



# Finding reason for school dropouts using repeated average method on fuzzy soft sets

R. Sophia Porchelvi<sup>1</sup>, C. Dorathy<sup>2\*</sup> and B. Snekaa<sup>3</sup>

## Abstract

In this paper, we have found out the major reason for school drop outs and the stage at which there are maximum number of drop outs. For finding these things we have used, repeated average method and relativity function.

## Keywords

Repeated average method, Relativity function, Comparison matrix, School drop outs.

## AMS Subject Classification

03E72.

<sup>1,2,3</sup>Department of Mathematics, A.D.M. College for Women (Autonomous) (Affiliated to Bharathidasan University), Nagapattinam-611001, Tamil Nadu, India.

\*Corresponding author: <sup>2</sup> [dorathy1995tvr@gmail.com](mailto:dorathy1995tvr@gmail.com)

Article History: Received 14 April 2020; Accepted 29 September 2020

©2020 MJM.

## Contents

1	Introduction .....	1547
2	Methods .....	1547
2.1	Relativity Function and Comparison Matrix .	1547
2.2	Repeated Average Method . . . . .	1547
2.3	Proposed Algorithms . . . . .	1548
3	Illustration .....	1548
4	Conclusion .....	1550
	References .....	1550

## 1. Introduction

Decision making is an act to choose correct option between two or more choices. Sometimes decision making will be like problem solving activity. There are many techniques to improve decision making process or activity and quality of decisions. Fuzzy plays a vital role in decision making process [5]. Individual decision making, Multi person decision making, Multi criteria decision making, Multi stage decision making are different methods in fuzzy for decision making. Sanchez's approach of medical diagnosis is one of the best methods to solve real life problems. Many problems were solved using Sanchez's approach of medical diagnosis by many researchers.

Relativity function introduced by Shimura in [4] was used by many researchers in their research, for medical diagnosis for decision making and all. And the repeated average method

introduced by Hasan et al., [2,3] helps the researchers to solve fuzzy soft matrices easily.

## 2. Methods

### 2.1 Relativity Function and Comparison Matrix

Let  $x$  and  $y$  be variables defined on a set  $X$ , the relativity function denoted as  $f(x/y)$  is defined as,

$$f(x/y) = \frac{f_y(x)}{\max [f_y(x), f_x(y)]}, \quad (2.1)$$

where the memberships function of  $x$  with respect to  $y$  be  $f_y(x)$  and  $f_x(y)$  be the membership function of  $y$  with respect to  $x$ . The relativity function is a measurement of the membership value of preferring (or) choosing  $x$  over  $y$ . The relativity function  $f(x/y)$  can be regarded as the membership of preferring variable  $x$  over the variable  $y$ . Also Equation (2.1) can be extended for many variables.

Let  $A = \{x_1, x_2, \dots, x_i, x_{i-1}, x_{i+1} \dots x_n\}$  be the set of  $n$  variables defined on universe  $X$ . From a matrix of relativity values  $f(x_i/x_j)$  where  $x_i$ 's for  $i = 1$  to  $n$ , are  $n$  variables defined on an universe  $X$ . The matrix  $C = C_{ij}$  a square matrix of order  $n$  with  $C_{ij} = f(x_i/x_j)$  is called the comparison matrix (or)  $C$ -matrix.

### 2.2 Repeated Average Method

The repeated average method was introduced by Hasan, et.al., [2], which is an easy and reliable method for the problems

related to decision making, and the method is given below,

**Step 1.** Construct the fuzzy soft matrix for each expert (called Expert Fuzzy Soft Matrix).

Let  $A_s = [a_{ij}] \in FSM_{m \times n}$  are fuzzy soft matrices with  $m$  objects, each of which has  $n$  parameters, where  $s = 1, 2, 3, \dots, k$  and  $i = 1, 2, 3, \dots, n$  and for all  $a_{ij} \in [0, 1], \forall i, j$ . Then fuzzy soft matrix for each expert is constructed as follow,

$$A_1 = \begin{pmatrix} a_{11}^1 & a_{12}^1 & \dots & a_{1n}^1 \\ a_{21}^1 & a_{22}^1 & \dots & a_{2n}^1 \\ \vdots & \vdots & \dots & \vdots \\ a_{m1}^1 & a_{m2}^1 & \dots & a_{mn}^1 \end{pmatrix}, A_2 = \begin{pmatrix} a_{11}^2 & a_{12}^2 & \dots & a_{1n}^2 \\ a_{21}^2 & a_{22}^2 & \dots & a_{2n}^2 \\ \vdots & \vdots & \dots & \vdots \\ a_{m1}^2 & a_{m2}^2 & \dots & a_{mn}^2 \end{pmatrix}$$

$$\dots \quad A_k = \begin{pmatrix} a_{11}^k & a_{12}^k & \dots & a_{1n}^k \\ a_{21}^k & a_{22}^k & \dots & a_{2n}^k \\ \vdots & \vdots & \dots & \vdots \\ a_{m1}^k & a_{m2}^k & \dots & a_{mn}^k \end{pmatrix}$$

**Step 2.** Compute the mean of each Expert Fuzzy Soft Matrix. The mean of each Expert Fuzzy Soft Matrix for above constructed Expert Fuzzy Soft Matrix is given as follows,

$$\overline{A_1} = \begin{pmatrix} \frac{\sum_{j=1}^n a_{1j}^1}{n} \\ \frac{\sum_{j=1}^n a_{2j}^1}{n} \\ \vdots \\ \frac{\sum_{j=1}^n a_{mj}^1}{n} \end{pmatrix}, \overline{A_2} = \begin{pmatrix} \frac{\sum_{j=1}^n a_{1j}^2}{n} \\ \frac{\sum_{j=1}^n a_{2j}^2}{n} \\ \vdots \\ \frac{\sum_{j=1}^n a_{mj}^2}{n} \end{pmatrix}, \dots, \overline{A_k} = \begin{pmatrix} \frac{\sum_{j=1}^n a_{1j}^k}{n} \\ \frac{\sum_{j=1}^n a_{2j}^k}{n} \\ \vdots \\ \frac{\sum_{j=1}^n a_{mj}^k}{n} \end{pmatrix}$$

**Step 3.** Computer the mean of all expert’s scores from the mean score Fuzzy Soft Matrix.

$$\frac{1}{k} \sum_{s=1}^k \overline{A_s} = \begin{pmatrix} \frac{\frac{\sum_{j=1}^n a_{1j}^1}{n} + \frac{\sum_{j=1}^n a_{1j}^2}{n} + \dots + \frac{\sum_{j=1}^n a_{1j}^k}{n}}{k} \\ \frac{\frac{\sum_{j=1}^n a_{2j}^1}{n} + \frac{\sum_{j=1}^n a_{2j}^2}{n} + \dots + \frac{\sum_{j=1}^n a_{2j}^k}{n}}{k} \\ \vdots \\ \frac{\frac{\sum_{j=1}^n a_{mj}^1}{n} + \frac{\sum_{j=1}^n a_{mj}^2}{n} + \dots + \frac{\sum_{j=1}^n a_{mj}^k}{n}}{k} \end{pmatrix}$$

**Step 4.** Pick up the maximum score and select the most efficient and trustable object (Candidate or product).

**Step 5.** If ties arise, fuzzy coefficient of variation might be applied for selecting the best object (Use the data from the mean score fuzzy soft matrix). For standard

$$\text{deviation, } \sigma = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum X}{N}\right)^2}$$

And for coefficient of variation,

$$\text{Coefficient of variation} = \frac{\sigma}{\text{Mean}} \times 100.$$

### 2.3 Proposed Algorithms

#### Algorithm: 1

**Step 1.** Construct a fuzzy pair wise comparison soft matrix using criteria.

**Step 2.** Use relativity function on the fuzzy pair wise comparison soft matrix.

**Step 3.** The values obtained from step 2 are the weight of each criterion. (The Criterion with maximum weight will be the main factor or reason for the problem we construct pair wise comparison fuzzy soft matrix.). Mention it as  $W$ .

**Step 4.** Construct the fuzzy soft matrix for each expert using criteria and alternatives.

**Step 5.** Find the average for all the fuzzy soft matrix formulated with the opinion of experts.

**Step 6.** Multiply the weight  $W$  we got from step 3 with the fuzzy soft matrix of step 5. Name the resulting matrix as  $K$ .

**Step 7.** Compute the mean for the matrix  $K$ .

**Step 8.** Pick up the maximum score and select that as the answer for our problem.

**Step 9.** If tie arises fuzzy coefficient of variation might be applied for selecting the best option/object. Use the data from the mean score fuzzy comparison soft matrix.

#### Algorithm: 2

In this with repeated average method we combined an algorithm used by Krishna Gogoi (2014)[1] and the algorithm is given below,

**Step 1.** Construct a fuzzy pair wise comparison soft matrix using criteria.

**Step 2.** Use relativity function on the fuzzy pair wise comparison soft matrix.

**Step 3.** The values obtained from step 2 are the weight of each criterion. (The Criterion with maximum weight will be the main factor or reason for the problem we construct pair wise comparison fuzzy soft matrix.). Mention it as  $W$ .

**Step 4.** Construct the fuzzy soft matrix for each expert using criteria and alternatives.

**Step 5.** Find the average for the entire fuzzy soft matrix formulated with the opinion of experts.

**Step 6.** Multiply the weight  $W$  we got from step 3 with the fuzzy soft matrix of step 5. Name the resulting matrix as  $K$ .

**Step 7.** Formulate the comparison table.

**Step 8.** Find the row-sum and column sum of the comparison table and find their difference.

**Step 9.** Pick up the maximum score and select that as the answer for our problem.

### 3. Illustration

In recent years there have been many dropouts of students from the schools in Nagapattinam district. This fact was revealed while analyzing the school records. The researcher indented to find out the major reasons and the main reason for this state of affair; and the stage (level) in which this kind of



issues occur more in number. So she enquired 3 sets of sample teachers (primary, high school and higher secondary school teachers). As the result, the following factors were found out as the major reasons for dropping out of the children.

**Bad Influence:** Bad influence on children was the most common reason for students dropping out of school. That the phrase ‘Bad Influence’ means early exposure to alcohol, drugs, internet, and television distract children from pursuing academics and initiated them into antisocial activities instead.

**Academic Difficulty:** Inability to cope with the academic pressure was another reason for students to opt out of school. Studies also prove that students who do not read proficiently by fourth grade are four times more likely to drop out of school. Studies also reinstate the fact that students who fail in math and English in the eighth grade are 75% more likely to drop out of high school. The sample teachers too accepted the fact.

**Family and Socio-Economic Needs:** Many researches reveal that students belonging to low-income groups are more likely to drop out of school. They have to work to support their family. Some children need to stay back at home to take care of their siblings while the parents go out to work. Divorce or separation of parents also affects the education of children adversely. The analysis of the sample teachers’ responses supports the above contention.

**Poor Health:** As per the teachers’ answer to the interview schedule, the health of a child greatly affects his learning ability and performance at school. Illnesses that occur during studentship and continue lifelong, curb a student’s ability to complete school.

**Retention:** Retention was another major factor that has its role in the drop out of the students. For, it has a negative impact on the self-esteem of children. The retained children feel bad being older than their classmates and tend to drop out of school.

**Disinterest:** Many students find school boring. According to a study, almost 71students become disinterested in high school while they are in the 9th and 10th grades. They prefer to go late to school, skip classes and take long lunch breaks. The lack of interest often leads to dropping out of school. Some students find it difficult to have smooth relation with the teachers. The sample teachers too accepted that disinterest of the students play a major part in the students’ dropping out of school.

**Transition:** The data collected from the teachers reveal that transition plays a major role in the students dropping of schools. Studies also indicate that a shift from the cohesive environment of middle school to the anonymity of high school

takes a toll on the academic interest of students. The relationship with the teachers is not as strong as it was in the middle school. It demotivates students and makes them lose interest in studies.

**Problem:**

Let, the three stages of school be denoted as,

$A_1$  – Primary School Level

$A_2$  – High School Level

$A_3$  – Higher Secondary School Level.

And the factors be denoted as,

$f_1$  – Bad influence student gets

$f_2$  – Academic difficulty faced by the student

$f_3$  – Family or social economic need of the student

$f_4$  – Poor health of the student

$f_5$  – Retention

$f_6$  – Disinterest

$f_7$  – Transition

Let the pair wise comparison matrix using criteria be denoted as  $P$  and is given as,

$$P = \begin{matrix} & \begin{matrix} f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \end{matrix} \\ \begin{matrix} f_1 \\ f_2 \\ f_3 \\ f_4 \\ f_5 \\ f_6 \\ f_7 \end{matrix} & \begin{bmatrix} 1 & 0.7 & 0.6 & 0.8 & 0.9 & 0.9 & 0.9 \\ 0.7 & 1 & 0.6 & 0.7 & 0.9 & 0.8 & 0.5 \\ 0.5 & 0.6 & 1 & 0.5 & 0.6 & 0.7 & 0.5 \\ 0.6 & 0.6 & 0.7 & 1 & 0.7 & 0.5 & 0.4 \\ 0.7 & 0.5 & 0.2 & 0.8 & 1 & 0.8 & 0.7 \\ 0.3 & 0.7 & 0.3 & 0.5 & 0.7 & 1 & 0.7 \\ 0.7 & 0.5 & 0.7 & 0.6 & 0.7 & 0.5 & 1 \end{bmatrix} \end{matrix}$$

Using relativity function on the above matrix we have,

$$W = \begin{matrix} & \begin{matrix} f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \end{matrix} \\ \begin{matrix} f_1 \\ f_2 \\ f_3 \\ f_4 \\ f_5 \\ f_6 \\ f_7 \end{matrix} & \begin{bmatrix} 1 & 1 & 0.83 & 0.75 & 0.78 & 0.33 & 0.78 \\ 1 & 1 & 1 & 0.86 & 0.56 & 0.89 & 1 \\ 1 & 1 & 1 & 1 & 0.33 & 0.43 & 1 \\ 1 & 1 & 0.71 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0.89 & 1 & 0.89 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0.71 \\ 1 & 1 & 0.71 & 0.67 & 1 & 1 & 1 \end{bmatrix} \end{matrix}$$

$$W = \begin{bmatrix} 0.33 \\ 0.56 \\ 0.33 \\ 0.71 \\ 0.89 \\ 0.71 \\ 0.67 \end{bmatrix} .$$



From this we can conclude that the main reason for drop outs is retention. Now construct a fuzzy matrix of expert’s opinion,

$$K_1 = \begin{matrix} & f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} & \begin{bmatrix} 0.9 & 0.3 & 0.1 & 0.2 & 0.3 & 0.5 & 0.6 \\ 0.7 & 0.7 & 0.8 & 0.3 & 0.7 & 0.7 & 0.4 \\ 0.7 & 0.8 & 0.9 & 0.3 & 0.9 & 0.8 & 0.4 \end{bmatrix} \end{matrix}$$

$$K_2 = \begin{matrix} & f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} & \begin{bmatrix} 0.8 & 0.3 & 0.2 & 0.2 & 0.3 & 0.6 & 0.7 \\ 0.6 & 0.7 & 0.7 & 0.4 & 0.8 & 0.7 & 0.5 \\ 0.7 & 0.8 & 0.8 & 0.4 & 0.7 & 0.8 & 0.6 \end{bmatrix} \end{matrix}$$

$$K_3 = \begin{matrix} & f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} & \begin{bmatrix} 0.7 & 0.3 & 0.1 & 0.3 & 0.2 & 0.3 & 0.5 \\ 0.5 & 0.6 & 0.7 & 0.6 & 0.5 & 0.6 & 0.5 \\ 0.8 & 0.9 & 0.8 & 0.6 & 0.5 & 0.7 & 0.5 \end{bmatrix} \end{matrix}$$

Find the average of the matrices,  $k_1$ ,  $k_2$  and  $k_3$  and construct a matrix  $k$  using it,

$$K = \begin{matrix} & f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} & \begin{bmatrix} 0.80 & 0.30 & 0.13 & 0.23 & 0.27 & 0.47 & 0.60 \\ 0.60 & 0.67 & 0.73 & 0.43 & 0.67 & 0.67 & 0.47 \\ 0.73 & 0.83 & 0.83 & 0.43 & 0.70 & 0.77 & 0.50 \end{bmatrix} \end{matrix}$$

Now multiply the matrix  $K$  with the weight  $W$  obtained above, and is given below,

$$K = \begin{matrix} & f_1 & f_2 & f_3 & f_4 & f_5 & f_6 & f_7 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} & \begin{bmatrix} 0.264 & 0.168 & 0.043 & 0.163 & 0.240 & 0.334 & 0.402 \\ 0.198 & 0.375 & 0.241 & 0.305 & 0.596 & 0.476 & 0.315 \\ 0.241 & 0.465 & 0.274 & 0.305 & 0.623 & 0.547 & 0.335 \end{bmatrix} \end{matrix}$$

By repeated average method we get,

$$K = \begin{bmatrix} 0.230 \\ 0.357 \\ 0.397. \end{bmatrix}$$

From  $K$  we can conclude that there is a maximum number of drop outs in the  $A_3$  level. That is at the higher secondary level there is a maximum number of drop outs. Now we are using algorithm- 2, for the same problem. Here the steps will be same till step 6. After that we applying step 7 of algorithm-2, we get,

$$W = \begin{matrix} & A_1 & A_2 & A_3 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} & \begin{bmatrix} 3 & 2 & 2 \\ 5 & 3 & 1 \\ 5 & 7 & 3 \end{bmatrix} \end{matrix}$$

Table 1

Levels in schools	Row-sum	Column-sum	Value	Rank
A <sub>1</sub>	7	13	-6	3
A <sub>2</sub>	9	12	-3	2
A <sub>3</sub>	15	6	9	1

### 4. Conclusion

From  $K$  of algorithm-1 and the table- 1 of algorithm-2 we are getting same result, i.e by using algorithm-1, and algorithm-2, we are getting same result. Thus we may use any one of them to solve our problem and from both the algorithms we are getting a result that there are many drop outs at the higher secondary level and next to it there are many drop outs in high school level, and there are low drop outs in primary level. And the main reason for drop outs is retention.

### Acknowledgement

The authors would like to acknowledge the support and assistance provided by A.D.M. College for women (Autonomous), Nagapattinam, Tamil Nadu, India.

### References

- [1] Krishna Gogoi, Alock Dr. Dutta, Chandra Chutia, Application of Fuzzy Soft Set Theory in Day to day Problems, *International Journal of Computer Applications*, 85(7), (2014), 0975–8887.
- [2] M. K. Hasan, Yasin Ali. Md, Abeda Sultana and N. K. Mitra, Decision making with help of the Repeated Average Method of Fuzzy Soft Matrix, *International Journal of Advances in Mathematics*, 2019(1), (2019), 83–91.
- [3] M. K. Hasan, M. M. Rahman and Abeda Sultana, Application of Repeated Average Method on Generalized Fuzzy Soft Matrix For Decision Making, *Journal of the Asiatic Society of Bangladesh, Science*, 45(2), (2019), 249–259.
- [4] M. Shimura, Fuzzy Sets Concepts in Rank-Ordering Objects, *Journal of Mathematical Analysis and Applications*, 43(1973), 717–733.
- [5] L. A. Zadeh, Similarity Relations and Fuzzy Orderings, *Information Science*, 3(1971), 177–200.

\*\*\*\*\*  
 ISSN(P):2319 – 3786  
 Malaya Journal of Matematik  
 ISSN(O):2321 – 5666  
 \*\*\*\*\*

