

Application of Fuzzy Decision-Making Methods in the NBA Team Ranking

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Abstract. In this paper, a simple decision-making model has been established based on the method of fuzzy opinion centralized decision, and the data about the NBA teams of Western part has been analyzed. In this model, the *Borda* number method and weighted *Borda* number method are presented to rank the capability of NBA teams of Western part, and a satisfactory ranking result is obtained.

Introduction

Fuzzy decision-making is decision process of choosing a satisfactory one from many research objects, or a ranking process for many research objects according to some given rules. The fuzzy ranking of team's capability, is not identical for different fans, but in some certain conditions we need scientific analysis and evaluation for the team's capability, such as the team's technical statistics data (Score, Rebound, Offensive and Defensive Deficit, Assist, Steals, Block Shot, Turnover, etc.). To rank the team's overall capability, the traditional method is to simply sum the technical statistics for the technical achievement, and then determine the team with the highest score as the best team. By using the same method, we can get all ranking results for all team. This method is easy to operate, and have a strong intuitive, but it can cause a lot of useful and scientific information losing [1]. In order to overcome this defect, in this paper, the scientific method has been used for sorting, analyzing and mining the team's technical statistical data of western part, and the overall capability of NBA teams of western part has been analyzed finally by using the method of fuzzy opinion centralized decision, and then the ranking results of team's overall capability is obtained. The results showed that the ranking order is reasonable.

Method of Fuzzy Opinion Centralized Decision

In this paper, we used seven technical indexes referred in the introduction, and supposed that the capability of some western teams belongs to the above index system. We will take the elements of some western teams in order, and choose m specialists to form an expert group. Each specialist in the expert group gives an order according to the elements in the set U , and we can get the m orders of fuzzy suggestions and regard it as a set $V = (v_1, v_2, \dots, v_m)$, (v_i means that the order of fuzzy suggestions given by the i th specialist). How to transform the fuzzy opinion sequences into a reasonable opinion called "method of fuzzy opinion centralized decision" as follows.

Supposed that $u \in U$, $B_i(u)$ means that the numbers of elements which is after u in the i th fuzzy opinion sequence v_i , for example, if u is in the first place in the i th fuzzy opinion sequence v_i , $B_i(u) = n - 1$. If u is in the second place in the i th fuzzy opinion sequence v_i , $B_i(u) = n - 2$, and so on. If u is in the k th place in the i th fuzzy opinion sequence v_i , $B_i(u) = n - k$. We consider

$B(u) = \sum_{i=1}^m B_i(u)$ as Borda number [2]. It is obvious to understand that $B(u)$ denotes the team U 's

overall score in each order v_1, v_1, \dots, v_m . As a result, we take the elements which stand for all different teams in the domain in order according to the size of Borda number, and this order uses a relatively reasonable opinion after Method of Fuzzy Opinion Centralized Decision. It is easy to operate in practice and make comprehensive evaluation of fuzzy decision quickly, [3-4] and it also has some disadvantages. For example, when its outcomes derived from this method don't conform to the actual value, and it may be caused by the different effects of the elements in the domain on the evaluation targets. In order to avoid this disadvantage, we introduced weighted Borda number:

$$B(u) = \sum_{i=1}^m \alpha_i B_i(u), \text{ and } \sum_{i=1}^m \alpha_i = 1.$$

Example Analysis

Data from the technical statistics of the western part of the 07/08 NBA season has been used, Fuzzy opinion of centralized decision method has been used to rank each team's technical statistics, as Table 1. In Table 1, u_i stands for the total score ranking ($i = 1, 2, \dots, 10$).

The process is as follows:

(1) The set of 10 teams structural scheme is denoted as $U = (u_1, u_2, \dots, u_{10})$.

(2) 7 technical statistics has been ranked with values, and experts fuzzy opinion set has been denoted as $V = (v_1, v_2, \dots, v_7)$.

(3) Calculate each team's *Borda* number.

(4) Rank the capability of teams of western part according to the values of *Borda* number.

According to Table 2, take u_1 for example: the score of u_1 ranking the third, so u_1 is ranking the third one as the first way, and $B_1(u_1) = 10 - 3 = 7$. But u_1 is ranking the fourth one as the second way.

$B_2(u_1) = 10 - 4 = 6$ likely, put the data for the expert opinion matrix's first column.

The $B_{7 \times 10}$ expert opinion matrix is given as follows.

$$\begin{pmatrix} 7 & 6 & 4 & 8 & 9 & 1 & 5 & 0 & 2 & 3 \\ 6 & 9 & 1 & 7 & 3 & 5 & 0 & 8 & 2 & 4 \\ 9 & 2 & 7 & 1 & 0 & 8 & 3 & 6 & 5 & 4 \\ 9 & 4 & 7 & 6 & 8 & 2 & 3 & 1 & 5 & 0 \\ 8 & 3 & 7 & 9 & 1 & 4 & 5 & 2 & 0 & 6 \\ 3 & 8 & 2 & 9 & 5 & 1 & 4 & 7 & 0 & 6 \\ 3 & 5 & 4 & 0 & 7 & 6 & 9 & 2 & 8 & 1 \end{pmatrix}.$$

Sum up each element of this matrix's column, we can get u_i 's *Borda* number. To calculate simply, we use C++ program and then we get $B_{u_1} = 45$, $B_{u_2} = 37$, $B_{u_3} = 32$, $B_{u_4} = 40$, $B_{u_5} = 33$, $B_{u_6} = 27$, $B_{u_7} = 29$, $B_{u_8} = 26$, $B_{u_9} = 22$, $B_{u_{10}} = 24$. So the new order is $u_1, u_4, u_2, u_5, u_3, u_7, u_6, u_8, u_{10}, u_9$. Obviously, a part of the team's rank has changed, such as u_2 and u_4 . Furthermore, each factor of u_2 's ranking: 4, 1, 8, 6, 7, 2, 5. Among them, rebound, block shot rank ahead (1, 2), but it's score, steals (4, 7) lower than u_4 . The rank of u_4 's each statistic capability is: 2, 3, 8, 4, 1, 1, 10, and relatively stable. So this rank that contain each statistic capability is reasonable. In addition, we can see u_1, u_3, u_5, u_6 can enter the playoffs.

It easy to explain why u_1, u_3 could enter the playoffs, but it cannot explain why u_5, u_6 could enter the playoffs. For further analysis it can be find, the offensive and defensive deficit and turnover of u_6 rank ahead, if the team want enter the playoffs, the first thing is to have good defensive. In other words, turnover and defensive are very important. Also, we consider the weighted *Borda* number, score, rebound, Offensive and Defensive Deficit, Assist, Steals, Block Shot, Turnover, the

corresponding weights are 2, 1, 5, 2, 1, 1, 5, and the fuzzy vector is $W = (\frac{2}{17}, \frac{1}{17}, \frac{5}{17}, \frac{2}{17}, \frac{1}{17}, \frac{1}{17}, \frac{5}{17})$.

From $B(u) = \sum_{i=1}^m \alpha_i B_i(u)$, each team's Weighted *Borda* number can be calculated. Then rank with Weighted *Borda* number is $u_1, u_5, u_3, u_6, u_7, u_9, u_2, u_8, u_4, u_{10}$. Clearly, a part of team's ranking has changed, and it can explain why u_6 can enter the playoffs, u_2 and u_4 stop and have no chance for the finals can be explained as well.

Table 1. The technical statistics of the western part of the 07/08 NBA season

Team	Score v_1	Rebound v_2	Offensive and Defensive Deficit v_3	Assist v_4	Steals v_5	Block Shot v_6	Turnove v_7	Total Score
Utah Jazz u_1	96.7	42.6	−90.1	25.5	8.6	4	−15.4	71.900
Dallas Mavericks u_2	95.5	46	−99.1	19.9	7	4.9	−13.5	60.700
Charlotte Hornets u_3	95.1	38.9	−93	21.1	8.3	4	−14.3	60.100
Denver Nuggets u_4	99.3	43.1	−101.6	21	9.1	5.3	−16.6	59.600
Minnesota Timberwolves u_5	100.7	41.3	−105.6	24.4	6	4.7	−11.9	59.600
Houston Rockets u_6	91.6	42.3	−91.3	17.4	7.3	3.1	−12.9	57.500
Portland Trail Blazers u_7	95.3	38.8	−99	19.4	7.3	4.6	−11	55.400
Seattle Supersonics u_8	90.4	45.2	−97.1	16	6.8	4.9	−15.8	50.400
San Antonio Spurs u_9	92.1	39.9	−98.1	20.4	3.7	2.7	−11.3	49.400
Ancouver Grizzlies u_{10}	92.8	42.2	−98.2	15.8	7.9	4.8	−16.6	48.700

Table 2. The technical ranking of the western part of the 07/08 NBA season

	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten
v_1	u_5	u_4	u_1	u_2	u_7	u_3	u_{10}	u_9	u_6	u_8
v_2	u_2	u_8	u_4	u_1	u_6	u_{10}	u_5	u_9	u_3	u_7
v_3	u_1	u_6	u_3	u_8	u_9	u_{10}	u_7	u_2	u_4	u_5
v_4	u_1	u_5	u_3	u_4	u_9	u_2	u_7	u_6	u_8	u_{10}
v_5	u_4	u_1	u_3	u_{10}	u_7	u_6	u_2	u_8	u_5	u_9
v_6	u_4	u_2	u_8	u_{10}	u_5	u_7	u_1	u_3	u_6	u_9
v_7	u_7	u_9	u_5	u_6	u_2	u_3	u_1	u_8	u_{10}	u_4

Conclusions

In this paper, the *Borda* number and Weighted *Borda* number have been used to rank the overall capability of NBA teams of western part twice. The ranking results can be a good real to reflect the team's overall capability. The presented method is simple and effective, and has very strong maneuverability. If we want to analyze the overall capabilities of more NBA teams, we can use the computer to do this calculating work.

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