IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IMPLEMENTATION OF CURRENCY EXCHANGE RATE PREDICTION USING MACHINE LEARNING

[1]Dr. M. Saraswathi, [2]Nanduri Raghu Ram, [3]Devaraguttu Haneef

[1]Assistant Professor,[2]Graduate Student,[3] Graduate student
Dept. of Computer Science Engineering,
SCSVMV University, Enathur, India

Abstract: The currency exchange market is the largest and most liquid market in the world. The average daily trading volume in the global foreign exchange and related markets is estimated at $4 trillion. Currencies are fundamental to the majority of people in the globe because they must be traded in order to execute international trade and business, the trading of different currencies and the purchase prediction of one currency in relation to another is the topic that never get old. At the end of the day, fair and accurate estimates of these exchange rates manage international transactions and the worldwide financial system. Effectively estimating the currency exchange rate is a challenging task. We developed a Currency Exchange Rate Prediction System that uses machine learning algorithms to predict Exchange Rate accurately.

***Keywords*:** Trading, Currency Exchange Rate, Estimates, Machine Learning

1.INTRODUCTION

Since the global economy is entirely dependent on the global market, it is crucial to estimate the exchange rates of the main currencies. Knowing the exchange rate between the currency of your home country and the currency of your destination country is essential when travelling to a foreign country. The exchange rate is the price at which one currency can be transferred into another.

A range of factors can cause fluctuations in currency exchange rates. One explanation is that the inflation rates in various nations vary. The percentage rate at which the cost of goods and services rises over time is known as the inflation rate.

A country's currency may often lose value in comparison to another country's currency if it has a greater inflation rate than the other country. The various interest rates in various nations is another factor which might create changes in currency exchange rates. The proportion of a loan that a lender charges the borrower is known as the interest rate. When one country has a higher interest rate than another, the value of the first country's currency tends to rise in comparison to the second country's currency. Political events may also have an impact on currency exchange rates. For instance, if a nation is going through political unrest, its currency is probably going to lose value.

We developed a system for reliably predicting currency exchange rates using machine learning algorithms. As a result, both an individual and a country will profit from currency exchange rate prediction.

2. LITERATURE SURVEY

In this paper, Md.Fazle Rabbi etc. used Support Vector Regression, Random Forest Regression and Long Short-Term Memory algorithms and stated that overall performance of all machine learning algorithms is good, but the performance of deep learning algorithm (LSTM) is better than others. This study is not to train logit regression and decision tree algorithms [1].

In this paper, Md.Soumon Aziz Sarkar etc. used Linear Regression for prediction. The analysis found that the daily time-series graph is more accurate than the hourly time series graph and also the daily time frame is ahead in terms of accuracy. The errors in finding the analysis are different as there are more errors in the daily time series [2].

In this article, Andrew Nguyen used Linear Regression, Multiple Linear Regression, Polynomial Regression, Ridge Regression (L2 Regularization), Lasso Regression (L1 Regularization) Algorithms. The Performance of The Machine Learning Models Is Good but

By Using Regularization Got Good Results. The Model Follows the Overfitting and Got Less R2score (0.677 For Linear Regression, 0.872 For Multiple Linear Regression, 0.88 For L2 Regression, 0.87 For L1 Regression) [3].

In this article, Aman Kharwal used Linear Regression and Random Forest Regression algorithms for development of the system. The Model Performed Better with Random Forest Regression Than Linear Regression and Got a The Good Results. The Dataset used for prediction contains very less observations [4].

In this paper, Sumanjit Das etc. used Optimization Techniques development of the system. The Machine Learning Model Tested with Time Series Database to Predict Open Price for Exchange Rate of Dollar to Indian Rupees and Also to Euro Predicted Very Close to Actual Price. The Model is executed In Certain Range of Parameters and Conditions (Mean Square Error, Mean Absolute Error) only [5].

2.1 PROBLEM STATEMENT

For predicting the daily change of the currency exchange rates many systems have been developed. Predictions are made using different machine learning algorithms including support Vector Regression, Linear Regression and Polynomial Regression. Some works also use Deep Learning models like Long Short-Term Memory and perform comparison with Machine Learning models.

But all these systems have some drawbacks, they are:

i. Got Less R2SCORE (0.872 For Multiple Linear Regression).

ii. The Dataset used for prediction contains very less observations.

iii. The System is not to train logit regression and decision tree algorithms.

To overcome these drawbacks, we developed a system for reliably predicting currency exchange rates using machine learning algorithms. As a result, both an individual and a country will get benefited.

3. PROPOSED SYSTEM

Despite the enormous number of currency pairings that are traded globally, we only pay attention to the most popular ones. We examine the three currency exchange pairs

a) INR to USD
b) EUR to USD
c) CAD to USD

Of which datasets have been taken.

To predict the exchange rate, our system is given with three datasets which shows the currency rates of INR to USD, EUR to USD, CAD to USD respectively. User provides his choice of Currency Exchange from the above-mentioned pairs, then basing on the choice, System intakes corresponding dataset. System first builds the correlation matrix and then by using Multiple Linear Regression, Random Forest Regression, Decision Tree Regression, Gradient Boosting Regressor Algorithm and Hybrid Machine Learning Algorithm (using Voting Regressor, combining Decision Tree Regression, Random Forest Regression and Gradient Boosting Regressor Algorithm), the system will predict the Currency Exchange Rate.

Advantages Of Proposed System:

i. Accurate & Convenient.
ii. User can have access to 3 pairs of currency exchange rates.
iii. Result can be easily figured out.

3.1 SYSTEM ARCHITECTURE

It is represented in the Fig 1 below the step-by-step work done by the system in a flow type starting from selecting a currency exchange pair.

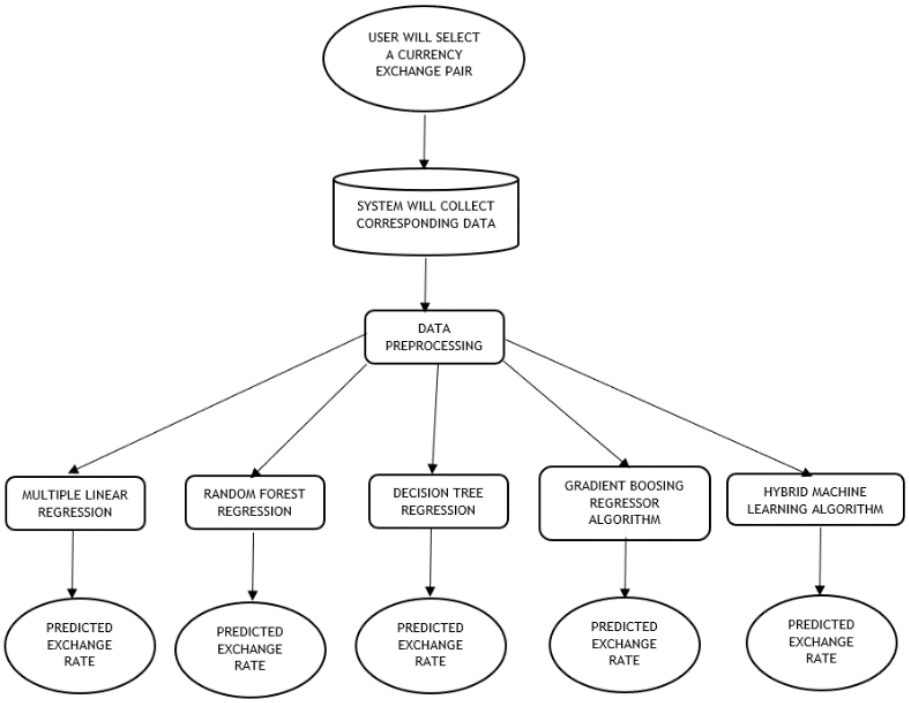

Fig 1. System Architecture

3.2 ALGORITHMS USED

In our system, five Machine learning algorithms are used for the prediction are:

a) **MULTIPLE LINEAR REGRESSION:** Multiple linear regression (MLR), often known as multiple regression, is a statistical approach that predicts the outcome of a response variable using multiple explanatory variables. Multiple regression is a variant of linear regression that utilizes only one explanatory variable.

b) **RANDOM FOREST REGRESSION:** Random Forest is an ensemble approach that may solve regression and classification problems by combining several decision trees and using techniques like Bootstrap and Aggregation. The core idea is to use numerous decision trees to determine the final output rather than depending on individual decision trees.

c) **DECISION TREE REGRESSION:** Decision Tree Regression trains a model in the form of a tree to predict data in the future and provide useful continuous output by observing the features of an object. Continuous output denotes the absence of discrete output, i.e., output that is not only represented by a discrete, well-known set of numbers or values.

d) **GRADIENT BOOSRING REGRESSOR ALGORITHM:** Gradient Boosting is the difference between the existing prediction and the known actual target value is determined through regression. The residual is the name given to this differential.

e) **HYBRID MACHINE LEARNING ALGORITHM:** A hybrid algorithm is combination of two or more other algorithms that solve the same problem, and is mostly used in programming languages. We combined three algorithms (Decision Tree Regression, Random Forest Regression, Gradient Boosting Regressor Algorithm) by using Voting Regressor.

3.3 IMPLEMENTATION PROCEDURE:

i. Importing the packages used in our program Pandas, numpy, matplotlib, sklearn(ensemble, preprocessing, linear_mpodel,metrics, tree ,model_selection), seaborn, plotly statsmodel.
ii. Using “if else” statements for getting the user defined currency exchange rates.
iii. Creating dfl variable which stores the corresponding data using pandas.
iv. Using null().sum() function for knowing the null values in the dataset.
v. Displaying the numerical features, categorical features, discrete features.
vi. Filling the null values using the fillna method.
vii. Knowing the relation between the features using correlation matrix.
viii. Plotting box plot for open, high, low, close, adj close features in the data.
ix. Plotting a line graph for the data.
x. Splitting the data into training and the testing models using traintestsplit() method.
xi. Fitting the training data into Multiple Linear Regression, Random Forest Regression, Decision Tree Regression, Gradient Boosting Regressor Algorithm, Voting Regressor.

xii. Testing the data and then knowing how good the model predicts the values using r2 score.
xiii. Representing the predicted values in a scatter plot for visual representation.
xiv. Implementing the Ordinary Least Squares (OLS) Regression Table.

4. RESULTS:

Results were got for all three conversions respectively, out of which IND-USD is attached below for sample. Basing upon the dataset at first Box Plot represented in Fig 2 and Line Graph represented in Fig 3 are Drawn.

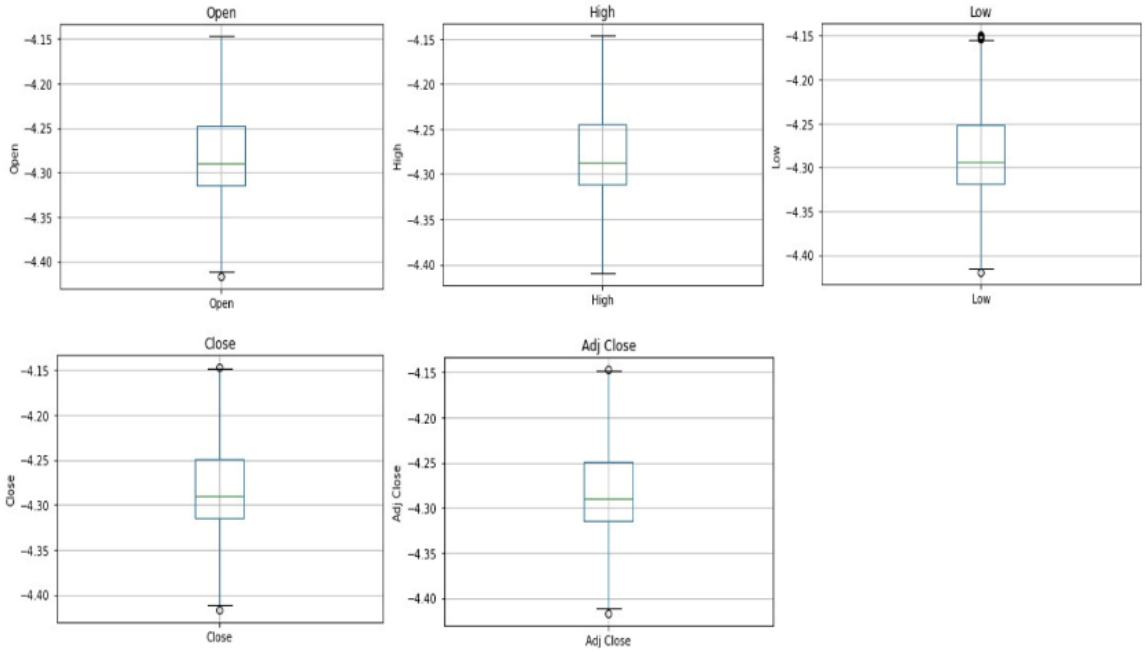

Fig 2. Box Plot

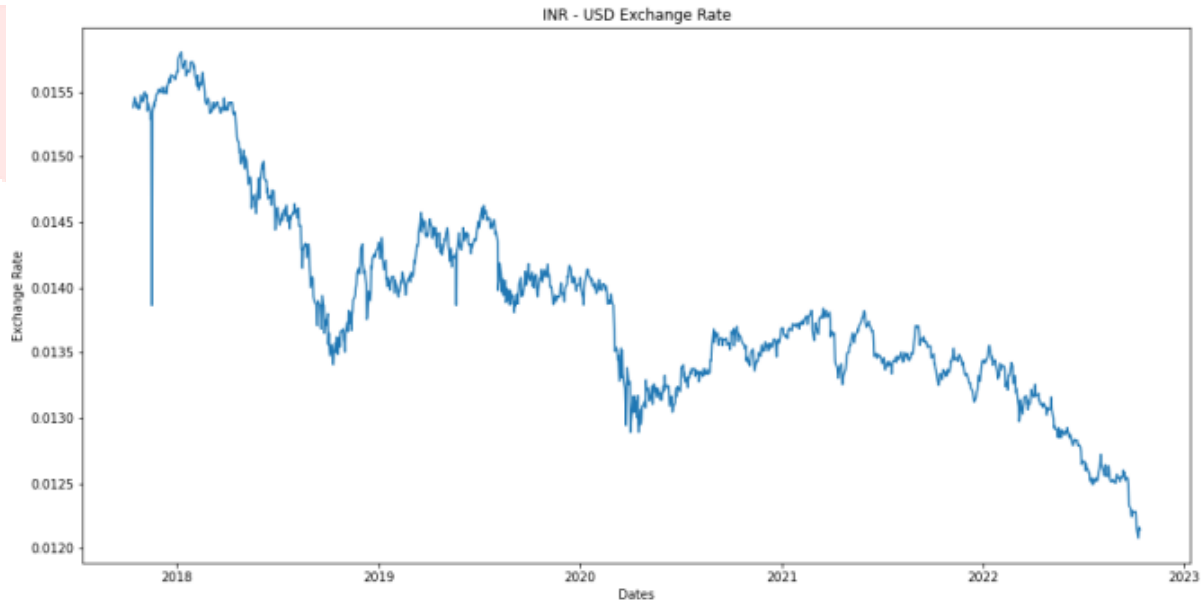

Fig 3. Line Graph

Testing Dataset have been used to predict the Currency exchange rate by applying below mentioned each and every Machine Learning algorithm mentioned below, R2SCORES are also produced below the predicted values. The predicted values and R2SCORES are represented in below figures (Fig 4, Fig 5, Fig 6, Fig 7, Fig 8) for each of machine learning algorithms.

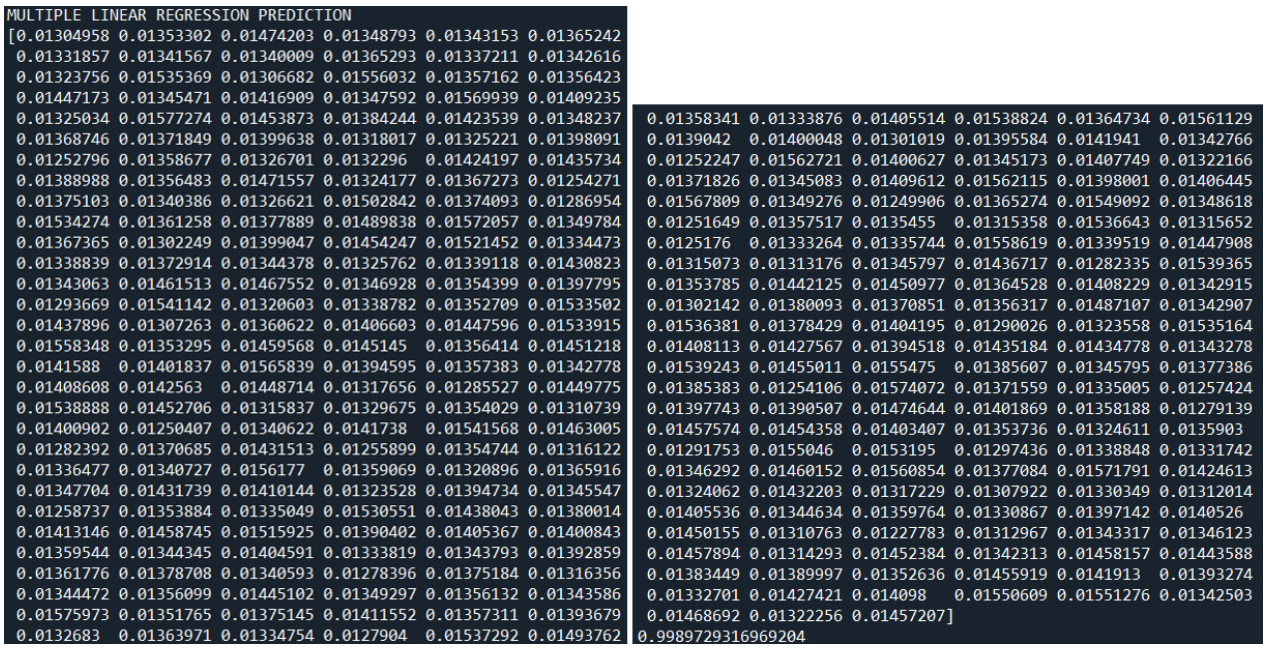

Fig 4. Multiple Linear Regression

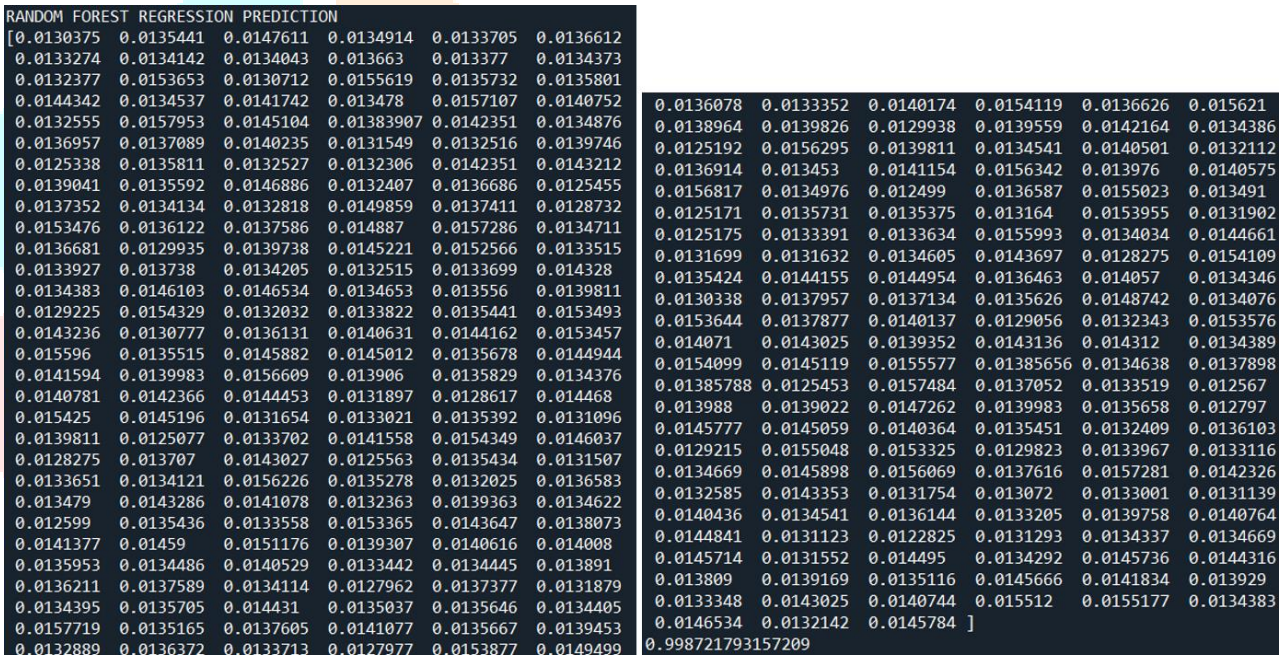

Fig 5. Random Forest Regression

```
DECISION TREE REGRESSION PREDICTION
[0.0130515  0.01353867 0.0147895  0.0134945  0.0134415  0.01365667
 0.013347   0.013416   0.01340433 0.01366367 0.0133745  0.01343
 0.0132325  0.01537267 0.013065   0.01555133 0.01354    0.0135715
 0.01441267 0.013455   0.01418633 0.01348067 0.0157065  0.014026
 0.0132615  0.0157875  0.014524   0.0137805  0.0142465  0.0134865
 0.0137     0.013721   0.014006   0.013137   0.0132305  0.013983
 0.012532   0.0135885  0.013271   0.01324    0.0142465  0.01431867
 0.01393167 0.0135755  0.014677   0.0132325  0.0136565  0.012545
 0.013683   0.013413   0.013295   0.014987   0.01374733 0.01287067
 0.01534733 0.013588   0.013804   0.014902   0.015736   0.01346233
 0.0136565  0.0129515  0.0139535  0.014524   0.0151275  0.01335133
 0.013394   0.0137365  0.0134485  0.013245   0.013394   0.014322
 0.013431   0.0145815  0.01464633 0.01347433 0.0135455  0.013983
 0.012926   0.01543    0.01321133 0.01338233 0.01353867 0.01534733
 0.01432767 0.0130755  0.0136055  0.01408467 0.01441267 0.01534733
 0.01558233 0.0135265  0.014547   0.014501   0.0135885  0.0145245
 0.014173   0.014022   0.015667   0.013915   0.0135885  0.01343
 0.01408467 0.01423467 0.01441267 0.013187   0.0128515  0.014459
 0.015439   0.0144875  0.013166   0.0132925  0.013495   0.013111
 0.01399    0.01249733 0.0133725  0.014162   0.01543    0.014547
 0.012828   0.01369    0.01430533 0.0125545  0.01355    0.01316
 0.013366   0.013413   0.01562367 0.0136     0.013203   0.013674
 0.01348067 0.014337   0.01408733 0.013245   0.013932   0.0134715
 0.0126     0.013568   0.0133605  0.01533    0.014376   0.01379933
 0.014142   0.0145735  0.0151275  0.013931   0.0140875  0.014006
 0.0136     0.0134485  0.01406933 0.013345   0.0134485  0.013915
 0.013614   0.013838   0.01341    0.01279033 0.0137365  0.013187
 0.0134485  0.0135755  0.0144485  0.013528   0.0135455  0.0134415
 0.0157875  0.0135385  0.0137365  0.0141215  0.0135755  0.0139715
 0.0132305  0.013639   0.0133935  0.01279033 0.015394   0.014952
 0.0136145  0.01333633 0.01398833 0.015413   0.01365667 0.01562367
 0.0139015  0.014006   0.01301067 0.013934   0.01418633 0.01342767
 0.012516   0.015656   0.0139965  0.0134485  0.01408467 0.01321133
 0.0136795  0.013455   0.01408733 0.01562367 0.013983   0.01408467
 0.015685   0.0134945  0.01249733 0.01365667 0.015501   0.0134945
 0.012516   0.0135805  0.01355    0.0131605  0.015407   0.0132205
 0.012516   0.013323   0.0133605  0.01558233 0.01340433 0.0144785
 0.0131605  0.01316    0.01346567 0.014376   0.012828   0.015413
 0.01353867 0.01442333 0.0145245  0.01364767 0.01408467 0.01342767
 0.0131555  0.013737   0.013715   0.0135645  0.014902   0.013431
 0.01535833 0.013804   0.01398833 0.012905   0.013226   0.01535833
 0.014018   0.01428333 0.013932   0.01431867 0.0143505  0.01342767
 0.015413   0.014501   0.01555133 0.01385035 0.0134715  0.01378933
 0.01385035 0.0125435  0.015736   0.0137055  0.01335133 0.012569
 0.013983   0.0139015  0.014719   0.014006   0.01354    0.01279033
 0.0145735  0.014501   0.014017   0.01353867 0.013248   0.013622
 0.012926   0.015501   0.015335   0.0129775  0.013399   0.0133415
 0.01346567 0.0145815  0.01562367 0.013774   0.015736   0.0142185
 0.013255   0.01432967 0.013173   0.013079   0.013311   0.013116
 0.01406567 0.0134485  0.0136145  0.01329    0.01397867 0.01406933
 0.014459   0.013107   0.012269   0.013129   0.013433   0.0134715
 0.014593   0.01316    0.014501   0.01342267 0.014593   0.014444
 0.0137805  0.013884   0.013495   0.014593   0.01418633 0.0139035
 0.01333633 0.01428333 0.01406    0.0155155  0.0155155  0.01343
 0.01464633 0.01321133 0.014593  ]
0.9982584833779641
```

Fig 6. Decision Tree Regression

```
GRADIENT BOOSTING REGRESSOR ALGORITHM PREDICTION
 [0.01304141 0.01354737 0.01477132 0.01349881 0.01343161 0.01365727
 0.01332828 0.01342094 0.01341627 0.01365727 0.01337666 0.01342726
 0.01322447 0.01537606 0.01306184 0.01556451 0.01357115 0.01357033
 0.01444219 0.013451   0.01418225 0.01346869 0.01570481 0.01407944
 0.01325206 0.01578248 0.01454386 0.01382741 0.01422947 0.01349881
 0.01369212 0.01371615 0.01399642 0.01316493 0.01325206 0.01396766
 0.01253707 0.01357969 0.01325505 0.01322715 0.01422632 0.01431739
 0.01389806 0.01356236 0.01470041 0.01324489 0.01366338 0.01254322
 0.01372704 0.01341145 0.01329376 0.01500269 0.01372685 0.01287403
 0.01534252 0.01361801 0.01377017 0.01490088 0.01572695 0.0134662
 0.01366338 0.01297881 0.01395633 0.01454386 0.01522943 0.01334466
 0.01338851 0.0137287  0.01344984 0.0132544  0.01338851 0.01432068
 0.01343044 0.01461929 0.01464095 0.01346869 0.01355024 0.01396766
 0.01290338 0.0154393  0.01319414 0.01338534 0.01354737 0.01534252
 0.01434404 0.01306184 0.01361365 0.01405141 0.01444219 0.01534846
 0.0155925  0.01354892 0.01457872 0.01450881 0.01358444 0.01449534
 0.01415004 0.01400689 0.01566485 0.01392369 0.01357453 0.01342726
 0.01408201 0.01423844 0.01444678 0.01317423 0.01286212 0.01447885
 0.01541135 0.01449197 0.01316181 0.01329376 0.01354124 0.01310702
 0.01399573 0.01251018 0.01339281 0.01415891 0.0154432  0.01461929
 0.01283347 0.01371615 0.01431426 0.01254891 0.01354616 0.01316484
 0.01336876 0.01341814 0.01562194 0.01355331 0.01319494 0.01365973
 0.01346869 0.01431984 0.01410765 0.01324336 0.0139464  0.01346869
 0.01260033 0.01355085 0.01336082 0.01533753 0.01434897 0.01381407
 0.0141365  0.0145683  0.01512891 0.01391176 0.01405871 0.01399642
 0.01359397 0.01344226 0.01405155 0.013341   0.01343909 0.01391839
 0.01363302 0.01377017 0.01342094 0.0127735  0.01372774 0.01320412
 0.01346753 0.01356512 0.01442184 0.01349881 0.01357033 0.01344226
 0.0157644  0.0135068  0.01371911 0.01411341 0.01356512 0.01393852
 0.01325505 0.01363929 0.01337699 0.0127735  0.01538881 0.014937
 0.01358666 0.01333844 0.01403216 0.01541378 0.01365727 0.0156202
 0.01390368 0.01399112 0.01301746 0.01395847 0.01421612 0.01343044
 0.01251711 0.01563408 0.01398802 0.013451   0.01406039 0.01322077
 0.01371237 0.01344984 0.01411341 0.01564164 0.01396766 0.01405141
 0.01568412 0.01350299 0.01249248 0.01366092 0.01550043 0.01349881
 0.01251711 0.01357861 0.01354616 0.01316181 0.01538528 0.01320118
 0.01251711 0.0133375  0.01336921 0.01559271 0.01340864 0.0144615
 0.01316181 0.01315867 0.01346869 0.01435903 0.01283269 0.01541424
 0.01354616 0.01442184 0.01448756 0.01364504 0.01406039 0.01343044
 0.01305552 0.01381407 0.01372147 0.01356919 0.01487308 0.01342927
 0.01535643 0.01377663 0.01403216 0.01290186 0.01323398 0.01535543
 0.01406039 0.01429366 0.0139464  0.01431739 0.01432247 0.01343044
 0.01541379 0.01453612 0.01556451 0.0138646  0.01346753 0.01378653
 0.01385125 0.01254891 0.01574798 0.01372852 0.01334814 0.01256799
 0.01396766 0.01390498 0.0147154  0.01399633 0.01356921 0.0127735
 0.01457299 0.01453177 0.01403862 0.01354616 0.01324489 0.01359788
 0.01290338 0.01550043 0.01533753 0.0130473  0.01337621 0.01332999
 0.01346869 0.01458572 0.01562194 0.01377318 0.01572695 0.01425054
 0.01326492 0.01432158 0.01316817 0.01307443 0.0132878  0.01310603
 0.01405141 0.01344899 0.01361212 0.01333036 0.0139687  0.01405155
 0.01447491 0.01311017 0.01229473 0.01313713 0.01343044 0.01346869
 0.0145713  0.01315967 0.01451977 0.01342927 0.01457299 0.01443728
 0.01382741 0.01390498 0.01351951 0.01457582 0.01419493 0.01392381
 0.01333287 0.01429366 0.01407944 0.01551492 0.01551492 0.01342211
 0.01464095 0.01320035 0.0145713 ]
0.998691798728898
```

Fig 7. Gradient Boosting Regressor Algorithm

```
HYBRID MACHINE LEARNING ALGORITHM PREDICTION
  [0.01304514 0.01354316 0.01477402 0.01349478 0.01341458 0.01365839
 0.01333449 0.01341691 0.01340816 0.01366132 0.01337606 0.01343178
 0.01323138 0.01537124 0.01306595 0.01555943 0.01356107 0.01357446
 0.01442898 0.01345311 0.014181   0.01347566 0.01570737 0.01406045
 0.01325653 0.01579079 0.01452615 0.01381562 0.01423731 0.01349085
 0.01369554 0.01371555 0.0140091  0.01315536 0.0132449  0.0139755
 0.01253436 0.01358102 0.01325933 0.01323221 0.01423629 0.01431675
 0.01391054 0.0135662  0.01468871 0.01323933 0.01366298 0.01254481
 0.01371514 0.01341248 0.01328968 0.01499196 0.01374153 0.0128726
 0.01534571 0.01360672 0.01377921 0.01489656 0.01573038 0.01346832
 0.01366226 0.01297377 0.01396162 0.01453005 0.01517891 0.01334894
 0.0133916  0.0137339  0.01343966 0.01325026 0.013384   0.0143236
 0.01343467 0.01459855 0.01464694 0.01346942 0.01355147 0.01397767
 0.01291995 0.01543372 0.01320281 0.01338355 0.01354327 0.01534628
 0.01433403 0.01307161 0.0136108  0.01406613 0.01442298 0.01534718
 0.01559031 0.01354224 0.01457126 0.01450336 0.01357878 0.0145048
 0.01416088 0.01400904 0.01566429 0.01391492 0.01358102 0.01343188
 0.01408171 0.01423689 0.01443465 0.01318362 0.01285841 0.01446867
 0.01542502 0.01449975 0.01316476 0.01329561 0.0135263  0.01310914
 0.01398887 0.01250488 0.01338022 0.01415842 0.01543555 0.01458485
 0.01282976 0.01370458 0.01430624 0.01255315 0.01354671 0.01315789
 0.01336673 0.01341453 0.01562252 0.01356594 0.01320052 0.01366449
 0.01347599 0.01432852 0.01410095 0.01324203 0.0139382  0.01346742
 0.01259955 0.01355334 0.013359   0.01533463 0.01436452 0.01380685
 0.01413877 0.01457842 0.01512418 0.01392444 0.01406816 0.01400394
 0.0135979  0.01344641 0.01405788 0.01334313 0.01344429 0.0139081
 0.01362264 0.01379065 0.01341397 0.01278678 0.01373409 0.01318998
 0.01345189 0.01357064 0.01443321 0.01351065 0.01356062 0.01344138
 0.01577449 0.01352043 0.0137414  0.01411422 0.01356927 0.01395174
 0.0132579  0.01363818 0.01337304 0.01278728 0.01538963 0.01494566
 0.01360277 0.01333673 0.01401174 0.01541293 0.01365885 0.01562163
 0.01390092 0.01399365 0.01300652 0.01394942 0.01420635 0.01343366
 0.01251807 0.01563964 0.01398804 0.01345106 0.01406479 0.01321454
 0.01369499 0.01345268 0.0141054  0.01563316 0.01397597 0.01406426
 0.01568353 0.01349824 0.01249608 0.01365844 0.01550132 0.01349465
 0.01251737 0.01357713 0.01354474 0.01316246 0.01539613 0.01320287
 0.0125175  0.01333359 0.01336437 0.01559156 0.01340557 0.01446484
 0.01316443 0.01316046 0.01346493 0.01436768 0.01282937 0.01541242
 0.0135426  0.01441846 0.01450325 0.01364635 0.01406749 0.01343121
 0.01308236 0.01378221 0.01371701 0.01356629 0.01489204 0.01342267
 0.01535974 0.01379126 0.01401138 0.01290476 0.01323124 0.01535729
 0.01404954 0.01429348 0.01393783 0.01431568 0.01432429 0.01343378
 0.01541208 0.01451636 0.01555803 0.01385713 0.01346768 0.01378868
 0.01385312 0.01254513 0.01574246 0.01371381 0.01335046 0.01256822
 0.01397997 0.01390285 0.01472024 0.014002   0.01355861 0.01278705
 0.01457583 0.01451262 0.01403065 0.0135435  0.01324456 0.01360906
 0.01291758 0.01550215 0.01533558 0.01299941 0.01339075 0.01332921
 0.01346706 0.01458408 0.01561729 0.01377018 0.01573021 0.01423611
 0.01325901 0.01432691 0.01317149 0.01307508 0.01330118 0.01311182
 0.0140533  0.0134507  0.01361394 0.01331363 0.01397441 0.01406571
 0.0144724  0.01310988 0.01227564 0.01313177 0.01343234 0.01346899
 0.01457851 0.01315822 0.01450602 0.01342709 0.01458097 0.01443806
 0.01380559 0.01390192 0.01351045 0.01457691 0.01418829 0.01391916
 0.01333466 0.01429348 0.01407151 0.01551422 0.01551612 0.01342991
 0.01464694 0.01320859 0.01458204]
0.9987359943477803
```

Fig 8. Hybrid Machine Learning Algorithm

Out Of the above predicted values, predicted values got through Hybrid Machine Learning Algorithm, Random Forest Regression and Decision Tree Regression are plotted in the below Fig 9.

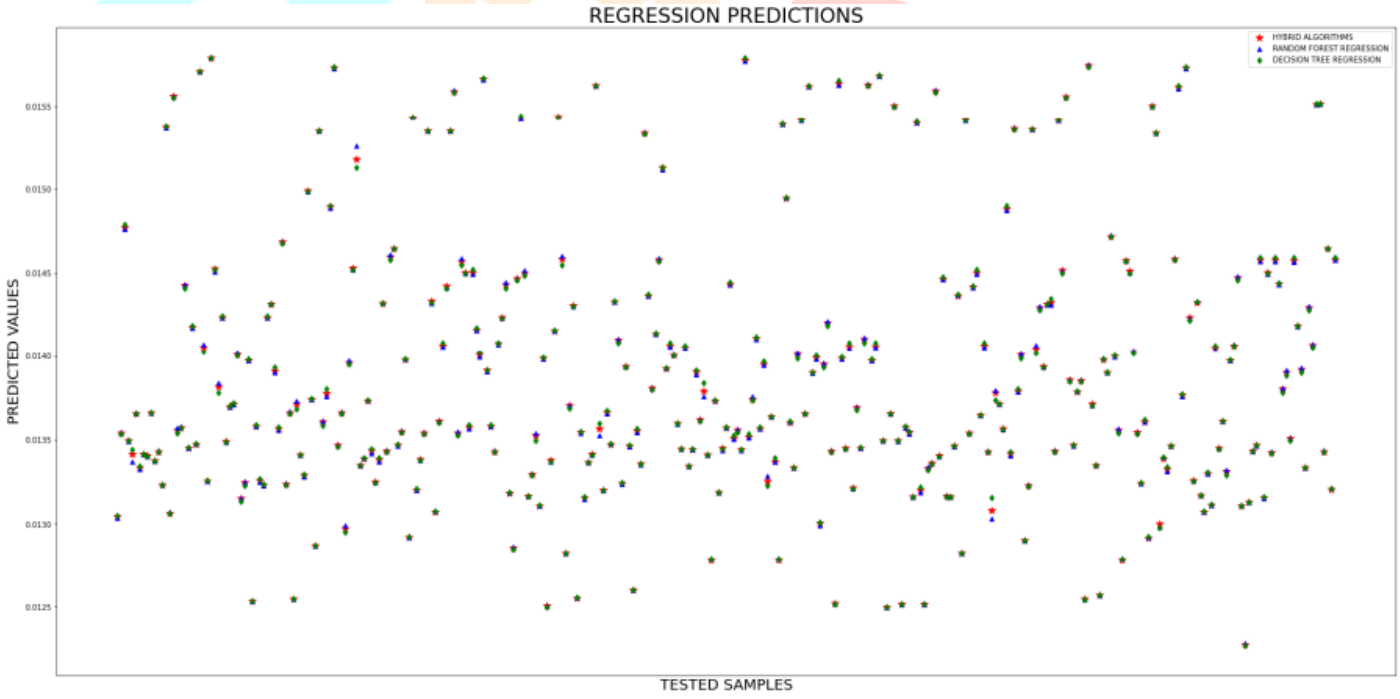

Fig 9. Scatter Plot

5. CONCLUSION

We built a system that predicts the currency exchange rates. We got an Accuracy of 99%, improved when compared with existing system (67%). We have visually represented the output. We also plotted Scatter Plot for predicted currency exchange rate values we got which is visually appealing.

In Future, we can improve this system by providing an user friendly platform and giving daily updates of currency exchange rates.

REFERENCES:

1. Md. Fazle Rabbi, Mahmudul Hasan Moon, Fahmida Tasnim Dhonno, Ayrin Sultana, and Mohammad Zoynul Abedin "Foreign Currency Exchange Rate Prediction Using Long Short-Term Memory, Support Vector Regression and Random Forest Regression" Research Gate (2022)
2. Md. Soumon Aziz Sarkar, U.A. Md. Ehsan Ali "EUR/USD Exchange Rate Prediction Using Machine Learning" International Journal Of Mathematical Sciences and Computing (2022)
3. Chikashi Tsuji "Exchange Rate Forecasting via a Machine Learning Approach" Scinetific Reasearch Publishing (2022)
4. Jonathan Felix Pfahler "Exchange Rate Forecasting with Advanced Machine Learning Methods" Journal Of Risk and Financial Management (2022)
5. Yang Sun, Jiajun Li "Deep Learning for Intellige nt Assessment of Financial Investment Risk Prediction" Hindawi Computational Intelligence and Neuroscience (2022)
6. Manaswinee Madhumita Panda, Surya Narayan Panda,Prasant Kumar Pattnaik "Forecasting Foreign Currency Exchange Rate using Convolutional Neural Network" International Journal of Advanced Computer Science and Applications (2022)
7. Zhenlin Liang, Xiang Li "Exchange Rate Forecasting Using Machine learning: Explore Gains From External Information" International Conference on Algorithms, Computing and Systems (2021)
8. Aman Kharwal "Currency Exchange Rate Prediction with Machine Learning" THECLEVERPROGRAMMER (2021)
9. Mohammad Zoynul Abedin, Mahmudul Hasan Moon, M. Kabir Hassan, Petr Hajek "Deep learning-based exchange rate prediction during the COVID-19 pandemic" Annals of Operations Research (2021)
10. Shahrokh Firouzi, Xiangning Wang, Ali Totonchyfardmotlagh "Machine Learning Forecasting of Foreign Exchange Markets Trend Based on Order Flow and US Economic News" IEEE (2021)
11. O.S. Adewale, D.I. Aronu, Adedayo D. Adeniyi "Currency Exchange Forecast Using Sample Mean Estimator and Multiple Linear Regression Machine Learning Models" FUOYE Journal of Engineering and Technology (2021)
12. Andrew Nguyen "Exchange Rate Prediction: Machine Learning with 5 Regression Models" Towards Data Science (2020)
13. Sumanjit Das, Mohammed Siddique "CURRENCY EXCHANGE RATE PREDICTION USING MACHINE LEARNING TECHNIQUES" International Journal Of Modern Agriculture (2020)
14. Kristina Sanjaya Putri, Siana Halim "Currency movement forecasting using time series analysis and long short-term memory" IJIO (2020)
15. XuanyiSonga, YuetianLiu, LiangXue, JunWang, JingzheZhang, JunqiangWang, LongJiang, ZiyanCheng "Time-series well performance prediction based on Long Short-Term Memory (LSTM) neural network model" Journal of Petroleum Science and Engineering (2020)