



# Analysis and Research on Technical Characteristics of Basketball Players Based on Big Data Mining – Taking CBA League as an Example

Lie Li, Suzi Tu<sup>(✉)</sup>, and Weijing Xu

School of Management, Wuhan University of Technology, Hongshan, Wuhan, Hubei, China  
1587265812@qq.com

**Abstract.** In today's world, With the rapid progress of information technology innovation, the development of big data is a necessity of the times, and the data mining technology is a signature product within the development of the big data era. This paper uses mathematical statistics and data mining technology to analyze and study the various data and technical characteristics of basketball players in CBA League, including technical application and shot selection. Thus, it is helpful for coaches to arrange game tactics, make training plans, make personnel adjustment decisions, and ultimately contribute to improving the team's winning rate.

**Keywords:** Big data mining · sports data analysis · CBA League

## 1 Introduction

As a team sport, striving to win is the eternal theme of basketball. In the major professional basketball leagues, all the teams compete fiercely for the championship. Therefore, how to improve the winning rate and win the game is the most concerned problem for the coaches and teams in every basketball professional league. [1] Therefore, this paper aims to use data mining technology to find out the technical application, shot selection and other technical characteristics of key players that significantly affect the trend of matches in the current league by a number of data analysis, so as to make suggestions for coaches to effectively arrange the tactics of matches, training plans and personnel adjustment. [2, 3].

## 2 Research Objects and Methods.

### 2.1 Objects

The research selected the technical statistics of key players of Liaoning Team and Ningbo Team in the first 13 rounds of CBA in the 2021–2022 season as its object.[4].

© The Author(s) 2023

J. Yen et al. (Eds.): ICBIS 2023, AHCS 14, pp. 1485–1493, 2023.

[https://doi.org/10.2991/978-94-6463-198-2\\_154](https://doi.org/10.2991/978-94-6463-198-2_154)

## 2.2 Research methods

### 1) Literature research method.

Check CBA official statistics website and read periodicals and magazines.

### 2) Mathematical statistics method.

Make technical statistics and comparative analysis on the key players in the first 13 rounds of Liaoning Team and Ningbo Team.

### 3) Data mining method.

Extract the effective information hidden in the actual competition data, which is random, incomplete and fuzzy, then find out the potential relationship between the data.

### 4) Video analysis method.

In order to provide necessary materials for this study, a comprehensive and detailed analysis is made on the key players in all 25 games of the two teams in the first 13 rounds of the competition.

## 3 Results & Discussion

### 3.1 Player ability analysis

Based on the data collection and statistics in Table 1, we can carry out theoretical analysis and establish a five level radar chart that can conduct ability analysis for players. In this radar chart, each indicator is divided into 5 levels. The innermost circle is grade E and the outermost circle is grade A. The apex of each indicator is the highest grade in the league. Take Guo Ailun belonging to Liaoning Team as an example, as shown in Fig. 1

As can be seen from Fig. 1, Guo Allen's scoring ability is the top in the league, with 23.3 points per game only 0.9 points lower than the highest 24.2 in the league history. Moreover, Guo Allen's playing time is less than 30 min, which is enough to show that Guo Allen is one of the most lethal scorers in the league. In addition, while maintaining offensive firepower, Guo is also achieve average 6.6 assists per game showing a remarkable ability to share the ball. His efficiency rating impressively reaches 20.4, but he also has 3.4 turnovers, with a turnover to assist ratio of nearly 2:1.

### 3.2 Analysis of players' shot selection

Through the video analysis method, the key players in all 25 games of the two teams, in the first 13 rounds of the league, were analyzed in a comprehensive and detailed way, and the hot spot map of the shooting area of the players was established based on the technical statistics in Table 1. Through the map, we can intuitively observe the shot selection and shot preference of the player. Take Zhao Jiwei belonging to Liaoning Team as an example, his shot selection map is shown in Fig. 2:

As can be seen from Fig. 2, Zhao Jiwei tends to shoot from 30 to 60 degrees from the left outside the three-point line. Inside the 3-point line and outside the 3-s zone, Zhao's shot options were concentrated near the free throw line and on the right side of the 3-s zone. In the three-second zone, Zhao jiwei's shot choices were basically in the reasonable collision zone and evenly distributed.

**Table 1.** Data of Excellent players of Liaoning team and Ningbo Team in the 2021–2022 CBA Season

Name	Guo Ailun	Zhao Jiwei	Han Dejun	Zhang Zhenlin	Zhang Biao	Ma Zhenxiang	Han Delong
Team	Liaoning	Liaoning	Liaoning	Liaoning	Ningbo	Ningbo	Ningbo
Points	23.3	13	14.8	13.1	17.7	11.8	11.1
Rebound	3.3	2.8	11	5.4	2.7	3	1.9
Front rebound	0.7	0.2	3.7	0.8	0.4	0.6	0.5
Back rebound	2.6	2.5	7.3	4.6	2.3	2.4	1.4
Assists	6.6	9.4	1.9	2.3	3.5	1.5	4
Steals	0.9	1.7	0.7	1.6	1.2	1.1	1.7
Blocks	0.1	0	0.9	0.3	0.3	0.8	0
FGs	48	38.9	68	41	59.2	42.6	41.7
3-point FGs	46.2	32.6	0	36.2	0	37.8	35.7
Free throw	81.6	85.7	67.9	76.5	81.4	64.3	73.3
Turnover	3.4	2.2	1.7	2.7	1.9	1.5	1.7
Fouls dunk	2	2.1	2.4	1.3	2.9	2.2	2.3
PER	20.4	17.3	23.4	12.6	17.8	10.3	11
PTS	12.6	8.6	11.1	14.5	-14.2	-10.8	-14.2
Time (min)	27	29	25	33	30	30	29

Take Zhang Zhenlin of Liaoning team as an example, his shot selection map is shown in Fig. 3.

It can be seen from Fig. 3 that Zhang Zhenlin is more inclined to shoot from 30 degrees left to 60 degrees right, while there are fewer shots from 0 degrees bottom corner on both sides. Besides, inside the three-point line and outside the three-second zone, Zhang Zhenlin's shot choices are concentrated at 30 degrees to 60 degrees on the left side of the three-second zone. In the three-second zone, Zhang Zhenlin's shot choices are basically in the reasonable collision zone and evenly distributed.

### 3.3 Analysis of players' field goals

We use mathematical statistics to make a comprehensive and detailed analysis of the shooting data and field goals of the players, and establish the shooting area hit map of the players according to the technical statistics in Fig. 1, so as to intuitively see the shooting

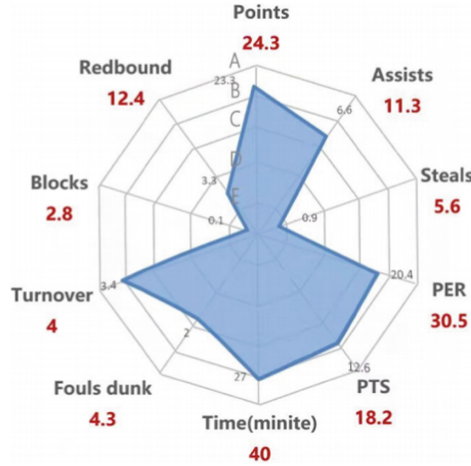


Fig. 1. Level 5 radar diagram of Guo Ailun

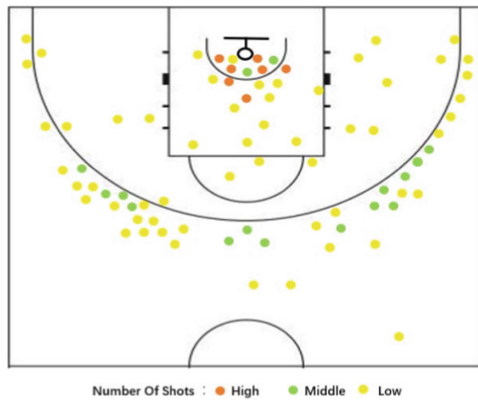


Fig. 2. Zhao Jiwei's hot spot map of the shooting area

situation of the players in each area. Take Ma Zhenxiang of Ningbo Team as an example, his shooting area hit map is shown in Fig. 4:

Figure 4 clearly shows that Ma Zhenxiang's field—goal percentage is up to 52% from the left three-point range, but less than 40% from the right. In addition, Ma Zhenxiang also has a excellent field-goal percentage from the left corner of the three-point line. In addition to the three-point line, Ma Zhenxiang prefers to shoot from the left side of the three- second zone and the reasonable collision zone, with the high field-goal percentage.

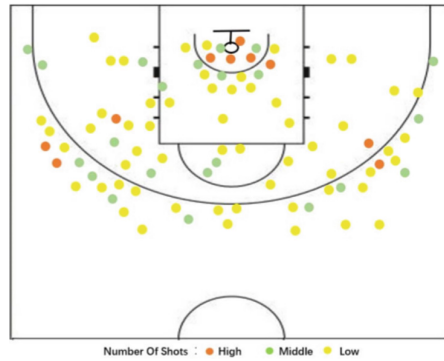


Fig. 3. Zhang Zhenlin’s hot spot map of the shooting area

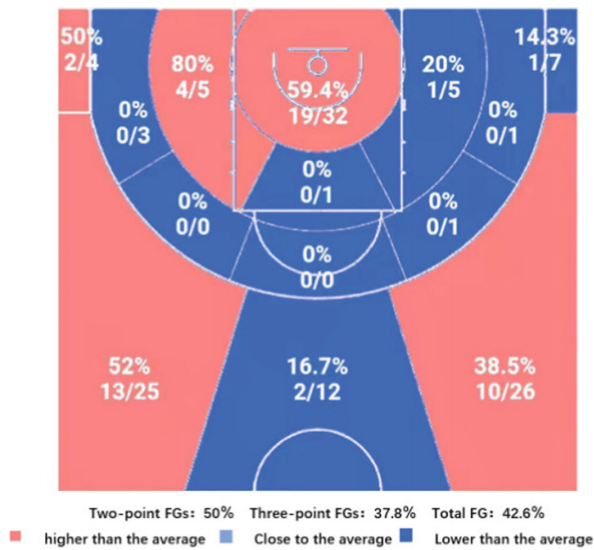


Fig. 4. The shooting area hit map of Ma Zhenxiang.

## 4 Results and Research

The analysis and research results obtained from the big data analysis and mining of players can be applied to the coaches’ tactical arrangement, training plan, personnel adjustment and other aspects, providing help for the coaches’ tactical reserve and on-the-spot command, ultimately contributing to the improvement of the team’s winning rate.[5].

### 4.1 Tactical arrangement research

Through the big data analysis of the players, as well as the analysis of the players’ ability and shot selection, it can help the coach to formulate the exclusive offensive

and defensive tactics for the players. On the one hand, exclusive offensive tactics can be applied in the crucial period of the game and the key ball, thus establishing an advantage. On the other hand, defensive tactics can better suppress the performance of the other side. In general, the combination of offensive and defensive tactics can greatly improve the winning rate of the game.

Take Guo Ailun for example. He reached averaging 17.9 field goal attempts and had the field-goal percentage of 48 percent this season (through the first 13 rounds). He made 3.7 shots from 3-point range and had the 3-point field-goal percentage of 46.2 percent, which has improved by leaps and bounds this season. However, there also exists instability. For example, on October 25, In the match with Xinjiang Team, he shot five out of five, but on November 6 and 11, they were 0- for-5 and 1-for-5 respectively. Guo's main means of scoring is offensive rebounds. He has made 36 rebounds out of 65 attempts this season, with the field-goal percentage under the basket of 55.4 percent.

Therefore, when developing a defensive strategy against Guo, consider one leading the defense, with two or three to help break through and supplement the defense. While Guo is averaging 6.6 assists per game this season, he also has 3.4 turnovers, meaning he's prone to turnovers when faced with collaborative defense.

Taking Han Dejun as an example, he is shooting 68% from the field with an average of 5.8 shots and 8.6 attempts per game through the first 13 rounds. However, Han has not attempted a single shot from beyond the three-point line and has only attempted six shots from outside the three-second zone this season, making three of them. As a traditional inside player, Han Dejun scored mainly by attacking the basket from close range. He has made 67 of 97 attempts around the basket this season with the basket hit ratio as high as 69. 1%. Therefore, when making the defensive tactics against him, consider a 2-3 zone defense, in which the three defenders near the baseline try to compress Han's offensive space and prevent the defenders from passing the ball to Han's hands while taking care of their own zone. As a result, Han Dejun will be far away from his most comfortable offensive area, and his hit rate will be significantly reduced. What's more, Han's ability to rebound, averaging 3.7 rebounds a game, will be severely limited as he stays away from the basket. In general, complete defensive success will be achieved.

Take Zhang Zhenlin for example. Through the first 13 games of the season, he has been averaged 11.6 field goal attempts and 4.8 field goals per game, with a 41 percent shooting percentage. To be specific, he shot 43.5 percent from 2-point range and 36.2 percent from 3-point range. It can be seen that as a forward player, Zhang Zhenlin has a lot of shooting areas to choose from, and he has been shot from the left side of the three-point line from 30 degrees to 75 degrees for 17 times, hitting 8 shots with a 47. 1% shooting percentage. In addition, using physical advantages to impact the basket is still Zhang Zhenlin's main means of scoring. This season, he made 32 of 55 shots from near the charging zone, with a 41% high shooting percentage. Therefore, when developing a defensive strategy against him, the coach can select a fast- moving forward player to play alongside an inside player with strong ability to protect the rim. The fast-moving forward player defends from the 3-point line, especially from the left, trying to block Zhang's three-point attempts. What's more, when Zhang chooses to break through, the forward players can quickly catch up with him and send him to the basket without losing position. They will double attack Zhang zhenlin with the interior players with strong

ability to protect the rim to interfere with zhang's shooting under the basket and reduce his shooting percentage, so that the defense succeeds.

## 4.2 Training plan research

Through the big data analysis of the players, as well as the analysis of the players' ability and shot selection, the research can help the coach to formulate an exclusive shooting training plan for the player, specifically improve the shooting ability of the player, avoid shooting in the low-hitting area, and increase the field-goal percentage of the game.

Take Ma Zhenxiang for example. This season, he made 13 of 25 shots from the left three-point line with FGs of 52 percent and 10 of 26 shots from the right three-point line with FGs of 38.5 percent, so he can practice shooting from the right three-point line more in daily training and shoot from the left three-point line more in games. Since he doesn't have a good shot option or percentage from one step inside the 3-point line or outside the 3-s zone, he can try more shots in practice and games.

Take Zhang Biao for example. He played as a power forward through the first 13 rounds of the season. He made 5 of 11 long two-point attempts inside the left three-point line for a 45.4 percent percentage and 12 of 24 long two-point attempts outside the left three-second zone for a 50 percent percentage. Besides, He made 5 of 7 long two-point attempts inside the right three-point line for a 71.4 percent percentage and 11 of 18 two-point attempts outside the left three-second zone, shooting 61.1 percent. He also shot well from the free throw line and the arc of the three-point line. But he hasn't attempted a shot from beyond the three-point line this season. It can be seen that Zhang Biao's shooting area is in the three-point line, and has a high hit rate in the three-point line. Therefore, he can practice shooting from the right corner more in training, and try to shoot from the right three-point line in the game. Once he tries to shoot from the right three-point line without success, he will step forward to the hot spot of his shooting.

## 4.3 Personnel adjustment research

Through the analysis of players' big data and players' ability, the research can help coaches make targeted personnel adjustments for their teams according to the exchange of opposing players, so as to lay the game advantage and improve the game winning rate.

Take Liaoning Team as example, when Guo Ailun and Zhao Jiwei played at the same time, The defense will implement a targeted defensive strategy, such as cutting off Guo Ailun and Zhao Jiwei's contact first, making adjustments to allow players with a physical advantage to play against them, increasing physical intensity to stop Zhao Jiwei's organization and so on. When Guo Alun and Zhang Zhenlin form a fast break team to drive to the basket, the defense should carry out targeted defense around the basket, such as increasing the height of the front line and optimizing the selection of power centers and so on. When Zhao Jiwei and Han Dejun are present at the same time, the defenders should cut off the contact between Zhao Jiwei and Han Dejun and prevent Zhao Jiwei from passing the ball to Han Dejun. For example, they should give tight defense to Zhao Jiwei, give more physical confrontation, increase the defense intensity, and try to restrain his organization.

Take the Ningbo team for example. The team is currently bottom of the league. The key is to maximize the ability of key players such as Zhang Biao and Ma Zhenxiang. For example, the coach can selectively select the playing nodes of key players such as Zhang Biao according to the different lineups of the defense side, so that the key players can attack more easily, so as to play a better level, and then drive the team; In addition, it is also important to choose appropriate players and offensive tactics according to the technical characteristics of key players and the lineup of the defensive side. For example, when facing high, heavy, but slow inside defenders, the coach can make use of the technical characteristics of Zhang Biao's medium and long range shooting, so that he can better play against the defenders.

## 5 Conclusions

This study excavates and analyzes the big data of CBA players. The analysis results are obtained from three aspects: player ability analysis, player shot selection analysis and player field-goal percentage analysis. Then make the tactical arrangement, training plan and personnel adjustment according to the analysis results of the three aspects and draw the conclusion.

This conclusion can provide targeted advice, including tactical arrangements, training plans and personnel adjustments, for coaches from various professional league, national team and school team. To increase the comprehensiveness of coaches' on-the-spot command and pre-match arrangement, and improve the game winning rate. But this research only includes the analysis and conclusion on the level of player data, not the players of the game, Random variables such as physical condition and emotional performance were taken into account.

## References

1. Zhong Weidong. (2014) "Data analysis of liaoning team and Xinjiang team in CBA league - Take the CBA playoffs during the 2012-2013 season". *Modern Sports technology*, vol.4, pp. 131- 132.
2. Zhao Yixin.(2018) "Research on the Application of Big Data in NBA League". *Harbin Journal of Physical Education*, vol.36, pp.78-82.
3. Yang Shuangyan, Zhaoshuining.(2003)"Application of Data Mining in PE data analysis". *Zhejiang Sports Science*,vol.25.pp.49-51.
4. Zhu Hongjun. (2018) "The statistical analysis of Chinese men's basketball players in the World Series and CBA League", pp. 261-262.
5. Wang Xiaohui, Pang Shulan.(2019) "Application of data mining technology in CBA League", *Trend of science and technology*, vol. 10, pp.95-95.



**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

