MJ Maheronnaghsh V[1]
Department of Computer Engineering,
Sharif University of Technology
email: m.j.maheronnaghsh@gmail.com

M. Gheidi V[1]
Department of Computer Engineering,
Sharif University of Technology
email:

A. Younesi V[1]
Department of Computer Engineering,
Sharif University of Technology
email:

Leveraging AI and ML Techniques for Stock and Currency Price Prediction: A Comprehensive Comparative Study

In the dynamic world of financial markets, accurate price predictions are essential for informed decision-making. This research proposal outlines a comprehensive study aimed at forecasting stock and currency prices using state-of-the-art Artificial Intelligence (AI) and Machine Learning (ML) techniques. By delving into the intricacies of models such as Transformers, Ichimoku Cloud, LSTM, Simple RNN, NHits, and NBeats, we seek to contribute to the realm of financial forecasting, offering valuable insights for investors, financial analysts, and researchers. This article provides an in-depth overview of our methodology, data collection process, model implementations, evaluation metrics, and potential applications of our research findings.

Keywords: Machine Learning, Finance, Stock Price Prediction

1 Introduction

The financial landscape is marked by its complexity and rapid changes, making precise price predictions a formidable challenge yet a crucial endeavor. Recent advancements in AI and ML, particularly in the domains of Transformers, LSTM, Simple RNN, NHits, and NBeats, exhibit promising results in various time-series forecasting tasks. This research proposal aims to thoroughly investigate and compare the performance of these cutting-edge techniques in the prediction of stock and currency prices.

2 Methodology

3.1 Data Collection Our study will rely on historical stock and currency price data sourced from reputable financial databases, APIs, and institutions. This rich dataset forms the foundation for training and evaluating our models.

3.2 Data Preprocessing Before feeding the data into our models, a rigorous preprocessing phase will be conducted. This includes addressing missing values, handling outliers, and applying standardization or normalization techniques to ensure consistent scaling across diverse features.

3.3 Data Partitioning The collected and preprocessed data will be partitioned into distinct sets: a training set for model parameter learning, a validation set for hyperparameter tuning, and a test set for unbiased evaluation.

3.4 Model Implementation Six distinct models will be implemented:

a. Transformers: The powerful Transformer architecture will be realized using libraries such as TensorFlow or PyTorch, incorporating attention mechanisms and positional encoding for effective sequence modeling.

b. Ichimoku Cloud: The implementation involves intricate calculations of cloud components like Tenkan-sen, Kijun-sen, Senkou Span A, Senkou Span B, and Chikou Span based on historical price data.

c. LSTM: Long Short-Term Memory (LSTM) models will be established, with careful consideration given to the number of layers, hidden units, and dropout rates.

d. Simple RNN: The Simple RNN model will be set up with a specific number of recurrent units and tailored hyperparameters.

e. NHits: An ensemble forecasting model, NHits, will be implemented, amalgamating various time-series forecasting methods to generate composite predictions.

f. NBeats: The NBeats deep learning architecture will be realized, designed to effectively capture intricate time-series patterns.

3.5 Model Training, Validation, and Evaluation a. Training: Each model will undergo training using the training dataset, employing suitable optimization algorithms like Adam or RMSprop with carefully selected learning rates.

b. Validation: The validation dataset will be employed to fine-tune hyperparameters, striking a balance between learning rates, batch sizes, and epochs to optimize model performance.

c. Evaluation Metrics: The efficacy of our models will be evaluated using widely accepted metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE).

3.6 Comparative Analysis a. Performance Metrics: A rigorous quantitative comparison of models will be conducted, relying on the aforementioned evaluation metrics. This analysis will aid in identifying the most accurate and reliable model for financial prediction.

b. Statistical Analysis: Statistical tests such as t-tests or ANOVA will be performed to ascertain the statistical significance of observed differences in model performance.

[1]Corresponding Author.
Version 1.18, August 30, 2023

List of Figures

List of Tables