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INTUITIONISTIC FUZZY SOFT MATRIX AND ITS APPLICATION IN YOGA ON ASTHMA

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ABSTRACT

F*uzzy Soft Matrices and intuitionist fuzzy soft matrices have been newly been applied in many fields of real life script. Here we introduce a new methodology has been developed involving product to solve intuitionistic fuzzy soft set based real life decision making problems. Which may include more than one decision maker. In this paper, research on the possible benefit of yoga intervention for individuals with asthma especially when practiced with inclusion of the whole of its traditional techniques provides benefit for asthma suffers. The recommended practice will help patients with asthma develop a new awareness of how physical posture and breathing techniques can minimize the frequency and severity of asthma episode.*

Key words: *Soft set, fuzzy soft set, intuitionistic fuzzy soft matrix, value matrix, score matrix, Asthma.*

I. INTRODUCTION

In real world we solve so many uncertainties in all walks of life fields. However most of the existing Mathematical tools for formal modeling, reasoning and computing are crisp deterministic and percise in character. There are theories viz, theory of probability evidence, fuzzy set, intuitionist fuzzy set rough set for dealing with uncertainties. Soft set theory has a rich factual for application in solving workout problems in economics, social science, Medical science etc., Matrices play an important role in the board area of science and engineering. However, the classical matrix theory sometimes give out to solve the problems involving uncertainties. Chetia *et al.* [9] proposed new intuitionistic fuzzy soft Matrix theory, Accordingly, Rajarajeswari *et al.* [10, 11, 12] proposed new definitions for intuitionistic fuzzy soft matrices and its types. Also extended and applied some, operations on it. In this paper, a new approach for medical diagnosis is proposed by employing intuitionistic fuzzy soft Matrices. In order to attain this, value Matrix and score Matrix are employed. The solution is obtained based on the maximum score in the score Matrix. Sanchez's approach for decision making is studied and the concept is generalized by the application of intuitionistic fuzzy soft set theory.

Asthma is a complex and often not fully understood process. Because asthma has many possible contributing factors, including exercise allergic reaction, air pollution, emotional factors, and genetics, it is best to consider a multi facted approach to prevention treatment. In a review of non traditional approaches to asthma. Perlman and serbin reported that yoga is a helpful complementary therapy for asthma. Holistic approaches to asthma a care can include establishing a regular and effective yoga, practice.

II. PRELIMINERIES

Definition 2.1: Suppose that U is an initial universe set and E is set of parameters, let P(U) denotes the power set of U. A pair (F, E) is called a soft set over U where F is a mapping given by $F : E \to P(U)$. Clearly, a soft set is a mapping from parameters to P (U) and it is not a set, but a parameterized family of subsets of the Universe.

Definition 2.2: Let U be an initial universe set and E be the set of parameters. Let $A \subseteq E$. A Pair (F, A) is called 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 fuzzy subset of U.

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Definition 2.3: Let U=$\{C_1, C_2, C_3, ...C_m\}$ be the universal set and E be the set of parameters given by E =$\{e_1, e_2, ...e_n\}$. Let $A \subseteq E$ and (F,A) be a fuzzy soft set in the fuzzy soft class (U,E). Then fuzzy soft set (F, A) in a matrix form as $A_{mxn} = [a_{ij}]_{mxn}$ or A= $[a_{ij}]$

I = 1,2,…… m , j = 1,2,3,……..n

where $$aij = \begin{cases} \mu_j(c_i) & \text{if } e_j \in A \\ 0 & \text{if } e_j \notin A \end{cases} \quad \mu_j(C_i)$$

Represents the membership of C_i in the fuzzy set $F(e_j)$

Definition 2.4: Let U be the universal set and E be the set of Parameters. Let $A \subseteq E$. A pair (F, A) is called intuitionistic fuzzy soft set over U where F is a mapping given by $F : A \to I^U$, where I^U denotes the collection o all intuitionistic fuzzy subset of U.

Definition 2.5: Let U=$\{C_1, C_2, C_3, ...C_m\}$ be the universal set and E be the set of parameters given by E= $\{e_1, e_2, ...e_n\}$ let $A \subseteq E$ and (F, A) be a intuitionistic fuzzy soft set in the fuzzy soft class (U, E). Then intuitionistic fuzzy soft set (F,A) in a matrix form as

$A_{mxn} = [a_{ij}]_{mxn}$ or A= $[a_{ij}]$ i = 1,2,.....m

J = 1,2,3 .....n where aij = $\begin{cases} \mu_j(c_i) & \text{if } e_j \in A \\ (0,1) & \text{if } e_j \notin A \end{cases}$

$\mu_j(C_i)$ represents the membership of C_i in the intuitionistic fuzzy set $F(e_j)$. $V_j(C_i)$ represents the non – membership of C_i in the intuitionistic fuzzy set F (e_j).

Definition 2.6: *if* $A = [a_{ij}] \in IFSM_{mxn}, B = [b_{jk}] \in IFSM_{nxp}$
then we defined A * B, Product of A and B as

A * B = $[c_{ik}]_{mx\,p}$

= $[Max \min(\mu_{Aj}, \mu_{Bj}), Min \max(V_{Aj}\ V_{Bj})]\ \forall i,j$

Definition 2.7: If $A = [a_{ij}] \in IFSM_{mxn}$, where $C_{ij} = (\mu_j(C_i), V_j(C_i))$. then AC is called a intuitionistic fuzzy soft complement matrix if $A^C = [b_{ij}]_{mxn}$

$bij = (V_j(C_i), \mu_j(C_i))\ \forall i,j$

Definition 2.8: If $A = [a_{ij}] \in IFSM_{mxn}$, where $a_{ij} \in IFSM_{mxn}$. then we define score matrix of A and B as $S(A,B) = [d_{ij}]_{mxn}$ where $[d_{ij}] = V(A) - V(B)\ \forall\ i,j$.

III. ALGORITHM

Step-1: Input the intuitionstic fuzzy soft set (F, E), (G,E) and obtain the intuitionistic fuzzy soft matrices A, B corresponding to (F,E) and (G, E) respectively.

Step-2: Write the intuitionstic fuzzy soft complement set $(F,E)^C, (G,E)^C$ and obtain the intuitionistic fuzzy soft Matrix A^C, B^C corresponding to $(F,E)^C$ and $(G,E)^C$ respectively.

Step-3: Compute (A*B) , (A^C * B^C), V (A * B) , V (A^C * B^C)

Step-4: Compute the Score Matrix.

Step-5: Find P for which Max(S_i). Then we conclude that the patient P_j is suffering from diseases d_j, In case max (S_i) occurs for more then one value, then reassess the symptoms to break the tie.

IV. CASE STUDY

There are five patients Suresh, Karthic, Chandran, Gopal, Anandh are practiced in yoga with symptoms coughing, wheezing, shortness of breath, and chest pressure. Let the possible diseases related to the above symptoms be allergic asthma, Cough variant asthma, work related asthma and Night time asthma.

Now take $P=\{P_1,P_2,P_3,P_4,P_5\}$ as the universal set where P_1,P_2,P_3,P_4 *and* P_5 represents patients Suresh, Karthic, Chandran, Gopal, Ananth respectively. Let $S=\{S_1,S_2,S_3,S_4\}$ as the set of symptoms S_1,S_2,S_3,S_4 represents the symptoms coughing, Wheezing, Shortness of breath, chest pressure respectively. Suppose that IFSS (G, S) over P, where G is a mapping $G:S\to I^P$ gives a collection of an approximate description symptoms in the hospital.

(G,S) = {G(S_1) = { (P_1,0.4,0.6), (P_2,0.6,0.2), (P_3,0.8,0.1), (P_4,0.5,0.2), (P_5,0.2,0.7)
{G(S_2) = { (P_1,0.3,0.7), (P_2,0.4,0.5), (P_3,0.5,0.4), (P_4,0.3,0.6), (P_5,0.6,0.4)
{G(S_3) = { (P_1,0.6,0.2), (P_2,0.4,0.5), (P_3,0.3,0.7), (P_4,0.2,0.5), (P_5,0.8,0.1)
{G(S_4) = { (P_1,0.4,0.2), (P_2,0.5,0.4), (P_3,0.5,0.5), (P_4,0.2,0.8), (P_5,0.5,0.3)

Case-(i): Consider the Intuitionistic fuzzy soft Matrix

$$A = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} (0.4,0.6) & (0.3,0.7) & (0.6,0.2) & (0.4,0.2) \\ (0.6,0.2) & (0.4,0.5) & (0.4,0.5) & (0.5,0.4) \\ (0.8,0.1) & (0.5,0.4) & (0.3,0.7) & (0.5,0.5) \\ (0.5,0.2) & (0.3,0.6) & (0.2,0.5) & (0.2,0.8) \\ (0.2,0.7) & (0.6,0.4) & (0.8,0.1) & (0.5,0.3) \end{pmatrix} \end{array}$$

Next consider the set S={S_1, S_2, S_3, S_4) as universal set where S_1, S_2, S_3, S_4 represents symptoms Coughing, Wheezing, Shortness of breath, Chest Pressure respectively and the Set D = {d_1, d_2, d_3, d_4) Where d_1, d_2, d_3, and d_4 represent the disease Allergic – Asthma, Cought – Variant Asthma, work related Asthma, and Night time Asthma respectively. Suppose that IFSS (FD) Over S, where F is a mapping $F:D\to I^S$ gives as approximate description of Intuitionistic fuzzy soft medical knowledge of the four diseases and their symptoms, let,

F,D = {F(d_1) = {(S_1,0.4,0.2), (S_2,0.6,0.3), (S_3,0.4,0.5), (S_4,0.5,0.5)
{F(d_2) = {(S_1,0.6,0.2), (S_2,0.7,0.1), (S_3,0.7,0.2), (S_4,0.3,0.7)
{F(d_3) = {(S_1,0.4,0.4), (S_2,0.4,0.3), (S_3,0.8,0.1), (S_4,0.5,0.4)
{F(d_4) = {(S_1,0.9,0.1), (S_2,0.8,0.1), (S_3,0.7,0.2), (S_4,0.6,0.3)

This intuitionistic fuzzy soft set is represented by the following intuitionistic fuzzy soft matrix.

$$B = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} (0.4,0.2) & (0.6,0.2) & (0.4,0.4) & (0.9,0.1) \\ (0.6,0.3) & (0.7,0.1) & (0.4,0.3) & (0.8,0.1) \\ (0.4,0.5) & (0.7,0.2) & (0.8,0.1) & (0.7,0.2) \\ (0.5,0.5) & (0.3,0.7) & (0.5,0.4) & (0.6,0.3) \end{pmatrix} \end{array}$$

C**ase-(ii):** Then the intuitionistic fuzzy set complement Matrices are

$$A^C = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} (0.6,0.4) & (0.7,0.3) & (0.2,0.6) & (0.2,0.4) \\ (0.2,0.6) & (0.5,0.4) & (0.5,0.4) & (0.4,0.5) \\ (0.1,0.8) & (0.4,0.5) & (0.7,0.3) & (0.5,0.5) \\ (0.2,0.5) & (0.6,0.3) & (0.5,0.2) & (0.8,0.2) \\ (0.7,0.2) & (0.4,0.6) & (0.1,0.8) & (0.3,0.5) \end{pmatrix} \end{array}$$

$$B^C = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} (0.2,0.4) & (0.2,0.6) & (0.4,0.4) & (0.1,0.9) \\ (0.3,0.6) & (0.1,0.7) & (0.3,0.4) & (0.1,0.8) \\ (0.5,0.4) & (0.2,0.7) & (0.1,0.8) & (0.2,0.7) \\ (0.5,0.5) & (0.7,0.3) & (0.4,0.5) & (0.3,0.6 \end{pmatrix} \end{array}$$

Case-(iii): Then the product Matrices are,

$$A * B = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} (0.4,0.5) & (0.6,0.2) & (0.6,0.2) & (0.6,0.2) \\ (0.5,0.2) & (0.6,0.2) & (0.5,0.4) & (0.6,0.2) \\ (0.5,0.2) & (0.5,0.2) & (0.4,0.4) & (0.6,0.2) \\ (0.5,0.2) & (0.5,0.2) & (0.4,0.4) & (0.5,0.2) \\ (0.6,0.4) & (0.7,0.2) & (0.8,0.1) & (0.7,0.2) \end{pmatrix} \end{array}$$

$$A^C * B^C = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} (0.3,0.4) & (0.2,0.1) & (0.4,0.4) & (0.2,0.6) \\ (0.5,0.4) & (0.4,0.5) & (0.4,0.4) & (0.2,0.6) \\ (0.5,0.4) & (0.5,0.5) & (0.4,0.5) & (0.3,0.6) \\ (0.5,0.4) & (0.7,0.3) & (0.4,0.6) & (0.3,0.6) \\ (0.3,0.4) & (0.5,0.5) & (0.4,0.4) & (0.3,0.6) \end{pmatrix} \end{array}$$

$$V(A*B) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} -0.1 & 0.4 & 0.4 & 0.4 \\ 0.3 & 0.4 & 0.1 & 0.4 \\ 0.3 & 0.3 & 0.0 & 0.4 \\ 0.3 & 0.3 & 0.0 & 0.3 \\ 0.2 & 0.3 & 0.7 & 0.5 \end{pmatrix} \end{array}$$

$$V(A^C * B^C) = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} -0.1 & 0.1 & 0.0 & 0.4 \\ 0.1 & -0.1 & 0.0 & -0.4 \\ 0.1 & 0.0 & -0.1 & -0.3 \\ 0.1 & 0.4 & -0.2 & -0.3 \\ -0.1 & -0.2 & 0.0 & -0.3 \end{pmatrix} \end{array}$$

Case-(iv): Calculate the Score Matrix

$$S = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array} \begin{array}{c} \begin{array}{cccc} d_1 & d_2 & d_3 & d_4 \end{array} \\ \begin{pmatrix} 0.0 & 0.3 & 0.4 & 0.0 \\ 0.2 & 0.5 & 0.1 & 0.8 \\ 0.2 & 0.3 & 0.1 & 0.7 \\ 0.2 & -0.1 & 0.2 & 0.6 \\ 0.3 & 0.5 & 0.7 & 0.8 \end{pmatrix} \end{array}$$

Case-(v): It is clear from the above matrix the patients Karthic, Chandran, Gopal, Anandh (P_2, P_3, P_4, P_5) is suffering from Cough variant Asthma (d_4) and suresh (P_1) suffering from Allergic Asthma (d_1).

CONCLUSION

It is seen that Max - Min and Min – Max composition method gives the Same Maximum score in the Score Matrix of the Patient and the Diseases. New approach in medical diagnosis, by implementing intuitionistic fuzzy soft Matrices. This algorithm is more flexible. Practice of yoga and Breathing Exercise reduce the stress and anaxity related asthma . It increase the sympathetic activity which helps to improve from recover from asthma attack.

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