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Grey's NBA basketball factor analyses

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ABSTRACT

This paper uses the improved grey correlation degree model based on the coefficient of variation of the sequence K0 and sequence K0i, and conducts the correlation analysis on various technical indicators of champion Miami Heat in 2012-2013 season the NBA basketball championship finals. In the study it dimensionless processes the official data in seven games on the Heat team finals, uses gray correlation degree model algorithm to obtain the special formula of various technical indicators; the results show that the correlation degree sort of the total score and various indicators is shooting average, free throw times, free throw percentage, assists and steals.

KEYWORDS

Correlation degree;
Generalized coefficient;
Factor analyses.

INTRODUCTION

NBA officials will conduct detailed statistics on a variety of data in the match, including: playing time, the total number of shooting times and hit times and hit rate, two-point shooting times and the total hit times and hit rate, three-point shooting times and the total hit times and hit rate, the free throw times and hit rate and hit times, offensive rebounds and defensive rebound, assists times, turnovers times, steals times, blocks times, fouls times and the total score and other projects. On this basis the official will conduct comparative analysis of historical data on the players and the team, we can draw the maxima, average and minimum values of the historical data for each statistical project. Under this inductive statistics determine with what game data that the player or team can win or lose. Many people have made efforts on the NBA Tournament research and grey correlation analysis method trial. The former research result has a detailed summary on the technology in NBA game and provides a more exciting theoretical platform for this world's attention game. The latter research results provide a more extensive trial range for the application of grey correlation analysis method.

The annual event NBA Basketball Tournament is the world's attention. The competition on the one hand can increase the value of the player, on the other hand it can drive the global basketball fever, which aims to provide better employment opportunities and social development, and the final is a concern. The champion of 2012-2013 season NBA basketball finals is Miami Heat, the team's offensive and defensive skills and tacit understanding degree is among the worlds top-level. In order to provide better guidance theme for basketball teaching, it is essential to analyze the technical indicators and the total score of the Miami Heat. This paper

uses the improved grey correlation quantitative model to analyze the technical indicators of champion team (Miami Heat) in 2012-2013 season NBA basketball finals, in order to provide new research methods and valuable theoretical guidance for the basketball teaching technology.

ESTABLISHMENT OF IMPROVED GRAY CORRELATION DEGREE MODEL

Grey correlation degree is used to describe the tightness degree of the relationship between the system factors. Under normal circumstances we can be quantify the system's change trend, which can be represented by the sequence of change trend, however, the change trend of each sequence always changes according to a certain order and trend. Currently, the computational model that is used to determine the size of grey correlation degree between sequences includes Tangs correlation, gray B-type correlation degree, C-type correlation degree, T-type correlation degree, dubbed correlation degree, grey slope ratio correlation degree and gray Euclidean correlation degree. But the above algorithm has shortcomings as no normalization, inconsistencies and ordinal number effect, so the article makes further improvements based on the original correlation degree model.

First consider the slope ratio of the reference sequence and the comparative sequence in each corresponding period; we can use it to reflect the correlation degree between the sequences. If the slope ratio of each period is close to 1, the better the concentration is, on the contrary the poorer the correlation is; the dispersion degree of the ratio slope of the two given sequences can be expressed by the coefficient of variation. If the variation coefficient is smaller, the slope ratio of each time intervals is more concentrated, whereas the more scattered. Therefore, in order to determine whether the slope ratio is concentrated in a neighborhood of 1, the generalized coefficient of variation is defined on the basis of the coefficient of variation. Finally taking it as the material to create new gray correlation model, improve the gray correlation model based on the above ideas.

Grey correlation degree quantitative model

Definition 1: There are sequences of formula (1) below:

$$X = (x_1(1), x_2(2), ..., x_n(n)) \quad (1)$$

On the basis of the formula (1) the slope α of X in the interval $[k-1, k]$ is shown in formula (2) below:

$$\alpha = x(k) - x(k-1), k = 2,3,..., n \quad (2)$$

Suppose the length of the reference sequence X_0 and the comparative sequence X_i is the same, as shown in the formula (3):

$$\begin{aligned} X_0 &= (x_{01}(1), x_{02}(2), ..., x_{0n}(n)) \\ X_i &= (x_{i1}(1), x_{i2}(2), ..., x_{0in}(n)), i = 1,2,..., m \end{aligned} \quad (3)$$

The slope sequence of X_0 and X_i in the interval [k-1,k] is in the formula (4) below:

$$\begin{aligned} K_0 &= (k_{01}, k_{02}, ..., k_{0(n-1)}) \\ K_i &= (k_{i1}, k_{i2}, ..., k_{i(n-1)}) \end{aligned} \quad (4)$$

The sequence of slope ratio in the respective corresponding period of X_0 and X_i is in the formula (5) below:

$$K_{0i} = K\left(\frac{X_0}{X_i}\right) = \left(\frac{k_{01}}{k_{i1}}, \frac{k_{02}}{k_{i2}}, ..., \frac{k_{0(n-1)}}{k_{i(n-1)}}\right) \quad (5)$$

Definition 2: The coefficient of variation of the sequence K_0 is in formula (6):

$$\delta(X_0) = \frac{S_0}{\overline{K_0}} \times 100\ \% \quad (6)$$

The expression form of S_0, K_0 in Formula (6) is as formula (7) below:

$$S_0 = \sqrt{\frac{\sum_{j=1}^{n-1}(k_{0j} - \overline{K_0})^2}{n-2}}, \overline{K_0} = \frac{\sum_{j=1}^{n-1} k_{0j}}{n-1} \quad (7)$$

Definition 3: The generalized coefficient of variation of sequence K_{0i} is in formula (8):

$$\xi\left(\frac{X_0}{X_i}\right) = \frac{S_{0i}}{\overline{K_{0i}}} \times 100\ \% \quad (8)$$

The expression form S_0, K_0 of in Formula (8) is as formula (9) below:

$$S_{0i} = \sqrt{\frac{\sum_{j=1}^{n-1}\left(\frac{k_{0j}}{k_{ij}} - 1\right)^2}{n-2}}, \overline{K_0} = \frac{\sum_{j=1}^{n-1}\left(\frac{k_{0j}}{k_{ij}}\right)}{n-1} \quad (9)$$

Definition 4: The improved grey correlation degree of reference sequence X_0 and comparative sequence

FULL PAPER

X_i is as formula (10) below:

$$\gamma(X_0, X_i) = \begin{cases} \dfrac{1 + |\delta(X_0)|}{1 + |\delta(X_0)| + \left|\xi\left(\dfrac{X_0}{X_i}\right)\right|}, \overline{K}_{0i} \geq 0 \\ \dfrac{-(1 + |\delta(X_0)|)}{1 + |\delta(X_0)| + \left|\xi\left(\dfrac{X_0}{X_i}\right)\right|}, \overline{K}_{0i} \leq 0 \end{cases} \quad (10)$$

The model calculation step of improved grey correlation degree

STEP1: Based on the actual problem determine whether the data sequence to be dimensionless processed;

STEP2: According to the calculation method in 2.2 to solve X_0, X_i and K_{0i};

STEP3: Solving the coefficient of variation of sequence K_0 and the sequence K_{0i} generalized coefficient of variation;

STEP4: Solving Grey correlation degree $\gamma(X_0, X_i)$;

Grey correlation degree property

Property 1: The range of $\gamma(X_0, X_i)$ is [-1, 1], when $\gamma(X_0, X_i)=1$ and only $X_i(k) = X_0(k)+c$, then k=1,2...,n and c is a constant;

Property 2: Two sequences $X_i, X_j \in X = \{X_s | s = 0,1,2,...,m; m \geq 2\}$ have a non-symmetrical property, that is $\gamma(X_i, X_j) \neq \gamma(X_j, X_i)$;

Property 3: Grey correlation degree is associated with the sequence shapes, and has nothing to do its relative position in space;

Property 4: The slope ratio of the two sequences X_0, X_i in each period is closer to 1; the grey correlation degree is greater.

DATA OPERATIONS AND RESULTS ANALYSIS

Dimensionless processing of original data

In the 2012-2013 NBA season, the Miami Heat carried out seven games in basketball championship finals, so the sequence is divided into seven time intervals, the sequence number is 15, respectively, score X_0, shot times X_1, shooting average X_2, three-point shot times X_3, three-point shooting average X_4, free throw times X_5, free throw percentage X_6, front rebounds X_7, rear rebounds X_8, total rebounds X_9, assists X_{10}, steals X_{11}, blocked shots X_{12}, turnovers X_{13}, and fouls X_{14} as shown in TABLE 1:

As shown in TABLE 1, there are a total of 15 sequences, and each sequence has 7 time intervals; taking the score as a reference sequence, the 15 sequences are in formula (11):

TABLE 1: Seven games' data of championship Miami Heat in 2012-2013 season NBA basketball championship finals

Sequence	Race 1	Race 2	Race 3	Race 4	Race 5	Race 6	Race 7
X_0	92	103	77	109	104	103	95
X_1	84	83	76	85	86	81	82
X_2	41.67%	49.40%	40.79%	52.94%	43.02%	46.91%	43.90%
X_3	23	19	19	12	23	19	32
X_4	30.23%	52.63%	44.44%	33.33%	47.83%	57.89%	37.50%
X_5	18	14	10	17	23	21	16
X_6	83.33%	78.57%	70.00%	88.24%	82.61%	76.19%	68.78%
X_7	6	9	10	7	12	12	11
X_8	31	27	27	34	22	30	32
X_9	37	36	36	41	34	42	45
X_{10}	16	22	21	23	25	23	14
X_{11}	6	9	12	13	8	10	8
X_{12}	5	6	8	6	3	6	4
X_{13}	4	6	16	9	13	15	16
X_{14}	12	17	21	26	24	26	19

$$
\begin{aligned}
X_0 &= (92,103,77,109,104,103,95)\\
X_1 &= (84,83,76,85,86,81,82)\\
X_2 &= (0.4167,0.494,0.4079,0.5294,0.4302,0.4691,0.439)\\
X_3 &= (23,19,19,12,23,19,32)\\
X_4 &= (0.3023,0.5263,0.4444,0.3333,0.4783,0.5789,0.375)\\
X_5 &= (18,14,10,17,23,21,16)\\
X_6 &= (0.8333,0.7857,0.7,0.8824,0.7619,0.6878)\\
X_7 &= (6,9,10,7,12,12,11)\\
X_8 &= (31,27,27,34,22,30,32)\\
X_9 &= (37,36,36,41,34,42,45)\\
X_{10} &= (16,22,21,23,25,23,14)\\
X_{11} &= (6,9,12,13,8,10,8)\\
X_{12} &= (5,6,8,6,3,6,4)\\
X_{13} &= (4,6,16,9,13,15,16)\\
X_{14} &= (12,17,21,26,24,26,19)
\end{aligned}
\quad (11)
$$

Solving the slope sequence

The slope sequence K_0, K_i and K_{0i} of X_0 and X_i, i=1,2..,14 in the interval [*k*-1,*k*] is shown in TABLE 2:

TABLE 2 : The slope sequence of seven games of Miami Heat

Sequence	[1,2]	[2,3]	[3,4]	[4,5]	[5,6]	[6,7]
K_0	11	-26	32	-5	-1	-8
K_1	-1	-7	9	1	-5	1
K_2	7.73%	-8.61%	12.15%	-9.92%	3.89%	-3.01%
K_3	-4	0	-7	11	-4	13
K_4	22.40%	-8.19%	-11.11%	14.50%	10.06%	-20.39%
K_5	-4	-4	7	6	-2	-5
K_6	-4.76%	-8.57%	18.24%	-5.63%	-6.42%	-7.41%
K_7	3	1	-3	5	0	-1
K_8	-4	0	7	-12	8	2
K_9	-1	0	5	-7	8	3
K_{10}	6	-1	2	2	-2	-9
K_{11}	3	3	1	-5	2	-2
K_{12}	1	2	-2	-3	3	-2
K_{13}	2	10	-7	4	2	1
K_{14}	5	4	5	-2	2	-7
K_{01}	-11.00	3.71	3.56	-5.00	0.20	-8.00
K_{02}	142.30	301.97	263.37	50.40	-25.71	265.78
K_{03}	-2.75	/	-4.57	-0.45	0.25	-0.62
K_{04}	49.11	317.46	-288.03	-34.48	-9.94	39.23
K_{05}	-2.75	6.50	4.57	-0.83	0.50	1.60
K_{06}	-231.09	303.38	175.44	88.81	15.58	107.96
K_{07}	3.67	-26.00	-10.67	-1.00	/	8.00
K_{08}	-2.75	/	4.57	0.42	-0.13	-4.00
K_{09}	-11.00	/	6.40	0.71	-0.13	-2.67
K_{010}	1.83	26.00	16.00	-2.50	0.50	0.89
K_{011}	3.67	-8.67	32.00	1.00	-0.50	4.00
K_{012}	11.00	-13.00	-16.00	1.67	-0.33	4.00
K_{013}	5.50	-2.60	-4.57	-1.25	-0.50	-8.00
K_{014}	2.20	-6.50	6.40	2.50	-0.50	1.14

Solving correlation degree

From Table 2 we can obtain the formula (12), (13), (14), (15) and (16):

$$\overline{K_0} = \frac{\sum_{j=1}^{n-1} k_{0j}}{n-1} = 0.5 \quad (12)$$

$$S_0 = \sqrt{\frac{\sum_{j=1}^{n-1}\left(k_{0j} - \overline{K_0}\right)^2}{n-2}} = 37.56 \quad (13)$$

$$\delta(X_0) = \frac{S_0}{\overline{K_0}} \times 100\% = 751\% \quad (13)$$

$$S_{0i} = \sqrt{\frac{\sum_{j=1}^{n-1}\left(\frac{k_{0j}}{k_{ij}} - 1\right)^2}{n-2}} = \begin{cases} 7.42, i=1 \\ 224.79, i=2 \\ 3.21, i=3 \\ 194.34, i=4 \\ 3.49, i=5 \\ 197.53, i=6 \\ 13.61, i=7 \\ 3.30, i=8 \\ 6.15, i=9 \\ 13.14, i=10 \\ 14.65, i=11 \\ 10.92, i=12 \\ 5.52, i=13 \\ 4.27, i=14 \end{cases}, \overline{K_0} = \frac{\sum_{j=1}^{n-1}\left(\frac{k_{0j}}{k_{ij}}\right)}{n-1} = \begin{cases} -1.11, i=1 \\ 171.17, i=2 \\ -1.35, i=3 \\ 4.85, i=4 \\ 2.47, i=5 \\ 138.23, i=6 \\ -7.42, i=7 \\ 0.22, i=8 \\ 1.08, i=9 \\ 8.18, i=10 \\ 5.57, i=11 \\ -4.73, i=12 \\ -3.38, i=13 \\ 0.61, i=14 \end{cases} \quad (14)$$

$$\frac{S_{0i}}{\overline{K_{0i}}} \times 100\% = \begin{cases} -668.78\%, i=1 \\ 131.33\%, i=2 \\ -237.48\%, i=3 \\ 4007.01\%, i=4 \\ 141.46\%, i=5 \\ 142.90\%, i=6 \\ -183.43\%, i=7 \\ 1499.64\%, i=8 \\ 569.20\%, i=9 \\ 160.63\%, i=10 \\ 262.98\%, i=11 \\ -230.86\%, i=12 \\ -163.43\%, i=13 \\ 700.79\%, i=14 \end{cases} \quad \gamma(X_0, X_i) = \begin{cases} -0.56, i=1 \\ 0.87, i=2 \\ -0.78, i=3 \\ 0.18, i=4 \\ 0.86, i=5 \\ 0.86, i=6 \\ -0.82, i=7 \\ 0.36, i=8 \\ 0.60, i=9 \\ 0.84, i=10 \\ 0.76, i=11 \\ -0.79, i=12 \\ -0.84, i=13 \\ 0.55, i=14 \end{cases} \quad (15)$$

By the formula (15) we can obtain formula (16):

$$\gamma(X_0, X_2) > \gamma(X_0, X_5) \geq \gamma(X_0, X_6) > \gamma(X_0, X_{10}) > \gamma(X_0, X_{11}) > \text{Otherwise} \quad (16)$$

Therefore, when *i*=2,5,6,10,11 the correlation degree is large, that is, the corresponding shooting average, free throw times, free throw percentage assists and steals have the best correlation on the final score.

The actual game analysis shows that the key to score is in the shooting average. But in order to win the shot chance, assists and steals are particularly important, and the outcome of the game is not in the hands of high

FULL PAPER

difficulty techniques (such as blocks and three-point shots). International top basketball game like NBA almost never lead to victory due to team fouls. Of course, reasonable tactical arrangements can induce the opponent fouls and get free throws, the increase of free throws and free throw percentage can also greatly improve the win rate.

CONCLUSIONS

Based on improved grey correlation analysis model, this paper analyzes the relationship between the technical indicators and total score of seven games of the 2012-2013 season NBA final champion Miami Heat, obtains the shooting average, free throw times, free throws shooting, assists and steals these five indexes have the maximum correlation with the total score and match with the actual situation. The algorithm given in the research can not only study the correlation between the final score and a few remaining items, but also can obtain the correlation between arbitrary one item and various other items; through data analysis and conclusions we draw the general Procedure to study sports game using grey correlation degree, but also provides a scientific approach for the analysis of NBA basketball team's technical indicators.

REFERENCES

[1] Bing Zhang, Yan Feng; The Special Quality Evaluation of the Triple Jump and the Differential Equation Model of Long Jump Mechanics Based on Gray Correlation Analysis. International Journal of Applied Mathematics and Statistics, **40(10)**, 136-143 **(2013)**.

[2] Bing Zhang; Dynamics Mathematical Model and Prediction of Long Jump Athletes in Olympics. International Journal of Applied Mathematics and Statistics, **44(14)**, 422-430 **(2013)**.

[3] Cai Cui; Application of Mathematical Model for Simulation of 100-Meter Race. International Journal of Applied Mathematics and Statistics, **42(12)**, 309-316 **(2013)**.

[4] Cao Ming-xia; Research on grey incidence analysis model and its application. Nanjing University of aeronautics and astronautics, **01**, 26-32 **(2007)**.

[5] Guo Yong-dong; Analysis on offense and defense ability of the Chinese man basketball team in the 28th Olympic games. Journal of Beijing University of Physical Education, **28(4)**, 556-558 **(2005)**.

[6] Haibin Wang, Shuye Yang; An Analysis of Hurdle Performance Prediction Based On Mechanical Analysis and Gray Prediction Model. International Journal of Applied Mathematics and Statistics, **39(9)**, 243-250 **(2013)**.

[7] Han Wei, Wang Lei; Comparative analysis of the ability of offence and defense of NBA ambiguous position player with the traditional position players. Journal of Southwest China Normal University (Natural Science Edition),**32(2)**,153-158 **(2013)**.

[8] Hongwei Yang; Evaluation Model of Physical Fitness of Young Tennis Athletes Based On AHP-TOPSIS Comprehensive Evaluation. International Journal of Applied Mathematics and Statistics, **39(9)**, 188-195 **(2013)**.

[9] Mi Le, Li Ke-ke, Zhang Hui, Feng Jie; On the influence of the offensive and defensive abilities of NBA bench for the game results. Journal of Capital Institute of Physical Education, **20(4)**,106-107 **(2008)**.

[10] Tang Wu-xiang; The concept and the computation method of T's correlation degree. Application Of Statistics And Management, **14(1)**,34-37, 33 **(1995)**.

[11] Yi Liu; The Establishment of Hierarchical Model for Basketball Defensive Quality. International Journal of Applied Mathematics and Statistics, **44(14)**, 245-252 **(2013)**.

[12] Yong Fan; Statistical Analysis Based On Gray System Theory Basketball Team Scores Its Technical Indicators Associated. International Journal of Applied Mathematics and Statistics, **44(14)**, 185-192 **(2013)**.

[13] Zuojun Tan; Fuzzy Data Envelopment Analysis and Neural Network Evaluation Mathematical Applications Model Which Based On Martial Arts Competition. International Journal of Applied Mathematics and Statistics, **44(14)**, 37-44 **(2013)**.