To Handle Uncertain Data for Medical Diagnosis Purpose using Neutrosophic Set

Soumitra De and Jaydev Mishra
Computer Science & Engineering Department
College of Engineering and Management, Kolaghat,
Kolaghat, Purba Medinipur, 721171,West Bengal,India
soumitra@cemk.ac.in,jsm03@cemk.ac.in

***Abstract*- Here we proposed a new approach which is based on Neutrosophic logic to help the patient by taking proper decision through pathological report based analysis. Neutrosophic set is used for uncertain data. Fuzzy data is used to handle incomplete data by only truth value and vague data is applicable for uncertain data by truth and false values. But both are unable to handle uncertain data for any analytical based system. Now neutrosophic set is being used to handling uncertain data in the form of neutrosophic data for pathological test report based decision making operation.**

Keywords- neutrosophic set; neutrosophic data; membership domain; equation of neutrosophic data; new approach of decision making.

I INTRODUCTION

Incomplete data in these areas are problematic in relational model. To overcome from difficult uncertainties already fuzzy set and vague set have been studied. Data based on fuzzy and vague logics are applied in different real problems where uncertainty is the major factor. Some cases it is very difficult to solve using fuzzy logic [1, 2, 3]. The vague set [5, 6, 7] is handled the uncertain data using truth and false values. Fuzzy and vague both data cannot be represented as three membership value, so they are unable to process uncertain data which is consists of true, indeterminacy and false, these three values. Smarandache [8, 9] was created the concept of neutrosophic set and logic for solving the indeterminacy problems. Neutrosophic set and its applications are progressing quickly in different fields of research work. We found a lot of literature in this regard in [10, 11]. Inference of problem is very good using neutrosophic set for handling the membership value of incentives. We are introduced an approach using neutrosophic set which is good for any uncertain data based decision making operation. In this paper we have minimized some doubts by processing uncertainties and we get proper solution. We are basically applying our new approach based neutrosophic set for identify the disease of a patient through some pathological report based data.

II CONCEPT OF NEUTROSOPHIC SET

In this paper we are introducing the domain of each membership value and the equation of neutrosophic set.

Definition 1

A neutrosophic set Y on U is defined as $Y = \{< y, t_y(x), i_y(x), f_y(x) >, x \in U\}$, where $t_y : x \rightarrow [0,1]$; $i_y : x \rightarrow [0,1]$; $f_y : x \rightarrow [0,1]$, $t_y(x) + i_y(x) + f_y(x) \leq 2$ and $t_y(x) + f_y(x) \leq 1$.

The neutrosophic set takes the value from the closed interval [0, 1]. Each membership value cannot cross 1 and if truth is 0 false should be maximum 1. Indeterminacy value of uncertain data is playing a vital role for taking most accurate decision.

Example 1

Suppose a question paper is made of 15 questions for an examination. In time t_1, 7 questions ―known, 3 questions ―unknown and 5 questions are incomplete. It is represented in neutrosophic logic; v (0.7, 0.5, 0.3).

Example 2

Let A be the phones set and X is the parameters set. Every parameter is based on neutrosophic concept .Consider A = {nokia, lava, lenevo, sony*}*. Here each mobile phone is represented by neutrosophic data of three membership values. Suppose that, two phones are present in the universe U which is given by, $U = \{a_1, a_2\}$ and the set of parameters $X = \{x_1, x_2, x_3\}$, where x_1 stands for 'nokia', x_2 stands for 'lava',x_3 stands for 'lenevo'. We have shown information based knowledge from Table I.

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Neutrosophic set and parameter	Data Representation of Neutrosophic
A(nokia)	<a_1,0.5,0.48,0.35>, <a_2, 0.4, 0.6, 0.5 >
A(lava)	<a_1,0.8, 0.02, 0.1 >, <a_2, 0.7, 0.52, 0.2 >
A(lenevo)	<a_1,0.3, 0.5, 0.65 >, < a_2, 0.6, 0.1, 0.3 >

Table I. **Neutrosophic data representation of three mobile phones.**

III NEW APPROACH FOR DECISION MAKING USING NEUTROSOPHIC LOGIC

Method 1

Step 1. If t >=2f and t> i, Then the result is positive (+ve)

Step 2. If t + f < = 1 and t < = f, Then consider the i value within the Step 2.

Step 2.1. If difference of (t, i) < difference of (i,f) , then the result is positive(+ve)

Step 2.2. If difference of (t, i) = difference of (i,f), then ignore the result for decision.

Step 3. If t + f < = 1 and t > f and i< avg. of i of each column, Then the result is positive (+ve).

Problem 1

We have applied the method 1 on a patient who is suffering from high fever. We have several pathological laboratories report of a patient to find the actual status of the diseases for which high fever came. Finding the proper disease is a challenging work for the patient. We have used neutrosophic logic based data for disease identifying operation.

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Problem Data of a Patient

Lab	Patient suffering from high fever			
	Leukemia	Cancer	Dengue	Dialysis
L_1	<.6,.12,.30>	<.58,.01,.40>	<.50,.15,.43>	<.48,.17,.50>
L_2	<.57,.05,.40>	<.49,.02,.50>	<.56,.03,.40>	<.56,.03,.40>
L_3	<.48,.10,.50>	<.50,.15,.42>	<.70,.01,.25>	<.64,.02,.32>
L_4	<.40,.20,.30>	<.61,.20,.30>	<.65,.12,.30>	<.72,.01,.22>
L_5	<.45,.11,.50>	<.45,.16,.40>	<.45,.16,.44>	<.46,.20,.50>

Table II. **Problem data**

Solution

Lab	Patient suffering from high fever			
	Leukemia	Cancer	Dengue	Dialysis
L_1	t>=2f ; .60>=.30 (+ve)	t>f ; .58>.40 i<avg. i; .01<.108 (+ve)	t>f ; .5>.43 i<avg. i .15<.094 (-ve)	t<f ; .48<.50 d(.48,.17)=.31 d(.5,.17)=.33 .31<.33 (+ve)
L_2	t>f ; .57>.40 i<avg. i; .05<.116 (+ve)	t<f ; .49<.50 d(.49,.02)=.47 d(.5,.02)=.48 .47<.48 (+ve)	t>f ; .56>.40 i<avg. i; .03<.094 (+ve)	t>f ; .56>.4 i<avg. i; .03<.086 (+ve)
L_3	t<f ; .48<.50 d(.48,.1)=.3 d(.5,.1)=.4 .38<.4 (+ve)	t>f ; .5>.42 i<avg. i; .15<.108 (-ve)	t>=2f ; .7>=0.25 (+ve)	t>=2f ; .64>=0.32 (+ve)
L_4	t>f; .40>.30 i<avg. i; .2>.116 (-ve)	t>=2f ; .61>=.30 (+ve)	t>=2f ; .65>=0.3 (+ve)	t>=2f ; .72>=0.22 (+ve)
L_5	t<f; .45<.5 d(.45,.11)=.34 d(.5,.11)=.39 .34<.39 (+ve)	t>f ; .45>.40 i<avg. i; .16<.108 (-ve)	t>f ; .45>.44 i<avg. i; .16<.094 (-ve)	t<f ; .46<.50 d(.46,.2)=.26 d(.5,.2)=.3 .26<.3 (+ve)
	Total : 4 (+ve) 1(-ve)	**Total : 3 (+ve) 2(-ve)**	**Total : 3 (+ve) 2(-ve)**	**Total : 5 (+ve) 0 (-ve)**

Table III. **Solution process**

As per the solution approach we got 4 different sets of result as per diseases are concerned. We got maximum number of positive results for dialysis disease .So the patient is suffering from high fever due to dialysis disease.

IV CONCLUSION

Here we focused on a new procedure of Neutrosophic set and it has applied in a medical diagnosis system to identify the disease of a patient through different pathological reports are based on neutrosophic data. In any pathological report, it consists of some uncertain data or information which are been only handled by three membership neutrosophic data for making a decision. Neutrosophic logic is applied in different areas with comprising of relational database and it helped us for making decision by processing of uncertain data or information's which are present with the problem. That's why neutrosophic logic and its approach for solving any uncertain problem is much better than the fuzzy or vague logic.

REFERENCES

[1] L. A. Zadeh, "Fuzzy Sets", Information and Control, Vol. 8, No. 3, pp. 338-353, 1965.

[2] M. I. Sözat and A. Yazici "A complete axiomatization for fuzzy functional and multivalued dependencies in fuzzy database relations", Fuzzy Sets and Systems, Vol. 117, No. 2, pp.161-181, 2001.

[3] O. Bahar and A Yazici., "Normalization and Lossless Join Decomposition of Similarity-Based Fuzzy Relational Databases", International Journal of Intelligent Systems, Vol. 19, No. 10, pp. 885-917, 2004.

[4] F. Zhao, Z. M. Ma and L. Yan, "A Vague Relational Model and Algebra", Fourth International Conference on Fuzzy Systems and Knowledge Discovery (FSKD 2007), Vol. 1, pp. 81-85, 2007.

[5] J. Mishra , S. Ghosh, "A New Functional Dependency in a Vague Relational Database Model", "International Journal of Computer Applications (IJCA)", Vol. 39, No. 8, pp. 29-33, 2012.

[6] J. Mishra , S. Ghosh, "Uncertain Query Processing using Vague Sets or Fuzzy Set: Which one is Better?", International Journal of Computers, Communications and Control (IJCCC), Vol. 9, No. 6, pp. 730-740, 2014.

[7] F. Smarandache, "First International Conference on Neutrosophy, Neutrosophic Probability, Set, and Logic", University of New Mexico, Vol. 1, No. 3, 2001.

[8] F. Smarandache, "A Unifying Field in Logics: Neutrosophic Logic, in Multiple-Valued Logic", International Journal, Vol. 8, No. 3, pp.385-438, 2002.

[9] M. Arora and R. Biswas, "Deployment of Neutrosophic technology to retrieve answers for queries posed in natural language", in 3rd International Conference on Computer Science and Information Technology ICCSIT 2010, Vol. 3, pp. 435-439, 2010.

[10] S. Broumi, "Generalized Neutrosophic Soft Set", International Journal of Computer Science, Engineering and Information Technology, Vol. 3, No. 2, pp. 17–30, 2013.

[11] I. Deli and S. Broumi, "Neutrosophic soft relations and some properties, Annals of Fuzzy Mathematics and Informatics", Vol. 9, No. 1, pp. 169–182, 2015.