Index Number of Multi Fuzzy Sets

K. Hemabala, B. Srinivasa Kumar

Abstract: Multi fuzzy set theory is an extension of fuzzy set theory. In this paper we developing the theory of Index number of multi fuzzy sets. This theory is applied to medical diagnosis system and will help doctors to select the effective symptoms and could make diagnosis of diseases concern. This theory also helps in selecting right political leaders.

Keywords: Multi fuzzy sets, Index number, Index number of multi fuzzy sets.

I. INTRODUCTION

Fuzzy set was initiated by L.A.ZADEH in 1965. So many researchers were conducted the generalization of the notion of fuzzy sets. Fuzzy numbers are convenient for representing impecise numerical quantities in a vague environment and their comparison or ranking is very important for application purpose. Despite many methods suggested in the literature there is no single measure that is universally applicable to a wide variety of situations. This paper suggests a new method for comparing fuzzy sets based on the index number by using simple aggregate average. It seems that the medical community has recognized fuzzy set most, for their ability to introduce notion of community into deductive thinking many other, like Sanchez applied the theory of fuzzy relation to medical diagnosis system. De.et.al have studied Sanchez method of medical diagnosis using intutionistic fuzzy set Also Dr. Khyalappa R, Y.S Pawar, S.H. Dhanani applied ($\in,\in$VQ)fuzzy ideals to medical diagnosis system.

The major task of medical sciences is to prevent and diagnosis of diseases, a symptom could have many differential diagnosis. At times, an in experience doctor may need other doctors or consultants experts opinion regarding two or more diseases.

In this paper we use the concept of index numbers of fuzzy sets. Using this we can find index number of patient and compare this with the expert values. This theory not only in the diagnosis system we can also apply the method to select the right politician. In this case we compare the index number of politicians with the right politician.

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II. PRLIMINARIES

A. Definition

A fuzzy subset of a universe X (a fuzzy set) is a mathematical object A described by its (generalized) characterstic function (membership function) $\mu_A : X \to [0,1]$

B. Definition

Let X is a non empty set. A multi fuzzy set A in X is a set of ordered sequence

$A = \{<x,A_1(x),A_2(x),\ldots.A_k(x)>:x\in X\}$

where $A_j(x) \in [0,1]$ $\forall j=1$ to k

If the sequences of the membership function have k terms then k is called the dimension of A. The set of all multi fuzzy set in X of dimensions K is denoted by $M^K FS(X)$.

C. Definition

Let A be a multi fuzzy set of X then A: $X \to [0,1]$. Then the index of y with respect to base value x is given in terms of its fuzzy sets by

$I_{xy} = \frac{\sum A(y)}{\sum A(x)} \times 100$ $\qquad x, y \in X$

D. Definition

Let A and B two multi fuzzy sets of X then the index of B with respect to A is given by $I_{AB} = \frac{\sum B(x)}{\sum A(x)} \times 100$ $\qquad x \in X$

III. APPLICATIONS

A. Application

Algorithm

Index number method can be applied in general by following algorithm as

1) Record values of test taken by patient during diagnosis.
2) Fuzzify the recorded value to get A
3) Input the values Pi given by expert which tell us about how much the test useful to identify diseases based on their knowledge and experience.
4) The values of P_i can be taken as base value
5) Finding index number of A with respect to P_i by using

$I_{P_iA} = \frac{\sum A}{\sum P_i} \times 100$

Take index

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number of base value is 100%

6) Finding deviations of A from the base value of P_i(i.e $|I_{pi}-I_{PiA}|$)

Case: 1

40 years male patient came with complaint of chill & rigors, body pain, head ache, weakness, fever with irregular high temperature. The doctor initially assumed

7) Minimum deviation value concludes that the patient A suffers from disease P_i

some possible fevers such as Malaria(P_1), Typhoid (P_2), Dengue(P_3). For confirmation, he advised patient for the following tests

SL.NO	TEST	VALUES	NORMAL VALUES	Ai	P_1	P_2	P_3
1	Hemoglobin (gm%)	7	13-15	0.8	0.6	0	0
2	ESR mm	42	25-40	1	1	0.8	0.7
3	TC	13000	4000-110000	1	1	0	0.6
4	Polymorphs	72	42-70	1	1	0	0
5	Lymphocytes	18	20-45	0.8	0	0	0
6	Monocytes	2	2-8	0	0.2	0.1	0
7	Eosnophils	8	1-6	1	0	0	0
8	P.Vivax	Abnormal	NORMAL/ABNORMAL	1	1	0	0
9	Falci Form	Normal	NORMAL/ABNORMAL	0	0	0	0
10	Typhoid	Normal	NORMAL/ABNORMAL	0	0	1	0
11	Dengue	Normal	NORMAL/ABNORMAL	0	0	0	1
12	Platelets	2.7 lakhs	1.5lakhs-4 lakhs	0.6	0.7	0.7	1

The fuzzy set defined for various best are given below

$$A_1(x) = \frac{13-x}{8} \text{ , if } 5 \leq x \leq 13$$
$$= 1 \text{ , } x < 5$$
$$= 0 \text{ , else}$$

$$A_2(x) = \frac{x-14}{26} \text{ , } 14 \leq x \leq 40$$
$$= 1 \text{ , } x > 40$$
$$= 0 \text{ , else}$$

$$A_3(x) = \frac{12000-x}{2000} \text{ , } 10000 \leq x \leq 12000$$
$$= 1 \text{ , } x > 12000$$
$$= 0 \text{ , else}$$

$$A_4(x) = \frac{70-x}{40} \text{ , } 30 \leq x \leq 70$$
$$= 1 \text{ , } x > 70$$
$$= 0 \text{ , else}$$

$$A_5(x) = \frac{45-x}{35} \text{ , } 10 \leq x \leq 45$$
$$= 1 \text{ , } x > 45$$
$$= 0 \text{ , else}$$

$$A_6(x) = \frac{x-2}{8} \text{ , } 2 \leq x \leq 10$$
$$= 1 \text{ , } x > 10$$
$$= 0 \text{ , else}$$

$$A_7(x) = \frac{6-x}{6} \text{ , } 0 \leq x \leq 6$$
$$= 1 \text{ , } x > 6$$
$$= 0 \text{ , else}$$

$$A_8(x) = 1 \quad \text{Abnormal}$$
$$= 0 \quad \text{Normal}$$

$$A_9(x) = 1 \quad \text{Abnormal}$$
$$= 0 \quad \text{Normal}$$

$$A_{10}(x) = 1 \quad \text{Abnormal}$$
$$= 0 \quad \text{Normal}$$

$$A_{11}(x) = 1 \quad \text{Abnormal}$$
$$= 0 \quad \text{Normal}$$

$$A_{12}(x) = \frac{x-1}{3} \text{ , } 1 \leq x \leq 4$$
$$= 1 \text{ , } x < 1$$
$$= 0 \text{ , else}$$

$I_{P1A} = \frac{\sum A}{\sum P1}$ x 100 $= \frac{.8+1+1+1+0.8+1+1+0.6}{0.6+1+1+1+0.2+1+0.7}$ x 100 =

$\frac{7.2}{5.5}$x 100 = 130.9

$I_{P2A} = \frac{\sum A}{\sum P2}$ x 100 $= \frac{.8+1+1+1+0.8+1+1+0.6}{0.8+0.1+1+0.7}$ x 100 =

$\frac{7.2}{2.6}$ x100 = 276.9

$I_{P3A} = \frac{\sum A}{\sum P3}$ x100 $= \frac{.8+1+1+1+0.8+1+1+0.6}{0.7+0.6+1+1}$ x100 =

$\frac{7.2}{3.3}$x100=218.1

$|I_{P1}-I_{P1A}| = |100-130.9| = 30.9$

$|I_{P2}-I_{P2A}| = |100-276.9| = 176.9$

$|I_{P3}-I_{P3A}| = |100-218.1| = 118.1$

Result:

Patient suffers with malaria

Case: 2
A patient 42 years age of female came with Tingling, Numbness. Let P1 denotes Diabetic, P2 denotes neuropaths, P3 denotes paler

SL.NO	TEST	VALUES	NORMAL VALUES	Ai	P_1	P_2	P_3
1	Hemoglobin (gm%)	6	13-15	0.9	0	0	0.6
2	FBS(mg)	80	70-100	0.8	0.1	0.7	0.7
3	PPBS	140	100-160	0	0.3	0	0
4	Nerve Conduction Test	ABNORMAL	NORMAL/ABNORMAL	1	0	0	1

The fuzzy set defined for various test are given below

$A_1(x) = \frac{13-x}{8}$, if $5 \leq x \leq 13$
$= 1$, x<5
$= 0$, else

$A_2(x) = \frac{150-x}{90}$, $60 \leq x \leq 150$
$= 1$, x>150
$= 0$, else

$A_3(x) = \frac{250-x}{100}$, $150 \leq x \leq 250$
$= 1$, x > 250
$= 0$, else

$A_4(x) = 1$ Abnormal
$= 0$ Normal

$I_{P1A} = \frac{\sum A}{\sum P1}$ x100 $= \frac{0.9+0.8+1}{0.1+0.3}$ x100 $= \frac{2.7}{0.4}$x100=675

$I_{P2A} = \frac{\sum A}{\sum P2}$ x100 $= \frac{0.9+0.8+1}{0.7}$ x100 $= \frac{2.7}{0.7}$x100=385.7

$I_{P3A} = \frac{\sum A}{\sum P3}$ x100 $= \frac{0.9+0.8+1}{0.6+0.7+1}$ x100 $= \frac{2.7}{2.3}$x100=117.4

$|I_{P1}-I_{P1A}| = |100-675| = 575$

$|I_{P2}-I_{P2A}| = |100-385.7| = 285.7$

$|I_{P3}-I_{P3A}| = |100-117.4| = 17.4$

Result:
Patient suffers with paler
Note: P1, P2, P3 values given by expert which tell us about how much the test useful to identity diseases based on their knowledge

B. APPLICATION

The second application of index number is selecting political candidates. Parties can select their candidates in many different ways. In numerous cases, the existing legal frame work establishes that the political parties should democratically elect their candidates, but this concept is very vague, and there are few if any applicable legal provisions only in a few cases does legislation lay down the process by which the candidates should be selected and the selection process can have a direct impact on the depth and breadth of the democratic process: particularly if a given party's candidate selection process is non transparent Using this theory we compare candidates (Pi) index number to the good qualities of candidate (A) index number. Generally P be the base. Factors such as electoral system, party ideology, political culture and the organizational government have been thought to have an influence on the centralization and participation in the candidates selection process.
Following factors are considered for the selection of candidates

1. Behavior
2. Age
3. Character
4. Publicity
5. Education

Algorithm

Index number method can be applied in general by following algorithm as

1. Set the good qualities of the leader like behavior, age, character, publicity, education by party leader
2. Fuzzify the recorded value to get A
3. Input the value of candidates for the selection and fuzzify these values to get Pi
4. The values of A can be taken as base value
5. Finding index numbers of p_i with respect to A by using

$$I_{APi} = \frac{\sum Pi}{\sum A} \times 100$$

   Take index number of base value I_A is 100%
6. Finding deviations of p_i from the base value of A(i.e $|I_A - I_{APi}|$)
7. Minimum deviation value gives the better qualities of the politician , hence we can conclude P_i for the party candidate

IV. CONCLUSION

This theory of Index number will help doctors to select the effective symptoms and could make diagnosis of the disease concern. Also this theory most widely help to output (Industrial Production, Agriculture Production), volume of imports and export. An index number is a relative number which expresses the relationship between two variables or two groups of variables where one of the group used as base.

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