, 0.61]))\}$

F (I_2) = $\{g_1, ([0.61, 0.71], [0.51, 0.72]), (g_2, ([0.51, 0.63], [0.51, 0.73]),$

$(g_3, ([051., 0.62], [0.75, 0.81])), (g_3, ([041., 0.62], [0.61, 0.71]))\}$

The IIVFS set (F, I) is parameter set. $\{F(I_1), F(I_2)\}$ of all IIV Set over the set X then find from specialist records of medical persists . Then FS set (F, I) is the rough report f IIVFSS medical information of two illness and the identifications. The IIVFSS (F, I) and the $(F, I)^C$ are fixed by two matrix relation R_1 and R_2,called identification-ilness matrix

$$R_1 = \begin{matrix} g_1 \\ g_2 \\ g_3 \\ g_4 \end{matrix} \overset{\quad I_1 \qquad\qquad\qquad\qquad I_2}{\begin{bmatrix} [0.51,0.61],[0.61,0.72] & [0.61,0.71],[0.51,0.72] \\ [0.41,0.53],[0.61,0.73] & [0.51,0.63],[0.51,0.73] \\ [0.41,0.52],[0.65,0.71] & [0.51,0.62],[0.75,0.81] \\ [0.51,0.62],[0.51,0.61] & [0.41,0.62],[0.61,0.71] \end{bmatrix}}$$

Assume also $H = \{H_1, H_2, H_3\}$ be the global set , where H_1, H_2 and H_3 represent Human's and $X = \{g_1, g_2, g_3, g_4\}$ be the set of parameters . Then we take

$$F_1(g_1) = \{H_1,([0.81,0.91],[0,61,0.72]),\ H_2,([0.21,0.31],[0,41,0.52]), H_3,([0.41,0.51],[0,61,0.72])\}$$

$$F_1(g_2) = \{H_1,([0.61,0.71],[0,51,0.62]),(H_2,([0.31,0.41],[0,51,0.62]),(H_3,([0.61,0.71],[0,81,0.92])\}$$

$$F_1(g_3) = \{H_1,([0.21,0.31],[0,31,0.42]),\ (H_2,([0.51,0.61],[0,61,0.72]),\ (H_3,([0.81,0.91],[0,61,0.82])\}$$

$$F_1(g_4) = \{H_1,([0.11,0.2],[0,31,0.42]),\ (H_2,([0.41,0.51],[0,51,0.62]),\ (H_3,([0.71,0.81],[0,61,0.72])\}$$

The IIVFSS(F_1, X) is next parameter group of IIVFS and this implies the set of inexact details of the Human's in the Clinic. This IIVFSS (F_1, X) produce the matrix relation G the Human's identification matrix gives G

$$= \begin{matrix} H_1 \\ H_2 \\ H_3 \end{matrix} \overset{g_1 \qquad\qquad\qquad g_2 \qquad\qquad\qquad g_3 \qquad\qquad\qquad g_4}{\begin{bmatrix} [0.81,0.91],[0,61,0.72] & [0.61,0.71],[0,51,0.62] & [0.21,0.31],[0,31,0.42] & [0.11,0.23],[0,31,0.42] \\ [0.21,0.31],[0.41,0.52] & [0.61,0.71],[0,81,0.92] & [0.51,0.61],[0,61,0.72] & [0.41,0.51],[0,51,0.62] \\ [0.41,0.51],[0.61,0.72] & [0.61,0.71],[0,81,0.92] & [0.81,0.91],[0,61,0.82] & [0.71,0.81],[0,61,0.72] \end{bmatrix}}$$

Then join the matrix relation R_1 and R_2 individually with G we get two matrices T_1 and T_2 be the Human's illness and Human's – non illness matrix given as

$$T_1 = G.R_1 = \begin{matrix} H_1 \\ H_2 \\ H_3 \end{matrix} \overset{\quad I_1 \qquad\qquad\qquad\qquad I_2}{\begin{bmatrix} [0.51,0.61],[0.61,0.72] & [0.61,0.71],[0.51,0.72] \\ [0.21,0.31],[0.41,0.52] & [0.61,0.83],[0.51,0.73] \\ [0.41,0.51],[0.61,0.72] & [0.51,0.72],[0.75,0.91] \end{bmatrix}}$$

$$T_2 = G.R_2 = \begin{matrix} H_1 \\ H_2 \\ H_3 \end{matrix} \overset{\quad I_1 \qquad\qquad\qquad\qquad I_2}{\begin{bmatrix} [0.41,0.51],[0.51,0.62] & [0.21\ ,0.31],[0.41,0.52] \\ [0.31,0.63],[0.51,0.63] & [0.51,0.63],[0.61,0.73] \\ [0.21,0.31],[0.31,0.42] & [0.41,0.52],[0.51,0.61] \end{bmatrix}}$$

We calculate finally

[1] $\max\{XT_1 - XT_2\}$	[2] I_1	[3] I_2
[4] H_1	[5] 0.11	[6] 0.21
[7] H_2	[8] 0.32	[9] 0.22
[10] H_3	[11] 0.1	[12] 0.1 6

V. CONCLUSION

We have applied for this concept for IIVFSM in sanchez"s process of using medical analysis Human's illness. A study has been the use of display this process.

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