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Studies on evaluation of rural sports based on fuzzy comprehensive evaluation method

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ABSTRACT

The developing level of rural sports is benefit for improving the healthy of peasants, the correct evaluation results of rural sports can offer the theory basis for improving the rural sports, and then the application of fuzzy comprehensive evaluation method is applied in it. Firstly, the fuzzy comprehensive evaluation model based on genetic algorithm is studied, and the weight of index is confirmed by genetic algorithm. Secondly, the evaluation indexes of rural sports are established based on the suggestions of experts. Finally, the comprehensive evaluation of rural sports is carried out; results show that the developing situation of the rural sports is normal.

Key words: rural sports; fuzzy comprehensive evaluation method; genetic algorithm

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INTRODUCTION

China is a large agricultural country. Advancement and development of countryside can concern success of socialist modernization with the improvement of rural productivity, and the rural sports have also made great progress. But the rural sports as a part of spiritual civilization construction are not better than urban sports. The rural sports can enhance the constitution of peasants; improve the health of peasants, and vary the extracurricular activities of countryside. The rural sports can be benefit for forming the scientific, civilized and healthy lifestyle. In order to offer the theory basis for guiding and promoting the rural sports, the quantitative method should be used to evaluate the developing level of rural sports. Then the development of rural sports can promoted, which suits for the economic development and social progress of a country [1].

In order to improve the correctness of evaluation of rural sports, the fuzzy comprehensive evaluation method can be applied in it. The fuzzy comprehensive evaluation method has been applied in engineering, economic management and social life widely. The reliability and correctness of this method mainly are decided by reasonable distribution of weight of the factors and choose of evaluation model. One of the difficult points is to synthesize the problems with many indexes into a form with a single index scientifically. Its essence is to confirm the weight of these indexes reasonably. The current processing method exists strong subjective and can not obtain the optimal judging matrix, and can only amend individual elements in judging matrix. The current processing method lacks the guidance of scientific theory and method. In order to make up the disadvantages of the current method, the genetic algorithm is introduced into the fuzzy comprehensive evaluation method to amend the consistency of judging matrix and calculating the weight of every evaluation index [2].

1 Fuzzy Comprehensive Evaluation Model Based on Genetic Algorithm

There are several steps for constructing the fuzzy comprehensive evaluation model based on genetic algorithm, which are listed as follows: (1) Establish the factor assembly and remark assembly; (2) Confirm the weight by genetic algorithm; (3) Construct the subordinate degree matrix; (4) Calculate the comprehensive evaluation vector; (5) Present a normalization processing [3].

Step 1: Confirm the factor assembly F , remark assembly E and orders of magnitude

The factor assembly F is the collection of indexes, which can classify and grade the evaluation index. The first level index is defined by $F=\{f_i\}$, $i=1,2,\cdots,n$. The second level index corresponding to the every first level index is defined by $F=\{f_{ij}\}$, $i=1,2,\cdots,n; j=1,2,\cdots,m$. The factor assembly F can be confirmed according to the situation of rural sports.

The remark assembly E is the collection of evaluation grade, which is defined by $E=\{e_s\}$, $s=1,2,\cdots,h$, the quantization value of remark assembly is defined by $V=\{v_s\}$, $s=1,2,\cdots,h$. The remark conclusions are divided into five levels, which are very good, good, normal, poor, very poor, and the choice remark assembly is expressed as follows [4]:

$$E=\{e_1,e_2,e_3,e_4,e_5\} \tag{1}$$

Step 2: Calculating model of weight based on genetic algorithm
The modeling procession of genetic algorithm concludes three steps:

Firstly, the fuzzy evaluation matrix is constructed through handling the evaluation indexes dimensionless.

Secondly, the judging matrix $B=(b_{ik})_{n\times m}$ which can confirm the weight of every evaluation index based on fuzzy evaluation matrix $R=(r(i,j))_{n\times m}$.

Finally, the consistency inspection and revision are carried out for judging matrix, and the weight ω_i is calculated. The following conditions should be satisfied:

$$\omega_i>0,\ \sum_{i=1}^{n}\omega_i=1 \tag{2}$$

According to the definition of judging matrix B, the following expression can be obtained:

$$b_{ik}=\frac{\omega_i}{\omega_k} \tag{3}$$

The matrix B satisfies the following characteristics [5]:

$$b_{ii}=\frac{\omega_i}{\omega_i}=1 \tag{4}$$

$$b_{ki}=\frac{\omega_k}{\omega_i}=\frac{1}{b_{ik}} \tag{5}$$

$$b_{ik}b_{kl}=(\frac{\omega_i}{\omega_k})(\frac{\omega_k}{\omega_l})=\frac{\omega_i}{\omega_l}=b_{il} \tag{6}$$

If the judging matrix satisfies expression (3), $\frac{\omega_i}{\omega_k}$ can be evaluated precisely, then the judging matrix B has complete consistency, the following expression is satisfied:

$$\sum_{i=1}^{n}\sum_{i=1}^{n}|b_{ik}\omega_k-\omega_i|=0 \tag{7}$$

If the judging matrix B has not consistency, it should be amended. The revising judging matrix of B is defined

by $Y=\{y_{ik}\}_{n\times n}$. The weight of every element in Y is also defined by ω_i, ($i=1,2,\cdots,n$). The matrix Y that makes the following expression minimum is the optimal consistency judging matrix:

$$\min \quad CIC(n)=\sum_{i=1}^{n}\sum_{k=1}^{n}\frac{|y_{ik}-b_{ik}|}{n^2}+\sum_{i=1}^{n}\sum_{k=1}^{n}\frac{|y_{ik}-\omega_i|}{n^2} \tag{8}$$

$$s.t. \quad y_{ii}=1, \ i=1,2,\cdots,n \tag{9}$$

$$\frac{1}{y_{ki}}=y_{ik}\in|b_{ik}-d\cdot b_{ik},b_{ik}+d\cdot b_{ik}|, \ i=1,2,\cdots,n;k=i+1,i+2,\cdots,n \tag{10}$$

$$\omega_i>0, \ i=1,2,\cdots,n \tag{11}$$

$$\sum_{i=1}^{n}\omega_i=1 \tag{12}$$

where, $CIC(n)$ denotes the consistency index coefficient. d is not negative parameter, $d\in[0,1/4]$.

The genetic algorithm which can simulate the survival of the fittest of living things is a global optimal method. The genetic algorithm can solve the expression (8) effectively. The procedure of algorithm is listed as follows [6]:

① Confirm the scale of population, which is defined by N, the maximum evolution time of algorithm is defined by $I_{\max}$, controlling parameters of chaos optimization are defined by β and ψ.

② Let $I=0$, original population is defined by H_g, and the corresponding chaos optimization model can be expressed by:

$$\phi_{i,j}=\lambda\phi_{i,j}^{0}(1-\phi_{i,j}^{0}) \tag{13}$$

where, $\phi_{i,j}$ denotes the chaos vector, $\phi_{i,j}^{0}$ denotes the original value, $i=1,2,\cdots N-1$, $j=1,2,\cdots,m$, m denotes the dimension of deciding vector. The chaos variable is mapped into the deciding vector, the corresponding value scope is $(x_{j\min},x_{j\max})$, which satisfies the following expression:

$$x_{i,j}=x_{j\min}+(x_{j\max}-x_{j\min})\phi_{i,j} \tag{14}$$

③ Non dominated sorting means is used to deal with population H_g, non dominated level denotes the fitness of every solution, then the next generation population S_g with the same scale can be obtained through choosing, intersection and variation operation.

④ The intersection operation is carried out for the past and next generation, that is $C_g=H_g\bigcup S_g$, the leading surface of synthetic population C_g can be obtained through Non dominated sorting means, which is expressed by $U=(U_1,U_2,\cdots)$.

⑤ The crowding distance of non dominated leading surface is calculated, and the intersection operation is carried out, that is $H_{g+1}=H_{g+1}\bigcup U_i$, $i=i+1$, the ending condition of iteration is $|H_{i+1}|+|U_i|\leq N$. According to sorting results of U_i, the optimal $(N-|H_{g+1}|)$ solutions are chosen .

⑥ Judge whether the optimal evolution population is obtained, when the number of individuals whose grade is 1 is same with the kinds of scale, the chaos refinement technology of population is used to search the top 10% of next generation, and the searching space of variable changes to $(x'_{j\min}, x'_{j\max})$, the corresponding expression is listed as follows:

$$\begin{cases} x'_{j\min} = x^*_{i,j} - \kappa(x_{j\max} - x_{j\min}) \\ x'_{j\max} = x^*_{i,j} + \kappa(x_{j\max} - x_{j\min}) \end{cases} \tag{15}$$

where, κ denotes the searching factor, $\kappa \in [0,0.5]$.

When $x'_{j\min} < x_{j\min}$, $x'_{j\min} = x_{j\min}$; when $x'_{j\max} > x_{j\max}$, $x'_{j\max} = x_{j\max}$.

The chaos variable is mapped into the deciding variable, and the new chaos variable $x'_{i,j}$ can be obtained. Then, the chaos linear sum of variables $x'_{i,j}$ and $x_{i,j}$ can be obtained:

$$x''_{i,j} = (1-\gamma)x'_{i,j} + \gamma x_{i,j} \tag{16}$$

where, γ denotes the adaptive regulating factor.

Repeat steps ③-⑤, and enter into the next step until the maximum iteration is obtained.

⑦ When the maximum evolution generation $I_{\max}$ is obtained, the optimal solution collection is output, and the calculation is over.

The expression can be solved based on the procedure of genetic algorithm. When judging matrix consistency coefficient $CIC(n) < 0.1$, the judging matrix has the good consistency.

Step 3: Construct the membership matrix

The evaluation index is evaluated according to the evaluation scale, and the value of membership is confirmed, and the final membership matrix $R_k = (r_{is}^k)$ is expressed as follows [7]:

$$R = [r_{is}]_{n\times h} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1h} \\ r_{21} & r_{22} & \cdots & r_{2h} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nh} \end{bmatrix} \tag{17}$$

Construction of membership matrix is an important part of fuzzy comprehensive evaluation. The general principle of constructing fuzzy relational matrix is listed as follows: using the actual situation as standard, considering the real characteristics of fuzzy pheromone, and summarizing the experience of experts.

Step 4: Calculate the comprehensive evaluation vector and quantization value of comprehensive evaluation

After the weight vector W and the membership matrix A_k are confirmed, and the comprehensive evaluation vector is calculated according to the following expression:

$$S_k = W \cdot R_k \tag{18}$$

The quantization value of comprehensive evaluation is calculated by the following expression:

$$N_k = S_k \cdot V^T \tag{19}$$

The evaluation results can be obtained through comparing the relations between N_k and evaluation standard.

2 Establishing the evaluation indexes of rural sports

The evaluation indexes system of rural sports should reflect the developing level of rural sports, which must be confirmed through analyzing the structure, function, character and objection of developing system of rural sports. The object of rural sports is to improve the healthy of peasants and form a good countryside fitness system. A good rural sports system can satisfy the requirement of peasants, and improve the service system and guarantee system of countryside fitness system [8].

The evaluation index of rural sports should be scientific, maneuverable and complete. The meaning of evaluation index should be explicit, which can be measured and counted with standard computation method, the data sources must be reliable. The evaluation index should reflect the situation character and developing trend of rural sports. The maneuverability of the evaluation indexes use the current material, relevant standard and criterion as far as possible. The evaluation indexes have measurability and comparability, which are easy to quantify and can be applied in the actual application. The completeness of evaluation index should reflect and measure the developing situation and trends of rural sports.

According to the reasonable suggestions of sports administrators and relevant experts, the evaluation index system of rural sports is established, which is shown in table 1.

Table 1 Evaluation index system of rural sports

First level index	Second level index
sports life quality A_1	sports facility A_{11}
	sports Instructors A_{12}
	sports material consumption A_{13}
	sports Spirit consume A_{14}
sports guarantee condition A_2	sports organizations A_{21}
	capital investments A_{22}
	sports activities A_{23}
sports efficiency A_3	constitution situation A_{31}
	sports talents cultivation A_{32}
	sports property resource distribution A_{33}
	sports human resource distribution A_{34}

3 Comprehensive evaluation of rural sports

(1) Confirm the weight of evaluation index

The genetic algorithm is applied to establish the weight of evaluation index, the simulation program is compiled by MATLAB software, and the scale of population is 200, the maximum iteration times is 120, $\kappa = 0.3$, $\gamma = 0.5$, $\beta = 0.45$, $\psi = 0.85$. The weight of index is shown in table 2.

Table 2 Weight of evaluation index of rural sports

First level index	Weight	Second level index	Weight
A_1	0.32	A_{11}	0.19
		A_{12}	0.32
		A_{13}	0.29
		A_{14}	0.20
A_2	0.39	A_{21}	0.40
		A_{22}	0.25
		A_{23}	0.35
A_3	0.29	A_{31}	0.15
		A_{32}	0.33
		A_{33}	0.31
		A_{34}	0.20

(2) Quantization procession of fuzzy evaluation

The reasonable parameter should be confirmed according to the evaluation level, which can be standard of score, and offer scientific basis for amending the rural sports. The grade parameter is shown in table 3. As seen from table 3, the parameter column vector is $V = (95,85,60,50,15)$.

Table 3 Grade parameter of evaluating rural sports

Grade	Choice remark	Score interval	Grade parameter vector
First grade	e_1	[85,100]	95
Second grade	e_2	[75,85]	85
Third grade	e_3	[55,75]	60
Fourth grade	e_4	[40,55]	50
Fifth grade	e_5	[15,40]	15

The membership matrix R can be obtained through questionnaire survey, and the comprehensive evaluation result is listed as follows:

$$S = W \cdot R = (0.30,0.20,0.16,0.20,0.14).$$

The final evaluation result is listed as follows:

$$N = S \cdot V^T = 67.2$$

According to the table 3, the evaluation grade of rural sports is third grade, the developing situation of the rural sports is normal.

CONCLUSION

In order to improve the developing level of rural sports and healthy of peasants, the fuzzy comprehensive method is applied in evaluate the level of rural sports. The genetic algorithm is introduced into the traditional fuzzy comprehensive method, and the weight of every index is confirmed based on the genetic algorithm. The evaluation index system of rural sports is established based on designed principles of evaluation index. The evaluation of rural sports is carried out based on fuzzy comprehensive method, and the developing level of rural sports is evaluated, which can offer the theory basis for develop the rural sports.

REFERENCES

[1] Dong Xin guan, Xiao Min, Ding Pen. Research on Sports Evaluation Index System in Rural Areas, **2007**, 27(10): 49-55.
[2] Zeng Zhi jian, Wang Dong dong. *Journal of Wuhan Insititute of Physical Education*, **2011**, 45(12): 50-55.
[3] Wang Yi , Yang Wei feng, Li Ming , Liu Xi. *International Journal of Rock Mechanics and Mining Sciences*, **2012**, 52(6): 50-55.
[4] Jianing Wu, Shaoze Yan, Liyang Xie, Peng Gao. *Acta Astronautica*, **2012**, 76(8): 136-144.
[5] Jianguo Zhou, Yingxue Wang, Bin Li. *Systems Engineering Procedia*, **2012**, 4(1): 210-218.
[6] M.H. Moradi, M. Abedini. *International Journal of Electrical Power & Energy Systems*, **2012**, 34(1): 66-74.
[7] Zhang Qiu wen, Zhong Ming. *Journal of Computers*, **2011**, 6(8): 1670-1676.
[8] Han Xin Gong, Bai Lin feng. *Lecture Notes in Electrical Engineering*, **2013**, 207(1): 685-691.