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Intelligent Computing and Algorithm Analysis for a Class of Fuzzy Comprehensive Decision Optimization Model

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Abstract*:* In recent years, big data analysis has become one of the most challenging frontier emerging technologies in current and future research. The combination of big data and intelligent computing is the solution to the big data service and application problems in many fields nowadays. Applying the majorized method of fuzzy transformation and fuzzy integral, this paper discusses theoretically and pragmatically about how to make Fuzzy optimal multidimensional synthetical decision and analyzes its reliability, provides the optimal mathematical model of Fuzzy optimal multidimensional synthetical decision, promotes the expertise of synthetical decision and widens its application in fields of natural science and social science.

Keywords: Intelligent Computing, Majorized model, Fuzzy transformation, Fuzzy integral, Possibility measure, Reliability analysis.

INTRODUCTION

With the development of modern science, its emphasis now shifts more and more rapidly form the research on the definite object by the method of analysis to the research on the indefinite object by the method of synthesis. After every concrete science has the typical phenomenon of either-or in its own sphere fully studied, it is now engaged in enlarging scope sphere and is ready to make the research on the untypical phenomenon of both-and. The trend of the penetrating between the different natural science, between the different social science and between the social science and natural science appears apparently with the time going by. The former branch-bound line is broken and the frontier science springs up. The fuzzy mathematics appearing in 1960's is a great breakthrough in the prolongation of mathematics research.

We can use fuzzy mathematics to study the fuzzy phenomenon in the objective world, so the limitation of the tradition mathematics has been smoothed away and many problems which can not be solved by tradition mathematics have been solved. And fuzzy mathematics applies a good situation to the mathematicization of natural science, social science, system science, idea science and body science. In recent years, many achievements concerning the fuzzy mathematics have appeared, but fuzzy decision theory is now in its childhood. [Zimmermann, *et. al.*, 1985] So this article tries to conduct the research on the best fuzzy multidimensional synthetical decision and enlarge the sphere in which the best fuzzy multidimensional synthetical decision can be applied [kao, *et. al.*, 2014].

INTELLIGENT COMPUTING AND ALGORITHM ANALYSIS FOR OPTIMIZATION MODEL

Many system in the world are influenced by many factors as well as have many aims, this is so-called "Multidimensional Synthetical Decision". Generally a decision problem is always coupled with fuzziness, rardomness an experience characteristics.

So it is common to adopt the fuzzy synthetical decision. The following would lay the

Emphasis on zhis problem.

In order to evaluate something synthetically, we must pay attention to the following three factors:

Collection of elements $U = \{u_1, u_2, \Lambda\ , u_n\}$

u_i shows the factor that has to be considered by something;

Decision collection $V = \{v_1, v_2, \Lambda\ , v_m\}$

v_i shows the stage of decision;

Single elements decision, it is a fuzzy mapping from $U \to V$. According to the

fuzzy mapping law, a fuzzy mapping $\underset{\sim}{f}$ can decide a fuzzy relation $\underset{\sim}{R}_{\underset{\sim}{f}}$, it can be expressed by a fuzzy matrix $\underset{\sim}{R} \in M_{n \times m}$. So $\underset{\sim}{R}$ can be considered as a fuzzy transformation from $U \to V$.

Thus an evaluation space （U,V,$\underset{\sim}{R}$）may make up a model of synthetical evaluation.

Suppose a fuzzy subset in U

$\underset{\sim}{A} = (a_1, a_2, \Lambda\ , a_n)$, in which a_i represents the weighted number and it satisfies

$$\sum_{i=1}^{n} a_i = 1.$$

In the given fuzzy transformation $\underset{\sim}{R}$ and factor weight $\underset{\sim}{A}$, we can get a fuzzy subset form the fuzzy relations compositive operation，that is：

$$\underset{\sim}{A} \circ \underset{\sim}{R} = \underset{\sim}{B} \in M_{l\times m}$$

in it $\mu_{\underset{\sim}{B}} = \mu_{\underset{\sim}{A}\circ\underset{\sim}{R}} = \bigvee_{u\in U}\{\mu_{\underset{\sim}{A}}(u) \wedge \mu_{\underset{\sim}{R}}(u,v)\}$

The aforementioned is a mathematical model of fuzzy snythetical evaluation. In fact, the fuzzy snythetical evaluation is using the known inverte image（weight matrix）and mapping （one-factor evaluation matrix）to get the result of synthetical evaluations.

In additional，we can use fuzzy integrate to form a sort of the model of the synthetical evaluation.

Suppose $U = \{u_1, u_2, \Lambda\ , u_n\}$ is a collection consisting of n factors. $P(U)$ is

U′s preparing field. We have the given fuzzy vector on U

$$M = (m_1, m_2, \Lambda\ , m_n)$$

Expresses the “chief factor”. It is actually the leaders′ evaluations on the

importance of n factors.

Every state on U，there′s $H \in F(U)$

$$H = (h_1, h_2, \Lambda\ , h_n)$$

H about “chief factor”—M′s synthetical evaluation is：

$$\int_u H(u) \circ \prod(\bullet) = H \circ M = \bigvee_{k=1}^{n}(h_k \wedge m_k)$$

The aforementioned possibility measure and fuzzy integral theory solve the rationality of the evaluation model [Behrman, *et. al.*, 2012][Tone, *et. al.*, 2009].

In order to aviod the above model’s defects caused by omitting the subimportant factor, we can pretreat the evaluation. For example,we can give a bottom line to every factor’s satisfactory degree, when one object’s satisfactory degree is below the standard, we can drive the object off the evaluation. Today, Fuzzy N—integrade enlarges operator sphere of fuzzy integrate, and on the base of $(\vee,\wedge)$ some new operators appear.

We can use every sort of synthetical evaluation models resulting from different fuzzy integrate to deal with some different practical questions.

Suppose the fuzzy Vector M which stands for the possibility measures is fixed. There are m evaluators to evaluate the given object a individually, then

$$H_j = (h_{j1}, h_{j2}, \Lambda\ , h_{jn}) \in F(U)$$

stands for the satisfactory evaluation on α of Evaluator Number j, $j = 1,2,\Lambda\ , m.$

And to the fixed factor $u_i \in U$

$$H_1(u_i) = h_{1i}, H_2(u_i) = h_{2i}, \Lambda\ , H_m(u_i) = h_{mi}$$

can be considered as sample value whose volume is m resulting from motherbody U_i. U_i stands for the random variable of the objective evaluation of α on factor u_i. If you consider the social evaluation on u_i true, then the aforementioned abstraction is reasonable.From the strong law of large number in probability theory

$$p\left\{\lim_{m\to\infty}\frac{1}{m}\sum_{j=1}^{m} H_j(u_i) = h_i\right\} = 1$$

h_i is the mathematical expectation of the random rariable U_{i1} which stands for the social evaluation on the base of social outlook on value. If we let i run from 1 to n, then we get $H \in F(U)$,

$$H = (h_1, h_2, \Lambda\ , h_n)$$

stands the social evaluation of the satisfaction on α. We can not get H directly, but we can get the sample value $H_1, H_2, \Lambda\ , H_m$ mentioned above and then we have

$$p\left\{\lim_{m\to\infty}\frac{1}{m}\sum_{j=1}^{m} H_j = H\right\} = 1$$

(2)

According to the convergence theorem of fuzzy integrate series to the fuzzy integrate function H, $H_n, n = 1,2,\Lambda\ ,$ on the finite field U, If

$$\lim_{m\to\infty} H_n = H$$

then we can get

$$\lim_{m\to\infty}\int_U H_n(u) \circ \prod(\bullet) = \int_U H(u) \circ \prod(\bullet)$$

(3)

That’s also $E_0 = \int_U H(u) \circ \prod(\bullet) = H_0 M, E_0$ is the social synthetical evaluation to α.For the same reason, $E_j = \int_U H_j(u) \circ \prod(\bullet) = H_j \circ M$ is the synthetical evaluation of the evaluator number i on $\alpha, j = 1,2,\Lambda\ , m.$

Let′s combine (2) with (3) , then we can get

$$P\left\{\lim_{m\to\infty}\int_U \frac{1}{m}\sum_{j=1}^{m} H_j(u) \circ \prod(\bullet) = \int_U H(u) \circ \prod(\bullet)\right\} = 1$$

(4)

In other words, when m is very big, according to rrobability 1

$$\int_U \frac{1}{m}\sum_{j=1}^{m} H_j(u) \circ \prod(\bullet) = E_0 \quad (5)$$

Attention,the fuzzy integral doesn't fit the common addition of function to the distributive(aw) thus, in general,we say

$$\frac{1}{m}\sum_{j=1}^{m}\int_U H_j(u) \circ \prod(\bullet) \neq \int_U \frac{1}{m}\sum_{j=1}^{m} H_j(u) \circ \prod(\bullet)$$

that is to say,we cannot use $\frac{1}{m}\sum_{j=1}^{m} E_j$ to evaluate E_0.

We call E_j the individual evaluation, $j = 1,2,\Lambda\ ,m,$ and call E_0 the group evaluation true value, while $\int_U \frac{1}{m}\sum_{j=1}^{m} H_j(u) \circ \prod(\bullet)$ is called a group evaluation whose volum is m, we write it down as $\hat{E}(m)$. $\hat{E}(m)$ as an approximation of E_0, is fairer than any other E_i [Rundell, *et. al.*, 1987].

APPLICATION EXAMPLES

The fuzzy multidimensional synthetical decision can be widely used in every field in natural science and social science [Calvet, *et. al.*, 2009]. For examle, the consultative system of the medical experts and the computer interrogation, which marks the modernization in medical diagnosis, is an excellent achievement in scientific research that combines the fuzzy multidimensional synthetical decision with ractice. The fundamental prodedure in diagnosis is:

$$\underset{\text{import}}{(\text{patient})\ \boxed{\underset{\sim}{A}}\ \rightarrow(\text{symptom})} \quad \underset{\text{experts system}}{(\text{symptom})\ \boxed{\underset{\sim}{R}}\ \rightarrow(\text{patient})} \quad \underset{\text{export}}{(\text{diagnosis})\ \boxed{\underset{\sim}{B}}}$$

THE MAIN MODEL

The exerts'experience in treating or curing the patients → mathematicism → computer study → feedback revise →consultative system of experts → computer interrogation.

It is not difficult to realise "the sensor interrogating" with the help of the fuzzy transformation and computers. In fact, in our country, the fuzzy mathematical model that Doctor Guang Youbo uses to cure liver diseases has been made into the software of the expert system, and the computer interogation has been realized successfully.

The best fuzzy multidimensional synthetical decision is an optimization.This method is often used in solving the problem with multiple targets and factors, which is difficult to evaluate, but it can be settled by the fuzzy transformation [Blin, et. al., 1974], [Rodrigues, et. al., 2006]. If we can program the computer and realize the automation of the evaluation, the effect will be still better. In addition, if we can choose the proper factors $u_1, u_2, \Lambda\ , u_n$ and show the weighted numbers of every factor, and if those who take part in evaluation possess representative and practical experience, there is very important significance in improving the effect of the fuzzy multidimensional synthetical decision.

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