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Soccer Performance Analysis Using ML & CV

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# Introduction

The advent of digital data has brought up a new era in information technology, when the volume, variety, and speed of information exceed the capabilities of conventional data processing techniques. The study of big data becomes essential as we find ourselves at the intersection of constantly growing digital universe and data-intensive technologies. New approaches and methods for data gathering, storage, analysis, and interpretation are required due to the opportunities and challenges caused by the vast volume of data as well as its diverse structures and velocities.

When information becomes recordable, storage able, and easy to transfer, it becomes modern. Today, an era of information explosion characterized by massive, volatile, timely transmission, and diversified forms has truly arrived, producing what is now known as the "big data era.". (Cheng & Song, 2021). Big data stands for a massive and complicated dataset, including both structured and unstructured information. It implicates in a variety of domains such as sports, finance, healthcare, and education. (Patel et al., 2020)

The fundamental characteristics of Big Data are summed up in the 5 Vs. Volume indicates to the massive amount of data, highlighting its huge quantities that exceed the capacity of traditional processing. Velocity refers to the rapid collection and processing speed, which is particularly essential for real-time applications. Variety highlights the fact that data is presented in a wide range of formats and comes from a variety of sources. Veracity investigates the data's reliability and truthfulness, examining potential biases and contradictions. Finally, value is the ultimate goal, as the true value of Big Data depends on the relevant insights and knowledge that can be extracted, providing a challenge to standard data management practices. (Patel et al., 2020)

Big data in sports offers an outstanding opportunity to improve understanding of players' technical, tactical, biomechanical, and physiological behavior. This has resulted in an important change in player monitoring, with the scientific community focused on developing precise and dependable technologies to help practitioners, such as coaches and medical staff, manage training loads and optimize performance. (Rojas-Valverde et al., 2019). Big data services, such as exercise performance, health data, training statistics, and analysis, may successfully contribute in athletes' daily training and game strategy development. (Bai & Bai, 2021). Moreover, processing soccer match data from the perspective of a complex system could expose hidden patterns and the importance of behaviors. (Wu et al., 2020). Specifically, soccer is a complicated sport, and determining how to fairly evaluate a player’s performance, gestures, tactical, biomechanical, and physiological behavior has always been challenging. (Liu et al., 2020). By collaborating with computer science, solutions to these challenges may be solved. (Meerhoff et al., 2020).

The objective of this proposal is to utilize machine learning and computer vision to analyze soccer players' movements, positions, gestures, statistics, physiological data, and biomechanics in depth. The research aims to identify players' strengths, weaknesses, and areas for advancement, provide coaches with insights for strategic adjustments, estimate their future match performance, forecast possible injuries, and even predict the possibility of a player obtaining a penalty card. The purpose of this advanced technology is to provide a complete overview of player characteristics and behaviors in order to improve both individual and team performance.

# Literature Review

The convergence of big data and machine learning has an effect on many fields, including sports science and performance analysis. Big data can be defined by its volume, velocity, variety, veracity, and value. It contains valued information that when effectively utilized, can provide outstanding insights into athlete performance, injury prevention, and strategic decision-making. Machine learning algorithms, particularly in the domain of predictive analytics, enable sports experts to make educated decisions by uncovering patterns and trends within enormous datasets. This literature review investigates the relationship between big data, machine learning, and sports science applications. Trying to reveal the revolutionary impact of these technologies on athlete training, injury management, and overall sports performance by delving into major research and breakthroughs.

This research paper has proposed a framework for real-time violence detection in soccer. They used big data, analyzed it, and utilized deep learning to detect violence within soccer games. They used the Bidirectional Long Short-Term Memory (BLSTM) network to recognize the violence and trained it on a dataset of videos. The videos were transformed into frames and then trained the model on them. Their model achieved an accuracy of 94.5% in detecting violence action, it has been tested on only 410 video clips. The limitation here is that their model has been tested on a relatively small dataset and only relies on video data without taking any data such as player history. (R. a et al., 2019)

This article has researched in sports with another perspective, which is how they can analyze sports medicine data in order to predict the risk or potential of sports medicine-related diseases. They have proposed a cloud-based hardware-in-the-loop simulation model that analyzed and mined sports medicine data from different sources such as wearable sensors, medical devices, and electronic health records. And to assess and extract important information, they used a resampling algorithm, tensor convolution self-coding algorithm, and ural network model. Due to all of these techniques and data used, the model was able to accurately predict and assess the risk of diseases. The author has discussed a limitation of their model, is that the model does not consider the characteristics of each individual as a patient, which can affect the model predictions. (Ma & Pang, 2019)

Moreover, to this article which presented an expert system that predicts the outcome of hockey games. They have utilized big data and machine learning to predict the outcomes of the National Hockey League (NHL). They gathered comprehensive data of NHL games for the 2014-2015 season, the data included a player performance statistics such as goals, assists, and shots. Also, it included team statistics such as goals scored, goals allowed, and penalty scoring efficiency. Although, the data included upcoming game schedules and past game results. They have used a machine learning algorithm called Symbolic Regression and combined it with an evolutionary optimization algorithm called Genetic Programming. The model has achieved an accuracy above 90% among testing data. The limitations here are that the model focuses only on predicting game outcomes and did not delve into predicting game’s specific events such as goals, penalties, or injuries. Moreover, this model depends on a very large data set that includes a wide range of features, which will require more computing power and that can be a limitation for less popular leagues or lack of historical data. (Gu a et al., 2019)

This research paper, Analyzed and investigated the impact of big data analytics on different areas of sports science, including performance analysis, which involved tracking and analyzing player performance indicators, identifying trends and patterns, and optimizing training programs using big data. As Well As improve recovery methods by predicting injury risks. In addition, big data can help in identification of talent and assess their potential. moreover, they reviewed Existing literature and research projects on the application of big data analytics in sports science. Furthermore, they identified important difficulties and opportunities linked with big data analytics application in sports science. In addition, some recommendations for future study and development in the fields of big data analytics and sports science were offered. Their limitation is that they research sports in general and not in a specific field such as soccer in detail, also they did not discuss the ethical considerations and data privacy concerns in collecting data. (Kaur et al., 2021)

The article provides a comprehensive review of the machine learning utilization techniques in forecasting sport event outcomes. It dives into the researchers’ various techniques and algorithms that are used to analyze massive volumes of sports data and extract significant insights that can be used to make predictions. The authors did a comprehensive literature review that included over 100 research publications on the subject. They analyzed the approaches, techniques, and findings given in these researches in order to discover common themes, trends, and new areas of interest. Their research discovered that feature selection and feature extraction are critical in ML-based sports prediction. Various strategies are frequently used by researchers to extract useful and interesting aspects from raw sports data, such as individual statistics and team performance measures. These collected features are fitted by the machine learning algorithms, which allow them to find patterns and associations which impact game outcomes. The authors also discovered a widespread application of classification algorithms in sports forecasting. Classification algorithms are built to assign data points to preset groups, making them ideal for predicting binary outcomes like wins or losses. In sports prediction, popular used classification techniques are neural networks, logistic regression, and support vector machines. (Horvat & Job, 2020)

This study focuses at the use of an Optimized Convolutional Neural Network (OCNN) in sports medicine, namely the detection and assessment of medical problems associated with sports injuries. Recognizing the limitations of traditional algorithms in processing the increasing number of sports medical data, the researchers suggest an enhanced OCNN model. This model, involving the Self-Adjustment Resizing (SAR) algorithm and the self-coding method of convolution (SCM), is intended for the effective classification of sports-related medical data. The experimental results show that designing a cloud-based fusion system, developing an enhanced medical data network for sports medicine analysis, is technically feasible. In multi-dimensional sports medicine data analysis, the suggested OCNN, augmented with SAR and SCM algorithms, provides promising results. (Song et al., 2021)

The researchers performed a comprehensive assessment of papers that employed machine learning (ML) in predicting or preventing sports injuries. In their review, they included 11 studies. ML approaches such as tree-based ensemble methods, artificial neural networks, and support vector machines were used in the research. The scientists discovered that ML may be used to predict injuries with an acceptable level of accuracy. The best ML models could predict injuries with an accuracy of roughly 80%. The researchers also discovered that ML may be used to identify athletes who are at high risk of injury. This data can be utilized to prevent injuries by delivering tailored solutions to athletes, such as particular training activities or equipment modifications. The authors acknowledged the limits of machine learning (ML) in the prediction and prevention of sports injuries. These include the necessity for huge amounts of high-quality data, which can be difficult to acquire due to athletes' injuries, training habits, and medical histories. generalizing ML models trained on data from a single athlete population can be difficult, because of the limits of training on diverse sports or competition levels. Furthermore, there is no standardized approach to ML methodologies, which makes comparing results and developing accurate guidelines for utilizing ML in practice challenging. (Eetvelde et al., 2021)

# Research questions

* Can we provide accurate insights of players based on their performance?
* Can we forecast a soccer player's future match performance based on historical data?
* Can we predict if a player would face any injuries or penalty cards?

# Research objectives

* To employ machine learning and computer vision techniques for comprehensive analysis of soccer player movements, positions, gestures, and biomechanics during matches.
* To provide actionable insights to coaches by integrating machine learning findings into team strategy recommendations, including optimal player positioning and tactical adjustments.
* To develop predictive models leveraging player statistics, movements, biomechanics, and physiological indicators to forecast individual performance and susceptibility to injuries.
* To design a predictive model capable of assessing the likelihood of a soccer player receiving penalty cards during matches, utilizing historical data and contextual game situations.

# Research Methodology

## Research Approaches

Research is a dynamic and broad endeavor driven by the desire of understanding, gain knowledge, and find solutions to complicated challenges. Researchers use a variety of approaches to investigate and analyze the information, in a way that is consistent with their study aims. There are three primary research methodologies: qualitative, quantitative, and mixed method. Where each one offers different yet complementary information, each contributes to a unique insight to enrich and enhance the overall research process.

Qualitative research is a methodology which investigates human experiences and behaviors. Characterized by the collection of non-numerical data, which is frequently conducted through methods such as interviews and focus groups. The goal of this methodology is to identify the meanings, patterns, and insights that people relate to their experiences. This method is especially useful when pursuing expert opinions and experience, or delvin`g into complex social and cultural issues, since it allows for a more in-depth analysis and detailed understanding. Qualitative findings contribute to a deeper knowledge of the subject and provide valuable context in complex research landscapes. (Hennink et al., 2020)

Quantitative research is a structured methodology in collecting and analyzing numerical data. This method uses statistical techniques to extend results from a sample to a larger population. In quantitative research, surveys, and experiments are often used techniques. The priority is on gathering data that can be more generalizable to a larger population while being objective and accurate in the research process. This method enables researchers to test hypotheses, uncover trends, and figure out relevant relationships. (What is the difference between quantitative and qualitative data, and what’s mixed methods? Which is better? 2018)

In order to take advantage of each methodology, mixed methods research combines qualitative and quantitative approaches into a single methodology. This approach provides a greater comprehension of the study topic by integrating the scope of quantitative research with the depth of qualitative research. Research using mixed methods, whether sequential or simultaneous, enables researchers to combine insights, approve findings, and leverage on the advantages of both qualitative and quantitative techniques.

In my research, I used qualitative research methodology. I used this methodology as I conducted interviews with some of the soccer coaches.

## Saunder’s research onion

1. **Research philosophy**

In this layer, there is a positivism and constructionism methodology. My research follows constructionism methodology, as I conducted a number of interviews with soccer coaches. Interviews provide personal perspectives and understanding of reality, as every coach has their own perception and comprehension of soccer. Especially in soccer, each coach has their own different understanding of soccer and their evaluation techniques.

1. **Research approach**

There are two approaches in research, deductive and inductive. Where the research approach chosen for this study is deductive. The research theory states that there is a relationship between the biomechanics, statistics, positions, gestures, and movements of soccer players and their evaluation results and upcoming performance. The prediction is that by analyzing these elements using machine learning and computer vision technologies, an accurate understanding of players' characteristics and performances will be obtained, which will give coaches the ability to predict future performance, provide insights for coaching strategies and player positioning, and predict the potential of players receiving penalty cards or injuries. The experiment includes conducting interviews with soccer coaches to gather information on player characteristics and evaluation procedures. The data will next be examined to determine the relevance and importance of the relationship between these factors and the results mentioned earlier.

1. **Research strategy**

In research strategies, we have four strategies. Experimental, case study, action, and systematic literature review. My research follows an experimental strategy where we test hypothesis and determine the importance and existence of relationships between variables. Which involved gathering comprehensive information on soccer players' characteristics and evaluation metrics in order to further comprehend their performance results.

1. **Methodological choice**

For my methodological choice, I chose a mono-method qualitative approach, using interviews as the primary data gathering method. This decision depends on the nature of my research, that focuses on understanding soccer players' movements, positions, gestures, statistics, physiological data, biomechanics. By conducting interviews with soccer coaches, I can acquire an in-depth understanding of their perspectives on player interactions, assessment procedures, and strategies. The mono-method qualitative approach enables an intensive and in-depth study of these characteristics, providing significant and detailed data that can be utilized to improve the analysis and interpretation of research findings.

1. **Time horizon**

For the time horizon of my research, I adopted a cross-sectional approach, collecting data from a number of interviews conducted at a specific point in time. This methodological approach enables for an overview analysis of soccer coaches’ perceptions and procedures regarding player dynamics, assessment techniques, and tactics. By conducting interviews with different coaches at the same time, I aimed to gather a broad range of perspectives and concepts within a limited time period.

1. **Data collection and analysis**

For data gathering and analysis, I utilized primary research, specifically interviews with soccer coaches. This choice is explained by the need to acquire direct information from soccer coaches on player dynamics, evaluation techniques, and tactics. Interviews provide an in-depth and personal perspective, which allows an in-depth analysis of individual perspectives and knowledge regarding soccer. To conduct this research, I constructed a semi-structured interview structure with open-ended questions for obtaining comprehensive responses. I conducted interviews with a number of coaches either in-person or online. After data gathering, I documented and thematically analyzed the interviews to identify patterns and insights. This approach gives an extensive understanding of player evaluation and soccer coaching processes.

## Research processes flow chart

Firstly, when I was assigned with the assignment of starting a research project and writing a research proposal, I started thinking in finding and defining a problem that is suitable to be worked on. After that I defined the purpose of my research which is named by the purpose statement. This purpose statement is crucial as it serves as guiding beacon through the whole research.

Then I comprehended and assessed 7 published research papers as literature review of my research, these papers were recent and published on well-known publications. This was beneficial as I learned about their findings and merits, and also, I identified their gaps in order to improve my research. After that, I stated the research objectives and questions, which are crucial in evaluating the research after I finish it and check if the research was successful, met the research objectives, and answered the research questions.

Then I started conducting interviews with multiple soccer coaches in order to collect qualitative data from them. The aim of these interviews was to prove the relationship between the historical data and matches insights in predicting the future performance and predicting the possibility of injuries or penalty cards. After conducting these interviews, I started analyzing the responses using the thematic analysis method.

After that, I came up with my research findings and results from my primary and secondary research. Then I checked if my research results answered the research questions, and my research objectives were met in order to measure the success of my research. After that I stated some recommendations and further improvements, that if I or anyone else wants to research in this topic, they will be beneficial.

## Data Collection

In order to carry out with my research, I started with collecting data. Where the two fundamental approaches used by researchers are primary and secondary research. The method of gathering firsthand data directly from the source is known as primary research. This specific data, which was collected using techniques including surveys, interviews, observations, experiments, and focus groups, collected to a specific study goal. Researchers can gain new insights from primary research and adapt data collecting to meet their own objectives.

On the other hand, secondary research includes the investigation and analysis of pre-existing data that has been previously gathered by others. Publications including books, academic journals, articles, reports, and databases can be considered as secondary research. By providing background or confirming the research's hypothesis, secondary research complements the results of the primary research.

In order to gather information about the assessment and performance of soccer players, I used primary as well as secondary research methodologies in my study. In order to gather information for my primary research, I interviewed a number of soccer coaches about their evaluation techniques and their used strategies in the matches. Through these interviews, I acquired information about several measures that are used to evaluate players and gained insight into the coaches' perspectives on the relation between past performance and player potential and future performance. Their own experiences and observations provide insightful background information and practical perspectives on player assessment techniques. The tools used for conducting these interviews included face-to-face interactions and open-ended questioning to facilitate a comprehensive understanding of the coaches' insights.

In addition, I completed secondary research by thoroughly analyzing research papers and projects relevant to my topic. In order to do this, it was necessary to examine how previous studies that had addressed related research problems reached their results. I learned more about their implementation approaches and used technologies, their results and analysis, and best practices and techniques in player assessment research. The tools used for conducting this secondary research included comprehensive literature reviews, database searches, and citation analysis to identify relevant research papers and extract valuable insights from them.

By integrating data gathered through secondary research and thorough interviews with soccer coaches, I've been able to gather a wide range of perspectives and approaches for player assessment. This comprehensive approach has improved my knowledge and directed the carrying out of my research, helping me choose appropriate tools and techniques for evaluating and predicting soccer players’ performance.

### Access Ethical Issues and Limitations

* **Accessibility Challenges**

Due to their restricted availability and unwillingness to engage in such interviews, coaches proven to be challenging to approach for interviews. It was necessary to establish a connection and confidence with coaches in order to get beyond these obstacles and acquire important information about player assessment techniques.

* **Preserving Participant Rights in Information Gathering**

Participants' confidentiality and anonymity have become ethically challenging, especially when sensitive data concerning player assessment techniques is being gathered. Ensuring informed permission and anonymization of participants is critical for respecting their privacy and protecting their rights throughout the data gathering process.

* **Related Secondary Data Availability**

The lack of secondary data on soccer players that was accessible was a major obstacle since the datasets that were available were sometimes insufficient or nonexistent. This obstacle made it more difficult to perform thorough analyses and comparisons, underscoring the necessity for improved data accessibility and guidelines in the area of research on soccer and sports in general.

* **Data Gathering Equipment Issues**

A further obstacle was the lack of sensor and camera data from matches, which restricted the amount of information that could be gathered and examined. To efficiently acquire and utilize match data, innovative approaches and partnerships with sports organizations were needed to overcome these technical limitations.

### Data Collection Merits

Despite these challenges, data gathering had several benefits that enhanced the research process. Through direct communication with coaches via interviews, important specific knowledge about player assessment techniques was acquired, adding to a better comprehension of this topic. Furthermore, ethical issues were thoroughly examined to guarantee study integrity and participant rights. Moreover, the integration of secondary data from recent research articles published in credible journals offered supplementary perspectives and insights, enriching the study's broadness. Taking everything considered, the benefits of data gathering resided in its ability to provide comprehensive, contextually relevant information that enhances knowledge and comprehension in the area of soccer player assessment and prediction.

## Data Analysis

This research serves a dual purpose: firstly, to figure if there is a relationship between historical and matches data with future outcome, particularly concerning future player performance, and likelihood of injuries and penalty cards. Secondly, it aims to validate the ability of machine learning and computer vision in detecting and analyzing such relationships to predict future outcomes accurately. The primary research, consisting of interviews with football coaches, validates the first objective. Moreover, the literature review reveals numerous studies demonstrating the effectiveness of ML and CV in analyzing match data and making precise predictions, thereby confirming the second objective.

This research applies thematic analysis as the used analytical method for its primary data analysis. Thematic analysis provides an organized and methodical way for analyzing data, making it easier to find and understand themes or patterns in the data. Thematic analysis provides a solid framework for identifying important themes connected to player assessment methods, metrics, and information resources, as well as the relationship between previous data and future performance. The research intends to offer a thorough examination of the coaches' viewpoints and methods via the use of theme analysis, highlighting their methods for player evaluation and performance enhancement techniques.

### Primary data analysis

**Player Assessment Approach**

During matches, the coaches engage directly and hands-on with the soccer players as part of their approach to player evaluation. This topic emphasizes the coaches' effort to constant observation and thorough execution of given tasks on the field. By immersing themselves in the game's real-time dynamics, coaches obtain not only a basic awareness of player behaviors, but also dive into the details that characterize their performance. This comprehensive, experiential technique allows for a deeper and detailed assessment, allowing the coaches to identify complexities that typical analytical methods may ignore. The focus on personal involvement demonstrates a coaching style that goes beyond statistical data, promoting a thorough understanding of player dynamics and leading to a more thorough assessment of on-field performance.

**Metrics and Information Resources**

Coaches agreed that there is a wide range of measures and data sources are used to evaluate players. This covers offensive and defensive contributions, running patterns, and particular statistical measures such as passes and shots. The coaches' efforts to using a varied variety of data points emphasizes the analysis' completeness. By considering multiple aspects of player dynamics, the coach receives a comprehensive picture, guaranteeing that the evaluation process captures the varied nature of on-field performance.

**Relationship Between Historical Data and Future Performance**

By utilizing historical data, the thematic analysis reveals an approach to strategy toward player growth. The coaches believe in recognizing and resolving weaknesses while enhancing strengths based on past performance. It is consistent with a prospective viewpoint, in which past data is more than simply a historical tool, but also a useful resource for projecting and improving a player's future match performance. The strategic application of past data reveals a proactive attitude to player development and performance improvement.

### Results

The coaches' answers make it evident that they put significant importance on players participating effectively in matches and that they go beyond statistics to gain a better understanding of individuals. This is exactly in line with our goal of analyzing player positioning and movements using innovative techniques. Furthermore, the utilization of many measurements and data sources by coaches emphasizes the significance of recording all aspects of on-field performance, which aligns with our goal of creating predictive models for individual player performance. Their proactive approach to handling penalties and injuries, which is based on historical data, also aligns with our mission of giving coaches useful information, ensuring that our study is not only theoretical but also useful and applicable in the real world.

Upon closer examination of our results, it becomes clear that the coaches' approaches are strongly based on their previous experiences and observations. Players might develop tactics for future success by concentrating on their strengths and weaknesses from past matches. This is consistent with our goal of predicting player performance through the use of past data. Additionally, their preventive management of possible penalties and injuries demonstrates a comprehensive comprehension of player health and team dynamics, which is consistent with our goal of implementing machine learning insights into coaching methodologies. All things considered, our study not only validates the predictive power of historical data in predicting future results, but it also emphasizes the useful uses of advanced analytics in maximizing player performance and team success.

Furthermore, the reviewed research papers demonstrate that advanced technologies, such as machine learning and computer vision have the capability to detect relations and analyze real-time data effectively. Moreover, their ability to make accurate predictions regarding future performance, injuries, and penalty cards. Implementing such technologies in sports, particularly in soccer stadiums, stands to benefit coaches and players alike, ultimately enhancing the overall game experience.

Our study's results strongly support the predefined research objectives, showing a precise connection between the objectives mentioned before and the procedures observed in coaches' approaches. firstly, the coaches' demand for a thorough player evaluation approach that goes beyond simple statistics analysis to explore deeper individual performance insights is a consequence of our goal to use cutting edge methods to analyze player movement and posture. Moreover, it validates our goal of providing coaches with useful insights from advanced analytics, ensuring the practical significance of our research in the real-world manner.

Furthermore, their high dependence on a variety of measurements and metrics shows how important it is to capture the complexity of on-field performance, which supports our goal of developing predictive models which utilize a range of player statistics. And the reviews research papers showed that such these predictive models can detect the complexity of matches and performance. Finally, the coaches' tendency to use past observations and experiences to inform future tactics corresponds to our goal of utilizing historical data to predict player performance, highlighting the predictive ability of historical match data.

The coaches' strategic point of view not only validates the reliability of past data in forecasting future occurrences, but it also highlights the usefulness of advanced analytics in maximizing player and team performance. Overall, our research successfully demonstrates how the combination of computer vision and machine learning techniques can transform player evaluation, enable coaches to make strategic decisions, and eventually improve player performance. This completes our study's objectives and provides coaches and sports analysts with insightful information.

# Conclusion & Recommendations

Based on the results and outcomes of this research, the following recommendations are proposed to enhance player assessment practices and optimize team strategies in soccer:

* Integrate advanced Analytics Tools: Employing advanced statistical tools and techniques, including machine learning algorithms, to thoroughly analyze player movements, positions, and physiological data. Coaches may make informed choices to maximize team success and obtain more insight into players' performance by using these tools.
* Proactive Injury Prevention tactics: Coaches and medical professionals should put preventative measures based on historical data analysis and develop the proactive injury management tactics we discovered in our research in order to avoid injuries as much as possible. Identifying injury patterns and risk factors enables the development of specialized training and injury prevention programs to reduce the possibility of player injuries during matches.
* Employ Predictive Models in Penalty Management: Utilize predictive algorithms based on player statistics and historical data to forecast individual players' probability of having penalties during matches. Coaches may reduce the risk of receiving goals and increase their team's chances of winning on the field by proactively adjusting player position and team plans to decrease the likelihood of penalties.
* Gather more historical data of players: Collect more historical data on player performance to improve player assessment methods and team strategies. This grew dataset will enable the use of advanced technologies such as machine learning and computer vision for providing accurate and deeper insights about player behavior, strengths, weaknesses, and opportunities for development. These techniques will allow for more accurate predictions and informed decision-making in team management and strategies, finally improving player evaluation processes and team performance in soccer.

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