Application of Decision Making Problem in Bipolar Fuzzy Soft Expert Set

S. Yuvashri and K. Selvakumari*

Abstract--- *In this paper, we combine the concept of bipolar fuzzy soft set and bipolar fuzzy soft expert set. We introduce the notation of bipolar fuzzy soft set and study basic definitions. We also given an Algorithm and Numerical experiment regarding bipolar fuzzy soft expert set to solve in decision making problems.*

Keywords--- *Soft Set, Expert Set, Bipolar Fuzzy Soft Set, Bipolar Fuzzy Soft Expert Set, Decision Making.*

I. INTRODUCTION

Most of the problems in engineering, medical science, economics, environments, and so forth, have various uncertainties. These problems may not be successfully modelled by existing methods in classical mathematics. Mathematical algorithms in fuzzy set theory (Zadeh, 1965), rough set theory (Pawlak, 1982), theory of interval mathematics (Pawlak, 1982) and probability theory are well-known and are operative tools for handling vagueness and uncertainties. However, these theories have their own difficulties which were pointed out by Molodtsov (1999). To overcome these difficulties, he suggested the concept of soft set as a new mathematical tool to deal with uncertainties. Recognising soft set theory as a powerful tool to describe uncertainties, Maji et al. (2001a) introduced the notion of fuzzy soft set, a more generalized notion, which is a combination of fuzzy set and soft set, and proceeded further in proposing the concept of intuitionistic fuzzy soft sets (Maji et al., 2001b) by combining intuitionistic fuzzy sets with soft sets.

Fuzzy set is a type of important mathematical structure to represent a collection of objects whose boundary is vague. There are several types of fuzzy set extensions in the fuzzy set theory, for example, intuitionistic fuzzysets, interval-valued fuzzysets, vaguesets, etc. bi-polar-valued fuzzy set is another extension of fuzzy set whose membership degree range is different from the above extensions. In 2000, Lee initiated an extension of fuzzy set named bi-polar-valued fuzzy set and later provided a comparsion of interval valued fuzzy set, intuitionistic fuzzy set and bipolar valued fuzzy set. In case of Bi-polar-valued fuzzy sets membership degree range is enlarged from the interval $[0,1]$ to $[-1, 1]$. In a bi-polar-valued fuzzy set, the membership degree 0 indicate that elements are irrelevant to the corresponding property, the membership degrees on $(0, 1]$ assign that elements somewhat satisfy the property, and the membership degrees on $[-1,0)$ assign that elements somewhat satisfy the implicit counter-property. In this article, we combine the concept of bipolar fuzzy soft set and bipolar fuzzy soft expert set. We introduce the notation of bipolar fuzzy soft set and study basic definitions. We also given an Algorithm and Numerical experiment regarding bipolar fuzzy soft expert set to solve in decision making problems.

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II. PRELIMINARIES

Definition 2.1 A bipolar fuzzy set A in a universe U is an object having the form,

$A = \{(x, \mu_A{}^+(x), \gamma_A{}^-(x)) : x \in U\}$ where $\mu_A{}^+(x)$: U →[-1,0].

So $\mu_A{}^+(x)$ denote for positive information and $\gamma_A{}^-(x)$ denote for negative information.

Definition 2.2 Let U be a universe, E be the set of parameters and $A \subset E$. Define

$F : A -\rangle BFU$, where BF^U is the collection of all bipolar fuzzy subsets of U. Then

(F, A) is said to be bipolar fuzzy soft set over a universe U. It is defined by

$(F, A) = F(e_i) = \{(c_i, \mu^+(c_i), \mu^-(c_i)) : \forall c_i \in U, \forall e_i \in A\}$.

$Let\ Z = E \times X \times O\ and\ A \subset Z.$

Definition 2.3 Let U be a universe, E be the set of parameters and A ⊂ E,

$and\ P(U)$ is the power set of U. Then (F, A) is called a soft set, where

$F : A \to P(U)$.

Definition 2.4 For two soft sets $(F, A)\ and\ (G, B)$ over a common universe U, we say that (F, A) is a soft subset of (G, B), denoted by $(F, A) \subset (G, B)$, if it satisfies.

1. $A \subset B$

2. $\forall a \in A, F(a)\ is\ a\ subset\ of\ G(a)$.

Similarly, (F, A) is called a superset of $(G, B)\ if\ (G, B)$ is a soft subset of (F, A). This relation is denoted by $(F, A) \supset (G, B)$.

Definition 2.5 An agree - soft expert set $(F, A)_1$ over U is a soft expert subset of (F, A) defined as follows:

$(F, A)_1 = \{F_1(\alpha) : \alpha \in E \times X \times \{1\}\}$.

Definition 2.6 An disagree- soft expert set $(F, B)_0$ over U is a soft expert subset of (F, A) defined as follows:

$(F, A)_0 = \{(F)_0(\alpha) : \alpha \in E \times X \times \{0\}\}$.

Definition 2.7 Let A and B be two bipolar valued fuzzy sets over a universe U.

1. $A \subset B$ if and only if, $\mu_A{}^+(x) \leq \mu_B{}^+(x)$ and $\mu_A{}^-(x) \geq \mu_A{}^-(x)$, for all $x \in U$.

2. $A = B$ if and only if, $\mu_A{}^+(x) = \mu_B{}^+(x)$ and $\mu_A{}^-(x) = \mu_A{}^-(x)$, for all $x \in U$.

III. BIPOLAR FUZZY SOFT SETS

Definition 3.1 Let U be a universe, E a set of parameters and $A \subset E$. Define

$F : A \to BF^U$, where BF^U is the collection of all bipolar fuzzy subsets of U. Then (F, A) is said to be a bipolar fuzzy soft set over a universe U. It is defined by

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$(F,A) = F(e_i)$

$F(e_i) = \left(c_i, \mu^+(c_i), \mu^-(c_i)\right): \forall c_i \in U, \forall e\ i \in A.$

Example

Let $M = \{a_1, a_2, a_3\}$ be the set of four pens under consideration and $P = \{b_1 = Parker\ pen, b_2 = Gel\ pen, b_3 = Stick\ pen\}$ be the set of parameters and $X = \{b_{1,}, b_{2,} b_3\} \subseteq P$. Then,

$$(F,X) = \begin{cases} F(b_1) = \begin{Bmatrix} (a_1, 0.2, -0.3) \\ (a_2, 0.1, -0.4) \\ (a_3, 0.3, -0.5) \end{Bmatrix} \\ F(b_2) = \begin{Bmatrix} (a_1, 0.5, -0.6) \\ (a_2, 0.8, -0.5) \\ (a_3, 0.7, -0.4) \end{Bmatrix} \\ F(b_3) = \begin{Bmatrix} (a_1, 0.2, -0.3) \\ (a_2, 0.1, -0.4) \\ (a_3, 0.3, -0.5) \end{Bmatrix} \end{cases}$$

Definition 3.2 Let U be a universe and E a set of attributes. Then (U,E) is the collection of all bipolar fuzzy soft sets on U with attributes from E and is said to be bipolar fuzzy soft class.

Definition 3.3 Let $(F,A)\ and\ (G,B)$ be two bipolar fuzzy soft sets over a common universe U. we say that $(F,A)\ and\ (G,B)$ are bipolar fuzzy soft equal sets if (F,A) Is a bipolar fuzzy soft subset sets of

$(G,B)\ and\ (G,B)$ is a bipolar fuzzy soft subset of (F,A).

IV. Bipolar Fuzzy Soft Expert Sets – (BFSES)

Let U be a universe of elements, E a set of parameters, X be a set of experts (agents), and O = {1 = agree, 0 = disagree} a set of opinions.

$Let\ Z = E \times X \times O\ and\ A \subseteq Z.$

Definition 4.1 Let $U = \{u_1, u_{2,} \ldots . u_n\}$ be a universe of elements, $E = \{e_1, e_2, \ldots . e_m\}$ be a universe of parameters, $X = \{x_{1,} x_2, \ldots . x_i\}$ be a set of experts (agents) and O = {1 = agree, 0 = disagree} be a set of opinions.

Let $Z = \{E \times X \times O\}$ and $A \subseteq Z$. Let F: A → BF^U where BF^U denotes the collection of all bipolar fuzzy subsets of U. Suppose F: A → BF^U is a function defined as:

$F(a) = F(a)(u_i), \forall u \in U$

Then $F(a)$ is called a bipolar fuzzy soft expert set over the soft universe (U,A). For each $a_i \in$ A, F(a_i) = F(a_i)(u), where F(a_i) represents either the satisfaction degree to property corresponding to a bipolar fuzzy soft expert set $F(a)$ or satisfaction degree to implicit counter-property corresponding to a bipolar fuzzy soft expert set $F(a)$ for elements of U in $F(a_i)$.

$F(a_i) = \left\{\frac{u_i}{F(a_i)(u_i)}\right\}$ for i = 1,2,3…,

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Where $F\ (a_i)\ (u_i)$ = $(\mu^{+}_{F(ai)}(u_i), \gamma^{-}_{F(ai)}(u_i))$ with $\mu^{+}_{F(ai)}(u_i)$, denotes the satisfaction degree of each element $(u_i) \in U$ to the property corresponding to a bipolar fuzzy soft expert set $F(a)$ and$\gamma^{-}_{F(ai)}(u_i)$, denotes the satisfaction degree of each element $(u_i) \in U$ to some implicit counter-property of bipolar fuzzy soft expert set $F(a)$. We can write F as (F, Z). If $A \subseteq Z$ we can also have a BFSES (F, A).

Example Suppose a man wishes to buy the car and checking the most important three facilities of cars and wants to take the opinion of some experts about these cars. Let $U = \{u_1, u_2, u_3\}$ be a set of products, E = $\{e_1$=durability, e_2 = fuel efficient,$e_3 = \text{elegant}\}$ be a set of decision parameters and X = $\{x_1, x_2\}$ be a set of experts. Suppose that:

$F\ (e_1, x_1, 1) = \left\{\frac{u_1}{<0.1,-0.3>}, \frac{u_2}{<0.4,-0.6>}, \frac{u_3}{<0.3,-0.2>}\right\}$,

$F\ (e_1, x_2, 1) = \left\{\frac{u_1}{<0.2,-0.5>}, \frac{u_2}{<0.1,-0.3>}, \frac{u_3}{<0.4,-0.13>}\right\}$,

$F\ (e_2, x_1, 1) = \left\{\frac{u_1}{<0.4,-0.0>}, \frac{u_2}{<0.7,-0.8>}, \frac{u_3}{<0.41,-0.85>}\right\}$,

$F\ (e_2, x_2, 1) = \left\{\frac{u_1}{<0.3,-0.6>}, \frac{u_2}{<0.8,-0.4>}, \frac{u_3}{<0.3,-0.6>}\right\}$,

$F\ (e_1, x_1, 0) = \left\{\frac{u_1}{<0.32,-0.56>}, \frac{u_2}{<0.7,-0.3>}, \frac{u_3}{<0.5,-0.2>}\right\}$,

$F\ (e_1, x_2, 0) = \left\{\frac{u_1}{<0.1,-0.8>}, \frac{u_2}{<0.9,-0.72>}, \frac{u_3}{<0.6,-0.5>}\right\}$,

$F\ (e_2, x_1, 0) = \left\{\frac{u_1}{<0.78,-0.59>}, \frac{u_2}{<0.12,-0.24>}, \frac{u_3}{<0.7,-0.9>}\right\}$,

$F\ (e_2, x_2, 0) = \left\{\frac{u_1}{<0.6,-0.8>}, \frac{u_2}{<0.5,-0.31>}, \frac{u_3}{<0.4,-0.1>}\right\}$,

Then (F, Z) is a bipolar fuzzy soft expert set over the soft universe (U, Z).

Definition 4.2 Let (F, A) *and* (G, B) be two bipolar fuzzy soft expert sets over the common universe U. (F, A) is a bipolar fuzzy soft expert subset of (G, B) if

1. $A \subseteq B$

2. $\forall e \in A, F(e)$ is a bipolar fuzzy subset of $G(e)$.

This relationship is denoted by $(F, A) \subseteq (G, B)$, and (G, B) is called the bipolar fuzzy soft expert superset of (F, A).

Definition 4.3 Let (F, A) *and* (G, B) be two bipolar fuzzy soft expert sets over the common universe U. (F, A) *and* (G, B) are bipolar fuzzy soft expert equal sets if (F, A) is a bipolar fuzzy soft expert subset of (G, B) *and* (G, B) is a bipolar fuzzy soft expert subset of (F, A).

V. ALGORITHM

Step 1 Input the BFSES (F, A).

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Step 2 Find the values of ($\mu^{+}_{F(ai)}(u_i)$ - ($\gamma^{-}_{F(ai)}(u_i)$) for each element $u_i \in U$

Where $\mu^{+}_{F(ai)}(u_i)$, are the positive membership function and $\gamma^{-}_{F(ai)}(u_i)$ are the negative membership function of each element $(u_i) \in U$ respectively.

Step 3 Find the highest numerical grade for the agree-BFSES and disagree-BFSES.

Step 4 Compute the score of each element $(u_i) \in U$ by taking the sum of the products of the numerical grade of each element for the agree-BFSES and disagree-BFSES, denoted by Y_i and N_i respectively.

Step 5 Find the values of the score $K_i = Y_i - N_i$ for each element $u_i \in U$.

Step 6 Determine the value of the highest score $K = max\,(u_i) \in U(k_i)$**.** Then the decision is to choose element u_i as the optimal or best solution to the problem. If there are more than one element with the highest k_i score, any one of them could be chosen based on its option.

VI. NUMERICAL EXAMPLE

Suppose Mr.Vasu is going to buy a mobile on basics of the best company. Our aim is to find out the best mobile for Mr.Vasu.

Let $U = \{u_1, u_2, u_3, u_4, u_5\}$ be the set of five mobiles under consideration also say U is the universe and

$E = \{e_1 = Samsung, e_2 = Vivo, e_3 = Oppo, e_4 = One\ plus, e_5 = Real\ me\}$ to evaluate mobiles

for $i = 1,2,3,4,5$ the parameters $e_i (i = 1,2,3,4,5)$ stands for the mobiles.

Let $X = \{P, Q, R\}$ be the set of experts.

(F, Z) = $(e_1, P, 1) = \left\{\frac{u_1}{<0.3,-0.4>}, \frac{u_2}{<0.5,-0.4>}, \frac{u_3}{<0.6,-0.13>}, \frac{u_4}{<0.6,-0.9>}, \frac{u_5}{<0.4,-0.13>}\right\}$,

$(e_2, P, 1) = \left\{\frac{u_1}{<0.4,-0.0>}, \frac{u_2}{<0.7,-0.81>}, \frac{u_3}{<0.41,-0.85>}, \frac{u_4}{<0.1,-0.3>}, \frac{u_5}{<0.7,-0.1>}\right\}$,

$(e_3, P, 1) = \left\{\frac{u_1}{<0.3,-0.5>}, \frac{u_2}{<0.8,-0.46>}, \frac{u_3}{<0.31,-0.4>}, \frac{u_4}{<0.7,-0.9>}, \frac{u_5}{<0.8,-0.17>}\right\}$,

$(e_4, P, 1) = \left\{\frac{u_1}{<0.32,-0.56>}, \frac{u_2}{<0.7,-0.3>}, \frac{u_3}{<0.5,-0.2>}, \frac{u_4}{<0.1,-0.3>}, \frac{u_5}{<0.4,-0.19>}\right\}$,

$(e_5, P, 1) = \left\{\frac{u_1}{<0.1,-0.81>}, \frac{u_2}{<0.94,-0.72>}, \frac{u_3}{<0.6,-0.5>}, \frac{u_4}{<0.6,-0.3>}, \frac{u_5}{<0.4,-0.13>}\right\}$,

$(e_1, Q, 1) = \left\{\frac{u_1}{<0.32,-0.56>}, \frac{u_2}{<0.5,-0.2>}, \frac{u_3}{<0.9,-0.7>}, \frac{u_4}{<0.4,-0.32>}, \frac{u_5}{<0.47,-0.13>}\right\}$,

$(e_2, Q, 1) = \left\{\frac{u_1}{<0.78,-0.86>}, \frac{u_2}{<0.78,-0.3>}, \frac{u_3}{<0.7,-0.6>}, \frac{u_4}{<0.3\ -0.3>}, \frac{u_5}{<0.5,-0.72>}\right\}$,

$(e_3, Q, 1) = \left\{\frac{u_1}{<0.86,-0.26>}, \frac{u_2}{<0.4,-0.7>}, \frac{u_3}{<0.5,-0.2>}, \frac{u_4}{<0.9,-0.3>}, \frac{u_5}{<0.1,-0.13>}\right\}$,

$(e_4, Q, 1) = \left\{\frac{u_1}{<0.31,-0.51>}, \frac{u_2}{<0.7,-0.3>}, \frac{u_3}{<0.52,-0.28>}, \frac{u_4}{<0.1,-0.3>}, \frac{u_5}{<0.0,-0.23>}\right\}$,

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$$(e_5, Q, 1) = \left\{\frac{u_1}{\langle 0.31,-0.56\rangle}, \frac{u_2}{\langle 0.5,-0.3\rangle}, \frac{u_3}{\langle 0.6,-0.2\rangle}, \frac{u_4}{\langle 0.0,-0.3\rangle}, \frac{u_5}{\langle 0.4,-0.13\rangle}\right\},$$

$$(e_1, R, 1) = \left\{\frac{u_1}{\langle 0.12,-0.5\rangle}, \frac{u_2}{\langle 0.4,-0.2\rangle}, \frac{u_3}{\langle 0.1,-0.2\rangle}, \frac{u_4}{\langle 0.1,-0.13\rangle}, \frac{u_5}{\langle 0.7,-0.23\rangle}\right\},$$

$$(e_2, R, 1) = \left\{\frac{u_1}{\langle 0.32,-0.26\rangle}, \frac{u_2}{\langle 0.12,-0.16\rangle}, \frac{u_3}{\langle 0.7,-0.1\rangle}, \frac{u_4}{\langle 0.7,-0.2\rangle}, \frac{u_5}{\langle 0.4,-0.13\rangle}\right\},$$

$$(e_3, R, 1) = \left\{\frac{u_1}{\langle 0.32,-0.58\rangle}, \frac{u_2}{\langle 0.4,-0.3\rangle}, \frac{u_3}{0.14,-0.7\rangle}, \frac{u_4}{\langle 0.2,-0.3\rangle}, \frac{u_5}{\langle 0.7,-0.23\rangle}\right\},$$

$$(e_4, R, 1) = \left\{\frac{u_1}{\langle 0.23,-0.65\rangle}, \frac{u_2}{\langle 0.7,-0.4\rangle}, \frac{u_3}{\langle 0.7,-0.8\rangle}, \frac{u_4}{\langle 0.6,-0.32\rangle}, \frac{u_5}{\langle 0.14,-0.15\rangle}\right\},$$

$$(e_5, R, 1) = \left\{\frac{u_1}{\langle 0.37,-0.16\rangle}, \frac{u_2}{\langle 0.1,-0.3\rangle}, \frac{u_3}{\langle 0.52\ -0.2\rangle}, \frac{u_4}{\langle 0.3,-0.3\rangle}, \frac{u_5}{\langle 054,-0.13\rangle}\right\},$$

$$(e_1, P, 0) = \left\{\frac{u_1}{\langle 0.6,-0.5\rangle}, \frac{u_2}{\langle 0.7,-0.4\rangle}, \frac{u_3}{\langle 0.6,-0.2\rangle}, \frac{u_4}{\langle 0.7,-0.3\rangle}, \frac{u_5}{\langle 0.8,-0.13\rangle}\right\},$$

$$(e_2, P, 0) = \left\{\frac{u_1}{\langle 0.3,-0.45\rangle}, \frac{u_2}{\langle 0.7,-0.39\rangle}, \frac{u_3}{\langle 0.5,-0.92\rangle}, \frac{u_4}{\langle 0.1,-0.39\rangle}, \frac{u_5}{\langle 0.4,-0.19\rangle}\right\},$$

$$(e_3, P, 0) = \left\{\frac{u_1}{\langle 0.21,-0.56\rangle}, \frac{u_2}{\langle 0.4,-0.3\rangle}, \frac{u_3}{\langle 0.8,-0.2\rangle}, \frac{u_4}{\langle 0.8,-0.3\rangle}, \frac{u_5}{\langle 0.8,-0.13\rangle}\right\},$$

$$(e_4, P, 0) = \left\{\frac{u_1}{\langle 0.62,-0.46\rangle}, \frac{u_2}{\langle 0.17,-0.3\rangle}, \frac{u_3}{\langle 0.65,-0.2\rangle}, \frac{u_4}{\langle 0.1,-0.7\rangle}, \frac{u_5}{\langle 0.4,-0.18\rangle}\right\},$$

$$(e_5, P, 0) = \left\{\frac{u_1}{\langle 0.12,-0.26\rangle}, \frac{u_2}{\langle 0.9,-0.3\rangle}, \frac{u_3}{\langle 0.8,-0.2\rangle}, \frac{u_4}{\langle 0.7,-0.5\rangle}, \frac{u_5}{\langle 0.6,-0.13\rangle}\right\},$$

$$(e_1, Q, 0) = \left\{\frac{u_1}{\langle 0.5,-0.56\rangle}, \frac{u_2}{\langle 0.4,-0.3\rangle}, \frac{u_3}{\langle 0.3,-0.2\rangle}, \frac{u_4}{\langle 0.3,-0.31\rangle}, \frac{u_5}{\langle 0.2,-0.13\rangle}\right\},$$

$$(e_2, Q, 0) = \left\{\frac{u_1}{\langle 0.74,-0.61\rangle}, \frac{u_2}{\langle 0.4,-0.32\rangle}, \frac{u_3}{\langle 0.3,-0.22\rangle}, \frac{u_4}{\langle 0.2,-0.3\rangle}, \frac{u_5}{\langle 0.1,-0.13\rangle}\right\},$$

$$(e_3, Q, 0) = \left\{\frac{u_1}{\langle 0.42,-0.56\rangle}, \frac{u_2}{\langle 0.7,-0.3\rangle}, \frac{u_3}{\langle 0.5,-0.25\rangle}, \frac{u_4}{\langle 0.1,-0.32\rangle}, \frac{u_5}{\langle 0.9,-0.63\rangle}\right\},$$

$$(e_4, Q, 0) = \left\{\frac{u_1}{\langle 0.92,-0.56\rangle}, \frac{u_2}{\langle 0.8,-0.3\rangle}, \frac{u_3}{\langle 0.7,-0.1\rangle}, \frac{u_4}{\langle 0.6,-0.32\rangle}, \frac{u_5}{\langle 0.5,-0.13\rangle}\right\},$$

$$(e_5, Q, 0) = \left\{\frac{u_1}{\langle 0.64,-0.56\rangle}, \frac{u_2}{\langle 0.6,-0.3\rangle}, \frac{u_3}{\langle 0.54,-0.3\rangle}, \frac{u_4}{\langle 0.34,-0.8\rangle}, \frac{u_5}{\langle 0.4,-0.64\rangle}\right\},$$

$$(e_1, R, 0) = \left\{\frac{u_1}{\langle 0.82,-0.56\rangle}, \frac{u_2}{\langle 0.64,-0.3\rangle}, \frac{u_3}{\langle 0.9,-0.5\rangle}, \frac{u_4}{\langle 0.14,-0.7\rangle}, \frac{u_5}{\langle 0.4,-0.98\rangle}\right\},$$

$$(e_2, R, 0) = \left\{\frac{u_1}{\langle 0.87,-0.56\rangle}, \frac{u_2}{\langle 0.37,-0.3\rangle}, \frac{u_3}{\langle 06.5,-0.8\rangle}, \frac{u_4}{\langle 0.6,-0.4\rangle}, \frac{u_5}{\langle 0.4,-0.88\rangle}\right\},$$

$$(e_3, R, 0) = \left\{\frac{u_1}{\langle 0.32,-0.56\rangle}, \frac{u_2}{\langle 0.8,-0.3\rangle}, \frac{u_3}{\langle 0.4,-0.5\rangle}, \frac{u_4}{\langle 0.1,-0.2\rangle}, \frac{u_5}{\langle 0.4,-0.69\rangle}\right\},$$

$$(e_4, R, 0) = \left\{\frac{u_1}{\langle 0.67,-0.56\rangle}, \frac{u_2}{\langle 0.3,-0.35\rangle}, \frac{u_3}{\langle 0.1,-0.3\rangle}, \frac{u_4}{\langle 0.1,-0.8\rangle}, \frac{u_5}{\langle 0.3,-0.33\rangle}\right\},$$

$$(e_5, R, 0) = \left\{\frac{u_1}{\langle 0.18,-0.47\rangle}, \frac{u_2}{\langle 0.6,-0.9\rangle}, \frac{u_3}{\langle 0.8,-0.2\rangle}, \frac{u_4}{\langle 0.75,-0.3\rangle}, \frac{u_5}{\langle 0.32,-0.93\rangle}\right\},$$

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Table 1: Value of $(\mu^{+}_{F(ai)}(u_i) - \gamma^{-}_{F(ai)}(u_i))$

U	U_1	U_2	U_3	U_4	U_5
$(e_1, P, 1)$	0.7	0.9	0.73	1.5	0.53
$(e_2, P, 1)$	0.4	1.51	1.26	0.4	0.8
$(e_3, P, 1)$	0.8	1.26	0.71	1.6	0.97
$(e_4, P, 1)$	0.88	1	0.7	0.4	0.59
$(e_5, P, 1)$	0.91	1.66	1.1	0.9	0.53
$(e_{1,} Q, 1)$	0.88	0.7	1.6	0.72	0.6
$(e_{2,} Q, 1)$	1.64	1.08	1.3	0.6	1.22
$(e_{3,} Q, 1)$	1.12	1.1	0.7	1.2	0.23
$(e_{4,} Q, 1)$	0.82	1	0.8	0.4	0.23
$(e_{5,} Q, 1)$	0.87	0.8	0.8	0.3	0.53
$(e_1, R, 1)$	0.62	0.6	0.3	0.23	0.93
$(e_2, R, 1)$	0.58	0.28	0.8	0.9	0.53
$(e_3, R, 1)$	0.9	0.7	0.84	0.5	0.93
$(e_4, R, 1)$	0.88	1.1	1.5	0.92	0.29
$(e_5, R, 1)$	0.53	0.4	0.72	0.6	0.67
$(e_1, P, 0)$	1.1	1.1	0.8	1.0	0.93
$(e_2, P, 0)$	0.75	1.09	1.42	0.49	0.59
$(e_3, P, 0)$	0.77	0.7	1.0	1.1	0.93
$(e_4, P, 0)$	1.08	0.47	0.85	0.8	0.58
$(e_5, P, 0)$	0.38	1.2	1.0	1.2	0.73
$(e_1, Q, 0)$	1.06	0.7	0.5	0.61	0.33
$(e_2, Q, 0)$	1.35	0.72	0.52	0.5	0.23
$(e_3, Q, 0)$	0.98	1.0	0.75	0.42	1.53
$(e_4, Q, 0)$	1.48	1.1	0.8	0.92	0.63
$(e_5, Q, 0)$	1.2	0.9	0.84	1.14	1.04
$(e_1, R, 0)$	1.38	0.94	1.4	0.84	1.38
$(e_2, R, 0)$	1.43	0.67	1.45	1.0	1.28
$(e_3, R, 0)$	0.88	1.1	0.9	0.3	1.09
$(e_4, R, 0)$	1.23	0.65	0.4	0.9	0.63
$(e_5, R, 0)$	0.65	1.5	1.0	1.65	1.25

Table 2: Numerical Grade For Agree – Bfses

U	U_i	Highest Numerical Grade
$(e_1, P, 1)$	u_4	1.5
$(e_2, P, 1)$	u_2	1.51
$(e_3, P, 1)$	u_4	1.6
$(e_4, P, 1)$	u_2	1
$(e_5, P, 1)$	u_2	1.66
$(e_{1,} Q, 1)$	u_3	1.6
$(e_{2,} Q, 1)$	u_1	1.64
$(e_{3,} Q, 1)$	u_4	1.2
$(e_{4,} Q, 1)$	u_2	1
$(e_{5,} Q, 1)$	u_1	0.87
$(e_1, R, 1)$	u_5	0.93
$(e_2, R, 1)$	u_4	0.9
$(e_3, R, 1)$	u_5	0.93
$(e_4, R, 1)$	u_3	1.5
$(e_5, R, 1)$	u_3	0.72

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Table 3: Numerical Grade Foe Disagree - BFSES

U	U_i	Highest Numerical Grade
$(e_1, P, 0)$	u_2	1.1
$(e_2, P, 0)$	u_3	1.42
$(e_3, P, 0)$	u_4	1.1
$(e_4, P, 0)$	u_1	1.08
$(e_5, P, 0)$	u_2	1.2
$(e_1, Q, 0)$	u_1	1.06
$(e_2, Q, 0)$	u_1	1.35
$(e_3, Q, 0)$	u_5	1.53
$(e_4, Q, 0)$	u_1	1.48
$(e_5, Q, 0)$	u_1	1.2
$(e_1, R, 0)$	u_3	1.4
$(e_2, R, 0)$	u_3	1.45
$(e_3, R, 0)$	u_2	1.1
$(e_4, R, 0)$	u_1	1.23
$(e_5, R, 0)$	u_3	1.65

Table 4: The Score $K_i = Y_i - N_i$

SCORE	Y_i	N_i	K_i
u_1	2.51	7.4	-4.89
u_2	5.17	3.4	1.77
u_3	3.82	4.27	-0.45
u_4	5.2	1.1	**4.1**
u_5	1.86	1.53	0.33

Since $K = max\ (u_i) \in\ U\ (k_i)\ = \boldsymbol{k_4}$**,** So we will suggest $\boldsymbol{e_4}$ is the best Mobile to Mr.Vasu.

VII. CONCLUSION

In this paper we learnt the concept of bipolar fuzzy soft set and bipolar fuzzy soft expert set. Also we given an Numerical example of bipolar fuzzy soft expert set into decision making problem. Therefore, this paper gives an idea for the beginning of a new study for approximations of data with uncertainties.

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