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INCONSISTENT DATA PROCESSING USING NEUTROSOPHIC LOGIC WITH SIMILARITY MEASURE FORMULA

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ABSTRACT

Here, we have designed two different Similarity Measure formulas which are applicable to find the closeness of two different neutrosophic data. Then we have performed imprecise query on these two sets of similarity measure values and check which one will give better result for a certain cut-off value. Each neutrosophic data is based on truth, indeterminacy and false membership values.

Keywords : Neutrosophic Data, Similarity Measure Formula, Indeterminacy Query, Tolerance Value.

I. INTRODUCTION

Smarandache [1, 2, 3] has discussed the logic of neutrosophic set in 2001, for solving the problems of inconsistent data. A neutrosophic set is considered as a next generalization of vague set [4, 5, 6, 7] is based on three interval-based memberships instead of vague set based two interval-based memberships. A very few work on neutrosophic set has been reported in literature [8, 9, 10, 11]. Here, we have designed two different similarity measure formulas which are used on neutrosophic data for finding closeness value between two neutrosophic data separately. Several authors have used vague set to execute imprecise query but no such work has been reported literature using neutrosophic data. Here, we run the imprecise query on two different similarity value sets which are got from different similarity measure formula. Imprecise query is based on SQL command with some tolerance value for retrieving desired tuples from the table of a database.

II. NEUTROSOPHIC SET

A neutrosophic set N is given by:

truth membership $t_n \rightarrow [0,1]$,

false membership $f_n \rightarrow [0,1]$ and

indeterminacy membership function $I_n \rightarrow [0,1]$ such that $t_n + f_n \leq 1$ and $t_n + f_n + i_n \leq 2$ and is represented as

$N = \{< n, [t_n, i_n, f_n] >\}$.

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III. DIFFERENT SIMILARITY MEASURE FORMULA

We have designed two different similarity measure formulas, which are an expansion of similarity measure for vague data [11, 12], to calculate closeness value between two neutrosophic data. The newly introduced similarity measure formulas are given below.

Similarity Measure (S.M.) between two neutrosophic values:

Let m and n be any two neutrosophic values such that $m=[t_m, i_m, f_m]$ and $n=[t_n, i_n, f_n]$ where $0\le t_m+f_m\le 1$, $0\le t_n+f_n\le 1$, $t_m+i_m+f_m\le 2$, $t_n+i_n+f_n\le 2$.

Formula_1:

Let SE (m, n) denote the similarity measure between m and n.

Then,

$$SE(m,n)=\frac{\min(t_m,t_n)+\min((1-f_m),(1-f_n))+\min((1-i_m),(i-i_n))}{\max(t_m,t_n)+\max((1-f_m),(1-f_n))+\max((1-i_m),(1-i_n))}$$

Formula_2:

Let SE (m, n) denote the similarity measure between m and n.

Then,

$$SE(m,n)=1-\frac{|(t_m-t_n)+(i_m-i_n)+(f_m-f_n)|}{6}-\frac{\max\{|(t_m-t_n)|,|(i_m-i_n)|,|(f_m-f_n)|\}}{3}$$

IV. CALCULATE SIMILARITY MEASURE VALUES

In this work, we have experimentally observed how two neutrosophic data can retrieve different similarity measure value using two different formulas. These calculated similarity measure values are further required to run an imprecise query with certain tolerance value to examines which formula based similarity values are optimized as per the closeness of tolerance value is concerned. To explain this, we have considered the following Customer relational as given in Table 1 and uncertain query given below:

4.1 Problem Data

EName	Exp (yrs)	Esal (Rs)
Jones	11	15000
Tomas	8	10000
Kates	10	12000
Joshep	12	20000
Rock	19	28000
Smith	14	24000
Rokey	16	26000
Adams	25	40000

Table 1. Customer Relation

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4.2 Solution

At first, we have designed the neutrosophic representation of Exp on which two different similarity measure formulas are used to find the closeness value. Next to apply imprecise query on two different similarities measured based columns with some cut-off value. Neutrosophic representation of Exp is shown in Table 2.

EName	Exp (yrs)	Esal (Rs)	Neutrosophic representation of Exp[t,i,f]
Jones	11	15000	<11[.97,.03,.02]>
Tomas	8	10000	<8[.73,.15,.25]>
Kates	10	12000	<10[.96,.04,.03]>
Joshep	12	20000	<12[1,0,0]>
Rock	19	28000	<19[.68,.35,.31]>
Smith	14	24000	<14,[.95,.03,.04]>
Rokey	16	26000	<16[.91,.12,.06]>
Adams	25	40000	<25[.43,.42,.52]>

Table 2. Neutrosophic Representation of Exp in Employee Relation

We calculate the closeness values of Exp using formula_1 of similarity measure.

For example, let us consider the two neutrosophic data m=<12[1,0,0]> and n= <11,[.97,.03,.02]>.

Here,

$$t_m = 1, i_m = 0, f_m = 0, t_n = .97, i_n = .03, f_n = .02$$

Then

$$S.M(m,n) = \frac{\min(1,.97) + \min((1-0),(1-.03)) + \min((1-0),(1-.02))}{\max(1,.97) + \max((1-0),(1-.03)) + \max((1-0),(1-.02))} = \frac{.97 + .97 + .98}{3} = .973$$

Again, for m=<12,[1,0,0]> and n=<8,[.73,.15,.25]>, $t_m = 1, i_m = 0, f_m = 0, t_n = .73, i_n = .15, f_n = .25$. This gives

$$S.M(m,n) = \frac{.73 + .75 + .85}{3} = .776$$

Again, for m=<12,[1,0,0]> and n=<10,[.96,.04,.03]>, $t_m = 1, i_m = 0, f_m = 0, t_n = .96, i_n = .04, f_n = .03$. This gives

$$S.M(m,n) = \frac{.96 + .97 + .96}{3} = .963$$

and so on.

Next, we calculate the closeness values of Exp using formula_2 of similarity measure.

Again, for m=<12,[1,0,0]> and n=<19,[.68,.35,.31]>, $t_m = 1, i_m = 0, f_m = 0, t_n = .68, i_n = .35, f_n = .31$. This gives

$$S.M.(m,n)=1-\frac{|(1-.68)+(0-.35)+(0-.31)|}{6}-\frac{\max\{|(1-.68)|,|(0-.35)|,|(0-.31)|\}}{3}$$
$$=\frac{5.66}{6}-\frac{.35}{3}=.943-.116=.83$$

Again, for m=<12,[1,0,0]> and n=<14,[.95,.03,.04]>, $t_m=1, i_m=0, f_m=0, t_n=.95, i_n=.03, f_n=.04$. This gives

$$S.M.(m,n)=1-\frac{|(1-.95)+(0-.03)+(0-.04)|}{6}-\frac{\max\{|(1-.95)|,|(0-.03)|,|(0-.04)|\}}{3}$$
$$=\frac{5.98}{6}-\frac{.05}{3}=.996-.016=.98$$

Again, for m= <12,[1,0, 0]> and n = <16, [.91, .12, .06]>, $t_m=1, i_m=0, f_m=0, t_n=.91, i_n=.12, f_n=.06$. This gives

$$S.M.(m,n)=1-\frac{|(1-.91)+(0-.12)+(0-.06)|}{6}-\frac{\max\{|(1-.91)|,|(0-.12)|,|(0-.06)|\}}{3}$$
$$=\frac{5.91}{6}-\frac{.12}{3}=.985-.04=.96$$

and so on.

The calculated two different similarity measures for the neutrosophic data are shown in Table 3.

EName	Exp (yrs)	Esal (Rs)	Neutrosophic representation of Exp[t,i,f]	S.M of Exp using formula_1(T_1)	S.M of Exp using formula_2(T_2)
Jones	11	15000	<11[.97,.03,.02]>	.97	.99
Tomas	8	10000	<8[.73,.15,.25]>	.78	.88
Kates	10	12000	<10[.96,.04,.03]>	.96	.98
Joshep	12	20000	<12[1,0,0]>	1	1
Rock	19	28000	<19[.68,.35,.31]>	.67	.83
Smith	14	24000	<14,[.95,.03,.04]>	.96	.98
Rokey	16	26000	<16[.91,.12,.06]>	.91	.96
Adams	25	40000	<25[.43,.42,.52]>	.50	.75

Table 3. Two different S.M Calculations for Exp

Now, we perform the imprecise query with tolerance value on formula_1 and formula_2 based data set to see which type of similarity measure values will retrieve less numbers of tuples from the Table 3.

Next, we process the imprecise query on similarity measure values of neutrosophic data:

SELECT * FROM EMPLOYEE WHERE $T_1 \geq 0.95$

EName	Exp (yrs)	Esal (Rs)
Jones	11	15000
Kates	10	12000
Joshep	12	20000
Smith	14	24000

Table 4. Imprecise Query onT_1

SELECT * FROM EMPLOYEE WHERE $T_2 \geq 0.95$

EName	Exp (yrs)	Esal (Rs)
Jones	11	15000
Kates	10	12000
Joshep	12	20000
Smith	14	24000
Rokey	16	26000

Table 5. Imprecise Query on T_2

V. CONCLUSION

A comparison between two different similarity measure formulas based on neutrosophic data and calculating similarity measure values using these formulas has been expressed in our current work. Each formula is used to find the closeness value set from two neutrosophic data. Here one neutrosophic value is always fixed and other is changed tuple to tuple. Finally, SQL command based imprecise query is executed with certain tolerance value on the similarity measure value based specific single column of a table. Here we are performed two different queries on two different columns of similarity measure value set. Finally we observed that formula_1 based imprecise query retrieves less numbers of tuples than formula_2 based imprecise query and formula_1 based outputs are more closure than formula_2 based outputs. So, we are determined that Type-1 formula is more suitable for calculating similarity measure values from the table of a relational database which is based on neutrosophic data.

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