An Arithmetic Mean of FSM in Making Decision

T. Geetha, S. Anitha Raj

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. INTRODUCTION

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. [47], Thanjavur, India Advisor, Department of Mathematics, K.N,Govt,Arts College for Women (Autonomous), Thanjavur, India

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Dr. T. Geetha M.Sc., M.Phil., Ph.D., Assistant Professor, Research Advisor, Department of Mathematics, K.N., Govt., Arts College for Women (Autonomous), Thanjavur, India
S. Anitha Raj M.Sc., B.Ed., M.Phil K.N., Govt., Arts College for Women (Autonomous), Thanjavur, India

D. Universal Fuzzy Soft Matrix

Let \([cij] \in \text{FSM}_{m \times n}\). Then \([cij]\) is known as Universal fuzzy soft matrix and it is denoted by \([2]\), if \(c_{ij}=1\) for all \(i\) and \(j\).

E. Arithmetic Mean Of Fuzzy Soft Matrix

Let \(\tilde{A} = \{c_{ij} \in \text{FSM}_{m \times n}\}. \) The AM of FSM of membership value denoted by \(\tilde{A}_{AM}\) is defined as

\[
\tilde{A}_{AM} = \frac{\sum_{i=1}^{n} \mu_{i}^{h}}{n}
\]

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 soft set over \(E\) with the membership function,

\[
\mu_{y}: E \rightarrow [0, 1]
\]

Then \(f_{ps}\)-set \(F_{ps}\) over \(U\) is a set defined by a function \(f_{y}\) representing a mapping \(F_{y}: E \rightarrow p(U)\), Such that \(f_{ps}(y) = \varnothing\) if \(\mu_{y}(y) = 0\).

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

Thus \(f_{ps}\) set \(F_{y}\) over \(U\) represented by the set of ordered pairs

\[
F_{y} = \{(\mu_{y}(y) / y, f_{ps}(y)): Y \in E, f_{y}(y) \in p(U) \mu_{y}(y) \in [0, 1]\}
\]

Let \((f_{ps}, E)\) be the fuzzy soft set over \(U\), then \(U = \{u_{1}, u_{2}, \ldots, u_{n}\}\) and \(E = \{c_{1}, c_{2}, \ldots, c_{m}\}\) \(\forall u_{i} \in U\), \(\forall c_{j} \in E\), there exist the membership degree \(c_{ij} = f_{ps}(u_{i})\).

Then we write the membership degrees in a table as

| \(u_{1}\) | \(c_{11}\) | \(c_{12}\) | \(\ldots\) | \(c_{1n}\) |
| \(u_{2}\) | \(c_{21}\) | \(c_{22}\) | \(\ldots\) | \(c_{2n}\) |
| \(\ldots\) | \(\ldots\) | \(\ldots\) | \(\ldots\) | \(\ldots\) |
| \(u_{m}\) | \(c_{m1}\) | \(c_{m2}\) | \(\ldots\) | \(c_{mn}\) |

Then the fuzzy soft matrix of \((f_{ps}, E)\) over \(U\) be as,
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\[ \hat{A}_{m \times n} = [c_{ij}]_{m \times n} = \begin{pmatrix} 
 c_{11}, c_{12}, \ldots, c_{1n} \\
 c_{21}, c_{22}, \ldots, c_{2n} \\
 \vdots \\
 c_{m1}, c_{m2}, \ldots, c_{mn} 
\end{pmatrix} \]

Where \( i = 1, 2, 3 \ldots \), \( j = 1, 2, 3 \ldots, n \)

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

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 \( m \times n \) fuzzy soft matrices over \( U \) would be denoted by \( \text{FSM}_{m \times n} \)

**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](image1.jpg)

![Fig:2 The Samba season rainfall requirement for five years](image2.jpg)

![Fig:3 The Thaladi season rainfall requirement for five years.](image3.jpg)

**IV. ALGORITHM**

**Step: 1**

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

**Step: 2**

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

**Step: 3**

Find \( R_K, R_S \) and \( R_T \) for the FSM \( m \times n \).

**Step: 4**

Compute the \( \hat{A}_{AM} = \frac{\sum_{j=1}^{n} R_j}{n} \)

**Step: 5**

Find the decision which has highest membership value.

**V. FUZZY SOFT MATRICES 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**

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

**Step: 2**

\[
B = \begin{pmatrix}
0.63 & 0.14 & 0.12 & 0.53 & 0.1 \\
0.109 & 0.3 & 0.057 & 0.11 & 0.009 \\
0.226 & 0.26 & 0.0 & 0.10 & 0.66 \\
0.38 & 0.0 & 0.0 & 0.0 & 0.0 \\
0.110 & 0.94 & 0.02 & 0.28 & 0.070 
\end{pmatrix}
\]

**Step: 3**

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

**Step: 4**

\[
[c_{ij}] = \begin{pmatrix}
0.147 & 0.113 & 0.71 & 0.119 & 0.63 \\
0.116 & 0.44 & 0.219 & 0.182 & 0.109 \\
0.82 & 0.29 & 0.145 & 0.324 & 0.226 \\
0.109 & 0.40 & 0.92 & 0.49 & 0.38 \\
0.253 & 0.124 & 0.125 & 0.214 & 0.110 
\end{pmatrix}
\]
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\[
R_K = \begin{pmatrix}
0.513 \\
0.670 \\
0.806 \\
0.328 \\
0.826
\end{pmatrix}
\]

\[
A_{AM}(R_K) = \begin{pmatrix}
0.1026 \\
0.134 \\
0.1612 \\
0.0656 \\
0.1652
\end{pmatrix}
\]

\[
R_S = \begin{pmatrix}
0.63 \\
0.14 \\
0.12 \\
0.53 \\
0.1
\end{pmatrix}
\]

\[
[d_i] = \begin{pmatrix}
0.109 \\
0.3 \\
0.057 \\
0.11 \\
0.009
\end{pmatrix}
\]

\[
R_S = \begin{pmatrix}
0.109 \\
0.226 \\
0.38 \\
0.110 \\
0.0656
\end{pmatrix}
\]

\[
B_{AM}(R_K) = \begin{pmatrix}
0.143 \\
0.189 \\
0.328 \\
0.38 \\
0.304
\end{pmatrix}
\]

\[
[d_i] = \begin{pmatrix}
0.109 \\
0.226 \\
0.38 \\
0.110 \\
0.0656
\end{pmatrix}
\]

\[
R_S = \begin{pmatrix}
0.0286 \\
0.0378 \\
0.0656 \\
0.076 \\
0.0608
\end{pmatrix}
\]

\[
B_{AM}(R_S) = \begin{pmatrix}
0.18 \\
0.30 \\
0.11 \\
0.147 \\
0.113
\end{pmatrix}
\]

\[
[e_i] = \begin{pmatrix}
0.140 \\
0.9 \\
0.51 \\
0.116 \\
0.44
\end{pmatrix}
\]

\[
R_S = \begin{pmatrix}
0.319 \\
0.360 \\
0.279 \\
0.358 \\
0.490
\end{pmatrix}
\]

\[
B_{AM}(R_S) = \begin{pmatrix}
0.0638 \\
0.072 \\
0.0558 \\
0.0716 \\
0.098
\end{pmatrix}
\]

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.

REFERENCES


AUTHORS PROFILE

Dr.T.GEETHA M.Sc.,M.Phil.,Ph.D
Assistant Professor, Research Department of Mathematics, 70 papers are published, Research work held in mathematical modeling.

S.ANITHA RAJ, M.Sc.,B.Ed.,M.Phil Research scholar of K.N.Govt,Arts College for Women (Autonomous), Thanjavur,