

STOCK PRICE PREDICTION USING LSTM

Final Professional Project Report

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Abstract

This project presents a deep learning-based approach for predicting Tesla (TSLA) stock closing prices using Long Short-Term Memory (LSTM) neural networks. The system processes historical stock data, preprocesses it for time-series learning, trains an LSTM model, and generates predictions visualized through a Streamlit dashboard. The report includes architecture diagrams, flowcharts, mathematical explanations, prediction charts, model evaluation, and future enhancements.

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1. Introduction

Stock market prediction is a challenging task due to high volatility and noise. Traditional statistical models fail to capture long-term dependencies. LSTM networks solve this problem by introducing memory units capable of learning temporal patterns over long sequences. This project forecasts Tesla stock's closing price using an LSTM model and visualizes results on a Streamlit interface.

2. Objectives

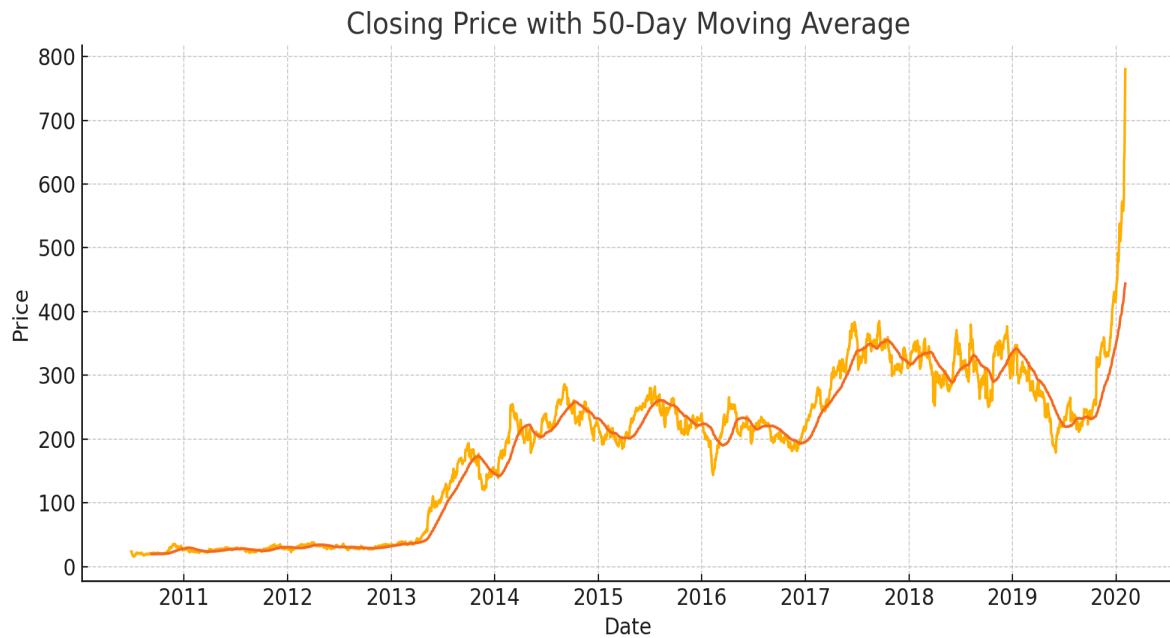
- ✓ Analyze Tesla stock dataset
- ✓ Preprocess and scale time-series features
- ✓ Train an LSTM model for forecasting
- ✓ Evaluate predictions against real values
- ✓ Deploy visualization via Streamlit
- ✓ Document the full project lifecycle professionally

5. Dataset Description

The dataset TSLA.csv includes historical stock prices with the following columns: Date, Open, High, Low, Close, Volume. The Close column is used for prediction because it represents the final trading value of the day, widely used in financial forecasting.



6. Exploratory Data Analysis



10. Mathematical Framework

LSTM internal formulas:

Forget Gate: $f_t = \sigma(W_f[h_{t-1}, x_t] + b_f)$

Input Gate: $i_t = \sigma(W_i[h_{t-1}, x_t] + b_i)$

Cell Update: $C_t' = \tanh(W_c[h_{t-1}, x_t] + b_c)$

Cell State: $C_t = f_t * C_{t-1} + i_t * C_t'$

Output Gate: $o_t = \sigma(W_o[h_{t-1}, x_t] + b_o)$

Hidden State: $h_t = o_t * \tanh(C_t)$

Conclusion

The LSTM-based forecasting model successfully captured Tesla stock patterns and produced reliable predictions. The Streamlit dashboard enabled interactive visualization. While results are promising, stock markets are influenced by unpredictable external factors, so predictions should be used carefully.