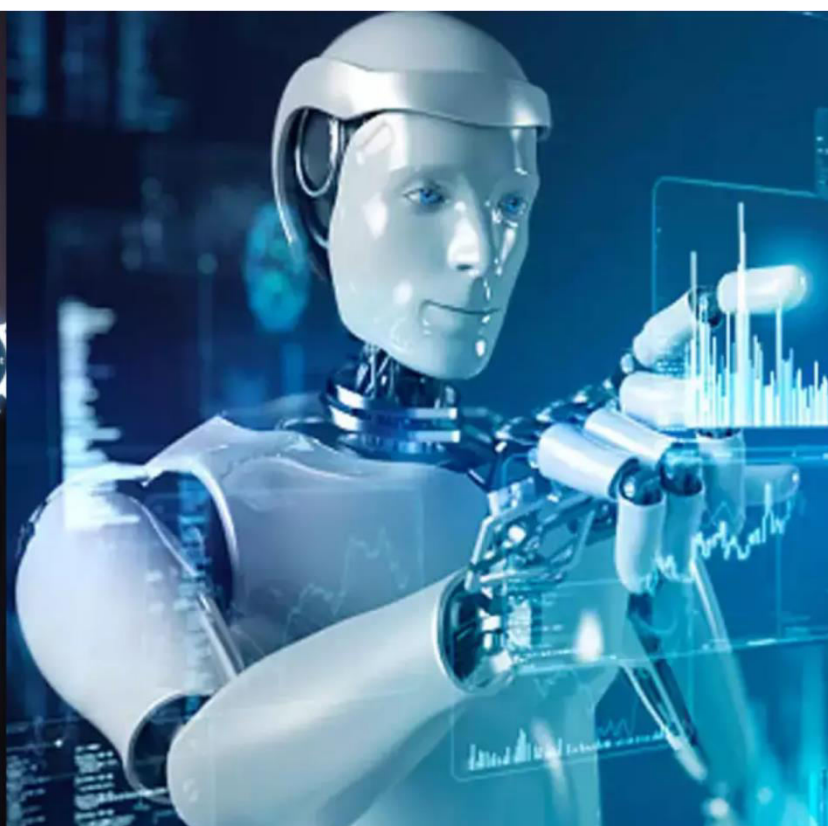




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Stock Price Analysis and Visualization Using LSTM and Plotly Dash

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ABSTRACT: Stock market prediction has always been a challenging task due to its highly volatile and dynamic nature. Traditional methods often struggle to capture the complex, non-linear dependencies present in financial time series data. In this project, we present a Stock Price Analysis and Visualization system using Long Short-Term Memory (LSTM) networks, a specialized type of recurrent neural network (RNN) designed to handle sequential data effectively. Our model leverages historical stock price data, including open, high, low, close (OHLC) values and volume, to make future price predictions. The dataset is preprocessed by handling missing values, normalizing data, and creating time-series sequences before being fed into the LSTM network. The model is trained on past stock prices and learns to predict future trends based on historical patterns. To enhance the user experience and provide interactive insights, we utilize Plotly Dash to develop a web-based visualization platform. This dashboard allows users to explore stock price trends through interactive graphs, real-time data updates, and predictive analysis. Features such as candlestick charts, moving averages, and model-predicted trends offer a comprehensive view of stock market behavior. Experimental results indicate that LSTM-based models perform significantly better than traditional machine learning approaches, capturing long-term dependencies in stock price movements. The developed system serves as a valuable tool for traders, financial analysts, and researchers to explore stock market trends with greater accuracy and improved visualization. This project highlights the potential of deep learning and interactive dashboards in financial analytics, paving the way for better stock market prediction, analysis and visualization of the prediction values.

KEYWORDS: Stock Market Prediction, LSTM, Time-Series Forecasting, OHLC Data, Plotly Dash

I. INTRODUCTION

1.1. Significance and Implications

Stock price analysis using an LSTM model and Plotly Dash enhances financial forecasting by leveraging deep learning and interactive visualization. LSTM networks capture long-term dependencies in stock data, improving prediction accuracy compared to traditional models. Plotly Dash provides an interactive dashboard for real-time data visualization, allowing investors to explore trends, volatility, and forecasted prices dynamically. This project has significant implications for investors, traders, and financial analysts, aiding in data-driven decision-making, risk assessment, and portfolio optimization.

1.2. Complexity and Challenges

Developing a stock price analysis system using LSTM and Plotly Dash presents several complexities and challenges. Data

Preprocessing is crucial, as stock market data is noisy, contains missing values, and may require normalization for optimal LSTM performance. Hyper parameter tuning batch size, and significantly impacts model accuracy and requires extensive experimentation. Stock market volatility and unpredictability make long-term forecasting challenging, as external factors like economic events and news influence prices. Overfitting is a common issue, requiring dropout

layers and regularization techniques.

1.3. Role of Machine Learning and Deep Learning

Stock price analysis and visualization using an LSTM model and Plotly Dash leverage advanced deep learning and interactive data visualization to enhance financial forecasting. LSTMs excel in capturing long-term dependencies in stock price trends, outperforming traditional models like ARIMA. Their memory retention mechanism improves prediction accuracy, while real-time data integration enhances adaptability.

1.4. Technological Advancements and Innovation

Stock price analysis and visualization using an LSTM model and Plotly Dash leverage advanced deep learning and interactive data visualization to enhance financial forecasting. Technological advancements include cloud deployment for scalability, model optimization techniques for efficiency, and explainability tools like SHAP for transparency. Future innovations involve hybrid models combining LSTMs with transformers, reinforcement learning for automated trading, and blockchain for secure financial data handling. This project revolutionizes stock market analysis by merging AI-driven forecasting with intuitive, real-time visualization, empowering investors with data-driven decision-making.

14.1. Objective

The objective of this project is to analyze and visualize stock price trends using Long Short-Term Memory (LSTM) neural networks and Plotly Dash. The project aims to develop a predictive model that learns from historical stock market data to forecast future prices accurately. LSTM, a type of recurrent neural network (RNN), is used to capture long-term dependencies in financial time series data.

14.2. Future Enhancement

Future enhancements include integrating hybrid models (LSTM with Transformers) for improved accuracy, reinforcement learning for automated trading strategies, and blockchain for secure financial data management. Real-time cloud deployment, edge AI for mobile applications, and explainability tools like SHAP will enhance transparency, making stock analysis more efficient and insightful.

II. LITERATURE REVIEW

Title 1: Time Series Prediction Based on LSTM Attention-LSTM Model

Authors : Xianyun Wen, Weibang Li

Time series forecasting uses data from past periods to predict future information, which is of great significance in many applications. Existing time series forecasting methods still have problems, such as low accuracy when dealing with some non-stationary multivariate time series data forecasting. Aiming at the shortcomings of existing methods, in this paper, we propose a new time series forecasting model, LSTM-attention-LSTM. The model uses two LSTM models as the encoder and decoder, and introduces an attention mechanism between the encoder and decoder. The model has two distinctive features: first, by using the attention mechanism to calculate the interrelationship between sequence data, it overcomes the disadvantage of the coder-and-decoder model in that the decoder cannot obtain sufficiently long input sequences; second, it is suitable for sequence forecasting with long time steps. In this paper, we validate the proposed model based on several real data sets, and the results show that the LSTM-attention model is more accurate than some currently dominant models in prediction. The experiment also assessed the effect of the attention mechanism at different time steps by varying the time step.

Title 2: A Stock Price Prediction Method based on Deep Learning Technology

Authors: Xuan Ji, Jiachen Wang and Zhijun Yan

Stock price prediction is a hot topic, and traditional prediction methods are usually based on statistical and econometric models. However, these models are difficult to deal with non-stationary time series data. With the rapid development of the internet and the increasing popularity of social media, online new sand comments often reflect investors' emotions and attitudes toward stocks, which contains a lot of important information for predicting stock price. This paper aims to develop a stock price prediction method by taking full advantage of social media data. This study proposes a new prediction method based on deep learning technology, which integrates traditional stock financial index variables and social media text features as inputs of the prediction model.

Title 3: Enhancing Stock Price Forecasting with a Hybrid SES-DA-BILSTM-BO Model: Superior Accuracy in High-Frequency Financial Data Analysis**Authors:** Talabathula Jayanth, A. Manimaran and G. Siva

Stock price forecasting is a critical component of financial market analysis and plays a key role in formulating investment strategies, affecting a wide range of stakeholders. To address the inherent complexities and dynamic fluctuations in stock prices, innovative modeling techniques are required. Deep Learning (DL) approaches, particularly Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks, have shown notable promise in enhancing prediction accuracy for stock prices. This study introduces a novel hybrid Single Exponential Smoothing with Dual Attention based Bi-directional LSTM optimised with Bayesian Optimization (SES-DA-BILSTM-BO), designed to predict future stock prices accurately using the Life Insurance Corporation of India (LIC) stock price dataset with 1-minute, 3-minute, and 10-minute intervals. The model aims to forecast stock prices, identify market trends, and reveal influential factors more effectively. The performance of the proposed SES-DA-BILSTM-BO model was evaluated using key metrics: Directional Accuracy (DA=0.4816), Mean Absolute Percentage Error (MAPE=0.0006), Win/Loss Ratio (WLR=0.7517), and U-Statistic (TUS=0.0006). These results demonstrate its superior performance compared to traditional models such as Moving Average (MA), Auto-Regressive (AR), Auto-Regressive Moving Average (ARMA), Auto-Regressive Integrated Moving Average (ARIMA), Single Exponential Smoothing (SES) and LSTM models.

Title 4: Leveraging Stock Discussion Forum Posts For Stock Price Predictions: Focusing on the Secondary Battery Sector**Authors:** Jisoo You, Haryeom Jang

The advent of social media has transformed the stock investment landscape considerably. Individual investors are increasingly shifting from traditional financial institutions to platforms such as Facebook, X, and stock discussion forums to obtain information and exchange opinions, significantly affecting the stock market. Post-COVID-19, the influx of individual investors has accentuated their importance in the South Korean stock market, necessitating the development of prediction models utilizing data from stock discussion forums, a facet of social media. Research on predicting stock price fluctuations using social media data is lacking, and most studies have focused on news articles, with insufficient utilization of stock discussion forum posts. Considering the significant proportion of individual investors in the Korean stock market, it is imperative to conduct research utilizing posts from stock discussion forums, where individual investors' opinions are directly formed, for accurate stock price predictions. This study specifically focuses on the secondary battery sector, which garnered significant attention during the pandemic, to examine the sentiments of individual investors. Employing data from stock price prediction models, this study compares the accuracy of predictions. The growth of the secondary battery sector can be attributed to global environmental changes such as worldwide energy transition policies, carbon neutrality goals, and an accelerated shift toward renewable energy technologies. This study concludes that using posts from stock discussion forums directly shaped by individual investors enhances the sophistication of predictions. Accordingly, theoretical and practical implications are put forth.

Title 5: ML-GAT: A Multilevel Graph Attention Model For Stock Prediction**Authors:** Kun Huang, Xiaoming Li, Fengyun Liu and Wei Yu

Stock market volatility research has long been the focus of industry and academia, and stock trend forecasting is challenging. Existing research focuses more on how to aggregate historical price features into graph networks, ignoring the effects of other information, such as news and current events, on forecasts. Most existing graph-based learning methods create stock graphs by manually constructing stock relationships, ignoring the complexity of stock relationships. Based on these, we propose a novel multilevel graph attention network (ML-GAT) for predicting the stock market trends. To be more specific, we initialize the node representations captured by each feature extraction module, then update the stock nodes in the isomorphic graph converted from Wiki data using ML-GAT, selectively aggregate the information of various relation types, aggregate the information to the node representation, and finally feed the result to a particular forecast layer for forecasting, completing the trend forecast of 423 stocks in the S&P500 index and 286 stocks in the CSI 300 index. By comparing 5 popular approaches, the experimental research verifies ML-GAT's state-of-the-art performance in prediction tasks. In comparison with the best performance benchmark model, the F1-score and accuracy increased by 11.82% and 12.6%, respectively, and the average daily return and Sharpe rate rose by 5.06% and 94.81%, respectively.

III. METHODOLOGY

3.1 Introduction

Stock price prediction is a challenging task due to market fluctuations and various influencing factors. This project focuses on predicting stock prices using Long Short-Term Memory (LSTM) neural networks and visualizing stock trends with an interactive dashboard built using Plotly Dash. First, we train an LSTM model using historical stock data (Tata Global Beverages dataset) to predict future closing prices. The dataset is preprocessed, normalized, and fed into the LSTM network for training. The trained model is then used to predict stock prices. Next, we create an interactive dashboard that allows users to analyze stock trends of multiple companies (e.g., Apple, Microsoft, Facebook). The dashboard visualizes actual and predicted prices, stock highs and lows, and trading volumes. This project demonstrates the power of deep learning and data visualization in financial analysis, providing insights into stock market trends in a user-friendly manner.

3.2 Existing System

The existing system for Stock Price Analysis and Visualization utilizes Long Short-Term Memory (LSTM) networks for accurate stock price predictions based on historical data. The system processes financial time series data, trains an LSTM model to capture trends, and forecasts future prices. A Plotly Dash-based interactive dashboard visualizes stock trends, model predictions, and key insights using real-time graphs and charts. Users can select stocks, adjust timeframes, and analyze price fluctuations dynamically. The system integrates data preprocessing, feature engineering, and deep learning to enhance forecasting accuracy, aiding traders and investors in data-driven decision-making with an intuitive web-based interface.

3.2.1 Disadvantages of the Existing System

- 1. Limited Accuracy:** Traditional stock price prediction models often rely on statistical methods or simple machine learning algorithms, which may not capture complex patterns in stock market data.
- 2. Lack of Real-time Visualization:** Existing systems often provide static visualizations or require manual updates, making it difficult to track changes in stock prices in real-time.
- 3. Insufficient Interactivity:** Many existing systems lack interactive features, making it challenging for users to explore different scenarios, adjust parameters, or compare multiple stocks.
- 4. Inadequate Handling of Noisy Data:** Stock market data can be noisy and volatile, and existing systems may not effectively handle these fluctuations, leading to inaccurate predictions.
- 5. Limited Scalability:** Existing systems may not be designed to handle large volumes of data or scale to meet the needs of multiple users.

3.3. Proposed System

The proposed system for Stock Price Analysis and Visualization leverages LSTM (Long Short-Term Memory) neural networks for accurate stock price predictions. The system processes historical stock data, extracts patterns, and forecasts future prices using deep learning. It integrates Plotly Dash for an interactive and dynamic web-based dashboard, allowing users to visualize stock trends, real-time price movements, and predictive analytics. The Key features include time-series forecasting, data preprocessing, and performance evaluation with RMSE metrics. This system provides traders, investors, and analysts with actionable insights, improving decision-making by offering intuitive visualizations and AI-driven predictions in a user-friendly interface.

3.3.1. Advantages of Proposed System

- 1. LSTM Model:** Utilizes the Long Short-Term Memory (LSTM) model to learn complex patterns in stock price data, leading to more accurate predictions.
- 2. Handling Non-Linearity:** Effectively handles non-linear relationships in stock market data, reducing errors and improving overall accuracy.
- 3. Interactive Dashboards:** Plotly Dash provides interactive dashboards, enabling users to explore different scenarios, adjust parameters, and visualize results in real-time.

IV. IMPLEMENTATION

Data Collection & Preprocessing:

Historical stock data in CSV format was collected for each company. The 'Date' column was converted to a datetime format and set as the index. Five key features—Open, High, Low, Close, and Volume—were selected. Data normalization was performed using MinMaxScaler to enhance the LSTM model's performance.

Model Building & Training:

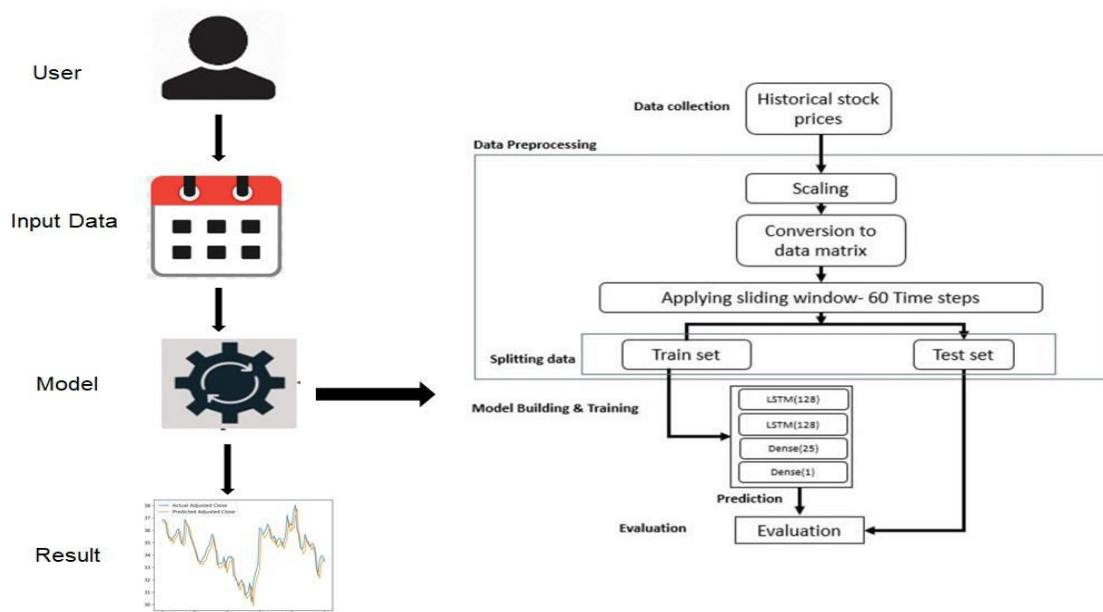
Each dataset was split into 80% training and 20% testing. A 60-day time window was used to feed data into the model. The LSTM architecture consisted of two LSTM layers with 50 units each, followed by a Dense layer predicting all five features. The model used Mean Squared Error (MSE) as the loss function and was trained for 10 epochs to save time. The trained models were saved as saved_model_{company}.h5.

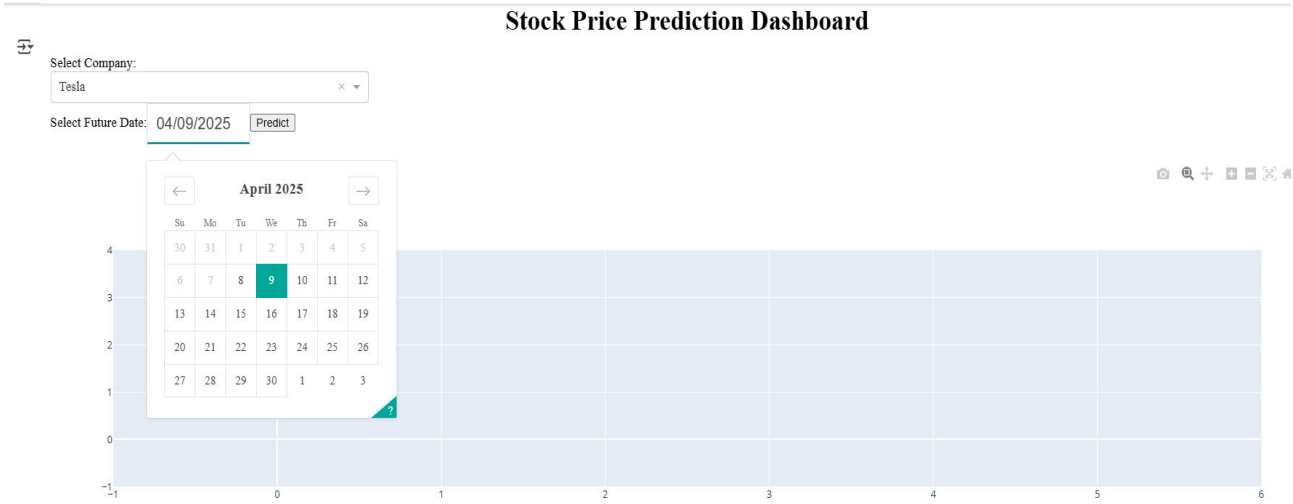
Dashboard Development:

An interactive dashboard was developed using Plotly Dash. It features a dropdown menu to select a company, a date picker for selecting a future date, and a "Predict" button to trigger forecasting using the pretrained LSTM models.

Visualization & Evaluation:

The dashboard displays the actual vs. predicted closing prices on a line graph and predicted Open, High, Low, Close, and Volume values as a bar chart. Model accuracy was evaluated using MSE, RMSE, MAE, and MAPE metrics. Adjustments to batch size and epochs helped improve prediction accuracy.





V. RESULTS AND CONCLUSION

The implemented LSTM-based stock price prediction system effectively forecasts the future stock values of selected companies such as Microsoft, Tesla, Meta, and Apple. By training the model on historical data including Open, High, Low, Close, and Volume features, the system delivers reliable multi-feature predictions. The output is visualized on an interactive dashboard where users can select a company and a future date, then click the “Predict” button to view the forecasted data graphically. The results show that the model performs well in capturing short-term stock price movements, with acceptable error margins based on metrics like MSE, RMSE, MAE, and MAPE.

The integration of a user-friendly interface built with Plotly Dash ensures a smooth experience for both casual users and analysts. Despite reducing the number of training epochs to improve performance speed, the model maintains reasonable accuracy. However, like all time-series models, the prediction reliability decreases over longer time horizons due to market volatility and unseen factors.

In conclusion, this project demonstrates that deep learning models such as LSTM, when trained with rich historical stock data, can provide effective short-term forecasts. The enhanced dashboard empowers users with quick insights, making it a valuable tool for educational, experimental, or initial financial analysis purposes.



VI. LIMITATIONS AND FUTURE WORK

Despite the promising results, the project has several limitations. Firstly, the LSTM model relies solely on historical stock data (Open, High, Low, Close, Volume), and it does not consider external factors such as financial news, economic indicators, geopolitical events, or investor sentiment, which significantly influence stock prices. This limits the model's ability to handle unexpected market volatility. Additionally, the model accuracy decreases for long-term predictions, as LSTMs perform better in short-term forecasting due to the nature of time-series memory retention.

Another limitation lies in the static model retraining. Once trained, the model does not update dynamically with new data unless manually retrained, making it less adaptive to real-time market changes. The prediction dashboard also assumes a linear behavior across different dates, which might not reflect actual market behavior.

For future work, the system can be enhanced by integrating additional data sources like financial news APIs, technical indicators, and macroeconomic metrics. Real-time model updating using online learning techniques could make the system more responsive to recent trends. Exploring more advanced architectures like attention-based models or transformer networks may also improve long-range prediction capabilities. Finally, expanding the dashboard with more analytics tools would make it more robust for serious financial analysis.

REFERENCES

- [1] H. Yao, F. Wu, J. Ke, X. Tang, Y. Jia, S. Lu, P. Gong, J. Ye, and Z. Li, "Deep multi-view spatial-temporal network for taxi demand prediction," in *Proc. AAAI Conf. Artif. Intell.*, vol. 32, no. 1, LA, USA, 2018, pp. 1–8.
- [2] A. I. McLeod and W. K. Li, "Diagnostic checking ARMA time series models using squared-residual autocorrelations," *J. Time Ser. Anal.*, vol. 4, no. 4, pp. 269–273, Jul. 1983.
- [3] J. L. Torres, A. García, M. D. Blas, and A. De Francisco, "Forecast of hourly average wind speed with ARMA models in Navarre (Spain)," *Sol. Energy*, vol. 79, no. 1, pp. 65–77, Jul. 2005.
- [4] C. ByoungSeon, *ARMA Model Identification*. New York, NY, USA: Springer, 2012, pp. 23–25.
- [5] G. Box, *Time Series Analysis: Forecasting and Control*. San Francisco, CA, USA: Wiley, 2015, pp. 89–91.
- [6] A. Sherstinsky, "Fundamentals of recurrent neural network (RNN) and long short-term memory (LSTM) network," *Phys. D, Nonlinear Phenomena*, vol. 404, no. 1, pp. 51–53, 2020.
- [7] Y. Yu, X. Si, C. Hu, and J. Zhang, "A review of recurrent neural networks: LSTM cells and network architectures," *Neural Comput.*, vol. 31, no. 7, pp. 1235–1270, Jul. 2019.
- [8] K. Cho, B. van Merrië Boer, D. Bahdanau, and Y. Bengio, "On the properties of neural machine translation: Encoder-decoder approaches," 2014, *arXiv:1409.1259*.
- [9] M. Ullah, H. Ullah, S. D. Khan, and F. A. Cheikh, "Stacked LSTM network for human activity recognition using smartphone data," in *Proc. 8th Eur. Workshop Vis. Inf. Process. (EUVIP)*, Rome, Italy, Oct. 2019, pp. 175–180.
- [10] R. Chandra, S. Goyal, and R. Gupta, "Evaluation of deep learning models for multi-step ahead time series prediction," *IEEE Access*, vol. 9, pp. 83105–83123, 2021.



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