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Stock and Currency Price Prediction Using ML Methods

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# Overview

This proposal outlines a research study aimed at predicting stock and currency prices using state-of-the-art AI and ML techniques, including **Transformers**, **LSTM**, **Simple RNN**, **NHits**, and **NBeats**. The primary objective of this research is to explore the efficacy of these models in forecasting financial markets' price movements and comparing their performance in terms of accuracy, efficiency, and robustness. The proposed research aims to contribute to the existing body of knowledge in the field of financial forecasting and provide valuable insights for investors, financial analysts, and researchers. This article/project will detail the methodology, data collection, model implementation, evaluation metrics, and potential applications of the research findings.

The financial markets are characterized by complex and dynamic price movements, making accurate predictions challenging but crucial for informed decision-making. Recent advances in AI and ML, especially Transformers, LSTM, Simple RNN, NHits, and NBeats, have shown promising results in various time-series forecasting tasks. This research proposal seeks to investigate and compare the performance of these techniques in predicting stock and currency prices.

# Goals (Objectives)

1. To explore the applicability of Transformers, LSTM, Simple RNN, NHits, and NBeats for stock and currency price prediction.
2. b. To assess the predictive accuracy of each model under different market conditions and time horizons.
3. c. To identify the strengths and weaknesses of each model and their suitability for real-world financial forecasting applications.

# Specifications (Methodology)

## Data Collection

Historical stock and currency price data will be collected from reliable financial sources, such as financial market databases, APIs, or financial institutions.

## Data Preprocessing

The collected data will undergo preprocessing to handle missing values, outliers, and other data anomalies. Standardization or normalization may be applied to ensure consistent scaling across different features.

## Data Partitioning

Divide the historical data into training, validation, and test sets to assess the models' performance accurately. The training set will be used for model parameter learning, the validation set for hyperparameter tuning, and the test set for unbiased evaluation.

## Model Definition (Model Architecture)

Here we are going to define 5 models:

1. **Transformers**: Implement the Transformer architecture using libraries such as TensorFlow or PyTorch, with attention mechanisms and positional encoding for sequence modeling.
2. **LSTM**: Set up the Long Short-Term Memory (LSTM) model using the chosen deep learning framework, configuring the number of LSTM layers, hidden units, and dropout rates as necessary.
3. **Simple RNN**: Implement the Simple RNN model, specifying the number of recurrent units and other hyperparameters.
4. **NHits**: Implement the NHits ensemble forecasting model, incorporating various time-series forecasting methods to generate combined predictions.
5. **NBeats**: Implement the NBeats deep learning architecture, designing the necessary components for effective time-series forecasting.

## Model Training, Validation and Evaluation

1. **Training**: Train each model using the training data and appropriate optimization algorithms (e.g., Adam, RMSprop) with suitable learning rates.
2. **Validation**: Utilize the validation set to tune hyperparameters, such as learning rates, batch sizes, and the number of epochs, to optimize model performance.
3. **Evaluation Metrics**: Assess the models' predictive accuracy using common evaluation metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE).

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# Milestones

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Some other notes:

* The final objective of this project is to publish it in journals, conferences, or - at least - Arxiv.
* A proper title for the article: Leveraging AI and ML Techniques for Stock and Currency Price Prediction: A Comprehensive Comparative Study
* The supervisor of this project is Mr. Abolfazl Younesi and the supervising professor is Professor M. Amin Fazli.