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Best Eleven Forecast for Bangladesh Cricket Team with Machine Learning Techniques

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***Abstract*—Cricket is one of the most well-known team sports in the world. Machine learning algorithms have a significant impact on sports analysis, and cricket is no exception. With the help of Machine learning algorithms, we may create new methodologies, predict the outcome of a game, measure the player's performance, and pick the squad for the next matches by anticipating the player's performance. As a result, predicting individual and team performance became an intriguing topic for researchers, and only a few works have been done on it, with a few downsides. This study attempts to anticipate the most suitable players for a particular game to be organized. To predict the perfect players for the match to be played, we suggest a machine learning approach. This study and project aimed to identify the squad of eleven players for the Bangladesh (ODI) cricket team. We forecast the squad for Bangladesh (ODI) cricket team using Support Vector Machine, Naive Bayes, and Random Forest machine learning algorithms. We obtained 94% accuracy for the batsman and 93% for the bowler.**

***Index Terms*—Machine learning, Prediction, Cricket, SVM, Naive Bayes, Random Forest**

I. Introduction

Even though football has long been popular in Bangladesh, cricket has grown in popularity among Bangladeshis since the Bangladesh cricket team successfully competed in test cricket. Regardless of the fact that Ha-Du-Du is Bangladesh's national sport, few people are interested in it; instead, they are more concerned about cricket and player selection for the Bangladesh cricket team. A fan of the Bangladesh cricket team, whether fifteen or seventy years old, keeps an eye on the player selection committee and forecasts who will play the following games first. In cricket, player selection is critical to a team's success. For a game, each team must choose their best athletes. Furthermore, in order to win a game, each team must consider its best athletes for the competition in the specified position for the opposing team. One player may be the best in the group, yet he may struggle against a specific country. A particular position may also have a weakness when it comes to playing in specific venues. In Bangladesh, only humans are used to pick players for a tournament. Every day, new players enter the league, and the selection committee is oblivious to a player's finest strength, weaknesses, and unique skills. Occasionally, the selection committee has difficulty grasping the method and is befuddled prior to the player selection. All of these factors influenced our decision to conduct this study.

Machine learning approaches allow computers to learn autonomously based on previous observations, experiences and evaluating patterns within a data collection. Naive Bayes, Support Vector Machines, Random Forest, linear regression, and K nearest neighbors are examples of machine learning approaches that can predict how many runs a batter will score and how many runs a bowler will give, as well as pick the best eleven players in a squad. Based on historical data, we developed a method to train and forecast the roster of eleven players for Bangladesh's one-day international cricket squad. The study's goal was to create a system for selecting a team's most influential players. It analyzes a player's strengths and weaknesses and will help them enhance their performance and chances of winning a game. Assists the BCB selection committee in identifying the most prominent players linked with the best team. The provided technology analyzes historical data from the Bangladesh one-day international cricket squad, and displays desired outcomes.

The goals achieved from this research are given below:

- Forecast most effective players for the cricket team.
- Measures a player's strength or weakness rank the players.
- To assist the selection committee for selecting players.
- Boost winning chance of a team for a game.

II. Literature Review

In recent years technology has been involved in various aspect of modern life.Everyone is trying to build a secured and online base system like E-voting [1], [2], supply chain management [3] robotics [4], vehicle registration [5], national identity card management [6], sentiment analysis [7], and so more with the help of blockchain, machine learning and AI. Authors [8] and [9] use neural networks to predict the performance of an individual in the selection of cricket teams. They developed neural networks and fuzzy systems for player selection. Two MLPs, one linear neural network, and two RBF networks are selected for ranking by statistical intelligent miner mode and have maximum 86% accuracy in the selection of batman and maximum 80% accuracy in the selection of blower. Neeraj et al. [10] forecast the result of one-day cricket of a team by building up a tool called COP (Cricket Outcome Predictor),

which gives yields the success/misfortune likelihood of a one-day cricket match. They employed Naive Bayesian, Random Forest and Support Vector Machine, for foreseeing the result and got a mean 60% accuracy. M.M Rahman et al. [11] examine Bangladesh one day (ODI) cricket information utilizing AI and showed the significance of specific highlights, and found the anticipated result. They gathered seventeen highlights and examined those highlights with Naive Bayes, KNN, Random Forest, SVM, choice tree calculations and predict the outcome and utilizing the most recent adaptation of the choice tree calculation that is C5.0 which shows the precision of 63.63% before beginning the game, 72.72% for first innings 81.81% for second innings. In another article [12] authors applied some machine learning algorithms to build player's ratings and foresee the batmen's and bowlers' exhibitions independently in one day international(ODI) cricket. They obtained 90.74% precision for the run prediction and 92.25% for foreseeing wickets taken prediction with the Random Forest algorithm. It gave the most accurate accuracy of 51.45% for runs prediction and 68.78% for wickets taken prediction.

M.J Hossain et al. [13] used a genetic algorithm to predict the Bangladesh cricket squad by analyzed the previous two years' performance of 30 Bangladeshi players and selected the final 14 players for the team, which is almost comparable to the (ODI) squad of Bangladesh cricket team. SVM model with linear and nonlinear poly and RBF kernels was studied by Sandesh Bananki et al. [14] there are 75% accuracy, 83.5% precision and a 62.5% recall. Amal Kaluarachchi et al. [15] used three artificial intelligence methods as association rule mining, clustering, and classification to foreseen the possibilities of victory by examining distinctive features with Decision Tree, Naive Bayes, Ada Boost, and Bagging algorithms and developed a tool called CricAI and made the most effective result with Naive Bayes. To predicate the squad author of [16] and [17] and [18] examine unique machine classifiers algorithms like Weighted Random Forest, Random Forest, Support Vector Machine, Naive Bayes and Decision Tree. Weighted Random Forest, Logistic Regression divine the most remarkable precision of the rate that is 93.73% and 71% and 76% . Mr. AltonBodly et al [19] analyzes different machine classifiers like Rpart, J48 , Random Forest. They used data mining for team selection and used genetic algorithm for player selection. Here Rpart model predicts highest accuracy of percentage that is 80% for selecting team. J48 model accuracy percentage is 40% and Random Forest model accuracy percentage is 65%. Haseeb Ahmad et al. [20] used precedence, productivity and ranking for quantifying team of cricket game . Productivity precedence's algorithm is actually a change from the worldly pager dank algorithm. Productivity yield three distinct precedence's and that is batting, bowling and team. To analysis the attributes of the player's, Rodrigues et al. [21] used Multiple Random Forest Regression. Using the past record of a player against a particular team, they provided a mathematical approach. Madjid Tavana et al. [22] proposed a two-phase framework to select a team that does not have higher accuracy, but this method helps the coaches to think systematically about complex multi-criteria decision-making problems and improves the quality of their decisions for player selection and team formation. Authors of [23] done a survey about predicting player's performance and team recommendation in cricket game. Most of the researchers used and classification techniques and supervised learning algorithms such as Naive Bayesian, Support Vector Machine, and Random Forest, K nearest neighbors to predict player's performance and predict the final squad. Authors of [24], [25] analyzed different types of approaches to predict a match outcome and select cricket team. They used Generic Algorithm, historical Cricket data and Collective Knowledge Approach based on Batting, Bowling, Keeping, Fielding, Experience, Injuries, Constitution.

III. Data Set

In machine learning-based primarily project, data is crucial, and the collection of relevant information from a trustworthy source is exceptionally troublesome. To attain magnificent accuracy, we would like to investigate a large amount of data.

A. Data collection

Data has been collected from the Espncricinfo website [26]. We additionally gathered the information of this current year, including a year ago, by choosing highlights for a player choice, for example, matches played against an opponent, highest scores, strike rates, number of hundreds, number of 'fifties, the quantity of' sixes, amount of fours, the total number of runs scored by a player, average runs scored, ball faced by a player in the matches. Information like matches compete against opponents, and overs bowled, maidens won, the wicket was taken, economical rate, runs conceded, bowling avg, the bowling strike rate is collected for the bowler. At that point, in our data set, the data is handled. Fig 1 depicts the a part of the batsman dataset.

B. Data prepossessing

Prepossessing data is a vital and additionally sophisticated task. Once we collect information, we have analyzed so processed the info. We had to delete some noisy data. Then within the information set, some data is missing, we had to replace them with 0. There will be some options that we tend to did not to use. It created finishing this study more prosperous.

Player	Span	Mat	Inns	NO	Runs	HS	Ave	BF	SR	hundred	fifty
Abdur Razzak	2004-2014	153	97	39	779	53	13.43	1020	76.37	0	1
Abul Hasan	2012-2018	7	3	0	11	7	3.66	16	68.75	0	0
Abu Hider	2018-2018	2	1	0	1	1	1.00	11	9.09	0	0
Afif Hossain	2020-2020	1	1	0	7	7	7.00	4	175.00	0	0
Aftab Ahmed	2004-2010	85	85	6	1954	92	24.73	2353	83.04	0	14

Fig. 1. A part of the batsman dataset.

We labeled that data after separating noisy data (we will discuss it more in the methodology section). This is the

process of classifying and specified data that are a vital part of processing data. This segment labeled the data to perform it more valuable, instructive, and understandable for the computer. This method is completed using attributes and splitting the data into two sections: batsmen and others for bowlers of the Bangladesh ODI cricket team.

C. Dataset Understanding

Examining data may be a meaningful and additionally challenging job. We've studied and investigated data by visualizing the complete data set in several methods in which some vital pictures are provided here.

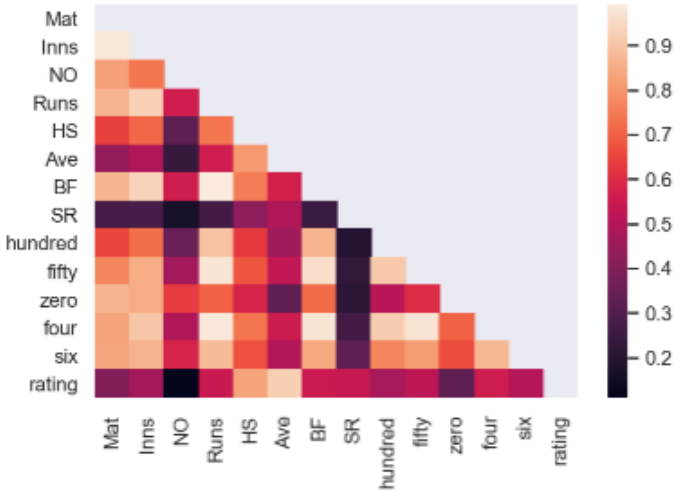

Fig. 2. Correlation map of batsman dataset.

Each square of figure 2 shows the correlation between the variables on every axis. Correlation ranges from -1 to +1. Values nearer to zero suggests that there's no linear relation between the two variables. The on the point value 1 indicate that there are strong relationship between them. A correlation nearer to -1 is comparable, however rather than each increasing one variable can decrease because the alternative will increase.The color theme and worth given right facet of the figure. The square's color lighter is indicating higher the correlation between the two variables and therefore the darker color is indicating lower the correlation between the two variables.

We used scatter plot to show relationships between rating and runs because a scatter plots are used to observe relationships between variables. So we can see from figure 3 how rating and runs relevant to res 0 and 1. The significance of this figure is to see how runs effect on rating calculation.

IV. Methodology

In this part, we unveil our way of dealing with the issue in detail and the definitions. Therefore, the mechanics of various algorithms accustomed model the batsmen, bowlers, and the Bangladesh one-day cricket team. We assembled our verifiable past data of batsmen and bowlers. Our initial challenge was

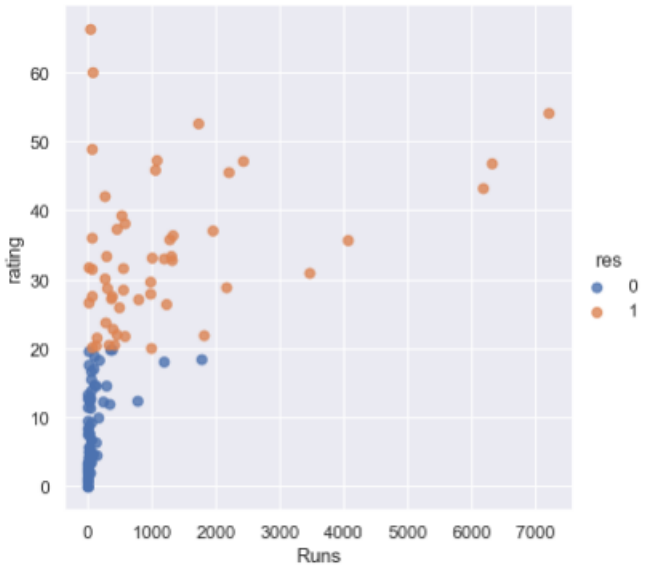

Fig. 3. Scatter plot of rating and runs of batsman dataset

refining data (examined in the data prepossessing segment) from the collected, recorded data and marking the information in the useful of the data. In the useful of preparing data, we chose highlights and calculations to construct a model for preparing. After training the model, we evaluated the model and anticipated the squad of Bangladesh one day cricket team. Graph of the work process given below in 4 and 5.

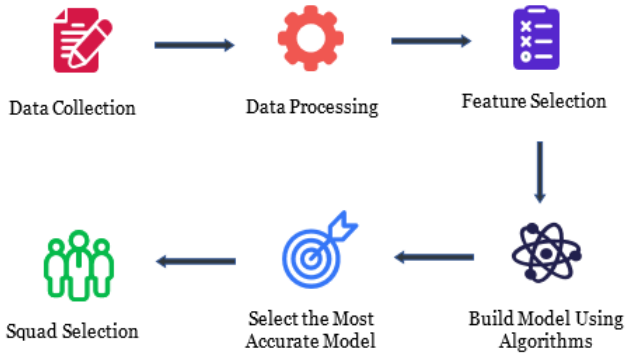

Fig. 4. Flow of work for predicting squad Bangladesh one day cricket team

A. Feature selection for batsman

- "Mat"- Matches played against opponent.
- "HS"- Highest score of a batsman
- "SR"- Strike rate of a batsman.
- "Hundreds"- Number of Hundreds of a batsman
- "Fifty" - Number of Fifties of a batsman
- "Six"- Number of Sixes of a batsman
- "Four" - Number of Fours of a batsman
- "Runs"- Number of runs scored by a batsman
- "Ave"- Average runs scored by a batsman
- "Inns"- Number of innings played a batsman

- "BF"- Total ball faced a batsman

After the features selection of batsman, we calculate a rating based on some features that can help to determine player's batting performance and also considered International Cricket Council's batsman rating criteria. Rating calculation equations are given below.

$$FSI = \frac{(4 * Four) + (6 * Six)}{Inns} \quad (1)$$

$$HFI = \frac{Hundred + Fifty}{Inns} \quad (2)$$

$$TRI = \frac{TotalRuns}{TotalInns} \quad (3)$$

$$TRBF = \frac{TotalRuns}{TotalBallFaced} \quad (4)$$

$$BR(BatsmanRating) = TRI + TRBF + HFI + FSI \quad (5)$$

B. Feature selection for bowler

- "Mat"- Matches played against opponent.
- "Overs"- Overs bowled a bowler
- "Maidens" - Maidens earned by a bowler
- "Wicket"- Wicket taken by a bowler
- "Economy" - Economy rate of a bowler
- "Runs"- Runs given by a bowler
- "Ave"- Bowling average of a bowler
- "Inns"- Number of innings played a bowler
- "SR"- Bowling strike rate of a bowler.

After the features selection of bowlers, we calculate a rating based on some features that can help to determine player bowling performance and also considered International Cricket Council's bowler rating criteria. Rating calculation equations are given below.

$$TWI = \frac{WicketTaken}{TotalInnings} \quad (6)$$

$$WTR = \frac{WicketTaken}{RunsConcede} \quad (7)$$

$$RCO = \frac{RunsConceded}{Overs} \quad (8)$$

$$MDO = \frac{Maidenwon}{Overs} \quad (9)$$

$$BowlerRating = TWI + WTR + RCO + MDO \quad (10)$$

All the ratings are calculated based on overall profile. We did not consider recent performance of players. After producing a rating for every batsman and bowler, we identified every player as either '0' or '1'. '1' indicates that the athlete is fit to play, and '0' signifies the player isn't meet all requirements to play. We made three models with three machine learning algorithms: SVM,Naive Bayes, and Random Forest, and has trained the model with data. Standards principle of those models as if the rating of a player is equivalent or more prominent than twenty in the batsman dataset, the player is acknowledged ('1') able to play, and the rating is under twenty player is not suited ('0') to play. On the off chance that the rating is equivalent to or more noteworthy than thirty-five in the bowler dataset, the player is recognized ('1'), able to play, and the player's rating is under thirty-five players isn't passed ('0') to play. In preparing the model, we assessed the model, forecast the squad of eleven players for the Bangladesh ODI cricket team. We applied the tkinter package to fabricate the interface and showed the finalize players.

C. Proposed System Flow

The proposed system flow is given below.

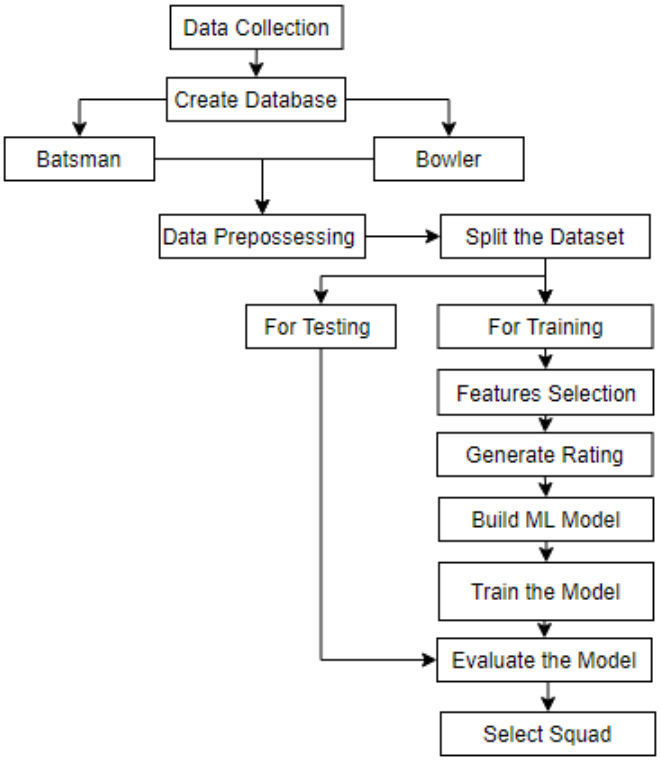

Fig. 5. Proposed system flow of predicting squad for Bangladesh one day cricket team

V. Results Analysis

We chose the best players for the playing squad in this part, dependent on their characteristics, utilizing machine learning algorithms, comparing their performances with one another, and picking the best algorithm among them. We applied three machine learning algorithms such as Naive Bayes Classifier, Support Vector Machine, Random Forest for the forecast of the Bangladesh one-day cricket team. We used Anaconda Environment and Jupyter Notebook interpreter to conduct this research. Models have been trained with the training datasets

and evaluated the model with the test data set. The percentage accuracy we got is given below.

	precision	recall	f1-score	support
0	0.96	0.96	0.96	26
1	0.92	0.92	0.92	13
accuracy			0.95	39
macro avg	0.94	0.94	0.94	39
weighted avg	0.95	0.95	0.95	39

Fig. 6. Precision & Recall of SVM for batsman dataset

Figure 6 Precision & Recall of SVM shows the accuracy of batsman dataset is 94% which is higher and good accuracy than the Naive Bayes algorithm.

	precision	recall	f1-score	support
0	0.86	1.00	0.92	12
1	1.00	0.88	0.94	17
accuracy			0.93	29
macro avg	0.93	0.94	0.93	29
weighted avg	0.94	0.93	0.93	29

Fig. 7. Precision & Recall of SVM for bowler dataset

In figure 7 Precision & Recall of Support Vector Machine algorithm shows the precision of bowler dataset is 93% which is higher and good accuracy than Naive Bayes algorithm.

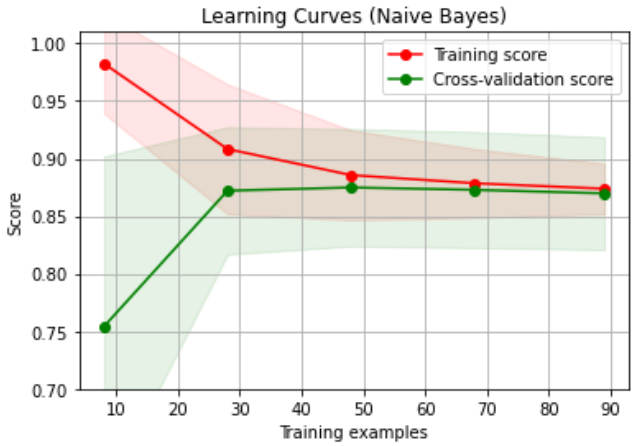

Fig. 8. Learning curve of Naive Bayes classifier for batsman dataset

Figure 8 showed the learning curve of Naive Bayes algorithms and we can see it gave the training accuracy of the batsman data set is 87% and validation accuracy almost the same as training accuracy.

Figure 9 showed the learning curve of Naive Bayes algorithms showed the training accuracy of bowler dataset is 76% and validation accuracy is 74% accuracy, which is lower much than batsman dataset's accuracy.

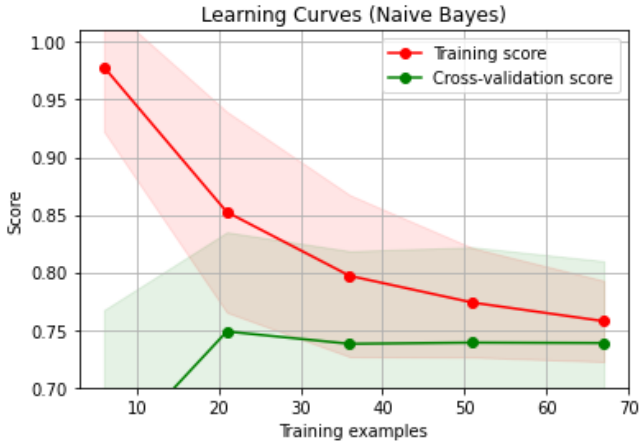

Fig. 9. Learning curve of Naive Bayes classifier for bowler dataset

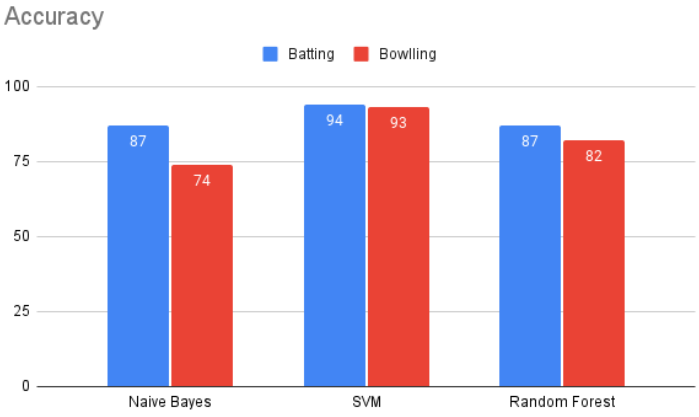

Fig. 10. Accuracy comparing between Naive Bayes, SVM and Random Forest

We can see from precision contrasting between Naive Bayes, SVM and Random Forest diagram from figure 10 we got 87% percent for batsman dataset and 74% for a bowler dataset with Naive Bayes, 94% for the batsman dataset and 93% percent for bowler dataset with Support Vector Machine, 87% precision for the batsman dataset and 82% accuracy for a bowler dataset with Random Forest. We obtained the most remarkable accuracy with Support Vector Machine for batsman dataset and bowler. For batsman and bowler, we received the most lower accuracy with Naive Bayes. Therefore we are able to say that SVM is that the best algorithm for this dataset.

In the figure 11 showed us the final squad of 11 players. There are 6 batsman including all rounder, 4 fast bowler and 1 spin bowler. Final squad can be changed depended on how many batsman or bowler we want.

VI. Conclusion and Future Works

We have proposed a model for forecast of Bangladesh (ODI) cricket team for a cricket match. Here, we used three algorithms for machine learning. With Naive Bayes, we got 87% accuracy, 94% precision with SVM, 87% accuracy with Random Forest for batsman data collection. We got 74%

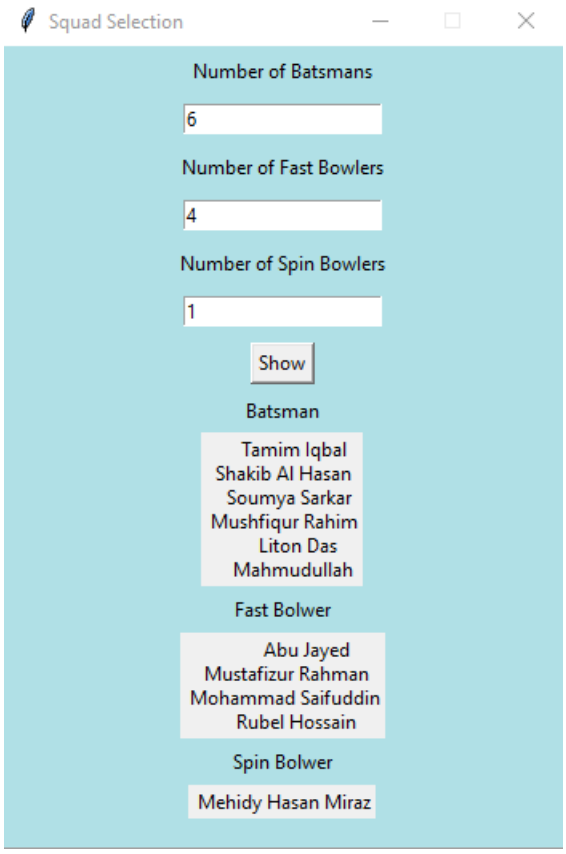

Fig. 11. Final squad of Bangladesh one day cricket team

precision with Naive Bayes in the bowler dataset, 93% precision with SVM, 82% precision with Random Forest. We just worked on the Bangladesh team, but with their huge data collection, there are still more foreign teams. We will operate at a domestic level that will gradually increase the accuracy of the model because the more data set it gets, the more it will predict the machine.In addition, the home team may be facilitated by evaluating the winning team or the best batsman or the best bowler of the opposition. Therefore, in this field, there is sufficient scope to work with these methodologies.

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