

Statistic analysis of IPL match score and winner inning wise using machine learning algorithms

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Abstract

This study explains the statistical analysis of cricket match score prediction using machine learning. According to recent changes in data science and sports, the use of sports-based machine learning and data mining shows the importance of process in outcome performance and prediction. The scope of this research paper is to evaluate current measurements used in the previous work to understand the estimation the ways used to model and analyze data and characterize the variables that govern performance using statistical methods. Actually, this research article will present a reliable statistical tool for data analysis using machine learning algorithms.

At present, sports organizations produce enough statistical information on every player, team, match, and season for particular related sports. The first sports researchers were thought to be experts, coaches, team managers, and analysts. Sports organizations want to do statistical analysis of player from their previous data stored on their database using different data mining and machine learning algorithms. Sports data helps coaches and managers in many ways, such as predicting results, analyzing player performance, and skills, and evaluating strategies. Forecasts help managers and organizations make decisions to win teams and competitions. The current evaluation of research shows that primary studies of data mining systems can predict outcomes and evaluate the strengths and weaknesses of each system. Statistical analyses are made for each match for result predictions. Although in many respects this application is very limited. These are prime factors which important to examine machine learning algorithms in these situations to see if the application can give the nearest results in analysis.

This research aims to give solutions that will help to make predictions more accurate and precise than previous methods, using more accurate data and machine learning.

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Keywords: IPL score prediction, Machine learning, Data analysis, Predictive modeling, Cricket analytics.

1. Introduction

In computer science technology, a subclass of artificial intelligence which is ML provides service using statistical methods to let machines “learn” from training data without being outside specified.

Simultaneous advances in computer technology, big data, and theoretical understanding, The 21st century saw the development of machine learning techniques, and machine learning concepts are now fundamental to computer science, software, and the technology sector. They aid in the resolution of several complex problems in engineering and research investigations. The primary goals of are to ascertain the significance of influencing the match outcomes and to choose the optimal machine learning model based on data fit and performance. A few projects pertaining to cricket match prediction have been released. The accuracy is

lower because only a few crucial factors are used. Nevertheless, the machine learning model was incorrect in other investigations. As a result, the optimal model for training and data analysis must be taken into account, along with all the significant aspects that could impact the match's outcome.

This will increase the results' accuracy. Over the years, supervised machine learning has been used in numerous finished and published research articles to predict cricket match outcomes. Different algorithms from supervised and unsupervised learning play important role in finding solutions for regression problems. Cricket is a sport played worldwide and there is a lot of fans following of IPL because overseas player also played IPL. As fans watching the IPL, When people watch a match, they make their own predictions based on the data they have, utilizing different statistics and records to predict who will win. There is a huge demand for algorithms that predict the best score and winning team. For all IPL matches, predictions will be made. Machine learning algorithms are used to predict the results of matches using machine learning algorithms.

Our paper is planned as in section 2, we define related research to our objectives. Section 3 discusses a general methodology used for implementation. Section 4 provides information about the Machine Learning algorithms used to finding results. Finally, in section 5 we draw results and conclusions.

2. Literature Survey

The Indian Premier League (IPL) is a well-known professional Twenty20 cricket competition in India. Predicting the scores of IPL matches can be difficult due to their intricate nature. Numerous machine learning methods have been used to forecast the outcomes and point totals of IPL games. A study of the literature has been done to give a general overview of the methods and research that have been done so far for IPL score prediction using machine learning.

According to Witten IH et al. (2006),[1], data mining has become a crucial field of research as computing applications in healthcare and biomedicine progress. The understanding of various data and decision support tasks in bio-signal processing, such as the identification, visualization, and classification of complex relationships between patient groups or diagnostic variables, has also been greatly aided by data mining approaches, techniques, and applications..

Sharma, A., & Saini, R. (2018). [2] presented an approach for IPL score prediction using multiple machine learning model such as decision trees, random forests, and support vector machines (SVM) with good accuracy. The authors compared the accuracy and F1 score of these algorithms and evaluate their accuracy in predicting the scores of IPL matches.

In order to forecast IPL scores, Kulkarni, P., & Gokhale, A. (2019) [3] introduced an ensemble learning approach that integrates many machine learning methods. The authors test a number of classifiers, such as logistic regression, SVM, and k-nearest neighbors (KNN).

Awan M.J. et. Al. (2021),[4] author explains the need for big data analytics is growing, as are the opportunities to use this data effectively in many beneficial ways. Researcher implement the regression model with Big data and without Big data. For measuring accuracy in the results author used the RMSE, MSE and MAE approaches and get the 95%,30.2,1350.34and 28.2 respectively.

Famandes et. al. (2021),[5] Researchers aim is to examine how effective teams coordinate their defenders' tactical and technical actions to recover the ball in light of various contextual factors. In 32 games of the 2014 FIFA World Cup playoffs, a total of 15,368 (480 ± 113) events and 49 to 12,398 distinct patterns were found and examined.

Garcia-Aliaga et al. (2021)[6] aim to use machine learning methods to forecast the on-field locations of a group of football players built on their planned-technical behavior. Some nontemporal signifiers, including the build-up, distrustful, and offensive traits, were computed to characterize each player based on OPTA's on-ball event data of the games for eighteen national leagues between the 2k12 and 2k19 seasons.

The author Polepaka et al. (2023)[7] forecasts cricket scores using machine learning techniques; the recovered data set used for the prediction is openly accessible. Model selection is used to compare and choose different regression techniques; feature engineering is used to collect and manipulate relevant input data; and performance evaluation is used to assess the accuracy and robustness of the models. The findings show that machine learning methods can accurately forecast cricket scores.

The research given by Singh, H., and Grover, A. (2020) [8] focuses on the application of random forest regression and long short-term memory (LSTM) together for IPL score prediction.. The authors propose a hybrid model that leverages the sequence modeling capabilities of LSTM and the ensemble learning approach of random forests. The suggested model's performance is assessed and contrasted with alternative methods.

Jaiswal, A., & Singh, S. (2021). [9] explores the application of the XGBoost algorithm, a gradient boosting technique, for IPL score prediction. The authors describe the feature selection process and evaluate the performance of the XGBoost model.

Convolutional neural networks (CNNs), a type of deep learning technique, are used to predict IPL scores in Gupta, M., & Khandelwal, M. (2021). [10]. They assess the model's functionality and talk about how well it can predict scores.

Researchers' interest in IPL score prediction through machine learning techniques has grown significantly. The literature review presents a range of methods for predicting IPL scores, such as deep learning algorithms, XG Boost, LSTM, and ensemble learning.

Indika Wickramasinghe et. al.(2022),[14] The author considers the two decades of data for explaining the application as well as the research area of ML in cricket. chi-Square, feature selection based on the correlation, and GBF selection are used for data reduction and feature extraction techniques.

Stefan M. Stefanov et. Al.[2021] [23], studied the nonlinear algebraic equations with even power. Two types of problem related with the system has been discussed with the solutions. First is nondifferentiable unconstrained minimization problem and the differentiable unconstrained minimization problem also called least squares problem. Subgradient approach is utilized for solving the unconstrained minimization problem and iterative gradient method for solving the differentiable problem.

Table 1
Application of ML techniques to analyses the cricket data [20]

S. No.	ML techniques	Application
1	Support Vector Machine	Gesture modelling, Action modelling, Result prediction, Performance classification
2.	Random forest	Winner prediction, All -rounder classification
3.	Navey Bayes	Winner prediction, Performance of batting and bowling, Behaviour of pitch
4.	Regression	Score prediction, Influential factor of match
5.	Decision tree	Influential factor of match, Winner prediction
6.	KNN	Classification of player-performance
7.	XGBoot	Workload prediction of bowlers

Using a mathematical machine learning model, Md. Ashraful Babu et al.[2022] [24] predicted the COVID outbreak for the foreseeable future. In this model they developed the SEIRD based model and tested this model's accuracy by fitting the result with respect to the data from 8th march 2020 to 14th oct 2021. Researcher also test the model with real datasets of outbreaks. Table 1 includes the ML techniques with respect to their application in cricket.

3. Methodologies

Data Collection and Exploration: The core component and initial phase of the project is data collection. The primary goal is to gather relevant datasets that meet our demands and The initial stage of data analysis is called data exploration, during which data is examined and visualized to find patterns or regions that require more investigation or to reveal insights from the outset. Without making any presumptions about the input data, data examination aims to determine the properties and possible issues of a data set. Match.csv, deliveries.csv, and ipl.csv are the data sets we take from Kaggle[19].

Data pre-processing: Data pre-processing plays a critical role in machine learning, providing highly accurate and discerning outputs that we may use to inform our model. Many of the data in a data collection are not useful to us, therefore we preprocess the data and organize it into a format that best suits our needs. The higher the data quality, the more dependable the generated outcomes are. Datasets from the real world are often noisy, inconsistent, and incomplete. By correcting discrepancies, lowering noise, and filling in missing or incomplete data, data pre-processing enhances the quality of the data.

Data cleaning: The act of eliminating errors from data and replacing them with accurate values is known as data cleaning. Because the gathered data sets include noisy data, such as null values and erroneous values, they must be cleaned. The data is cleaned by adding zeros to any null values and organizing the information into the correct columns so that it may be analyzed efficiently.

Data visualization: The information is visualized using the collected data to aid with comprehension. The graphs showing team wins in different cities according to their venues and player strike rate were created using Matplotlib and the Seaborn Library.

Splitting into train and test : By feeding the train data to the model and having it predict the data on test data and fresh data, the train test

split technique divides a dataset into two sections that are used to measure the performance of a machine learning model. A train test is the way of structuring your machine learning project so that you can test your hypothesis quickly and inexpensively. Basically, it's a way to divide the training data so that you can try your algorithm to one half and evaluate the result on the other half. When you divide your data into a testing set and a training set, this is known as a train-test split. The training set is used for training the model, while the testing set is utilized to test your model. This enables us to test the correctness of our models on the testing set that is hidden after training them on the training data set. While there are a few variations on how to execute a train test split, splitting your data into two sets is the most popular method. 80% for instruction and 20% for testing, for instance [18,25-27].

4. Algorithm Used

Linear Regression: A dependent variable and one or more independent variables can have a linear connection established using the statistical modeling technique known as linear regression. It seeks to minimize the discrepancy between the expected and actual values by fitting a straight line to the data points. The following equation represents a linear regression model in its generic form:

$A = a_0 + a_1x_1 + a_2x_2 + \dots + a_nx_n$ where: A is taken as the target variable. a_0 is the intercept, $a_1, a_2, \dots, a_n$ are the slopes associated with the independent variables $x_1, x_2, \dots, x_n$. To generate predictions, it seeks to build a linear relationship between independent variables (analysts) and a dependent variable (goal). By analyzing historical data and training a linear regression model, one can make predictions about the scores of future IPL matches, providing valuable insights for teams, analysts, and cricket enthusiasts.[10].

Logistic Regression: One of the most beneficial machine learning algorithms is logistic regression, which is based on a statistical modeling method that investigates the relationship between one or more independent factors and predicts the dependent data variable. It is often used for binary classification problems like as yes or no, 0 or 1, True or False, while it is not typically used directly for forecasting scores in IPL matches, it can be applied for estimating the possibility of a team winning or losing a match depending on numerous parameters. In this case, the likelihood of a team winning an IPL match can be calculated using logistic regression. A

match's probability of winning can be inferred by logistic regression using past data and pertinent characteristics.[11].

Lasso Regression: Lasso Regression, a linear regression method that sometimes goes by the name L1 regularization, uses a penalty term to reduce the coefficients of less significant features to zero in order to promote sparse solutions.. While Lasso Regression is not commonly used for direct IPL score prediction, it can be applied to select important features that influence the score and improve the model's performance. Lasso Regression helps in feature selection by highlighting the most influential features in predicting the IPL scores. By reducing the coefficients of less important features to zero, it provides a sparse solution and simplifies the model.[12]. **Ridge Regression:** Ridge Regression is a method of linear regression that incorporates L2 regularization as a regularization term.. It is commonly used for predicting IPL scores by minimizing the sum of squared errors while also shrinking the regression coefficients. Ridge Regression is a useful technique for IPL score prediction by incorporating regularization to prevent overfitting and shrink the coefficients.[13]

MODEL: Predicting sports scores, such as IPL cricket match scores, using machine learning models can be an interesting and challenging task. The process of developing a machine-learning model for IPL sports score prediction is outlined below in general. **Model Selection:** Select a suitable machine learning method for predicting sports scores. Algorithms like regression models, such as logistic regression, lasso regression, ridge regression, random forest regression, and linear regression, can be taken into consideration depending on the nature of the issue and the properties of the data [15]. **Model Evaluation:** Utilizing the validation set, assess the trained model. Use assessment measures like mean squared error (MSE), root mean square error (RMSE), mean absolute error (MAE), or other pertinent metrics unique to sports prediction to gauge its effectiveness [16]. In Table 2 the value of assessment measures like mean squared error (MSE), root mean square error (RMSE), mean absolute error (MAE),

Table 2
Model Evaluation for IPL FIRST INNINGS SCORE PREDICTION

Model	MSE	RMSE	MAE	Accuracy
Linear Regression	257.5	16.04	12.31	72.16
Ridge Regression	257.11	16.03	12.29	72.2
Lasso Regression	263.73	16.24	12.34	71.49

accuracy are calculated by Linear , ridge and lasso regression for sports prediction to gauge its effectiveness [14]. Assess how well the model predicts the sports scores compared to the actual scores.

In Table 3 Logistic Regression is used to predict winning scores of 2nd inning.

Table 3
Model Evaluation for 2nd INNINGS WIN PREDICTION

Model	Accuracy
Logistic Regression	83.1

Final Model Evaluation: Once the model is optimized, evaluate its performance using the testing set, which represents unseen data. Calculate the performance metrics to assess the model’s predictive ability and determine its effectiveness in predicting sports.

Deployment and Prediction: Use the finished model to forecast fresh, never-before-seen sports match data. Provide the relevant features for each match as input to the model, and it will predict the scores based on the learned patterns and relationships from the training process. Figure 1 shows the steps of models, which we already covered in the paragraph.

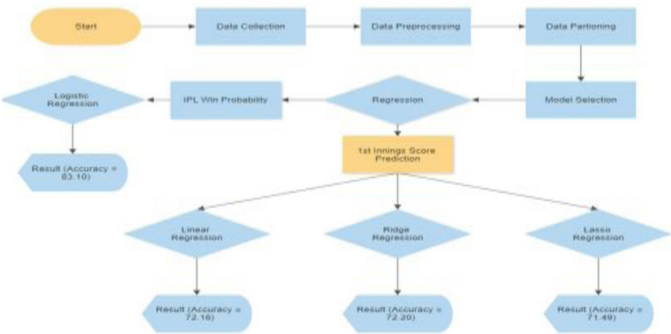


Figure 1
Flow Chart of the Model

5. Results and Conclusion

In our model, there are two types of prediction, the first one is “IPL FIRST INNINGS SCORE PREDICTION” and the second one is the winning probability of the team who is chasing “IPL WIN PREDICTION”. After selecting the “IPL FIRST INNINGS SCORE PREDICTION”, There is a

page where user have to give the inputs like “Select the batting team”, “Select the bowling team”, “Overs Completed”, “Runs”, “Wicket Out”, “Run Scored in previous 5 overs”, “Wicket Taken in previous 5 overs” to predict the winner of match after clicking on “Predict Probability”.

Figure 2 shows the front end of the score prediction field and when the user enters the values into the given fields the machine learning model predicts the score and displays it.

The screenshot shows a web application titled "IPL FIRST INNINGS SCORE PREDICTION". On the left is a sidebar menu with "Homepage" and "IPL WINNER PREDICTION". The main content area has a title "IPL FIRST INNINGS SCORE PREDICTION" and a subtitle "IPL WINNER PREDICTION". Below the title are two dropdown menus: "Select the batting team" (set to "Royal Challengers Bangalore") and "Select the bowling team" (set to "Chennai Super Kings"). There are four input fields with increment/decrement buttons: "Overs Completed" (8.00), "Runs" (110.00), "Wickets Out" (1.00), and "Run Scored in pre. 5 overs" (80.00). There are also two input fields for "Wicket Taken in pre. 5 overs" (0.00). A "predict probability" button is located below these fields. At the bottom, a row of team names is displayed: "bat_team_Chennai_Super_Kings", "bat_team_Delhi_Capitals", "bat_team_Gujarat_Titans", and "bat_team_Royal_Challengers_Bangalore". Below this row, the "Projected Score: [219.0735668]" is shown.

Figure 2
IPL FIRST INNINGS SCORE

Prediction

After choosing “IPL WIN PREDICTION,” the user is prompted to provide information on “Select the batting team,” “Select the bowling team,” “Select host city,” “Target,” “Score,” “Overs Completed” and “Wickets Out” to forecast the match’s winner. The user then clicks “Predict Probability.” To sum up, machine learning models have demonstrated potential in forecasting IPL scores and identifying the victorious team. These models can identify patterns and associations to generate well-informed forecasts by utilizing past match data together with pertinent characteristics like player performance, team composition, pitch conditions, and location. However, it is important to acknowledge that predicting IPL scores and determining the winning team is a challenging task due to the inherent uncertainties and complexities of cricket matches. Factors such as player form, injuries, team strategies, weather conditions, and other unforeseen events can have a significant impact on the outcome. Machine learning models provide a systematic approach to analyze and extract insights from the available data, but they have boundaries. The quality and applicability of the data, the selection of suitable features, and the model selection all have a significant impact on how accurate the

predictions are. Additionally, models need to be regularly updated and refined with new data to adapt to changing trends and dynamics in the sport. While machine learning can improve prediction accuracy to some extent, it is very vital to consider other factors such as expert knowledge, match analysis, and contextual information when making IPL score and win predictions. Combining machine learning models with human expertise can lead to more robust and accurate predictions. Overall, machine learning models serve as valuable tools in the domain of IPL score and win prediction, providing insights and aiding decision-making. Nevertheless, to take into consideration the intricate and erratic nature of matches, they must to be applied in concert with additional analytical techniques and professional judgment.

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