**Currency Value Prediction**

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# Introduction:

Currency value forecasting is critical in financial decision-making and economic research. The goal of this project is to forecast currency values using exchange rate and inflation data. We can dynamically change our predictions based on fresh data by employing an online learning model. This report describes our currency rate prediction project's methodology, outcomes, and ramifications.

# Description of the Dataset:

For our analysis, we used two datasets:

* Inflation Rate Data
* Exchange Rate Data.

## Data on Inflation Rates:

From 1960 until 2021, the inflation rate dataset offers historical data on annual inflation rates. Each record gives the year, the percentage of inflation, and the annual change. The dataset has 63 rows and 3 columns.

## Data on Exchange Rates:

The exchange rate dataset contains information on currency exchange rates. We concentrated on US Dollar exchange rates. The dataset contains information such as the rate date, currency, year, month, buying rate, central rate, and selling rate. There are 52,227 rows and 7 columns in the dataset.

# Project Pipeline:

* Data Preprocessing
* Model Training
* Online Learning and Adaptability

# Data Preprocessing:

Data preprocessing is the initial stage in the project pipeline. Using the pandas library, load the inflation rate data and exchange rate data into separate dataframes. The inflation rate dataset offers historical data on annual inflation rates, whereas the exchange rate dataset contains information on currency exchange rates. Irrelevant columns are removed to retrieve the features needed for analysis. The data is rearranged to accommodate model training.

# Model Training:

After the data has been preprocessed, the next step is to train the model. In this research, an online learning model is utilized to predict both the inflation rate and the exchange rate.

* Inflation Rate Model Training
* Exchange Rate Model Training

### Inflation Rate Model Training:

The training data for the inflation rate model is divided into batches, and the model is trained for numerous iterations. The SGDRegressor class is used to create the online learning model. The stochastic gradient descent optimization technique with squared loss and L2 regularization is used by the SGDRegressor. During training, the model incrementally modifies its parameters based on each batch of data, allowing it to adapt to and learn from new information. To guarantee optimal performance, the input features are scaled using the Standard Scaler during the training phase.

### Exchange Rate Model Training:

The exchange rate model is trained in the same way, using the same online learning model technique. To learn the relationship between the rate year and the central exchange rate, the training data is divided into batches and the model is incrementally updated. To optimize the model's performance, the SGDRegressor is used with proper setup settings. Scaling the input features with the Standard Scaler throughout the training process ensures consistency and accuracy in predictions.

# Online Learning and Adaptability:

One of the primary benefits of the online learning paradigm is its ability to adjust to new data. After initial training, the models are meant to continuously update and react to new data. Because economic fundamentals and market dynamics change over time, adaptability is critical in currency rate forecast. The online learning models provide scalable and rapid processing of fresh data, ensuring that forecasts are correct and up to date.

#### Online Learning:

The Stochastic Gradient Descent (SGD) algorithm, specifically the SGDRegressor class is used to implement online learning in the project. Instead of analyzing the full dataset in one go, this approach provides iterative updates to the model's parameters using small batches of training data at a time.

Multiple repetitions of the data are used to train the models, with each iteration consisting of randomly mixed batches. This method allows models to learn from multiple subsets of data, minimizing overfitting and generating more robust predictions.

During online learning, the models incrementally update their internal parameters, altering the model's representation based on new information without rejecting past data knowledge. This guarantees that the models are capable of adapting to and capturing any underlying patterns or changes in the inflation rate and exchange rate dynamics.

#### Adaptability:

As fresh inflation rate and exchange rate data become available, the models can be trained online by processing the incoming data in batches and incrementally updating the model parameters. This keeps the models current and capable of capturing any changes or trends in currency rates.

The models are built to efficiently process new data, eliminating the need to retrain the entire model from scratch. Because of the incremental updates, the models can adjust fast to changes, making them suited for real-time prediction scenarios where new data is constantly arriving.

The models' versatility makes them useful in dynamic contexts where currency values are influenced by a variety of factors such as economic events, policy changes, or market volatility. The models can deliver more accurate and relevant predictions by including the most recent data, allowing for more informed decision-making.

# Prediction:

The trained models are then used to forecast currency rates. The user enters the desired year to anticipate a future currency rate, and the models project the inflation rate and exchange rate for that year. After then, the anticipated numbers are utilized to calculate the future currency rate. To preserve a fair level of precision and user-friendliness, the predictions are rounded.

# Results:

The accuracy and dependability of currency rate predictions are assessed. The models' performance is evaluated by comparing the projected currency rates to the actual values in the dataset. Any differences or limits of the models are explored, as well as potential areas for development. The evaluation results provide insight into the models' efficacy and applicability for currency rate prediction jobs.

##### Points:

* The anticipated currency rates for different years are compared to the actual rates in the dataset. This provides for a quantitative assessment of the models' accuracy performance.
* Any disparities or variances between projected and actual rates are analyzed and discussed. Economic events and market volatility, for example, are factors that may contribute to these discrepancies.
* The models' shortcomings and potential areas for improvement are investigated. This includes recognizing any obstacles or flaws in the prediction process and offering potential model additions or refinements.

# Currency Rate Calculation:

A function is created to calculate future or previous currency values based on user input. The function takes the user's provided number of years and whether they want to compute the currency's future or historical value. To estimate the currency value, it takes into account the predicted inflation rate and exchange rate for the selected number of years. Scaling the input data, model inference, and rounding of predicted values are all part of the process. This feature enables users to acquire currency value estimates that are suited to their unique needs.

# Graphical User Interface (GUI):

A graphical user interface (GUI) is created to provide a user-friendly experience. The graphical user interface (GUI) allows users to engage with the currency rate forecast system. Users can choose the learning mode (inflation or exchange), enter data for model training, and generate currency values according on their needs. The graphical user interface (GUI) improves accessibility and usability, making the currency values forecast method more intuitive and interesting for users.

# Discussion:

The experiment demonstrates the possibility and effectiveness of employing an online learning approach to anticipate currency rates. The models can react to shifting market conditions and deliver accurate projections by using existing data and continuously updating the models with fresh information.

# Conclusion:

Finally, employing inflation and exchange rate data, this study successfully implements an online learning approach for currency rate prediction. In projecting currency rates, the models demonstrate adaptability, scalability, and accuracy. They provide credible projections for future currency values by combining the most recent information and continuously updating the models.

However, it is critical to recognize the models' limitations, such as their reliance on historical data and the assumption that future trends will mimic past patterns. Furthermore, external causes and unforeseen occurrences can influence currency rates, and the models may not account for all of these influences. As a result, it is best to use the models as part of a holistic decision-making process that includes additional criteria and expert expertise.

# Recommendation:

Based on the project's findings, the following suggestions are made:

* To improve accuracy and adaptability, keep the models up to date with the most recent data.
* Consider adding elements or aspects that can influence currency rates, such as economic indicators, political events, or worldwide market patterns.
* Investigate ensemble methods or other advanced machine learning approaches to boost prediction performance even further.
* Test and validate the models rigorously on a wide range of historical data, and compare their performance to competing approaches.
* Monitor and analyse the models' performance against real-world currency rate fluctuations on a regular basis to discover areas for improvement or correction.