

A New Model for Analyzing the Win Probability and Strength of the Two Sides of the Table Tennis Match

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ABSTRACT: Table tennis contest is an important event in the sports competition. The strength of the table tennis analyses is often presented in the literature. The purpose is to ease the table tennis game by creating a system which helps the table tennis coaches, athletes and the scientific research personnel, in the face of strong antagonism and competitive major competitions. It will pave the way for open mentality, improve the tactical thinking quality, reduce the game decision-making errors, and increases the chances of winning. Further, it enriches the table tennis tactical analysis theory, for the Chinese table tennis team to get excellent results in the Olympic Games and to provide theoretical support. In this paper, the design of a novel calculation method and the model was put up, and through the calculation of the model the result will document the pros and cons of both sides. The work will also help to find the win probability, which is more effective for analysis and conducive to the formation of a fierce confrontation.

Keywords: Sports Calculation Model, Win Probability, Sport Strength, Table Tennis Match

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1. Introduction

In the Internet age, we are facing the output of voluminous amount of data that is increasing continuously. The data produced is manifested in several databases, where how to fully use the data effectively and improve the quality of data is a challenge. Scientists in combination with multidisciplinary algorithms develop data mining techniques in many subjects [1]. Is through the computer with the aid of statistical data mining related principles derived from a large amount of data we are interested in, or derived from observation of huge data and analysis of the relationship is a question; which is not ascertained. Data mining emerged in the late 1980s, and after 20 years of development, has been widely used in the field of data analysis, and data mining is becoming more and more important in the game data analysis [2]. As a research at random, the phenomenon statistical regularity is investigated, and it is observed that the theory of probability has wider applications in science and technology,

management, and economy, which is increasingly deep into our life and work. Similarly, in order to meet the “higher, faster, stronger” sports spirit, or to increase the competition of suspense, or increase the competition of the match is very exciting. To maintain fair competition, probability in the formulation of the rules of sports competition also has a broad application and embodiment. Probability analysis, also known as risk analysis, through the research of various uncertainty factors has different variations of probability distribution and its influence on project economic benefit indexes, and feasibility of project risk and using an uncertainty analysis method of judgment is investigated [3]. Probability analysis is often used in several important large and medium-sized projects evaluation and decision making. Probability analysis of specific methods mainly includes the expected value method, utility function method and model analysis, etc., [4]. 1). *Expectancy Method*: The expected value method is the most widely used in project evaluation through the calculation of expectations. When the net present value of project is greater than or equal to zero, the cumulative probability with comparative advantages and disadvantages, determine the feasibility and the degree of risk. 2). *Utility Function Method*: So-called utility, efficiency, value or contribution to the overall goal is the size of a measure. In the case of risk decision, usable utility is to quantify decision makers’ attitude to risk. Through this measure, some can be hard to quantify. If there are qualitative differences (events) to give quantitative value, it will consider factors which are converted into the utility value to different schemes to make decisions. The utility function reflects a policy maker’s attitude to risk. Different decision makers differ in different circumstances, and the utility function is different. 3) *Model Analysis*: Using the computer simulation technology, the simulation analysis is to simulate the uncertainty of the project, by extracting project uncertainty distributed random number, calculate project economic effect evaluation index, and it is concluded that the probability distribution of project economic effect evaluation index, to provide a project on the impact of uncertainty on project economic indicators comprehensive situation [5]. Probability analysis is based on the uncertainty factors in a certain range of random change, analysis and determine the probability distribution of the shift, and the expected value and the standard deviation are calculated for the project risk decision provides the basis of an analysis method. In sports, it is full of uncertainty, where the probability theory plays a unique role in the objective or subjective, and the probability of hidden knowledge behind this knowledge help us to better understand the charm of sports. The statistics plays an important role, and also can play a better probability of role, for the development of sports and make greater contribution to human progress [6]. As an applied strong discipline, probability theory has deep into our life and work, and expanding its application scope and depth.

Two athletes in the game have the strength of the stability of the situation and the single ball score probability has been always in a fixed value fluctuation [7]. Assuming that the probability of winning - B, the two players of the game in the process of each ball is fixed, then both sides of a single Bureau winning probability can be calculated. Both sides eventually winning probability can also and according to the rules of the game, are calculated [8]. The effect can be analyzed from two aspects, one is conducive to a modest increase in the game of chance; the second is conducive to the formation of the fierce confrontation, and making changes in the competition system can achieve the desired effect of the practice. Contingency focuses on the outcome of the game, while the intensity of the analysis focuses on the course of the game [9].

The chance of the game is to refer to the situation of the weak against the strong, through the probability function for drawing, we can draw the changes in the strength of both sides and the chance to increase the competition but not excessively. The fierce competition can be defined by a single game of expectations [10]. The closer the score of the game, the greater the intensity of the game, and the more is able to stimulate the enthusiasm of the audience. Also increased the objective of the game, at the same time, the similarity score will inspire the potential of game players, and increase the probability of winning.

2. Problem Description and Analysis

Given a user’s query string, relative to the string is a set containing all the relevant documents. We think this collection as an ideal result document collection, after the ideal result set is given, we can easily get the result document. So we can put the query processing set properties as the result of the ideal document processing. The problem is that we cannot know exactly these attributes, but we know there are indexing terms to represent these attributes. Due to this fact, these properties are not visible during the query, and it needs to estimate the attributes in the initial stage. The initial phase of the estimates for the first time allows us to retrieve the document collection to return to the ideal result sets, and generate an initial probability description [11].

Probability analysis, by calculating the project target (such as net present value) of the expected value and the target value is greater than or equal to the zero cumulative probability to determine the size of project risk, provide a basis for decision-making for the investors as shown in Figure 1.

A and, B are the two table tennis teams for a five game match of table tennis, playing two factions of the 3 players, and each has



Figure 1. Table tennis match

three players in the order of appearance (denoted as $\alpha_1, \alpha_2, \alpha_3$ and $\beta_1, \beta_2, \beta_3$). According to the past record of performance, it can be predicted that if a team in order of α_i appearance and B team in order β_j to play five games, a team defeating a_{ij} the bureau is full.

In the Table tennis match with both sides who will win can be seen as a probability problem. So we can use the ideas and methods to solve the problem of probability to analyze this problem. According to the meaning of the example, each team has 3 players to play, and each has 3 kind of out of order. (Record as $\alpha_1, \alpha_2, \alpha_3$ and $\beta_1, \beta_2, \beta_3$). Based on past experience and matrix bureau gives a play of 5 games, the team 'A' can win. We can find out the probability of winning each game in some kind of appearance in the two sides through this matrix, and the corresponding matrix is obtained. Because, it is a system of three victories in five games, winning situation, including: winning the first three innings, end of the whole; finished fourth after the end, namely the first three innings only won two innings. After finishing the fifth innings, namely the first four games only won two innings. We can then seek out the probability of winning the 'A' team in the whole game.

We can compare against the two sides in a variety of appearances in order to determine the average value of the game to determine which side is strong the strength. Events in another event 'B' have occurred under the condition of probability. We can find out each team in the selection of a certain appearance order, to win the whole game of probability, which can actually be regarded as the problem of conditional probability. The probability of a large average is the secure solution for the desired. For example a team choose 'A1' exit plan won the probability of the whole game, calculated in the 'B' team to all appearance scheme, a team winning probability of the average value, if the average than A2, A3 is great, for a team, where 'A1' scheme is secure scheme. But also seek out the 'B' team with a variety of matrices. Similar to the problem (two), a more secure solution is to be the

games before the results of the competition are out, there is no need for the following a few games. (shown in Figure 2).

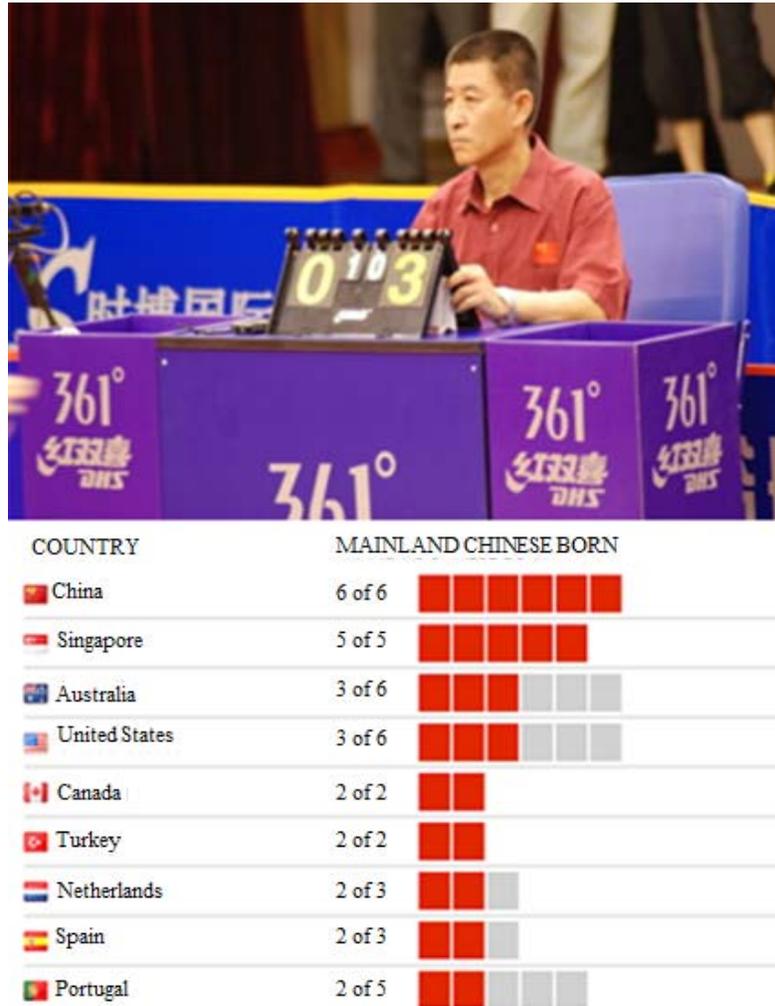


Figure 2. Table tennis match score and the outcome

3. Model Building

Generally speaking, the method of mathematical model is established in general can be divided into two kinds, one kind is mechanism analysis method, and another kind is testing analysis method. The mechanism analysis is based on the understanding of the real object properties, analyzes its cause and effect, find out to reflect the law of the internal mechanism, and establish the models which often have clear physical or practical significance.

The game is to win the final victory in the three games five wins game by the three games five wins system which is the real victory. Here, we calculate the probability of winning the final victory in the three games of the five games.

Let $p_{ij} = P_{1ij}$,

(1) If the first of three wins, the probability of this situation is p_{ij}^3 .

(2) If the two of three wins, the probability of such a situation is formular (1).

$$C_3^2 p_{ij}^2 (1-p_{ij}) p_{ij} = 3p_{ij}^3 (1-p_{ij}) \tag{1}$$

(3) If the two games are won among the four games and the last one, then the probability of such a situation is formula (2).
(2)

The probability of winning the final victory in the three games of the five games is the formula (3).

$$q_{ij} = p_{ij}^3 + 3p_{ij}^2(1-p_{ij}) + 6p_{ij}(1-p_{ij})^2 = p_{ij}^3[1 + 3(1-p_{ij}) + 6(1-2p_{ij} + p_{ij}^2)]$$

$$= p_{ij}^3(10 - 15p_{ij} + 6p_{ij}^2)$$
(3)

The average winning probability for the A team is formula (4)

$$p1 = \left(\sum_{i=1}^3 \sum_{j=1}^3 r_{ij} \right) / 9$$
(4)

The average winning probability for the B team is formula (5)

$$p2 = \left(\sum_{i=1}^3 \sum_{j=1}^3 q_{ij} \right) / 9$$
(5)

4. Solving Model

The model is solved as follows,

(1) $p1 = \left(\sum_{i=1}^3 \sum_{j=1}^3 r_{ij} \right) / 9 = 0.52$, $p2 = \left(\sum_{i=1}^3 \sum_{j=1}^3 q_{ij} \right) / 9 = 0.48$, $p1 > p2$, A team strength is stronger.

(2) $p_{\alpha1} = \left(\sum_{j=1}^3 r_{1j} \right) / 3 = 0.44$, $p_{\alpha2} = \left(\sum_{j=1}^3 r_{2j} \right) / 3 = 0.54$, $p_{\alpha3} = \left(\sum_{j=1}^3 r_{3j} \right) / 3 = 0.58$, A team's most secure program is the order of α_3

$C_4^2 p_{ij}^2 (1 - p_{ij})^2$ appearance $p_{ij}^3 (1 - p_{ij})^2$

(3) $p_{\beta1} = \left(\sum_{j=1}^3 q_{1j} \right) / 3 = 0.56$, $p_{\beta2} = \left(\sum_{j=1}^3 q_{2j} \right) / 3 = 0.53$, $p_{\beta3} = \left(\sum_{j=1}^3 q_{3j} \right) / 3 = 0.35$. B team's most secure program is the order of β_1 appearance.

(4) When the 'A' team in order to α_3 the 'B' team in order to β_1 finding the corresponding 'R2', or 'Q2' matrix, that will eventually win the 'A' team. Under the steady scheme, the A team won the probability of 1, so will choose to play in the order of the competition.

5. Conclusion

The competition is for the five wars with three wins, but the element of the matrix R is in full play in the case of the five sets of the data processing and the forecasting methods have shortcomings. Although it is playing the full five games to get in, but it can be speculated that the strength of the two teams, in order to guide the appearance scheme that just played the full five games to get in, does not meet the actual specifications of competitors. The above illustration is for reference only, but cannot completely rely on. For the other events, such as tennis, volleyball, as well as chess, we can also take the above similar programs, find the establishment of the corresponding model, so as to find the optimal solution.

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