Turkish Journal of Computer and Mathematics Education Vol.12 No. 1s (2021), 718- 721

Research Articl

Application Of Neutrosophic Soft Set In Medical Diagnosis

Karuppayi.K[1], Monica Mary.A[2] & Thanalakshmi.K[3]

[1]Assistant Professor in Department of Mathematics, Providence College for Women, Coonoor, The Nilgiris - 643104, Tamil Nadu, India.
[2]Ph.D Research Scholar in Mathematics, Providence College for Women, Coonoor, The Nilgiris - 643104, Tamil Nadu, India[3]Associate Professor in Department of Mathematics Kamaraj College of Engineering and Technology, Virudhunagar,Madurai-625701,Tamil Nadu, India.

Article History: Received: 11 January 2021; Accepted: 27 February 2021; Published online: 5 April 2021

Abstract: Fuzzy theory and neutrosophic theory are almost trending in all the fields. This paper exhibit techniques of neutrosophic soft set by demonstrating a case study of the patients. Analyse the medical report of the patients; the result obtained in the current work is compared with the existing earlier result to carry out the conclusion.

Keywords: fuzzysoftset, $\mathcal{N}_{SS}$,$\mathcal{N}_{SSM}$, defuzzification.

1. Introduction

The present situation of every person's life is unpredictable. Since the day to day life style of people are changing new problems in health also occurs. The most commonly found health problem all around the world is Diabetes which has become usual to all generations at present. Diabetes is incurable, but to lead a healthy life with diabetes we should keep the sugar level under control by food habits, exercises, taking regularly the prescribed medicine and regular checkup. At times when the sugar level is uncontrolled it becomes complicated and it may lead to other co-related diseases. To investigate the health problem at earlier stage, even with the insufficient or indistinct information we can find out the state of disease in earlier by neutrosophic soft set ($\mathcal{N}_{SS}$). Fuzzy mathematics as an approach of describing uncertainty was put forward in 1965 by Lotfi.A.Zadeh [11].Molodtsov [5] brings out the inherent difficulties in fuzzy concept using soft set theory. Soft set theory has many potential applications. Extensive research has been done and new methods of medical diagnosis have been proposed with Sanchez's approach. Florentine Smarandache [1] introduced a novel concept called Neutrosophic set for handling data with imprecise, indeterminacy and inconsistent. Later Maji [6] presented a new topic named Neutrosophic soft set. In this paper we are going to use neutrosophic soft set and the well-known Sanchez's medical approach, for diagnosing a diabetes patient having certain symptoms of medical issues. The Neutrosophic soft set along with the Sanchez's approach would help to get treated at primary stage. This paper contributes a small step to prevent the disease and live a long.

2. PRELIMINARIES

DEFINITION[3]:The**defuzzificationof triangular fuzzy number** $\square_b$=(*a*, b, c) is given by$C^{\square}{}_b$= $\frac{a+b+c}{3}$

D**EFINITION** [1]: The **neutrosophic set** A on the universe of discourse X is defined asA ={< x, $T_A(x)$, $I_A(x)$, $F_A(x)$ > : x∈X}, where T_A, I_A, F_A : X→ (0, 1) and $^{-}0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3^{+}$; T_A , I_A , F_A are called ***neutrosophic components***.

DEFINITION [6]: If U is an initial universe set and E said to be a set of parameters. Let $A \subset E$, P (U) denotes the set of all neutrosophic sets of U. Then the collection (F, A) is termed to be the **neutrosophic soft set** ($\mathcal{N}_{SS}$) over U, and F is a mapping given by F:A→P(U).

DEFINITION [8]: If x_{ij} = ($T_A(u_i, e_j)$,$I_A(u_i, e_j)$, $F_A(u_i, e_j)$), then **neutrosophic soft set matrix($\mathcal{N}_{SSM}$) of order m x n** is given by $(\overset{\vee}{x_{ij}})_{m\,x\,n}$=$(x_{ij})_{m\,x\,n}$

DEFINITION (**Max - Min Product of**N_{SSM}) [9]: The max - min product of twoN_{SS} matrices A and B is given by $A \otimes B$ = $(c_{ik})_{m \times p}$ where A = $(a_{ij})_{m \times n}$, $a_{ij} = (T^a_{ij}, I^a_{ij}, F^a_{ij})$, B = $(b_{jk})_{n \times p}$, $b_{jk} = (T^b_{jk}, I^b_{jk}, F^b_{jk})$ and $c_{ik} = (\max_j \min(T^a_{ij}, T^b_{jk}), \min_j \max(I^a_{ij}, I^b_{jk}), \min_j \max(F^a_{ij}, F^b_{jk}))$ Clearly $B \otimes A$ cannot be defined here.

3. Research analsis and methodology

Let us consider a case study of three patients namely Marvi, Radha and Desai of different ages having type1 and type 2 diabetes taking treatment in a private hospital and these three people have diabetes along with it each person has different symptomsnamely,

Symptom 1-anemia, dry and itchy skin and swelling in feet and ankles.

Symptom 2- severe pain in joints, lingering discomforts, and redness in affected joints.

Symptom 3-unexplained weight loss, weight gain andconstipation. *Symptom 4*-fatigue, dry skin, and muscle weakness. These sympto ms in medical reference may lead practicable to other diseases like d_{e1}- *uric acid*,d_{e2} - *chronic kidney disease* and d_{e3} - *thyroid disorder*. Let P_t = {p_{t1}, p_{t2}, p_{t3}} be patients andS_m= {s_{m1}, s_{m2}, s_{m3}, s_{m4}} where S_m is the universal set denoting the different symptoms for different patients and $F(S_m)$ is the set of all$N_S$subsets of S_m and D_e = {d_{e1}, d_{e2}, d_{e3}} representing different diseases respectively. Let us apply $N_{SS}$with Sanchez's approach in determining what kind of disease to a patient. The constructed two neutrosophic soft set matrices parameterized with S_m. The first N_{SS}(M, P_t) over S_m where M is a mappingM: $P_t \rightarrow F(S_m)$. Suppose,

$M(p_{t1})$ = {s_{m1}/(0.9, 0.9, 0.9), s_{m2}/(0.1, 0.1, 0.1), s_{m3}/(0.8, 0.9, 0.9), s_{m4}/(0.5, 0.7, 0.9)},

$M(p_{t2})$ = {s_{m1}/(0.1, 0.2, 0.3), s_{m2}/(0.9, 0.9, 0.9), s_{m3}/(0.1, 0.1, 0.1), s_{m4}/(0.7, 0.8, 0.9)}, $M(p_{t3})$ = {s_{m1}/(0.0, 0.0, 0.0), s_{m2}/(0.0, 0.0, 0.0), s_{m3}/(0.0, 0.0, 0.0), s_{m4}/(0.9, 0.9, 0.9)}

which gives a relation matrix named R_o.This $R_o$representingpatients - symptoms matrix. The second N_{SS}(N, S_m) over D_e, where N is a mapping N: $S_m \rightarrow F(D_e)$. Suppose,

$N(s_{m1})$ = {d_{e1}/(0.5, 0.5, 0.5),d_{e2}/(0.1, 0.1, 0.1),d_{e3}/(0.1, 0.2, 0.3)},

$N(s_{m2})$ = {d_{e1}/(0.1, 0.1, 0.2),d_{e2}/(0.5, 0.5, 0.5),d_{e3}/(0.1, 0.1, 0.1)}, $N(s_{m3})$ = {d_{e1}/(0.1, 0.1, 0.1),d_{e2}/(0.1, 0.1, 0.2),d_{e3}/(0.1, 0.1, 0.3)}, $N(s_{m4})$ = {d_{e1}/(0.2, 0.2, 0.3),d_{e2}/(0.1, 0.1, 0.1),d_{e3}/(0.3, 0.4, 0.5)}

which gives a relation matrix named R_S, representing symptoms -diseases matrix.

ALGORITHM

Step1:Construct two sets of neutrosophic soft set matrices.

Step 2:From the constructed sets of neutrosophic soft set matrices we get a relation matrix R_o and R_S.

Step 3:Calculate the product of matrices $R_O \otimes R_S$, using the definition (*Max- Min Product of*N_{SSM}) we get$N_{SSM}D^*$.**Step 4**:From D^*, to get the defuzzified values we use the definition (*Defuzzificationof triangular fuzzy number*) we get N_{SSM} D^{**}. **Step 5**:Find the maximum from each row in$N_{SSM}D^{**}$-relate patient to which disease.

PROCEDURE

Two neutrosophic soft set matrices R_o and R_S is defined

R_O =

	s_{m1}	s_{m2}	s_{m3}	s_{m4}
p_{t1}	(0.9,0.9,0.9)	(0.1,0.1,0.1)	(0.8,0.9,0.9)	(0.5,0.7,0.9)
p_{t2}	(0.1,0.2,0.3)	(0.9,0.9,0.9)	(0.1,0.1,0.1)	(0.7,0.8,0.9)
p_{t3}	(0.0,0.0,0.0)	(0.0,0.0,0.0)	(0.0,0.0,0.0)	(0.9,0.9,0.9)

R_S=

d_{e1}	d_{e2}	d_{e3}

$$\begin{array}{c} \\ s_{m1} \\ s_{m2} \\ s_{m3} \\ s_{m4} \end{array} \begin{pmatrix} (0.5,0.5,0.5) & (0.1,0.1,0.1) & (0.1,0.2,0.3) \\ (0.1,0.1,0.2) & (0.5,0.5,0.5) & (0.1,0.1,0.1) \\ (0.1,0.1,0.1) & (0.1,0.1,0.2) & (0.1,0.1,0.3) \\ (0.2,0.2,0.3) & (0.1,0.1,0.1) & (0.3,0.4,0.5) \end{pmatrix}$$

To obtain D^*, we product neutrosophic soft set matrices $R_O \otimes R_S$

$$D^* = \begin{array}{c} \\ p_{t1} \\ p_{t2} \\ p_{t3} \end{array} \begin{array}{c} \begin{array}{ccc} d_{e1} & d_{e2} & d_{e3} \end{array} \\ \begin{pmatrix} (0.5,0.1,0.2) & (0.1,0.5,0.5) & (0.3,0.1,0.1) \\ (0.2,0.1,0.1) & (0.5,0.1,0.2) & (0.3,0.1,0.3) \\ (0.2,0.1,0.1) & (0.1,0.1,0.1) & (0.3,0.1,0.1) \end{pmatrix} \end{array}$$

After defuzzifying the above matrix we get,

$$D^{**} = \begin{array}{c} \\ p_{t1} \\ p_{t2} \\ p_{t3} \end{array} \begin{array}{c} \begin{array}{ccc} d_{e1} & d_{e2} & d_{e3} \end{array} \\ \begin{pmatrix} 0.27 & 0.37 & 0.17 \\ 0.13 & 0.27 & 0.23 \\ 0.13 & 0.1 & 0.17 \end{pmatrix} \end{array}$$

Hence, from the D^{**} we conclude that the patients - p_{t1} andp_{t2} have complication in kidney and the patient - p_{t3} has thyroid disorder.

4. CONCLUSION

This paper put forth a method of determining the risk of person developing certain health complications based on the levels of different symptoms. This could be useful in early diagnosis of diseases leading to timely medical intervention.

REFERENCES

[1] Florentine Smarandache, Surapati Pramanik, New Trends in Neutrosophic Theory and Applications,ISBN: 978-1-59973-498-9. HAL Id:hal-01408066.

[2] Irfan Deli and Said Broumi, Neutrosophic soft matrices and NSM-decision making, Journal of Intelligent&FuzzySystems,Vol.28 (2015), pp. 22336.

[3] C. Kavitha and T.S.Frank Gladson, Design and Analysis of Fuzzy Arithmetic Neutrosopic soft set compositions using triangular fuzzy number, International Journal of Mechanical Engineering and Technology (IJMET), Vol. 9, Issue.5 (May 2018), pp. 425-435.

[4] Kaufmann.A.Gupta, MM:Introduction to fuzzy Arithmetic Theory and Applications. Van Nostrand-Reinhold, New York (1991).

[5] D. Molodtsov, Soft Set Theory- First Results, An International Journal of Computer &Mathematics with applications Vol.37 (1997), pp.19-31.

[6] Pabitra Kumar Maji, Neutrosophic Soft Set in Annals of fuzzy Mathematics andinformatics, ISSN: 2093-9310, Vol.5, No.1, (Jan 2013), pp.157-168.
[7] Pabitra Kumar Maji, Biswas.R, Roy.AR: Fuzzy soft set J. Fuzzy Math, 9 (3), pp. 677-692 (2001).
[8] Tanushree Mitra Basu and Shyamal Kumar Mondal, Neutrosophic Soft Matrix and its Application in Solving Group Decision Making Problems from medical Science in Computer Communication & Collaboration. ISSN: 2292-1028, Vol. 3, Issue.1 (2015).
[9]Tuhin Bera and Nirmal Kumar Mahapatra, Neutrosophic Soft Matrix and its application to Decision Making in Neutrosophic sets and systems, Vol.18 (2017).
[10] Yildiray Celik and Sultan Yamak,Fuzzy soft set theory applied to medical diagnosis using fuzzy arithmetic operations in Journal of Inequalities and Applications,doi:10.1186/1029– 242X-2013-82.
[11] L. A. Zadeh, Information and Control, 8(1965), pp.338-353