A study on Γ-neutrosophic soft set in decision making problem

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Use of Γ(Gamma)- Soft set in Application of Decision Making Problem

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Abstract--- Molodtsov 's soft settheory has been considered an effecient Mathematical tool is conduct along uncertainties. In our regular life, we frequently facing some real problems which need right decision making to get the best solution for these problems. Therefore, it is necessary to consider various parameters related to the best solution. In this paper, we applied Γ(Gamma)-Soft set theory in decision making problems.

Keywords--- Γ(Gamma)- Soft set; Fuzzy soft set; Fuzzy Γ(Gamma)- soft set; Reduct set; Choice value.

I. Introduction

In current days to deal the problems with uncertainties plenty of theories have been evolved inclusive of principle of fuzzy units, theory of vague sets, concept of hard sets, idea of probability and so on. But these kinds of theories have their inherent difficulties because the inadequacy of the parameterization. To keep away from these problems the Russian researcher, Molodtsov [1] become first initiated the smooth concept, as a very common Mathematical device to solve such issues with uncertainties. Soft set idea does not require the specialization of a parameter, as an alternative, it accommodates approximate descriptions of an object as its place to begin.

Decision making is the method of selecting the high-quality many of the options to be had. It involves identity of diverse alternatives and systematic evaluation of every alternative to pick out one that serves nice the accomplishment of the preferred goal. B.H Ahmad and Athar Kharal [3] studied the properties and a few operations on fuzzy smooth units like a fuzzy union, intersection and De Morgan's laws. P.K Maji and A.R. Roy [2] mentioned an utility of soft units in choice-making problem with the help of Rough Mathematics. Arindam Chaudhuri et al [4] studied the decision-making troubles the use of fuzzy soft relations. Kalaichelvi and Haritha Malini [5] tried a version on funding and savings problems. P.K. Das and R. Borgohain [6] carried out the Fuzzy tender set in a multi-observer and multi-criteria choice problems. Palash Dutta and Bulendra Limboo [12] introduced the idea of bell-fashioned fuzzy gentle set carried out to clinical diagnosis. Said Broumi et al [9] they implemented the concept of the intuitionistic neutrosophic soft set to ring idea.

Pabitra Kumar Maji [11] studied weighted neutrosophic gentle units that are a hybridization of neutrosophic units with sodt sets like weighted parameters. Krishna Gogoi et al [8] studied the utility of Fuzzy soft set concept in decision making. A.M. Ibrahim and Yusuf [7] were mentioned one of some kind algebraic systems thru soft set idea. Molodtsov (1999) [1] defines a Soft set as a parameterized own family of subsets of universe set in which each element is considered as a fixed of approximate factors of the Soft set. Onyeozil et al. [10] discussed numerous operations on gentle matrices and their basic residences. In this studies paper, we studied an utility technique of Γ(Gamma)-Soft sets in a hassle of decision-making hassle by way of taking an instance of choosing the best Television with distinct parameters of various manufacturers.

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II. Preliminaries

1. Soft set :

Let M be a preliminary Universal set and H be set of parameters. Suppose that P(M) denotes the electricity set of M and A be a non- empty sub set of H. A pair (F, A) is referred to as a soft set over M, in which $F : A \to P(\mathrm{M})$ is mapping.

2. Γ(Gamma)- Soft set:

The triode (F, A, Γ) is said to be a Γ- Soft set over the Universal set, M where (F, L, Γ) = { F(a, γ) : a ∈ L, γ ∈ Γ} and F is a function considered as F : A X Γ → P(M) such that M be the Universal set, P(M) be the power set of M in which H and Γ(Gamma) be the sets of parameters attributes and L is the sub set of H.

3. Fuzzy soft set:

Let M be the Universal set, H be the set of parameters and A ⊆ H. Also let I^M denote the set of all fuzzy sub sets of M. Then the pair (F, A) is called a fuzzy soft set over M, where F is a mapping from A to I^M.

4. Fuzzy Γ(Gamma)- soft set:

Let M be the Universal set and P(M) be the power set of M. Let H and Γ(Gamma) be the sets of parameters attributes. Also let I^M denote the set of all fuzzy sub sets of M. The triode (F, A, Γ) is called a Fuzzy Γ(Gamma)-Soft set over the Universal set, M is (F, A, Γ) = { F(a, γ) : a ∈ L, γ ∈ Γ} where F is a mapping given by F : A X Γ → I^M and A is the sub set of H.

III. Γ(Gamma)–Soft set Relations

1. Γ(Gamma)–Soft set Relation:

Let (F, A, Γ) and (G, B, Γ) are two Γ(Gamma)-Soft sets over a common Universal set, M. The relation between (F, A, Γ) to (G, B, Γ) is called Γ(Gamma)-Soft set relation, (R, N, Γ) if R is a Γ(Gamma)-Soft subset of (F, A, Γ) X (G, B, Γ), where (C, Γ) ⊆ (A, Γ) X (B, Γ) and R ((l, γ) , (m, γ)) = H ((l, γ), (m, γ)), Where, (H, (F, A) X (G, B)) = (F, A, Γ) X (G, B, Γ) .

2. Γ(Gamma)–Soft sub set Relation:

A Γ(Gamma)-Soft relation , R on (F, A, Γ) is a soft sub set of (F, A, Γ) X (F, B, Γ).
i.e., if (F, A, Γ) = { F (a, γ), F (b, γ), F (c, γ),…. } then F (a, γ) R F (b, γ) ↔ F (a, γ) X F (b, γ) ∈ R .

3. Domain :

The domain of a Γ(Gamma)-Soft relation , R is the Γ(Gamma)-Soft set (D, A_1, Γ) ⊆ (F, A, Γ), where A_1 ⊆ A and A_1 = {(a, γ) ∈ A X Γ…. ; H((a, γ), (b, γ)) ∈ R, for some (b, γ) ∈ B X Γ } and D(a_1, γ) = F(a_1, γ) ∀ (a_1, γ) ∈ A_1 X Γ.

4. Range :

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The range of a Γ(Gamma)-Soft relation , R is the Γ(Gamma)-Soft set $(E, B_1, \Gamma) \subseteq (G, B, \Gamma)$, where $B_1 \subseteq B$ and $B_1 = \{(b, \gamma) \in B \times \Gamma \ldots ; H((a, \gamma), (b, \gamma)) \in R$, for some $(a, \gamma) \in A \times \Gamma \}$ and $E(b_1, \gamma) = G(b_1, \gamma)\ \forall\ (b_1, \gamma) \in B \times \Gamma$.

5. Inverse :

The inverse of Γ(Gamma)-Soft relation , R is denoted by R^{-1} is a Γ(Gamma)-Soft relation from (G, B, Γ) to (F, A, Γ) defined by $R^{-1} = \{ G(b, \gamma) \times F(a, \gamma) : F(a, \gamma)\ R\ G(b, \gamma) \}$.

Example 1 :

Let U denotes set of five (5) Television sets given by $M = \{T_1, T_2, T_3, T_4, T_5\}$ and Γ is the parameter set which denotes the brand of television given by Γ = {brand – 1 , brand – 2 }. Let A and B are the parameter sets given by $A = \{a_1, a_2, a_3, a_4\}$ in which a_1 denotes' smart', a_2 denotes 'LCD', a_3 denotes 'LED' and a_4 denotes 'Plasma' and $B = \{b_1, b_2, b_3, b_4\}$ in which b_1 denotes 'curved' , b_2 denotes ' wega', b_3 denotes 'normal' and b_4 denotes 'trinitron'.
Let the Γ- soft set (F,A, Γ) is given by $(F,A,\Gamma) = \{ F(a_1, \gamma_1) = \{T_1, T_2\}, F(a_1, \gamma_2) = \{T_1, T_3\ T_4\}, F(a_2, \gamma_1) = \{T_4, T_5\}, F(a_2, \gamma_2) = \{T_2, T_4\}, F(a_3, \gamma_1) = \{T_1, T_5\}, F(a_3, \gamma_2) = \{T_1, T_4\}\}$ describes the televisions with different types of different brands.
Let $(G,B,\Gamma) = \{ G(b_1, \gamma_1) = \{T_1, T_2, T_5\}, G(b_1, \gamma_2) = \{T_3, T_4, T_5\}, G(b_2, \gamma_1) = \{T_1, T_2\}\quad G(b_2, \gamma_2) = \{T_1, T_2, T_5\}\}$ describes the televisions with different styles of different brands.
If we define the relation R from (F,A, Γ) to (G,B, Γ) as follows
$F(a, \gamma)\ R\ G(b, \gamma) \leftrightarrow F(a, \gamma) \subseteq G(b, \gamma)$ then $R = \{ F(a_1, \gamma_1) \times G(b_1, \gamma_1), F(a_2, \gamma_1) \times G(b_1, \gamma_2), F(a_2, \gamma_1) \times G(b_1, \gamma_2), F(a_3, \gamma_1) \times G(b_2, \gamma_2)\}$
(i) **Domain of R** $= (D,A_1,\Gamma) = \{ (a_1, \gamma_1), (a_2, \gamma_1), (a_3, \gamma_1)\} \subseteq A \times \Gamma, \rightarrow (D,A_1,\Gamma) = (F,A,\Gamma)$.
(ii) **Range of R** $= (E,B_1,\Gamma) = \{ (b_1, \gamma_1), (b_1, \gamma_2), (b_2, \gamma_2)\} \subseteq B \times \Gamma$ and $E(b, \gamma) = G(b, \gamma)$
Inverse Relation, $R^{-1} = \{ G(b_1, \gamma_1) \times F(a_1, \gamma_1), G(b_1, \gamma_2) \times F(a_2, \gamma_1), G(b_2, \gamma_2) \times F(a_3, \gamma_3)\}$

3.6. Application

Let $M = \{ y_1, y_2, y_3, y_4, y_5, y_6 \}$ be a set of six Televisions and the parameter set, E = { e_1= expensive, e_2= cheaper, e_3= smart, e_4= with operating system, e_5= beautiful, e_6= LCD }, another parameter set $\Gamma = \{ \gamma_1, \gamma_2 \}$, in which γ_1 denotes brand-1 and γ_2 denotes brand-2.
Consider the Γ- soft set (F, E, Γ) describes the attractness of the Televisions given by
$(F, E, \Gamma) = \{ (e_1, \gamma_1), (e_2, \gamma_1), (e_3, \gamma_1), (e_4, \gamma_1), (e_5, \gamma_1), (e_6, \gamma_1), (e_1, \gamma_2), (e_2, \gamma_2), (e_3, \gamma_2), (e_4, \gamma_2), (e_5, \gamma_2), (e_6, \gamma_2) \}$
Where
$(e_1, \gamma_1) = \{ y_1, y_2, y_3, y_4, y_5, y_6\}$
$(e_2, \gamma_1) = \{ y_2, y_4, y_6 \}$
$(e_3, \gamma_1) = \{ y_3, y_4, y_5 \}$
$(e_4, \gamma_1) = \{ y_4, y_5, y_6 \}$
$(e_5, \gamma_1) = \{ y_2, y_5, y_6 \}$
$(e_6, \gamma_1) = \{ y_1, y_2, y_3, y_4, y_6 \}$
$(e_1, \gamma_2) = \{ y_1, y_2 \}$
$(e_2, \gamma_2) = \{ y_1, y_2, y_4, y_5, y_6 \}$
$(e_3, \gamma_2) = \{ y_2, y_3, y_5, y_6 \}$
$(e_4, \gamma_2) = \{ y_2, y_4\}$
$(e_5, \gamma_2) = \{y_3, y_5\}$
$(e_6, \gamma_2) = \{ y_1, y_4, y_5, y_6 \}$
Suppose that Mr. X has to decide to buy a Television on the basis of his choice parameters like "**cheap, Smart and with operating system**" of brands 1 or 2 which constitute a Γ(Gamma)-Soft set sub set P = { e_2= cheaper, e_3= smart, e_4= with operating system } ⊆ E and $\Gamma = \{ \gamma_1, \gamma_2 \}$.
That is out of available Televisions in M, he is to select that a Television which qualifies with all parameters of the brands either 1 or 2 of the Γ(Gamma)-Soft set, P.
$\therefore\ P = \{ e_2, e_3, e_4 \}$.
Let Γ- soft set sub set (F, P, Γ) is defined as follows
$\therefore\ (F, P, \Gamma) = \{ (e_2, \gamma_1), (e_2, \gamma_2), (e_3, \gamma_1), (e_3, \gamma_2), (e_4, \gamma_1), (e_4, \gamma_2) \}$.

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Tabular Representation of Γ(Gamma)-Soft set :

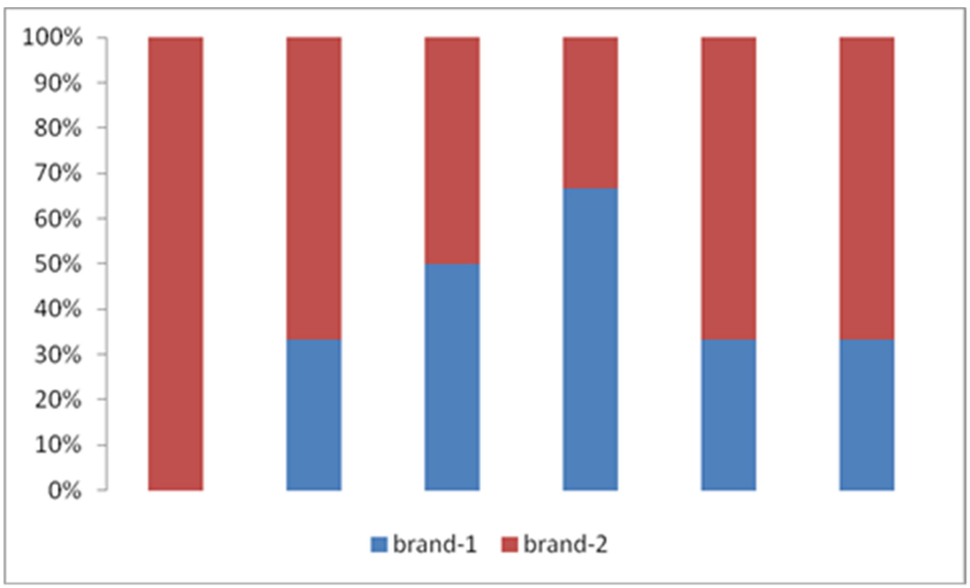
Lin and Yao's earlier tabular representation of soft sets. Based on this theory we present the Tabular Representation of Γ(Gamma)-Soft set in the format of binary table. Therefore we can represent the Γ(Gamma)-Soft set (F, P, Γ), which is Mr. X's choice to buy Television based on the parameter sets P and Γ as follows.
We construct the table as per the definition given by

$$y_{ij} = \begin{cases} 1, & if\ y_i \in (F, E, \Gamma) \\ 0, & if\ y_i \notin (F, E, \Gamma) \end{cases}$$

Table 1

M	(e_2, γ_1)	(e_3, γ_1)	(e_4, γ_1)	(e_2, γ_2)	(e_3, γ_2)	(e_4, γ_2)
y_1	0	0	0	1	0	0
y_2	1	0	0	1	1	1
y_3	0	1	0	0	1	0
y_4	1	1	1	1	0	1
y_5	0	1	1	1	1	0
y_6	1	0	1	1	1	0

Figure-1



From the figure-1, it is observed that there is no comparison for y_1 Television, in y_3 Television the two brands of equal weightage, whereas in y_2, y_5 and y_6 Televisions brand-2 has more weightage in y_4 Television brand-1 has more weightage.

IV. Reduct Table of Γ(Gamma)-Soft set

Consider Γ- soft set, (F, E, Γ). Let P $\subseteq$ E, (F, P, Γ) a Γ(Gamma)-Soft sub set of (F, E, Γ). We have defined reduct Γ- soft set of (F, P, Γ). If Q is reduct of P then the Γ- soft set of (F, Q, Γ) is termed as reduct Γ- soft set of (F, P, Γ).

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The reduct Γ- soft set of (F, Q, Γ) of the Γ(Gamma)-Soft set of (F, P, Γ), which describes all the approximate descriptions of the Γ(Gamma)-Soft set of (F, P, Γ).

V. Choice value of an object y_i

The choice value of an object $y_i \in M$, is C_i , given by $C_i = \sum_{i=1}^{n} y_{i\,j}$, where $y_{i\,j}$ are the entries made in the reduct Γ(Gamma)-Soft set.

VI. Methodology for selecting a Television

The following steps have to be followed by Mr. X to select the Television for his desire.

1. Consider the Γ(Gamma)-Soft set, (F, E, Γ).
2. Define the required parameters set of Mr. X, say P, which is a sub set of E.
3. Describe the possible reduct Γ(Gamma)-Soft set, (F, P, Γ).
4. Select one reduct Γ(Gamma)-Soft set, (F, P, Γ) out of available reduct Γ(Gamma)-Soft sets, say (F, Q, Γ) of (F, P, Γ).
5. Calculate the choice values C_i 's, of the objects out of these choice values, the maximum choice value of an object is the required option.

Let $\{e_2, e_4\}$ and $\{e_3, e_4\}$ are the two reduct Γ(Gamma)-Soft sets of $P = \{e_2, e_3, e_4\}$. Let $Q = \{e_2, e_4\}$ be one of the reduct of P.

Tabular Representation of Reduct set :

Table 2

M	(e_2, γ_1)	(e_3, γ_1)	(e_2, γ_2)	(e_3, γ_2)	γ_1	γ_2
y_1	0	0	1	0	0	1
y_2	1	0	1	1	1	2
y_3	0	1	0	1	1	1
y_4	1	1	1	0	2	1
y_5	0	1	1	1	1	2
y_6	1	0	1	1	1	2

Figure-2

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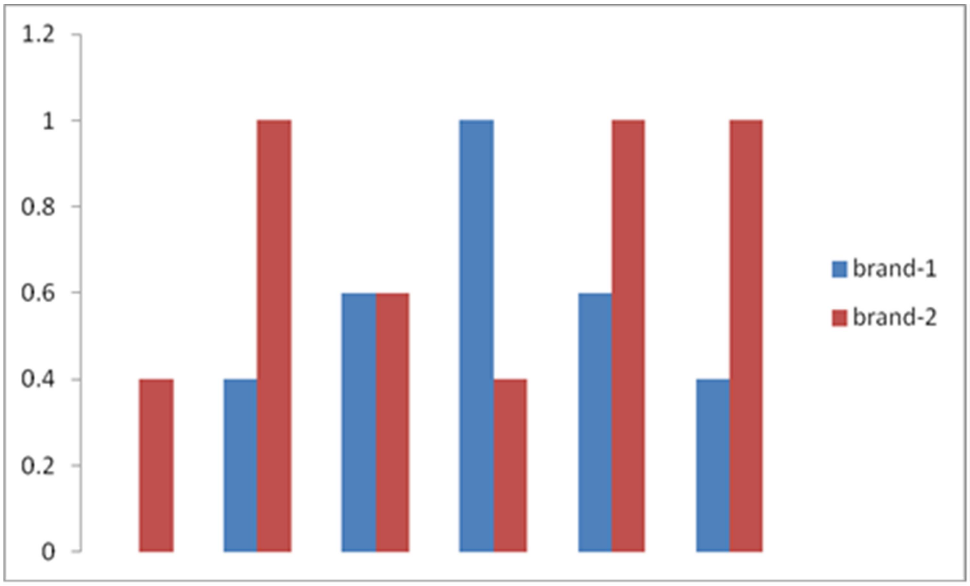

From figure-2 it is observed that this result coincides with the result of figure-1.
To decide the best option $C_i = \max.\{ \gamma_1\}$ or $\max.\{ \gamma_2\}$
$= \{ y_4 \}$ or $\{ y_2, y_5, y_6 \}$.

Decision

Therefore from the above methodology, Mr. X has to buy y_4 Television from brand-1 or from brand-2 he may buy y_2 or y_5 or y_6 Television.

VII. Conclusion

soft theory deals the problem with uncertainties which we face in the day to day life. Molodtsov has introduced the soft set theory with parameterization in order to deal uncertainty. In this research paper we introduced a parameter Γ to the soft set named as Γ(Gamma)-Soft set, Based on this concept we explained how to take the right decision by taking an example and also we defined some basic definition on Γ(Gamma)-Soft set theory

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