IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 14, Issue 2 Ver. VIII (Mar. - Apr. 2017), PP 47-52
www.iosrjournals.org

Decision Making Under Operation Performance by Fuzzy Set Theory

Alok Das[1], Ashu Kumar Pandey[2]
[1]*(Mechanical Department, GD Rungta College of Engineering & Technology, Bhilai (C.G.) India)*
[2]*(Mechanical Department, GD Rungta College of Engineering & Technology, Bhilai (C.G.) India)*

Abstract: *The aim of this paper is to apply fuzzy soft set theory to predict the decisionmaking of purchase goods. In approximate reasoning, relations on the fuzzy parameterized soft sets have shown to be of a primordial importance. The basic premises of fuzzy soft set are presented as well as a detailed analysis of fuzzy logic developed to solve various decision and matrix application problems.*

Keywords: *Fuzzy soft set, Matrix application, Uncertainty*.

I. Introduction

There is an interdependent relationship between supply and demand; organizations need to understand customer demand so that they can manage it, create future demand and, of course, meet the level of desired customer satisfaction. Most of the decisions take place under imprecision, uncertainty and partial truth. Some objectives and constraints are often difficult to be measured by crisp values. Traditional analytical techniques were found to be non-effective when dealing with problems in which the dependencies between variables are too complex or ill-defined. These mathematical models use different formulae and equations to solve such problems. During their education and training, engineers are most often directed to the use of exclusively objective knowledge. Many sources can contribute to the imprecision and uncertainty of data or information. It has been pointed out that in the future, it needs to learn how to manage data that is imprecise or uncertain, and that contains an explicit representation of the uncertainty. Classical data models often suffer from their incapability of representing and manipulating imprecise and uncertain information that may occur in many real-world applications [2]. These applications characteristically require the modeling and manipulation of complex objects and semantic relationships. Since classical relational database model and its extension of fuzziness do not satisfy the need of modeling complex objects with imprecision and uncertainty. From the information soft set theory is generally used to solve such problem.

II. Review Work

Deli et. al. defined relations on the fuzzy parametrized soft sets and study their properties. Finally, the method is successfully applied to problems that contain uncertainties [1]. Bora et. al. introduce the basic concept of intuitionistic fuzzy soft matrix theory. Further the concept of intuitionistic fuzzy soft matrix product has been applied to solve a problem in medical diagnosis [2]. Kalaichelviet. al. apply the concept of Intuitionist fuzzy soft matrices is applied to identify the group of children (based on age) worst affected. The influence of television on children causes great concern to the parents as excessive viewing by children results in physical, mental, behavioral, social and academic setbacks to younger generation[3]. Mondalet. al. forward the notion of fuzzy soft matrix theory and some basic results..Lastly we have given an application in decision making based on different operators of t-norms [4]. Basuet. al. purpose different types of matrices in fuzzy soft set theory. Moreover a new efficient solution procedure has been developed to solve fuzzy soft set based real life decision making problems which may contain more than one decision maker. [5]

III. Methodology

Fuzzification involves the conversion of the input into a number of fuzzy set. It can be observed that fuzzy logic control the transition from one fuzzy set to another provides a smooth transition from one control action to another which depends on their different type of behaviour as shown in Fig 1.

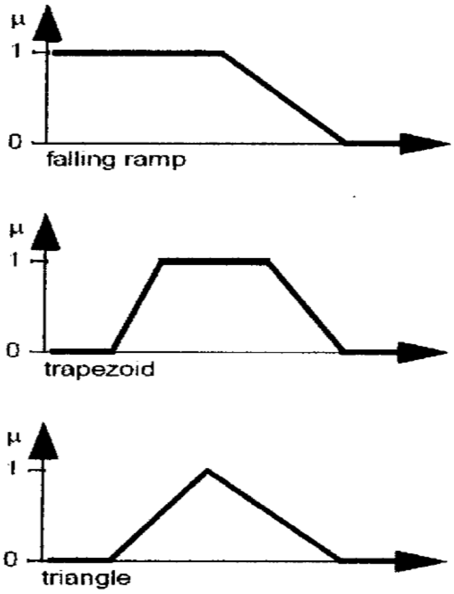

Fig 1 Type of Membership function

IV. Definition Of Fuzzy Soft Set

Mathematical developments have advanced to a very high standard and are still forthcoming today. The basic mathematical framework of fuzzy soft set theory will be described, as well as the most useful applications of this theory to other theories and techniques. The fuzzyparameters such as membership functions of the involved fuzzy variables must be tuned according to the knowledge base information; i.e, predicted data samples.

Let (S_A, S) be fuzzy soft set over U. Then U×S defined as

$$R_A = \{(U, S): S \in A, U \in S_A\}$$

Where R_A is known as the relation of fuzzy set (S_A, S) and is defined as in the form of matrix.

$$[a_{ij}] = \begin{bmatrix} S_{11} & S_{12} & \dots\dots\dots\dots\dots & S_{1n} \\ S_{21} & S_{22} & \dots\dots\dots\dots\dots & S_{2n} \\ \dots\dots & \dots\dots & \dots\dots\dots\dots\dots & \dots . \\ S_{m1} & S_{m2} & \dots\dots\dots\dots\dots & S_{mn} \end{bmatrix}$$

This is known as fuzzy soft set matrix of order m×n corresponding to the soft set (S_A, S) over U.

For example: Let us suppose that the universe set U contains five bages b_1, b_2, $b_{3,}$ b_4, b_5 and parameter set.
E= {costly, beautiful, cheap, comfortable, gorgeous} = {c_1, c_2, c_3, c_4, c_5}.
Let A= {c_1, $c_{2,}$ $c_{3,}$ c_4, c_5} C E and F: A= p(U) soft set.

$$F(c_1) = \left\{\frac{c_1}{0.8}, \frac{c_2}{0.3}, \frac{c_3}{0.6}, \frac{c_4}{0.5}, \frac{c_5}{0.2}\right\}$$

$$F(c_2) = \left\{\frac{c_1}{0.8}, \frac{c_2}{0.2}, \frac{c_3}{0.5}, \frac{c_4}{0.4}, \frac{c_5}{0.1}\right\}$$

$$F(c_3) = \left\{\frac{c_1}{0.3}, \frac{c_2}{0.7}, \frac{c_3}{0.5}, \frac{c_4}{0.4}, \frac{c_5}{0.9}\right\}$$

$$F(c_4) = \left\{\frac{c_1}{0.8}, \frac{c_2}{0.6}, \frac{c_3}{0.4}, \frac{c_4}{0.2}, \frac{c_5}{0.7}\right\}$$

$$F(c_{51}) = \left\{\frac{c_1}{0.5}, \frac{c_2}{0.2}, \frac{c_3}{0.8}, \frac{c_4}{0.3}, 0\right\}$$

And the relation form of (F:A) is written.

$$(a_{ij}) = \begin{bmatrix} 0.8 & 0.8 & 0.3 & 0.8 & 0.5 \\ 0.3 & 0.2 & 0.7 & 0.6 & 0.2 \\ 0.6 & 0.5 & 0.5 & 0.4 & 0.8 \\ 0.2 & 0.1 & 0.9 & 0.7 & 0 \end{bmatrix}$$

Definition non-fuzzy

X and Y are two non-fuzzy universes. A Fuzzy relation $R \subset X \times Y$ is a set of pairs (x, y), where each pair has now amembership degree μ_R (x, y) asigned

$$\mu_R(x, y) \in [0,1]$$
$$\mu_R : X \times Y \rightarrow [0, 1]$$

Example

X ={3,5,8,10}

XRY = " x is considerably less than y"

X × Y = {(3, 3), (3, 5), (3, 8), (3, 10), . . . (10, 10)}

XRY = "x is considerably less than y"

$$R = \begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \\ x_4 \end{array} \begin{array}{c} \begin{array}{cccc} x_1 & x_2 & x_3 & x_4 \end{array} \\ \begin{bmatrix} 00 & 0.5 & 0.8 & 1 \\ 00 & 00 & 0.5 & 0.8 \\ 00 & 00 & 00 & 00 \\ 00 & 00 & 00 & 00 \end{bmatrix} \end{array}$$

The above function is converted into matrix form and it can be solve by any matrix application to obtain single output which make decision in uncertainty.

Matrix Application

By applying fuzzy soft set theory it identify maximum and minimum satisfaction level of (particular model) mobile customers or users. In this example choose center lathe machine and asked from 8 users about different operation of this model. These features are listed as:

O_1 = Motor capacity

O_2 = Operation response

O_3 = Cutting time

O_4= Material removal rate

Let it denote the set of operation by O as:

$$O = \{O_1, O_2, O_3, O_4\}$$

The estimation of the maximum and minimum level is possible by employing a fuzzy relation, created due course to the definition formulated is;

$$\mu_{max}(O_j, O_k) = \frac{h}{m}$$

where j, k = 1,2 ….n

In this formulation h is the total high performance of operation and m is the total number of users. The user has given their opinion as comparing their operation which one is maximum performance is denoted by H and minimum performance is denoted by L. All collected data's are shown in tables 1 to table 6.

Table 1 Comparison operation 1&2

User	O_1	O_2
1	H	L
2	H	L
3	H	H
4	L	H
5	L	H
6	H	L
7	H	L
8	L	H

Table 2 Comparison operation 1&3

User	O_1	O_3
1	L	L
2	H	H
3	H	H
4	L	L
5	L	H
6	H	L
7	L	H
8	H	H

Table 3 Comparison operation 1&4

User	O_1	O_4
1	H	H
2	L	L
3	L	H
4	H	H
5	L	H
6	L	H
7	H	L
8	L	H

Table 4 Comparison operation 2&3

User	O_2	O_3
1	H	L
2	H	L
3	L	H
4	H	H
5	L	L
6	H	L
7	H	L
8	L	H

Table 5 Comparison operation 2&4

User	O_2	O_4
1	H	H
2	H	L
3	H	L
4	H	H
5	L	L
6	L	H
7	H	L
8	L	H

Table 6 Comparison operation 3&4

User	O_3	O_4
1	L	L
2	L	H
3	H	H
4	H	L
5	L	L
6	L	H
7	H	L
8	L	H

The membership degree of pair if calculated by the formulation:

$\mu_{max}(O_1, O_2) = 5/8 = 0.63$
$\mu_{max}(O_2, O_1) = 4/8 = 0.5$
$\mu_{max}(O_1, O_3) = 4/8 = 0.5$
$\mu_{max}(O_3, O_1) = 5/8 = 0.63$
$\mu_{max}(O_1, O_4) = 3/8 = 0.36$
$\mu_{max}(O_4, O_1) = 6/8 = 0.75$
$\mu_{max}(O_2, O_3) = 5/8 = 0.63$
$\mu_{max}(O_3, O_2) = 3/8 = 0.36$
$\mu_{max}(O_2, O_4) = 5/8 = 0.63$
$\mu_{max}(O_4, O_2) = 4/8 = 0.5$
$\mu_{max}(O_3, O_4) = 3/8 = 0.36$
$\mu_{max}(O_4, O_3) = 4/8 = 0.5$

In the above case it is very difficult to find the best performance or to give the grading according to their performance. So as per matrix application apply on the engineering problem, lathe machine performance data can be converted into matrix form to resolve which one is the best performance.

$$\mu_{max} = \begin{bmatrix} \mu_{max}(O_1, O_1) & \mu_{max}(O_1, O_2) & \mu_{max}(O_1, O_3) & \mu_{max}(O_1, O_4) \\ \mu_{max}(O_2, O_1) & \mu_{max}(O_2, O_2) & \mu_{max}(O_2, O_3) & \mu_{max}(O_2, O_4) \\ \mu_{max}(O_3, O_1) & \mu_{max}(O_3, O_2) & \mu_{max}(O_3, O_3) & \mu_{max}(O_3, O_4) \\ \mu_{max}(O_4, O_1) & \mu_{max}(O_4, O_2) & \mu_{max}(O_4, O_3) & \mu_{max}(O_4, O_4) \end{bmatrix}$$

For the diagonal entry $\mu_{max}(O_1, O_1)$, $\mu_{max}(O_2, O_2)$, $\mu_{max}(O_3, O_3)$, $\mu_{max}(O_4, O_4)$, half of the total performance in each coordination table of their individual performance.

$$\mu_{max}(O_1, O_1) = \frac{1}{2}\left[\frac{5}{8} + \frac{4}{8} + \frac{3}{8}\right]$$

$\mu_{max}(O_1, O_1) = 0.75$

Similarly:
$\mu_{max}(O_2, O_2) = 0.86$
$\mu_{max}(O_3, O_3) = 0.69$
$\mu_{max}(O_4, O_4) = 0.86$

Now substitute all values of membership performance in above matrix μ_{max};

$$\mu_{max} = \begin{bmatrix} 0.75 & 0.63 & 0.50 & 0.36 \\ 0.50 & 0.86 & 0.63 & 0.63 \\ 0.63 & 0.36 & 0.69 & 0.36 \\ 0.75 & 0.50 & 0.50 & 0.86 \end{bmatrix}$$

V. Application On Decision Making

Case Study on Lathe Machine

The above matrix is converting into fuzzy membership function

- 1.0- 0.7 = H
- 0.7- 0.6 = M
- 0.6- 0.0 = L

$$\mu_{max} = \begin{bmatrix} H & M & L & L \\ L & H & M & M \\ M & L & M & L \\ H & L & L & H \end{bmatrix}$$

$$\mu_{max} = \begin{bmatrix} L \\ M \\ M \\ H \end{bmatrix}$$

$$\mu_{max} = [M]$$

The value which comes in 0.7- 0.6 have the optimal solution for these uncertainties to make the decision that which function is best. Under these circumstances the operations are;

M= {$\mu_{max}(O_1, O_2)$, $\mu_{max}(O_3, O_1)$, $\mu_{max}(O_2, O_3)$, $\mu_{max}(O_2, O_4)$, $\mu_{max}(O_3, O_3)$}

Select the operation which has performing maximum no. of times in these circumstances i;e,

M = {O_3}

So in this case clearly prove that all users are referred to best cutting time machine. Finally the all will chose that machine which have better cutting time.

VI. Conclusion

In addition, the complete description of a real system would often require far more detailed data than a human being could ever found simultaneously, process, and understand. In this decision the operation has to optimize which is more significant and machine will be purchase on the basis optimise operation.

Reference

[1]. Deli I., Cagman N., (2014) "Relations on FP-Soft Sets Applied to Decision Making Problems", Comput. Math. Appl. Pp.1-13.

[2]. Bora M., Bora B., Neog T. J., Sut D. K., (2014), "Intuitionistic fuzzy soft matrix theory and its application in medical diagnosis" Annals of Fuzzy Mathematics and Informatics Volume 7, No. 1, pp. 143-153.

[3]. A. Kalaichelvi, P. Kanimozhi. "Impact Of Excessive Television Viewing By Children – An Analysis Using Intuitionistic Fuzzy Soft Matrices" Int Jr. of Mathematics Sciences & Applications Vol.3, No.1, 2013. Pp. 103 – 108.

[4]. Mondal J.I., Roy T.K., "Theory of Fuzzy Soft Matrix and its Multi Criteria in Decision Making Based on Three Basic t-Norm Operators" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 10, 2013. Pp. 5715 – 5723.

[5]. Basu T.M., Mahapatra N.K. and Mondal S.K., Different Types of Matrices in Fuzzy Soft Set Theory and Their Application in Decision Making Problems IRACST – Engineering Science and Technology: An International Journal (ESTIJ), ISSN: 2250-3498,pp. 389-398.Vol.2, No. 3, 2012

[6]. Borah M., Neog T.J., Sut D.K., "A STUDY ON SOME OPERATIONS OF FUZZY SOFT SETS" International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.2, 2012, pp-219-225.

[7]. Ibrahim A. M., Yusuf A. O., "Development of Soft Set Theory", American International Journal of Contemporary Research Vol. 2 No. 9; 2012, pp. 205-210

[8]. Sarkar A., Sahoo G. andSahoo U.C., APPLICATION OF FUZZY LOGIC IN TRANSPORT PLANNING, International Journal on Soft Computing (IJSC) Vol.3, No.2, (2012).

[9]. Borah M. J., Neog T.J., Sut D. K, Fuzzy Soft Matrix Theory And Its Decision Making, International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.2, Mar-Apr 2012pp-121-127