TOPGRAY ANALYSIS OF EVALUATION FOR EFFECTIVENESS OF THE APPOINTMENT OF FACULTY POSITIONS IN UNIVERSITYUNDER BIPOLAR FERMATEAN FUZZY SOFT ENVIRONMENT

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Abstract:"Bipolarity refers to the propensity of the human mind to reason and make decisions on the basis of positive and negative effects and the positive information states what is possible, satisfactory, permitted, desired, or considered as being acceptable. Whereas the negative statements express what is impossible, rejected or forbidden. In this article, we use the hybrid score – accuracy functions of bipolar fermatean fuzzy soft numbers (BFFSNS) and ranking method for BFFSNS. To rank the alternatives and recruit the most desirable professors, we use the overall evaluation formula of the weighted hybrid score accuracy functions for each alternative. To illustrate the effectiveness of the proposed model, the education problem for assistant professor selection is provided. we compare this result with TOPGREY Algorithm and also evaluated for effectiveness of the appointment.

Keywords: fuzzy set, soft set, bipolar fuzzy set, fermatean fuzzy set, score function, accuracy function, Topgray algorithms. effectiveness, soft numbers.

1.Introduction: An uncertainty set was first introduced by Zadeh [19] and then the uncertainty sets have been used in there. The uncertainty set theory becomes a strong area of making observations in different areas like medical science, social sciences, engineering, management sciences, artificial intelligence, robotics, computer networks, decision making and so on. Due to unassociated sorts of unpredictability occurring in different areas of life like economics, engineering, medical sciences, management sciences, psychology, sociology, decision making and uncertainty set as noted and often effective mathematical instruments have been offered to make, be moving in and grip those unpredictability. Since the establishment of uncertainty set, several ideas have been made such as Atanassov's [2] work on intuitionistic fuzzy set (IFSs) was quite remarkable as he extended the concept of FSs by assigning non membership degree say "N(x)" along with membership degree say "P(x)" with condition that $0 \leq Px + N(x) \leq 1$. Strengthening the concept bifuzzy set suggest Pythagorean uncertainty sets which somehow enlarge the space of positive membership and negative membership by introducing some new conditions that $0 \leq P^2x + N^2(x) \leq 1$. Senapathi and Yager ([17],[18]) specified basic activities over the FUSs and concentrated new score mappings and accuracy mappings of FUSs. They proposed the technique for order preference by similarity to ideal solution (TOPSIS) way to deal with taking care of the issue with fermatean uncertainty data. Manimaran and Nagarajan studied novel cubic fermatean fuzzy soft ideal structures in [11]. The concept of soft sets introduced by D.Molodtsov's [15]. Therein, the basic notions of the theory of soft sets and some of its possible applications were presented.Recruitment process can be regarded as a multi-criteria group decision making (MCGDM) problem that generally consists of the selection of the most desirable alternative from all the feasible alternatives. Balamurugan and Nagarajan defined various aspects fermatean techniques in [[12],[13]].Compared to a fuzzy set a bipolar approach is more general and suitable way to deal with imprecise information, Bosc and Pivert [5] said that. At recent times, many authors or algebraic structures study the bipolar fuzzy models.J.Chen.al [6] has studied the m-polar fuzzy set and has illustrated how many concepts have been defined on bipolar fuzzy sets. Many results have been examined, related to these conceptswhich can be generalized to the case of m-polar fuzzy set and illustrates how many results which are related to these concepts whichcan be generalized to the case of m-polar fuzzy sets. To show how to apply m-polar fuzzy sets in real world problems, numerical examples are also being proposed. P.Bosc and O.Pivert [5] has introduced a study called the bipolar fuzzy relations where each tuple associates with a pair of satisfactory degrees, bipolar value fuzzy ideal and bipolar valued fuzzy ideal. Assistant professor Recruitment process for higher education is regarded as a special case of personnel selection.

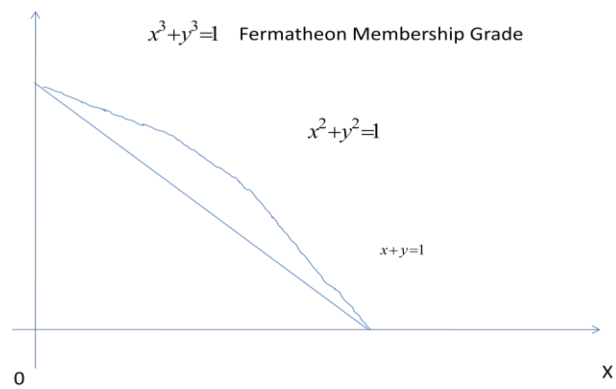
Karsak [9] has presented the fuzzy MCDM approach based on the ideal and the anti ideal solutions for the selection of the most suitable candidateZ.Gunar [10] has developed the analytical hierarchy process for the sake of personnel selection. M.DogDevigen[7] has studied about the hybrid model based on the analytical network process [ANP] and has modified the technique for order preference by similarity to ideal solution for supporting the personnel selection process in the manufacturing systems.IT.Robertson and B.Smith [16] investigate the role of top analysis, the contemporary models of work performance, and the set of criteria which has been employed in the personnel selection process. In this article, we use the hybrid score – accuracy functions of bipolar fermatean fuzzy soft numbers (BFFSNS) and ranking method for BFFSNS. To rank the alternatives and recruit the most desirable professors, we use the overall evaluation formula of the weighted hybrid score accuracy functions for each alternative. To illustrate the effectiveness of the proposed model, the education problem for assistant professor selection is provided. we compare this result with TOPGREY Algorithm and also evaluated for effectiveness of the appointment.

2. Some basic concepts of bipolar fuzzy soft sets

2.2 Definition:[**L.A.Zadeh, 1965**] Let 'X' be a collection of all elements. An uncertainty collection A falls from X is expressed as A= $\{(x: \mu_A(x)) / x \in X\}$ whereμ_A: A $\rightarrow$ [0, 1] is the grade function of the uncertainty collections A.

2.3 Definition:[**K.Lee, 2009**] Let X is a Universe. Then a bipolar uncertainty collection A on X is represented by positive member ship map μ_A^+, that is,μ_A^+: X → [0,1] and a negative membership map μ_A^-, (i,e), μ_A^- : X→[-1,0].For the state of easy way, we always utilize the symbol A= {(x, μ_A^+, μ_A^-) / x ϵ X}.

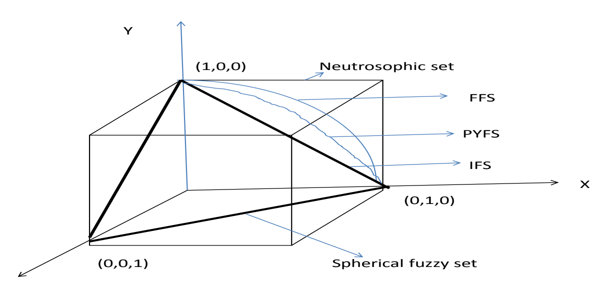
2.4 Definition: [**Senapati and Yager, 2019**] Let X is universe of discovers. A fermatean fuzzy set (FFS) F in X is a domain has the formulation asF ={(x, $m_F(x)$, $n_F(x)$/xϵX},where $m_F(x)$:X→[0, 1] and $n_F(x)$:X→ [-1, 0], which includes the result0 $\leq (m_F(x))^3 + (n_F(x))^3 \leq 1$, for allxϵX, the numbers $m_F(x)$ denotes the degree of elements and $n_F(x)$ denotes the degree of non-membership of the element x in F, for any fermatean uncertainty set 'F' and xϵX.$\prod_F(x)=\sqrt[3]{1-(m_F(x))^3-(n_F(x))^3}$ is defined as the degree of middle of x to F. For convince ,Senapati and Yagercalled ($m_F(x)$, $n_F(x)$) fermatean fuzzy number (FFN) denoted by F= (m_F, n_F).



We will explain the membership grades (MG's) related fermatean uncertainty collections as fermatean membership grades.

2.3 Theorem:[Senapati and Yager, 2019a] The collections of FMG's is higher than the set of Pythagorean membership grades (PMG's) and bi –fuzzy membership grades (BMG's).

Proof: This improvement can be evidently approved in the following figure.



Here we find that BMG's are all points beneath the line $x + y \leq 1$, the PMG's are all points with $x^2 + y^2 \leq 1$. We see that the BMG's enable the presentation of a bigger body of non-standard membership grades than BMG's and PMG's.

2.5 Definition :[**Moldtsov 1999**]Let 'U'is an initial Universe, P(U) isthe power set of U and E is the collection of all notations and A⊆E. A parameterized collections(δ_A, E) on the Universe 'U' is explained by the collections of order pairs (δ_A, E) = {(e, δ_A(e)): e ∈ E, δ_A∈P(U)}, where δ_A: E → P (U) such that δ_A(e) = ϕif e∉ A. Here δ_A is called atentative function of the parameterized collections.

2.6 Example: Let U = { v , v_2 , v_3 , v_4 } be a collection of of four pants and E={white(e_1),red(e_2),blue(e_3)}be a set of parameters. If A = {e_1,e_2}⊆E. Let $\delta_A(e_1)$= {v_1, v_2,v_3, v_4 } and δ_A (e_2)={ v_1 , v_2 , v_3 } then we write thesoft set (δ_A ,E)={(e_1 ,{ v_1 , v_2 , v_3 , v_4 }), (e_2,{v_1,v_2,v})} over 'U' which symbolized the "colour of the pants"whichMr.X is going to buy. This can be represented the soft set in the following format.

∑	e_1	e_2	e_3
v_1	1	1	0
v_2	1	1	0
v_3	1	1	0
v_4	1	0	0

2.7 Definition:[**Bipolar fermatean uncertainty soft set BPFFSS**] Let X is a collection of all elements. A bipolar fermatean uncertainty soft set (BPFFSS).F = {(a, m_F^P, n_F^P, m_F^N, n_F^N) / a ϵX} where m_F^P: X→ [0,1], n_F^P: X → [0,1], m_F^N: X → [0,1], m_F^N: X→ [0,1] are the mappings such that $0 \leq (m_F)^3 + (n_F)^3 \leq 1$ and $-1 \leq (m_F)^3 + (n_F)^3 \leq 0$ and m_F^p(a) denote the positive membership degree, n_F^p represent the positive non-membership degree, n_F^N(a) represent the negative membership degree, n_F^N(a) represents the negative non-membership degree. The degree of indeterminacy.

$\prod_F^P(a) = \sqrt[3]{1-\left(m_F{}^P(a)\right)^3-\left(n_F{}^P(a)\right)^3}$ and $\prod_F^N(x) = \sqrt[3]{1-\left(m_F{}^N(a)\right)^3-\left(n_F{}^N(a)\right)^3}$

2.8 Definition: Let $F_1 = \{(a, m_{F1}{}^P, n_{F1}{}^P, m_{F1}{}^N, n_{F1}{}^N) / x \epsilon X\}$ and $F_2 = \{(a, m_{F2}{}^P, n_{F2}{}^P, m_{F2}{}^N, n_{F2}{}^N)$ be BPFFS sets then,

(i) $F_1 U F_2 = \{(a, \max(m_{F1}{}^P, m_{F2}{}^P), \min(n_{F1}{}^P, n_{F2}{}^P), \min(m_{F1}{}^N, m_{F2}{}^N), \max(m_{F1}{}^N, m_{F2}{}^N / a \epsilon X\}$

(ii) $F_1 \cap F_2 = \{(a, \min(m_{F1}{}^P, m_{F2}{}^P), \max(n_{F1}{}^P, n_{F2}{}^P), \max(m_{F1}{}^N, m_{F2}{}^N), \min(m_{F1}{}^N, m_{F2}{}^N / a \epsilon X\}$

(iii) $F_1{}^C = \{(a, n_F{}^P, m_F{}^P, n_F{}^N, m_F{}^N / x \epsilon X\}$

(iv) $F_1 \subset F_2$ = iff $m_{F1}{}^P(a) \le m_{F2}{}^P(a)$, $n_{F1}{}^P(a) \ge n_{F2}{}^P(a)$, $m_{F1}{}^N(a) \ge m_{F2}{}^N(a)$, $n_{F1}{}^N(a) \le n_{F2}{}^N(a)$.

3. Ranking methods for Bipolar Fermatean fuzzy soft number

In this subsection, we define the score function, accuracy function and hybrid score accuracy function of a BFFSN and the ranking method for BFFSNS.

3.1Definition:[Score function and accuracy function]

Let x = <P(x), N(x)> be a BFSN. Then the score function and accuracy function of the BFSN can be presented respectively as follows.

Score function $S(x) = \frac{1+P(x)-N(x)}{2}$, for $S(x) \in [-1,1]$ → (1)

Accuracy function $h(x) = \frac{2+P(x)-N(x)}{3}$, for $h(x) \in [-1,1]$ → (2)

for the score function of a BFFSN ‘x’ if the positive membership p(x) is bigger and the negative membership N(x) is Lower, then the score value of BFSN is a greater for the accuracy function of a BFFSN ‘x’ if the sum of P(x) and 1 – N(x) is greater than the statement is more affirmative.That is the accuracy of the BFSN ‘x’ is higher.Based on score and accuracy functions for BFSNS, two theorems are stated below.

3.2Theorem: For any two BFFSNS x_1 and x_2 if $x_1 > x_2$, then $S(x_1) > S(x_2)$

3.3Theorem: For any two BFSNS x_1 and x_2 if $S(x_1) = S(x_2)$and $x_1 \ge x_2$, then$h(x_1) \ge h(x_2)$ Based on theorems 5.3.2 and 5.3.3, a ranking method between BFFSNS can be given by the following definition.

3.4Definition: Let x_1 and $x_2$is two BFFSNS hen the ranking method can be defined as follows. (i) if $S(x_1) > S(x_2)$, then $x_1 > x_2$, (ii) if $S(x_1) = S(x_2)$ and $h(x_1) \ge h(x_2)$, then $x_1 \ge x_2$.

3.5 Parameters of the term stated in the problem

(i) **Academic performance:** This implies the percentage of marks (if grades are given, transform it into marks) obtained in post graduate examinations.

(ii) **Teaching Aptitude:**Degree of knowledge in strategies of institution and information communication technology.

(iii) **Subject Knowledge:**Degree of knowledge of a person in his/her respective field of study to be delivered during his/her instruction.

(iv) **Research experience:**Research experience of a person implies his/her contribution of new knowledge in the form of publication is reputed peer reviewed journals with highly impact factor.

(v) **Leadership quality:**A leadership quality of a person to maintain and control the team members and giving effectiveness through their academic.

4. Proposed Topgrey analysis method: In this section we have presented a new method namely topgrey. This is the extension of the idea of new types of Grey Relation based on techniques of order preference by simplifying ideal solution (TOPSIS) for selection of best Assistant Professor recruitment and it appears to be more appropriate. Also we analyse the degree of grey relation among every professors and BFFαIS and BFFβIS iscalculated.In Grey Relational analysis, its coefficient $\xi-\left(R_{ij}\right)$ can be expressed as follows

$$\left(R_{ij}\right)=\xi=\frac{\Delta_{\min}+\rho\Delta_{\max}}{\Delta_{x_i(k)}+\rho\Delta_{\max}}\rightarrow \qquad (10)$$

Here ρ to be fixed value between 0 and 1.For simplicity of representation $\left|H^{\alpha}(j)-H_i(j)\right|$ and $\left|H^{\beta}(j)-H_i(j)\right|$ will be represented Δ_i^{α} and Δ_i^{β} respectively.After evaluating ξ of equation (10), separation measurements will be calculated according to the following formula

$$M_i^{\alpha}=\frac{1}{n}\sum_{j=1}^{n}R_{ij}^{\alpha}\ ,\ \ for\ \ i=1,2,3,............m.$$

$$M_i^{\beta}=\frac{1}{n}\sum_{j=1}^{n}R_{ij}^{\beta}\ ,\ \ for\ \ i=1,2,3,............m.$$

Now we will give the operations of proposed method. The main procedure of this method is presented in the following steps. In this section, bipolar fermatean fuzzy alpha ideal solutions denoted by the symbol (BFFαIS) and bipolar fermatean fuzzy beta ideal solutions denoted by the symbol (BFFβIS) for the convenience.

4.1 Topgrey relation algorithum:

Step 1: Let us choose the problem

Step 2: By choosing Linguistic Rooting values, from the weighted bipolar fermateanfuzzy parameter matrix D.

Step 3: Formweighted normalized bipolar fermatean fuzzy parameter matrix P and construct Weighted Vector $W = (w_1, w_2, w_3, ...w_n)$.

Step 4: Construct bipolar fermateanfuzzy decision matrices D_k for each decision makers and find bipolar fuzzy average decision matrix.

Step 5: Build of weighted bipolar fermatean fuzzy decision matrix R.

Step 6: Finding bipolar fuzzy valued α -ideal solution BFFαIS and bipolar fuzzy valued β -ideal solution BFFβIS.

step 7: Evaluating of the Measurement $\left(M_i^{\alpha}, M_i^{\beta}\right)$ for each parameter.

Step 8: Finding the relative closeness C_i^{α} of alternative to the ideal solution by using the formula $C_i^{\alpha} = \dfrac{M_i^{\alpha}}{M_i^{\alpha} + M_i^{\beta}}$.

Step 9:arrange the ranking preference order.

4.2 Numerical example: Suppose that chennaiAnnaUniversity is going to recruit in the post of Assistant Professors for a particular subject. After initial screening, five candidates (that is alternatives) A_1, A_2, A_3, A_4, A_5 remain for further evaluation.

A committee of four decision makers or exports D_1,D_2,D_3,D_4 has been formed to conduct the interview and select the most appropriate candidate, five criteria obtained from expert opinions, namely, Academic performance - (C_1), Subject knowledge - (C_2), Teaching aptitude - (C_3), Research Experience- (C_4), Leadership Quality- (C_5) are considered for recruitment criteria of four experts are required in the evaluation process, then the five possible alternatives A_i (i=1,2,3,.....5) are evaluated by the form of BFFSNS. Under the five attributes on the fuzzy concept **"Excellence"** thus the four bipolar fermateanvalued fuzzy soft decision matrices can be obtained from the four experts and expressed respectivelyasfollows(See table 1,2,3,4).

Table 1

Bipolar fermatean fuzzy soft decision matrix (D_1):

	C_1	C_2	C_3	C_4	C_5
A_1	[0.8, -0.4]	[0.6, -0.3]	[0.7, -0.2]	[0.5, -0.3]	[0.4, -0.3]
A_2	[0.8,-0.6]	[0.6, -0.5]	[0.7, -0.4]	[0.5, -0.2]	[0.4, -0.2]
A_3	[0.8, -0.3]	[0.6, -0.4]	[0.7, -0.1]	[0.5, -0.1]	[0.4, -0.1]
A_4	[0.8, -0.1]	[0.6, -0.2]	[0.7, -0.3]	[0.5, -0.4]	[0.4, -0.4]
A_5	[0.8, -0.2]	[0.6, -0.1]	[0.7, -0.1]	[0.5, -0.3]	[0.4, -0.3]

Table 2

Bipolar fermatean fuzzy soft decision matrix (D_2):

	C_1	C_2	C_3	C_4	C_5
A_1	[0.6, -0.4]	[0.7, -0.4]	[0.5, -0.3]	[0.4, -0.3]	[0.6, -0.5]
A_2	[0.6, -0.3]	[0.7, -0.5]	[0.5, -0.4]	[0.4, -0.2]	[0.6, -0.4]
A_3	[0.6, -0.2]	[0.7, -0.3]	[0.5, -0.3]	[0.4, -0.1]	[0.6, -0.3]
A_4	[0.6, -0.1]	[0.7, -0.1]	[0.5, -0.1]	[0.4, -0.2]	[0.6, -0.2]
A_5	[0.6, -0.1]	[0.7, -0.2]	[0.5, -0.2]	[0.4, -0.1]	[0.6, -0.1]

Table 3

Bipolar fermatean fuzzy soft decision matrix (D_3)

	C_1	C_2	C_3	C_4	C_5
A_1	[0.4, -0.2]	[0.5, -0.4]	[0.6, -0.5]	[0.7, -0.6]	[0.8, -0.5]
A_2	[0.4, -0.1]	[0.5, -0.3]	[0.6, -0.3]	[0.7, -0.5]	[0.8, -0.6]
A_3	[0.4, -0.3]	[0.5, -0.2]	[0.6, -0.2]	[0.7, -0.4]	[0.8, -0.5]
A_4	[0.4, -0.2]	[0.5, -0.1]	[0.6, -0.1]	[0.7, -0.3]	[0.8, -0.4]
A_5	[0.4, -0.1]	[0.5, -0.3]	[0.6, -0.5]	[0.7, -0.2]	[0.8, -0.3]

Table 4

Bipolar fermateanfuzzy soft decision matrix (D_4)

	C_1	C_2	C_3	C_4	C_5
A_1	[0.6, -0.5]	[0.7, -0.6]	[0.8, -0.6]	[0.5, -0.4]	[0.4, -0.1]
A_2	[0.6, -0.4]	[0.7, -0.5]	[0.8, -0.5]	[0.5, -0.3]	[0.4, -0.3]
A_3	[0.6, -0.3]	[0.7, -0.4]	[0.8, -0.6]	[0.5, -0.2]	[0.4, -0.2]
A_4	[0.6, -0.4]	[0.7, -0.3]	[0.8, -0.5]	[0.5, -0.1]	[0.4, -0.3]
A_5	[0.6, -0.5]	[0.7, -0.2]	[0.8, -0.4]	[0.5, -0.3]	[0.4, -0.1]

Table-5

Step 2: In this problem we have same Linguistic terms such as.

Linguistic term for Evaluation of parameter

Linguistic term	**Bipolar fermateanfuzzy values**
High(H)	[0.81 , - 0.4]
Very High(VH)	[0.90 , - 0.6]
Low(L)	[0.60 , - 0.3]
Very Low(VL)	[0.40 , - 0.2]
Medium(M)	[0.50 , - 0.4]

Table-6

Step 3: Construct a weighted bipolar fermateanfuzzy parameter matrix P is as follows:

$$P = \begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \end{array} \begin{array}{c} \begin{array}{ccccc} C_1 & C_2 & C_3 & C_4 & C_5 \end{array} \\ \begin{bmatrix} [0.6,-0.3] & [0.4,-0.2] & [0.9,-0.6] & [0.81,-0.4] & [0.5,-0.4] \\ [0.9,-0.6] & [0.81,-0.4] & [0.5,-0.4] & [0.6,-0.2] & [0.4,-0.2] \\ [0.5,-0.4] & [0.6,-0.3] & [0.81,-0.2] & [0.4,-0.2] & [0.9,-0.6] \\ [0.4,-0.2] & [0.9,-0.6] & [0.6,-0.3] & [0.5,-0.4] & [0.81,-0.4] \\ [0.81,-0.4] & [0.5,-0.4] & [0.4,-0.2] & [0.9,-0.6] & [0.6,-0.3] \end{bmatrix} \end{array}$$

And the weighted vector W= (0.4, -0.2, 0.41, -0.112, 0.51)

Step 4: Bipolar fermateanvalued fuzzy soft decision matrices D_1, D_2, D_3 and D_4 (Table) refer Sec(6) from the problem. The average weighted bipolar fermateanfuzzy decision matrix is given by

$$V = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} [0.6,-0.375] & [0.625,-0.425] & [0.65,-0.40] & [0.525,-0.40] & [0.55,-0.350] \\ [0.6,-0.350] & [0.625,-0.450] & [0.65,-0.40] & [0.525,-0.30] & [0.55,-0.375] \\ [0.6,-0.270] & [0.625,-0.325] & [0.65,-0.30] & [0.525,-0.20] & [0.55,-0.275] \\ [0.6,-0.200] & [0.625,-0.175] & [0.65,-0.25] & [0.525,-0.25] & [0.55,-0.325] \\ [0.6,-0.220] & [0.625,-0.200] & [0.65,-0.30] & [0.525,-0.225] & [0.55,-0.200] \end{bmatrix} \end{array}$$

Step 5: We construct Weighted Bipolar fermateanfuzzy decision matrix R as follows

$$R = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \\ \left[\begin{array}{ccccc} [0.13,-0.02] & [0.15,-0.06] & [0.21,-0.07] & [0.43,-0.02] & [0.41,-0.08] \\ [0.14,-0.03] & [0.22,-0.05] & [0.26,-0.03] & [0.31,-0.03] & [0.36,-0.07] \\ [0.15,-0.01] & [0.17,-0.07] & [0.16,-0.04] & [0.21,-0.07] & [0.39,-0.06] \\ [0.03,-0.05] & [0.21,-0.04] & [0.24,-0.06] & [0.11,-0.04] & [0.47,-0.05] \\ [0.12,-0.04] & [0.25,-0.03] & [0.22,-0.05] & [0.17,-0.05] & [0.29,-0.09] \end{array} \right] \end{array}$$

Step 6: Bipolarfermateanfuzzy valued α -ideal solution BFFαIS and bipolarfermateanfuzzy valued β -ideal solution BFFβIS is as follows

$$H^{\alpha} = H^{\alpha}(1) = 0.15, H^{\alpha}(2) = 0.25, H^{\alpha}(3) = 0.26, H^{\alpha}(4) = 0.43, H^{\alpha}(5) = 0.47,$$
$$H^{\beta}(1) = -0.03, H^{\beta}(2) = -0.03, H^{\beta}(3) = -0.03, H^{\beta}(4) = -0.02, H^{\beta}(5) = -0.05.$$

Construction as BFFαIS

(0.02,-0.03)	(0.1,-0.03)	(0.05,-0.04)	(0, 0)	(0.06,-0.03)
(0.01,-0.02)	(0.03,-0.02)	(0, 0)	(0.12,-0.01)	(0.11,-0.02)
(0, 0)	(0.08,-0.04)	(0.1,-0.01)	(0.22,-0.05)	(0.08,-0.01)
(0.12,-0.04)	(0.04,-0.01)	(0.02,-0.03)	(0.32,-0.02)	(0, 0)
(0.03,-0.03)	(0, 0)	(0.04,-0.02)	(0.26,-0.03)	(0.2,-0.04)

Step 7: The separation measurement individual measurement $\left(M_i^{\alpha}, M_i^{\beta}\right)$ for each parameter is obtained as follows. Grey Relation values of (GRV) each alternative to the α -ideal $I\left(H_{ij}{}^{\alpha}, H_i(j)\right)$ and β -ideal $I\left(H_{ij}{}^{\beta}, H_i(j)\right)$, $I\left(H^{\alpha}(j), H_i(j)\right)$, $I\left(H^{\beta}(j), H_i(j)\right)$ solution can be followed as below

$l = GLB\ \Delta_i^{\alpha}$, $m = GLB\ \Delta_i^{\beta}$, $L = LUB\ \Delta_i^{\alpha}$, $M = LUB\ \Delta_i^{\beta}$ $l^* = GLB\left\{ GLB\ \Delta_i^{\alpha} \right\}$ $m^* = GLB\left\{ GLB\ \Delta_i^{\beta} \right\}, L^* = LUB\left\{ LUB\ \Delta_i^{\alpha} \right\}, M^* = LUB\left\{ LUB\ \Delta_i^{\beta} \right\}$ Also grey Relational coefficient R_{ij} is obtained by equation (1)

$$R_{ij} = \frac{\Delta_{\min} + \rho \Delta_{\max}}{\Delta_{x_i(k)} + \rho \Delta_{\max}}$$

By choosing ρ =0.5, we have

	C_1	C_2	C_3	C_4	C_5	l	L
A_1	0.75	0.333	0.5	1	0.478	**0.333**	1
A_2	0.857	0.666	1	0.571	0.352	**0.352**	1
A_3	1	0.578	0.523	0.421	0.578	**0.421**	1
A_4	0.571	0.8	0.88	0.33	1	**0.33**	1
A_5	0.812	1	0.764	0.38	0.393	**0.38**	1
l^*						**0.33**	
L^*							1

Also we have the ideal solution is calculated as

Table calculation (2)

	C_1	C_2	C_3	C_4	C_5
A_1	0.01	0.4	0.3	1	0.66
A_2	0.5	0.5	1	0.714	0.453
A_3	1	0.384	0.66	0.33	0.714
A_4	0.33	0.66	0.4	0.55	1
A_5	0.4	1	0.5	0.454	0.33

After calculative, equation (1) separation measurements M_i^{α} and M_i^{β} will be calculated from the i^{th} requirement, $(i=1,2,3,4,5)$.

$M_1^{\alpha}=0.6116$, $M_2^{\alpha}=0.6890$, $M_3^{\alpha}=0.6200$, $M_4^{\alpha}=0.7160$, $M_5^{\alpha}=0.6690$

$M_1^{\beta}=0.480$, $M_2^{\beta}=0.633$, , $M_4^{\beta}=0.588$, $M_5^{\beta}=0.536$

Step 8: Now we calculate according to relative closeness C_i^{α} formula

$$C_i^{\alpha}=\frac{M_i^{\alpha}}{M_i^{\alpha}+M_i^{\beta}}$$

$C_1^{\alpha} = 0.56002,\ C_2^{\alpha} = 0.5211,\ C_3^{\alpha} = 0.5012,\ C_4^{\alpha} = 0.549,\ C_5^{\alpha} = 0.555.$

Step 9:Ranking alternative: Arrange the ranking reference order from step (8) is given by

$$C_1^{\alpha} > C_5^{\alpha} > C_4^{\alpha} > C_2^{\alpha} > C_3^{\alpha}$$
$$A_1 > A_5 > A_4 > A_3 > A_2$$

Hence A_1 is the best Assistant Professor using TOPGREY Analysis method comparing these two algorithms, we have come to one conclusion, both algorithm, gives the same solution.

Conclusion:we employ the scope and accuracy function, hybrid score accuracy functions of BFFSNS to recruit best professor for higher education, under bipolar fermateanfuzzy soft Environment, where the weights of decision makers are completely unknown and the weights of attributes are incompletely known. Also comparatively algorithm has to be verified with the help of TOPGREY analysis and obtain the best way of selecting professors.

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References

[1]. S.Abdullah,M.Aslam and K.Ullah,Bipolar fuzzy soft sets and its application in decision making problem journal of intelligent and fuzzy systems 27(2),(2014) 729-742.

[2].K.T.Atanasav., "Intuitionistic fuzzy set", Fuzzy sets and Systems, 35 (1986), 87-96.

[3].K.Balamurugan and R.Nagarajan ,fermatean fuzzy implicative p-ideal structure in ku-algebra's, Neuro Quantology, vol.20, No.10 (2022),PP 2587-2597.

[4]. K.Balamurugan and R.Nagarajan some algebraic attributes of (3,2)-uncertainty group structures, Positif Journal,vol.22, No.9 (2022), PP 154-165.

[5]P.Bosc,O.Pivert, on a fuzzy by polar relational algebra,Information sciences,219 (2013),1-16.

[6]J.Chen, S.Liu, Ma and X.Wong, m-polar fuzzy sets, An extension of Bipolar fuzzy sets, the scientific world journal (2014).

[7]M.Dagdeviren, A hybrid multi criteria decision making model for personnel selection in manufacturing system. Journal of intelligent manufacturing, 21 (2010), 451 -460.

[8]Z.Gunor, G.Serhadliongu and S.E.Kesen, A fuzzy Attribute approach to personnel selection problem, Applied soft computing, 9 (2009), 641-646.

[9]E.E. Karsak, personnel selection using a fuzzy MCDM approach based on ideal and anti-ideal solutions, lecture notes in Economics and Mathematical systems, 507 (2001), 393-402.

[10]K. M. Lee, Bipolar-valued fuzzy sets and their operations ,Proc. Int. Conf. on Intelligent Technologies, Bangkok, Thailand, pp.307-312, 2000.

[11]. S.V.Manemaran and R.Nagarajan, "Novel Cubic Fermatean fuzzy soft ideal structures", International Journal of innovative Technology and Exploring Engineering, Vol.9, No.2(2019), 4915-4920.

[12] K.Balamurugan and R.Nagarajan,"Fermatean fuzzy P-implicative ideals in KU-algebra's" , Neuroquantology,vol.20, No.10(2022), pp 2587-2597.

[13] K.Balamurugan and R.Nagarajan,"Applications of cube root fuzzy sets in Decision making approach" European journal of Molecular & Clinical Medicine" Vol.10, N0.1(2023),3546-3558.

[14].Maji, P.K., Biswas, R. and Roy, A.R. (2003). "Soft set theory". Computers and Mathematics with Applications, 45: 555-562.

[15].Molodtsov, D. (1999). "Soft set Theory-First results", Computers and Mathematics with Applications, 37: 19-31. berg, 2005.

[16] I.T. Robinson and B.Smith personnel selection, journal of Occupational and organizational, psychology, 74 (2001), 441-472.

[17].Senapati, T., Yager, R.R. (2019a). "Fermatean Fuzzy Sets", Communicated.

[18].Senapati, T., Yager, R.R. (2019b), " Fermatean Fuzzy Weighted Averaging/Geometric Operators and Its Application in Multi-Criteria Decision-Making Methods", Communicated.

[19]. A.Zadeh., " Fuzzy sets", Information and control 8 (1965).338-353.

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