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Application of Fuzzy Soft Sets in Job Requirement Problem

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ABSTRACT

In Our real life we often face some problems in which the right decision making is highly essential. But in some of the cases we become confused to get right solution. In that case we can apply fuzzy soft set theory. Applications of fuzzy soft sets in decision making problem is one of the most recent topics developed while trying to solve real life situations. An algorithm fulfils the requirements of the job. We illustrate one numerical example of this by using fuzzy soft sets.

Keywords: Fuzzy set, soft set, fuzzy soft set, decision making.

1. INTRODUCTION

Most of our real life problems in engineering, medical science, economic, environments, etc. have various uncertainties. In 1999, Molodtsov[7] initiated a novel concept of soft set theory, which is a completely new approach for modelling vagueness and uncertainty. The soft set theory has been applied to many different fields with great success. Recently, many scholars study the properties and applications on the soft set theory. Many efforts have been devoted to further generalizations and extensions of Molodtsov's soft sets. Applications of soft set theory in other disciplines and real life problems are now catching momentum soft set is a parameterised family of sets – intuitively, this is 'soft' because the boundary of the set depends on the parameters. Molodtsov applied this theory to several directions, and then formulated the notions of soft number, soft derivative, soft integral, etc. Maji *et al*.[5] gave first practical applications of soft sets in decision making problem. Maji *et al*.[6] defined fuzzy soft sets by combining soft sets with fuzzy sets; in other words, a degree is attached with the parameterization of fuzzy sets while defining a fuzzy soft set. Many researchers have contributed towards the fuzzification of the notion of soft sets.

In this paper, we present some result on an applications of fuzzy soft sets in decision making problem. The final identification of the object is based on the set of inputs from different observers who provide the overall object characterisation in terms of diverse set of parameters.

The remaining part of this paper is organized as follows. In Section 2, we present some basic Definitions of fuzzy set, soft set and fuzzy soft set, Section 3 deals with the fuzzy soft sets in Decision Making Problem, In Section 4 deal with Algorithm, Section 5 deal with Numerical Example and Section 5 deals with conclusion of this paper.

2. PRELIMINARIES

2.1 Definition: [4]

A **fuzzy set** $\tilde{A}$ can be defined as $\tilde{A}= \{(x, \mu_{\tilde{A}}(x)): x \in A\}$. Here $(x, \mu_{\tilde{A}}(x))$, the first element belong to the classical set A, the second element $\mu_{\tilde{A}}$(x), belong to the interval [0,1] is called membership function.

2.2 Definition: [4]

Let U be the universal set and W is the set of parameters. A **soft set** (F, W) on the universe is defined by the set of pairs $(F, W) = \{(w, F(w): w \in W, F(w) \in P(U)\}$ where $F: W \to P(U)$, such that $F(w) = \emptyset \; if \; w \notin A.$

EXAMPLE:

Consider U is the set of house, $U = \{h_1, h_2, h_3, h_4, h_{5,} h_6\}$.

Let E is the parameter set, each parameter is a word or sentence, E = {e_1 (expensive), e_2 (beautiful), e_3 (wood), e_4 (cheap), e_5 (environment)}.

Assume that F (e_1) = {h_2, h_4}, F (e_2) = {h_1, h_3}, F (e_3) = {h_3, h_4, h_5}, F (e_4) = {h_1, h_3, h_5}, F (e_5) = {h_1}. (F, E) is the soft set on the U. Soft set (F, E) describes the attractiveness of the house.

Table: 1 Soft Set

U	e_1	e_2	e_3	e_4	e_5
h_1	0	1	0	1	1
h_2	1	0	0	0	0
h_3	0	1	1	1	0
h_4	1	0	1	0	0
h_5	0	0	1	1	0
h_6	0	0	0	0	0

2.3 Definition: [5]

Let U be the Universal set and W be the set of all parameters and $A \subseteq W$. A Pair (F, A) is called a **fuzzy soft set** over U where $F: A \to P\ (U)$ is a mapping from A into $P(U)$, Where P(U) represent the collection of all fuzzy subsets of U.

EXAMPLE:

Consider U is the set of house, $U = \{h_1, h_2, h_3, h_4, h_5, h_6\}$. E is the set parameters, and each parameter is a word or a sentence, E = {e_1 (expensive), e_2 (beautiful), e_3 (wood), e_4 (cheap), e_5 (environment)}.

Assume that F (e_1) = {0.5/h_1, 1.0/h_2, 0.4/h_3, 1.0/h_4, 0.3/h_5, 0.0/h_6},
F (e_2) = {1.0/h_1, 0.4/h_2, 1.0/h_3, 0.4/h_4, 0.6/h_5, 0.8/h_6},
F (e_3) = {0.2/h_1, 0.3/h_2, 1.0/h_3, 1.0/h_4, 1.0/h_5, 0.0/h_6},
F (e_4) = {1.0/h_1, 0.0/h_2, 1.0/h_3, 0.2/h_4, 1.0/h_5, 0.2/h_6},
F (e_5) = {1.0/h_1, 0.1/h_2, 0.5/h_3, 0.3h_4, 0.2/h_5, 0.3/h_6}.

(F, E) is the basic fuzzy soft set on U. Fuzzy soft set (F, E) describes The attractiveness of the house to buyers, in order to facilitate the computer store, (F, E) will be said with the form, according to table 2: Table2. Basic fuzzy Soft Set (F, E)

Table: 2 Fuzzy Soft Set

U	e_1	e_2	e_3	e_4	e_5
h_1	0.5	1.0	0.2	1.0	1.0
h_2	1.0	0.4	0.3	0.0	0.1
h_3	0.4	1.0	1.0	1.0	0.5
h_4	1.0	0.4	1.0	0.2	0.3
h_5	0.3	0.6	1.0	1.0	0.2
h_6	0.0	0.8	0.0	0.2	0.3

3. FUZZY SOFT SETS IN DECISION MAKING

Let $U = \{P_1, P_2, P_3, P_4\}$ be the universe, which may be characterised by a set of parameters $\{e_1, e_2, e_3, e_4\}$. The parameter space E may be written as $E \supseteq \{e_1 \cup e_2 \cup \ldots \cup e_i\}$. Let each parameter set E_i represent the i^{th} class of parameters and the elements of E_j represents a specific property set. Here we assume that these property sets may be viewed as fuzzy sets.

In the view of above we now define a fuzzy soft set (F_i, E_i) which characterises a set of objects having the parameter set E_i.

4. ALGORITHM

Step (1) Input the fuzzy soft sets.
Step (2) Obtain the matrix representation of fuzzy soft sets
Step (3) Find the performance evaluation soft decision matrix.
Step (4) Construct the comprehensive decision matrix.
Step (5) Find the comparison table.

The row sum is denoted by s_i and is calculated by using the formula,

$$S_i = \sum_{j=1}^{n} c_{ij} \,..$$

and the column sum is denoted by c_j and is calculated by using the formula,

$$\boldsymbol{C_j} = \sum_{j=1}^{n} c_{ij} \,.$$

Step (6) Obtain the score V_{ij} for the persons and it may be given as

$$V_{ij} = S_i + C_i$$

5. NUMERICAL EXAMPLE

Job allocation problem in Indian industrial scenario

Let us assume the decision making problem of allocating a particular job to the best person who fulfils the requirements of the job. Let $U = \{p_1, p_2, p_3, p_4\}$ be the four persons for the job and E = $\{ e_1 = average, e_2 = confident, e_3 = willing\ to\ take\ risks, e_4 = unwilling\ to\ take\ risks \}$ be the set of parameters.
The objective of this problem is to find the candidate who best suits the requirements of the job using fuzzy soft sets.

Step 1
Assume that decision making constructs a feasible fuzzy subsets of U is given by

$$U = \left\{ \begin{array}{ll} F_1(e_1) = \left\{\frac{p_1}{0.6}, \frac{p_2}{0.4}, \frac{p_3}{0.3}, \frac{p_4}{0.8}\right\}; & F_1(e_2) = \left\{\frac{p_1}{0.4}, \frac{p_2}{0.5}, \frac{p_3}{0.7}, \frac{p_4}{0.2}\right\}; \\ F_1(e_3) = \left\{\frac{p_1}{0.2}, \frac{p_2}{0.3}, \frac{p_3}{0.6}, \frac{p_4}{0.9}\right\}; & F_1(e_4) = \left\{\frac{p_1}{0.11}, \frac{p_2}{0.18}, \frac{p_3}{0.16}, \frac{p_4}{0.14}\right\} \end{array} \right\}$$

$$\left\{ \begin{array}{ll} F_2(e_1) = \left\{\frac{p_1}{0.32}, \frac{p_2}{0.28}, \frac{p_3}{0.27}, \frac{p_4}{0.33}\right\}; & F_2(e_2) = \left\{\frac{p_1}{0.14}, \frac{p_2}{0.56}, \frac{p_3}{0.68}, \frac{p_4}{0.72}\right\}; \\ F_2(e_3) = \left\{\frac{p_1}{0.21}, \frac{p_2}{0.3}, \frac{p_3}{0.17}, \frac{p_4}{0.23}\right\}; & F_2(e_4) = \left\{\frac{p_1}{0.62}, \frac{p_2}{0.53}, \frac{p_3}{0.7}, \frac{p_4}{0.68}\right\} \end{array} \right\}$$

$$\left\{ \begin{array}{ll} F_3(e_1) = \left\{\frac{p_1}{0.81}, \frac{p_2}{0.3}, \frac{p_3}{0.55}, \frac{p_4}{0.78}\right\}; & F_3(e_2) = \left\{\frac{p_1}{0.62}, \frac{p_2}{0.45}, \frac{p_3}{0.26}, \frac{p_4}{0.87}\right\}; \\ F_3(e_3) = \left\{\frac{p_1}{0.21}, \frac{p_2}{0.32}, \frac{p_3}{0.43}, \frac{p_4}{0.54}\right\}; & F_3(e_4) = \left\{\frac{p_1}{0.31}, \frac{p_2}{0.33}, \frac{p_3}{0.53}, \frac{p_4}{0.94}\right\} \end{array} \right\}$$

$$\left\{ \begin{array}{ll} F_4(e_1) = \left\{\frac{p_1}{0.66}, \frac{p_2}{0.36}, \frac{p_3}{0.45}, \frac{p_4}{0.19}\right\}; & F_4(e_2) = \left\{\frac{p_1}{0.78}, \frac{p_2}{0.68}, \frac{p_3}{0.6}, \frac{p_4}{0.5}\right\}; \\ F_4(e_3) = \left\{\frac{p_1}{0.92}, \frac{p_2}{0.58}, \frac{p_3}{0.87}, \frac{p_4}{0.58}\right\}; & F_4(e_4) = \left\{\frac{p_1}{0.81}, \frac{p_2}{0.42}, \frac{p_3}{0.73}, \frac{p_4}{0.65}\right\} \end{array} \right\}$$

Step 2
The matrix representation of above four fuzzy soft sets is as follows.

$$\mathbf{(F_1, E)} = \begin{bmatrix} 0.6 & 0.4 & 0.3 & 0.8 \\ 0.4 & 0.5 & 0.7 & 0.2 \\ 0.2 & 0.3 & 0.6 & 0.9 \\ 0.11 & 0.18 & 0.16 & 0.14 \end{bmatrix}$$

$$(\mathbf{F_2, E}) = \begin{bmatrix} 0.32 & 0.28 & 0.27 & 0.33 \\ 0.14 & 0.56 & 0.68 & 0.72 \\ 0.21 & 0.30 & 0.17 & 0.23 \\ 0.62 & 0.53 & 0.7 & 0.68 \end{bmatrix}$$

$$(\mathbf{F_3, E}) = \begin{bmatrix} 0.81 & 0.3 & 0.55 & 0.78 \\ 0.62 & 0.45 & 0.26 & 0.87 \\ 0.21 & 0.32 & 0.43 & 0.54 \\ 0.31 & 0.33 & 0.53 & 0.94 \end{bmatrix}$$

$$(\mathbf{F_4, E}) = \begin{bmatrix} 0.66 & 0.36 & 0.45 & 0.19 \\ 0.78 & 0.68 & 0.6 & 0.5 \\ 0.92 & 0.58 & 0.87 & 0.58 \\ 0.81 & 0.42 & 0.73 & 0.65 \end{bmatrix}$$

Step 3

The performance evaluation matrix of above fuzzy soft set matrix is

$$A = \begin{bmatrix} 0.81 & 0.36 & 0.55 & 0.8 \\ 0.78 & 0.68 & 0.7 & 0.87 \\ 0.92 & 0.58 & 0.87 & 0.9 \\ 0.81 & 0.53 & 0.73 & 0.94 \end{bmatrix}$$

Step 4

The comprehensive decision matrix D can be obtained by the transpose of A and it as follows

$$D = \begin{bmatrix} 0.81 & 0.78 & 0.92 & 0.81 \\ 0.36 & 0.68 & 0.58 & 0.53 \\ 0.55 & 0.7 & 0.87 & 0.73 \\ 0.8 & 0.87 & 0.9 & 0.94 \end{bmatrix}$$

$$D \cong \begin{bmatrix} 0.8 & 0.8 & 0.9 & 0.8 \\ 0.4 & 0.7 & 0.6 & 0.5 \\ 0.5 & 0.7 & 0.9 & 0.7 \\ 0.8 & 0.9 & 0.9 & 0.9 \end{bmatrix}$$

Step 5

The comparison table of the above comprehensive decision matrix is

	P_1	P_2	P_3	P_4	**Row sum** (S_i)
P_1	4	4	5	4	17
P_2	1	3	1	2	7
P_3	2	3	5	3	13
P_4	4	5	5	5	19
Column sum (C_j)	11	15	16	14	56

Step 6

The score for each person are as follows

	S_i	C_j	V_{ij}
P_1	17	11	28
P_2	7	15	22
P_3	13	16	29
P_4	19	14	**33**

Here $\boldsymbol{P_4}$ **= 33** is the maximum score. Hence, we conclude that, $\boldsymbol{P_4}$ is the best person who fulfils the requirements of the job.

6. CONCLUSION

A soft set is a mapping from parameter to the crisp subset of universe. However, the situation may be more complicated in real world because of the fuzzy characters of the parameters. In this paper, we considered the concept of soft set theory, fuzzy soft set theory. Applications of fuzzy soft sets in decision making problem is one of the most recent topics developed while trying to solve real life situations. Here, we proposed the score concept of fuzzy soft set in job allocation problem in Indian industrial scenario.

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