



Miami heat basketball technical indicators relational degree analysis based on grey correlation model

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ABSTRACT

By adopting grey system correlation analysis, carry out analysis NBA Miami Heat 5 competitions from Jan.10th to Jan.19th 2011, establish grey correlation analysis model. Calculate Miami Heat technical indicators and team ranking relational degree by mathematical software, solve teams each technical indicator and its performance correlation. Compare Miami Heat technical indicators and relational degree values in competition performance and make sorting, get the team indicators sort as inside shooting, field-goal percentage, layup, jump shot hit, free throw percentage, three-point shot percentage, fault times, fast break scoring, assist times, follow-up shot, block shot times, rebound totals, success dunk, steal times, secondary attack. With Miami Heat technical indicators and their scores relations, calculate team each technical indicator weight accounts for, make reasonable suggestions on team development according to each technical indicator weight.

Key words: Grey correlation analysis, indicator weight, basketball technique, Miami Heat

INTRODUCTION

Since NBA predecessor BAA was founded, NBA development has already 63 years' history. The original intention of founding NBA is to fill professional ice hockey federation non-competition day idle arena. In the beginning of founding, NBA experiences a hard time, most of clubs suffered seriously loss. Now, NBA not only successfully breaks through sports, cultural transmission and entertainment industry bounds, it becomes America even world highest professional extent sports federation, and with the help of global economic integration opportunity, pack competitive basketball into a kind of each skin and race warmly pursued cultural commodity, and deep into every corner on the earth. Just by the basketball charm and cultural worship, NBA continuously enlarge its domains and carries out global expansion, finally it develops into whole world possessing huge economic markets business entertainment brand [1-3].

NBA officials would make detailed statistics on competition each data, from which statistics items are playing time, shooting total times as well as hit times and hit rate, two-point shot total times as well as hit times and hit rates, three-point shot total times as well as hit times and hit rates, free throw times as well as hit times and hit rates, front-court rebounds and back-court rebounds, assist times, fault times, steal times, block shot times, foul times as well as score totals and other items, on that basis officials would implement comparison analysis of historical data on players and teams, it can get each statistical item historical data maximum value, average value and minimum value, define players or teams arrive at what competition data so that they can win or fail under these conclusions statistics [4, 5]. For NBA dual meet research and grey correlation analysis method trial, lots of people has made efforts, the former research result has detailed summary on techniques in NBA competition process and provides more wonderful theory platform for the competition that attracts world attention, the latter research result provides more widely trial range for grey correlation analysis method application [6-8].

Grey correlation theory carries out relational degree analysis of each sub system, it can explore system each sub system (or factor) values relations by a certain method. Therefore, grey relational degree analysis provide measurement method for a system development change that is proper for making ball game dynamic course analysis. Therefore, this paper establish grey correlation analysis model to research on NBA Miami Heat.

MODEL ESTABLISHMENTS

Miami Heat indicator and competition performance correlation analysis

Implement technical data statistics on Miami Heat five competitions from Jan.10th to Jan.19th in 2011 (refer to Table 1), and handle with table data, further consider team each indicator status, and analyze team technical indicator and the team scores relational degree.

Table 1: Miami Heat each item technical statistics

Session	Miami Heat Vs New York Knicks	Miami Heat vs Brooklyn Nets	Miami Heat Vs Washington Wizards	Miami Heat Vs Philadelphia 76ers	Miami Heat Vs Charlotte Bobcats
Scores	92	95	97	101	104
Assist times	20	19	22	30	16
Block shot times	4	2	1	12	5
Rebound totals	32	39	35	38	43
Steal times	7	5	6	13	5
Fault times	15	14	12	17	12
Success Dunk	3	2	5	3	2
Jump shot hit	19	18	24	20	14
Layup	13	13	7	12	14
Follow-up shot hit	1	1	1	3	1
Fast break scoring	14	9	13	9	7
Inside scoring	42	44	42	44	44
Secondary attack	5	2	12	15	9
Field-goal percentage%	54.4	42.5	44	47.5	49.4
Three-point shot percentage%	33.3	26.1	28	34.8	33.3
Free throw percentage%	52.4	77.8	94.1	85	65.5

According to above data, we utilize Excel tool, get Figure 1 as following:

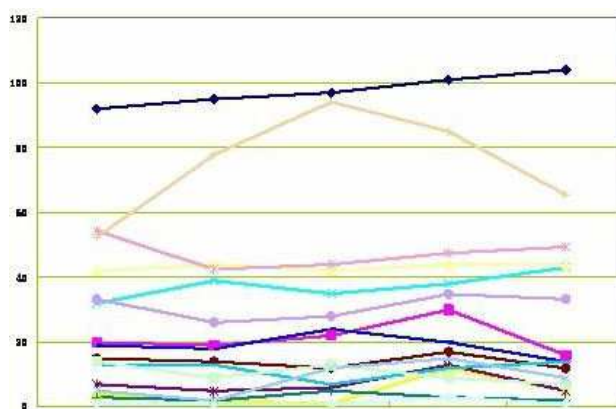


Figure1: Miami Heat technical statistics

Miami Heat 5 rounds competition performance record as $x_0 = \{x_0(k) | k = 1, 2, \dots, 5\}$, x_0 as criterion series:

$$x_0 = \{x_0(k) | k = 1, 2, \dots, 5\} = (x_0(1), x_0(2), x_0(3), x_0(4), x_0(5))$$

Among them, k is game session, $x_0(k)$ is x_0 technical statistic values in the k game session. Record $x_a = 1, 2, \dots, 15$ as Miami Heat each item technical indicator; construct competition performance into comparison series:

$$x_a = \{x_a(k) | k = 1, 2, \dots, 5\} = (x_a(1), x_a(2), x_a(3), x_a(4), x_a(5)) \quad (a = 1, 2, \dots, 17)$$

Then, comparison series x_i correlation coefficient for criterion series x_0 in k is:

$$\xi_a(k) = \frac{\min_a \min_k |x_0(k) - x_a(k)| + \rho \max_a \max_k |x_0(k) - x_a(k)|}{|\min_a \min_k |x_0(k) - x_a(k)| + \rho \max_a \max_k |x_0(k) - x_a(k)|}$$

Among them, technical statistics and comparison criterion correlation coefficient is expressed by $\xi_a(k)$, $\rho \in [0, 1]$ is called resolution coefficient, $\min_a \min_k |x_0(k) - x_a(k)|$ is called two-level minimum difference, $\max_a \max_k |x_0(k) - x_a(k)|$ is called two-level maximum difference. Normally, resolution coefficient ρ values 0.5.

Define comparison series x_a relational degree on criterion series x_0 to judge system indicators relational degree sizes indicator. Comparison series and criterion series relational degree in one session is called correlation

$$r_a = \frac{1}{n} \sum_{k=1}^n \xi_a(k)$$

coefficient, relational degree is:

Calculate each session correlation coefficient average value, carry out data handling. Observe Table 1, convert Miami Heat each technical indicator data as dimensionless data, set net and Miami Heat competition data as criterion, and implement conversion, let original series to be: $X = (x(1), x(2), \dots, x(n))$

$$\bar{X} = \left(\frac{x(1)}{x(2)}, 1, \frac{x(3)}{x(2)}, \dots, \frac{x(n)}{x(2)} \right)$$

Then its composed initial series is:

Because initial series is not dimensionless series, convert all original series into initial series, get initial series table as following Table 2 shows.

Table 2: Miami Heat initial series table

Session	Miami Heat Vs New York Knicks	Miami Heat vs Brooklyn Nets	Miami Heat Vs Washington Wizards	Miami Heat Vs Philadelphia 76ers	Miami Heat Vs Charlotte Bobcats
Scores	0.968	1.000	1.021	1.063	1.095
Assist times	1.053	1.000	1.158	1.579	0.842
Block shot times	2.000	1.000	0.500	6.000	2.500
Rebound totals	0.821	1.000	0.897	0.974	1.103
Steal times	1.400	1.000	1.200	2.600	1.000
Fault times	1.071	1.000	0.857	1.214	0.857
Success Dunk	1.500	1.000	2.500	1.500	1.000
Jump shot hit	1.056	1.000	1.333	1.111	0.778
Layup	1.000	1.000	0.538	0.923	1.077
Follow-up shot hit	1.000	1.000	1.000	3.000	1.000
Fast break scoring	1.556	1.000	1.444	1.000	0.778
Inside scoring	0.955	1.000	0.955	1.000	1.000
Secondary attack	2.500	1.000	6.000	7.500	4.500
Field-goal percentage%	1.280	1.000	1.035	1.118	1.162
Three-point shot percentage%	1.276	1.000	1.073	1.333	1.276
Free throw percentage%	0.674	1.000	1.210	1.093	0.842

Initial series: $\min_a \min_k |x_0(k) - x_a(k)| = 0$

$$\xi_i(k) = \frac{0.5 \times \max_a \max_k |x_0(k) - x_a(k)|}{|\min_a \min_k |x_0(k) - x_a(k)| + 0.5 \times \max_a \max_k |x_0(k) - x_a(k)|}$$

So simplified correlation coefficient formula is:

Among them, $\rho \in [0, 1]$ is called resolution coefficient, technical statistics and comparison criterion correlation coefficient is expressed by $\xi_a(k)$, two-level maximum difference is expressed by $\max_a \max_k |x_0(k) - x_a(k)|$.

$$r_a = \frac{1}{n} \sum_{k=1}^n \xi_a(k)$$

Relational degree formula is:

According to grey correlation analysis model, use Matlab software to program, get Miami Heat each technical indicator and competition performance relational degree (refer to Table 3).

Matlab program:

```
x0=[0.96842, 1, 1.0211, 1.0632, 1.0947;];
x1=[1.0526, 1, 1.1579, 1.5789, 0.84211;2, 1, 0.5, 6, 2.5;0.82051, 1, 0.89744, 0.97436, 1.1026;1.4, 1, 1.2, 2.6,
1;1.0714, 1, 0.85714, 1.2143, 0.85714;1.5, 1, 2.5, 1.5, 1;1.0556, 1, 1.3333, 1.1111, 0.77778;1, 1, 0.53846, 0.92308,
1.0769;1, 1, 1, 3, 1;1.5556, 1, 1.4444, 1, 0.77778;0.95455, 1, 0.95455, 1, 1;2.5, 1, 6, 7.5, 4.5;1.28, 1, 1.0353, 1.1176,
1.1624;1.2759, 1, 1.0728, 1.3333, 1.2759;0.67352, 1, 1.2095, 1.0925, 0.8419;];
p=0.5;
for i=1:5
for j=1:15
y(j, i)=x0(i)-x1(j, i);
end
end
y;
y=abs(y)
ma=max(max(y));
mi=min(min(y));
for j=1:15
for i=1:5
ksai(j, i)=(mi+p*ma)/(p*ma+y(j, i));
end
end
ksai=ksai';r=sum(ksai)/5;
```

Table 3: Correlation coefficient table

r_1	r_2	r_3	r_4	r_5	r_6	r_7	r_8
0.9197	0.9139	0.9020	0.8745	0.9250	0.8791	0.9562	0.9625
r_9	r_{10}	r_{11}	r_{12}	r_{13}	r_{14}	r_{15}	\
0.9159	0.9241	0.9855	0.5779	0.9740	0.9533	0.9558	\

Each technical indicator sort

Adopt Matlab mathematical software to solve Miami Heat each technical indicator and competition score relational degree values and get results. Miami Heat sort results as Table 4:

Table 4: Miami Heat technical indicator sort

Rank	Technical indicator	Rank	Technical indicator
1	Inside scoring	9	Assist times
2	Field-goal percentage	10	Follow-up shot hit
3	Layup	11	Block shot times
4	Jump shot hit	12	Rebound totals
5	Free throw percentage%	13	Success Dunk
6	3-point shot percentage%	14	Steal times
7	Fault times	15	Secondary attack
8	Fast attack scoring	\	\

Each indicator weight

Analyze each item relational degree, it can get that “score” larger relational degree technical indicators should be fully played when in competition so as to improve team performance. In training, train more small relational degree technical indicators as much as possible, make Miami team get rapidly improvement in overall strength [9].

According to relational degree sort results, select Miami Heat normal training required trained assist times, block shot times, rebound totals, success dunk; steal times, secondary attack relative subjects. Solve these 7 items

technical indicators weight coefficients, and add them together getting: $\sum r_i = r_1 + r_2 + r_3 + r_4 + r_6 + r_9 + r_{12}$

Adopt formula r_i weight = $\frac{r_i}{\sum r_i} \times 100\%$, calculate it and get Table 5:

Table 5: Each technical indicator weight

Indicator x_i	x_1	x_2	x_3	x_4	x_6	x_9	x_{12}
Weight	18.15%	18.04%	17.80%	17.26%	17.35%	18.08%	11.40%

Among them, x_1 represents assist times, x_2 represents block shot times, x_3 represents rebound totals, x_4 represents steal times, x_6 represents success dunk, x_9 represents follow-up shot hit, x_{12} and represents secondary attack.

CONCLUSION

Adopted grey system correlation model to research each item indicator system and team performance correlations, defined measurement standards, clearly reflected Miami Heat technical indicators and the team performance correlation essence. According to weight proportions, made suggestions for team with stronger targeting, more correspond with team realistic existing problems. According to above team technical indicators and scores relations, for Miami Heat, strengthen training players cooperation, and strengthen block shot technical training, focus on cooperation and improve fast break steal techniques. Totally adopt method with making best use of advantages and bypassing the disadvantages, fast improve team strength.

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