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NEUTROSOPHIC SOFT MATRICES AND ITS APPLICATION IN DIAGNOSIS OF DISEASE AND ITS CONTROL

[1]Geetha P, [2]Karthika Devi K and Karpagam B[3]
[1]Assistant Professor, [2,3]II – M.Sc Mathematics,
V.V.Vanniaperumal College for Women (Autonomous),
Virudhunagar-626 001.

Corresponding Author's mail id: geetha@vvvcollege.org

ABSTRACT

Neutrosophic set theory was introduced by Florentin Smarandache, which is used to deal the problems under uncertainty. Neutrosophic soft matrix theory plays a vital role in decision making problem with imprecise and inconsistent data. In this paper, min-max product of neutrosophic soft matrices is defined. Also, an algorithm is developed using min-max product to diagnose the diseases and how to control it. The associative property is proved under min-max product.

Keywords: Neutrosophic set, Neutrosophic soft set, Neutrosophic soft matrix, Min-Max product, Associative law, Decision-Making Problem.

INTRODUCTION

Neutrosophy is a mathematical tool which helps to bring out the conclusions for the uncertainty problems. Such uncertainties are usually handled with the help of the topics like probability, fuzzy sets, intuitionistic fuzzy sets, interval mathematics, rough sets etc. Then there is a rising concept neutrosophic sets was discovered by Florentin Smarandache (2019) in the year 1998 and which came into the existence in 2003. Zadeh (1965) is the one who is well known for fuzzy logics. Later, Maji (2001) worked and showed up his ideas in the fuzzy soft set theory and intuitionistic fuzzy set in 2001. The soft set theory was also proposed by Maji (2003). Matrices play a vital role in the field of medicine, astronomy, machine learning and other technology. Several authors worked and brought out fuzzy matrices, fuzzy soft matrices and intuitionistic fuzzy soft matrices. Also, where the emerging of neutrosophic soft sets and neutrosophic soft matrices are defined by Deli and Broumi (2015). The neutrosophic soft matrices play a crucial role in handling indeterminant and inconsistent information during decision making process.

In this paper, min-max product of neutrosophic soft matrices is defined. Also, an algorithm is developed using min-max product to diagnose the diseases and how to control it. The associative property under min-max product is proved.

PREMILNARIES

In this section under preliminaries some fundamental definitions are discussed.

Soft set 2.1 [7]: Let U be the initial Universe of discourse and E is the set of parameters. Let P(U) denote the power set of U. A pair (E,F) is called a soft set over U where F is a mapping given by F: E → P(U). Clearly soft set is a mapping from parameters to P(U).

Fuzzy soft set 2.2 [5(e)]: Let U be the Universe of discourse and E is the set of parameters. Let P(U) denotes the collections of all fuzzy subsets of U. Let A ⊆E. A pair (F_A, E) is called fuzzy soft set over U where F_A is a mapping given by F_A: E →P(U).

Neutrosophic sets 2.3 [8(b)]: Let U be the Universe of discourse. The neutrosophic set A on the Universe of discourse U is defined as A={T (x), I (x), F (x) : x ϵU }, where the characteristic functions T , I , F : U →[0 , 1] and $^-0 \leq T+I F \leq 3^+$; T, I, F are neutrosophic components which defines the degree of membership, the degree of indeterminancy and the degree of non-membership respectively.

Neutrosophic soft sets 2.4 [5]: Let U be the Universe of discourse and E is the set of parameters. Let P(U) denotes the collections of all neutrosophic subsets of U. Let A ⊆ E. A pair (F_A, E) is called a neutrosophic soft set over U where F_A is a mapping given by F_A: E →P(U).

Neutrosophic soft matrix 2.5 [3]: Let U = $\{u_1, u_2, \cdots , u_m\}$ and E = $\{e_1, e_2, \cdots , e_n\}$ be the universal set of objects and the parametric set, respectively. Suppose, N be a neutrosophic soft set over (U, E) given by N = {< (e, f_N(e)) >: e ∈ E} where f_N(e) = {< u, ($T_{f N (e)}$(u), $I_{fN (e)}$(u), $F_{fN (e)}$(u)) >: u ∈ U}.Thus, f_N(e) corresponds a relation on {e}× Ui.e., $f_N(e) = \{(e, u_i):1 \leq i \leq m\}$ for each e ∈ E. It is obviously a symmetric relation.

Now, consider a relation R_E on U × E given by R_E = {(u,e) : e ∈E,u∈f_N (e)}. It is called a relation form of the NSS N over (U, E). The characteristic function of R_E is χ_{R_E} : U × E → [0, 1] × [0, 1] × [0, 1] and is defined as:

$$\chi_{R_E} (u, e) = (T_{f N (e)}(u), I_{fN (e)}(u), F_{fN (e)}(u))$$

The tabular representation of R_E is given in Table

	e_1	e_2	……	……	e_n
u_1	$\chi_{R_E}(u_1,e_1)$	$\chi_{R_E}(u_1,e_2)$	……	……	$\chi_{R_E}(u_1,e_n)$
u_2	$\chi_{R_E}(u_2,e_1)$	$\chi_{R_E}(u_2,e_2)$	……	……	$\chi_{R_E}(u_2,e_n)$
. .	. .	. .	. .	. .	. .
u_n	$\chi_{R_E}(u_m, e_1)$	$\chi_{R_E}(u_m, e_2)$	……	……	$\chi_{R_E}(u_m,e_n)$

If $a_{ij} = \chi_{R_E}(u_i, e_j)$, then we can define a matrix

$$[a_{ij}]_{m\times n}=\begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mn} \end{pmatrix}$$

where $a_{ij} = (T_{fN(ej)}(u_i), I_{fN(ej)}(u_i), F_{fN(ej)}(u_i)) = (T_{ij}^a, I_{ij}^a, F_{ij}^a)$

DECISION MAKING PROBLEM USING NEUTROSOPHIC SOFT MATRICES

In this section, min-max product rule in neutrosophic soft matrices and the associative property is proved and the example is verified. Also, we develop an algorithm using min-max product to diagnose the diseases and how to control it.

Min-Max Product Rule 3.1: Two NSMs A and B are said to be conformable for the product A * B if the number of columns of the NSM A be equal to the number of rows of the NSM B and this product becomes also an NSM. If $A = [a_{ij}]_{m\times n}$ and $B = [b_{jk}]_{n\times p}$,then $A * B = [c_{ik}]_{m\times p}$ where $a_{ij} = (T^a_{ij}, I^a_{ij}, F^a_{ij})$, $b_{jk} = (T^b_{jk}, I^b_{jk}, F^b_{jk})$ and $c_{ik} = (\min_j \max (T^a_{ij}, T^b_{jk}), \min_j \max (I^a_{ij}, I^b_{jk}), \max_j \min (F^a_{ij}, F^b_{jk}))$. Clearly, B * A cannot be defined here.

Theorem 3.2: Associative Property

Let $A = [a_{ij}]_{m\times n}$, $B = [b_{jk}]_{n\times p}$ and $C=[c_{kn}]_{p\times n}$ then (A*B)*C= A*(B*C)

Where $a_{ij} = (T^a_{ij}, I^a_{ij}, F^a_{ij})$, $b_{jk} = (T^b_{jk}, I^b_{jk}, F^b_{jk})$ and $c_{jk} = (T^c_{jk}, I^c_{jk}, F^c_{jk})$

Proof:

$A*B= [\min_j(\max(T_{ij}^a,T_{jk}^b)),\min_j(\max(I_{ij}^a,I_{jk}^b)), \max_j(\min(F_{ij}^a,F_{jk}^b))]$

$A*B=ab_{ik}=(T_{ik}^{ab},I_{ik}^{ab}, F_{ik}^{ab})$

$(A*B)*C=[\min_k(\max(T_{ik}^{ab},T_{kn}^c)), \min_k(\max(I_{ik}^{ab},I_{kn}^c)), \max_k(\min(F_{ik}^{ab},F_{kn}^c))]$

$(A*B)*C=(T_{in}^{(ab)c},I_{in}^{(ab)c}, F_{in}^{(ab)c})$

$B*C=[\min_k(\max(T_{jk}^b,T_{kn}^c)), \min_k(\max(I_{jk}^b,I_{kn}^c)), \max_k(\min(F_{jk}^b,F_{kn}^c))]$

$B*C=bc_{kn}=(T_{jn}^{bc},I_{jn}^{bc}, F_{jn}^{bc})$

$A*(B*C)=[\min_j(\max(T_{ij}^a,T_{jn}^{bc})), \min_j(\max(I_{ij}^a,I_{jn}^{bc})), \max_j(\min(F_{ij}^a,F_{jn}^{bc}))]$

$A*(B*C)=(T_{in}^{a(bc)},I_{in}^{a(bc)}, F_{in}^{a(bc)})$

$(T_{in}^{(ab)c},I_{in}^{(ab)c}, F_{in}^{(ab)c}) =(T_{in}^{a(bc)},I_{in}^{a(bc)}, F_{in}^{a(bc)})$

Hence, **(A*B)*C= A*(B*C)**

Example 3.2.1: Consider the following matrices

$$A=\begin{pmatrix} (0.8,0.2,0.1) & (0.5,0.3,0.5) \\ (0.5,0.2,0.6) & (0.7,0.4,0.2) \end{pmatrix} \quad B=\begin{pmatrix} (0.3,0.2,0.7) & (0.9,0.1,0.2) \\ (0.8,0.2,0.1) & (0.7,0.3,0.2) \end{pmatrix}$$

$$C=\begin{pmatrix} (0.8,0.2,0.1) & (0.8,0.4,0.3) \\ (0.9,0.1,0.1) & (0.8,0.3,0.2) \end{pmatrix}$$

First evaluate A*B using the defined min-max product rule,

C_{11}= [min (0.8,0.8), min (0.2, 0.3), max (0.1,0.1)]= (0.8,0.2,0.1)

C_{12}= [min (0.9,0.7), min (0.2,0.3), max (0.1,0.2)]= (0.7,0.2,0.2)

C_{21}= [min (0.5,0.8), min (0.2,0.4), max (0.6,0.1)]= (0.5,0.2,0.6)

C_{22}= [min (0.9,0.7), min (0.2,0.4),max (0.2,0.2)]= (0.7,0.2,0.2)

$$A*B=\begin{pmatrix}(0.8,0.2,0.1) & (0.7,0.2,0.2)\\(0.5,0.2,0.6) & (0.7,0.2,0.2)\end{pmatrix}$$

Secondly, obtain (A*B)*C

C_{11}= [min (0.8,0.9), min (0.2, 0.2), max (0.1,0.1)]= (0.8,0.2,0.1)

C_{12}= [min (0.8,0.8), min (0.4,0.3), max (0.1,0.2)]= (0.8,0.3,0.2)

C_{21}= [min (0.8,0.9), min (0.2,0.2), max (0.1,0.1)]= (0.8,0.2,0.1)

C_{22}= [min (0.8,0.8), min (0.4,0.3),max (0.3,0.2)]= (0.8,0.3,0.3)

$$(A*B)*C=\begin{pmatrix}(0.8,0.2,0.1) & (0.8,0.3,0.2)\\(0.8,0.2,0.1) & (0.8,0.3,0.3)\end{pmatrix}$$

Third evaluate for B*C,

C_{11}= [min (0.8,0.9), min (0.2, 0.1), max (0.1,0.1)]= (0.8,0.1,0.1)

C_{12}= [min (0.8,0.9), min (0.4,0.3), max (0.3,0.2)]= (0.8,0.3,0.3)

C_{21}= [min (0.8,0.9), min (0.2,0.3), max (0.1,0.1)]= (0.8,0.2,0.1)

C_{22}= [min (0.8,0.8), min (0.4,0.3),max (0.1,0.2)] = (0.8,0.3,0.2)

$$B*C=\begin{pmatrix}(0.8,0.1,0.1) & (0.8,0.3,0.3)\\(0.8,0.2,0.1) & (0.8,0.3,0.2)\end{pmatrix}$$

Fourth evaluate A*(B*C),

C_{11}= [min (0.8,0.8), min (0.2, 0.3), max (0.1,0.1)]= (0.8,0.2,0.1)

C_{12}= [min (0.8,0.8), min (0.3,0.3), max (0.1,0.2)]= (0.8,0.3,0.2)

C_{21}= [min (0.8,0.8), min (0.2,0.4), max (0.1,0.1)]= (0.8,0.2,0.1)

C_{22}= [min (0.8,0.8), min (0.3,0.4),max (0.3,0.2)]= (0.8,0.3,0.3)

$$A*(B*C)=\begin{pmatrix}(0.8,0.2,0.1) & (0.8,0.3,0.2)\\(0.8,0.2,0.1) & (0.8,0.3,0.3)\end{pmatrix}$$

Hence, (A*B) *C=A*(B*C)

We conclude that neutrosophic soft matrix is associative under min-max product.

Score matrix 3.3:

The score matrix A, B and C is defined as S[(A*B)] = W'. where W'=[w'_{ij}], $w'_{ij} = T^A_{ij} + I^A_{ij} - F^A_{ij}$. And S[(A*B)*C)] = V'. where V'=[v'_{ij}], $v'_{ij} = T^A_{ij} + I^A_{ij} - F^A_{ij}$.

Algorithm 3.4:

Step 1: Input neutrosophic soft sets (F, E), (G, D), and (H, O) and obtain neutrosophic soft matrices A, B, C.

Step 2: Evaluate A*B using the min-max product rule.

Step 3: The resulted matrix A*B gives the people diseased matrix due to unhealthy food.

Step 4: Next compute for (A*B)*C.

Step 5: The evaluated matrix A*B*C gives out the patient disease control matrix.

Step 6: Compute score matrix S(A*B) and S ((A*B)*C).

Step 7: Identify maximum score for the people Pi in such way that whose disease is able to control by consuming organic food and exercise.

DECISION MAKING PROBLEM

The survey from five students namely, Karpagam, Karthika, Uma, Guru, Sureka from II MSc., Mathematics class is been collected based on their junk food habits. Let the five students denoted as follows S = {s_1, s_2,s_3, s_4, s_5} as the Universal set. The junk foods consumed by the students are fast-food, pasteries, soft-drinks, processed meat, sweets/chocolates. Let the junk food set be Un= {Un_1, Un_2, Un_3,Un_4,Un_5} Let the possible diseases caused on consuming junk foods be Diabetics, Obesity, High-Blood pressure, Cardiovascular disease, Cholesterol and Ulcer. And the disease set D= {D_1, D_2, D_3, D_4, D_5}.

Now let Un= {Un_1, Un_2, Un_3, Un_4, Un_5} where Un_1, Un_2, Un_3, Un_4, Un_5 represents the fast-food, pastries, soft-drinks, Processed meat, sweets/chocolates be the universal set. Let the possible diseases caused on consuming junk foods D= {D_1, D_2, D_3, D_4, D_5, D_6} be Diabetics, Obesity, High-Blood pressure, Cardiovascular disease, Cholesterol and Ulcer. Suppose that NSS (F,Un) over S, where F:Un→ F^S gives the collection of an approximation of people consuming the junk food.

(F,Un)={F(Un_1)={(S_1,0.8,0.2,0.1),(S_2,0.5, 0.2,0.6),(S_3,0.6,0.4,0.2),(S_4,0.9,0.1,0.1), (S_5,0.9,0.1,0.2)},(F(Un_2)={(S_1,0.5,0.3,0.5), (S_2,0.7,0.4,0.2),(S_3,0.8,0.1,0.1),(S_4,0.6,0.4, 0.3),(S_5,0.4,0.1,0.6)},(F(Un_3)={(S_1,0.2,0.1, 0.9),(S_2,0.3,0.1,0.8),(S_3,0.1,0.1,0.7),(S_4,0.7 ,0.3,0.2),(S_5,0.1,0.1,0.9),(F(Un_4)={(S_1,0.1, 0.2,0.9), (S_2,0.1,0.1,0.9), (S_3,0.5,0.3,0.5), (S_4,0.3,0.1,0.7),(S_5,0.2,0.2,0.8)}, (F(Un_5)={(S_1,0.9,0.2,0.1),(S_2,0.8,0.1,0.2), (S_3,0.8,0.2,0.2),(S_4,0.9,0.1,0.1), (S_5,0.1,0.2,0.8)}}

The neutrosophic soft set (F, E) represented by the following neutrosophic soft matrix A to describe the people consuming junk food relationship.

$$
\begin{array}{c c} & \begin{array}{ccccc} Un_1 & Un_2 & Un_3 & Un_4 & Un_5 \end{array} \\
\begin{array}{c} A=S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} &
\begin{pmatrix}
(0.8,0.2,0.1) & (0.5,0.3,0.5) & (0.2,0.1,0.9) & (0.1,0.2,0.9) & (0.9,0.2,0.1) \\
(0.5,0.2,0.6) & (0.7,0.4,0.2) & (0.3,0.1,0.8) & (0.1,0.1.0.9) & (0.8,0.1,0.2) \\
(0.6,0.4,0.2) & (0.8,0.1,0.1) & (0.1,0.1,0.7) & (0.5,0.3,0.5) & (0.8,0.2,0.2) \\
(0.9,0.1,0.1) & (0.6,0.4,0.3) & (0.7,0.3,0.2) & (0.3,0.1,0.7) & (0.9,0.1,0.1) \\
(0.9,0.1,0.2) & (0.4,0.1,0.6) & (0.1,0.1,0.9) & (0.2,0.2,0.8) & (0.1,0.2,0.8)
\end{pmatrix}
\end{array}
$$

Let Un= {Un_1, Un_2, Un_3, Un_4, Un_5} where Un_1, Un_2, Un_3, Un_4, Un_5 represents the fast-food, pastries, soft-drinks, processed meat, sweets/chocolates be the universal set. Let the possible diseases caused on consuming junk foods D= {D_1, D_2, D_3, D_4, D_5, D_6} be Diabetics, Obesity, High-Blood pressure, Cardiovascular disease, Cholesterol and Ulcer. Suppose that NSS(G, D) over Un, where G:D→F^{Un} gives the collection of an approximation of people consuming the junk food.

(G,D)={G(D_1)={(Un_1,0.3,0.2,0.7),(Un_2,0.8, 0.2,0.1),(Un_3,0.7,0.1,0.3),(Un_4,0.3,0.1,0.7),

(Un_5,0.9,0.1,0.1)},(G(D_2)={(Un_1,0.9,0.1,0.2),(Un_2,0.7,0.3,0.2), (Un_3,0.8,0.2,0.1), (Un_4,0.5,0.2,0.6),(Un_5,0.9,0.2,0.1)},(G(D_3) ={(Un_1,0.6,0.3,0.2), (Un_2,0.2,0.1,0.6), (Un_3,0.4,0.3,0.4),(Un_4,0.9,0.1,0.2),(Un_5,0.1, 0.1,0.9)}, (G(D_4)=(Un_1,0.7,0.3,0.1), (Un_2,0.2,0.2,0.7),(Un_3,0.4,0.3,0.7),(Un_4,0.8, 0.1,0.1), (Un_5,0.1,0.2,0.7)}, (G(D_5)={(Un_1,0.9,0.1,0.2),(Un_2,0.8,0.2,0.3) ,(Un_3,0.9,0.1,0.2), (Un_4,0.9,0.1,0.3), (Un_5,0.8,0.1,0.2)},(G(D_6)={(Un_1,0.8,0.2,0.2),(Un_2,0.1,0.1,0.8), (Un_3,0.1,0.1,0.9), (Un_4,0.1,0.1,0.8), (Un_5,0.1,0.2,0.7)}}.

The neutrosophic soft set (G, D) represented by the following neutrosophic soft matrix B to describe the people consuming junk food diseased relationship.

B=	D_1	D_2	D_3	D_4	D_5	D_6
Un_1	(0.3,0.2,0.7)	(0.9,0.1,0.2)	(0.6,0.3,0.2)	(0.7,0.3,0.1)	(0.9,0.1,0.2)	(0.8,0.2,0.2)
Un_2	(0.8,0.2,0.1)	(0.7,0.3,0.2)	(0.2,0.1,0.6)	(0.2,0.2.0.7)	(0.8,0.2,0.3)	(0.1,0.1,0.8)
Un_3	(0.7,0.1,0.3)	(0.8,0.2,0.1)	(0.4,0.3,0.4)	(0.4,0.3,0.7)	(0.9,0.1,0.2)	(0.1,0.1,0.9)
Un_4	(0.3,0.1,0.7)	(0.5,0.2,0.6)	(0.9,0.1,0.2)	(0.8,0.1,0.1)	(0.9,0.1,0.3)	(0.1,0.1,0.8)
Un_5	(0.9,0.1,0.1)	(0.9,0.2,0.1)	(0.1,0.1,0.9)	(0.1,0.2,0.7)	(0.8,0.1,0.2)	(0.1,0.2,0.7)

Let O= {O_1, O_2, O_3, O_4, O_5, O_6} where O_1, O_2, O_3,O_4,O_5,O_6 represents the organic foods such as Vegetables, Millets/cereals, Exercise, Oil free-foods, saltless foods, fruits thebe the Universal set. Let the possible diseases caused on consuming junk foods D= {D_1, D_2, D_3, D_4, D_5, D_6} be Diabetics, Obesity, High-Blood pressure, Cardiovascular disease, Cholesterol and Ulcer. Suppose that NSS(H, O) over O, where H:O$\rightarrow$ F^D Hives the collection of an approximation of Disease caused on consuming the unhealthy food can be controlled on organic food and exercise.

(H,O)={H(O_1)={(O_1,0.8,0.2,0.1),(O_2,0.9,0.1,0.1),(O_3,0.7,0.3,0.2), (O_4,0.8,0.2,0.1), (O_5,0.8,0.2,0.3), (O_6,0.9,0.1,0.1)}, (H(O_2)= {(O_1,0.8,0.4,0.3), (O_2,0.8,0.3,0.2), (O_3,0.8,0.3,0.1), (O_4,0.9,0.2,0.1), (O_5,0.7,0.4,0.2), (O_6,0.6,0.3,0.4)}, (H(O_3)={(O_1,0.9,0.1,0.1), (O_2,0.9,0.1,0.1), (O_3,0.7,0.3,0.4), (O_4,0.8,0.2,0.1), (O_5,0.9,0.1,0.1), (O_6,0.2,0.1,0.8)}, (H(O_4) = {(O_1,0.7,0.2,0.3), (O_2,0.9,0.2,0.3), (O_3,0.9,0.1,0.1), (O_4,0.8,0.1,0.2), (O_5,0.9,0.1,0.1), (O_6,0.3,0.2,0.7)}, (H(O_5)={(O_1,0.6,0.4,0.3), (O_2,0.7,0.2,0.3), (O_3,0.9,0.2,0.3), (O_4,0.8,0.1,0.1), (O_5,0.9,0.2,0.1), (O_6,0.4,0.2,0.5)}, (H(O_6)= {(O_1,0.2,0.1,0.7), (O_2,0.5,0.3,0.5), (O_3,0.4,0.3,0.5), (O_4,0.6,0.4,0.3), (O_5,0.7,0.3,0.2), (O_6,0.3,0.3,0.7)}}.

The neutrosophic soft set (H, O) represented by the following neutrosophic soft matrix C to describe the diseased control relationship.

C=	O_1	O_2	O_3	O_4	O_5	O_6
D_1	(0.8,0.2,0.1)	(0.8,0.4,0.3)	(0.9,0.1,0.1)	(0.7,0.2,0.3)	(0.6,0.4,0.3)	(0.2,0.1,0.7)
D_2	(0.9,0.1,0.1)	(0.8,0.3,0.2)	(0.9,0.1,0.1)	(0.9,0.2.0.3)	(0.7,0.2,0.3)	(0.5,0.3,0.5)
D_3	(0.7,0.3,0.2)	(0.8,0.3,0.1)	(0.7,0.3,0.4)	(0.9,0.1,0.1)	(0.9,0.2,0.3)	(0.4,0.3,0.5)
D_4	(0.8,0.2,0.1)	(0.9,0.2,0.1)	(0.8,0.2,0.1)	(0.8,0.1,0.2)	(0.8,0.1,0.1)	(0.6,0.4,0.3)
D_5	(0.8,0.2,0.3)	(0.7,0.4,0.2)	(0.9,0.1,0.1)	(0.9,0.1,0.1)	(0.9,0.2,0.1)	(0.7,0.3,0.2)
D_6	(0.9,0.1,0.1)	(0.6,0.3,0.4)	(0.2,0.1,0.8)	(0.3,0.2,0.7)	(0.4,0.2,0.5)	(0.3,0.3,0.7)

Compute A*B, Min-Max compositions of two neutrosophic soft matrices will produce the following results,

Let us suppose A* B= [Cij] m× n

C_{11}=[min (0.8,0.8,0.7,0·3,0.9), min (0.2, 0.3, 0.1, 0.2,0.2), max (0.1,0.1,0.3,0.7,0.1)]

C_{11}=(0.3,0.1,0.7)

C_{12}=[min (0.9,0.7,0.8,0.5,0.9), min (0.2,0.3,0.2,0.2,0.2), max (0.1,0.2,0.1,0.6,0.1)]

C_{12}=(0.5,0.2,0.6)

C_{13}=[min (0.8,0.5,0.4,0.9,0.9), min(0.3,0.3,0.1,0.2,0.2), max (0.1,0.5, 0.4,0.2, 0.1)]

C_{13}=(0.4,0.1,0.5)

C_{14}=[min (0.8, 0.5,0.4,0.8,0.9), min(0.3,0.3,0.2,0.2,0.2), max (0.1, 0.5, 0.2,0.1,0.6)]

C_{14}=(0.4, 0.2,0.6)

C_{15}=[min (0.9,0.8,0 .9, 0·9, 0.9), min (0.2, 0.3, 0.1, 0.2,0.2) max (0.1,0.3,0.2.0.3,0.1)]

C_{15}=(0.8,0.1,0.3)

C_{16}=[min (0.8, 0.5, 0.2,0.1,0.9), min (0.2.0.3, 0.1, 0.2,0.2), max (0.1,0.5,0 .9,0.8,0.7)]

C_{16}=(0.1, 0.1, 0.9)

Proceeding the min-max product until the last element of the matrix A*B is obtained. The obtained matrix A*B is

	D_1	D_2	D_3	D_4	D_5	D_6
S_1	(0.3,0.1,0.7)	(0.5,0.2,0.6)	(0.4,0.1,0.5)	(0.4,0.2,0.6)	(0.8,0.1,0.3)	(0.1,0.1,0.9)
S_2	(0.3,0.1,0.7)	(0.5,0.2,0.6)	(0.4,0.1,0.4)	(0.4,0.1.0.7)	(0.8,0.1,0.3)	(0.1,0.1,0.8)
S_3	(0.5,0.1,0.5)	(0.5,0.2,0.5)	(0.4,0.1,0.4)	(0.4,0.2,0.7)	(0.8,0.1,0.3)	(0.1,0.1,0.7)
S_4	(0.3,0.1,0.7)	(0.5,0.1,0.6)	(0.6,0.1,0.3)	(0.6,0.1,0.3)	(0.8,0.1,0.3)	(0.3,0.1,0.7)
S_5	(0.3,0.1,0.7)	(0.5,0.1,0.6)	(0.6,0.1,0.3)	(0.6,0.1,0.3)	(0.8,0.1,0.3)	(0.3,0.1,0.7)

Similarly calculate the for A*(B*C), the resultant matrix is given as

	O_1	O_2	O_3	O_4	O_5	O_6
S_1	(0.7,0.1,0.3)	(0.6,0.2,0.4)	(0.2,0.1,0.8)	(0.3,0.1,0.7)	(0.4,0.2,0.5)	(0.3,0.1,0.7)
S_2	(0.7,0.1,0.3)	(0.6,0.2,0.4)	(0.2,0.1,0.8)	(0.3,0.1.0.7)	(0.4,0.1,0.5)	(0.3,0.1,0.7)
S_3	(0.7,0.1,0.3)	(0.6,0.2,0.4)	(0.2,0.1,0.7)	(0.3,0.1,0.7)	(0.5,0.2,0.5)	(0.3,0.1,0.7)
S_4	(0.7,0.1,0.3)	(0.6,0.2,0.4)	(0.3,0.1,0.7)	(0.3,0.1,0.7)	(0.4,0.1,0.5)	(0.3,0.1,0.7)
S_5	(0.7,0.1,0.3)	(0.6,0.2,0.4)	(0.2,0.1,0.7)	(0.3,0.1,0.7)	(0.4,0.2,0.5)	(0.3,0.1,0.7)

Evaluate the score matrix for A*B,

W' =

	D_1	D_2	D_3	D_4	D_5	D_6
S_1	−0.3	0.1	0	0	0.6	− 0.7
S_2	−0.3	0.1	0.1	− 0.2	0.6	− 0.6
S_3	0.1	0.2	0.1	− 0.1	0.6	− 0.5
S_4	−0.3	0	0.4	0.4	0.6	− 0.3
S_5	−0.3	0	−0.6	− 0.4	0.6	− 0.7

People P_i on taking unhealthy food caused disease D_i is P_1, P_2, P_3, P_4, $P_5$by D_6 and P_4 by D_1

The score matrix of (A*B)*C

V' =

	O_1	O_2	O_3	O_4	O_5	O_6
S_1	0.9	0.4	−0.5	− 0.3	0.1	− 0.3
S_2	0.9	0.4	−0.5	− 0.3	0	− 0.3
S_3	0.9	0.4	−0.4	− 0.3	0.2	− 0.3
S_4	0.9	0.4	−0.3	− 0.3	0	− 0.3
S_5	0.9	0.4	−0.4	− 0.3	0.1	− 0.3

It is advisable to consume more vegetables. Obtaining the minimum value in W' so that disease is found for each student by using min-max product rule. Next obtaining the maximum value in V' to control the disease by intake of organic food. It is suggested that only minimum score of disease can always be controlled in an organic way. We are dealing about controlling not about the prevention.

CONCLUSION

In this paper, the min-max product rule is defined and the associative property is proved and verified with the suitable example. An algorithm is developed using min-max product rule to diagnose the disease and how to control it. All these decision-making problems are widely solved by neutrosophic soft matrices. It is suggested that this method of finding the students suffering from various disease due to the consumption of junk foods is controlled by the intake of organic food from the case study, where the system of inconsistent data is handled. We look forward that our step will be applied to various other situations that carry uncertain parameters.

This paper will enhance the essence towards the study of neutrosophy under various sectors and handle the real-time applications.

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