Fuzzy Clustering Research on Mobilization Enterprises

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***Abstract*-By means of fuzzy clustering analysis, this paper does clustering research on mobilization enterprises under crisis condition with the help of MATLAB platform. On the basis of different degree of membership, it gets classified configuration of mobilization enterprises in different conditions. The paper aims at simplifying choice-decision of mobilization enterprises under crisis condition, then applying this simplified process at following practical woks.**

Keywords-Fuzzy clustering, Matlab, Mobilization enterprise

I. INTRODUCTION

With the development of national economy mobilization cause, related organizations of national economy mobilization are involved increasingly in the emergency event management. How to choose proper mobilization enterprises and fulfill mobilization task efficiently and agilely is one problem which need mobilization organization considers. Professor Kong zhaojun[1]put forward such concept-agile mobilization. Based on this conception, docter Zhang jihai[2] mention agile mobilization organization on the basis of mobilization alliance and constructed index system to measure agility. As core of mobilization alliance, choice optimization of mobilization enterprises plays an important role in accomplishing mobilization task smoothly. Mobilization enterprise is an unit of mobilization alliance, and do clustering research on it can simplify mobilization enterprise-choice decision under crisis condition.

Referring to method and strategy how to choose supplier, this paper studies on mobilization enterprises-choice problem. Hu huanan ect.[3]set up Hybrid multiple attribute decision model for the problem of book suppliers-choice. They use 0-1planning and linear weighted and method respectively to solve evaluation value of decision group to various suppliers, and take advantage of 0-1planning to solve final ordering result of decision group to suppliers. Huang xunjiang etc.[4]constructs evaluation index, and use The triangle fuzzy comprehensive judgment matrix to select technical equipment suppliers. By applying cone ratio C2 WH model, Duan yongri etc.[5]provides a method which need not given weight in advance, but can reflect decision makers preference, and research on supplier-choice with this method.

This paper aims to apply fuzzy clustering method, and then simplifies further study of problem of enterprise-choice.

II. PROBLEM DESCRIPTION

A. problem background

An emergency event happens in a city. In terms of requirement of project and its amount, national economy mobilization institution activates potential investigation and pre-arranged planning, and seeks for proper enterprises among several mobilization enterprises to accomplish mobilization task. Due to wide range of mobilization materials, this paper chooses only one kind of mobilization material to discuss. There are four enterprises to produce mobilization material. In line with characteristic of emergency works, the paper selects mobilization time, mobilization cost and robustness as index to do fuzzy clustering analysis on these four mobilization enterprises.

B.index system construction and assignment

Doing classify description for coherence of four mobilization enterprises:

Supposing 4 mobilization enterprises constitute a group: $X=(x_1,x_2,\cdots,x_4)$ .each enterprise has 3 attributes (mobilization time, mobilization cost, robustness) as statistical index, namely $X_{ij}=\{X_{i1},X_{i2},X_{i3}\}$ .the three indexes are as follows: mobilization time X_{i1} , mobilization cost X_{i2}, robustness X_{i3}.

Specific value of index of 4 mobilization enterprises is given in the Table.1

III. FUZZY CLUSTERING ANALYSIS

A. Xij data normalization

We use range transformation to normalize data, as shown in the formula below:

$$X'_{ij}=\frac{x_{ij}-x_{\min}}{x_{\max}-x_{\min}} \qquad (1)$$

In the formula 1, x_{ij} denotes j th index value of i th mobilization enterprise, and $x_{ij}^{'}$ denotes j th index normalization value of i th mobilization enterprise.

$x_{ij}=x_{\min}$, $X^{'}=0$;

$x_{ij} = x_{\max}$, $X' = 1$.

B. Construction of similar matrix by Maximum minimum method

we use maximum minimum method to calculate r_{ij}:

$$r_{ij} = \frac{\sum_{k=1}^{m}(x_{ik} \wedge x_{jk})}{\sum_{k=1}^{m}(x_{ik} \vee x_{jk})} \quad (2)$$

$r_{ij} \in [0,1], (i = 1,2,\cdots,4\, j = 1,2,3)$ indicates the similarities of enterprise i and enterprise j in 5 attributes. Using MATLAB software to programming (programming process is neglected):

similar matrix is got:

$$R = \begin{bmatrix} 1 & 0.57 & 0.33 & 0 \\ 0.57 & 1 & 0.63 & 0.16 \\ 0.33 & 0.63 & 1 & 0.27 \\ 0 & 0.16 & 0.27 & 1 \end{bmatrix}$$

a) Transformation for similar matrix to equivalence matrix

Matrix R satisfies reflexivity and symmetry, but can't satisfy transitivity. In order to solve equivalent matrix, we need to solve transitive closure.

According to square method:

$$R^2 = R \circ R = \begin{bmatrix} 1 & 0.57 & 0.57 & 0.27 \\ 0.57 & 1 & 0.63 & 0.27 \\ 0.57 & 0.63 & 1 & 0.27 \\ 0.27 & 0.27 & 0.27 & 1 \end{bmatrix}$$

$$R^4 = R^2 \circ R^2 = \begin{bmatrix} 1 & 0.57 & 0.57 & 0.27 \\ 0.57 & 1 & 0.63 & 0.27 \\ 0.57 & 0.63 & 1 & 0.27 \\ 0.27 & 0.27 & 0.27 & 1 \end{bmatrix}$$

$$R^8 = R^4 \circ R^4 = \begin{bmatrix} 1 & 0.57 & 0.57 & 0.27 \\ 0.57 & 1 & 0.63 & 0.27 \\ 0.57 & 0.63 & 1 & 0.27 \\ 0.27 & 0.27 & 0.27 & 1 \end{bmatrix}$$

on the basis of this program, we solve R^4 and R^8 (matrix is left out)

$R^8 = R^4 \circ R^4 = R^4$

So transitive closure is as follows: $\hat{R} = R^4$,which is fuzzy equivalent matrix, which is used to fuzzy analyze 4 mobilization enterprises.

λ decreases from 1 to 0 in order to solve R_λ, and do clustering analysis of 4 mobilization enterprises according to different confidence level.

• when λ=1, we get an unit matrix(R1 is left out)

X can be classified 6 groups: $\{x_1\}$, $\{x_2\}$, $\{x_3\}$, $\{x_4\}$

• When λ=0.63, we get the second matrix(R2 is left out)

X can be classified 3 groups: $\{x_1\}$, $\{x_2, x_3\}$, $\{x_4\}$

• When λ=0.57, we get the third matrix (R3 is left out)

X can be classified 2 groups: $\{x_1, x_2, x_3\}$, $\{x_4\}$

When λ=0.27, we get the sixth matrix (R4 is left out)

X can be classified 1 group: $\{x_1, x_2, x_3, x_4\}$

From the above analysis, we can get the following dynamic clustering figure(Figure.1):

From the above figure, different λ value corresponds to different classified result. In accordance with various condition, we could choose proper λ value, thus doing clustering analysis on four mobilization enterprises.

IV. CONCLUSION

When λ=1, four mobilization enterprises are different; when λ=0.63, four mobilization enterprises are classified 3 groups; when λ=0.57, four mobilization enterprises can be classified 2 groups; when λ takes value of 0.27 and below, all mobilization enterprises are belong to the same kind.

This article conducts experiment on the basis of 4 mobilization enterprises. In practice, we could expand these mobilization enterprises to dozens or hundreds, and clustering analyze these enterprises in terms of different λ. Clustering analyzing many mobilization enterprises in terms of certain index could simplify the process of choosing mobilization enterprises.

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TABLE I. EVALUATION INDEX SYSTEM OF MOBILIZATION ENTERPRISES

Index	Mobilization enterprises			
	x_1	x_2	x_3	x_4
x_{i1}	15	20	18	10
x_{i2}	32	30	15	8
x_{i3}	12	23	25	35

TABLE II. STANDARDIZATION OF INDEX VALUE

Index	Mobilization enterprise			
	X_1	X_2	X_3	X_4
X_{i1}	0.5000	1.0000	0.8000	0.0000
X_{i2}	1.0000	0.9167	0.2917	0.0000
X_{i3}	0.0000	0.4783	0.5652	1.0000

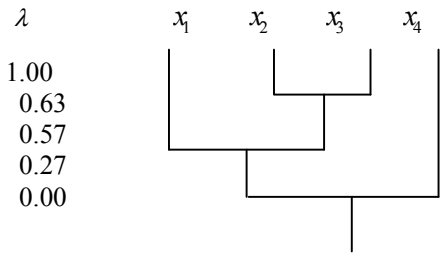

Figure 1. Dynamic clustering figure