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An Arithmetic Mean of FSM in Making Decision

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Abstract : This paper is to forward the notion of FSM. We use fuzzy soft matrix as to take decision in the rainfall level for five years. So many functions are expanded in the fuzzy soft matrices. Here we conclude the arithmetic mean of fuzzy soft matrices in decision making.

Keywords: Fuzzy soft matrices, Decision making, Rainfall level, Arithmetic mean.

I. INDTRODUCTION

In 2003, Maji et al [1] studied the theory of soft sets initiated by Molodtsov, who was introduced in 1999 [2] the new approaches of soft sets. By the follow of Molodtsov, Maji has developed so many basic notions of soft sets. Let Pei and Miao [3] and chen et al [4] in 2005 improved the fuzzy soft set theory of Maji et al [1]. Maji defined the operations of the soft set, then he described the study on soft set. Fuzzy soft set theory of application in decision making where introduced by cagman et al [5,6]. In this paper we use Arithmetic Mean function of fuzzy soft set theory to take decision in the rainfall level. Rainfall is one of the factors for the crop cultivation. Under the rainfed rice culture, rainfall is the most necessary limiting factor. Here we take rainfall level in based upon the three types of rice cultivation seasons (ie) Kuruvai, Samba, Thaladi.

II. DEFINITIONS

A.Fuzzy Set

Let Y be a space points, with a generic element of Y denoted by y, Thus Y = {y}. A fuzzy set A in Y is characterized as a membership function fA(y) which is associates with every point in Y as a real numbers between [0,1] is the values of fA(y) at y representing the grade of membership of y in A. Thus the nearer value of fA(y) is to unity, the higher grade of membership of y in A.

B.Soft Set

In 1999, Molodtsov was introduced soft set theory. It is a generalization of fuzzy set theory and he has described the uncertainty in a non parametric manner. A soft set is defined as, if y is a universal set and E is a set of parameters of pairs (f,A) where A is a set and f is a function then f(e) is a subset of Y where the element e of the set A for each e of the set f(e) is known as the value set of e in (f,A)

C.Fuzzy Soft Set

Let p (U) is denotes the set of all fuzzy sets of U. Let $A_i \subseteq E$. Then the pair of (F_i,A_i) is called a fuzzy soft set over U, the mapping of F_i is $F_i : A_i \rightarrow p(U)$

D.Universal Fuzzy Soft Matrix

Let [cij] ϵ FSMm*n. Then [cij] is known as Universal fuzzy soft matrix and it is denoted by [2], if c_{ij}=1for all i and j.

E.Arithmetic Mean Of Fuzzy Soft Matrix

Let $\tilde{A} = [c_{ij}] \epsilon FSM_{m*n}$. The AM of FSM of membership value denoted by $\tilde{A}_{AM}$ is defined as

$$\tilde{A}_{AM} = \frac{\sum_{j=1}^{n} \mu_{ij}^{\tilde{A}}}{n}$$

F.Fuzzy Soft Matrix

Let U be an initial universe p(U) be the power set of U,E be the set of all parameters and Y be the fuzzy set over E with the membership function,

$$\mu_y : E \rightarrow [0, 1]$$

Then f_{ps}-set F_y over U is a set defined by a function f_y representing a mapping F_y: E→ P (U), Such that $f_y(y) = \varphi$, if $\mu_y(y) = 0$

Here, f_y is called an approximate function of the f_{ps} set and the value of fy(y) is the set called Y elements of f_{ps} set for all y ϵ E.

Thus fps set F_y over U represented by the set of ordered pairs

$$F_y = \{(\mu_y(y) / y, f_y(y)): Y \epsilon E, f_y(y) \epsilon P(U) \mu_y(y) \epsilon [0, 1]\}$$

Let (f_n,E) be the fuzzy soft set over U, then U ={ $u_1,u_2,\ldots,u_m$} and E={$e_1,e_2,\ldots\ldots e_n$}∀ u_i ϵ U, , ∀ ei ϵ E, there exist the membership degree $c_{ij} = f_{ej}(u_i)$.

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Then we write the membership degrees in a table as

	e_1 e_2…… e_n
u_1	c_{11} c_{12} ……c_{1n}
u_2	c_{21} c_{22} ……c_{2n}
	……
	……
u_m	c_{m1} c_{m2} ……..c_{mn}

Then the fuzzy soft matrix of (f_n,E) over U be as,

$$\tilde{A}_{m*n} = [c_{ij}]_{m*n} = \begin{pmatrix} c_{11}, c_{12} \ldots\ldots\ldots\ldots c_{1n} \\ c_{21}, c_{22} \ldots\ldots\ldots\ldots c_{2n} \\ \ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots \\ c_{m1}, c_{m2} \ldots\ldots\ldots\ldots\ldots c_{mn} \end{pmatrix}$$

Where i=1, 2, 3…..… m, j=1, 2, 3……. n

$$c_{ij} = \begin{cases} \mu_j(a_i) & \text{if } e_j \in A \\ 0, & \text{if } e_j \notin A \end{cases}$$

Here $\mu_j(a_i)$ as the membership of a_i in the fuzzy set $F(e_j)$ We identify a fuzzy soft set with its FSM and we use these two concepts interchangeable. The set of all m*n fuzzy soft matrices over U would be denoted by FSM_{m*n}

III. RAINFALL REQUIREMENT

The water requirement of the rice cultivation is 1240 mm. The growth of the rice plant is depends on water irrigation. Water irrigation is provided for the growth and the yields are declared by the temperature and the solar radiation. Rice cultivation is under rainfed, rainfall is the most necessary liming factor for rice cultivation.The rainfall requirement for the five years of Kuruvai, Samba, Thaladi seasons are given as below in the figure.

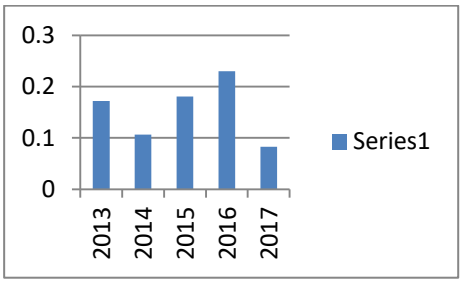

Fig:1 The Kuruvai season rainfall requirement for five years

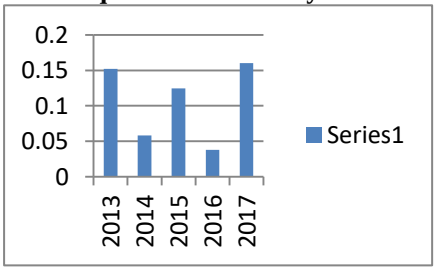

Fig:2 The Samba season rainfall requirement for five years.

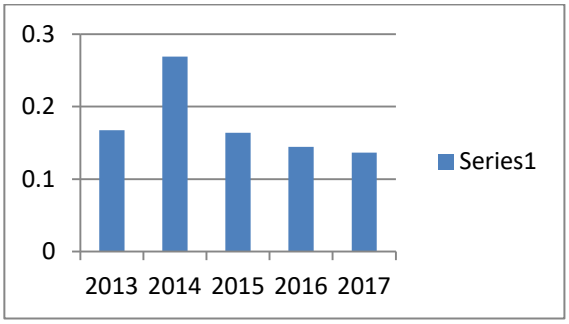

Fig:3 The Thaladi season rainfall requirement for five years.

IV. ALGORITHM

Step: 1

Take the set of parameters U= $\{u_1, u_2, \ldots u_n\}$ and E = $\{e_1, e_2, \ldots\ldots e_n\}$ for (f_n,E) over U,

Step: 2

Form the FSM $[c_{ij}]_{m*n}$ for the set of parameters, whose membership degree are $c_{ij} = f_{ej}(u_i)$

Step: 3

Find R_K, R_S and R_T for the FSM_{m*n} .

Step: 4

Compute the $\tilde{A}_{AM} = \frac{\sum_{j=1}^{n} \mu_{ij}^{\tilde{A}}}{n}$

Step: 5

Find the decision which has highest membership value.

V. FUZZY SOFT MATRICS IN DECISION MAKING

Fuzzy soft matrices are used to Analysis the rainfall level for five years. The five years rainfall level is compute for three types of season cultivation. We take matrices A, B and C is similar to Kuruvai, Samba, Thaladi cultivation

Step: 1

$$A = \begin{pmatrix} 0.147 & 0.113 & 0.71 & 0.119 & 0.63 \\ 0.116 & 0.44 & 0.219 & 0.182 & 0.109 \\ 0.82 & 0.29 & 0.145 & 0.324 & 0.226 \\ 0.109 & 0.40 & 0.92 & 0.49 & 0.38 \\ 0.253 & 0.124 & 0.125 & 0.214 & 0.110 \end{pmatrix}$$

$$B = \begin{pmatrix} 0.63 & 0.14 & 0.12 & 0.53 & 0.1 \\ 0.109 & 0.3 & 0.057 & 0.11 & 0.009 \\ 0.226 & 0.26 & 0.0 & 0.10 & 0.66 \\ 0.38 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.110 & 0.94 & 0.2 & 0.28 & 0.070 \end{pmatrix}$$

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$$C = \begin{pmatrix} 0.18 & 0.30 & 0.11 & 0.147 & 0.113 \\ 0.140 & 0.9 & 0.51 & 0.116 & 0.44 \\ 0.97 & 0.30 & 0.41 & 0.82 & 0.29 \\ 0.115 & 0.52 & 0.42 & 0.109 & 0.40 \\ 0.27 & 0.67 & 0.19 & 0.253 & 0.124 \end{pmatrix}$$

step :2

$$[c_{ij}] = \begin{pmatrix} 0.147 & 0.113 & 0.71 & 0.119 & 0.63 \\ 0.116 & 0.44 & 0.219 & 0.182 & 0.109 \\ 0.82 & 0.29 & 0.145 & 0.324 & 0.226 \\ 0.109 & 0.40 & 0.92 & 0.49 & 0.38 \\ 0.253 & 0.124 & 0.125 & 0.214 & 0.110 \end{pmatrix}$$

$$R_K = \begin{pmatrix} 0.513 \\ 0.670 \\ 0.806 \\ 0.328 \\ 0.826 \end{pmatrix}$$

$$A_{AM}(R_K) = \begin{pmatrix} 0.1026 \\ 0.134 \\ 0.1612 \\ 0.0656 \\ 0.1652 \end{pmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$[d_{ij}] = \begin{pmatrix} 0.63 & 0.14 & 0.12 & 0.53 & 0.1 \\ 0.109 & 0.3 & 0.057 & 0.11 & 0.009 \\ 0.226 & 0.26 & 0.0 & 0.10 & 0.66 \\ 0.38 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.110 & 0.94 & 0.2 & 0.28 & 0.070 \end{pmatrix}$$

$$R_S = \begin{pmatrix} 0.143 \\ 0.189 \\ 0.328 \\ 0.38 \\ 0.304 \end{pmatrix}$$

$$B_{AM}(R_S) = \begin{pmatrix} 0.0286 \\ 0.0378 \\ 0.0656 \\ 0.076 \\ 0.0608 \end{pmatrix} \quad \ldots\ldots\ldots..\ldots\ldots\ldots\ldots (2)$$

$$[e_{ij}] = \begin{pmatrix} 0.18 & 0.30 & 0.11 & 0.147 & 0.113 \\ 0.140 & 0.9 & 0.51 & 0.116 & 0.44 \\ 0.97 & 0.30 & 0.41 & 0.82 & 0.29 \\ 0.115 & 0.52 & 0.42 & 0.109 & 0.40 \\ 0.27 & 0.67 & 0.19 & 0.253 & 0.124 \end{pmatrix}$$

$$R_S = \begin{pmatrix} \\ \\ \\ 0.360 \\ 0.279 \\ 0.358 \\ 0.490 \end{pmatrix} \quad 0.319$$

$$B_{AM}(R_S) = \begin{pmatrix} 0.0638 \\ 0.072 \\ 0.0558 \\ 0.0716 \\ 0.098 \end{pmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Thus, we get the result 1,2,3 in the above matrix the maximum Rainfall requirement of Kuruvai, Samba, Thaladi. The decision is made depend upon on highest membership value of each season. Hence the maximum rainfall requirement of Kuruvai season R_k secured in the year 2017, for Samba season R_s in the year 2015, for Thaladi season in the year 2016.

VI. CONCLUSION

In this paper, the Arithmetic mean of fuzzy soft matrices is to take decision for the five year rainfall requirement. The maximum rainfall requirement is secured in the year 2017 for Kuruvai, in the year 2015 for Samba and in the year 2016 for Thaladi. The future work is regard to the three season cultivation for above five years which years is to be requiring the maximum Achievements.

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