IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Impact Factor: 7.301

Volume 3, Issue 2, February 2023

Application of Fuzzy Membership Value Matrix

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Abstract: *Fuzzy set theory plays a dynamic role in medicinal fields. There are varieties of simulations involving fuzzy matrices to deal with different complicated aspects of medical diagnosis. Today may be a world of uncertainty with its associated problems, which may be well handled by fuzzy soft set theory. Sanchez formulated the diagnostic models including intuitionistic fuzzy matrices representing the medical knowledge between the symptoms and diseases. In this paper, an algorithm is developed and a few examples are proposed to construct the decision method for Diagnosis.*

Keywords: Algorithm, Case study, Decision making problem Fuzzy soft set, Fuzzy soft Matrix, Operations of Fuzzy soft matrix

Mathematics subject classification: 03B52, 92C50, 91B06

I. INTRODUCTION

FuzzySoft set theory is a generalization of soft set theory that was proposed by Molodtsov in 1999 to deal with uncertainty in a parametric manner. The most important steps for the new theory of soft sets was to define mapping on soft sets, which was achieved in 2009 by Athar Kharal and Bashir Ahmed, soft sets have also applied to the problem of medical diagnosis for use in medical expert systems. Fuzzy soft sets have also been introduced by Kharal and Ahmed. The matrix representation of a fuzzy soft set (Yong Yang and chen liji,2011) was successfully applied to the proposed notion of fuzzy soft matrix in certain decision making problems. In this paper fuzzy soft matrix theory has been introduced and also extended our approach with regard to fuzzy soft matrices based on reference function in medical diagnosis. Tuberculosis is an infectious disease that usually affects the lungs. Compared with other diseases caused by a single infectious agent, tuberculosis is the second biggest killer, globally. The world health organization estimates that 9 million people a year get sick with TB. It is among top 3 causes of death for women aged 5 to 44.It is an airborne pathogen

- **Latent TB**: Latent TB occurs when a person has being TB Bacteria within their body, but the bacteria are presenting very small numbers. They are kept control by the body's immune system and do not cause any symptoms and are not contagious, but they can become active.
- **Active TB**: The bacteria do cause symptoms and can be transmitted to others. This condition makes you sick and can spread to others. It can occur in the first few weeks after.

1.1 Soft Set

Let U be an initial universal 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) there exists F_A (e) = ϕ is e ∉ 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 consists 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.

1.2 Fuzzy Soft Set

Let U be an initial universal 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.

1.3 Fuzzy Soft Class

Let U be an initial universal set and E be a 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.

IJARSCT
ISSN (Online) 2581-9429
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1.4 Fuzzy Soft Sub Set

For two fuzzy soft sets ($\tilde{F}_A$, E) and ($\tilde{G}_B$, E) over a common universal U, ($\tilde{F}_A$, E) ⊆($\tilde{G}_B$, E) if A ⊂Band ∀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).

1.5 Fuzzy Soft Complement Set

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

1.6 Fuzzy Soft Matrices

Let U={u_1,u_2,u_3,u_4…,u_m}be the universal set and E be the set of parameters given by E={e_1,e_2,…,e_n}.Then the fuzzy soft set ($\tilde{F}_A$, E)can be expressed in matrix form as $\tilde{A}$ = $\left[a_{ij}{}^{\tilde{A}}\right]_{m\times n}$ or simply by $\left[a_{ij}{}^{\tilde{A}}\right]$, i=1,2,3,….m;j=1,2,3,…n and $\left[a_{ij}{}^{\tilde{A}}\right]$ = [($\mu_{ij}{}^{\tilde{A}}$,$\gamma_{ij}{}^{\tilde{A}}$)]where $\mu_{ij}{}^{\tilde{A}}$ and $\gamma_{ij}{}^{\tilde{A}}$ represent the fuzzy membership function and fuzzy reference function respectively of value of u_i in the fuzzy set so that $\phi_{ij}{}^{\tilde{A}}$ = $\mu_{ij}{}^{\tilde{A}}$ - $\gamma_{ij}{}^{\tilde{A}}$ gives the fuzzy membership values of u_i . Identify a fuzzy soft set with its fuzzy soft matrix and use these two concepts inter changeable. The set of all m×n fuzzy soft matrices over U will be denoted by$\mathrm{FSM}_{m\times n}$.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.

II. MEMBERSHIP VALUE MATRIX

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

2.1 Zero Fuzzy Soft Matrix

Let $\tilde{A}$ =$\left[a_{ij}{}^{\tilde{A}}\right]_{m\times n}$∈$\mathrm{FSM}_{m\times n}$, where $a_{ij}{}^{\tilde{A}}$ = ($\mu_{ij}{}^{\tilde{A}}$,$\gamma_{ij}{}^{\tilde{A}}$);Then $\tilde{A}$ is called a fuzzy soft zero matrix denoted by $\widetilde{(1)}$, if $\delta_{ij}{}^{\tilde{A}}$ =0 be all i and j for usual fuzzy sets , $\delta_{ij}{}^{\tilde{A}}$ = $\gamma_{ij}{}^{\tilde{A}}$ ¥ i,j.

2.2 Identity Fuzzy Soft Matrix

Let $\tilde{A}$ =$\left[a_{ij}{}^{\tilde{A}}\right]_{m\times n}$∈$\mathrm{FSM}_{m\times n}$, where $a_{ij}{}^{\tilde{A}}$ = ($\mu_{ij}{}^{\tilde{A}}$,$\gamma_{ij}{}^{\tilde{A}}$);Then $\tilde{A}$ is called a fuzzy soft identity matrix denoted by $\widetilde{(1)}$, if m=n ,$a_{ij}{}^{\tilde{A}}$ = ($\mu_{ij}{}^{\tilde{A}}$,$\gamma_{ij}{}^{\tilde{A}}$) for all i ≠ j and $a_{ij}{}^{\tilde{A}}$ = (0, 1) i.e., $a_{ij}{}^{\tilde{A}}$ = 1 ¥ i,j.

2.3 Ompliment of Fuzzy Soft Matrices

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

2.4 Oduct of Fuzzy Soft Matrices

Let $\tilde{A}$ =$\left[a_{ij}{}^{\tilde{A}}\right]_{m\times n}$∈$\mathrm{FSM}_{m\times n}$, where $a_{ij}{}^{\tilde{A}}$ =($\mu_{ij}{}^{\tilde{A}}$,$\gamma_{ij}{}^{\tilde{A}}$); where $\mu_{ij}{}^{\tilde{A}}$ and $\gamma_{ij}{}^{\tilde{A}}$ represent the fuzzy membership function and fuzzy reference function respectively of u_i, so that $\delta_{ij}{}^{\tilde{A}}$ =$\mu_{ij}{}^{\tilde{A}}$-$\gamma_{ij}{}^{\tilde{A}}$ gives the fuzzy membership value of u_i . Also let $\tilde{B}$ = $\left[b_{ij}{}^{\tilde{B}}\right]_{n\times p}$ where $b_{ij}{}^{\tilde{B}}$=($\mu_{jk}{}^{\tilde{B}}$,$\gamma_{jk}{}^{\tilde{B}}$) , where $\mu_{jk}{}^{\tilde{B}}$ and $\gamma_{jk}{}^{\tilde{B}}$ represents fuzzy member function and fuzzy reference function of u_i. Now define $\tilde{A}$and $\tilde{B}$ as

$\tilde{A}.\tilde{B}$=$\left[d_{ik}{}^{\tilde{A}\tilde{B}}\right]_{m\times p}$=[max min ($\mu_{ik}{}^{\tilde{A}}$, $\mu_{jk}{}^{\tilde{B}}$), min max ($\gamma_{ik}{}^{\tilde{A}}$, $\gamma_{jk}{}^{\tilde{B}}$)],1≤i≤m, 1≤ k ≤ p for j =1,2,…,n

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
IJARSCT
Impact Factor: 7.301
Volume 3, Issue 2, February 2023

III. APPLICATION OF FUZZY MEMBERSHIP MATRIX IN MEDICAL DIAGNOSIS

Let us assume S is the set of types of some effects of tuberculosis D is the side effects related to these types and P is the set of Patients having the types of TB present in these set S. 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). name the matrix as symptom disease matrix. Similarly its complement $(\tilde{F}_A, D)^{\circ}$gives another relation matrix $\tilde{A}^{\circ}$ called symptom disease matrix name the matrices $\tilde{A}$ and $\tilde{A}^{\circ}$ as medical knowledge of fuzzy soft test, further construct another fuzzy soft set ($\tilde{F}_B$,S) over P. This fuzzy soft set gives the relation matrix $\tilde{B}$ called patient symptom disease matrix and its complement $(\tilde{F}_B, S)^{\circ}$gives the relation matrix $\tilde{B}^{\circ}$ called patient non- symptom disease matrix. Then using definition , obtain two new relation matrices $\widetilde{T_1}= \tilde{B}\tilde{A}$ and $\widetilde{T_2}= \tilde{B}\tilde{A}^{\circ}$ called Patient symptom disease matrix and patient non symptom disease matrix respectively. In a similar manner, obtain the relation matrices $\widetilde{T_3}=\tilde{B}^{\circ}\tilde{A}$ and $\widetilde{T_4}=\tilde{B}^{\circ}\tilde{A}^{\circ}$ called the patient symptom non disease matrix and patient non symptom non disease matrix respectively. Now $\widetilde{T_1}= \tilde{B}\tilde{A}$, $\widetilde{T_2}= \tilde{B}\tilde{A}^{\circ}$, $\widetilde{T_3}=\tilde{B}^{\circ}\tilde{A}$, $\widetilde{T_4}=\tilde{B}^{\circ}\tilde{A}^{\circ}$

Then one may obtain the corresponding membership value matrices MV($\widetilde{T_1}$), MV($\widetilde{T_2}$), MV($\widetilde{T_3}$) and MV($\widetilde{T_4}$). Calculate the diagnosis scores S$\widetilde{T_1}$and S$\widetilde{T_2}$for and against the disease respectively

$$S\widetilde{T_1}= \left[Y(\widetilde{T_1})_{IJ}\right]_{m\times n} \text{ Where } Y(\widetilde{T_1})_{IJ}= \delta(\widetilde{T_1})_{IJ} - \delta(\widetilde{T_3})_{IJ}$$

$$S\widetilde{T_2}= \left[Y(\widetilde{T_2})_{IJ}\right]_{m\times n} \text{ Where } Y(\widetilde{T_2})_{IJ}=\delta(\widetilde{T_2})_{IJ} - \delta(\widetilde{T_4})_{IJ}$$

Now if max [S$\widetilde{T_1}(p_i, d_j)$ − S$\widetilde{T_2}(p_i, d_j)$] occurs for exactly ($p_i, d_k$) only, then one 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 symptom.

IV. 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 softest ($\tilde{F}_B$,S) and compute $(\tilde{F}_B, S)^{\circ}$,compute the corresponding matrices $\tilde{B}$ and $\tilde{B}^{\circ}$
3. Compute $\widetilde{T_1}$,$\widetilde{T_2}$,$\widetilde{T_3}$,$\widetilde{T_4}$
4. Compute MV($\widetilde{T_1}$), MV($\widetilde{T_2}$), MV($\widetilde{T_3}$) and MV($\widetilde{T_4}$).
5. Compute S$\widetilde{T_1}$and S$\widetilde{T_2}$
6. Find S_k = max [S$\widetilde{T_1}(p_i, d_j)$ − S$\widetilde{T_2}(p_i, d_j)$] . Thus concluding that the patient p_i is suffering from the disease d_k

V. APPLICATION OF FUZZY MEMBERSHIP MATRIX IN MEDICAL DIAGNOSIS TO FIND THE PATIENTS HAVING LATENT AND ACTIVE TB

Suppose that there are the three patients p_1, p_2, p_3admitted in a hospital who affect the tuberculosis disease. Consider the set S = $\{e_1, e_2, e_3\}$ as a universal set where e_1, e_2 and e_3 represent the symptoms of Coughing up blood, unintentional weight loss, fatigue, loss of appetite 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 of Latent TB and Active TB

Step 1

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 appropriated ascription of fuzzy soft Medical knowledge of the side effect diseases and their symptoms appeared due to tuberculosis.

$$\text{Let } (\tilde{F}_A, D) = \begin{Bmatrix} \tilde{F}_A(d_1) = \{(e_1, 0.8,0), (e_2, 0.7,0), (e_3, 0.5,0)\} \\ \tilde{F}_A(d_2) = \{(e_1, 0.4,0), (e_2, 0.3,0), (e_3, 0.6,0)\} \end{Bmatrix}$$

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

$$(\tilde{F}_A, D)^{\circ}=\begin{Bmatrix} \tilde{F}_A(d_1) = \{(e_1, 1,0.8), (e_2, 1,0.7), (e_3, 1,0.5)\} \\ \tilde{F}_A(d_2) = \{(e_1, 1,0.4), (e_2, 1,0.3), (e_3, 1,0.6)\} \end{Bmatrix}$$

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

$$d_1 d_2 d_1 d_2$$

$$\tilde{A}=\begin{array}{c} e_1 \\ e_2 \\ e_3 \end{array}\begin{bmatrix} 0.8,0 & 0.4,0 \\ 0.7,0 & 0.3,0 \\ 0.5,0 & 0.6,0 \end{bmatrix} \text{ and } \tilde{A}^{\circ}=\begin{array}{c} e_1 \\ e_2 \\ e_3 \end{array}\begin{bmatrix} 1,0.8 & 1,0.4 \\ 1,0.7 & 1,0.3 \\ 1,0.5 & 1,0.6 \end{bmatrix}$$

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

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Impact Factor: 7.301

Volume 3, Issue 2, February 2023

Step 2

Again 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.

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

$$\text{Let } (\tilde{F}_B, S) = \begin{Bmatrix} \tilde{F}_B(e_1) = \{(p_1, 0.2, 0), (p_2, 0.7, 0), (p_3, 0.5, 0)\} \\ \tilde{F}_B(e_2) = \{(p_1, 0.1, 0), (p_2, 0.4, 0), (p_3, 0.3, 0)\} \\ \tilde{F}_B(e_3) = \{(p_1, 0.6, 0), (p_2, 0.8, 0), (p_3, 0.7, 0)\} \end{Bmatrix}$$

The fuzzy soft set $(\tilde{F}_B, S)$ by the following matrix $\tilde{B}$ patient symptom matrix

$$\tilde{B} = \begin{array}{c} \\ p_1 \\ p_2 \\ p_3 \end{array} \begin{array}{c} e_1 \quad e_2 \quad e_3 \\ \begin{bmatrix} 0.2,0 & 0.1,0 & 0.6,0 \\ 0.7,0 & 0.4,0 & 0.8,0 \\ 0.5,0 & 0.3,0 & 0.7,0 \end{bmatrix} \end{array}$$

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

$$(\tilde{F}_B, S)^\circ = \begin{Bmatrix} \tilde{F}_B(e_1) = \{(p_1, 1, 0.2), (p_2, 1, 0.7), (p_3, 1, 0.5)\} \\ \tilde{F}_B(e_2) = \{(p_1, 1, 0.1), (p_2, 1, 0.4), (p_3, 1, 0.3)\} \\ \tilde{F}_B(e_3) = \{(p_1, 1, 0.6), (p_2, 1, 0.8), (p_3, 1, 0.7)\} \end{Bmatrix}$$

$$\tilde{B}^\circ = \begin{array}{c} \\ p_1 \\ p_2 \\ p_3 \end{array} \begin{array}{c} e_1 \quad e_2 \quad e_3 \\ \begin{bmatrix} 1,0.2 & 1,0.1 & 1,0.6 \\ 1,0.7 & 1,0.4 & 1,0.8 \\ 1,0.5 & 1,0.3 & 1,0.7 \end{bmatrix} \end{array}$$

Step 3 and step 4

Thus

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

$$\tilde{T}_2 = \tilde{B}.\tilde{A}^\circ = \begin{array}{c} \\ e_1 \\ e_2 \\ e_3 \end{array} \begin{array}{c} d_1 \quad d_2 \\ \begin{bmatrix} 0.6,0.5 & 0.6,0.3 \\ 0.8,0.5 & 0.8,0.3 \\ 0.7,0.5 & 0.7,0.3 \end{bmatrix} \end{array}$$

The following membership value matrices MV($\tilde{T}_1$) and MV($\tilde{T}_2$)

$$MV(\tilde{T}_1) = \begin{array}{c} \\ p_1 \\ p_2 \\ p_3 \end{array} \begin{array}{c} d_1 \quad d_2 \\ \begin{bmatrix} 0.5 & 0.6 \\ 0.7 & 0.6 \\ 0.5 & 0.6 \end{bmatrix} \end{array}$$

$$MV(\tilde{T}_2) = \begin{array}{c} \\ p_1 \\ p_2 \\ p_3 \end{array} \begin{array}{c} d_1 \quad d_2 \\ \begin{bmatrix} 0.1 & 0.3 \\ 0.3 & 0.5 \\ 0.2 & 0.4 \end{bmatrix} \end{array}$$

$d_1 d_2$

IJARSCT
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International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Impact Factor: 7.301
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$$\widetilde{T_3} = \tilde{B}^{\circ}\tilde{A} = \begin{array}{c} p_1 \\ p_2 \\ p_3 \end{array}\begin{bmatrix} 0.8,0.1 & 0.6,0.1 \\ 0.8,0.4 & 0.6,0.4 \\ 0.8,0.3 & 0.6,0.3 \end{bmatrix}$$

$d_1 d_2$

$$\widetilde{T_4} = \tilde{B}^{\circ}\tilde{A}^{\circ} = \begin{array}{c} p_1 \\ p_2 \\ p_3 \end{array}\begin{bmatrix} 1,0.6 & 1,0.6 \\ 1,0.8 & 1,0.8 \\ 1,0.8 & 1,0.7 \end{bmatrix}$$

We have the following membership value matrices MV($\widetilde{T_3}$) and MV($\widetilde{T_4}$)

$d_1 d_2$

$$\mathrm{MV}(\widetilde{T_3}) = \begin{array}{c} p_1 \\ p_2 \\ p_3 \end{array}\begin{bmatrix} 0.7 & 0.5 \\ 0.4 & 0.2 \\ 0.5 & 0.3 \end{bmatrix}$$

$d_1 d_2$

$$\mathrm{MV}(\widetilde{T_4}) = \begin{array}{c} p_1 \\ p_2 \\ p_3 \end{array}\begin{bmatrix} 0.4 & 0.4 \\ 0.2 & 0.2 \\ 0.2 & 0.3 \end{bmatrix}$$

Conclude the diagnosis score $S\widetilde{T_1}$ and $S\widetilde{T_2}$ for against the diseases as below

$d_1 d_2$

$$S\widetilde{T_1} = \begin{array}{c} p_1 \\ p_2 \\ p_3 \end{array}\begin{bmatrix} 0.2 & 0.1 \\ 0.3 & 0.4 \\ 0.0 & 0.3 \end{bmatrix} \text{ and}$$

$d_1 d_2$

$$S\widetilde{T_2} = \begin{array}{c} p_1 \\ p_2 \\ p_3 \end{array}\begin{bmatrix} -0.3 & -0.1 \\ 0.1 & 0.3 \\ 0.0 & 0.1 \end{bmatrix}$$

Now, the difference for and against the diseases are

$S\widetilde{T_1} - S\widetilde{T_2}$	d_1	d_2	Maximum value
p_1	0.5	0.2	0.5
p_2	0.2	0.1	0.2
p_3	0.0	0.2	0.2

p_1, p_2 is suffering Latent TB and p_3 suffering Active TB

VI. CONCLUSION

In this Paper, the theory of fuzzy soft matrices in the field of medical diagnosis has been elucidated and some new concepts such as complement of fuzzy soft matrix has been enhanced based on reference function. The TB affected patients should be given awareness of how it has affected the body. Awareness programs should be set up to prevent the spread of this disease. 50 patients data has been collected and the above relation is formed with that. But for the purpose of understanding it is explained with 3 patients data which can be done the same way for hundreds of data also. In the above result most of the people affected Latent TB.

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