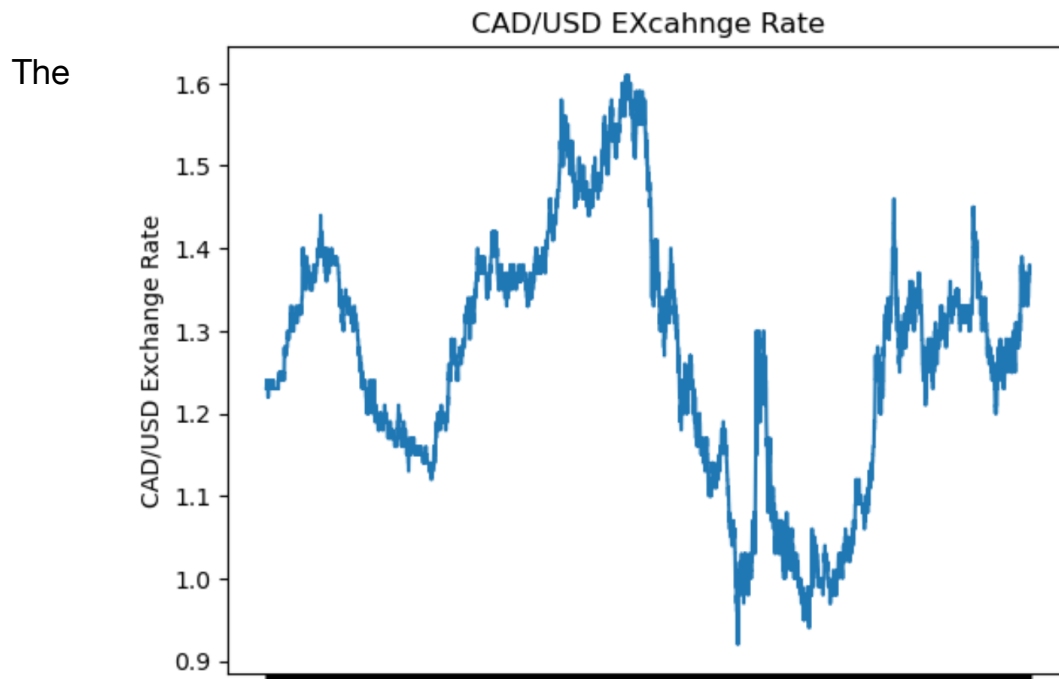


Machine learning for exchange rate (CAD/USD):-

The impact of exchange rate between CAD/USD and how we can use machine learning to project the exchange rate.



exchange rate between the Canadian dollar (CAD) and the United States dollar (USD) is an important indicator of the strength of the Canadian economy as it affects trade and investment between the two countries. When the exchange rate is high, Canadian exports become more expensive, which can lead to a decrease in demand from foreign markets. Conversely, when the exchange rate is low, Canadian exports become cheaper, which can lead to an increase in demand from foreign markets. The exchange rate also affects the cost of imports, which can have an impact on inflation and consumer prices.

Machine learning to project exchange rate:-

we can use machine learning algorithms that analyze historical data and patterns to make predictions. One popular algorithm for this is the recurrent neural network (RNN), which is designed to process sequential data. RNNs are



particularly effective for time-series data, such as stock prices, where the order of the data points matters.

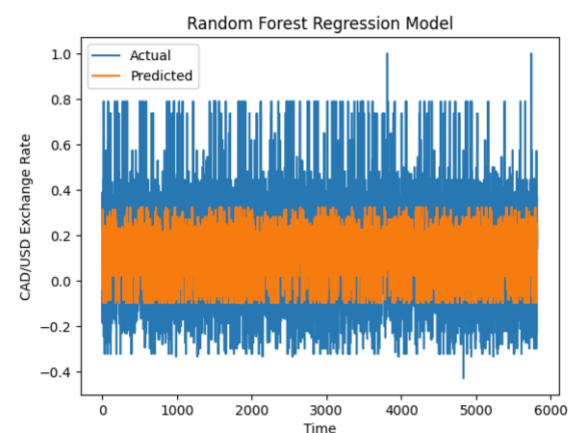
To use machine learning for exchange rate projection, we first need to collect relevant data, including historical exchange rates, economic indicators, and political events that may affect the exchange rate. Once we have the data, we can preprocess it to remove any noise and normalize the data.

Cluster Analysis:-

Cluster analysis is a statistical technique used to classify objects or observations into groups based on their similarities or differences. The goal of cluster analysis is to group together objects that are more similar to each other than to objects in other groups.

Random forest model:-

Random Forest is a machine learning algorithm that can be used for regression and classification tasks. It is a type of ensemble learning algorithm that combines multiple decision trees to make predictions. The algorithm works by creating multiple decision trees based on subsets of the training data and aggregating the predictions of the individual trees. This approach helps to



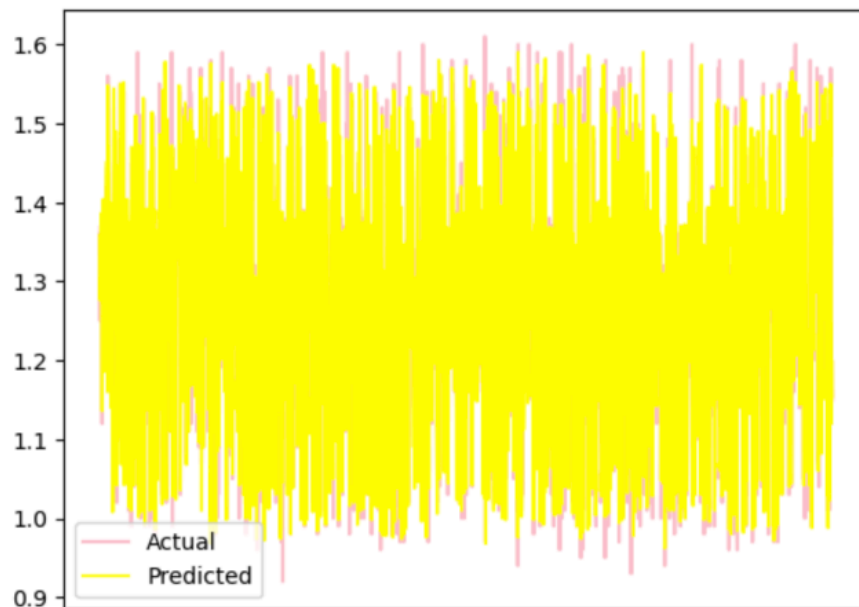
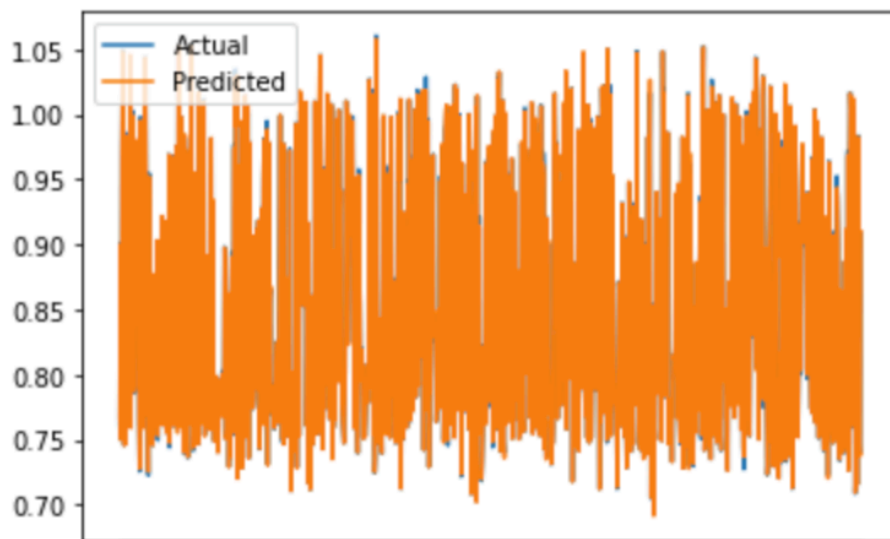
reduce the impact of individual decision trees' biases and errors, leading to more accurate and robust predictions.

KNN:-

The K-Nearest Neighbors (KNN) algorithm is a popular machine learning used for both classification and regression tasks. KNN is a non-parametric algorithm that makes predictions based on the similarity between a new data point and existing data points.

The dataset is usually split into a training set and a test set. The training set is used to train the model, and the test set is used to evaluate the model's performance.

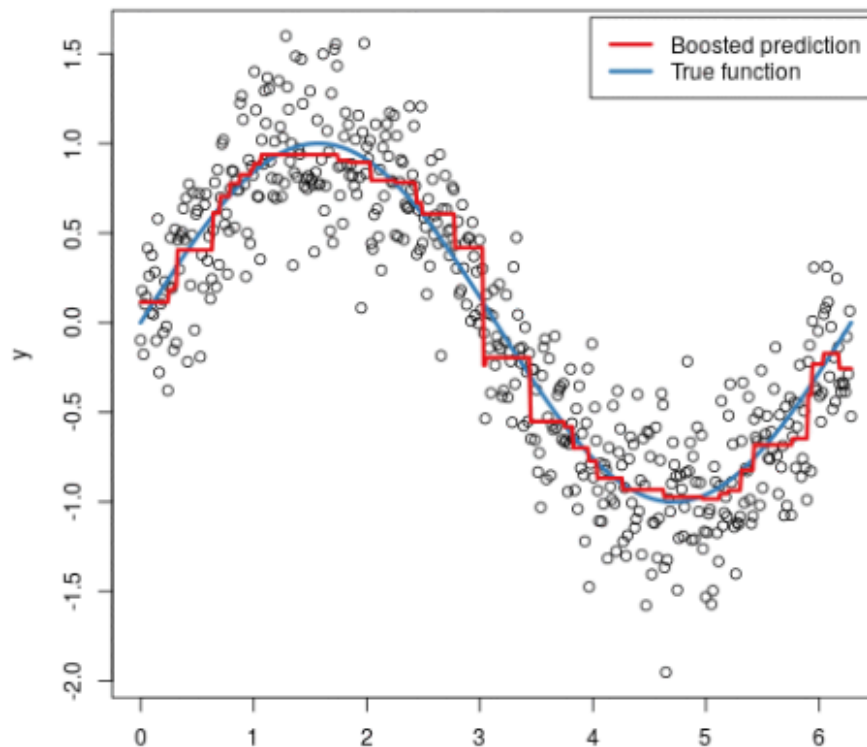
Once the model is trained, you can use it to make predictions on new data points



Gradient boosting regression:-

machine learning technique that involves building an ensemble of decision trees that are trained sequentially to minimize the loss function. To use the gradient boosting regression model.

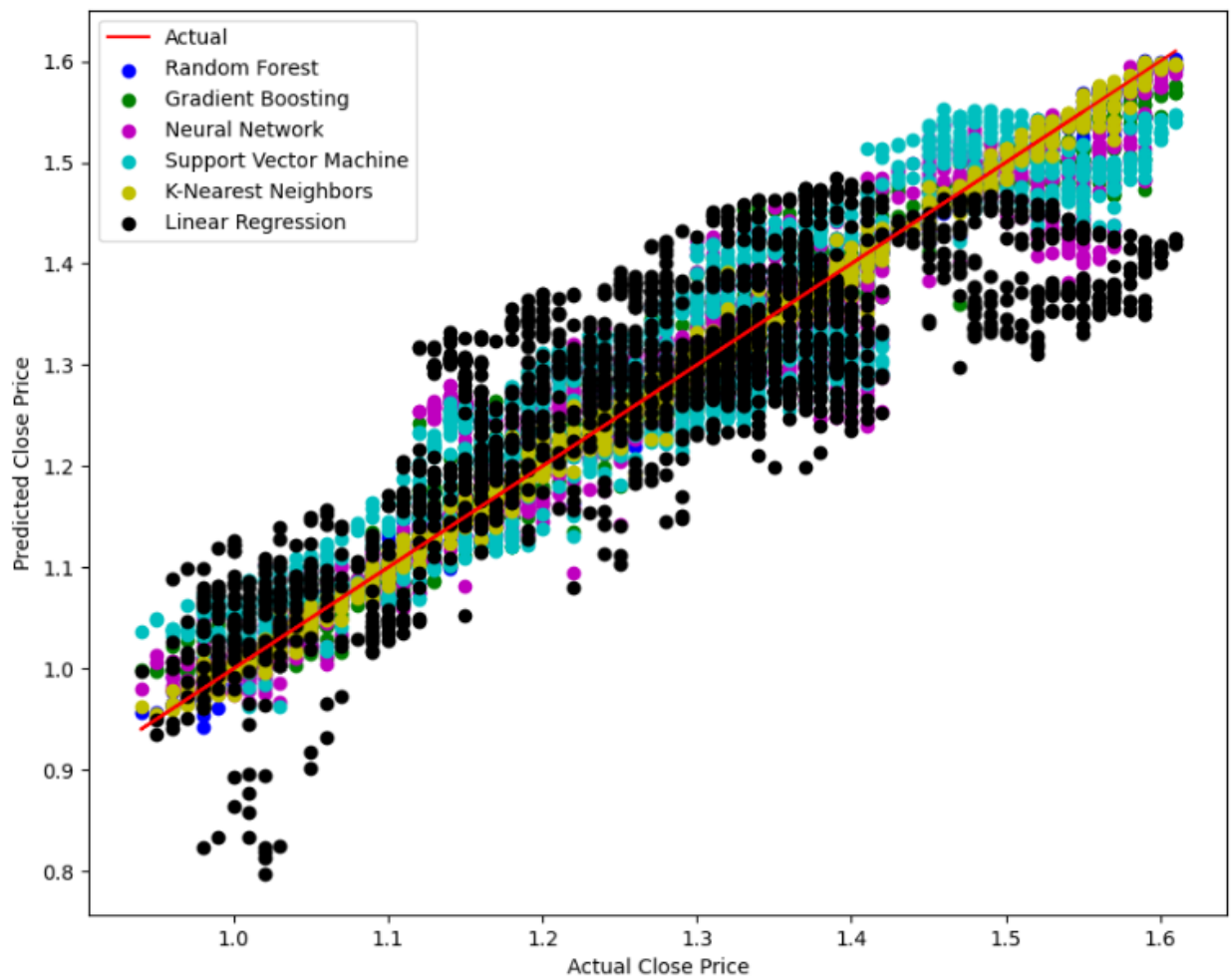
Gradient boosting regression can be a powerful tool for predicting continuous numerical values, but it requires careful tuning of hyperparameters to avoid overfitting.



Super vectore machines:-

The SVM algorithm seeks to find the optimal hyperplane that separates the data points into different classes. The optimal hyperplane is determined by maximizing the margin between the classes while minimizing the classification error.

The algorithm seeks to find the hyperplane that best fits the data points while limiting the deviation from the hyperplane



Conclusion :-

Using monthly rates for machine learning did not give us the best results due to the low number of data points and the high number of volatility within Foreign Reserve Differences and CPI differences. As a result the highest R-squared was K-Nearest Neighbors with about 0.53. In contrast to that, when we look at variables that were used on a daily basis such as the S&P500 index, SAS&P/TSX, crude oil rates, daily CPI for both US and Canada, the results for predictions based on training and testing the models were a lot more accurate. Two models stand out in particular, Random Forest and K-Nearest Neighbors in this case with R-squared means of above 0.99 and very small standard errors.

