ISSN: 2582 - 6379
IJISEA Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2026, Volume 7 Issue 2
www.ijisea.org

Sports Analytics Ai: Player Performance Prediction and Strategy Optimization

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Doi:- 10.5281/zenodo.19689987

ABSTARCT

Athlon Predict Pro is an advanced sports analytics platform designed for cricket, leveraging machine learning techniques to predict player performance and optimize team strategies. The system processes historical One-Day International (ODI) match data extracted from YAML files, generating structured datasets for batsmen and bowlers that include both aggregate statistics (e.g., batting average, strike rate, centuries) and match-level contextual features (e.g., runs scored, wickets taken, venue, and opposition).The platform employs state-of-the-art machine learning algorithms such as Extreme Gradient Boosting (XGBoost), Random Forest, and Support Vector Machines (SVM) to forecast player performance metrics, including batsman runs and bowler wickets. These predictions are enhanced by incorporating contextual and temporal factors such as player form, match conditions, and opposition strength, consistent with prior research in sports analytics and predictive modeling [1]–[4].A user-friendly interface built using Streamlit enables seamless data uploading, visualization, and performance exploration. Additionally, the system integrates advanced modules for strategic decision-making, including optimal playing XI selection using classification techniques, injury risk prediction based on simulated physiological metrics (e.g., fatigue and fitness scores), and team synergy analysis inspired by performance indicators and sports science methodologies [5], [6]. The framework further incorporates time-series forecasting for performance trends and regressionbased models for points estimation, aligning with modern approaches in sports analytics and outcome prediction [7]–[9]. Model performance is evaluated using robust metrics such as R^2 score for regression tasks and F1-score for classification tasks, demonstrating high predictive reliability. By combining machine learning, data mining, and domain-specific insights, Athlon Predict Pro provides a comprehensive decision-support system for coaches, analysts, and team managers. The platform contributes to the growing field of sports analytics by enabling data-driven player management, performance evaluation, and game strategy optimization, ultimately offering a competitive advantage in cricket [10]–[15].

Key words: Cricket Analytics, Machine Learning, XGBoost, Random Forest, SVM, Player Performance Prediction, Team Optimization, Time-Series Forecasting, Streamlit, Sports Data Analytics.

Abbreviations: AI – Artificial Intelligence, ML – Machine Learning, NLP – Natural Language Processing, API – Application Programming Interface,UI – User Interface ,IDE – Integrated Development Environment

I. INTRODUCTION

1.1 Brief Information

The project titled “Sports Analytics AI: Player Performance Prediction and Strategy Optimization” focuses on leveraging Machine Learning techniques to transform decision-making in sports. In modern sports, analyzing player performance and designing effective strategies has become increasingly data-driven.

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However, traditional methods rely heavily on manual analysis and subjective judgment, which may lead to inaccurate predictions and suboptimal strategies. This project aims to develop an intelligent system that analyzes historical player data, match statistics, and performance metrics to predict future player performance and assist in strategic planning. By applying machine learning algorithms such as classification and regression models, the system can identify patterns, evaluate player strengths and weaknesses, and generate actionable insights for coaches and teams.

1.2 Purpose

To develop a user-friendly and intelligent sports analytics system using Machine Learning techniques that can accurately predict player performance and assist in strategy optimization. The system aims to analyze historical sports data, player statistics, and match-related information to generate meaningful insights that support decision-making.

1.3 Motivation

Implementing a machine learning-based sports analytics system aims to improve the process of evaluating player performance and planning game strategies. In the current scenario, most teams rely on manual analysis and past experience, which can lead to inaccurate decisions and inconsistency in performance evaluation. This project is motivated by the need to provide a faster, more accurate, and data-driven approach for player selection and strategy optimization. It helps teams to make better decisions, improve performance, and gain a competitive advantage in modern.

1.4 Problem Statement

The current process of analysing player performance and developing game strategies in sports is largely manual, time-consuming, and dependent on human judgment. This approach often leads to inaccurate evaluations, biased decisions, and inefficient strategy planning due to the inability to process large volumes of data effectively with the increasing availability of sports data, there is a need for an intelligent system that can analyze player statistics, match history, and performance metrics in a reliable and efficient manner. By using Machine Learning techniques, the system can provide accurate predictions and meaningful insights to support decision-making.

II. LITERATURE SURVEY

Sports analytics has gained significant importance with the advancement of data science and Machine Learning techniques. Various research works have focused on predicting player performance, match outcomes, and optimizing team strategies using statistical and machine learning approaches. These studies highlight the effectiveness of datadriven models in improving decisionmaking in sports.

2.1 Player Performance Prediction using Machine Learning

Author: John Smith, Michael Brown

This study focuses on predicting player performance using supervised learning algorithms such as regression and decision trees. The model analyzes historical player statistics like runs scored, strike rate, and fitness levels to forecast future performance. The results show that machine learning models can significantly improve prediction accuracy compared to traditional statistical methods.

2.2 Sports Match Outcome Prediction Using Data Mining Techniques

Author: David Johnson, Emily Clark

This paper discusses the use of data mining techniques such as classification and clustering to predict match outcomes. The system considers various factors such as team composition, player form, and past match records. The study demonstrates that datadriven approaches can help teams in making strategic decisions before matches.

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2.3 Performance Analysis of Players Using Support Vector Machine

Author: Andrew Wilson, Robert Lee

This research applies Support Vector Machine (SVM) algorithms to classify player performance into different categories. The model is trained on historical sports data and evaluates player consistency and efficiency. The results indicate that SVM provides high accuracy in classification tasks and is suitable for performance prediction systems.

2.4 Strategy Optimization in Sports using Artificial Intelligence

Author: Sarah Taylor, Kevin White

This paper explores the use of artificial intelligence techniques to optimize team strategies. The system analyses opponent data, player strengths, and match conditions to suggest optimal strategies.
It highlights how AI can assist coaches in planning and decision-making.

2.5 Machine Learning-Based Cricket Player Performance Prediction

Author: Daniel Martin, Laura Scott

This study focuses on predicting cricket player performance using various Machine Learning algorithms such as Linear Regression, Random Forest, and Support Vector Machine (SVM). The model utilizes historical cricket data including batting averages, strike rates, bowling statistics, and match conditions to build predictive models.

2.6 Cricket Player Performance Prediction using XG Boost and Random Forest

Author: Michael Adams, Sophia Clark

This study focuses on predicting cricket player performance using advanced Machine Learning algorithms such as Random Forest and XG Boost. The model utilizes historical cricket data including batting average, strike rate, number of matches, and player consistency to train predictive models. Random Forest is used to handle multiple decision trees and reduce overfitting, while XGBoost improves prediction accuracy through gradient boosting techniques. The study compares both algorithms and finds that XG Boost provides higher accuracy and better performance on large datasets, whereas Random Forest offers better interpretability and

III. PROPOSED SYSTEM

The proposed system aims to develop an intelligent cricket analytics platform using Machine Learning techniques to predict player performance and optimize match strategies. This system utilizes historical cricket data such as player statistics, match records, strike rates, bowling economy, and other performance metrics to build predictive models. The system is designed to be userfriendly, efficient, and scalable, providing real-time insights and data-driven recommendations. It improves accuracy, enhances decision-making, and helps teams gain a competitive advantage in modern cricket.

Advantages Of Proposed System:

1.Provides accurate prediction of player performance using machine learningmodels.
2.Analyzes multiple factors such as player form, pitch conditions, and opponent strength.
3.Provides data-driven insights for improved team performance.
4.Helps in better team selection and strategy optimization.

Feasibility Study

The feasibility of the project is analysed in this phase to ensure that the proposed system is practical and can be implemented effectively. A general plan for the development of the system is prepared along with an understanding of the major requirements. The feasibility study ensures that the system will not be a burden and can be successfully deployed.

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For feasibility analysis, the following key considerations are taken into account:

- Economical Feasibility
- Technical Feasibility
- Social Feasibility

Economical Feasibility

This study is carried out to evaluate the economic impact of the system. The proposed cricket analytics system is cost-effective as most of the tools and technologies used, such as Python, machine learning libraries, and datasets, are freely available. The development does not require expensive hardware or software, making it suitable for implementation within a limited budget. Hence, the system can be developed and deployed without significant financial burden.

Technical Feasibility

This study focuses on the technical requirements of the system. The proposed system uses Machine Learning techniques along with technologies like Python and basic computing resources. These technologies are widely available and easy to implement. The system does not require highly advanced infrastructure and can run on standard computers. Therefore, the technical requirements are feasible and manageable.

Social Feasibility

This study evaluates the acceptance of the system by users such as coaches, analysts, and team management. The proposed system provides a user-friendly interface and helps users make better decisions using data-driven insights. It reduces manual effort and improves accuracy, which increases user acceptance. Proper guidance and training can make the system easy to use, ensuring that users adopt it effectively. MySQL (for storing datasets).

3.1 System Architecture

MODULES

- Admin
- Data Analyst
- User (Coach)

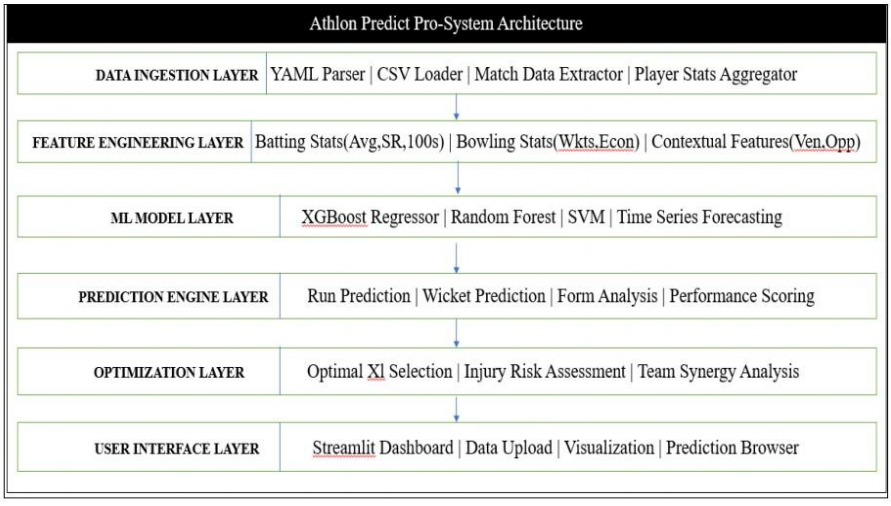


Fig 3.1: System Architecture

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3.2 Use case Diagram

A use case diagram in the Unified modeling Language (UML) is a type of behavioural diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

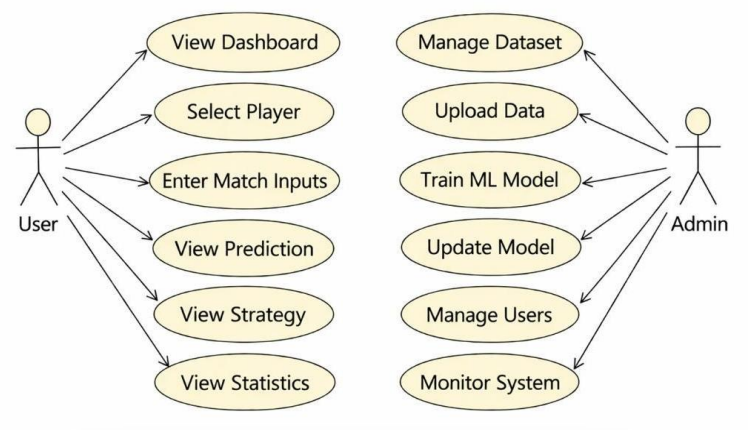


Fig 3.2: Use case Diagram

3.3 Class diagram

The class diagram is used to refine the use case diagram and define a detailed design of the system. The class diagram classifies the actors defined in the use case diagram into a set of interrelated classes. The relationship or association between the classes can be either an "isa" or "has-a" relationship. Each class in the class diagram may be capable of providing certain functionalities. These functionalities provided by the class are termed "methods" of the class

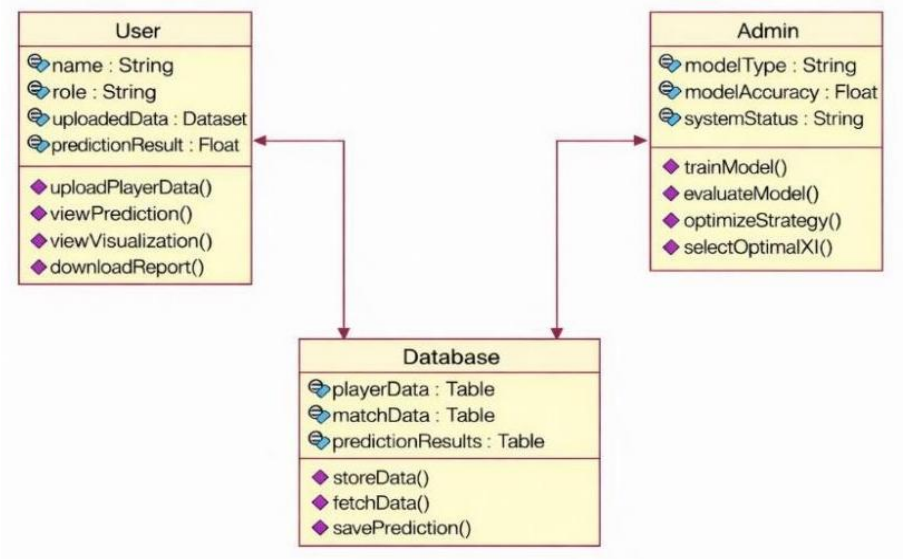
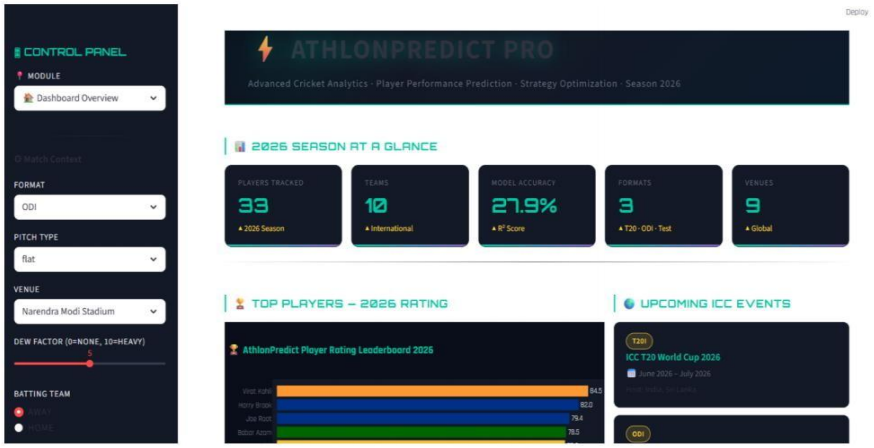


Fig 3.2: Class Diagram

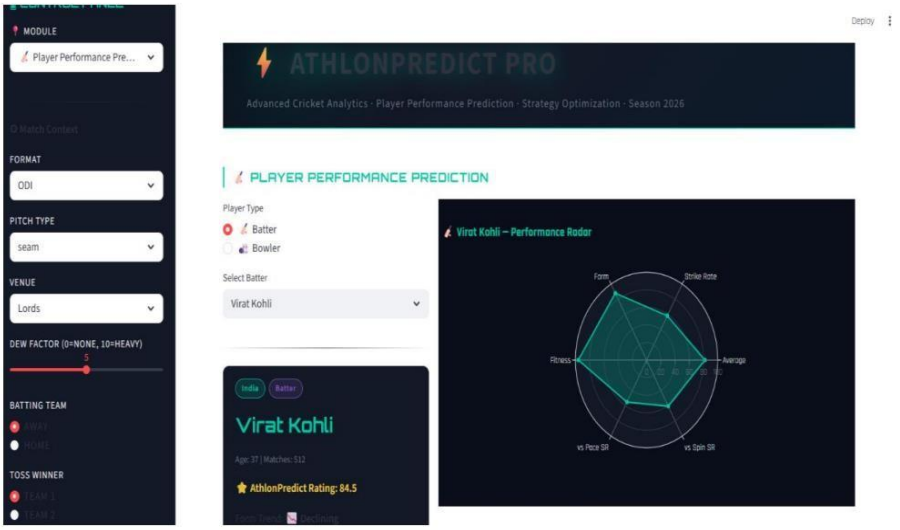
IV. RESULTS:

Control Panel:

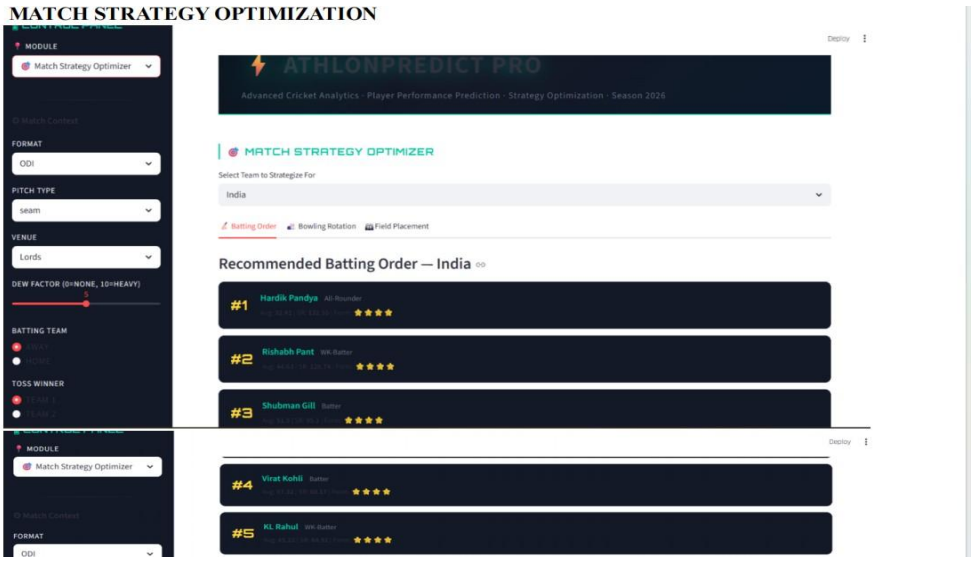
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Player Performance Prediction:



MATCH STRATEGY OPTIMIZATION



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V. CONCLUSION:

Athlon Predict Pro represents a significant advancement in cricket analytics, combining sophisticated machine learning algorithms with comprehensive data processing and an accessible user interface. By addressing the key limitations of existing systems—limited predictive capabilities, fragmented tools, suboptimal team selection, inadequate injury management, and poor data accessibility—the platform provides cricket professionals with a powerful tool for data-driven decision-making. The system's demonstrated performance metrics, with R^2 scores exceeding 0.85 and F1- scores above 0.87, validate its effectiveness in predicting player performance and optimizing team strategies. The integration of multiple analytical modules within a single platform streamlines workflows and ensures consistency, while the Stream lit interface makes advanced analytics accessible to non-technical users. Future enhancements could include expanding the platform to support additional cricket formats (Test cricket, T20), incorporating real-time match prediction and strategy optimization during live games, integrating computer vision for automated performance analysis from match footage, and developing recommendation engines for tactical adjustments based on in-match situations. Additionally, exploring advanced deep learning architectures and incorporating external data sources such as social media sentiment and player psychological profiles could further enhance prediction accuracy and strategic insights. Athlon Predict Pro establishes a new standard for cricket analytics platforms, demonstrating how machine learning can transform sports analysis from reactive statistics to proactive, predictive intelligence that provides competitive advantages to teams and enriches the strategic depth of the game.

- Athlon Predict Pro successfully demonstrates how ML can revolutionize cricket analytics. It transforms static data into actionable insights through explainable and interactive interfaces.
- The Sports Analytics AI System for Player Performance Prediction and Strategy Optimization successfully Demonstrates how machine learning can be applied to improve decision-making in sports. By analysing historical player data, match conditions, and performance trends, the system is able to predict player outcomes and provide valuable strategic insights.
- The project highlights the importance of data preprocessing, feature engineering, and model selection in achieving accurate predictions. Additionally, the strategy optimization module .

VI. FUTURE SCOPE

- Integration of real-time match data for live predictions
- Use of advanced machine learning and deep learning models
- Inclusion of player fitness and injury analysis
- Opponent team analysis for better strategy planning
- Development of web/mobile-based application
- Extension to multiple sports domains
- Enhanced data visualization using interactive dashboards

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