International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

Drug Addiction Effect in Medical Diagnosis by using Fuzzy Soft Matrices

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Accepted 28 Jan 2015, Available online 01 Feb 2015, **Vol.5, No.1 (Feb 2015)**

Abstract

In this paper, we establish the theme that the people who are in darkness due to drug addiction should be brought to light so as to enjoy their life like other healthy people. We create the awareness of side effects due to drug addiction in the field of medical diagnosis by using fuzzy soft matrices. Further, we extended our approach in the sector of addition and multiplication factors of fuzzy soft matrices based on reference function.

Keywords: *Soft set, Fuzzy soft set (FSS), Fuzzy soft matrices (FSM), Complement, Product of fuzzy soft matrices.*

1. Introduction

The concept of fuzzy set theory was first introduced (Zadeh,1965). Fuzzy soft set theory was explained (Molodtsov,1999) as a general mathematical tool for dealing with uncertainities and so fuzzy not clearly defined the objects. Then the theory of soft sets initiated by Molodtsov was studied by (Maji *et al*,2001) and developed into several basic notions soft set theory. The result of Maji again developed (Ahmad and Kharal,2009).

Soft matrices (Cagman *et al*,2010) which were a matrix representation of the soft sets and constructed a soft Max-Min decision making method. The matrix representation of a fuzzy soft set (Yong yang and Chenliji,2011) was successfully applied to the proposed notion of fuzzy soft matrix in certain decision making problems.

The representation of interval-valued fuzzy matrix used (Meenakshi *et al*,2011) have provided the techniques to study Sanchez's approach of medical diagnosis of interval valued fuzzy matrices. The matrix representation of fuzzy soft set (Neog and sut, 2011) have extended Sanchez's approach for medical diagnosis using our notion of fuzzy soft complement. To define the addition operation for fuzzy soft matrices (Neog and sut,2011) an attempt has been made to apply our notion in solving decision problem.

Fuzzy soft matrices was defined (Cagman and Enginoglu, 2012) and constructed a decision making problem. The application of similarity between two fuzzy soft sets was introduced (Rajeswari and Dhanalakshmi, 2012) based on distance. The notions related to fuzzy soft matrices was enlighted (Neog, Bora and Sut,2012).

To represent fuzzy soft matrices (Mamoni Dhar, 2013) have made use of reference function. An application of fuzzy soft matrix (Broumi, Florentin Smarandache, Mamoni Dhar, 2013) have utilized reference function in decision making problem.

Intuitionistic fuzzy soft matrices was introduced in agriculture (Dr.N.Sarala and Rajkumari, 2014) and intuitionistic fuzzy soft matrices was put forwarded in medical diagnosis (Dr.N.Sarala and Rajkumari, 2014). Further by using fuzzy soft matrices (Dr.N.Sarala and Rajkumari, 2014) have introduced the role model service rendered to orphans and also introduced the significant characters of fuzzy soft matrices (Dr.N.Sarala and Rajkumari, 2014).

In this paper, we proposed fuzzy soft matrix theory and also extended our approach with regard to fuzzy soft matrices based on reference function in medical diagnosis.

2. Preliminaries

In this we section, We recall some basic essential notion of fuzzy soft set and defined different types of fuzzy soft set.

2.1 Soft Set

Let U be an initial universe set and E be a set of parameters. Let P(U) denotes the power Set of U. Let A⊆E.

A pair (F_A,E) is called a soft set over U, where F_A is a mapping given by F_A :E→ P(U) Such that F_A(e) = φ if e ∉ A.

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Here F_A is called approximate function of the soft set (F_A,E). The set F_A(e) is called e-approximate value set which consist of related objects of the parameter e∈E. In other words, a soft set over U is a parameterized family of subsets of the universe U.

Example 2.1

Let U={u_1, u_2, u_3, u_4} be a set of four varieties of woods and E={High Quality(e_1), Medium Quality(e_2), Low Quality(e_3)} be the set of parameters. If A={e_1, e_2}⊆E. Let $F_A(e_1)$={u_1, u_2, u_3, u_4} and $F_A(e_2)$={ u_1, u_2,u_3}. Then we write the soft set

(F_A,E) ={(e_1,{ u_1, u_2, u_3, u_4}),(e_2,{ u_1, u_2,u_3})} over U which describe the "Quality of Wood" Which Mr.Z is going to buy.

We may represent the soft set in the following form:

Table 2.1.1

U	High Quality (e_1)	Medium Quality (e_2)	Low Quality (e_3)
u_1	1	1	0
u_2	1	1	0
u_3	1	1	0
u_4	1	0	0

2.2 Fuzzy Soft Set

Let U be an initial universe set and E be a set of parameters. Let A⊆E. A pair ($\tilde{F}_A$,E) is called a fuzzy soft set (FSS)over U, where$\tilde{F}_A$ is a mapping given by, $\tilde{F}_A$:E→ I^U, where I^U denotes the collection of all fuzzy subsets of U.

Example 2.2

Consider the example 2.1., here we cannot express with only two real numbers 0 and 1, we can characterized it by a membership function instead of crisp number 0 and 1, which associate with each element a real number in the interval [0,1]. Then

($\tilde{F}_A$,E) ={ $\tilde{F}_A(e_1)$ ={(u_1,0.4),(u_2,0.6),(u_3,0.7),(u_4,0.8)},
$\tilde{F}_A$ (e_2) ={(u_1,0.5),(u_2,0.3),(u_3,0.2)}}
is the fuzzy soft set representing the "Quality of Wood" which Mr.Z is going to buy.

We may represent the fuzzy soft set in the following form:

Table 2.2.2

U	High Quality (e_1)	Medium Quality (e_2)	Low Quality (e_3)
u_1	0.4	0.5	0.0
u_2	0.6	0.3	0.0
u_3	0.7	0.2	0.0
u_4	0.8	0.0	0.0

2.3 Fuzzy Soft Class

Let U be an initial universe set and E be the set of attributes. Then the pair (U,E) denotes the collection of all fuzzy soft sets on U with attributes from E and is called a fuzzy soft class.

2.4 Fuzzy Soft Subset

For two fuzzy soft sets $(\tilde{F}_A, E)$ and $(\tilde{G}_B, E)$ over a common universe U, we have $(\tilde{F}_A, E)$⊆($\tilde{G}_B$,E) if A⊂B and ∀ e∈A, $\tilde{F}_A$(e) is a fuzzy subset of $\tilde{G}_B$(e). i.e, $(\tilde{F}_A, E)$is a fuzzy soft subset of ($\tilde{G}_B$,E).

2.5 Fuzzy soft complement set[15]

The complement of fuzzy soft set $(\tilde{F}_A, E)$ denoted by $(\tilde{F}_A, E)^\circ$ is defined by $(\tilde{F}_A, E)^\circ$ = $(\tilde{F}_A^\circ, E)$, where $\tilde{F}_A^\circ$: E→I^U is a mapping given by $\tilde{F}_A^\circ$(e) = [$\tilde{F}_A$(e)]°, ∀ e∈E.

2.6 Fuzzy Soft Null Set[8]

A fuzzy soft set $(\tilde{F}_A, E)$ over U is said to be null fuzzy soft set with respect to the parameter set E, denoted by $\tilde{\varphi}$, if $\tilde{F}_A$(e) = $\tilde{\varphi}$, ∀ e∈E.

3. Fuzzy soft matrices relied upon reference function

In this section, we introduce the notion of fuzzy soft matrices with different types based on reference function.

3.1 Fuzzy soft matrices

Let U = {$u_1, u_2, u_3, \cdots u_m$} be the universal set and E be the set of parameters given by E = {e_1, e_2, e_3,⋯,e_n}. Then the fuzzy soft set $(\tilde{F}_A, E)$ can be expressed in matrix form as $\tilde{A}$ = $[a_{ij}^{\tilde{A}}]_{m\times n}$ or simply by $[a_{ij}^{\tilde{A}}]$, $i = 1,2,3,\cdots, m; j = 1,2,3,\cdots, n$ and $[a_{ij}^{\tilde{A}}]$ = $[(\mu_{ij}^{\tilde{A}},\gamma_{ij}^{\tilde{A}})]$; where $\mu_{ij}^{\tilde{A}}$ and $\gamma_{ij}^{\tilde{A}}$ represent the fuzzy membership function and fuzzy reference function respectively of u_i in the fuzzy set $\tilde{F}_A$(e_j) so that $\delta_{ij}^{\tilde{A}} = \mu_{ij}^{\tilde{A}} - \gamma_{ij}^{\tilde{A}}$ gives the fuzzy membership value of u_i. We shall identify a fuzzy soft set with its fuzzy soft matrix and use these two concepts interchangeable. The set of all m×n fuzzy soft matrices over U will be denoted by FSM $_{m\times n}$. For usual fuzzy sets with fuzzy reference function 0, it is obvious to see that $a_{ij}^{\tilde{A}}$ = $[(\mu_{ij}^{\tilde{A}},0)]$ ∀ i,j.

Example 3.1

Let U = {u_1, u_2, u_3} be the universal set and E be the set of parameters given by E = {e_1, e_2, e_3}.

We consider a fuzzy soft set

$(\tilde{F}_A, E)$ = {$\tilde{F}_A(e_1)$ ={(u_1,0.6,0),(u_2,0.4,0),(u_3,0.5,0)},
$\tilde{F}_A(e_2)$ ={(u_1,0.7,0),(u_2,0.2,0),(u_3,0.8,0)},
$\tilde{F}_A(e_3)$ ={(u_1,0.9,0),(u_2,0.1,0),(u_3,0.3,0)}}

We would represent this fuzzy soft set in matrix form as

$$[a_{ij}^{\tilde{A}}]_{3\times 3} = \begin{bmatrix} (0.6,0) & (0.7,0) & (0.9,0) \\ (0.4,0) & (0.2,0) & (0.1,0) \\ (0.5,0) & (0.8,0) & (0.3,0) \end{bmatrix}_{3\times 3}$$

3.2 Membership Value Matrix

The membership value matrix corresponding to the matrix $\tilde{A}$ as MV($\tilde{A}$) = $[\delta_{ij}^{\tilde{A}}]_{m\times n}$, where $\delta_{ij}^{\tilde{A}} = \mu_{ij}^{\tilde{A}} - \gamma_{ij}^{\tilde{A}} \forall$ $i = 1,2,3,\cdots,m$ and $j = 1,2,3,\cdots,n$, where $\mu_{ij}^{\tilde{A}}$ and $\gamma_{ij}^{\tilde{A}}$ represent the fuzzy membership function and fuzzy reference function respectively of u_i in the fuzzy set $\tilde{F}_A(e_j)$.

3.3 Zero fuzzy soft matrices

Let $\tilde{A} = [a_{ij}^{\tilde{A}}] \in FSM_{m\times n}$, where $a_{ij}^{\tilde{A}}=(\mu_{ij}^{\tilde{A}},\gamma_{ij}^{\tilde{A}})$. Then $\tilde{A}$ is called a fuzzy soft zero (or Null) matrix denoted by $[\tilde{0}]_{m\times n}$, or simply by$[\tilde{0}]$, if $\delta_{ij}^{\tilde{A}}=\tilde{0}$ for all i and j. For usual fuzzy sets, $\delta_{ij}^{\tilde{A}}= \mu_{ij}^{\tilde{A}}$ ∀ i, j.

3.4 Identify fuzzy soft matrices

Let $\tilde{A} = [a_{ij}^{\tilde{A}}] \in FSM_{m\times n}$, where $a_{ij}^{\tilde{A}}=(\mu_{ij}^{\tilde{A}},\gamma_{ij}^{\tilde{A}})$. Then $\tilde{A}$ is called a fuzzy soft unit or identify matrix denoted by $[\tilde{1}]$, if m=n, $a_{ij}^{\tilde{A}}=(\mu_{ij}^{\tilde{A}},\gamma_{ij}^{\tilde{A}})$ for all i≠j and $a_{ij}^{\tilde{A}}$= (1,0) i.e,$\delta_{ij}^{\tilde{A}}$ =1 ∀ i=j.

3.5 Complement of fuzzy soft matrices

Let $\tilde{A} = [(a_{ij}^{\tilde{A}},0)] \in FSM_{m\times n}$, where $a_{ij}^{\tilde{A}}=(\mu_{ij}^{\tilde{A}},\gamma_{ij}^{\tilde{A}})$ according to the definition in [8], the representation of the complement of the fuzzy matrix $\tilde{A}$ which is denoted by $\tilde{A}^{\circ}$ and then $\tilde{A}^{\circ}$ is called fuzzy soft complement matrix if $\tilde{A}^{\circ}= [(1,a_{ij}^{\tilde{A}})]_{m\times n}$ for all $a_{ij}^{\tilde{A}} \in[0,1]$. Then the matrix obtained from so called membership value would be the following $\tilde{A}^{\circ}= [a_{ij}^{\tilde{A}}] = [(1- a_{ij}^{\tilde{A}})]$ for all i and j.

3.6 Product of fuzzy soft matrices

Let $\tilde{A} = [a_{ij}^{\tilde{A}}]_{m\times n}$, $a_{ij}^{\tilde{A}}=(\mu_{ij}^{\tilde{A}},\gamma_{ij}^{\tilde{A}})$; where $\mu_{ij}^{\tilde{A}}$ and $\gamma_{ij}^{\tilde{A}}$ represent the fuzzy membership function and fuzzy reference function of u_i, so that $\delta_{ij}^{\tilde{A}} = \mu_{ij}^{\tilde{A}} - \gamma_{ij}^{\tilde{A}}$ gives the fuzzy membership value of u_i. Also let $\tilde{B} = [b_{jk}^{\tilde{B}}]_{n\times p}$, $b_{jk}^{\tilde{B}}=(\mu_{jk}^{\tilde{B}},\gamma_{jk}^{\tilde{B}})$; where $\mu_{jk}^{\tilde{B}}$ and $\gamma_{jk}^{\tilde{B}}$ represent the fuzzy membership function and fuzzy reference function of u_i, so that $\delta_{jk}^{\tilde{B}} = \mu_{jk}^{\tilde{B}} - \gamma_{jk}^{\tilde{B}}$gives the fuzzy membership value of u_i. We now define $\tilde{A}\cdot\tilde{B}$, the product of $\tilde{A}$ and $\tilde{B}$ as $\tilde{A}\cdot\tilde{B} = [d_{ik}^{\tilde{A}\tilde{B}}]_{m\times p}$ = [max min($\mu_{ij}^{\tilde{A}}$, $\mu_{jk}^{\tilde{B}}$), min max($\gamma_{ij}^{\tilde{A}}$, $\gamma_{jk}^{\tilde{B}}$)]$_{m\times p}$, $1\leq i \leq m$, $1\leq k \leq p$ for j = 1,2,3,⋯,n.

4. Application of FSM in Medical diagnosis

In this section, we are put forwarding the problem which is based upon FSM in medical diagnosis.

4.1 Effect of Drug Addition in Medical diagnosis

In this field, diseases are quite common owing to the different calamities and environmental features. In order to cure several diseases, drugs are administered. But there is negative use or misuse of drugs. Youngsters, especially used the drugs as stimulant factor for pleasure giving activities. This use of drugs gave negative impact on their behaviour which will be referred to as an addiction of drugs. The concept of fuzzy soft matrices is applied to identify the group of human being who are addicted to drugs. Real dangers occurred for users and there will be deterioration of health. Drug addiction not only affects the brain but also other parts of the body which result multifarious side effect on their body and analyze the same by using fuzzy soft matrices.

Now, we apply fuzzy soft matrices in decision making problem.

4.2 Fuzzy Soft Matrices in Medical Diagnosis

Let us assume S is the set of symptoms of some side effects due to over dosage of pills, D is the side effects related to these symptoms and P is the set of patients showing the symptoms present in the set S. We construct a fuzzy soft set $(\tilde{F}_A, D)$ over S. A relation matrix $\tilde{A}$ is obtained from the fuzzy soft set $(\tilde{F}_A, D)$. We would name the matrix as symptom-disease matrix. Similarly its complement $(\tilde{F}_A, D)^{\circ}$ gives another relation matrix $\tilde{A}^{\circ}$ called non symptom diseases matrix. We call the matrices $\tilde{A}$ and $\tilde{A}^{\circ}$ as medical knowledge of fuzzy soft set. Further, we construct another fuzzy soft set $(\tilde{F}_B, S)$ over P. This fuzzy soft set gives the relation matrix $\tilde{B}$ called patient-symptom matrix and its complement $(\tilde{F}_B, S)^{\circ}$ gives the relation matrix $\tilde{B}^{\circ}$ called patient- non symptom matrix. Then using **Definition 3.6 above,** we obtain two new relation matrices $\tilde{T}_1= \tilde{B}\tilde{A}$ and $\tilde{T}_2=\tilde{B}\tilde{A}^{\circ}$ called patient symptom disease matrix and patient symptom non disease matrix respectively. In a similar manner, we obtain the relation matrices $\tilde{T}_3=\tilde{B}^{\circ}\tilde{A}$ and $\tilde{T}_4=\tilde{B}^{\circ}\tilde{A}^{\circ}$ called the patient non symptom disease matrix and patient non symptom non disease matrix respectively.

Now $\tilde{T}_1= \tilde{B}.\tilde{A}$, $\tilde{T}_2=\tilde{B}.\tilde{A}^{\circ}$, $\tilde{T}_3=\tilde{B}^{\circ}.\tilde{A}$, $\tilde{T}_4=\tilde{B}^{\circ}.\tilde{A}^{\circ}$ **(4.2.1)**

using definition **3.1** we may obtain the corresponding membership value matrices MV($\tilde{T}_1$), MV($\tilde{T}_2$), MV($\tilde{T}_3$) and MV($\tilde{T}_4$).

We calculate the diagnosis score $S_{\tilde{T}_1}$ and $S_{\tilde{T}_2}$ for and against the disease respectively as

$S_{\tilde{T}_1} = [\gamma(\tilde{T}_1)_{ij}]_{mxn}$, Where $\gamma(\tilde{T}_1)_{ij} = \delta(\tilde{T}_1)_{ij} - \delta(\tilde{T}_3)_{ij}$ **(4.2.2)**

and

$S_{\tilde{T}_2} = [\gamma(\tilde{T}_2)_{ij}]_{mxn}$, Where $\gamma(\tilde{T}_2)_{ij} = \delta(\tilde{T}_2)_{ij} - \delta(\tilde{T}_4)_{ij}$ **(4.2.3)**

Now if $\max_j (S_{\tilde{T}_1}(p_i,d_j) - S_{\tilde{T}_2}(p_i,d_j))$ occurs for exactly (p_i,d_k) only, then we would be in a position to accept that diagnosis hypothesis for patient p_i is the disease d_k. In case there is a tie, the process is repeated for patient p_i by reassessing the symptoms.

5. Algorithm

1. Input the fuzzy soft set $(\tilde{F}_A, D)$ and compute $(\tilde{F}_A, D)^\circ$. Compute the corresponding matrices $\tilde{A}$ and $\tilde{A}^\circ$.
2. Input the fuzzy soft set $(\tilde{F}_B, S)$ and compute $(\tilde{F}_B, S)^\circ$. Compute the corresponding matrices $\tilde{B}$ and $\tilde{B}^\circ$.
3. Compute $\tilde{T}_1 = \tilde{B}.\tilde{A}$, $\tilde{T}_2 = \tilde{B}.\tilde{A}^\circ$, $\tilde{T}_3 = \tilde{B}^\circ.\tilde{A}$, $\tilde{T}_4 = \tilde{B}^\circ.\tilde{A}^\circ$.
4. Compute the corresponding membership value matrices MV($\tilde{T}_1$), MV($\tilde{T}_2$), MV($\tilde{T}_3$) and MV($\tilde{T}_4$).
5. Compute the diagnosis score $S_{\tilde{T}_1}$ and $S_{\tilde{T}_2}$.
6. Find $S_K = \max_j (S_{\tilde{T}_1}(p_i,d_j) - S_{\tilde{T}_2}(p_i,d_j))$. We conclude that the patient p_i is suffering from the disease d_k.
7. If S_K has more than one value, then go to step (1) and repeat the process by reassessing the symptoms for the patient.

6. Case Study

Suppose that there are three patients P_1, P_2, P_3 are admitted in a hospital those who intake over dosage for sensual pleasure which will affect the brain cells lead to the symptoms of hysteria, then the patient who used sleeping pills will have the side effect of headache and stomach pain, then the patient who take birth control pills will have the side effect of depression and stroke. We consider the set S=$\{e_1, e_2, e_3\}$ as universal set Where e_1, e_2 and e_3 represent the symptoms of hysteria, headache and stomach pain, depression and stroke problems respectively and the set D=$\{d_1, d_2\}$, where d_1 and d_2 represent the parameters of side effect in the human body, particularly brain and heart problem diseases respectively.

Step1

Let the fuzzy soft set $(\tilde{F}_A, D)$ over S, where $\tilde{F}_A$ is a mapping $\tilde{F}_A$:D→ $\tilde{F}(S)$, gives an approximate description of fuzzy soft medical knowledge of the side effect diseases and their symptoms appeared due to the abnormal usage of pills.

Let $(\tilde{F}_A, D) = \{\tilde{F}_A(d_1) = \{(e_1,0.3,0),(e_2,0.6,0),(e_3,0.5,0)\}$,
$\tilde{F}_A(d_2) = \{(e_1,0.9,0),(e_2,0.7,0),(e_3,0.8,0)\}\}$

Complement of $(\tilde{F}_A, D)$ (i.e) $(\tilde{F}_A, D)^\circ$ is given by

$(\tilde{F}_A, D)^\circ = \{\tilde{F}_A^\circ(d_1) = \{(e_1,1,0.3),(e_2,1,0.6),(e_3,1,0.5)\}$,
$\tilde{F}_A^\circ(d_2) = \{(e_1,1,0.9),(e_2,1,0.7),(e_3,1,0.8)\}\}$

We represent the fuzzy soft sets $(\tilde{F}_A, D)$ and $(\tilde{F}_A, D)^\circ$ by the following matrices $\tilde{A}$ and $\tilde{A}^\circ$ respectively.

$$\tilde{A} = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array} \begin{array}{c} \begin{array}{cc} d_1 & d_2 \end{array} \\ \begin{bmatrix} (0.3,0) & (0.9,0) \\ (0.6,0) & (0.7,0) \\ (0.5,0) & (0.8,0) \end{bmatrix} \end{array} \text{ and } \tilde{A}^\circ = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array} \begin{array}{c} \begin{array}{cc} d_1 & d_2 \end{array} \\ \begin{bmatrix} (1,0.3) & (1,0.9) \\ (1,0.6) & (1,0.7) \\ (1,0.5) & (1,0.8) \end{bmatrix} \end{array}$$

Step2

Again we take $P = (P_1, P_2, P_3)$ as the universal set where P_1, P_2 and P_3 represent three patients respectively and S= $\{e_1, e_2, e_3\}$ as the set of parameters, where e_1, e_2 and e_3 represent the symptoms of side effect diseases and stroke problem respectively.

Let $(\tilde{F}_B, S)$ fuzzy soft set, where $\tilde{F}_B$ is a mapping $\tilde{F}_B$:S→ $\tilde{F}(P)$, gives a collection of an approximate description of the patient side effect symptoms in the hospital.

Let $(\tilde{F}_B, S) = \{\tilde{F}_B(e_1) = \{(P_1,0.7,0),(P_2,0.8,0),(P_3,0.2,0)\}$,
$\tilde{F}_B(e_2) = \{(P_1,0.8,0),(P_2,0.5,0),(P_3,0.6,0)\}$
$\tilde{F}_B(e_3) = \{(P_1,0.3,0),(P_2,0.6,0),(P_3,0.7,0)\}\}$

We note this fuzzy soft set $(\tilde{F}_B, S)$ by the following matrix $\tilde{B}$, called patient symptom matrix.

$$\tilde{B} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{array}{c} \begin{array}{ccc} e_1 & e_2 & e_3 \end{array} \\ \begin{bmatrix} (0.7,0) & (0.8,0) & (0.3,0) \\ (0.8,0) & (0.5,0) & (0.6,0) \\ (0.2,0) & (0.6,0) & (0.7,0) \end{bmatrix} \end{array}$$

Complement of $(\tilde{F}_B, S)$ (i.e) $(\tilde{F}_B, S)^\circ$ is given by

$(\tilde{F}_B, S)^\circ = \{(\tilde{F}_B(e_1) = \{(P_1,1,0.7),(P_2,1,0.8),(P_3,1,0.2)\}$,
$\tilde{F}_B(e_2) = \{(P_1,1,0.8),(P_2,1,0.5),(P_3,1,0.6)\}$
$\tilde{F}_B(e_3) = \{(P_1,1,0.3),(P_2,1,0.6),(P_3,1,0.7)\}\}$

We note this fuzzy soft set $(\tilde{F}_B, S)^\circ$ by the following matrix $\tilde{B}^\circ$ called patient-non symptom matrix.

$$\tilde{B}^\circ = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{array}{c} \begin{array}{ccc} e_1 & e_2 & e_3 \end{array} \\ \begin{bmatrix} (1,0.7) & (1,0.8) & (1,0.3) \\ (1,0.8) & (1,0.5) & (1,0.6) \\ (1,0.2) & (1,0.6) & (1,0.7) \end{bmatrix} \end{array}$$

Step3 and step4

Thus we have

$$\tilde{T}_1 = \tilde{B}.\tilde{A} = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array} \begin{array}{c} \begin{array}{cc} d_1 & d_2 \end{array} \\ \begin{bmatrix} (0.6,0) & (0.7,0) \\ (0.5,0) & (0.8,0) \\ (0.6,0) & (0.7,0) \end{bmatrix} \end{array}$$

And

$$\tilde{T}_2 = \tilde{B}.\tilde{A}^\circ = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array} \begin{array}{c} \begin{array}{cc} d_1 & d_2 \end{array} \\ \begin{bmatrix} (0.8,0.3) & (0.8,0.7) \\ (0.8,0.3) & (0.8,0.7) \\ (0.7,0.3) & (0.7,0.7) \end{bmatrix} \end{array}$$

We have the following membership value matrices MV($\tilde{T}_1$), MV($\tilde{T}_2$).

$$MV(\tilde{T}_1) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{array}{c} \begin{array}{cc} d_1 & d_2 \end{array} \\ \begin{bmatrix} 0.6 & 0.7 \\ 0.5 & 0.8 \\ 0.6 & 0.7 \end{bmatrix} \end{array} \text{ and } MV(\tilde{T}_2) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{array}{c} \begin{array}{cc} d_1 & d_2 \end{array} \\ \begin{bmatrix} 0.5 & 0.1 \\ 0.5 & 0.1 \\ 0.4 & 0.0 \end{bmatrix} \end{array}$$

Again

$$\tilde{T}_3=\tilde{B}^{\circ}.\tilde{A}= \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{array}{c} \begin{matrix} d_1 & d_2 \end{matrix} \\ \begin{bmatrix} (0.6,0.3) & (0.9,0.3) \\ (0.6,0.5) & (0.9,0.5) \\ (0.6,0.2) & (0.9,0.2) \end{bmatrix} \end{array}$$ and

$$\tilde{T}_4=\tilde{B}^{\circ}.\tilde{A}^{\circ}= \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{array}{c} \begin{matrix} d_1 & d_2 \end{matrix} \\ \begin{bmatrix} (1,0.5) & (1,0.8) \\ (1,0.6) & (1,0.7) \\ (1,0.3) & (1,0.7) \end{bmatrix} \end{array}$$

We have the following membership value matrices $MV(\tilde{T}_3)$, $MV(\tilde{T}_4)$.

$$MV(\tilde{T}_3) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{array}{c} \begin{matrix} d_1 & d_2 \end{matrix} \\ \begin{bmatrix} 0.3 & 0.6 \\ 0.1 & 0.4 \\ 0.4 & 0.7 \end{bmatrix} \end{array} \text{ and } MV(\tilde{T}_4) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{array}{c} \begin{matrix} d_1 & d_2 \end{matrix} \\ \begin{bmatrix} 0.5 & 0.2 \\ 0.4 & 0.3 \\ 0.7 & 0.3 \end{bmatrix} \end{array}$$

We conclude the diagnosis score $S_{\tilde{T}_1}$ and $S_{\tilde{T}_2}$ for and against the diseases as below.

$$S_{\tilde{T}_1}= \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{array}{c} \begin{matrix} d_1 & d_2 \end{matrix} \\ \begin{bmatrix} 0.3 & 0.1 \\ 0.4 & 0.4 \\ 0.2 & 0.0 \end{bmatrix} \end{array} \text{ and } S_{\tilde{T}_2}= \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array}\begin{array}{c} \begin{matrix} d_1 & d_2 \end{matrix} \\ \begin{bmatrix} 0.0 & -0.1 \\ 0.1 & -0.2 \\ -0.3 & -0.3 \end{bmatrix} \end{array}$$

Step5

Now we have the difference for and against the diseases

$S_{\tilde{T}_1} - S_{\tilde{T}_2}$	d_1	d_2
P_1	0.3	0.2
P_2	0.3	0.6
P_3	0.5	0.3

We conclude that P_2 is suffering from more serious heart problem form the diseases d_2 and P_1 and P_3 are suffering from the disease d_1.

Conclusion

In this paper, we elucidate the theory fuzzy soft matrices in the field of medical diagnosis. We enhance some new concepts such as complement of fuzzy soft matrix based of reference function. The drug addicted persons should be given awareness of how it has affected the body. Rehabilitation camps should be set up to bring these people to come back to the society. Future work in this regard would be required to study whether the notions put forward in this paper yield a fruitful result.

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