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Result Analysis of Students Using Fuzzy Matrices

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Abstract- Fuzzy set theory was proposed by Lotfi A. Zadeh and has been found extensive applications in various fields. The concept of uncertainty was discussed by using fuzzy matrices. Throughout this article [0, 1] denotes the unit interval, as a fuzzy Interval. Also all fuzzy matrices are matrices but every matrix is not fuzzy in general. We analyses the results of three students using Fuzzy Matrix Solution (FMS) with the help of product of fuzzy matrices. Under usual matrix multiplication this is not a fuzzy matrix, so that we need to define compatible operation analogs to product that the product again happens to be a fuzzy matrix by introducing max-min operation & min-max operation. Finally we conclude the results of three students as pass or fail using fuzzy matrix.

Index Terms- FMS, visual basic, indication relation, max-min operation.

I. INTRODUCTION

Students play a major role in Educational field. Students are evaluated under different categories: By choosing their institution, studying well, gaining good knowledge, and getting good marks. Result analysis of each student paves the way for their higher education as well as their improvement in future. . Percentage marks prior to the grade scheme were converted into grades for ease of comparison.

The reliability of the new scheme was again studied using statistical analysis of data obtained from both the old and new schemes. Some assessment schemes use a grading category index (GCI) instead of actual mark for each assessment criterion. GCIs usually have a smaller number of options to choose from when awarding results. For example, the GCI may gave eight levels with the highest being awarded to exceptional students and the lowest being awarded to students of inadequate performance. This reduced level of categories has been shown to result in less variability between assessors compare to systems which use marking ranges between 0 and 100. The Results of the students are analyzed using Fuzzy Matrix Solution (FMS).

In this paper, we are analyzing the results of students using fuzzy matrix with the help of product of fuzzy matrices by introducing max-min operation & min-max operation. Finally we conclude that the Result of the student is Pass or Fail.

In this Section we recall some of the basic properties about fuzzy matrices and operations using them.

II. ADDITION OF FUZZY MARIX

A. Definition 1

Let X and Y be two fuzzy matrices ,we define the addition of fuzzy matrices as follows.

X+Y = max {X, Y} or min {X, Y}.

For Example,

We add two fuzzy matrices X and Y and get the sum of them by fuzzy matrix as follows.

Let $X = \begin{bmatrix} 0.3 & 0.7 & 0.8 \\ 0.6 & 0.5 & 1.0 \\ 0.9 & 0.4 & 0.6 \end{bmatrix}$ and

$Y = \begin{bmatrix} 1.0 & 0.2 & 0.3 \\ 0.8 & 0.5 & 0.2 \\ 0.5 & 0.1 & 0.8 \end{bmatrix}$ then

Max {X, Y}

$$= \begin{bmatrix} \max(0.3,1.0) & \max(0.7,0.2) & \max(0.8,0.3) \\ \max(0.6,0.8) & \max(0.5,0.5) & \max(1.0,0.2) \\ \max(0.9,0.5) & \max(0.4,0.1) & \max(0.6,0.8) \end{bmatrix}$$

$$= \begin{bmatrix} 1.0 & 0.7 & 0.8 \\ 0.8 & 0.5 & 1.0 \\ 0.9 & 0.4 & 0.8 \end{bmatrix}$$

Similarly **min {X, Y}** can be obtained.

III. MULTIPLICATION OF FUZZY MARIX

B. *Definition 2*

The Product of two fuzzy matrices under usual matrix multiplication is not a fuzzy matrix. So that we need to define compatible operation analogs to product that the product again happens to be a fuzzy matrix. However even for this new operation if the product XY is to be defined we need the number of columns of X is equal to the number of rows of Y. The types of operations which can have are max-min operation and min-max operation.

Let $X = \begin{bmatrix} 0.4 & 0.8 & 0.9 \\ 07 & 0.6 & 1.0 \\ 0.8 & 0.5 & 0.7 \end{bmatrix}$ and

$Y = \begin{bmatrix} 1.0 & 0.1 & 0.2 \\ 0.6 & 0.4 & 0.3 \\ 0.4 & 0.2 & 0.9 \end{bmatrix}$

then XY defined using max.min function.

$X*Y = \begin{bmatrix} C11 & C12 & C13 \\ C21 & C22 & C23 \\ C31 & C32 & C33 \end{bmatrix}$

Where,

C_{11} = max {min (0.4, 0.1), min (0.8, 0.6), min (0.9, 0.4)}
= max {0.1, 0.6, 0.4}
= 0.6

C_{12} = max {min (0.4, 0.1), min (0.8, 0.4), min (0.9, 0.2)}
= max {0.1, 0.4, 0.2}
= 0.4

And so on.

$$X*Y = \begin{bmatrix} 0.6 & 0.4 & 0.9 \\ 0.7 & 0.4 & 0.9 \\ 0.8 & 0.4 & 0.7 \end{bmatrix}.$$

Similarly for the same X and Y we can adopt the operation as min.max operation.

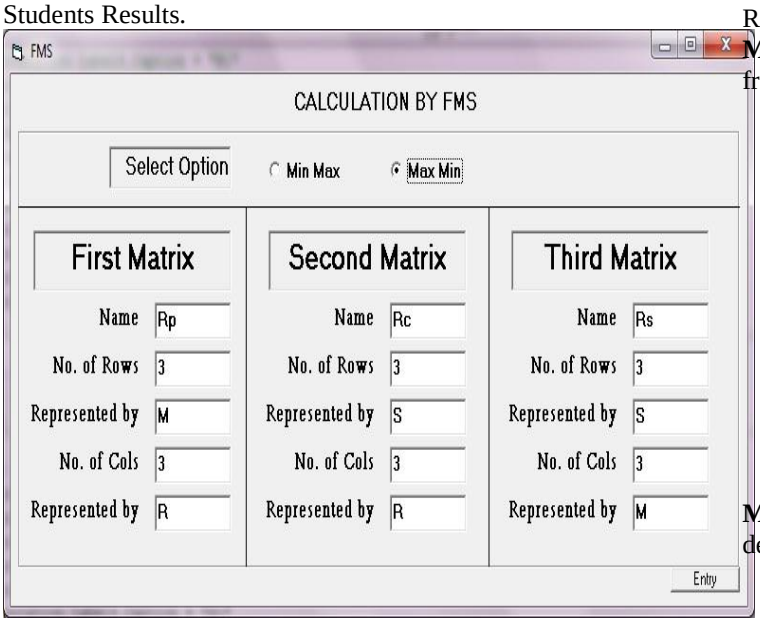
IV. ASSESSMENT OF MARKS

In this section the students results are mentioned as in the following categories:

Result Status	Corresponding Marks
Below Average	Less than 50
Average	Between 50 & 79
Above Average	Greater than or Equals 80

V. FUZZY MATRIX SOLUTION

It is observed that in our model we require composition of matrix using min.max or max.min operation it is difficult manually. Here we develop following software that enables the user to graphically design a fuzzy system for the analysis of Students Results.



VI. CRISP SET

C. Definition 3

A set means any well defined collection of objects. The words aggregate, class or collection are also used in place of the word "set of sets". But the use of the word set is common. In general capital letters like A,B,C,D…….etc are used to denote the sets and lower letters a, b, c, d,……to denote the objects or elements belonging to these sets. We express the relation between an object and a set to which it belongs by writing, a ϵ A. There are three basic methods by which sets can be represented.

(i) List method- A = {a1, a2, a3……an}
(ii) Set builder form
(iii) A characteristic function. But here we use the first method.

VII. MAIN RESULT

D. Notations

Considering,
M – Crisp set of all Marks,
R – Set of Results,
W- Set of all Students.
Consider M = {M_1, M_2, M_3}
Where,
M_1 - Marks of Subject I
M_2 - Marks of Subject II
M_3 - Marks of Subject III

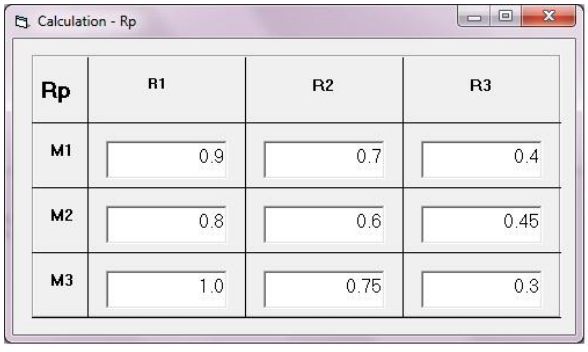
Consider R = {R_1, R_2, R_3}
R_1 - Above Average (≥ 80).
R_2 - Above Average (50-79).
R_3 - Below Average (< 50).

Let S = {S_1, S_2, S_3} set of three Students for testing this model.

VIII. ENTERING DATA PART

Entering data in Matrix format for occurrence relation, confirmative relation, and fuzzy relations denoted by R_o, R_c and R_s respectively.

Matrix for performance relation is $R_p = M \times R$, indicates the frequency of performance of Marks M which gives the Result R.



Matrix for Confirmative relation $R_c = S \times R$ corresponds to the degree to which the Students Marks confirms the Results.

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Calculation - Rc

Rc	R1	R2	R3
S1	1.0	0	0
S2	0	1.0	0
S3	0	0	1.0

Now assume a **fuzzy relation** $R_s = S \times M$, Specified Marks M_1, M_2 and M_3 for three Students S_1, S_2 and S_3 as follows:

Calculation - Rs

Rs	M1	M2	M3
S1	0.9	0.8	1.0
S2	0.7	0.6	0.75
S3	0.4	0.45	0.3

IX. CALCULATION PART

This is done using our software and relations R_p, R_c and R_s , we can now calculate the Results using four indication relations in four different stages 1. performance, 2.Confirmability 3. Non-performance, 4. Performance of Non-Specification as follows:

The Performance Indication Relation of Result calculated by $IR_1 = R_s * R_p =$

Composition - IR1

IR1	R1	R2	R3
S1	1.0	0.75	0.45
S2	0.75	0.75	0.45
S3	0.45	0.45	0.45

The Conformability Indication Relation of Result by $IR_2 = R_s * R_c =$

Composition - IR2

IR2	R1	R2	R3
S1	0.9	0.8	1.0
S2	0.7	0.6	0.75
S3	0.4	0.45	0.3

The Non-performance Indication Relation calculated by $IR_3 = R_s * (1-R_p) =$

Composition - IR3

IR3	R1	R2	R3
S1	0.2	0.4	0.7
S2	0.2	0.4	0.7
S3	0.2	0.4	0.45

The Non-Specification Indication Relation calculated by $IR_4 = (1-R_s) * R_p =$

Composition - IR4

IR4	R1	R2	R3
S1	0.2	0.2	0.2
S2	0.4	0.4	0.4
S3	0.7	0.7	0.45

X. CONCLUSION

From these Indications relations we may draw the following conclusions:

If R_1 and R2 is maximum, we conclude that the Student facing success in Examinations.

(i.e) The Result of the Student is Pass.

If $R_3$and R4 is maximum, we conclude that the Result of the Student faces the Failure in Examination

(i.e) The Result of the Student is Fail.

Using Visual Basic we develop software to calculate Fuzzy relation. After collecting datas we have to entered the Performance of students marks in matrix R_s observed from each individual student. The software calculates from R_1 to R_4 gives the status of Results of the students.

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