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Fuzzy Set Theory in Sociology

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Abstract: The purpose of this paper is to introduce fuzzy set theory which has a number of properties that makes it suitable for formalizing the uncertain information in dealing with systems comprising a very large number of interacting elements or involving a large number of variables in their decision trees. Basically Fuzzy set theory is affecting every aspect of life; social life is one of them. Fuzzy set theory has proved as mile stone in its development. Selection of one of the solutions for social life's problems and selection of possible way for the development of social life is become possible only due to ranking of fuzzy set theory.

Keywords: Fuzzy theory, Decision tree, social life, mile stone.

I. INTRODUCTION

"The pursuit of maximum precision is still an important aim in science." Galileo, who is often credited with being the father of the quantitative scientific experiment, was certainly responsible for many scientific advances through his philosophy of measuring everything measurable and trying to make measurable that which has not been measured so for although the limitation of this approach should be recognized.

People from any discipline need a structure for survival on earth. Structure needs a theory which is applied on a collection of well defined objects called a set. The quality of structure depends upon the quality of sets (higher the qualities of sets better the quality of structure). People for such structure are encountered with many problems in their life. To represent these problems, more than a few mathematicians have introduced the concept of sets in their own ways. These ways of representing problem are more inflexible. The solutions using this concept are not so meaningful in many conditions. This difficulty was overcome by the fuzzy concept, which was first introduced by an eminent American cyberneticist Prof. L.A. Zadeh in 1965 [2]. Since then it has evaded almost all domains of human life. The concepts of almost all branches of human knowledge have been redefined using fuzzy sets.

A. Definition- Vagueness

"The ship wherein Theseus and the youth of Athens returned [from Crete] had thirty oars, and was preserved by the Athenians down even to the time of Demetrius Phalereus, for they took away the old planks as they decayed, putting in new and stronger timber in their place, insomuch that this ship became a standing example among the philosophers, for the logical question of things that grow; one side holding that the ship remained the same, and the other contending that it was not the same."

Let N be the collection of natural numbers 1,2,3,..... Let it be given universe of discourse. We want to form a set A (say) by collecting these members of N which are less than S. Clearly $A = \{1,2,3,4\}$. The members of A are obviously 1,2,3 and 4 where as numbers like 5,6,7,..... Are not members of A. A member of this tradition set A has only two grades 0 and 1. We write here $1 \in A, 2 \in A, 3 \in A, 4 \in A$ where as $5 \notin A, 6 \notin A, 7 \notin A, \dots$ etc. A sharp unambiguous distinction between these two groups of membership and non membership exists.

But sometimes life situations describe sets that do not hold any particular definition is called vagueness, for example:

- 1) The set of poor people,
- 2) The set of red flowers,
- 3) The set of delicious dishes,
- 4) The set of good cricketers,
- 5) The set of very good looks,
- 6) The set of numbers much greater than one etc.

In all these sets, the adjectives poor, red, delicious good, very good, much greater bring a situation of unambiguity or vagueness in the listener.

B. Definition of fuzzy sets

A fuzzy subset A of a (base) set X is specified by its membership function

$$\mu_A : X \rightarrow [0, 1]$$

Assigning to each $x \in X$, the degree of grade to which x belongs to A . Other than ordinary subsets, fuzzy subsets allow the partial membership degree of their elements the degree of membership being expressed on a continuous scale from 0 to 1. $[0, 1]$ is called valuation set of μ_A . Other valuation sets are also possible the unit interval is the one introduced by Zadeh and is still the most common. Clearly, the membership function of a fuzzy set A of X is a generalization of the characteristic function of ordinary subset which has a binary valuation set $\{0, 1\}$. It is therefore legitimate to regard fuzzy sets as generalization of ordinary sets.

II. CASE STUDY (USE IN SOCIAL)

It is very difficult to find out which city is cleanest among 10 cities. But now Fuzzy set theory has eliminated this problem. Based on this Sawchha Survekshan 2017 is organized in 500 cities in India.

Sawchha Survekshan 2017 aimed to study the progress of the Sawchha Bharat Mission and rank 500 cities on the basis of cleanliness and sanitation. The ranking of the cities was based on data-collection from 3 sources, for which the survey has been segregated into 3 main parts

- A. Part 1 Municipal Documentation (45%):- Municipal documentation carried 45% weightage and can fetch a total of 900 marks.
- B. Part 2 Citizen Feedback (30%):- Citizen Feedback data carried 30% weightage and can fetch a total of 600 marks.
- C. Part 3 Independent Observation (25%):- Direct observation carried 25% weightage and can fetch a total of 500 marks.

Let there be 10 cities Indore, Bhopal, Visakhapatnam, Surat, Mysuru, Tiruchirappalli, New Delhi Municipal Council, Navi Mumbai, Tirupati and Vadodara in a Sawchha Survekshan 2017. Their basis is Municipal Documentation, Citizen Feedback and Independent Observation. Clearly

$A = \{\text{Indore, Bhopal, Visakhapatnam, Surat, Mysore, Tiruchirappalli, New Delhi Municipal Council, Navi Mumbai, Tirupati, Vadodara}\}$

And set of basis

$B = \{\text{Municipal Documentation, Citizen Feedback, Independent Observation}\}$

The fuzzy relation $C (A \rightarrow B)$ is given as in Table 1

Let the set of sum of the marks be $D = \{1807.72, 1800.43, 1796.53, 1762.49, 1743.36, 1715.84, 1707.96, 1705.14, 1703.86, 1703.07\}$

The Fuzzy relation $E (A \rightarrow D)$ is given as in Table 2

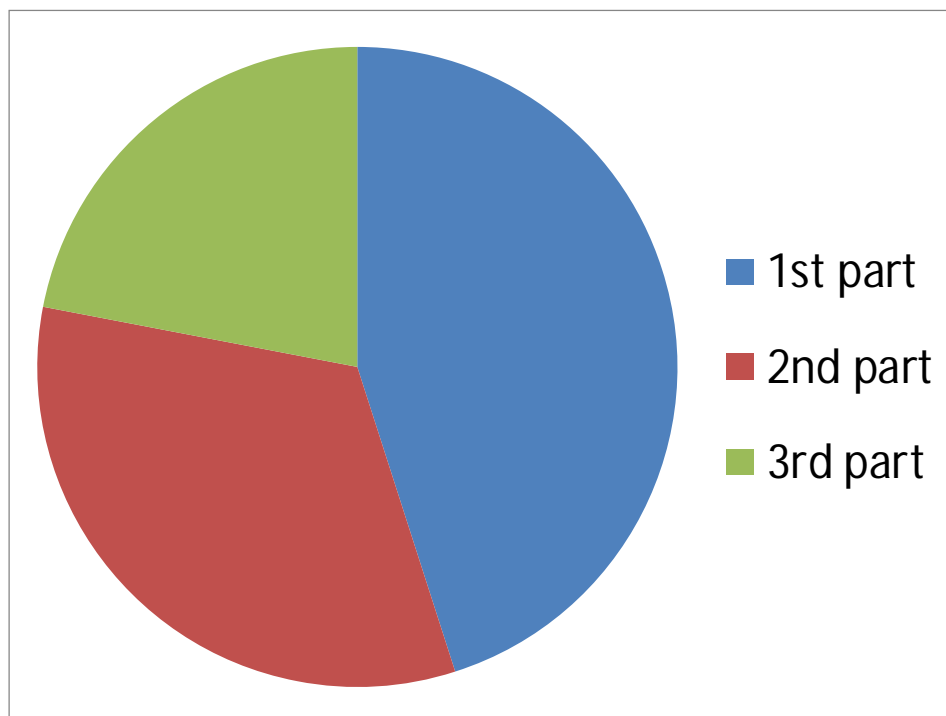


Table1: Ranking of Top 10 Cities on the Basis of Total Score

RANKING	CITY	MUNICIPAL DOCUMENTATION (900)	INDEPENDENT OBSERVATION (500)	CITIZEN FEADBACK (600)	TOTAL SCORE (2000)
1	Indore	875.00	435.78	496.94	1807.72
2	Bhopal	829.58	483.00	487.85	1800.43
3	Visakhapatnam	869.00	458.51	469.02	1796.53
4	Surat	848.58	424.66	489.25	1762.49
5	Mysore	833.37	460.25	449.74	1743.36
6	Tiruchirappalli	854.37	436.41	425.06	1715.84
7	NewDelhi Municipal Council	819.95	426.88	461.13	1707.96
8	Navi Mumbai	856.13	392024	456.77	1705.14
9	Tirupati	809.13	465.76	428.97	1703.86
10	Vadodara	837.25	406.24	459.58	1703.07

Table2

RANKING	CITY	TOTAL SCORE (2000)
1	Indore	1807.72
2	Bhopal	1800.43
3	Visakhapatnam	1796.53
4	Surat	1762.49
5	Mysore	1743.36
6	Tiruchirappalli	1715.84
7	New Delhi Municipal Council	1707.96
8	Navi Mumbai	1705.14
9	Tirupati	1703.86
10	Vadodara	1703.07

Clearly, Indore got 1st Rank in a Swacchha Survekshan 2017 and Vadodara is placed in last in a Sawchh Survekshan 2017.

III. CONCLUSION

The conclusion of this survey is that the applications of Fuzzy set theory to social problems have been modest but hopeful and creditable of attention. Finally, it would appear that L.A. Zadeh quite accurately anticipated the potentials of a Fuzzy set approach for this field.

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