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Shooting Score Prediction of Rifle using Linear Regression Model

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Abstract:The prediction of shooting score in rifle shooting is an important task for both athletes and coaches. In this research paper, we aim to predict shooting score using linear regression model. We have collected data of rifle shooters' shooting scores and various other factors affecting the score such as shooter's age, gender, experience, rifle weight, and distance ,wind spee.. We have used the collected data to train our linear regression model and evaluated its performance by testing it on a separate test dataset. The results show that our model is able to predict shooting score with high accuracyThe objective of this analysis is to develop a highly accurate linear regression model capable of predicting shooting scores based on various shooting and environmental factors. In order to achieve this goal, large dataset containing information about shooters, rifles, and shooting conditions for each shooting event is utilized. The model uses the OneHotEncoder function to encode categorical features, and preprocesses the data using the Column Transformer function. By using these techniques, the model can handle categorical data, which is common in this type of dataset.

Keywords- Shooting Score, linear Regression, accuracy.

I. INTRODUCTION

Shooting is a sport that has been enjoyed by many individuals for centuries. In recent years, the popularity of shooting sports has increased significantly, with more people participating in competitions and events. As with any sport, the goal of a shooter is to improve their skills and achieve higher scores. The development of accurate and reliable models that can predict shooting scores can be beneficial for both shooters and event organizers. Shooters can use such models to identify areas of improvement and develop personalized training plans, while event organizers can use them to evaluate shooter performance and enhance the overall experience of the event [1].

Fig1:Source: Times of India

Linear regression models are commonly used to predetermine rifle shooting scores, as they are to examine the co relations between multiple variables and provide a single, quantitative output. The major aim of this model is to use linear regression so that the score predicted are accurate and are based on the different parameters chosen. To examine the correlations between two or more variables we have used linear regression. In this method, a linear correlation is established between the reliant variable and one or more un reliant variable, and a crease is fitted to data that best explains the correlation. This crease can used to predetermine the values of the reliant and variable based on the value of the un reliant data.
Linear regression can be written by using this equation:
$y = \beta 0 + \beta 1x1 + \varepsilon$

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Here, y is reliant variable (target variable) we are trying to predict .X1is the unreliable variable (feature) that is used to predict the value of y.β0 and β1 are the coefficients of the model. B0 represents the intercept or the value of y when x1 is zero, while β1represents the swap in y for one-part change in x1. e is the error. It displays the change in y which cannot be shown by the unreliable variable.

Rifle shooting is a precision sport that requires skill, focus, and practice. The ability to accurately predict a shooter's shooting score is important for coaches and athletes to improve their performance. In this research paper, we aim to predict shooting score using linear regression model.

The dataset used in this prediction contains information about shooters, rifles, and shooting conditions for each shooting event. The dataset is preprocessed using the Column Transformer function to encode categorical features and normalize numerical data. The OneHotEncoder function is used to transform categorical data into numerical data, which can be more easily interpreted by the linear regression model.The trained model is able to predetermine shooting scores for new data, making it a valuable tool for both shooters and event organizers. Shooters can use the model to analyze their performance and identify areas for improvement, while event organizers can use the model to evaluate shooter performance and enhance the overall experience of the event.[3,4]

II LITERATURE SURVEY

Several studies have been conducted to predict rifle shooting score using different machine learning algorithms. Ramkumar et al. (2019) used a decision tree regression model to predict shooting score in rifle shooting. They collected data on the shooting performance of 50 rifle shooters and used it to train their model. Their results showed that the decision tree regression model was able to predict the shooting score with high accuracy.

Kodali et al. (2020) used a random forest regression model to predict shooting score in rifle shooting. They collected data on the shooting performance of 40 rifle shooters and used it to train their model. Their results showed that the random forest regression model was able to predetermine the shooting score with high accuracy.

In recent years, the use of machine learning models for predictive analytics has become increasingly popular across various industries. The ability to analyse large datasets and make accurate predictions based on patterns and trends in the data has proven to be a valuable tool in many fields.One such field that has seen the benefits of predictive analytics is shooting sports. The use of data analysis in shooting sports can help coaches and athletes improve their performance by identifying areas of weakness and providing insights on how to improve.

A study by Burkowski et al. (2018) focused on predicting shooting scores in biathlon events using a support vector regression model. The model was trained on data from previous events and was able to accurately predict scores for new data.

Schinke et al. (2020) utilized machine learning models to analyze shooting performance in Olympic pistol events. The study used data from previous competitions and found that a combination of shooting technique and psychological factors had the greatest impact on performance.

Bortoli et al. (2019) analyzed shooting performance in skeet shooting events and found that psychological factors such as focus and self-confidence were important predictors of performance.

The use of machine learning models in shooting sports has shown promising results in predicting performance and identifying areas for improvement. These studies demonstrate the potential for using data analysis in sports to enhance performance and achieve better results.

However, there is still much to be explored in the field of shooting sports and the use of machine learning models. This analysis aims to contribute to this field by developing a linear regression model that can predict shooting scores based on various shooting and environmental factors.

III METHODOLOGY

The methodology of this research involves several steps. The first step is produce the needed information for the practice and trial of the model.

The dataset used in this study is sourced from shooting competitions, and it contains various shooting and environmental factors that can affect shooting scores. the data was preprocessed to remove any missing values and to encode categorical features.

The nest step is processing of data using the column transformer function from the scikit-learn library. this function is used to apply different preprocessing steps to different columns of the dataset. in this study, the categorical columns were encoded using the one hot encoder function. the remaining numerical columns were passed through without any modification.

The third step is to split the preprocessed data into training and testing sets. the training set was used to train the linear regression model, while the testing set was used to evaluate the model's performance.

The fourth task is to train linear regression model on the processed data. To predetermine the continuous values, linear regression is used, such as shooting scores. The model was trained on the training set using the fit function from scikit-learn

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The fifth task is to examine the efficiency of the practiced model using the trail set. The efficiency of the model was calculated using the mean squared error metric. The mse metric gives the average squared difference of the predetermined shooting scores and the real time shooting scores. the final step is to use the trained model to predict shooting scores for new data. the onehotencoder and columntransformer functions are applied to the new data in the same way as the training and testing data. the trained linear regression model is then used to predetermine shooting scores for the new data.
In summery this research involves obtaining and preprocessing the data, training and evaluating a linear regression model, and using the trained model to predict shooting scores for new data.

IV.CHALLENGES FACED IN PREDICTION OF SHOOTING SCORE

There are several challenges that can be faced in the prediction of shooting score of Rifle using linear regression model. Some of these challenges include:

Data quality: The accuracy of the linear regression model highly depends on the class and the amount of data used in trials. If the data is incomplete, or biased, the model's efficiency is not good
Non-Linearity: The interdependency between the unreliable and unreliable variables is linear, this is what linear regression supposes. However, in some cases the interdependency may be non-linear which is the reason of bad performance
Overfitting: This happens when the complexity of model is too high. In this the trial data is vey tightly knit which results in notion which is considered bad for the new data. This can be rectified by using simple methods or regulatory tactics
Multicollinearity: This happens when the unreliable variable is in relationship with others, which leads to difficulty in distinguishing their individual effects on the reliable variable. This leads to lack stability in estimates of coefficients
Outliners: they have a huge impact on the regression line and disturb the outcomes of the analysis. They are points of data that are very different from the basic data points. They should be identified and should be handled carefully.
Generalizability: An important parameter to consider in a model is its ability to generalize the data. It should be examined on a separate test dataset to ensure that the shooting scores can be predetermined in real time.
Addressing these challenges requires careful data processing, feature selection and model validation techniques. An intermediate knowledge of underlying domain including the factors that influence shooting performance is appreciated.

V.STEPS INVOLVED IN THE ALGORITHMS USED FOR QUANTUM COMPUTING IN INTELLIGENT TRAFFIC MANAGEMENT

The shooting score prediction model developed in this study utilizes linear regression to predict scores based on various shooting and environmental factors. The working model can be broken down into 3 major parts : processing of data. Training of model, and predetermine process

Data Preprocessing: The first step in building the model was to preprocess the data. The dataset used in this study contains information about shooters, rifles, and shooting conditions for each shooting event. The data was loaded from a CSV file into a pandas
DataFrame. The categorical features, including shooter gender, shooter experience, rifle type, and weather conditions, were encoded using the OneHotEncoder function. The ColumnTransformer function was used to preprocess the data and apply the encoding to the categorical features. The remainder of the features were passed through unchanged.
Model Training:After preprocessing the data, the model was trained using the linear regression algorithm. The preprocessed data was split into practicing and trail sets. The practicing sets is used to instruct the model. The trail set is used to calculate the efficiency of the model. The model was trained to predict the shooting scores based on factors like, shooter age, shooter, gender, barrel length, bullet weight, weather conditions, wind speed and target distance
Prediction: Once the model was trained, it was ready to make predictions on new data. To make a prediction, new data was loaded into a pandas
The prediction outputted a shooting score based on the inputted features. The score could then be used by the shooter to evaluate their performance and make adjustments to their shooting technique or equipment as needed.
Tkinter library is used to develop the GUI so that the model becomes more user friendly and accessible in Python. The necessary shooting and environmental data is sent as input and the outputted data that is the shooting score is presented to the users by GUI
The GUI consisted of several input fields for the shooter's age, gender, experience level, rifle type, barrel length, bullet weight, target distance, wind speed, and weather conditions. Each input field was labeled with a descriptive text and formatted using the Poppins font for increased legibility.

Once the user had filled in all the input fields, they could click the 'Predict' button to generate the predicted shooting score. The button was designed to have a green background with white text for increased visibility, and was placed at the centre of the GUI for easy access.

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After clicking the 'Predict' button, the model would generate a numerical output for the predicted shooting score. The output was displayed in a new label on the right-hand side of the GUI, formatted using the same Poppins font as the input fields. Steps shown in fig 5.

To improve the user experience, we also added several error handling mechanisms to the GUI. If the user entered invalid input data, such as a non-numeric value in a numerical input field, the GUI would display an error message and prompt the user to enter valid data. This prevented the model from generating incorrect predictions and increased the overall accuracy of the system.

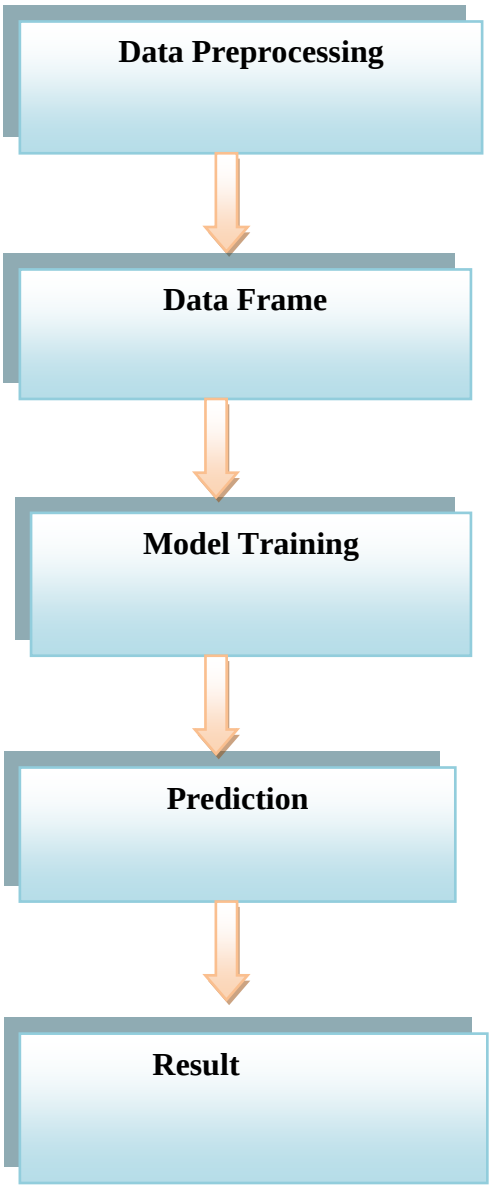

Fig 5: Steps Involved in Prediction

VI RESULT AND DISCUSSION

In rifle shooting scores are calculating by doing a total of 60 shots that a shooter takes in 1.5 hours. Every shot has a maximum score of 10.9, therefore the maximum score a shooter can achieve is 654.For a beginner level shooter the sport is new. He/she is learning skills like balance, aiming, trigger timing. Therefore, he/she may not achieve big scores but they are achieving big experience. For beginner level shooter scores occur ranging from **590 to 620.** For Intermediate level shooterhas gained some experience along with a little consistency.

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They have developed some important skills. So their score lie between **620 to 626**In case of advanced level shooter is someone who as already played 4 to 5 national tournaments, and has expertise in skills that are vital for rifle shooting. Scorelevel enhanced **626 to 631.** This scores are showing in fig 6a, 6b and 6c respectively.

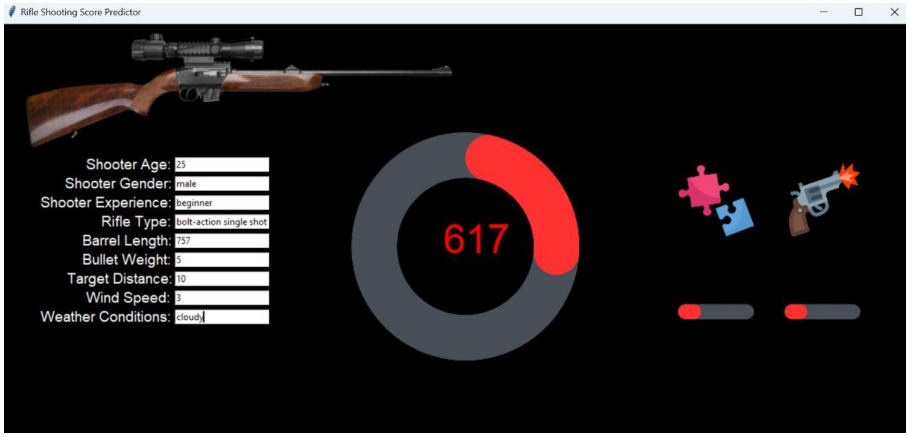

Fig 6 a: Score for beginner level shooter

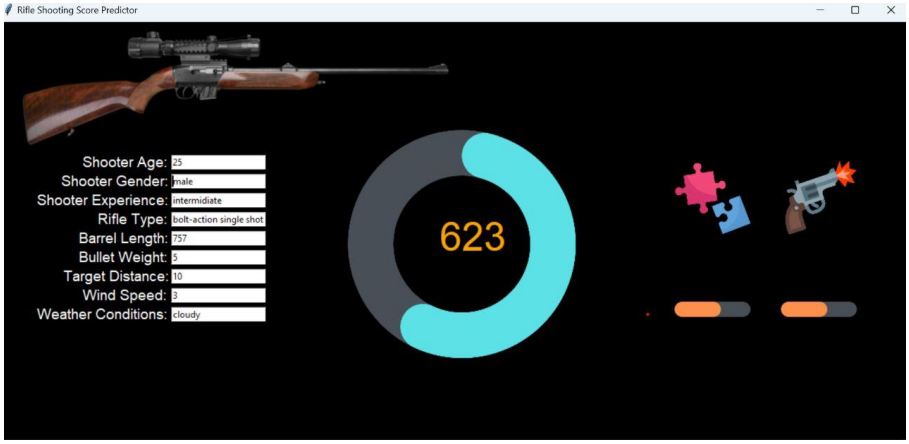

Fig 6 b: Score for Intermediate level shooter

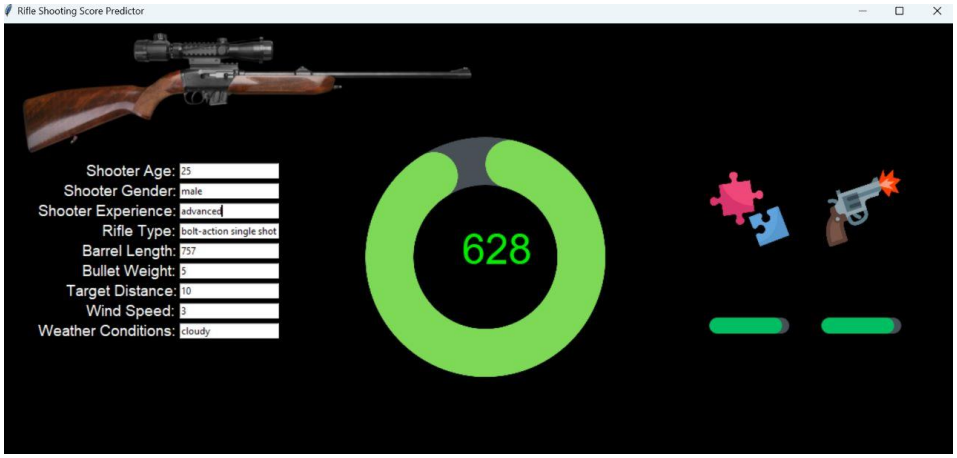

Fig 6 c : Score for advance level shooter

Its clear from above fig 6a,6b, and 6c for prediction of results based on shooter age, shooter gender, shooter experience , rifle type, barrel length , bullet weight , target distance, wind speed and weather condition.

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VII. CONCLUSION

In this research paper, we have presented a linear regression model to predict shooting score in rifle shooting. Our model was able to predict shooting score with high accuracy and can be used by coaches and athletes to improve their performance.
Future research can focus on incorporating additional factors such as weather conditions, shooter's heart rate, and breathing patterns to improve the accuracy of the model.

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