

## Use of Artificial Intelligence in Decision Making in Football

<sup>1</sup>Nirav Lodaya and <sup>2</sup>Shaikh Bilal Naseem

<sup>1</sup>Department of Computer Science, Somaiya  
Vidyavihar University, Mumbai, India

<sup>2</sup>Assistant Professor, Department of Computer Science,

Somaiya Vidyavihar University, Mumbai, India

[nirav.nl@somaiya.edu](mailto:nirav.nl@somaiya.edu), [mohammadbilal@somaiya.edu](mailto:mohammadbilal@somaiya.edu)

### Abstract

*This research paper presents the use of Artificial Intelligence (AI) in Decision Making in Football. As AI and humans have become more and more connected to each other, AI helps humans in many different ways. Referee decisions in world football are always controversial. Wrong decisions or choices by a referee in a football match leads to a negative or bad effect on results and are accordingly bad through the sporting view. The main interest of the use of this technology is to improve the exactness of referee decisions. This paper applies a lot of subjective examination techniques to survey the possibilities and cut-off points of the utilization of technology for the help of referees to make better decisions. Thus, this paper distinguishes possibilities for modern technologies like AI which can help in making the decision-making of referees more accurate, which plots the cut-off points in the referee's decision making.*

**Keywords:** Artificial Intelligence, Referee Decision, Decision Making, Football.

### 1. Introduction

Artificial intelligence in football these days is substantially more significant after human referees are less effective to take each choice to be right all along. Man-made technology like AI has become the best change possibilities in football. A worldwide study uncovers that a great part of the world population is interested in football. Football has an enormous sports market in the world and everyone knows that.

Computer-based intelligence in football is being introduced to change the result and fairness of matches. So, AI technology can come in very handy to match officials. Additionally, after using more and more computerized technology in world football, training sessions have improved significantly. Teams have started to use AI in post match analysis and have seen positive changes in results.[13][5] Teams are also using AI to analyze and keep a track on their rival teams so that they can create better strategies. Then again, football, similar to all different zones of society, is likewise evolving. Evaluation from Big Data makes electronic examinations possible. A camera captures all the little number of visuals and helps in evaluating a complete game.

### 2. Problem Statement

To be able to solve the problem of incorrect decisions taken by the referees on the field. An issue of any football match is that match officials can make some wrong decisions on the field and cannot reverse that decision on their own. They can choose the aftereffect of a match at the end of the day on their own, which is a big thing considering that the football market is big enough that this kind of mistake is unforgivable. Criticism and other problems come with it which can be mentally harming any person. Thus, the minimization of wrong choices is necessary.

### **3. Aim of the Study**

The main purpose of this paper is to investigate the technologies developed to help the referees make better decisions. The use of better modern technology is necessary. This paper will examine the wrong decisions taken by the match officials which could have been prevented or stopped by using modern computerized technology and AI to provide fair outcomes in football. It will also compare the decisions with the views of fans, players, and coaches. The use of innovation or technology would not only help to maintain law and order, but also it will help the referee in many certain ways. It will help coaches or managers pick better training programs other than just a better decision-making system for the referees.

### **4. Literature Review**

#### **4.1. Digital Transformation -**

The decision making field is evolving and is now supported by modern technology. To see whether the match-ball has completely crossed the line of goal, Goal Line Technology (GLT) helps the referee in making decisions. Although one referee stands near the goal post, he can still make a wrong decision as all the action goes on pretty fast, and sometimes it is not possible for humans to make the correct decision. So, Goal Line Technology helps the referee in this way. The Video Assistant Referee (VAR) is used to prevent wrong decisions taken by the referees. It helps them overturn their decision and rectify the mistake they have made. It helps make a game pretty fair. [5]

Even after all, the benefits of AI technologies have turned out to be controversial. Some of the coaches, players, fans also have opposed the use of AI technologies as it disrespects the decision taken by on-field match officials, and also the time it accumulates to take a decision is long which disrupts the player's momentum while playing.

This transformation is required to change the face of the game. So, the use of AI should be increased in football and should be more evolved so that it takes a decision faster and accurately.

#### **4.2. Artificial Intelligence -**

Artificial intelligence can also be called Smart technology or Machine Learning. Artificial intelligence (AI) has greatly helped the human race in which humans are not compatible to do some work on their own. AI can see things that are not possible to see with humans' naked eyes.

AI works in different ways that provide different kinds of Intelligence. Some of the ways are Automated, Assisted, Augmented, Autonomous Intelligence. [11]

AI can perform a specific task on its own and take a complete decision.[12] Some of these decisions include whether a player is offside or has the ball crossed the line of goal, the player being sent off by the referee is the correct decision. In taking these decisions no human intervention is required. Football has been greatly benefited by Artificial intelligence which is improving it in every aspect and as the technology will grow further, there is more and more room for improvement in the technology.[3]

#### **4.3. Decision Making -**

As per reports in the English football league, a referee makes nearly 245 decisions per game on average, which is a lot and considering it, and as we know it is not possible for a human to take every decision correctly. [4] A referee has to abide by the rule book while taking any decision. The International Football Association Board (IFAB) makes the rule in football. [11]

Match officials make choices depending on their observations and this decision also depends on the atmosphere present in the stadium.

Consequently, observation is consistently specific. Besides, observation is abstract. To apply his decision, it is expected that the match officials have a goal. Since the leader needs to evaluate various other options, the measure is an answer for some individual choice issues.

The decision making is an important aspect at least in football or in any other sports. Players have to respect any decision made by the referee concerning a sending off or a goal being disallowed as the referee has every right to make a decision from his point of view. At the end of the day, the referee's decision is a final decision that has to be respected by every player and coach involved, and thus to satisfy everyone the referee has to nearly give every decision correct without failing.

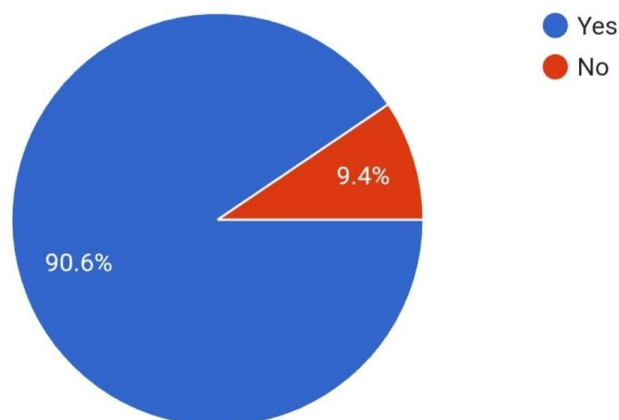
Also, the referee controls or resolves any dispute going on the field and the referee keeps watch on time, as he is the one who ends the match or stops the match in any regards. The Disciplinary Actions have to be taken without failing because a wrong sending off or a wrong sanction to a player might affect a team performance or also might lead to a defeat for the team. Red or Yellow cards are nearly given in almost every match played but sometimes referees fails to give a correct decision and might give red cards instead of yellow cards which again turn out to be bad for the losing team.

The referee only uses AI technologies to check whether there is a goal or no goal, is there a contact in the penalty box which might lead to a possible penalty, or when a red card is given and AI technologies are used to check if the sending off is fair or a mistake by the referee. These are the only time referee checks provide AI technologies and all the other decisions are taken by the referee himself.

The Laws of IFAB are updated every season as the years' progress and the law gets fairer only. All the referees and assistant referees before getting a referring license are trained by IFAB for the betterment of themselves. [10]

## 5. Survey Analysis

The survey report recorded 150 responses and it was conducted to see the view of people on Artificial Intelligence technology requirements in decision making in sports. Few questions were asked and one question was what did they think of the requirement of AI technologies in decision making in football and 90.6% of people thought AI technologies are required in decision making in football.



*Figure1*

Other questions in the survey were asked where should AI technologies replace the on-field referees and the results were mixed as only 49.1% of people wanted it to happen.

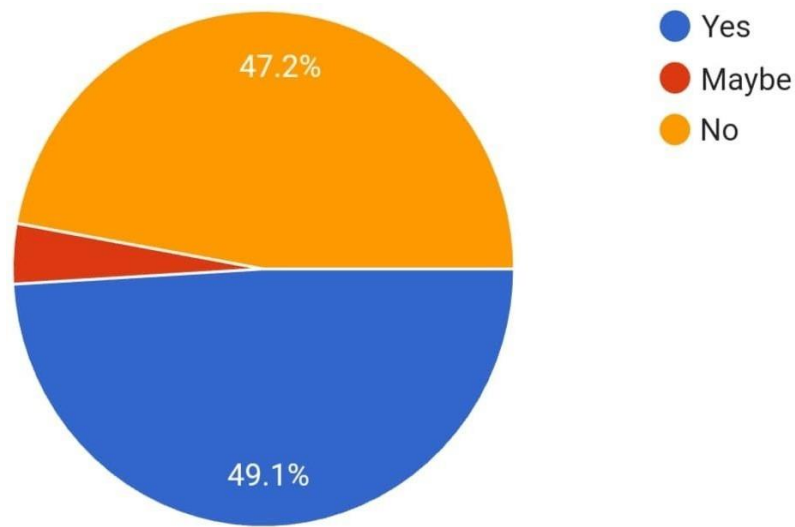


Figure2

Another question was while watching a game has the referee ever made a wrong decision which affected the match result and the morale of fans. The result was not surprising as 81.1% said this kind of thing has happened and it affects the players and others involved as well.

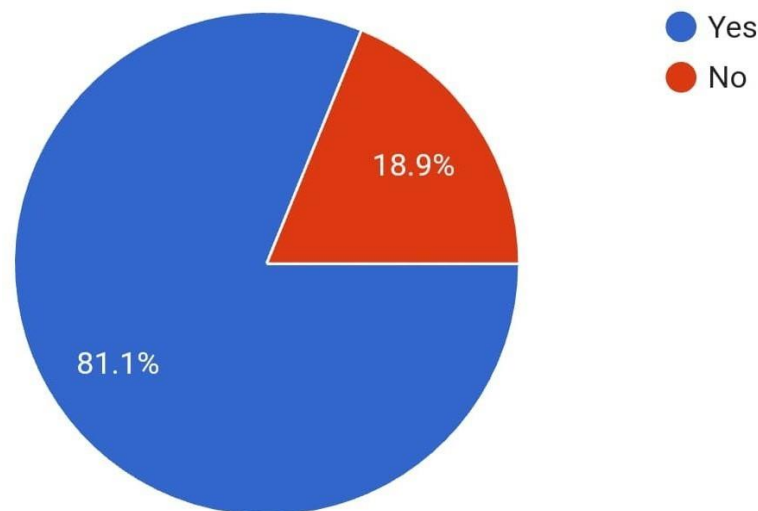


Figure3

So as per survey researcher, he thought the decision making could be made easier for referees by using AI technologies.

## 6. Research Methodology

In this paper researcher's aim is to investigate how AI technology can put an impact on the decision making of the referee and by going into shoes as fans, coaches, and players we will decide the need for it or how that decision could have turned and the losing team would have benefited from AI technologies.

The technique which will be used is the researcher will fill in the shoes of a fan, player, and coach. Some matches will be analyzed and the effect with and without AI technologies will be shown.

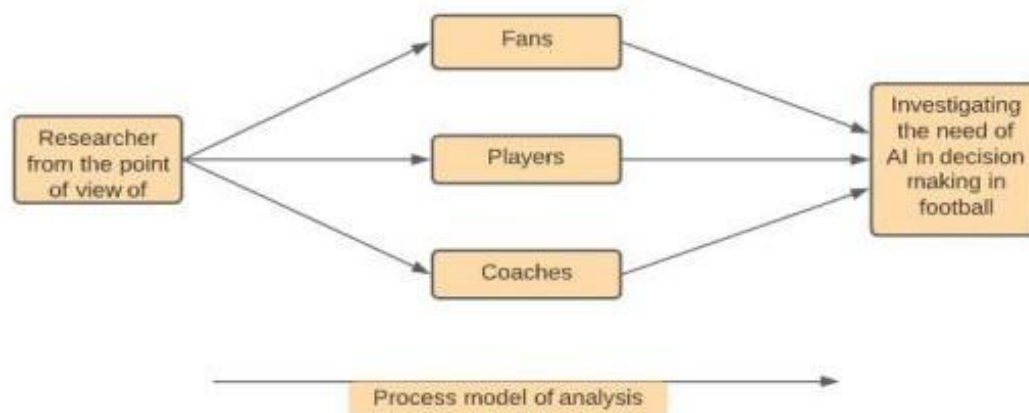
In the first match [6] observed, the assistant referee was at fault because he made a wrong decision and his error turned out to be in loss for the victim team. This match did create a lot of controversy post-match. As per the point of view of the fans, it was a clear decision that the ball had crossed the line of goal because they had a better view and it should have been given a goal. As a player or coach, it is very difficult to see your team getting knocked out from the world cup because of a refereeing error.

In the second match observed, the referee got it wrong when he gave away a goal where there was a handball in a build-up which led to a goal. It should have been disallowed and the victim team was knocked out from the tournament. As a fan, it would have been sad to see my team getting knocked out in this way. The same would have been from the view of the player and coach. The player admitted there was a handball in the build-up to the goal but the referee dismissed any requests and stayed on with his decision. [7]

In the third match observed, it was a big blunder by the referee as a wrong penalty was awarded to the team. As a fan, again it was a sight and should not have been a penalty. As a player or coach, it was a clear sight that it was not a penalty. Victim conceded more goals and lost the game. [8]

In the fourth match analyzed, the referee was very much biased towards the winning side as the losing side was denied 4 penalty appeals and many wrong decisions were given and as a result, the losing side suffered a lot and the match and referee were suspected of match-fixing too. As a fan of the victim team, it was quite disappointing and from the view of players and coaches, this match could have been different if AI technologies would have been used. [9]

The following figure illustrates the design by which this analysis was carried out:



## 7. Result

After all the analysis carried out by researchers, the result is simple as there was a need for

AI technologies to help referees make an accurate decision for making the game of football fairer. The ways in which AI technologies could help the referee to prevent wrong decisions are as follows:

- a) Decision making could be made fairer: In the matches analyzed if there would have been AI technologies to help referee, the result could have been different as in history. Many of these kinds of errors could be prevented which could help to make football fairer for the future generation.
- b) Handball and offsides: Handball and offsides are very fast action in real-time and sometimes it is not possible to see it with naked eyes. AI technologies could help more in it by using the camera footage captured and using it to check whether there was any wrongdoing in it or not.
- c) Wrong given fouls could be overturned: Without AI technologies the referee cannot overturn his decision on the basis of players trying to convince him to change it. But with AI technologies he can correct his mistakes by using AI technologies.
- d) Penalties: Penalties in crucial moments or at any moment are known to be game-changing as it changes the outcome of the match. There are scenarios where incorrect penalties are given and it is unfair to the opposing team, so AI can help in determining if the decision regarding the penalty is correct or not.
- e) Increasing fairness: The main duty for AI technologies needs to be used in football is to increase the fairness of the game. After all the analysis carried out, it looks AI is necessary for football.

## 8. Conclusion

In all the four-match observed nearly every wrong decision could have been avoided if AI technology would have been used in all these matches referee would have avoided the criticism and the result might have been fair. Now, finally, AI technologies are up and running. Technologies like Video Assistant Referee and Goal line technologies have been installed and are in working which is giving great results and it has helped in increasing fairness greatly. AI technologies should be improved more and more to give more accurate results and increase fairness in the game.

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It is a matter of great honor to work on the research project on "**Use of AI technologies in Decision Making in Football**". The project received excellent guidance from the project guide **Prof. Shaikh Mohammed Bilal N**. The project received their wholehearted assistance, inspiration, encouragement, and valuable guidance in all phases.

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