Research on the Optimal Calculation Model of Team Cooperative Attack Strategy Based on Intermediate Speed Confrontation Statistics

Tianbo Yu, Donghui Dai, Zhenwen Zhao, Rui Sun, Wenxin Hu, Yan Li, Peng Cheng, Xiaoni Man
Sports Department, Shenyang Jianzhu University, Shenyang110168, China

Abstract. With the rapid advancement of the theory of teamwork offensive tactics, this article uses computer mathematical statistics and derives from mathematical computer mathematics. In the combination of tactical characteristics, the penalty area scoring optimization model research, through the use of teamwork is the offense The main form of organization before scoring improved performance, using the mid-speed confrontation empirical formula, and finally through calculation and statistical comparison and analysis, it proved that the middle-speed statistical algorithm has a significant effect, and it explained the calculation of the team cooperation attack tactics to organize the middle-speed confrontation. Statistics play a positive role.

Keywords: Mathematical statistics, computer statistical algorithms.

1. Introduction
With the gradual increase in the popularity and influence of indoor futsal football in the international arena, various countries also pay more attention to it. In our country, the sport of futsal has also developed rapidly. After eleven years of professionalization, the Futsal League has gradually become formal, and has achieved good results so far. Five-a-side football is vigorously promoted in the school football of primary schools, which will also cultivate a large number of talents for the future Chinese football [1]. Due to the introduction of rules such as the shrinking of the field, no offside rules, no substitution restrictions, and a 10m penalty analysed after 5 fouls, the use of personal skills, tactical behaviour, and scoring in futsal games are all Great changes have taken place, and a unique scoring rule has been demonstrated.
2. Research objects and methods

2.1. Research object
Take the world's high-level five-a-side football game scoring rules as the research object.

2.2. Research methods

2.2.1 Recording statistics steps. Based on the main content of this research, design and select indicators, initially define the concept and scale of indicators, and determine 12 indicators, including foot shots, number of passes, ball possession time, sports battles, pass coordination, individual scores and 3 types Confrontation degree index and 3 kinds of movement speed index. This study observes the game videos of the Futsal World Cup and the Asian Futsal Championship [2]. According to the tactical behaviour and characteristics of scoring goals in the game, the preliminary statistics are pre-stated and the indicators are further modified, screened, and modified. classification. Through the statistics of the above indicators, the theoretical analysis part of this research provides specific actual combat data with specific characteristics.

2.2.2 Computer statistical model. Mathematical statistics is the study of how to effectively collect, organize and analyse data affected by random factors, make inferences about the problems under investigation, and provide scientific basis for making decisions and taking actions. The algorithm design in this paper is designed using this idea. This algorithm uses three-dimensional eigenvalues to form a sample space [3]. The mathematical expectation vector of the sample value is \( u_1, u_2, u_3, u_4 \) and the covariance matrix is \( \Sigma_1, \Sigma_2, \Sigma_3, \Sigma_4 \) respectively. Define the Mahala Nobis distance from the three-dimensional observation vector \( x \) to the overall sample \( G_i \) as

\[
d(X,G_i) = \left( (x-u_i)^T \Sigma_i^{-1} (x-u_i) \right)^{1/2}, i = 1, 2, 3, 4
\]

The distance of each sample space can be obtained by formula (1), and the characteristic distance threshold of each behaviour is set by statistical average in the above experiment. If the calculated distance satisfies formula (2), the observation can be determined the value belongs to the sample space. The detailed algorithm flow is shown in Figure 1.

\[
\min_{k \in [1,4]} \left\{d^2(\hat{X},G_k) \right\} \leq d^2(\hat{X},G_i)
\]

Then judge \( \hat{X} \in G_i \), where \( i=1,2,3,4 \).
3. Results

3.1. Regional characteristics of scoring goals
The areas with the most goals scored in high-level futsal football matches are zone 1 and zone 2, that is, zone one is the goal zone, zone two refers to the area between the second penalty kick (10m goal) and the goal line, excluding the goal Area. One area, namely the goal area, is the most scoring area, with a total of 799 goals, accounting for 51% of the total; followed by shots from outside the goal area and within the 10m line, with a total of 567 goals, accounting for 36% of the total (Table 1).

| Years | 2000 | 2004 | 2008 | 2012 | 2016 | Total/% |
|-------|------|------|------|------|------|---------|
| Area  | Goal | Goal | Goal | Goal | Goal | Goal |
| A district | 158 | 55 | 186 | 62 | 103 | 43 | 187 | 48 | 165 | 47 | 799/51% |
| Second District | 103 | 35 | 82 | 27 | 99 | 42 | 148 | 38 | 135 | 39 | 567/36% |
| Third District | 10 | 4 | 4 | 1 | 18 | 7 | 20 | 6 | 27 | 8 | 79/5% |
| Four districts | 3 | 1 | 4 | 1 | 2 | 1 | 9 | 2 | 8 | 2 | 26/2% |
| 6m penalty | 7 | 2 | 12 | 4 | 4 | 2 | 14 | 4 | 7 | 2 | 44/3% |
| 10m penalty | 9 | 3 | 14 | 5 | 11 | 5 | 9 | 2 | 7 | 2 | 50/3% |
| Total | 290 | 302 | 237 | 387 | 349 | 1565 |

The video observation and analysis of the game show that the characteristics of the scoring area are closely related to the organization of the offense before scoring. First of all, the scores in the penalty area (a zone) mostly come from the team's shots after cooperation, and these scores are mostly completed by pushing the inside of the foot. The main feature is that in the game, 2-3 people pass the ball to the player in the penalty area after breaking through the defends line. At this time, the players are mostly unmarked or far away from the side of the ball [4]. The position of the end post. Therefore, players often choose a larger and safer inner kick technique to complete the shot. Secondly, the area between the second penalty kick and the penalty area (the second area) mostly comes from individual shots after
getting rid of the defines or breaking through. Players mostly use the back of their feet to volley the top corner of the goal or toe shots. Such scores are powerful, sudden and concealed.

3.2. Time characteristics of scoring goals
A formal five-a-side football match has a stipulated time of 40 minutes (net time). Divide it into 8 quarters with 5min as a section, plus extra time, divide it into 9 time periods, and analyse the scoring time of the futsal game (Table 2).

| Years   | 2000 | 2004 | 2008 | 2012 | 2016 | Total/% |
|---------|------|------|------|------|------|---------|
| Area    | Goal | %    | Goal | %    | Goal | %      |
| 1-5     | 21   | 7.2  | 38   | 12.6 | 15   | 6.3    | 39      | 10.1   | 29     | 8.3   | 142/9.1 |
| 6-10    | 35   | 12.1 | 19   | 6.3  | 27   | 11.4   | 40      | 10.3   | 36     | 10.3  | 157/10 |
| 11-15   | 35   | 12.1 | 31   | 10.3 | 25   | 10.5   | 37      | 9.6    | 36     | 10.3  | 164/10.5 |
| 16-20   | 33   | 11.4 | 32   | 10.6 | 32   | 13.5   | 53      | 13.7   | 51     | 14.6  | 201/12.8 |
| 21-25   | 27   | 9.3  | 20   | 6.6  | 26   | 11     | 48      | 12.4   | 36     | 10.3  | 157/10 |
| 26-30   | 44   | 15.2 | 36   | 11.9 | 26   | 11     | 50      | 12.9   | 43     | 12.3  | 199/12.7 |
| 31-35   | 36   | 12.4 | 50   | 16.5 | 38   | 16     | 46      | 11.9   | 54     | 15.5  | 224/14.3 |
| 36-40   | 59   | 20.3 | 76   | 25.2 | 48   | 20.3   | 71      | 18.3   | 61     | 17.5  | 315/20.1 |
| Overtime| 0    | 0    | 0    | 0    | 0    | 0      | 3       | 0.8    | 3      | 0.9   | 6/0.4 |
| Total   | 290  | 302  | 237  | 387  | 349  | 1565   |

It can be seen from Table 2 that the scoring time in the World Cup futsal game shows three characteristics: 1) There are goals in each period, and each stage has a scoring rate of at least 10%; among them, the starting stage is 1-5min The time is the least, accounting for 9% of the total; the 36-40min period before the end of the whole game is the most, accounting for about 20% of the total; 2) The end of each half-time, that is, 15-20min, is the peak time for scoring goals in the game ;3) Judging from the time characteristics of the goals in the upper and lower half of the time, the number of goals in the second half is obviously more than the number of goals in the first half.

4. Design of Computer Scoring System for Football Match

4.1. System overall design
The football game scoring device consists of three parts: the main display panel, the laptop control terminal and the smart phone control terminal. The laptop control terminal and the smart phone control terminal can separately control the display panel to display the game team name, time, score and other data. The main display panel includes STC89C58 single-chip microcomputer control board, ESP8266 serial port WIFI module, LED seven-segment digital tube driver board, LED seven-segment digital tube, two 16×64 dot matrix display modules and power supply module [5]. The laptop control terminal or smart phone control terminal runs timing, scoring, and control programs, and transmits the data to the main display panel in real time via wireless WIFI for display. The overall design block diagram is shown in Figure 2.
4.2. Main display panel design

4.2.1 Microcontroller control board. The single-chip microcomputer control board mainly includes STC89C58 single-chip microcomputer, 74HC245 bus driver, 3.3V linear power supply, ESP8266 serial port WIFI module and other auxiliary components. The STC89C58 single-chip microcomputer is the control core. The single-chip microcomputer is cheap, rich in interface resources, high working frequency, fast running, and large on-chip RAM capacity, which can meet the storage and dynamic scanning requirements of 16×128 dot matrix data [6]. The 3.3V linear power supply converts the 5V voltage to 3.3V for use by the ESP8266 serial WIFI module. The linear power supply uses the AMS117-3.3 chip, which has a wide input voltage range and a maximum output current of 1A.

4.2.2 Digital tube driver board. The nixie tube driver board is mainly composed of 74HC595 and ULN2803. 74HC595 is an 8-bit serial input/output or parallel output shift register. There is also an 8-bit memory inside with a high-impedance shutdown state [7]. When the OE terminal is low, the data in the memory is output to the bus, and when OE is high, the bus is in a high impedance state. ULN2803 is an 8-channel NPN Darlington tube driver, which has the characteristics of high withstand voltage and large current. A set of 74HC595 and ULN2803 can drive a seven-segment digital tube. The display board needs 16-digit 7-segment digital tube to display at the same time. In order to meet the brightness requirements, this design uses 16 sets of 74HC595 and ULN2803 to statically drive the 16-bit digital tube. The single-chip microcomputer outputs the PWM signal to control the OE end of all 74HC595, so
that the brightness of the digital tube can be adjusted in a wide range to meet the use of different light intensity environments.

4.3. PC software design
The development environment used in the PC-side software design is the Visual Studio integrated development environment, which is completed in C# language. The PC software is mainly divided into timing, scoring module, data transmission module, and dot matrix extraction module. The timing and scoring module use the Timer control to generate an interrupt every 10ms for precise timing. The main function of the data transmission module is to establish a TCP connection with the main display panel, obtain input and output streams from the TCP connection, and establish a data path with the main display panel [8]. The final software effect on the PC side is shown in Figure 3. The PC side software can easily set the name of the game team, team name body, and control the brightness of the scoreboard.

![Figure 3. PC software interface](image)

5. Conclusion
After actual tests, the football game scoring device in this design has simple structure, stable and reliable work, simple operation, high brightness and large adjustable range, and can be used in indoor or outdoor games. The penalty area is the main area for scoring goals in a futsal game, followed by the area between the top of the arc and the second penalty kick, and the two areas are dominated by the score in the middle area in front of the goal. Each half has the most goals scored 5 minutes before the end of the game, and the relative defines is also the stage with the most points lost. According to the score changes, the team's adjustment of offensive and defensive tactics is the main objective factor that causes the increase in scores.

References
[1] Zaveri, N., Shah, U., Tiwari, S., Shinde, P., & Teli, L. K. Prediction of football match score and decision-making process. International Journal on Recent and Innovation Trends in Computing and Communication, 6(2) (2018) 162-165.
[2] Kelly, A., Wilson, M. R., Jackson, D. T., & Williams, C. A. Technical testing and match analysis statistics as part of the talent development process in an English football academy. International Journal of Performance Analysis in Sport, 20(6) (2020) 1035-1051.
[3] Brito Souza, D., López-Del Campo, R., Blanco-Pita, H., Resta, R., & Del Coso, J. A new paradigm to understand success in professional football: analysis of match statistics in LaLiga
for 8 complete seasons. International Journal of performance analysis in sport, 19(4) (2019) 543-555.

[4] Alfredo, Y. F., & Isa, S. M. Football match prediction with tree-based model classification. International Journal of Intelligent Systems and Applications, 11(7) (2019) 20-28.

[5] Constantinou, A. C. Dolores: a model that predicts football match outcomes from all over the world. Machine Learning, 108(1) (2019) 49-75.

[6] Allister, A., Byrne, P. J., Nulty, C. D., & Jordan, S. Game-related statistics which discriminate elite senior Gaelic football teams according to game outcome and final score difference. International Journal of Performance Analysis in Sport, 18(4) (2018) 622-632.

[7] Koopman, S. J., & Lit, R. Forecasting football match results in national league competitions using score-driven time series models. International Journal of Forecasting, 35(2) (2019) 797-809.

[8] Gourh, W., Poojary, K., Vengarai, M., & Parkar, N. Football Prognosis using Machine Learning Algorithm XGBoost. SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology, 12(1) (2020) 103-108.