Retraction

Retraction: Analysis of Application of Tennis Electronic Referee Based on Artificial Intelligence in Tennis Matches (*J. Phys.: Conf. Ser.* 1852 022028)

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This article has been retracted by IOP Publishing following an allegation that raises concerns this article may have been created, manipulated, and/or sold by a commercial entity. In addition, IOP Publishing has seen no evidence that reliable peer review was conducted on this article, despite the clear standards expected of and communicated to conference organisers.

The authors of the article have been given opportunity to present evidence that they were the original and genuine creators of the work, however at the time of publication of this notice, IOP Publishing has not received any response. IOP Publishing has analysed the article and agrees there are enough indicators to cause serious doubts over the legitimacy of the work and agree this article should be retracted. The authors are encouraged to contact IOP Publishing Limited if they have any comments on this retraction.

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Analysis of Application of Tennis Electronic Referee Based on Artificial Intelligence in Tennis Matches

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Abstract. In today's era of rapid development of artificial intelligence, with the continuous development of technology, electronic referees have become an important part of many sports events, and artificial intelligence technology has become the brain of competitive sports and integrated into major events. This article uses artificial intelligence algorithms, graph theory, and ID3 algorithms to establish an analysis of whether electronic referees violate rules in tennis matches. And use post-pruning technology to realize the pruning of the classification decision tree, generate classification rules, and complete the construction of the classification decision tree model used by the tennis electronic referee in the tennis match. The experimental results show that the application analysis of the artificial intelligence-based tennis electronic referees in tennis matches explored in this paper is more recognized and liked by athletes and spectators, and the athletes' perception of the fairness of the game has increased by about 55%.

Keywords: Artificial Intelligence Technology, Tennis Competitions, Electronic Referees

1. Introduction
Present, the rapid development of modern high-tech technology with artificial intelligence as the core has seriously questioned the traditional referee judgment and will cause great changes in the sports world [1]. Some sports event organizations in my country have consciously conducted in-depth research on the difference between electronic referees and traditional referees in tennis matches. However, due to the lack of correct theoretical guidance, there are still external forms and referees that pay too much attention to technology. Judge its own content system and logical structure, while ignoring the psychological characteristics of athletes and spectators for the game [2-3]. Therefore, how to make the game fair and equitable, use the means of electronic referees to conduct experiments and diversified explorations, and expand the learning space of electronic referees, is still a rather weak aspect [4-5]. Therefore, in order to respond to the introduction of electronic referees in tennis matches, change the traditional referee's penalties, the learning method will surely become the main method used by electronic referees in the new century [6-7].
Under the current background of my country’s active advancement of technological modernization, the popularization of artificial intelligence technology makes the most effective way to realize the organic integration of artificial intelligence and sports events is to build an artificial intelligence electronic referee system and adopt electronic referees. A new idea of combining self-learning with combined platforms [8]. Chinese scholar Zhao believes that this action has effectively improved the athletes’ perception of the fairness of the game, developed the athlete’s mental health, and cultivated the athlete’s enthusiasm and ability to actively participate in the game, which has very important practical significance [9]. Foreign scholar Colakoglu believes that the electronic referee with artificial intelligence is a combination of technology and innovation. The introduction of electronic referee technology into the tennis court can effectively reduce some other illegal disputes in the game, but there are still some technical problems in the introduction of electronic referee technology. This needs to improve the electronic referee [10].

In this article, I hope to improve the refereeing mode in tennis matches and reform the misjudgment and missed judgments in tennis matches through the reform of sports refereeing mode. I believe that through this practice and exploration, I can give my own answers to the above questions, which has certain research significance. The introduction of electronic referee technology into the tennis court can effectively reduce the number of illegal serve and receive illegal disputes. This requires corresponding changes in the tennis rules that cooperate with electronic referee technology.

2. Technical Research on Application of Tennis Electronic Referee in Tennis Match Based on Artificial Intelligence

2.1 The Use of Artificial Intelligence Algorithms
First major achievement of artificial intelligence is the development of chess programs that can solve difficult problems, such as chess. Some techniques used in chess programs, such as looking forward a few steps, and dividing difficult problems into some easier sub-problems, developed into basic artificial intelligence techniques such as search and problem reduction. Today’s computer programs can play all kinds of squares, backgammon and chess at the championship level. Another problem solving program assembles various mathematical formula symbols together, and its performance reaches a very high level, and it is being used by many scientists and engineers. Some programs can even use experience to improve their performance.

(1) Logical reasoning and theorem proof
Logical reasoning is one of the most enduring sub-fields in artificial intelligence research. Among them, it is particularly important to find some ways to focus only on the relevant facts in a large database, pay attention to credible proofs, and revise these proofs when new information appears. It is indeed an intelligent task to find a proof or counter-evidence for the theorems speculated in mathematics. This requires not only the ability to deduce based on assumptions, but also some intuitive skills.

(2) Artificial intelligence search algorithm
In an AND or tree, the "and" or "or" mark added to a node depends on the relationship between the node and its parent node. The tasks of the production system can be Think of it as looking for a solution graph from the start node to the end node. Roughly speaking, a solution graph from a node of an AND-OR graph to a set of nodes is similar to a path in an ordinary graph.

The recursive definition of solution graphs is defined as a solution graph from node n to a set of node N in some and or graph G. It of G. If n is an element of N, it is{\(n_1, n_2, \ldots, n_k\)} composed of a single node n; if there is an outward connector K pointing to node, there is a solution graph from each to K, where i= 1, 2, \ldots, are composed of node n, connector K, node{\(n_1, n_2, \ldots, n_k\)} and the
solution graph from each node in \{n_1, n_2, \ldots, n_k\} to N, otherwise There is no solution graph from n to N.

2.2 AO\(^*\) Algorithm
Describe the search process of an evaluation function with heuristic components, which can be designed for AND-OR graphs. \(h(n)\) is an estimate of \(h^*(n)\), and \(h^*(n)\) is the cost of an optimal solution graph from node n to a set of end nodes. Just like search in the figure, if \(h\) satisfies a certain limit, Then the search process sentence may be simplified to impose a monotonic restriction on \(h\), that is, \(h(n_1), n_2, \ldots, n_k\), to impose restrictions on each connector in the implicit graph from node n to its successor. Assumptions \(h(n)<c + h(n_1) + \ldots + h(n_k)\) Where \(c\) is the cost of the connector. This restriction is similar to the monotonic restriction on heuristic functions in ordinary graphs. For the case where n is in the set of terminal nodes, if \(h(n)=0\), then the monotonic restriction means that \(h\) is a lower bound of \(h^*\), that is, for all nodes n, \(h(n)<h^*(n)\)

2.3 Association Rules and AI Algorithms
The core of ID3 algorithm is to determine an optimal splitting attribute. The information gain metric is usually used to select attributes. Select the attribute with the highest information gain as the test attribute of the current node. Before giving the specific calculation formula of information, it is necessary to clarify the two basic conditions that the formula should meet:

(1) If there is no instance of a certain class, information=0;
(2) If the number of instances in each class is equal, information=1.

Let T be a set of t samples, and the target attribute has m values, namely \{C_1, C_2, C_3, \ldots, C_m\}. Let \(S_i\) be the number of samples of class \(C_i\). Then the information entropy required when classifying a given sample is:

\[
\inf \sigma(T) = -\sum_{i=1}^{m} p_i \log_2(p_i)
\]

(1)

Where \(p_i\) is the probability that any sample belongs to \(C_i\), that is, \(S_i/t\) estimation. Under normal circumstances, the logarithmic function takes 2 as the base, and the entropy uses bits as the unit.

Let attribute X have n different values \{C_1, C_2, C_3, \ldots, C_m\}. Then the information entropy divided into subsets by X is:

\[
\inf \sigma_X(T) = \sum_{i=1}^{n} \left[ \frac{|T_i|}{|T|} \right] \inf \sigma(T_i)
\]

(2)

\(\frac{|T_i|}{|T|}\) serves as the weight of the subset. The smaller the entropy, the higher the purity of the subset. Among them, the information entropy of subset \(T_i\):

3. Experimental Research on Application of Tennis Electronic Referee in Tennis Match Based on Artificial Intelligence

3.1 Experimental Data
The research object of this article is to randomly select 200 college students from various colleges and universities, including 120 boys and 80 girls. Then divide them into two groups A and B. Group A is
the experimental group and group B is the control group.

3.2 Experimental Process
First of all, this article randomly selected college students of physical education to conduct a questionnaire survey, and then use artificial intelligence big data to obtain the understanding of these 200 college students about the use of artificial intelligence-based tennis electronic referees in tennis matches, so as to understand more realistically Contemporary college students' views on the use of artificial intelligence-based tennis electronic referees in tennis matches. After that, using the artificial intelligence-based tennis electronic referee in the tennis match proposed in this article, the A group of college students watched 30 tennis matches that used artificial intelligence technology to judge the electronic referee, and under the same conditions, the B group of college students used traditional A tennis match penalized by referee mode. Finally, conduct a questionnaire survey and compare experimental data.

4. Experimental Analysis of the Application of Tennis Electronic Referees in Tennis Matches Based on Artificial Intelligence

4.1 College Students' views on the use of Artificial Intelligence-based Tennis Electronic Referees in Tennis Matches
This paper uses the questionnaire method to conduct a questionnaire survey on 200 randomly selected college students. In this way, the college students' understanding of the use of artificial intelligence-based tennis electronic referees in tennis matches can be obtained, so as to have a more true understanding of contemporary college students' views on the use of electronic referees. The purpose of the first questionnaire survey is to use artificial intelligence-based tennis electronic referees in tennis matches and the degree of preference for the game perception. The second questionnaire survey is to understand the use of the electronic referee technology proposed in this article by college students view. The survey results are shown in Table 1 and Figure 1.

| Understand resource pool | Used resource library | Like resource pool | Think resource pool is very important |
|--------------------------|----------------------|-------------------|--------------------------------------|
| Boys                     | 78                   | 53                | 21                                   | 74                                   |
| Girls                    | 54                   | 45                | 18                                   | 39                                   |

**Figure 1. PE College students' attitude towards two kinds of resource banks**
It can be seen from the survey data that most college students know very little about the referee model under the new model, don’t know much about it, and rarely have contact with it. Therefore, only a few students expressed their optimism about it. On the other hand, students cannot realize the importance of electronic refereeing technology under the new model for future sports events. Therefore, everyone is not very fond of the traditional game judgment mode, and did not realize the importance of the use of electronic referees under the new mode.

After using the two modes of referees' judgments on the audience’s sensory effects, after watching 30 games of college students in groups A and B, most college students in group A believed that the artificial intelligence-based tennis proposed in this article The new model used by electronic referees in tennis matches is more effective, more interesting, and fairer in the development of tennis matches, which improves the enthusiasm of athletes and spectators. However, college students in Group B who adopt the traditional refereeing mode generally have low evaluations. This is mainly because the new model of the application of artificial intelligence-based tennis electronic referees in tennis matches proposed in this article adopts the most popular artificial intelligence analysis technology today, which also makes the game more enjoyable.

4.2 Changes in the Degree of College Students' perception of Tennis Matches
This article allows group A college students to use a new model of artificial intelligence-based tennis electronic referees in tennis matches to watch 30 games. Under the same conditions, let group B college students use traditional refereeing methods to also play 30 games. Watch. In the course of the experiment, the college students were surveyed every 5 games they watched, and the changes in their perception of the tennis match were counted. We visualized the changes in the degree of perception of the tennis match between A and B groups of college students, and performed curve fitting according to the mean value. As shown in Table 2, Figure 2.

Table 2. Change of PE students' liking degree to vocal computer

| Time            | After 5 games | After 10 games | After 15 games | After 20 games | After 25 games | After 30 games |
|-----------------|---------------|----------------|----------------|----------------|----------------|----------------|
| Group A         | 50%           | 55%            | 63%            | 75%            | 81%            | 86%            |
| Group B         | 50%           | 54%            | 54%            | 60%            | 63%            | 69%            |

Figure 2. Changes of college students' liking for computer learning
artificial intelligence-based tennis electronic referee proposed in this article to watch the tennis match in the new electronic referee mode is gradually increasing, and the speed is increasing. It is faster than the class B students who use traditional refereeing. Moreover, the perception of group A students towards tennis matches is much higher than that of group B students. this has an important relationship with the new refereeing model of the fairness of the tennis game. Artificial intelligence has powerful data processing and analysis capabilities, which can improve the accuracy of judgments. Therefore, the use of artificial intelligence-based tennis electronic referees in tennis matches plays an important role in the fairness of tennis matches.

5. Conclusions
In the context of artificial intelligence, this paper studies the application of tennis electronic referees in tennis matches. Because tennis competitions have fewer rounds, faster ball speeds, greater intensity, and more points in a single round, the number of challenges to electronic referees should be increased. However, taking into account factors such as game fluency, this article writes that it can provide Challenge electronic referees, each person shall be limited to twice per round. In the case of a big one-to-one score, the game will be very anxious, and each penalty will affect the result of the entire game. Therefore, each person in the deciding game can add one more time and have the right to challenge the electronic referee three times. The player must have the ball landed, the referee will make a penalty, and the challenge must be made before the next serve begins. Players need to clearly make a "challenge" request to the referee and raise their hands. In each game, both players will have two opportunities to challenge the electronic referee. If the challenge fails, one will be lost. If the challenge is successful, the challenge will continue. The solution of technical problems.

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