

Synopsis: Stock Price Prediction using LSTM

1. Introduction

The stock market is one of the most dynamic and complex financial systems, influenced by numerous factors such as demand, supply, investor sentiment, and global economic trends. Predicting stock prices is a challenging task due to the market's highly volatile and nonlinear nature.

This project aims to develop a **Stock Price Prediction Model** using **Long Short-Term Memory (LSTM)** networks — a type of recurrent neural network (RNN) capable of learning long-term dependencies from sequential data. By training the model on historical stock price data, the project attempts to forecast future price trends with improved accuracy.

2. Objective

The main objective of this project is to:

- Predict future stock prices based on past historical data.
 - Analyze time-series trends using deep learning techniques.
 - Compare the predicted prices with actual market values to evaluate model accuracy.
 - Demonstrate the effectiveness of LSTM in modeling financial time-series data.
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3. Problem Statement

Traditional statistical models fail to accurately predict stock prices because they cannot handle nonlinear relationships or sequential dependencies. The challenge is to build a deep learning-based model that can capture these temporal patterns and provide more reliable forecasts of stock price movements.

4. Methodology

The following steps were implemented in the project:

1. **Data Collection:**

The dataset includes Google's historical stock prices, divided into training and testing sets.

2. **Data Preprocessing:**

- Handled missing values and normalized data using **MinMaxScaler**.
- Structured data into 60-day time steps to train the sequential model.

3. **Model Development:**

- Built a **Sequential LSTM Model** using TensorFlow/Keras.
- Added multiple LSTM layers and dropout regularization to prevent overfitting.
- Compiled the model with the **Adam optimizer** and **Mean Squared Error (MSE)** loss function.

4. **Model Training:**

- Trained on the preprocessed dataset for 50 epochs with a batch size of 32.

5. **Prediction and Visualization:**

- Predicted future stock prices using test data.

- Compared real vs. predicted prices through visualization using Matplotlib.
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5. Tools and Technologies Used

- **Programming Language:** Python
 - **Libraries:** TensorFlow, Keras, Pandas, NumPy, Matplotlib, Scikit-learn
 - **Platform:** Google Colab
 - **Model Type:** Long Short-Term Memory (LSTM) Neural Network
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6. Result and Conclusion

The model effectively learned the underlying patterns in historical data and produced predicted prices that closely followed the actual stock price trends. The visualization clearly shows that the LSTM-based model can successfully capture sequential dependencies and short-term market behavior.

In conclusion, this project demonstrates that **deep learning models, especially LSTM networks, can be powerful tools for stock price forecasting**, providing better accuracy compared to traditional statistical approaches.

7. Future Scope

- Incorporate additional features such as trading volume, opening and closing prices.
- Use Bidirectional LSTM or GRU networks for enhanced performance.

- Deploy the model as a **web or mobile application** for real-time stock forecasting.
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8. References

1. "Stock Market Prediction using LSTM Recurrent Neural Network," *IEEE Xplore*, 2020.
2. <https://arxiv.org/abs/2009.10819>
3. <https://www.sciencedirect.com/science/article/pii/S1877050920304865>