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Selection of Best Employee by using Weighted fuzzy Soft Matrix

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ABSTRACT
Decision making is a process to select best out of different alternatives possibilities. Here every process of decisions produces a final choice that may or not prompt action. It is the study of identifying the best choice according to decision maker. It is the central part of every activity in every process of decision. Now a day's soft set theory is taking major role in decision making process. This paper has attempted to use soft set has attempted to use soft set in solving the decision making problem of finding best worker in any working places.
Keywords : Fuzzy Sets, Soft sets, Soft matrix, Weighted fuzzy soft matrix

I. INTRODUCTION

Decision making is vital in today's fast moving world. It is significant for all categories of problems dealing with the problems in Engineering, Medical, Social Sciences, and Management etc. It involves the selection from two or more alternative courses of action. The decision maker [1] is presented with alternative courses of action who then selects the best one which meets the objectives of the problem satisfactorily based on logical and qualitative analysis. There are some popular mathematical tools which deal with uncertainties; two of them are fuzzy set theory, which was developed by Zadeh (1965), and soft set theory, which was introduced by Molodtsov (1999), that are related to this work. The soft set concept is devoid of all these problems and possess rich potential of solving certain decision making problem [2] involving recruitment problem, investment problem or selecting employee problem. Currently, work on the soft set theory is rapidly progressing .Maji et al (2003) defined operations on soft sets and made a detailed theoretical study on that. By using these definitions, the applications of soft set theory have been studied increasingly [3] [4] [5] [6] [7] [8] [9]. Here we define soft set, fuzzy soft set by extending the crisp and fuzzy set respectively and then applying the same to some decision making problems.In this paper we defining soft set, fuzzy soft set by extending the crisp and fuzzy set respectively and then applying the same to some decision making problems. Three major contributions of this work are as follows: Primarily, we have presented the idea of multi-soft sets construction from a multi-valued information system, AND and OR operations on multi-soft sets.Secondly, we have presented and applied the soft set theory for data reduction under multi-valued information system. using multisets and AND operation. Lastly, we show that results obtained using soft set theory could be applied to decision making.

II. PRELIMINARIES

In this section, we relates some basis notion of fuzzy soft set, fuzzy soft matrix, weighted fuzzy soft matrix which will be required later in this paper.

2.1 Fuzzy Set

Let X be a space of points, with a generic element of X denoted by x. Thus $X = \{x\}$.

A Fuzzy set A in X is characterized by a membership function fA(x) which associates with each point in X a real number in the interval $[0,1]$, with the values of fA(x) at X representing the "grade of membership" of x in A. Thus the nearer the value of fA(x) to unity, the higher the grade of membership of x in A.

2.2 Soft Set

Let U be an initial universe set and E be a set of Parameters.

Let P(U)denoted the power set of U. Let $A \subseteq E$. A Pair (F_A, E) is called a soft set over I, where F_A is a mapping given by $F_A: E \to P(U)$ such that $F_A(e) = \phi$, if $e \notin A$. Here F_A is called approximate function of the soft set (F_A, E). The set $F_A(e)$ is called e-approximate value set which consists of related objects of the parameter $e \in E$. In other words, a soft set over U is a parameterized family of subsets of the Universe U.

Example : 2.2

Let $U = \{u_1, u_2, u_3, u_4\}$ be a set of four sharees and $E = \{\text{white}(e_1), \text{Red}(e_2), \text{blue}(e_3)\}$ be a set of parameters. In $A = \{e_1, e_2\} \subseteq E$. Let $F_A(e_1) = \{U_1, U_2, U_3\}$ then we write the soft set $(F_A, E) = \{(e_1, \{U_1, U_2, U_3\}), (e_2, \{U_1, U_2, U_3\})\}$, over U which describe the "Colour of the Sharees" Which Mr.X is going to buy. We may represent the soft set in the following form

U	white(e_1)	Red(e_2)	blue(e_3)
u_1	1	1	0
u_2	1	1	0
u_3	0	1	0
u_4	1	0	0

Table 2.1.1

2.3 Fuzzy Soft Set

Let U be an initial universe set and E be a set of parameters. Let P(U) denoted the set of all fuzzy sets of U. Let $A \subseteq E$. A Pair (F_A, E) is called a fuzzy soft set (FSS) over U, where F_A is a mapping given by $F_A: E \to P(U)$ such that $F_A(e) = \tilde{\phi}$, if $e \notin A$, where $\tilde{\phi}$ is a null fuzzy set.

Example : 2.3

Consider the example 2.1, here we cannot express with only two real numbers 0 and 1, we can characterized it by a membership function instead of crisp numbers 0 and 1, which associate with each element a real number in the interval [0,1] then

$(F_A, E) = F_A(e_1)$
$= \{(u_1, 0.3), (u_2, 0.4), (u_3, 0.8), (u_4, 0.2)\}$
$(F_A, E) = F_A(e_2)$
$= \{(u_1, 0.2), (u_2, 0.5), (u_3, 0.9), (u_4, 0.3)\}$ is the fuzzy soft set representing the "Colour of the Sharees" which Mr.X is going to buy. We may represent the fuzzy soft set in the following form.

U	white(e_1)	Red(e_2)	blue(e_3)
u_1	0.3	0.2	0.0
u_2	0.4	0.5	0.0
u_3	0.8	0.9	0.0
u_4	0.2	0.3	0.0

Table 2.2.2

2.4 Fuzzy Soft Matrix (Fsm)

Let (F_A, E) be a fuzzy soft set over U. Then a subset of U×E is uniquely defined by $R_A = \{(u, e): e \in A, U \in FA(e)$ which is called Relation form of (FA,E) . The characteristic function of R_A is written by $\mu_R: U \times E \to [0,1]$, where $\mu_{R\,A}(u, e) \in [0,1]$ is the membership value of $u \in U$ for each $e \in U$ if $[\mu_{ij}] = \mu_{R\,A}(u_j, e_j)$, we can define a matrix

$$[\mu_{ij}]_{m\times n} = \begin{bmatrix} \mu_{11} & \mu_{12} & \cdots & \mu_{1n} \\ \mu_{21} & \mu_{21} & \cdots & \mu_{21} \\ \vdots & \vdots & \vdots & \vdots \\ \mu_{m1} & \mu_{m2} & \cdots & \mu_{mn} \end{bmatrix}$$

which is called an $m \times n$ soft matrix of the soft set (F_A, E) over U. Therefore we can say that a fuzzy soft set (F_A, E) is uniquely characterized by the matrix $[\mu_{ij}]_{m\times n}$ and both concepts are interchangeable.

Example : 2.4

Assume that $U = \{u_1, u_2, u_3, u_4, u_5\}$ is a universal set and $E = \{e_1, e_2, e_3, e_4\}$ is a set of all parameters, if $A \subseteq E = \{e_1, e_2, e_3\}$ and

$F_A(e_1)$
$= \{(u_1, 0.3), (u_2, 0.2), (u_3, 0.1), (u_4, 0.5), (u_5, 0.6)\}$
$F_A(e_2)$
$= \{(u_1, 0.6), (u_2, 0.5), (u_3, 0.1), (u_4, 0.4), (u_5, 0.2)\}$
$F_A(e_3)$
$= \{(u_1, 0.8), (u_2, 0.3), (u_3, 0.5), (u_4, 0.4), (u_5, 0.6)\}$

Then the fuzzy soft set (F_A, E) is a parameterized family $\{F_A(e_1), F_A(e_2), F_A(e_3)\}$ of all fuzzy soft set over U. Hence the fuzzy soft $[\mu_{ij}]$ can be written as

$$[\mu_{ij}] = \begin{bmatrix} 0.3 & 0.6 & 0.8 & 0.0 \\ 0.2 & 0.5 & 0.3 & 0.0 \\ 0.1 & 0.1 & 0.5 & 0.0 \\ 0.5 & 0.4 & 0.4 & 0.0 \\ 0.6 & 0.2 & 0.6 & 0.0 \end{bmatrix}$$

Weighted Fuzzy Soft Matrix

DEFINITION: Let $U = \{c_1, c_2, c_3, c_4, \ldots \ldots c_p\}$ be the universal set, P(U) be the power set of U, E be the set of all parameters provided by $E = \{e_1, e_2, e_3 \ldots \ldots \ldots .. e_q\}$ and $A \cdot E$. Then, a (F, A)be the fuzzy soft set in the fuzzy class $\{U, E\}$. The fuzzy soft set in matrix form will then be represented as $A\,[p * q] = [aij]p * q$ or by $A = [aij], i = 1, 2, 3 \ldots \ldots . p;$

$j = 1, 2, 3 \ldots \ldots \ldots \ldots \ldots \ldots . q,$

Where $a_{ij} = \mu_j\,(c_i)$ if e_j ⊡ $\in A$ and 0 if $e_j \notin$ ⊡A. $\mu_j\,(c_i)$ is representing the membership of c_i of fuzzy set $F(e_j)$.

EXAMPLE: 2.5

Let $U = \{u_1, u_2, u_3, u_4, u_5\}$ be the universal set E = be the set of all parameters provided by $E = \{e_1, e_2, e_3, e_4\}$. Let $P = \{e_2, e_4\} \cdot E$ and $\{F, P\}$ be the fuzzy soft set

$(F, P) = \{F(e_2)\}$
$= \{(u_1, 0.3), (u_2, 0.4), (u_3, 0.3), (u_4, 0.4)\}$
$\{F(e_4)\}$
$= \{(u_1, 0.6), (u_2, 0.7), (u_3, 0.3), (u_4, 0.1), (u_5, 0.2)\}$

The fuzzy soft matrix then will be represented as

$$A = \begin{bmatrix} 0 & 0.3 & 0 & 0.6 \\ 0 & 0.4 & 0 & 0.7 \\ 0 & 0.3 & 0 & 0.3 \\ 0 & 0.4 & 0 & 0.1 \\ 0 & 0 & 0 & 0.2 \end{bmatrix}$$

III. FUZZY WEIGHTED FUZZY SOFT MATRIX IN DECISION MAKING

In this section, we have put forward a weighted fuzzy soft matrix decision making method by using fuzzy soft sets and then we have discussed and applied it to decision-making problem. The idea of weighted fuzzy parameterized soft matrix set provides a mathematical framework for modeling and analyzing the decision-making problems in which all the parameters may not be of equal importance. These differences between the importances of parameters are characterized by the weight function in a weighted fuzzy parameterized soft matrix set.

3.1 Algorithm

Input: Fuzzy soft sets with p objects, each of which has q parameters.
Output: An optimal set

1. Get the Universal set having p objects
2. Choose the set of parameters
3. Consider the weights to be applied for each set of parameters based on the expert's decision and relevance of the attribute (parameter)
4. Compute the arithmetic mean of membership and non-membership value of fuzzy soft matrix as AAM
5. Assign Weights to each set of parameters based on the importance and thus compute the weighted arithmetic mean.
6. Choose the object with highest membership value.
7. In case of tie i.e. when more than one object with same highest membership value , choose the object with highest membership value as well as lowest non- membership value.
8. In case of applications which involve decision making of selecting large optimal number of persons, some threshold value could be set. The objects above that threshold value could be selected and the ones below the threshold could be rejected.
9. Thus the optimum decision set could be obtained.

IV. CASE STUDY

In the organization context, an employee is an important asset for the organization to achieve their goal and objectives. Employee performance appraisal is an important aspect of human resources management in order to assess each employee's contribution to the company. Performance appraisal is defined as the process of identifying, evaluating and developing the work performance of the employee in the organization, so that organizational goals and objectives are effectively achieved while, at the same time, benefiting employees in terms of recognition, receiving feedback and offering career guidance [11] Recognition from the company can motivate the employee to being the best. It is a big Challenge to create a system that helps the human resources development in the industry to make their work earlier without missing an opportunity to select a best employee. There are many methods which available in the performance appraisal such as informal appraisals that involves the assessment of an individual's performance by their supervisor. In [12] develops the decision making evaluating system for selecting best employee by using "Weighted fuzzy soft Matrix" based on the consultation of the company. Consider the huge set of objects which in the current application of the employee whom we are selecting and segregating from the universal set.

Let there be represented by $U = \{c_1, c_2, c_3, \dots, c_m\}$ respectively. The company gathered the information about the employees. Considering the parameters

1. Punctuality
2. Producing best output
3. Good Communication
4. Self improvement
5. Innovative skills
6. Confident

They take only four Parameters
$e_1 = \text{Punctuality}$
$e_2 = \text{Producing best output},$
$e_3 = \text{Good Communication};$
$e_4 = \text{Innovative skills}$

For further processing
Let $E = \{e_1, e_2, e_3, e_4, e_5, e_6\}$ be the set of parameters and $P = \{e_1, e_2, e_3, e_4\} \subseteq E$ and $\{F, P\}$ be the fuzzy soft set

$$(F, P) = \{F(e_1)\} = \{(U_1, 0.1), (U_2, 0.2)(U_3, 0.3), (U_4, 0.3)\}$$
$$(F, P) = \{F(e_2)\} = \{(U_1, 0.2), (U_2, 0.3)(U_3, 0.2), (U_4, 0.3)\}$$
$$(F, P) = \{F(e_3)\} = \{(U_1, 0.6), (U_2, 0.2)(U_3, 0.4), (U_4, 0.3)\}$$
$$(F, P) = \{F(e_4)\} = \{(U_1, 0.5), (U_2, 0.6)(U_3, 0.2), (U_4, 0.1)\}$$

$$A = \begin{vmatrix} 0.1 & 0.2 & 0.3 & 0.3 \\ 0.2 & 0.3 & 0.2 & 0.3 \\ 0.6 & 0.2 & 0.4 & 0.3 \\ 0.5 & 0.6 & 0.2 & 0.1 \end{vmatrix}$$

$$A_{AM} = \begin{vmatrix} 0.225 \\ 0.25 \\ 0.375 \\ 0.35 \end{vmatrix}$$

The weights for the parameter as follows
Punctuality…………….…..0.3
Producing best output……..0.4
Good Communication……..0.2
Self improvement…………..0.1
Using these weights the weighted fuzzy soft matrix are

$$A_{WAM} = \begin{vmatrix} 0.0675 \\ 0.1 \\ 0.075 \\ 0.035 \end{vmatrix}$$

In our sampling application this calculation is shown only for 4 employees. This can be extended to n employees. Now we need to select the best employee. In the present scenario if the threshold values are set as 0.12 then the employee c_2 is the best employee among the four employee.

V. CONCLUSION

In this paper, we have introduced the concept of setting threshold when large numbers of employees have to be selected and also used the earlier concept of soft set by assigning weights based on the relevance of attributes. In this weighted arithmetic mean has been used to derive the decision factors on the fuzzy soft matrix setFinally we have given one elementary application for decision making problem on the basis weighted arithmetic mean. This method can be further applied on other decision making problem having uncertain parameters.

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