Application of Multifactorial Evaluation in Education

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Abstract

Teaching examining and evaluation must be given in order to promoting education quality and teaching effect. The only work we have done in the past is qualitative not quantitative. This paper develops a unitized quantitative evaluation model and computer procedure to various teaching aspects by the fuzzy multifactorial evaluation.

Keywords: Fuzzy set, Multifactorial evaluation, Educational application.

Because of the complex of teaching activity,the contents of teaching examination and evaluation are also in many ways and grades. The unifized model is developed as follows:

Let A_0 denote the condition set

$$A_0 = \{u_1, u_2, \ldots, u_T\}$$

The different weights are given acording to its effect. Let the weights set be

$$A = \{a_1, a_2, \ldots, a_T \mid \sum_{i=1}^{T} a_i = 1\}$$

and S be the evaluation grade set, i.e

$$S = \{e_1, e_2, \ldots, e_F\}$$

The evaluation matrix $R = (r_{ij})_{TF}$ is given to single factor by the investigation and statistic , where r_{ij} denotes the grade degree of belonging to the jth grade to the ith condition, $0 \leqslant r_{ij} \leqslant 1$.

The procedure is as follows:

Let the judges write the quantitative evaluation card.

CARD   name of evaluated people Q$

A＼S	e_1	e_2	e_3	- - - - - - - - - - - - -	e_F	note
u_1						
u_2						
⋮						
u_T						

The judges give the evaluation by sumbol " O " in concerning column acording to the viewpoint and understanding of himself. In example, some judger considers the condition u_2 is bolonging to grade e_3 , then the symbol " o " is writen in position (2,3). Hence the matrix can be given in statistic method by computer as follows

$$B = \begin{pmatrix} b_{11} & b_{12} & \cdots\cdots & b_{1F} \\ b_{21} & b_{22} & \cdots\cdots & b_{2F} \\ \cdots\cdots\cdots\cdots \\ b_{T1} & b_{T2} & \cdots\cdots & b_{TF} \end{pmatrix}$$

where b_{ij} is the number of that the ith condtion is recorgnized as the jth grade. If the total number is w, then the matrix

$$B \cdot \frac{1}{w} = R = \begin{pmatrix} r_{11} & r_{12} & \cdots\cdots & r_{1F} \\ r_{21} & r_{22} & \cdots\cdots & r_{2F} \\ \cdots\cdots\cdots\cdots \\ r_{T1} & r_{T2} & \cdots\cdots & r_{TF} \end{pmatrix}$$

is said evaluation matrix to single factor, where $0 \le r_{ij} \le 1$.

Let $C = (c_1 \; c_2 \cdots\cdots c_F)$

where

$$c_j = \frac{\sum_{i=1}^{T}(r_{ij} \wedge a_i) + \sum_{i=1}^{T} a_i \, r_{ij}}{2} \qquad j=1,2,\ldots F.$$

We obtain $S = (s_1 \; s_2 \cdots\cdots s_F)$ to make C normative, where

$$s_j = \frac{c_j}{\sum_{k=1}^{F} c_k}$$

s_j is the evaluation result that evaluated people is recorgnized as belonging to jth grade.

In order to giving the order for all evaluated people, we can use the weights of percentage $K = (k_1 \; k_2 \cdots\cdots k_F)$ to give the final evaluation result

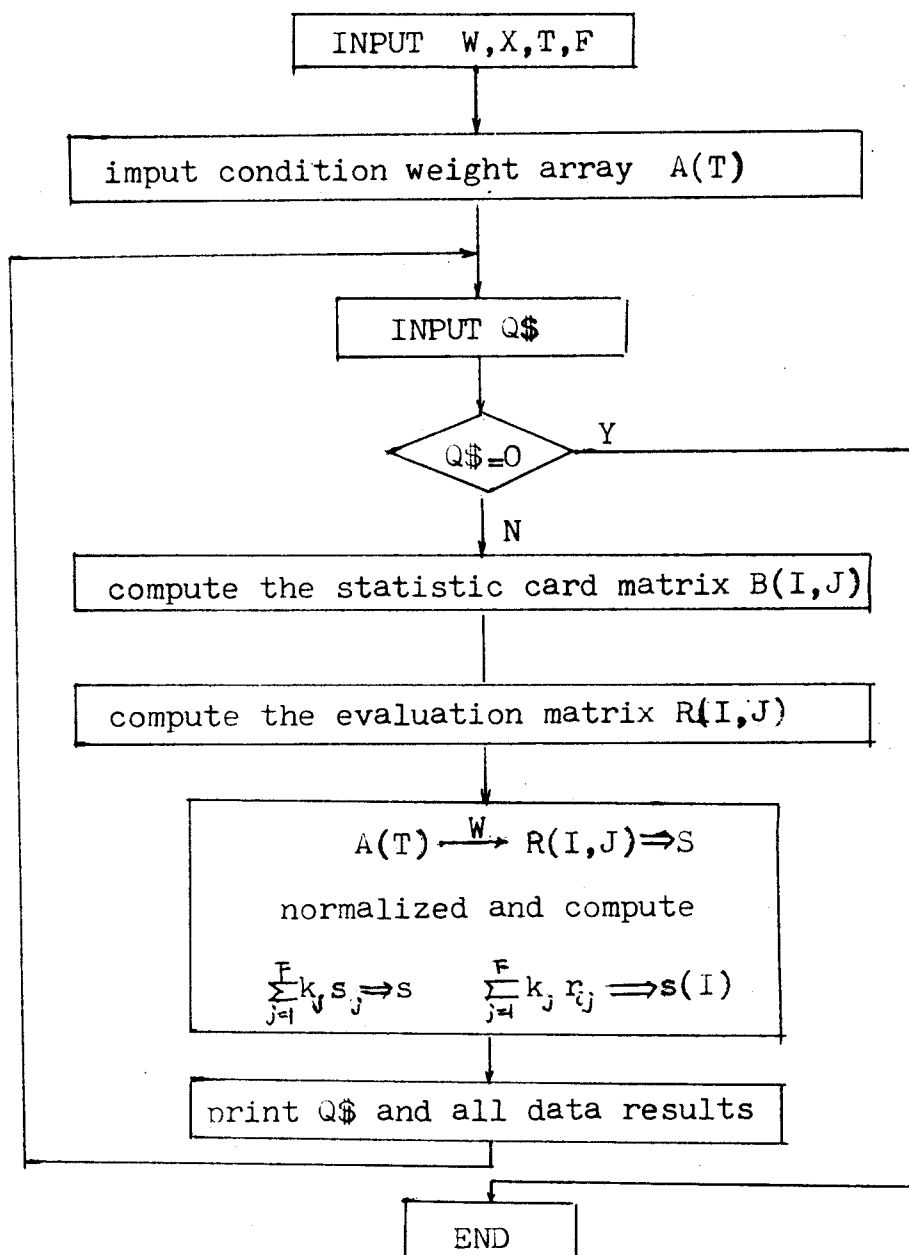$$s = \sum_{j=1}^{F} k_j \, s_j$$

Hence the optimal or inferior ordering to the all evaluated people could be given.

In order to discovering problem, we can give the evaluation result respectivly for various conditions

$$s(I) = \sum_{j=1}^{F} k_j \, r_{ij}$$

where s(I) denotes evaluation result to the ith condition for the evaluated people.

the computer flow diagram of the procedure above as follows

```
            ┌─────────────────────┐
            │   INPUT  W,X,T,F     │
            └──────────┬──────────┘
                       │
    ┌──────────────────▼──────────────────┐
    │  imput condition weight array  A(T)  │
    └──────────────────┬──────────────────┘
                       │
         ┌─────────────▼─────────┐
         │      INPUT Q$          │
         └─────────────┬─────────┘
                       │
                   ◇ Q$=0 ◇───── Y ────┐
                       │                │
                       │ N              │
    ┌──────────────────▼─────────────┐  │
    │ compute the statistic card      │  │
    │ matrix B(I,J)                   │  │
    └──────────────────┬─────────────┘  │
                       │                │
    ┌──────────────────▼─────────────┐  │
    │ compute the evaluation matrix   │  │
    │ R(I,J)                          │  │
    └──────────────────┬─────────────┘  │
                       │                │
    ┌──────────────────▼─────────────┐  │
    │   A(T) ──W──► R(I,J)⇒S           │  │
    │   normalized and compute         │  │
    │   ∑kⱼsⱼ⇒s     ∑kⱼrᵢⱼ⇒s(I)        │  │
    └──────────────────┬─────────────┘  │
                       │                │
    ┌──────────────────▼─────────────┐  │
    │ print Q$ and all data results   │  │
    └──────────────────┬─────────────┘  │
                       │                │
                   ┌───▼────┐◄──────────┘
                   │  END   │
                   └────────┘
```

$$A(T) \xrightarrow{\ W\ } R(I,J) \Rightarrow S$$

normalized and compute

$$\sum_{j=1}^{F} k_j s_j \Rightarrow s \qquad \sum_{j=1}^{F} k_j \, r_{ij} \Rightarrow s(I)$$

the model above may evaluate not only the teaching and scientific research effect of teachers, but also the students and the administrators. Of course , it is also suitable for evaluating some other things, such as the evaluation of food quality among the dining halls,and so on.