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Chinese Teenager Physical Health Information Service System Construction Research

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Abstract: The paper's research on Chinese teenager physical health information service system construction targeted at teenagers, it mainly involves objective selection, classification and sorting of selected objectives as well as endowing weights on all indicators, synthesizing these three aspects, the paper carries on t type test according to fuzzy clustering and combining with specific examples that takes normalization processing with multiple indicators, we further get fuzzy matrix weight coefficient, and obtain paper's selected four schoolgirls physique accurate result is that No.1 is 36, No.2 is 49.8, No.3 is 61.7 while No.4 is 64.6 through the method of fuzzy aggregation, from which it is clear about every schoolgirl physical conditions, so it proves the model's validity and rationality.

Keywords: Fuzzy clustering, information service, physical health, teenager.

1. INTRODUCTION

Physique refers to human physical quality conditions, it will change with age changes, there are great differences among different ages, period of teenager is the golden age in life, teenager physical conditions not only involve individual personal quality, but also the more important is it has connections with state future and destiny [1], so research on teenager physical health field is of great significance [2].

Regarding physical health field research, formers have made lots of efforts and gained certain achievements, such as Zhang Yu in Children and teenager physical evaluation, he had ever utilized China's Guangzhou, Xiangtan, Wuhan and Harbin four sites as research objects [3], carried out research on teenager physical health, and made evaluation on them through fuzzy analytic hierarchy process method, finally got that the article mentioned evaluation system was of reality in children and teenager physical evaluation system, and made comparison of different regions' teenagers physical health, got that Xiangtan, Wuhan and Harbin's were inferior to Guangzhou and other regions [4].

By formers researches, the paper combines with formers experiences to make further analysis and research on teenager physical issue, and analyze them by using fuzzy clustering, analytic hierarchy process and other methods, which provides theoretical supports for its exploration in teenager physical health research [5].

2. TEENAGER PHYSICAL HEALTH INFORMATION SERVICE SYSTEM THEORETICAL MODELS

Teenager physical health information service system construction, firstly it should select indicators, and classify and sort out them, but limits among them is not obvious, and so the paper applies fuzzy clustering method to handle with them, its principle is as following [6].

In daily life, we tend to need classifying multiple indicators according to certain criterions. But in most cases, classification limits are not very obvious, therefore fuzzy clustering analysis application in practice is very widely [7].

Fuzzy clustering analysis generally has following steps:

Establish matrix

Set classified object is $U=\{u_1,u_2,\nwarrow,u_n\}$, every object has *m* pieces of indicators to show its character:

$$x_i=\{x_{i1},x_{i2},\nwarrow,x_{im}\},\ i=1,2,\nwarrow,n \tag{1}$$

Therefore it appears matrix:

$$X=(x_{ij})_{n\times m} \tag{2}$$

In real application, different data corresponds to different dimensions, to easier comparing data, it needs to normalize data; in the following it introduces some common normalization methods.

Method that standardized standard deviation:

$$x'_{ij}=\frac{x_{ij}-\overline{x_j}}{s_j},\ i=1,2,\nwarrow,n;\ j=1,2,\nwarrow,m \tag{3}$$

Among them:

$$\overline{x_j}=\frac{1}{n}\sum_{i=1}^{n}x_{ij},\ s_j=\sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(x_{ij}-\overline{x_j}\right)^2} \tag{4}$$

Range orthonormal method:

$$x'_{ij}=\frac{x_{ij}-\min\{x_{kj}\}}{\max\limits_{1\le k\le n}\{x_{kj}\}-\min\limits_{1\le k\le n}\{k_{kj}\}},\ i=1,2,\nwarrow,n;\ j=1,2,\nwarrow,m \tag{5}$$

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Range standardized method:

$$x'_{ij} = \frac{x_{ij} - \overline{x_j}}{\max\limits_{1\le k\le n}\{r_{kj}\} - \min\limits_{1\le k\le n}\{k_{kj}\}}, \quad i = 1,2,\searrow,n; j = 1,2,\searrow,m \tag{6}$$

Maximum value normalized method:

$$x'_{ij} = \frac{x_{ij}}{\max\limits_{1\le k\le n}\{r_{kj}\}}, \quad i = 1,2,\searrow,n; j = 1,2,\searrow,m \tag{7}$$

Fuzzy similar matrix establishment

Establish x_i and x_j similarity level r_{ij} generally it has following methods.

Similarity coefficient method includes included angle cosine method and correlation coefficient method.

Included angle cosine method:

$$r_{ij} = \frac{\sum_{k=1}^{m} x_{ik} x_{jk}}{\sqrt{\sum_{k=1}^{m} x_{ik}^2}\sqrt{\sum_{k=1}^{m} x_{jk}^2}} \tag{8}$$

Correlation coefficient method:

$$r_{ij} = \frac{\sum_{k=1}^{m} \left|x_{ik} - \overline{x_i}\right|\left|x_{jk} - \overline{x_j}\right|}{\sqrt{\sum_{k=1}^{m} x_{ik}^2}\sqrt{\sum_{k=1}^{m} x_{jk}^2}} \tag{9}$$

Distance method:

In general, when using distance method, $r_{ij} = 1 - c\left(d\left(x_i, x_j\right)\right)^{\alpha}$, c, α are selected suitable parameters that let $0 \le r_{ij} \le 1$ to be true.

The method used distance $d\left(x_i, x_j\right)$ computational method is as following:

Euclidean distance:

$$d\left(x_i, x_j\right) = \sqrt{\sum_{k=1}^{m}\left(x_{ik} - x_{jk}\right)^2} \tag{10}$$

Hamming distance:

$$d\left(x_i, x_j\right) = \sum_{k=1}^{m}\left|x_{ik} - x_{jk}\right| \tag{11}$$

Chebyshev distance:

$$d\left(x_i, x_j\right) = \max_{1\le k\le m}\left|x_{ik} - x_{jk}\right| \tag{12}$$

Close degree method includes geometric average minimum method, maximin method and arithmetic average minimum method, the methods is as following:

Geometric average minimum method:

$$r_{ij} = \frac{\sum_{k=1}^{m}\left(x_{ik} \wedge x_{jk}\right)}{\sum_{k=1}^{m}\sqrt{x_{ik} x_{jk}}} \tag{13}$$

Maximin method:

$$r_{ij} = \frac{\sum_{k=1}^{m}\left(x_{ik} \wedge x_{jk}\right)}{\sum_{k=1}^{m}\left(x_{ik} \vee x_{jk}\right)} \tag{14}$$

Arithmetic average minimum method:

$$r_{ij} = \frac{\sum_{k=1}^{m}\left(x_{ik} \wedge x_{jk}\right)}{\frac{1}{2}\sum_{k=1}^{m}\left(x_{ik} + x_{jk}\right)} \tag{15}$$

Finally, it solves its fuzzy clustering indicator comprehensive scores.

2.1. Chinese Teenager Physical Health Information Service System Researches

In teenager physical health field research, it mainly takes 800 meters running, standing long jump, weight/height*1000, 50 meters running, sit-up as well as lung capacity/weight these indicators as research objects factors, for these indicators weights in the system of the paper, I define the weights by analytic hierarchy process, during calculation process, use different physiques students differences in all indicators as statistics to do normalization unified handling, and apply centesimal form to comprehensive evaluate the selected objects physical conditions.

The paper selects one province schoolgirls physical test result of Chinese teenager physical investigation in 2005, from which ratio between weight and height is represented by x_1, ration between lung capacity and weight is represented by x_2 ;50 meters sprint is represented by x_3, standing long jump is represented by x_4, while sit-up is represented by x_5, 800 meters running is represented by x_6. Corresponding all indicators test result is as following Table **1**.

2.2. Clustering Processing with Hundred Schoolgirls Physical Test Table

For above all indicators x_1, x_2, x_3, x_4, x_5, it applies formula $:[(x-\overline{x})/x]+5$, for above x_3, x_6 speed indicators, it applies formula 5-(x- $\overline{x}$)/ s to calculate, and can get all indicators standardized values as following Table **2**.

By above Table **2** all indicators variables values being below 5, then it can assume the paper selected sample clustering center is in the level of relative poor physique, samples' indicators variables values mean values are above 5 and then let the class II to represent better physique level and use it as its clustering center, we can adopt formula to do clustering:

$$d = \sum_{i=1}^{m}\left|x_i - \overline{x_i}\right| \tag{16}$$

Table 1. Hundred schoolgirls physical test table.

n	x_1	x_2	x_3	x_4	x_5	x_6
1	284.7	80.7	8.5	208	36	225.4
2	350.16	50.5	9.3	167	29	239.8
3	365.76	59.76	9.6	153	12	245.8
⋮	⋮	⋮	⋮	⋮	⋮	⋮
9	312.6	45.3	9.4	160	15	261.8
⋮	⋮	⋮	⋮	⋮	⋮	⋮
34	378.72	62.17	8.8	179	29	254.2
⋮	⋮	⋮	⋮	⋮	⋮	⋮
100	332.9	58.16	8.8	178	36	224.7
$\overline{x}$	320.8	59.18	9.19	163.7	21.9	253.4
s	34.45	8.58	0.69	15.43	9.27	26.99

Table 2. All indicators standardized values.

n	x_1	x_2	x_3	x_4	x_5	x_6
1	3.9	7.5	6.00	7.87	6.5	6.0
3	6.3	5.0	4.4	4.30	2.63	5.2
⋮	⋮	⋮	⋮	⋮	⋮	⋮
9	4.7	3.3	4.7	4.7	4.2	4.69
⋮	⋮	⋮	⋮	⋮	⋮	⋮
34	6.6	5.3	5.5	5.9	5.76	4.9
⋮	⋮	⋮	⋮	⋮	⋮	⋮
100	5.35	4.88	5.57	5.92	6.52	6.06

from which d represents center distance of all clustering, absolute value of them represents item x class I indicators center distance; in the case, value m as 6, according to paper sample n_1 and I to classify and explain, from which clustering center distance is :

$$d = |3.95 - 4.76| + |7.52 - 3.39| + \searrow + |6.05 - 4.68| = 12.97$$

Then n_1 and class II center distance is:

$$d = |3.95 - 6.66| + |7.52 - 5.37| + \searrow + |6.05 - 4.96| = 10.03$$

So it can conclude the class sample into class II.

After new samples getting into the class, the paper adopts $(x_i - \overline{x_i} \cdot n) / n + 1$ to define the II all indicators distances, in above examples, it has:

$$(3.59 + 6.69 \times 1)/1 + 1 = 5.3$$

$$(7.52 + 5.35 \times 1)/1 + 1 = 6.4$$

$$(6 + 5.75 \times 1)/1 + 1 = 5.8$$

By parity of reasoning, it can classify all indicators so that define its center position, through above method, and combine with the paper researched contents; we can get final clustering center results as following Table **3** shows:

Do normalization handling with above results according to formula: x_i weight $= t_i / \sum t_i \times 100\%$ to solve all indicators weights values, finally it can get all indicators weights so as to make evaluation, for the paper, it random selects four school girls six indicators to test as following Table **4**.

Write above Table **5** into matrix and combine with above gained weights, and then it has:

Table 3. School girls physique clustering center table.

Class	50 Meters Running	Lung Capacity / Weight	Weight/ Height×1000	800 Meters Running	Sit-up	Standing Long Jump
Class Ⅰ	4.70	4.74	4.53	4.59	4.41	4.49
Class Ⅱ	5.40	5.28	5.57	5.51	5.68	5.62

Table 4. Two classes' samples mean values test table.

Indicator	Class $\overline{x_{\Pi}}$	Class $\overline{x_{1}}$	P value	t value	$S_{\text{II-I}}$
Weight/ height×1000	5.28	4.74	<.05	2.16	0.25
Lung capacity / weight	4.70	5.40	<.01	2.69	0.26
Sit-up	5.68	4.41	<.01	5.52	0.23
Standing long jump	5.62	4.49	<.01	5.65	0.20
50 meters running	5.56	4.54	<.01	6.38	0.16
800 meters running	5.51	4.59	<.01	4.00	0.23

Table 5. Four school girls physical test result.

Schoolgirl No.	50 Meters Running (s)	½ Standing Long Jump (cm)	Weight/ Height ×1000	Lung Capacity / weight	Sit-up (Times)
1	9.2 (P_{50})	155 (P_{40})	310 (P_{50})	61 (P_{60})	27 (P_{50})
2	9.4 (P_{40})	155 (P_{40})	320 (P_{60})	55 (P_{40})	23 (P_{30})
3	9.0 (P_{60})	170 (P_{70})	340 (P_{80})	68 (P_{90})	29 (P_{60})
4	9.0 (P_{60})	160 (P_{70})	300 (P_{40})	63 (P_{70})	31 (P_{70})

$$R \cdot A = \begin{bmatrix} 60 & 40 & 40 & 40 & 30 & 20 \\ 50 & 60 & 50 & 40 & 50 & 60 \\ 40 & 70 & 60 & 50 & 70 & 80 \\ 80 & 90 & 60 & 70 & 60 & 50 \end{bmatrix} \cdot \begin{bmatrix} 0.08 \\ 0.10 \\ 0.24 \\ 0.21 \\ 0.21 \\ 0.15 \end{bmatrix}$$

$$= \begin{bmatrix} 60\times0.08+40\times0.1+40\times0.24+40\times0.21+30\times0.21+20\times0.15 \\ 50\times0.08+60\times0.1+50\times0.24+40\times0.21+30\times0.21+60\times0.15 \\ 40\times0.08+70\times0.1+60\times0.24+50\times0.21+70\times0.21+80\times0.15 \\ 80\times0.08+90\times0.1+60\times0.24+70\times0.21+60\times0.21+50\times0.15 \end{bmatrix}$$

Score above obtained result, then it has:No.1: 36; No.2:49.8; No.3:61.7; No.4:64.6.

CONCLUSION

The paper's research on Chinese teenager physical health information service system construction targeted at teenagers, it mainly involves objective selection, classification and sorting of selected objectives as well as endowing weights on all indicators. These three aspects are emphasis in the paper, the paper takes normalization processing with multiple indicators according to fuzzy clustering and combining with t type test, and then gets fuzzy matrix weight coefficient, and obtains its accurate result by fuzzy aggregation method.

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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