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Football game result influence factors discrete probability distribution model applied research

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ABSTRACT

Football game result not only can provide strength comparative reference and coaches experiences for team, but also brings into larger capital fluctuation for lottery industry, and football game result prediction accuracy provides better trend and a head start for the two. This paper makes analysis of football game result influence factors that makes contributions to game result prediction. As a result, it verifies model with Liverpool team and Arsenal team 90 games data from 1006 to 2008, and gets prediction result conforming to actual competition, which provides theoretical basis for football game result prediction.　　© 2014 Trade Science Inc. - INDIA

KEYWORDS

Football game;
Result prediction;
Poisson distribution;
Probability distribution.

INTRODUCTION

Football game result is not only the reflection of team strengths, but also the lotto players' money game, in order to get scientific seize on game trend and lottery head start, it should to analyze game result influence factors, this paper takes game result main influence factors as research objects, and proposes a kind of Poisson distribution prediction model method to provide theoretical basis for game result prediction.

For football game influence factors and football result prediction research, lot s of scholars have successively made efforts, just by these scholars efforts, game hosting party and lottery company can have a more reasonable seizing on game result and both the two can smoothly carry out their industries, from which Cao Ke Qu(2011) adopted fuzzy comprehensive evaluation method predicting football game winning, draw and fail relations, it realized unification between subjective judgment and objective evaluation[1]; Huang Xi-Fa etc.(2011) Based on game result and expectation larger differences hypothesis, they carried out questionnaire survey on football game spectators, investigated audiences and make comparison with audiences emotions evacuation leading response attitudes and other psychology and behaviors under very satisfied and very disappointed with results such two situations, preliminary analyzed Chinese football game audience evacuation psychology and behavior features that provided data basis for evacuation simulation[2]; Jin Chuan-Jiang(2007) Made comparative analysis of the 18th World Cup participating teams game technical statistical indicators and game result correlations, he got that game result larger influence technical statistical indicators are respectively in order as pass, success rate, number of shooting, shoot, possession time, corner ball,

FULL PAPER

yellow card and shot stopping, meanwhile he got each ranking phase team, each continent team has significant difference in multiple game technical statistical indicators, which reflected participating team overall levels and features differences[3].

It is well known that football game result is team's winning or failure, presentation of result is team strength exhibition, but football game result always is closely related to lotto players, one game win or fail usually gets involved in huge capital flow, just like starting from Germany World Cup in 2006, whole world every huge lottery company has already received around 60 billion dollars betting, which is 20% more by comparing with betting in Korean and Japanese World Cup, therefore football game one team win or failure prediction not only reflects in the aspects of nation's honor and technical ability, but also reflects in global capital flow direction, game result prediction has become global people focus, meanwhile it also the subject of scholars, financiers and sports researchers attentions, that is to say, game result prediction is very necessary.

In order to objective reflect teams' after participating game winning or failure result, it needs to analyze game result influence main factors, we know a game result will appear win, draw and fail such three situations, if participating two teams strength and external conditions are completely the same, both teams winning probability are 1/3, but actual result will suffer

strength and external factors influence, these influence factors include teams' strength, home or guest court, referee fairness and adaptation to bad weather as well as others, therefore in football game result prediction, it needs to take game result influence each item factors into comprehensive consideration, finally provides teams' winning probability. This paper based on previous researches, it analyzes football game result influence factors, applies previous standings as strength reflection variables, and establishes Poisson distribution model, in the hope of proposing scientific methods for football result prediction work.

CONDITIONAL HYPOTHESIS AND POISSON DISTRIBUTION MODEL ESTABLISHMENT

Conditional hypothesis and parameters setting

- Assume game result influence factors are teams' strength as well as home and away, without considering weather conditions influence factor;
- Assume that team strength is reflected by team recent games victory status;
- Assume that football game result conforms to Poisson distribution, and referees are absolute just no black whistle behavior;

Variables explanation is as TABLE 1 show.

TABLE 1 : Variables definition

Variable symbol	Definition	Variable symbol	Definition
		n_A	Away team's number of games
$P(goal = k)$	Team k goals probability		
		m_{iH}	Home team the i game's goals quantity
k_H	Home team goals quantity	m_{iA}	Away team the i game goals quantity
k_A	Away team goals quantity	$P(k_H : k_A)$	Probability of home team and away team scoring as $k_H : k_A$
λ_H	Home team goals strength	$P(k_H > k_A)$	Home team winning probability
λ_A	Away team goals strength	$P(k_H = k_A)$	Two teams draw probability
n_H	The number of home team games	$P(k_H < k_A)$	Away team winning probability

FULL PAPER

Poisson distribution model theory

French mathematician Simeon-DenisPoisson presented a kind of statistics and probability common discrete probability distribution –Poisson distribution in 1838, the distribution is fit for describing one incident random incidents occurrence times in unit intervals, its probability mass function is as formula (1) show:

$$P(X \quad k) \quad \frac{e}{k!} \tag{1}$$

In formula (1), λ is parameter that above 0, presents Poisson distribution expectation and variance, $\{0,1,2\cdots\}$ represents support set, λ also represents random incidents average occurrence rate in unit intervals.

The distribution in football game result prediction application, it can regard one football game as a random incident, the incident result has three types that are respectively 1. Home team wins, 2 Two teams make the draw, 3. The away team wins, and the three types of results occurrence probability sum is 1, therefore it meets probability distribution basic conditions, and the purpose of the prediction is trying to correctly get three types of results probability values.

Football game result is a discrete probability distribution, and random variables only can value non-negative integer, therefore Poisson distribution model can be used for result prediction basic model. In Poisson distribution, parameter

λ represents team strength, k represents goal number, team strength can apply the team previous standings average goals to measure, if one team total has m goals,totally joins n games, then team strength λ can be got by calculating as formula (2):

$$\lambda = \frac{m}{n} \tag{2}$$

In order to further precise describe team strength, it can start from home and away team two aspects, as formula (2) show, it defines home team strength as λ_H , and it defines the away team strength as λ_A .

Football game result prediction model establishment

If assume that team in n_H home court game the i

FULL PAPER

$P(k_H \quad k_A)$ and $P(k_H \quad k_A)$, three types of results corresponding probabilities computational method is as formula (8) show:

$$(\qquad) \qquad \underline{\qquad\qquad} \quad \underline{\qquad\qquad}$$

$$(\qquad)$$

(8)

MODEL VERIFICATION

Data analysis

This paper takes English Premier League from Sept.9th, 2006 to Dec.6th, 2008, Arsenal and Liverpool 90 games home court goals and away team goals as empirical probability evidence, and then applies Poisson distribution model to predict two teams' three types of results probabilities during game, as TABLE 2 show 90 English Premier League Arsenal and Liverpool team goal status.

From TABLE 2 data, it is clear that Liverpool team total goals in 45 home court games is 93, total goals in away court is 54, and Arsenal team total goals in 45 home court games is 94, total goals in away court is 70. It can utilize formula(3) and formula (4) to get Liverpool team home court goal strength λ_{LH}, Liverpool team away court goal strength λ_{LA}, Arsenal team home court goal strength λ_{AH} and Arsenal team away court goal strength λ_{AA}, and then input the four average goal strength into formula (7), it can get two teams goal probabilities distribution status, finally it can predict two teams actual fighting moment three types of results probabilities status.

Poisson distribution model solution

From TABLE 2 data analysis, it can get as formula (9) show the average goal strength parameters result:

$$\begin{matrix} LH \\ LA \\ AH \\ AA \end{matrix} \quad [\qquad\qquad 1.5556]^T$$

(9)

Number of Game	45 Liverpool home courts	45 Liverpool away courts	45 Arsenal home courts	45 Arsenal away courts
39	1	4	1	1
40	2	0	3	1
41	3	0	1	1
42	1	0	3	0
43	3	0	3	4
44	2	0	1	2
45	2	0	1	1

Input formula(9) result into formula(7), it can get as TABLE 3 showed Liverpool home court-Arsenal away court goal scored presented probability distribution TABLE 3.

From TABLE 3 data, it can get Liverpool home court-Arsenal away court goal probability distribution figure, as Figure 1 show.

Arsenal home court-Liverpool away court goal scored presented probability distribution is as TABLE 4 show.

From TABLE 4 data, it can get Arsenal home court-Liverpool away court goal probability distribution figure, as Figure 2 show.

By TABLE 3 and TABLE 4 data as well as formula (8), it can get result as formula (10) show:

$$(\qquad) \ (\qquad)$$
$$($$

(10)

Result analysis

From TABLE 3 and TABLE 4 as well as Figure 1 and Figure 2 presentation status, when Liverpool team home court wins the scores as 2:1 probability arrives at the maximum that is 0.0888; When Liverpool team

FULL PAPER

TABLE 4 : Arsenal home court-Liverpool away court goal scored probability distribution table

|		0	1	2	3	4	5	6	7
		Arsenal team goals							
	0	0.0373	0.0779	0.0814	0.0567	0.0296	0.0124	0.0043	0.0013
	1	0.0447	0.0934	0.0976	0.0680	0.0355	0.0148	0.0052	0.0015
Liverpool team	2	0.0268	0.0561	0.0586	0.0408	0.0213	0.0089	0.0031	0.0009
goals	3	0.0107	0.0224	0.0234	0.0163	0.0085	0.0036	0.0012	0.0004
	4	0.0032	0.0067	0.0070	0.0049	0.0026	0.0011	0.0004	0.0001
	5	0.0008	0.0016	0.0017	0.0012	0.0006	0.0003	8.9371E-05	2.6680E-05
	6	0.0002	0.0003	0.0003	0.0002	0.0001	5.1321E-05	1.7874E-05	5.3360E-05
	7	2.6500E-05	5.5400E-05	5.7847E-05	4.0294E-05	2.1051E-05	8.7979E-05	3.0642E-05	9.1474E-05
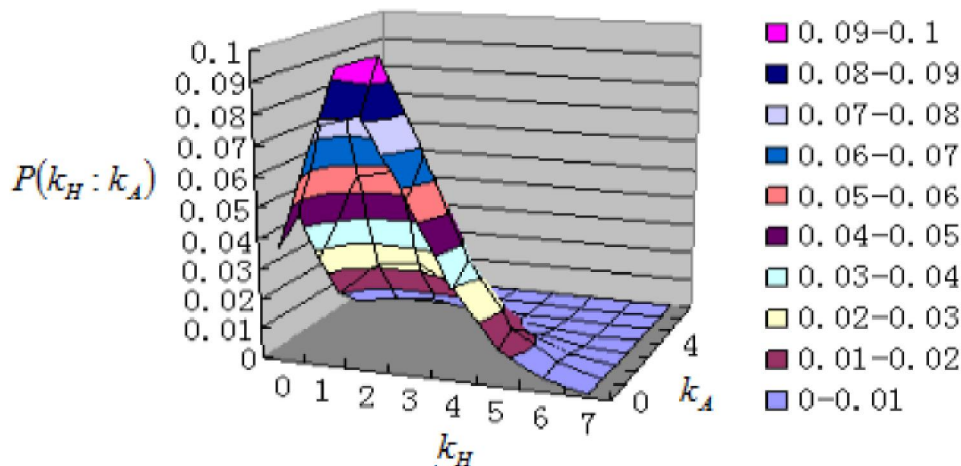
Figure 2 : Arsenal home court-Liverpool away court goal scored probability distribution Figure

home court makes the draw, the scores as 1:1 probability arrives at the maximum that is 0.0859; When Arsenal team away court wins, the scores as 1:2 probability arrives at the maximum that is 0.06681;When Arsenal team home court wins, the scores as 2:1 probability arrives at the maximum that is 0.09764; When Arsenal team home court makes the draw, the scores as 1:1 probability arrives at the maximum that is 0.09345; When Liverpool team away court wins, the scores as 1:2 probability arrives at the maximum that is 0.05607.

According to formula (10) presentation result, it is clear that two teams home court winning probability are larger, but Arsenal team home court winning probability is larger, and for away court winning probability, it is also Arsenal team larger, the conclusion is Arsenal team strength is slightly higher than Liverpool team. In actual game, which is Arsenal home court against Liverpool team in Dec.21st, 2008, according to prediction, gained score should be 2:1, 1:1 and 1:2, the actual status is 1:1, therefore the prediction model has

certain accuracy.

CONCLUSIONS

This paper firstly analyzes football game result significance and result prediction significance, as well as football game result influence main factors and game result presentation forms and types; To more objective compare game results and make evaluation, the paper proceeds with conditional hypothesis, sets controlled some random variables, and then make a list of definition explanation for required applying variables; in the paper, it simply states Poisson distribution mass function mathematical significance, as well as it available mathematical problems solution, and provides Poisson distribution features; according to football game presented features and Poisson distribution available described incidents features, it established Poisson distribution model for football game result prediction, and gets home and away court teams' scores probabilities,

winning probabilities, draw probabilities and failure probabilities computational methods; Utilize Liverpool team and Arsenal team 90 games from 2006 to 2008, 45 home courts and 45 away courts goal number as prior data, it predicts two teams actual fighting game result, and gets winning, draw and failure three types of results probabilities' maximum scores, by actual fighting comparison, it is known the two team fighting final scores are 1:1, which is the same as prediction result.

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