Teaming Strategies based on Two-level Fuzzy Comprehensive Evaluation

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Abstract

In general, the study of team strategies is to quantify the success of team cooperation through the analysis of the team's game data. This paper analyzes the various actions of the team members and their results, and uses the method of two-level fuzzy comprehensive evaluation to determine the scoring ability of each player. After evaluating the team cooperation in each match, this paper formulates the appropriate team strategy based on the minimal path model.

Keywords

Minimal Path Model; Two-level Fuzzy Comprehensive Evaluation.

1. Introduction

Nowadays, as people become more connected and the challenges in society are becoming more and more complex, people are more and more willing to form cross-professional teams with different expertise and different perspectives to solve these complex problems. The best team strategy plays a vital role in how the team works. As we all know, football is just a typical team sport. Without the support of a good team strategy, few teams can win the game. Therefore, the development of team strategy is particularly critical.

2. Establishment and Solutions of the Model

2.1 Problem One and Problem Two

2.1.1 Analysis and Modeling

In the establishment of the network model, the connections between nodes are directed vectors and each node can pass through repeatedly, so we think it is suitable to use the shortest path model between vertices to solve. We decide to give weights by counting the number of passes between two members at the macro level, and then finding the most segment path between each pair of vertices to obtain the winning macro formation.

In response to the second question, we believe that the individual player's ability performance is one of the important performance indicators of the entire team cooperation. According to common sense, we can know that there are different factors for the performance evaluation of players in different roles and different positions, and the weight allocation of the same factor is also different. Therefore, we use the second-level fuzzy synthesis in the multi-level fuzzy comprehensive assessment judging method to determine the performance of each player's ability. Then we use gray correlation analysis to analyze other indicators that affect team performance, such as the impact of opponent teams.

As for the first problem, we suppose the team has a total of n players, i and j represent the i-th and j-th among the n players ($i \neq j$).

We make the variable

$$w_{ij}=\begin{cases}\frac{1}{number\ of\ times\ i\ passed\ the\ soccer\ to\ j},\ i\ can\ pass\ to\ j\\ \infty,\ \ i\ can't\ pass\ to\ j\end{cases},\ i\neq j;$$

$$w_{ii}=0, i=1,2,\cdots,n.$$

Let P_i be the probability that the i-th player passes the ball to the player.

The goal we seek is $\max\prod_{i=1}^{30} P_i$.

In the second question, the performance evaluation of players is divided into three major indicators representing different abilities:

$$U_1(Duel),\ U_2(Others\ on\ the\ ball),\ U_3(Shot),$$

and

$$U_1 = \{u_{11}^i, u_{12}^i, u_{13}^i, u_{14}^i\};\quad U_2 = \{u_{21}^i, u_{22}^i, u_{23}^i\};\quad U_3 = \{u_{31}^i\},$$

The weight of each indicator is determined by the team coach or decision maker.

We set the weight of the first-level indicator to the fuzzy vector as follows

$$\vec{A^i}_{/} = [a_1^i, a_2^i, a_3^i],$$

We set the weights of the secondary indicators as the following three fuzzy vectors,

$$\vec{A^i}_{//_1} = [a_{11}^i, a_{12}^i, a_{13}^i, a_{14}^i],$$

$$\vec{A^i}_{//_2} = [a_{21}^i, a_{22}^i, a_{23}^i],$$

$$\vec{A^i}_{//_3} = [a_{31}^i],$$

Then we perform a first-level fuzzy comprehensive evaluation on multiple sub-factors to obtain a first-level evaluation vector,

$$\vec{B_i} = \vec{A^i}_{/} \cdot \tilde{R}_i,$$

Then we perform the secondary evaluation to obtain the secondary evaluation vector,

$$\vec{B} = \vec{A} \cdot R,$$

Comment set for player i is

$$V_i = \{v_{1i}, v_{2i}, \cdots, v_{mi}\}.$$

According to the principle of maximum membership, we consider that the performance of the i-th player is v_{1i}.

Then we analyze other characteristics,

$$V_k = [v_{1k}, v_{2k}, \cdots, v_{nk}], \qquad (k=1,2,3,4)$$

Then the original decision matrix is

$$V = (v_{ik})_{30\times 4},$$

The transformed decision matrix is written as

$$B = (b_{ik})_{30\times 4}.$$

Then standardize the data, that is,

$$b_{ij} = \frac{a_{ij} - \bar{a}_j}{s_j}, i = 1,2,\cdots,n,$$

and among them:

$$\bar{a}_j = \frac{1}{m}\sum_{i=1}^{m} a_{ij},$$

$$s_j = \sqrt{\frac{1}{m-1}}\sqrt{\sum_{i=1}^{m}(a_{ij} - \bar{a}_j)^2},\ j=1,2,\cdots,n.$$

The analysis of gray correlation is as follows:

Reference sequence is

$$b_0 = \{b_0(k)|k = 1,2,\cdots,n\},$$

The comparison sequence is

$$b_0 = \{b_i(k)|k = 1,2,\cdots,n\}, \quad i = 1,2,\cdots,30.$$

Extract the corresponding weight of each indicator,

$$C = [c_1,\cdots,c_4]\text{(the resolution factor is 0.5)},$$

Calculate the gray correlation coefficient and calculate the gray weighted correlation degree is

$$r_i = \sum_{k=1}^{4} c_i \xi_i(k)$$

.

Next, we use the entropy weight method to calculate the weight of each indicator,

$$K = \begin{bmatrix} W_{1j} & r_1 & g_1 \\ \vdots & \vdots & \vdots \\ W_{nj} & r_n & g_n \end{bmatrix},$$

And we normalize K^T to matrix F,

then we substitute the elements in F to calculate the information entropy,

$$H_I = \ln\frac{1}{n}\sum_{i=1}^{n}(f_{ij}\ln f_{ij}).$$

Then we calculate the indicators for each weight,

$$E_i = \frac{1 - H_i}{4 - \sum H_i},$$

	Reciprocal of Passes	Tacitness	Reciprocal of Personal Ability
Information Entropy	0.54	0.84	0.81
Weight	0.07	0.02	0.03

Figure 1. Information entropy and weight of each factor

Calculate an adjacency matrix D, where

$$d_{ij} = e_1 \cdot w_{ij} + e_2 \cdot r_i + e_3 \cdot \frac{1}{g}$$

Then we use Floyd Algorithm to solve the model, and we can get a shortest path.

Next, we take the impact of the opponent team on the Huskies team into account . Repeat the above calculation after adding a new indicator $d_{opponent}$

Similarly, we use the Floyd Algorithm to solve, and get the shortest path with the intervention of the opponent.

	Reciprocal of Passes	Tacitness	distance played by the opponent	Reciprocal of Personal Ability
Information Entropy	0.54	0.84	0.81	0.81
Weight	0.08	0.03	0.03	0.03

Figure 2. Information entropy and weight of each factor

2.1.2 Solutions of the Model

We choose the Floyd algorithm to solve the model, and the adjacency matrix is

$$W = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{21} & \cdots & w_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & w_{n2} & \cdots & w_{nn} \end{bmatrix},$$

$$w_{ij} = \begin{cases} \frac{1}{number\ of\ times\ i\ passed\ the\ soccer\ to\ j}, i\ can\ pass\ to\ j \\ \infty,\quad i\ can't\ pass\ to\ j \end{cases}, \text{ i≠j;}$$

$$w_{ii} = 0, i = 1,2,\cdots,n.$$

Use iterative formula when calculating,

$$W_k\ (i,j) = \min\left(W_{k-1}(i,j), W_{k-1}(i,k) + W_{k-1}(k,j)\right),$$

and the letter k is the number of iterations, i, j, k,=1, 2, …, n.

Finally, when k = n, it is the shortest path between the vertices.

2.2 Problem Three

2.2.1 Analysis and Ideas

In the previous work, we studied two situations with and without the presence of the opposing team. By comparing and analyzing the different performance of the A team in the two situations, we can draw the following two conclusions:

1) The distance between the opponent and the Huskies to the ball-handling player has a greater impact on the success rate.

2) The distance between the opposing player and the Huskies to the ball-handling player has a small effect on a small team of two or three people, and the Husky's passing strategy for the entire team is relatively small.

Therefore, we need to change other indicators to reduce the distance between the opponent player and the center's ball handlers as much as possible, so as to improve the success rate of the passing, and ultimately to improve the probability of scoring.

First of all, we can improve the comprehensive ability of the players to start. Under the premise of normal play of players, the influencing factors of the player's personal comprehensive ability are divided into four aspects: kick distance, accuracy, possession and professional performance.

Next we discuss the impact of the number of passes on the success rate during a dribble. We define each passing process involving three or more players as a team dribble. We count the number of passes for each team dribble in all games and draw an image, where the abscissa is the number of games and the ordinate is the number of times the team dribbles. The winning games are marked in red. Through the analysis of the image, we find: Most of the winning teams' dribbling passes are generally 2-5, and the dribbling process of passing 10 or more passes is rarely.

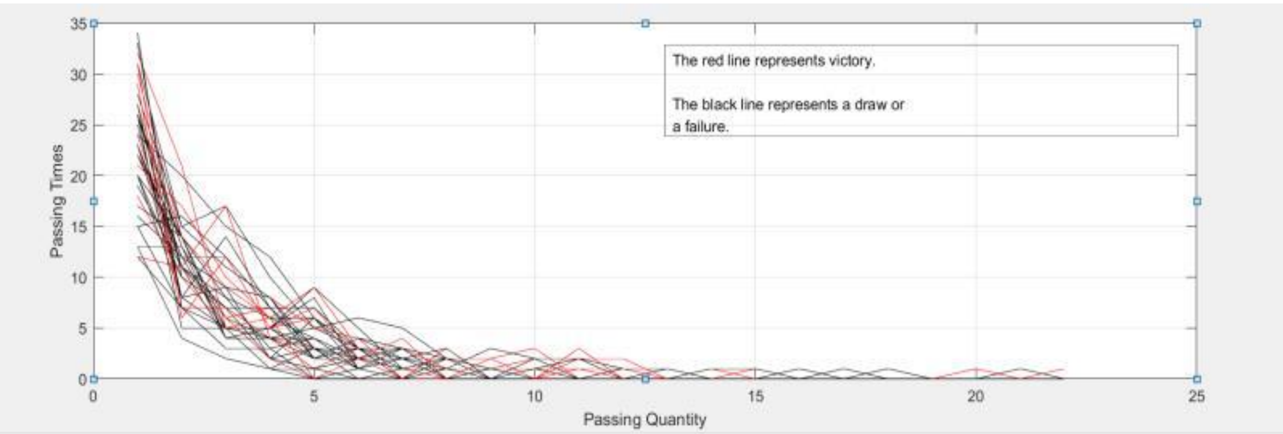

Figure 3. Relationship between games played and number of times in team dribble.

2.2.2 Conclusion

In response to the above analysis, the recommendations to coach of the Huskies are as follows:

1) Increase training distance for defence before the next season, so that their comprehensive ability can be improved.

2) Add training to all players on the accuracy of kicking and receiving, which will help improve the overall quality of the team.

3) Increase training on ball control for midfield to improve their defensive capabilities.

4) In the specific game, during each dribble, try to reduce the number of dribbles as much as possible.

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