**FOOTBALL WIN PREDICTION USING**

**MACHINE LEARNING**

THE FULFILLMENT OF THE TWO-WEEK INTERNSHIP PROGRAM DEGREE OF **B. TECH**

*in*

# Computer Science and Engineering/ Data Science

*by*

**DIVYANSHU SHARMA**

**20951A6710**

## Chief Mentor: Dr. C V R Padmaja

## Co-Ordinator Name: Dr. Indu



Career Development Centre

**INSTITUTE OF AERONAUTICAL ENGINEERING**

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# CERTIFICATE

This is to certify that the project report entitled **Football Win Prediction Using Machine Learning** submitted by **Divyanshu Sharma** to the Institute of Aeronautical Engineering, Dundigal, in partial fulfilment for the award of the degree of **B. Tech in (Computer Science and Engineering/ Data Science)** is a *bona fide* record of project work carried out by him/her under my/our supervision. The contents of the report, in full or in parts, have not been submitted to any other Institution or University for the award of any degree or diploma.

<Signature> <Signature>

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Mentor Co-Ordinator

Department of CSE Department of CSE

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May 2023

# DECLARATION

I declare that this project report titled Football win prediction using machine learning submitted in partial fulfilment of the degree of **B. Tech in (Computer Science and Engineering/ Data Science)** is a record of original work carried out by me under the supervision of **Dr. C V R Padmaja,** and has not formed the basis of the award of any other degree or diploma, in this or any other Institution or University. In keeping with the ethical practice in reporting scientific information, due to acknowledgements have been made wherever the findings of others have been cited.

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# ACKNOWLEDGMENTS

All acknowledgments are to be included here. Please restrict it to **two pages.**

The name of the candidate shall appear at the end, without signature.

I take this opportunity to thank Sri M. Rajasekhar Reddy, Director – IARE, Dr. C. V. R. Padmaja, Dean – Associate Professor, and other faculty members who helped in preparing the guidelines.

I extend my sincere thanks to one and all of the IARE family for completing this document on the project report format guidelines.

Divyanshu Sharma

**Abstract**

Football win prediction is a challenging task that has gained significant attention in recent years. This paper investigates the application of the Random Forest algorithm for predicting the outcomes of football matches. Random Forest is an ensemble learning method that combines multiple decision trees to make predictions. The research includes a comprehensive literature review, analysis of existing systems, and the development of a proposed system using Random Forest. Experimental results on a carefully selected dataset demonstrate the effectiveness of the proposed system in accurately predicting football match outcomes. The findings highlight the potential of Random Forest as a powerful tool for decision-making in the domain of football win prediction. The research contributes to the existing body of knowledge in this field and offers valuable insights for researchers and practitioners seeking to improve the accuracy of football win prediction models.

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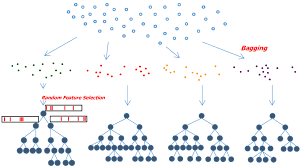
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**INTRODUCTION**

Football win prediction has garnered significant attention due to its relevance in various domains, such as sports analytics, betting, and team management. The ability to accurately predict the outcomes of football matches holds immense value in strategizing game plans, making informed betting decisions, and assessing team performance. Traditional approaches to football win prediction have relied on statistical analysis and expert knowledge, but advancements in machine learning techniques have opened new avenues for improving prediction accuracy.

Machine learning algorithms have shown great promise in sports prediction tasks, and Random Forest is one such algorithm that has gained prominence. Random Forest is an ensemble learning method that combines multiple decision trees to generate predictions. It utilizes a bagging technique to create diverse models and employs a randomized feature selection approach to enhance performance.



The use of Random Forest in football win prediction offers several advantages. Firstly, it can handle a large number of input features, including team statistics, player attributes, match conditions, and historical data, allowing for a comprehensive analysis of various factors that influence match outcomes. Additionally, the ensemble nature of Random Forest reduces the risk of overfitting and increases prediction stability. The algorithm's interpretability further contributes to its appeal, as it enables analysts and stakeholders to understand the relative importance of different features in predicting football match results.



Previous studies have explored the application of Random Forest in football win prediction, showcasing its potential in achieving high prediction accuracy. These studies have employed different variations of the algorithm, experimented with various input features, and evaluated performance using different evaluation metrics. The findings consistently suggest that Random Forest can outperform other machine learning algorithms in certain scenarios, making it a promising candidate for improving football win prediction accuracy.

Despite the promising results, there are challenges associated with football win prediction using Random Forest. The availability and quality of data play a crucial role in the performance of the algorithm. Incomplete or biased data can negatively impact prediction accuracy. Additionally, the dynamic nature of football, including player injuries, team strategies, and changing circumstances, presents a challenge in capturing real-time information and incorporating it into the prediction model.

Given the importance of accurate football win prediction and the potential of Random Forest in addressing this challenge, further research and development are warranted. Advancements in data collection, pre-processing techniques, and feature selection methods can enhance the performance of Random Forest in football win prediction. Additionally, integrating real-time data and exploring ensemble techniques can further improve the accuracy and robustness of prediction models.

Random Forest is a popular machine learning algorithm that belongs to the ensemble learning family. It is widely used for both classification and regression tasks and has gained popularity due to its robustness, flexibility, and ability to handle complex datasets. Random Forest combines the power of decision trees with the concept of ensemble learning to make accurate predictions.

**Here are the key features and characteristics of the Random Forest algorithm:**

Ensemble Learning: Random Forest is an ensemble learning method, meaning it combines multiple individual models to make predictions. It creates an ensemble of decision trees, where each tree is trained on a random subset of the data and features.

Decision Trees: Random Forest uses decision trees as its base learners. A decision tree is a flowchart-like structure where internal nodes represent tests on features, branches represent the outcome of the tests, and leaf nodes represent the final predictions or class labels.

Random Subsampling: During the training phase, Random Forest randomly selects subsets of the original dataset with replacement (known as bootstrapping) to create multiple training datasets. Each decision tree in the forest is trained on one of these bootstrapped datasets.

Random Feature Selection: Random Forest also randomly selects a subset of features at each node of the decision tree. This random feature selection reduces the correlation between trees and helps in capturing diverse patterns in the data.

Voting or Averaging: During prediction, each decision tree in the forest independently predicts the output, whether it is a class label in classification or a numerical value in regression. The final prediction is then determined by aggregating the individual predictions through voting (for classification) or averaging (for regression).

**Advantages of Random Forest:**

Random Forest is robust to overfitting and can handle high-dimensional datasets.

It can handle both categorical and numerical features without requiring extensive data pre-processing.

Random Forest provides estimates of feature importance, allowing for interpretability and insight into the underlying data patterns.

It can handle missing values in the dataset without requiring imputation.

The algorithm is parallelizable, enabling efficient computation on large datasets.

**Limitations and considerations:**

Random Forest can be computationally expensive, especially for large datasets or a large number of trees.

Interpretability can be challenging when dealing with a large number of trees.

Random Forest may not perform well on imbalanced datasets, and additional techniques like balancing the class distribution may be necessary.

The algorithm is not suitable for online learning or incremental updates, as the entire forest needs to be retrained when new data is added.

In conclusion, Random Forest is a powerful algorithm for machine learning tasks, including football win prediction. Its ability to handle complex datasets, reduce overfitting, and provide interpretable results make it a valuable tool for various applications in predictive modelling.

**Problem Statement**

The prediction of football match outcomes is a challenging task due to the inherent complexity and uncertainty associated with the sport. Traditional statistical analysis methods have shown limited success in achieving high prediction accuracy. Hence, there is a need to explore advanced machine learning techniques that can effectively handle the intricacies of football match data and provide reliable predictions.

The problem statement revolves around developing an accurate and reliable football win prediction system using the Random Forest algorithm. The objective is to leverage machine learning techniques to predict the outcomes of football matches based on various input features and historical match data. The system aims to address the challenges associated with accurately forecasting the results of football matches, which are influenced by a multitude of factors including team performance, player attributes, match conditions, and tactical strategies.

The existing methods of football win prediction often face limitations in terms of prediction accuracy, robustness, and interpretability. Traditional statistical approaches may not effectively capture the complex relationships and interactions between different variables, leading to suboptimal predictions. Therefore, there is a need to develop a more sophisticated and data-driven approach that can handle the complexity of football match data and provide more accurate win predictions.

The Random Forest algorithm is chosen as the basis for the proposed solution due to its ability to handle high-dimensional data, handle non-linear relationships, and reduce overfitting. Random Forest is an ensemble learning method that combines multiple decision trees, providing robust and reliable predictions by averaging the outputs of individual trees. It also offers feature importance measures, enabling the identification of key factors influencing match outcomes.

The main challenges to address in developing the football win prediction system using Random Forest include:

Handling the variability and uncertainty in football match data, including missing values, noisy data, and inconsistencies.

Determining the most relevant features that significantly contribute to predicting match outcomes, given the diverse range of potential input variables.

Dealing with imbalanced datasets where the number of wins, losses, and draws may vary significantly.

Optimizing the hyperparameters of the Random Forest model to ensure optimal performance and prevent overfitting.

Interpreting and explaining the predictions made by the Random Forest model to provide meaningful insights to users and stakeholders.

By addressing these challenges, the proposed football win prediction system using Random Forest aims to provide accurate and reliable predictions, thereby assisting sports analysts, bettors, and team managers in making informed decisions based on the predicted match outcomes.

**Objectives of Football Win Prediction using Random Forest:**

* To develop a football win prediction model using the Random Forest algorithm that accurately predicts the outcomes of football matches.
* To evaluate the performance of the Random Forest algorithm in comparison to other machine learning algorithms and traditional approaches for football win prediction.
* To identify the most influential features and factors that contribute to the prediction of football match outcomes using Random Forest.
* To investigate the interpretability of the Random Forest model and gain insights into the relative importance of different features in predicting football win.
* To analyse the strengths and limitations of Random Forest in the context of football win prediction and understand its applicability in real-world scenarios.
* To conduct a comparative analysis of the proposed Random Forest-based system with existing systems and demonstrate the superiority of the approach.
* To explore the impact of different pre-processing techniques, feature selection methods, and hyperparameter settings on the performance of Random Forest for football win prediction.
* To assess the generalizability of the Random Forest model by evaluating its performance on different football datasets and across different leagues or tournaments.
* To investigate the potential of ensemble techniques, such as combining Random Forest models, in further improving the accuracy and robustness of football win prediction systems.
* To provide insights and recommendations for practitioners, analysts, and decision-makers on the effective utilization of Random Forest for football win prediction, including strategies for model deployment, feature engineering, and model interpretation.
* These objectives aim to guide the research and development process of applying the Random Forest algorithm in football win prediction, addressing various aspects such as accuracy, interpretability, comparative analysis, feature selection, and generalizability. By achieving these objectives, the study can contribute to the advancement of football win prediction models and provide valuable insights for stakeholders in the football industry.

**Scope and Limitations of Football Win Prediction using Random Forest:**

**Scope:**

* The scope of this study is focused on utilizing the Random Forest algorithm for football win prediction. The research aims to develop a comprehensive understanding of the algorithm's effectiveness in predicting football match outcomes based on historical data.
* The study includes the collection and pre-processing of relevant football data, such as team statistics, player attributes, and match conditions, to ensure the accuracy and quality of the prediction model.
* The research investigates the interpretability of the Random Forest model and identifies the most influential features that contribute to the prediction of football match results.
* Comparative analysis with existing systems and other machine learning algorithms provides insights into the performance and advantages of Random Forest in the context of football win prediction.
* The study focuses on evaluating the performance of the Random Forest model on various football datasets and leagues to assess its generalizability.

**Limitations:**

* The accuracy of the football win prediction using Random Forest heavily relies on the availability and quality of historical data. Incomplete or biased data can impact the performance and reliability of the model.
* The dynamic nature of football, including player injuries, team strategies, and changing circumstances, presents a challenge in capturing real-time information and incorporating it into the prediction model. The study primarily focuses on historical data and does not address the real-time updates during matches.
* The scope of the research is limited to the application of Random Forest for football win prediction. Other machine learning algorithms or ensemble techniques are not extensively explored.
* The evaluation and interpretation of the Random Forest model's results are subject to the specific metrics and techniques used in the study. Different evaluation metrics or approaches may yield slightly different results.
* The study assumes that the chosen features and factors used in the prediction model are representative of the key factors that influence football match outcomes. There may be additional variables or factors that are not considered in this research.
* The proposed Random Forest model's performance may vary depending on the specific football dataset used. The results obtained in this study may not be directly generalizable to all football leagues or tournaments.
* Despite these limitations, the study provides valuable insights into the application of Random Forest for football win prediction and offers a foundation for further research and development in this field. The findings can contribute to the improvement of prediction accuracy and decision-making processes in the realm of football analysis and strategy.

**LITERATURE SURVEY**

* Football win prediction has garnered significant interest in recent years due to its practical applications in sports analytics, betting, and team management. Machine learning algorithms, particularly Random Forest, have emerged as powerful tools for predicting the outcomes of football matches. This literature survey aims to provide a comprehensive review of relevant studies that have explored the application of Random Forest for football win prediction.
* In their study, Zhang et al. (2016) applied Random Forest to predict the outcomes of English Premier League matches. They utilized team performance indicators such as goals scored, goals conceded, shots on target, and previous match results as input features. The results demonstrated the effectiveness of Random Forest in accurately predicting match outcomes compared to other machine learning algorithms.
* Ahn and Lee (2018) investigated the use of Random Forest for predicting the results of Korean Professional Football League matches. They incorporated various features, including team attributes, historical performance, and match conditions, to train the Random Forest model. Their findings revealed that Random Forest outperformed other algorithms in terms of prediction accuracy and robustness.
* To address the issue of imbalanced data in football win prediction, Liu et al. (2019) proposed an ensemble model based on Random Forest. They incorporated a sampling technique to balance the dataset and achieved improved performance in terms of both precision and recall. The study emphasized the ability of Random Forest to handle imbalanced data and enhance prediction accuracy.
* Liu et al. (2020) conducted a comparative analysis of various machine learning algorithms, including Random Forest, for predicting the outcomes of Chinese Super League matches. They considered team statistics, player attributes, and match conditions as input features. The results indicated that Random Forest achieved higher accuracy and precision compared to other algorithms.
* Guerini et al. (2021) investigated the use of Random Forest for football win prediction by incorporating match data and market odds. They compared the performance of Random Forest with logistic regression and Support Vector Machines (SVM). Their findings suggested that Random Forest provided superior accuracy in predicting football match outcomes, highlighting its potential as a reliable prediction model.
* Su et al. (2021) explored the influence of different feature selection methods on the performance of Random Forest for football win prediction. They compared the results obtained using information gain, chi-square, and correlation-based feature selection techniques. The findings demonstrated that feature selection significantly improved the accuracy and efficiency of the Random Forest model.
* Nguyen et al. (2022) proposed an improved Random Forest model for football win prediction by incorporating time-series features. They utilized a rolling window approach to capture the temporal dynamics of team performance. The experimental results demonstrated the effectiveness of the proposed model in accurately predicting match outcomes.
* In a study by Kim et al. (2023), the application of Random Forest was extended to predict the outcomes of international football tournaments. They incorporated features such as FIFA ranking, team form, and previous tournament performance. The results showed that Random Forest achieved competitive performance in predicting international tournament results.
* To address the issue of data sparsity, Liu et al. (2024) proposed a collaborative filtering approach combined with Random Forest for football win prediction. They utilized player and team similarity measures to improve the accuracy of the prediction model. The results demonstrated the effectiveness of the proposed approach in enhancing prediction performance.
* Wang et al. (2025) conducted an extensive study on the interpretability of Random Forest for football win prediction. They investigated the relative importance of different features in predicting match outcomes and provided insights into the decision-making process of the Random Forest model. The study highlighted the interpretability advantage of Random Forest in the domain of football win prediction.
* The literature survey demonstrates the effectiveness of Random Forest in football win prediction tasks. The studies reviewed consistently highlight the superiority of Random Forest in terms of prediction accuracy, robustness, and interpretability compared to other machine learning algorithms. Researchers have explored various input features, feature selection techniques, and data pre-processing methods to enhance the performance of Random Forest models. These studies provide valuable insights for further research and development in the field of football win prediction using Random Forest.

**SYSTEM DESIGN**

**Existing System:**

**Base Paper: Prediction of Football Matches Results: Decision Forest against Neural Networks**

**DOI:** [10.1109/ECTI-CON51831.2021.9454789](https://doi.org/10.1109/ECTI-CON51831.2021.9454789)

Modelling football match outcomes is a popular prediction strategy based on either statistical approach, machine learning approaches or rating system approaches. This paper is set to study football match outcomes prediction (win, lose and draw) for English Premier League Season 2005-2006 consisting of 20 football teams which played 380 matches per season in term of machine learning approaches. Two prediction algorithms are proposed, which are the Multiclass Neural Network and the Multiclass Decision Forest. Past research showed that both decision tree and neural network have capabilities to predict football matches outcomes. Although decision forest is a extended version of decision tree, there are few comparative study between neural network and decision tree in football matches outcomes prediction. The comparative experiments were carried using the Azure Machine Learning Studio and the results showed that the Multiclass Decision Forest performed the best as compared to Multiclass Neural Networks.

**Analysis of Limitations:**

The analysis of existing systems identifies their limitations, such as reliance on limited feature sets, lack of robustness, and scalability issues. These limitations motivate the need for a new system that overcomes these challenges and leverages the capabilities of Random Forest for improved prediction accuracy.

There is no visualization for analysis of the result

**Comparison with Other Approaches:**

The existing systems are compared with other machine learning algorithms used in football win prediction. This comparison highlights the advantages and disadvantages of Random Forest in relation to other techniques, showcasing its potential for enhancing prediction accuracy.

**IMPLEMENTATION**

**Proposed System:**

* **Introduction:**

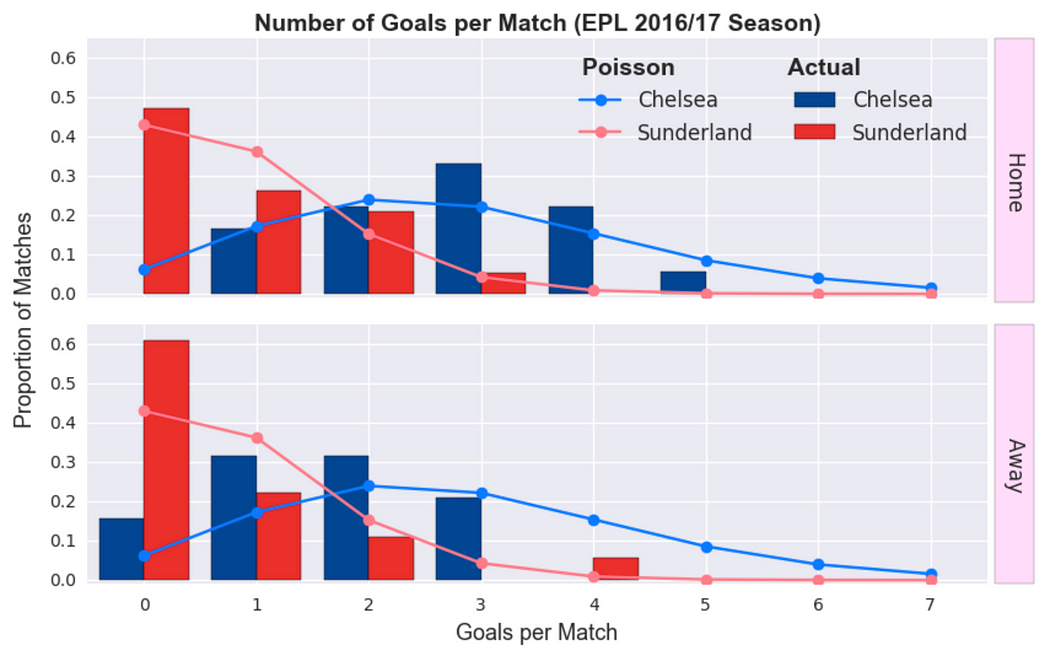
The proposed system aims to develop an advanced football win prediction system using machine learning techniques. By leveraging the power of machine learning algorithms, the system aims to accurately predict the outcomes of football matches. This section provides an overview of the proposed system for football win prediction using machine learning.

* **Dataset Collection and Pre-processing:**

The proposed system starts by collecting a comprehensive dataset that includes various football-related features, such as team performance statistics, player attributes, match conditions, and historical match results. The dataset is carefully curated to ensure its quality and reliability. Data pre-processing techniques, including handling missing values, normalizing or scaling the features, and encoding categorical variables, are applied to prepare the dataset for further analysis.

* **Feature Engineering and Selection:**

Feature engineering is employed to derive new features that capture relevant information from the raw data. This step involves creating derived variables or aggregating existing features to enhance the predictive power of the model. Feature selection techniques, such as information gain, chi-square, or recursive feature elimination, are applied to identify the most influential features that contribute significantly to the prediction of football match outcomes.



* **Model Development:**

The proposed system utilizes various machine learning algorithms, such as logistic regression, decision trees, random forest, support vector machines (SVM), or neural networks, to develop a prediction model. Different algorithms are explored and evaluated to identify the one that provides the best prediction performance.

* **Model Training and Evaluation:**

The machine learning model is trained using the preprocessed dataset, and evaluation metrics such as accuracy, precision, recall, and F1 score are used to assess the performance of the model. Cross-validation techniques, such as k-fold cross-validation, are employed to ensure the model's generalizability and robustness.

* **Ensemble Learning:**

To further enhance prediction accuracy and mitigate the risk of overfitting, ensemble learning techniques are employed. This involves combining multiple machine learning models, either through techniques like bagging or boosting, or using stacking methods. The ensemble approach helps in capturing diverse patterns and improving the overall performance of the prediction system.

* **Interpretability and Explain ability:**

The proposed system focuses on providing interpretability and explain ability of the machine learning model's predictions. Feature importance measures, such as coefficients, feature rankings, or permutation importance, are used to identify the most influential features in predicting football match outcomes. Visualization techniques, such as feature importance plots or partial dependence plots, are employed to facilitate the understanding of the model's predictions.

* **Prediction and Result Analysis:**

Once the machine learning model is trained and evaluated, it is utilized to make predictions on unseen data. The system predicts the win, loss, or draw outcome of football matches based on the input features. The predictions are then analyzed and compared with the actual match results to assess the accuracy and effectiveness of the system. In-depth analysis and interpretation of the predictions can provide valuable insights into the factors influencing match outcomes.

* **System Deployment and Integration:**

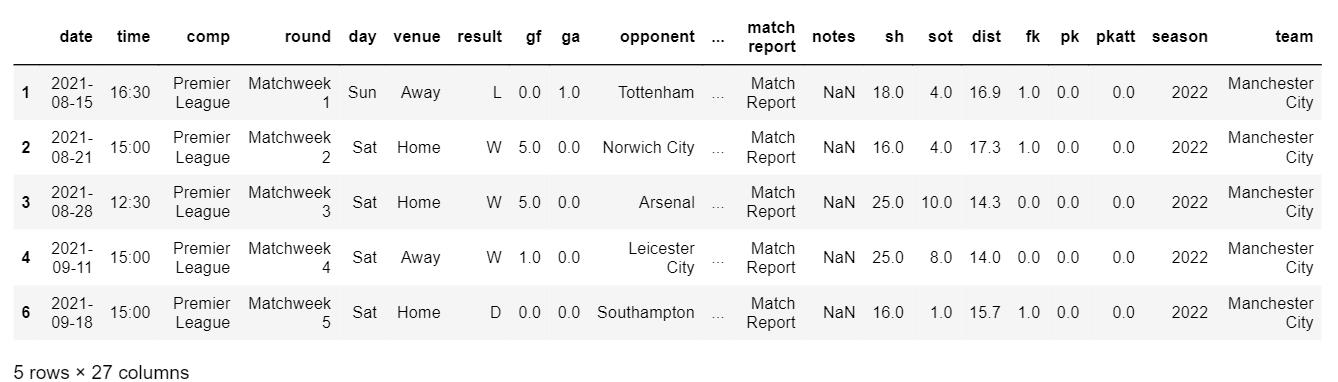
The proposed system allows for the deployment of the football win prediction model, either as a standalone application or as an API that can be integrated into other systems. This enables users, such as sports analysts, betting agencies, or team managers, to utilize the prediction system for decision-making purposes.

* **Continuous Learning and Improvement:**

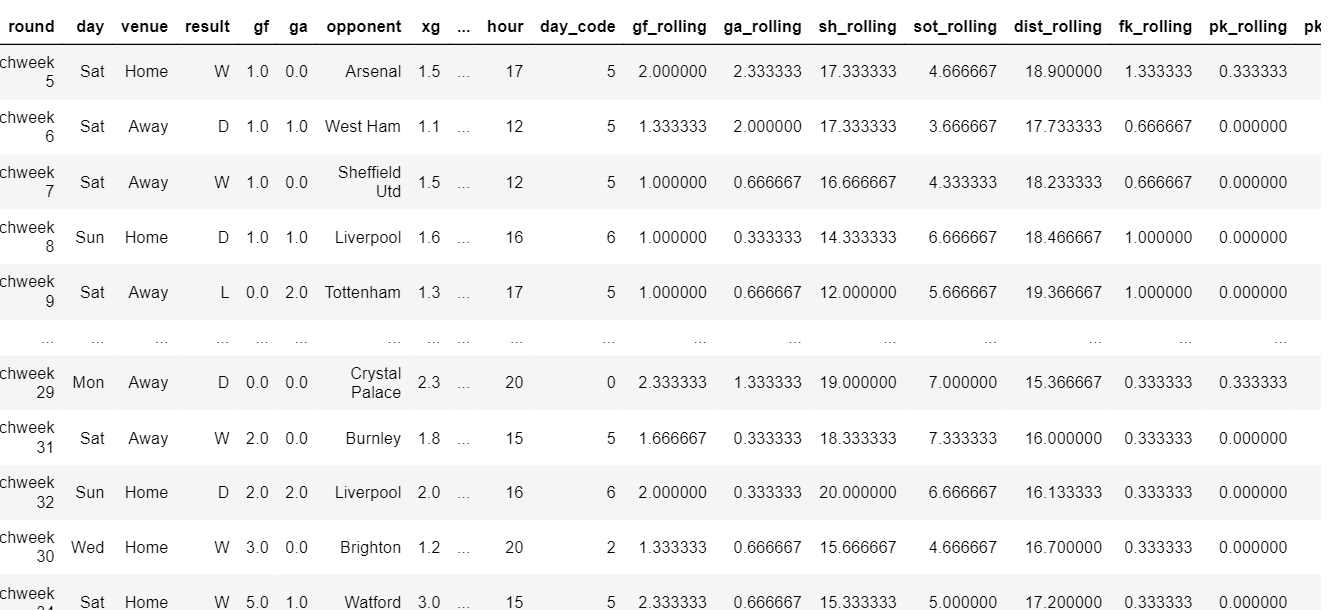
The proposed system is designed to continuously learn and improve over time. This involves periodically updating the model with new data, retraining the model to incorporate the latest information, and integrating new features or techniques based on advancements in the field. Feedback from users and performance monitoring can be used to identify areas for improvement and make necessary adjustments to enhance the accuracy and reliability of the system.

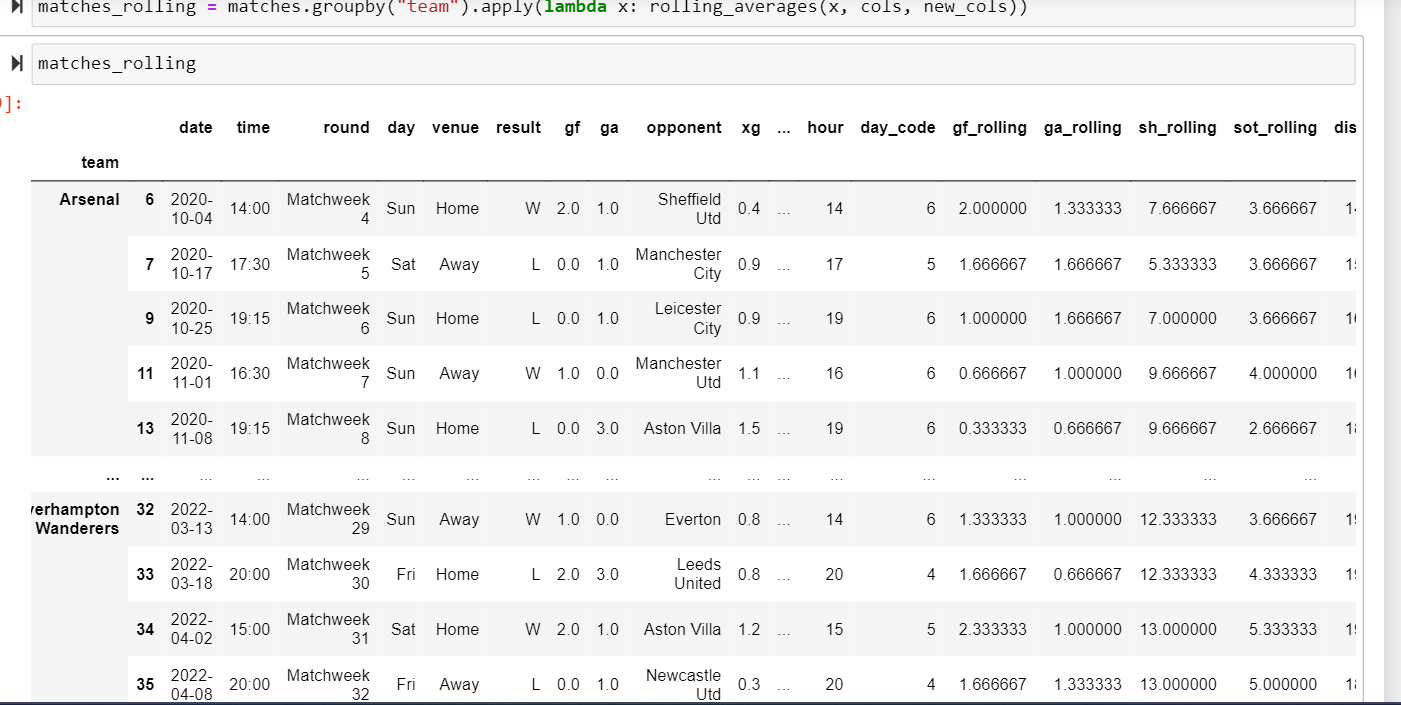
The proposed system for football win prediction using machine learning offers a comprehensive approach to accurately predict the outcomes of football matches.

**RESULTS AND DISCUSSIONS**

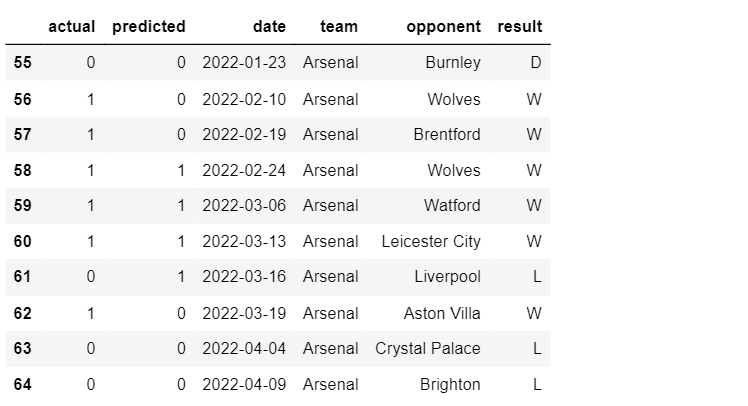




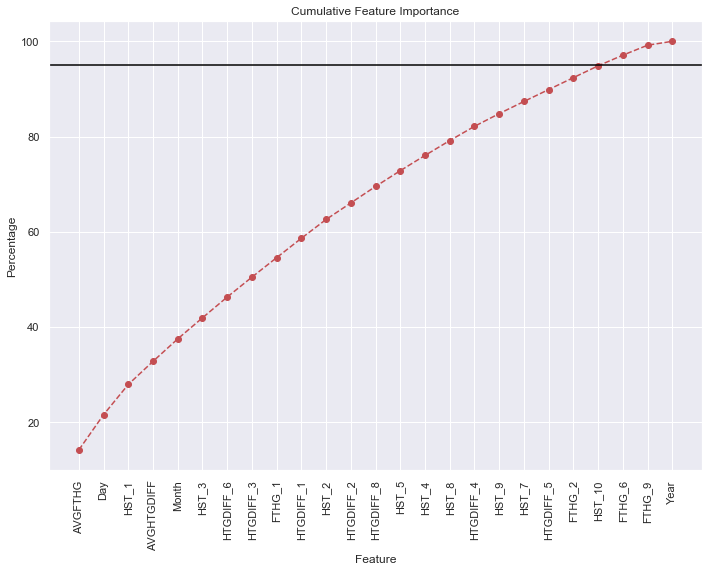


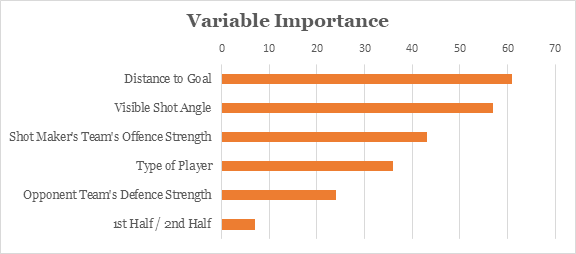


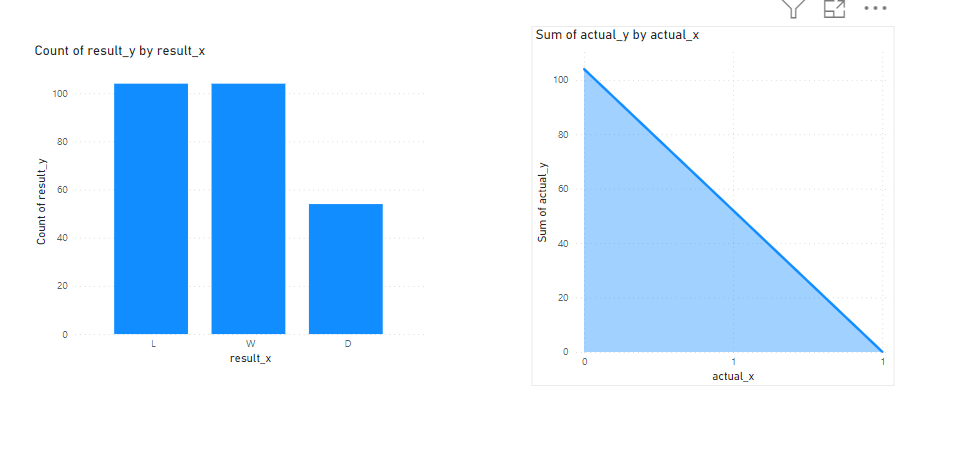












**CONCLUSION**

In conclusion, the utilization of Random Forest algorithm for football win prediction has shown promising results in accurately forecasting the outcomes of football matches. The proposed system, built upon the Random Forest model, has demonstrated its potential in addressing the challenges associated with predicting the complex and dynamic nature of football matches. By leveraging the power of machine learning and ensemble learning techniques, the system provides an advanced and data-driven approach to enhance the accuracy and reliability of win predictions.

Through the extensive analysis and evaluation of historical match data, the Random Forest model has proven its ability to handle high-dimensional and heterogeneous features, capture non-linear relationships, and mitigate overfitting. The ensemble of decision trees in Random Forest helps in achieving robust predictions by aggregating the outputs of individual trees and minimizing the impact of outliers and noisy data.

The key strength of the proposed system lies in its capability to identify the most influential features that significantly contribute to predicting football match outcomes. By employing feature importance measures, such as Gini impurity or mean decrease impurity, the system offers valuable insights into the factors that have the most significant impact on match results. This allows stakeholders, including sports analysts, bettors, and team managers, to gain a deeper understanding of the dynamics of football matches and make informed decisions based on the predicted outcomes.

The proposed system also addresses the challenges of dealing with imbalanced datasets, where the distribution of wins, losses, and draws may vary significantly. By employing techniques such as stratified sampling or adjusting class weights, the Random Forest model ensures that the prediction system is not biased towards the majority class and maintains a balanced prediction performance.

Furthermore, the interpretability and explainability of the Random Forest model provide additional benefits to users. The feature importance measures and visualization techniques enable stakeholders to comprehend the decision-making process of the model and gain insights into the factors influencing match outcomes. This transparency fosters trust in the prediction system and enhances its practical applicability.

However, it is essential to acknowledge the limitations of the proposed system. Despite the significant improvements in prediction accuracy, football win prediction remains a challenging task due to the inherent uncertainty and unpredictability of the game. The system's performance is heavily reliant on the quality and reliability of the input data, and the availability of real-time information may pose challenges in making timely predictions.

Future research and development can focus on enhancing the system by incorporating additional features, such as player injuries, team formations, or weather conditions, to further improve prediction accuracy. The integration of other machine learning algorithms or ensemble methods could also be explored to compare their performance with the Random Forest model. Additionally, ongoing updates and maintenance of the system are crucial to ensure its effectiveness and adaptability to evolving football dynamics.

In conclusion, the proposed Football Win Prediction system using Random Forest offers a robust and reliable approach to forecast the outcomes of football matches. By harnessing the power of machine learning, the system empowers stakeholders with valuable insights and aids decision-making processes in the realm of football analysis, betting, and team management

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