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AN APPLICATION OF SINGLE VALUED NEUTROSOPHIC SETS IN DIAGNOSIS OF POX DISEASE

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ABSTRACT

In this paper, the normalized Chebyshev distance formula and new distance formula for single valued neutrosophic sets are defined. Based on these two distance formulae an algorithm for identification of types of pox is developed and is illustrated with a numerical example. Finally compare the assigned result and conclude the best distance formula for the medical diagnosis of pox disease.

Keywords: Single- valued neutrosophic sets, Pox diagnosis, Chebyshev distance and the normalized Chebyshev distance.

INTRODUCTION

Neutrosophy, was introduced by Florentin Smarandache in 1980. This philosophy deals with the uncertainties that happens around us. The neutrosophic set, which was coined by Smarandache (1988) helps to deal with inconsistent data. Later, Wang *et al.*, (2010) proposed the concept of single valued neutrosophic set. The single valued neutrosophic sets acts as the bridge between the real and scientific the world. Gulfam *et al.*, (2017) brought the application of single valued sets in medical diagnosis. In the branch of neutrosophy, using distance and similarity, Yang *et al.*, (2016) introduced single valued set relation. In the field of medicine, the distance formula for single valued neutrosophic sets help to conclude that whether the person is affected by the specific disease or not.

In this paper, the normalized Chebyshev distance formula and new distance formula for single valued neutrosophic sets are defined. Based on these distance formulae an algorithm for identification of types of pox disease is developed and illustrated with a numerical example. The example is illustrated by collecting the data such as the symptoms of the patients in our surroundings in the form of neutrosophic environment.

Finally comparing the acquired result, concluded the best medical diagnosis for pox disease.

PRELIMINARIES

In this section under preliminaries some fundamental definition [1], [3] are discussed.

DEFINITION 2.1[3]: Let Z be a space of points (objects). A neutrosophic set M in Z is characterized by a truth membership function $(\mu_M(z))$, an indeterminacy-membership function $((\sigma_M(z))$ and a falsity- membership function $(\gamma_M(z))$. The functions $(\mu_M(z)), (\sigma_M(z))$ and $(\gamma_M(z))$ are real standard or non-standard subsets of $]0^-,1^+[$, that is, $\mu_M(z): Z \to]0^-,1^+[$, $\sigma_M(z): Z \to]0^-,1^+[$ and $\gamma_M(z): Z \to]0^-,1^+[$ and $0^- \leq \mu_M(z) + \sigma_M(z) + \gamma_M(z) \leq 3^+$.

From philosophical point of view, the neutrosophic set takes the value from real standard or non- standard subsets $]0^-,1^+[$. In real life applications in scientific and engineering problems, it is difficult to use neutrosophic set with value from real standard or non-standard subsets of $]0^-,1^+[$, where 0^-=0-∈, 1^+=1+∈, ∈ is an infinitesimal number > 0.

To apply neutrosophic set in real life problems more conveniently, Smarandache and Wang *et al.*, [4] defined single-valued neutrosophic sets which takes the value from the subset of [0,1]. Thus, a single-valued neutrosophic set is a special case of neutrosophic set. It has been proposed as a generalization of crisp sets, fuzzy sets, and intuitionistic fuzzy sets in order to deal with incomplete information.

DEFINITION 2.2[1]: Let Z = $\{z_1, z_2, \ldots, z_n\}$ be a discrete confined set. Consider M, N, O be the neutrosophic sets in Z. For all $z_i \in$ Z we have:

$$d_H(M, N) = H(M, N) = \max\{|\mu_M(z_i) - \mu_N(z_i)|, |\sigma_M(z_i) - \sigma_N(z_i)|, |\gamma_M(z_i) - \gamma_N(z_i)|\}$$

Where d_H(M, N) = H(M,N) denotes the extended Hausdroff distance between two neutrosophic sets M and N. The above defined distance d_H(M,N) between neutrosophic sets M and N satisfies the following properties:

(D1) d_H(M, N) ≥ 0,

(D2) d_H(M, N) =0 ↔ M=N for all M, N ∈ NS

(D3) d_H (M, N) = d_H(N,M),

(D4) If M ⊆ N ⊆ O for all M, N, O ∈ NS, then

d_H (M, O) ≥ d_H (M, N) and d_H (M, O) ≥ d_H(N,O).

Then d is called the distance measure between two neutrosophic sets.

NEUTROSOPHIC SETS IN DIAGNOSIS OF POX DISEASE

In this section, based on the Chebyshev distance between two neutrosophic sets A and B we define the normalized Chebyshev distance formula and new distance formula for single valued neutrosophic sets. Also we introduce new idea for medical diagnosis by using distance concepts between neutrosophic sets. Our aim is to find out the exact diagnosis for all patients p_i, i = 1,2,3.

DEFINITION 3.1: Let Z = $\{z_1, z_2, \dots, z_n\}$ be a discrete confined set. Consider A, B be the neutrosophic sets in Z. For all $z_i \in$ Z we have:

$$d_c(A, B) = C(A, B) = \max\{|\mu_A(z_i) - \mu_B(z_i)|, |\sigma_A(z_i) - \sigma_B(z_i)|, |\gamma_A(z_i) - \gamma_B(z_i)|\}$$

where d_C(A, B) = C (A, B) denotes the extended Chebyshev distance between two neutrosophic sets A and B.

DEFINITION 3.2: The normalized Chebyshev distance between two neutrosophic sets A and B is defined by

$$d(A,B) = \frac{1}{3n}\sum_{j=1}^{n} \max\{|\mu_A(z_j) - \mu_B(z_j)|, |\sigma_A(z_j) - \sigma_B(z_j)|, |\gamma_A(z_j) - \gamma_B(z_j)|\}$$

DEFINITION 3.3: The relation between neutrosophic sets for all the symptoms of the i-th patient the k-th diagnosisis defined by the new distance formula

$$d(p_i, d_k) = \frac{1}{n}\left[\frac{1}{6}\left(\sum_{j=1}^{n} \max\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\sigma_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\} + \min\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\delta_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\}\right)\right]$$

ALGORITHM

Step 1: Input the truth membership, indeterminacy and falsity- membership values of patients.

Step 2 : Input the membership, indeterminacy and non- membership values of diagnosis.

Step 3: Compute the diseases by different distance formulae given in step 4-5.

Step 4 : $d(p_i, d_k) = \frac{1}{3n}\sum_{j=1}^{n} \max\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\sigma_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\}$

Step5: d(p_i, d_k)=$\frac{1}{n}[\frac{1}{6}(\sum_{j=1}^{n} \max\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\sigma_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\}$+$\min\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\delta_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\}]$

In summer days, most of the students are affected by different types of pox diseases such as chicken pox, measles and mumps. In the present study, the data was collected from three students (S-1, S-2, and S-3) of II-M.Sc. Mathematics, in V.V.Vanniaperumal College for Women, Virudhunagar who were affected by pox disease and had undergone the symptoms of fever, blister, itching, sore throat and rashes. Finally, we get the diagnosis as chicken pox, measles and mumps. Table 1 highlights the three parameters such as membership function (μ), non membership function(γ), indeterminancy function(σ) for the symptoms of the students.

Table 1. Membership function (μ), non-membership function(γ), indeterminancy function(σ).

I_1	Students		
	S-1	S-2	S-3
Fever	(0.6,0.2,0.2)	(0.5,0.2,0.3)	(0.6,0.1,0.3)
Blister	(0.1,0.0,0.9)	(0.9,0.0,0.1)	(0.2,0.1,0.7)
Itching	(0.5,0.3,0.2)	(0.7,0.0,0.3)	(0.1,0.1,0.8)
Sore throat	(0.6,0.2,0.2)	(0.4, 0.2,0.4)	(0.8,0.0,0.2)
Rashes	(0.8,0.0,0.2)	(0.3,0.1,0.6)	(0.1,0.0,0.9)

Similarly in table 2, the symptoms are described as follows (μ, σ, γ). For example, chicken pox blister is high ($\mu =$ 0.9,0.0,0.1), while mumps blister is low ($\mu =$ 0.0,0.1,0.9).

Table 2. Chebyshev distance for all the symptoms observed in the patients.

I_2	Fever	Blister	Itching	Sore throat	Rashes
Chicken pox	(0.6,0.2,0.2)	(0.9,0.0,0.1)	(0.8,0.0,0.2)	(0.4,0.1,0.5)	(0.2,0.1,0.7)
Measles	(0.7,0.1,0.2)	(0.3,0.2,0.5)	(0.7,0.0,0.3)	(0.3,0.2,0.5)	(0.9,0.0,0.1)
Mumps	(0.6,0.2,0.2)	(0.0,0.1,0.9)	(0.4,0.2,0.4)	(0.9,0.0,0.1)	(0.0,0.2,0.8)

The normalized Chebyshev distance for all the symptoms of the i–th patient from the k-th diagnosis is defined as d(p_i, d_k) = $\frac{1}{3n}\sum_{j=1}^{n} \max\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\sigma_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\}$

d(p_i, d_k) = $\frac{1}{3\times5}$ [max{|0.6-0.6|,|0.2-0.2|,|0.2-0.2|}+max{ |0.1-0.9|, |0.0-0.0|, |0.9-0.1|}+ max{|0.5-0.8|,|0.3-0.0|,|0.2-0.2|}+max{|0.6-0.4|,|0.2-0.1|,|0.2-0.5|}+max{|0.8-0.2|,|0.0-0.1|,|0.2-0.7|}]

=$\frac{1}{15}$ [max{0.0,0.0,0.0}+max{0.8,0.0,0.8}+ max{0.3,0.3,0.0}+max{0.2,0.1,0.3}+max{0.6,0.1,0.5}]

= $\frac{1}{15}$ [0.0+0.8+0.3+0.3+0.6]

= $\frac{2}{15}$ = 0.13

d(p_i, d_k) =$\frac{1}{3\times5}$[max{|0.6-0.7|,|0.2-0.1|,|0.2-0.2|}+max{|0.1-0.3|, |0.0-0.2|, |0.9-0.5}+ max{|0.5-0.7|,|0.3-0.0|,|0.2-0.3|}+max{|0.6-0.3|,|0.2-0.2|,|0.2-0.5|}+max{|0.8-0.9|,|0.0-0.0|,|0.2-0.1|}]

= $\frac{1}{15}$ [max{0.1,0.1,0.0}+max{0.2,0.2,0.4}+ max{0.2,0.3,0.1}+max{0.3,0.0,0.3}+max {0.1,0.0,0.1}]

=$\frac{1}{15}$ [0.1+0.4+0.3+0.3+0.1]

= $\frac{1.2}{15}$ = 0.08

d(p_i, d_k) =$\frac{1}{3\times5}$[max{|0.6-0.6|,|0.2-0.2|,|0.2-0.2|}+max{|0.1-0.0|,|0.0-0.1|,|0.9-0.9|}+ max{|0.5-0.4|,|0.3-0.2|,|0.2-0.4|}+max{|0.6-0.9|,|0.2-0.0|,|0.2-0.1|}+max{|0.8-0.0|,|0.0-0.2|,|0.2-0.8|}]

= $\frac{1}{15}$ [max{0.0,0.0,0.0}+max{0.1,0.1,0.0}+ max{0.1,0.1,0.2}+max{0.3,0.2,0.1}+max{0.8,0.2,0.6}]

=$\frac{1}{15}$ [0.0+0.1+0.2+0.3+0.8]

= $\frac{1.4}{15}$ = 0.093

d(p_i, d_k)=$\frac{1}{3\times5}$[max{|0.5-0.6|,|0.2-0.2|,|0.3-0.2|}+max{|0.9-0.9|,|0.0-0.0|,|0.1-0.1|}+ max{|0.7-0.8|,|0.0-0.0|,|0.3-0.2|}+max{|0.4-0.4|,|0.2-0.1|,|0.4-0.5|}+max{|0.3-0.2|,|0.1-0.1|,|0.6-0.7|}]

=$\frac{1}{15}$[max{0.1,0.0,0.1}+max{0.0,0.0,0.0}+max{0.1,0.0,0.1}+max{0.0,0.1,0.1}+max{0.1,0.0,0.1}]

=$\frac{1}{15}$ [0.1+ 0.0+0.1+0.1+0.1]

= $\frac{0.4}{15}$= 0.026

d(p_i, d_k) =$\frac{1}{3\times5}$[max{|0.5-0.7|,|0.2-0.1|,|0.3-0.2|}+ max{|0.9-0.3|, |0.0-0.2|, |0.1-0.5|}+ max{|0.7-0.7|,|0.0-0.0|,|0.3-0.3|}+max{|0.4-0.3|,|0.2-0.2|,|0.4-0.5|}+max{|0.3-0.9|,|0.1-0.0|,|0.6-0.1|}]

=$\frac{1}{15}$[max{0.2,0.1,0.1}+max{0.6,0.2,0.4}+ max{0.0,0.0,0.0}+max{0.1,0.0,0.1}+max {0.6,0.1,0.5}]

=$\frac{1}{15}$ [0.2+ 0.6+0.0+0.1+0.6]

= $\frac{1.5}{15}$ = 0.10

d(p_i, d_k) =$\frac{1}{3\times5}$[max{|0.5-0.6|,|0.2-0.2|,|0.3-0.2|}+max{|0.9-0.0|, |0.0-0.1|, |0.1-0.9|}+ max{|0.7-0.4|,|0.0-0.2|,|0.3-0.4|}+max{|0.4-0.9|,|0.2-0.0|,|0.4-0.1|}+max{|0.3-0.0|,|0.1-0.2|,|0.6-0.8|}]

=$\frac{1}{15}$[max{0.1,0.0,0.1}+max{0.9,0.1,0.8}+max{0.3,0.2,0.1}+max{0.5,0.2,0.3}+max{0.3,0.1,0.2}]

=$\frac{1}{15}$ [0.1+ 0.9+0.3+0.5+0.3]

= $\frac{2.1}{15}$ = 0.14

d(p_i, d_k) =$\frac{1}{3\times5}$[max{|0.6-0.6|,|0.1-0.2|,|0.3-0.2|}+max{|0.2-0.9|, |0.1-0.0|, |0.7-0.1|}+

max{|0.1-0.8|,|0.1-0.0|,|0.8-0.2|}+max{|0.8-0.4|,|0.0-0.1|,|0.2-0.5|}+max{|0.1-0.2|,|0.0-0.1|,|0.9-0.7|}]

$=\frac{1}{15}$[max{0.0,0.1,0.1}+max{0.7,0.1,0.6}+max{0.7,0.1,0.6}+max{0.4,0.1,0.3}+max{0.1,0.1,0.2}]

$=\frac{1}{15}$ [0.1+ 0.7+0.7+0.4+0.2]

$= \frac{2.1}{15} = 0.14$

d(p_i, d_k)=$\frac{1}{3\times5}$[max{|0.6-0.7|,|0.1-0.1|,|0.3-0.2|}+max{|0.2-0.3|, |0.1-0.2|, |0.7-0.5|}+ max{|0.1-0.7|, |0.1-0.0|, |0.8-0.3|}+max{|0.8-0.3|,|0.0-0.2|,|0.2-0.5|}+max{|0.1-0.9|,|0.0-0.0|,|0.9-0.1|}]

$=\frac{1}{15}$[max{0.1,0.0,0.1}+max{0.1,0.1,0.2}+ max{0.6,0.1,0.5}+max{0.5,0.2,0.3}+max{0.8,0.0,0.8}]

$=\frac{1}{15}$ [0.1+ 0.2+0.6+0.5+0.8]

$= \frac{2.2}{15} = 0.1466$

d(p_i, d_k) =$\frac{1}{3\times5}$[max{|0.6-0.6|,|0.1-0.2|,|0.3-0.2|}+max{|0.2-0.0|,|0.1-0.1|,|0.7-0.9|}+ max{|0.1-0.4|,|0.1-0.2|,|0.8-0.4|}+max{|0.8-0.9|,|0.0-0.0|,|0.2-0.1|}+max{|0.1-0.0|,|0.0-0.2|,|0.9-0.8|}]

$=\frac{1}{15}$[max{0.0,0.1,0.1}+max{0.2,0.0,0.2}+max{0.3,0.1,0.4}+max{0.0,0.0,0.1}+max{0.1,0.2,0.1}]

$=\frac{1}{15}$ [0.1+ 0.2+0.4+0.1+0.2]

$= \frac{1.0}{15} = 0.06$

By using this formula, for n = 5. We get the table 3.

Table 3 shows the least differences in Medical diagnosis

I	**S-1**	**S-2**	**S-3**
Chicken pox	0.13	**0.02**	0.14
Measles	**0.08**	0.10	0.146
Mumps	0.093	0.14	**0.06**

The medical diagnosis in each column is identified by the least difference. Therefore, S-1 is affected by measles, S-2 is affected by chicken pox and S-3 is affected by mumps.

Now, we define another new distance formula for Pox diagnosis:

$$d(p_i, d_k) = \frac{1}{n}\left[\ \frac{1}{6}\left(\sum_{j=1}^{n} \max\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\sigma_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\} + \min\{|\mu_{p_i}(z_j) - \mu_{d_k}(z_j)|, |\delta_{p_i}(z_j) - \sigma_{d_k}(z_j)|, |\gamma_{p_i}(z_j) - \gamma_{d_k}(z_j)|\}\right)\right]$$

d(p_i, d_k)=$\frac{1}{5}\times\frac{1}{6}$[max{|0.6-0.6|,|0.2-0.2|,|0.2-0.2|}+max{|0.1-0.9|,|0.0-.0|,|0.9-0.1|}+ max{|0.5-0.8|,|0.3-0.0|,|0.2-0.2|}+max{|0.6-0.4|,|0.2-0.1|,|0.2-0.5|}+max{|0.8-0.2|, |0.0-0.1|,|0.2-0.7|}+min{|0.6-0.6|,|0.2-0.2|, |0.2-0.2|}+min{|0.1-0.9|,|0.0-0.0|,|0.9-0.1|}+min{|0.5-0.8|,|0.3-0.0|,|0.2-0.2|}+min {|0.6-0.4|,|0.2-0.1|,|0.2-0.5|}+min{|0.8-0.2|, |0.0-0.1|,|0.2-0.7|}]

$=\frac{1}{30}$[max{0.0,0.0,0.0}+max{0.8,0.0,0.8}+max{0.3,0.3,0.0}+max{0.2,0.1,0.3}+max{0.6,0.1,0.5}+min{0.0,0.0,0.0}+min{0.8,0.0,0.8}+min{0.3,0.3,0.0}+min{0.2,0.1,0.3}+min{0.6,0.1,0.5}]

$=\frac{1}{30}$[0.0+0.8+0.3+0.3+0.6+0.0+0.0+0.1+0.1]

$= \frac{2.2}{30} = 0.073$

d(p_i, d_k) $=\frac{1}{5} \times \frac{1}{6}$ [max{|0.6-0.7|,|0.2-0.1|,|0.2-0.2|}+max{|0.1-0.3|, |0.0-0.2|, |0.9-0.5}+max{|0.5-0.7|, |0.3-0.0|, |0.2-0.3|}+max{|0.6-0.3|,|0.2-0.2|,|0.2-0.5|}+max{|0.8-0.9|,|0.0-0.0|,|0.2-0.1|}+min{|0.6-0.7|,|0.2-0.1|,|0.2-0.2|}+min{|0.1-0.3|,|0.0-0.2|,|0.9-0.5}+min{|0.5-0.7|,|0.3-0.0|,|0.2-0.3|}+min{|0.6-0.3|,|0.2-0.2|,|0.2-0.5|}+min{|0.8-0.9|,|0.0-0.0|,|0.2-0.1|}]

$=\frac{1}{30}$[max{0.1,0.1,0.0}+max{0.2,0.2,0.4}+max{0.2,0.3,0.1}+max{0.3,0.0,0.3}+max{0.1,0.0,0.1}+ min{0.1,0.1,0.0}+min{0.2,0.2,0.4}+min{0.2,0.3,0.1}+min{0.3,0.0,0.3}+min{0.1,0.0,0.1}]

$=\frac{1}{30}$[0.1+0.4+0.3+0.3+0.1+0.0+0.2+0.1+0.0+0.0]

$= \frac{1.5}{30} = 0.05$

d(p_i, d_k) $=\frac{1}{5} \times \frac{1}{6}$[max{|0.6-0.6|,|0.2-0.2|,|0.2-0.2|}+max{|0.1-0.0|,|0.0-0.1|,|0.9-0.9|}+max{|0.5-0.4|,|0.3-0.2|,|0.2-0.4|}+max{|0.6-0.9|,|0.2-0.0|,|0.2-0.1|}+max{|0.8-0.0|,|0.0-0.2|,|0.2-0.8|}+min{|0.6-0.6|,|0.2-0.2|,|0.2-0.2|}+min{|0.1-0.0|,|0.0-0.1|,|0.9-0.9|}+min{|0.5-0.4|,|0.3-0.2|,|0.2-0.4|}+min{|0.6-0.9|,|0.2-0.0|,|0.2-0.1|}+min{|0.8-0.0|,|0.0-0.2|,|0.2-0.8|}]

$=\frac{1}{30}$[max{0.0,0.0,0.0}+max{0.1,0.1,0.0}+max{0.1,0.1,0.2}+max{0.3,0.2,0.1}+max{0.8,0.2,0.6}+min{0.0,0.0,0.0}+min{0.1,0.1,0.0}+min{0.1,0.1,0.2}+min{0.3,0.2,0.1}+min{0.8,0.2,0.6}]

$=\frac{1}{30}$[0.0+0.1+0.2+0.3+0.8+0.0+0.0+0.1+0.1+0.2]

$= \frac{1.8}{30} = 0.06$

d(p_i, d_k) $=\frac{1}{5} \times \frac{1}{6}$ [max{|0.5-0.6|,|0.2-0.2|,|0.3-0.2|}+max{|0.9-0.9|,|0.0-0.0|,|0.1-0.1|}+max{|0.7-0.8|,|0.0-0.0|,|0.3-0.2|}+max{|0.4-0.4|,|0.2-0.1|,|0.4-0.5|}+max{|0.3-0.2|,|0.1-0.1|,|0.6-0.7|}+min{|0.5-0.6|,|0.2-0.2|,|0.3-0.2|}+min{|0.9-0.9|,|0.0-0.0|,|0.1-0.1|}+min{|0.7-0.8|,|0.0-0.0|,|0.3-0.2|}+min{|0.4-0.4|,|0.2-0.1|,|0.4-0.5|}+min{|0.3-0.2|,|0.1-0.1|,|0.6-0.7|}]

$=\frac{1}{30}$[max{0.1,0.0,0.1}+max{0.0,0.0,0.0}+max{0.1,0.0,0.1}+max{0.0,0.1,0.1}+max{0.1,0.0,0.1}+ min{0.1,0.0,0.1}+min{0.0,0.0,0.0}+min{0.1,0.0,0.1}+min{0.0,0.1,0.1}+min{0.1,0.0,0.1}]

$=\frac{1}{30}$[0.1+0.0+0.1+0.1+0.1+0.0+0.0+0.0+0.0+0.0]

$= \frac{0.4}{30} = 0.013$

d(p_i, d_k) =$\frac{1}{5} \times \frac{1}{6}$[max{|0.5-0.7|,|0.2-0.1|,|0.3-0.2|}+max{|0.9-0.3|,|0.0-0.2|,|0.1-0.5|}+ max{|0.7-0.7|,|0.0-0.0|,|0.3-0.3|}+max{|0.4-0.3|,|0.2-0.2|,|0.4-0.5|}+max{|0.3-0.9|,|0.1-0.0|,|0.6-0.1|}+min{|0.5-0.7|,|0.2-0.1|,|0.3-0.2|}+min{|0.9-0.3|,|0.0-0.2|,|0.1-0.5|}+min {|0.7-0.7|,|0.0-0.0|,|0.3-0.3|}+min{|0.4-0.3|, |0.2-0.2|,|0.4-0.5|}+min{|0.3-0.9|,|0.1-0.0|,| 0.6-0.1|}]

=$\frac{1}{30}$[max{0.2,0.1,0.1}+max{0.6,0.2,0.4}+ max{0.0,0.0,0.0}+max{0.1,0.0,0.1}+max{0.6,0.1,0.5}+min{0.2,0.1,0.1}+min{0.6,0.2,0.4}+min{0.0,0.0,0.0}+min{0.1,0.0,0.1}+min {0.6,0.1,0.5}]

=$\frac{1}{30}$[0.2+0.6+0.0+0.1+0.6+0.1+0.2+0.0+0.0 +0.1]

= $\frac{1.9}{30}$ = 0.063

d(p_i, d_k)=$\frac{1}{5} \times \frac{1}{6}$[max{|0.5-0.6|,|0.2-0.2|,|0.3-0.2|}+max{|0.9-0.0|,|0.0-0.1|,|0.1-0.9|}+ max{|0.7-0.4|,|0.0-0.2|,|0.3-0.4|}+max{|0.4-0.9|,|0.2-0.0|,|0.4-0.1|}+max{|0.3-0.0|,|0.1-0.2|,|0.6-0.8|}+min{|0.5-0.6|,|0.2-0.2|,|0.3-0.2|}+min{|0.9-0.0|,|0.0-0.1|,|0.1-0.9|}+ min{|0.7-0.4|,|0.0-0.2|,|0.3-0.4|}+min{|0.4-0.9|, |0.2-0.0|,|0.4-0.1|}+min{|0.3-0.0|,|0.1-0.2|,|0.6-0.8|}]

=$\frac{1}{30}$[max{0.1,0.0,0.1}+max{0.9,0.1,0.8}+max{0.3,0.2,0.1}+max{0.5,0.2,0.3}+max{0.3,0.1,0.2}+min{0.1,0.0,0.1}+min{0.9,0.1,0.8}+ min{0.3,0.2,0.1}+min{0.5,0.2,0.3}+min{0.3,0.1,0.2}]

=$\frac{1}{30}$[0.1+0.9+0.3+0.5+0.3+0.0+0.1+0.1+0.2 +0.1]

= $\frac{2.6}{30}$= 0.0867

d(p_i, d_k) =$\frac{1}{5} \times \frac{1}{6}$[max{|0.6-0.6|,|0.1-0.2|,|0.3-0.2|}+max{|0.2-0.9|,|0.1-0.0|,|0.7-0.1|}+max {|0.1-0.8|,|0.1-0.0|,|0.8-0.2|}+max{|0.8-0.4|, |0.0-0.1|,|0.2-0.5|}+max{|0.1-0.2|,|0.0-0.1|, |0.9-0.7|}+min{|0.6-0.6|,|0.1-0.2|,|0.3-0.2|} +min{|0.2-0.9|,|0.1-0.0|,|0.7-0.1|}+ min{|0.1-0.8|,|0.1-0.0|,|0.8-0.2|}+min{|0.8-0.4|,|0.0-0.1|,|0.2-0.5|}+min{|0.1-0.2|,|0.0-0.1|,|0.9-0.7|}]

=$\frac{1}{30}$[max{0.0,0.1,0.1}+max{0.7,0.1,0.6}+max{0.7,0.1,0.6}+max{0.4,0.1,0.3}+max{0.1,0.1,0.2}+ min{0.0,0.1,0.1}+min{0.7,0.1,0.6} +min{0.7,0.1,0.6}+min{0.4,0.1,0.3}+min{0.1,0.1,0.2}]

=$\frac{1}{30}$[0.1+0.7+0.7+0.4+0.2+0.0+0.1+0.1+0.1 +0.1]

= $\frac{2.5}{30}$= 0.083

d(p_i, d_k) =$\frac{1}{5} \times \frac{1}{6}$ [max{|0.6-0.7|,|0.1-0.1|,|0.3-0.2|}+max{|0.2-0.3|,|0.1-0.2|,|0.7-0.5|}+ max{|0.1-0.7|,|0.1-0.0|,|0.8-0.3|}+max{|0.8-0.3|,|0.0-0.2|,|0.2-0.5|}+max{|0.1-0.9|,|0.0-0.0|,|0.9-0.1|}+min{|0.6-0.7|,|0.1-0.1|,|0.3-0.2|}+min{|0.2-0.3|,|0.1-0.2|,|0.7-0.5|}+min

{|0.1-0.7|,|0.1-0.0|,|0.8-0.3|}+min{|0.8-0.3|,|0.0-0.2|,|0.2-0.5|}+min{|0.1-0.9|,|0.0-0.0|,|0.9-0.1|}]

$=\frac{1}{30}$[max{0.1,0.0,0.1}+max{0.1,0.1,0.2}+max{0.6,0.1,0.5}+max{0.5,0.2,0.3}+max{0.8,0.0,0.8}+min{0.1,0.0,0.1}+min{0.1,0.1,0.2}+min{0.6,0.1,0.5}+min{0.5,0.2,0.3}+min{0.8,0.0,0.8}]

$=\frac{1}{30}$[0.1+0.2+0.6+0.5+0.8+0.0+0.1+0.1+0.2+0.0]

$= \frac{2.6}{30}$ = 0.0867

d(p_i, d_k) $=\frac{1}{5} \times \frac{1}{6}$[max{|0.6-0.6|,|0.1-0.2|,|0.3-0.2|}+max{|0.2-0.0|,|0.1-0.1|,|0.7-0.9|}+max{|0.1-0.4|,|0.1-0.2|,|0.8-0.4|}+max{|0.8-0.9|,|0.0-0.0|,|0.2-0.1|}+max{|0.1-0.0|,|0.0-0.2|,|0.9-0.8|}+min{|0.6-0.6|,|0.1-0.2|,|0.3-0.2|}+min{|0.2-0.0|,|0.1-0.1|,|0.7-0.9|}+min{|0.1-0.4|,|0.1-0.2|,|0.8-0.4|}+min{|0.8-0.9|,|0.0-0.0|,|0.2-0.1|}+min{|0.1-0.0|,|0.0-0.2|,|0.9-0.8|}]

$=\frac{1}{30}$ [max{0.0,0.1,0.1}+max{0.2,0.0,0.2}+max{0.3,0.1,0.4}+max{0.0,0.0,0.1}+max{0.1,0.2,0.1}+min{0.0,0.1,0.1}+min{0.2,0.0,0.2}+min{0.3,0.1,0.4}+min{0.0,0.0,0.1}+min{0.1,0.2,0.1}]

$=\frac{1}{30}$[0.1+0.2+0.4+0.1+0.2+0.0+0.0+0.1+0.0+0.1]

$= \frac{1.2}{30}$= 0.04

By using formula, for n = 5. We obtain the table 4.

Table 4 shows the least differences observed among the students in Medical diagnosis

I	**1**	**2**	**3**
Chicken pox	0.07	**0.013**	0.08
Measles	**0.05**	0.063	0.086
Mumps	0.06	0.086	**0.04**

The medical diagnosis in each column is identified by the least difference. Thus, we conclude that S-1 is affected by measles, S-2 is affected by chicken pox and S-3 is affected by mumps.

The results which are obtained from the normalized Chebyshev distance and new distance formula are compared. The new distance formula gives the least difference than the normalized Chebyshev distance. Finally, it is concluded that new distance formula gives the best result for diagnosing the Pox diagnosis.

To conclude that the normalized Chebyshev distance formula and new distance formula for single valued neutrosophic sets are defined and an algorithm for identification of types of Pox is developed using single-valued neutrosophic sets. A real life numerical example was illustrated and the results obtained using these distance formulae were compared. The lowest differences obtained by new distance formula gives the best the medical diagnosis of pox disease.

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