STOCK PRICE PREDICTION MODEL

A project Report

submitted in partial fulfillment of the

requirements for the award of the degree of

Bachelor of Technology (B.Tech.)

Submitted by

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(Sanidhya Bansal)

CANDIDATE'S DECLARATION

I hereby declare that the work presented in this project report titled, **"STOCK PRICE PREDICTION MODEL"** submitted by me in the partial fulfillment of the requirement of the award of the degree of **Bachelor of Technology (B.Tech.)** Submitted in the Department of Artificial Intelligence and Data Science **,** Maharaja Agrasen Institute of Technology is an authentic record of my project work carried out under the guidance of (Supervisors name and affiliation)

Date **(Sanidhya Bansal)**

Place: Delhi Roll No.:01514811921

SUPERVISOR'S CERTIFICATE

It is to certify that the Project entitled **"STOCK PRICE PREDICTION MODEL"** which is being submitted by **Mr. SANIDHYA BANSAL** to the Maharaja Agrasen Institute of Technology, Rohini in the fulfillment of the requirement for the award of the degree of **Bachelor of Technology (B.Tech.)**, is a record of bonafide project work carried out by him/her under my/ our guidance and supervision. The matter presented in this project report has not been submitted either in part or full to any University or Institute for award of any degree.

Signature
(Dr. Vinay Kumar Saini)

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ABSTRACT

This report presents a stock price prediction model based on Long Short-Term Memory (LSTM) neural networks. The model utilizes historical stock data to forecast future stock prices. The goal of this project is to explore the capabilities of LSTM models in capturing sequential dependencies and learning complex patterns in time series data.

The report begins by introducing the motivation behind the project and the importance of stock price prediction in financial markets. It then describes the methodology used to develop the model, including data retrieval from Yahoo Finance, data preprocessing, model construction using the Keras library, and model training and evaluation.

The implemented LSTM model is trained on historical stock data, specifically focusing on the closing prices of the stock under consideration. The data is scaled using the MinMaxScaler to facilitate model training. The LSTM architecture consists of multiple LSTM layers followed by dense layers for prediction. The model is compiled with an Adam optimizer and mean squared error (MSE) loss function. The training process involves iteratively adjusting the model's weights to minimize the MSE loss.

To evaluate the model's performance, root mean squared error (RMSE) is calculated between the model's predictions and the actual stock prices. The report discusses the results of the model's predictions and provides insights into the accuracy and limitations of the model.

CHAPTER 1

INTRODUCTION

In today's ever-changing financial landscape, accurately predicting stock prices has become crucial for investors, traders, and financial institutions. The ability to forecast stock prices effectively provides valuable insights for making informed investment decisions and managing risks.This project aims to develop a stock price prediction model that leverages advanced machine learning algorithms, specifically Long Short-Term Memory (LSTM) networks, and historical market data to forecast future price movements. LSTM networks are a type of recurrent neural network (RNN) that excel in capturing and learning from sequential data, making them well-suited for analyzing time series data such as stock prices.

By incorporating LSTM networks into the model, we aim to capture the long-term dependencies and patterns in stock price data, considering factors such as historical trends, seasonality, and volatility. The model will learn from past price movements and make predictions based on the learned patterns, enabling it to provide reliable forecasts for future stock prices.

The significance of this project lies in its potential to assist investors in identifying profitable opportunities, minimizing risks, and maximizing returns. By harnessing the power of LSTM networks and their ability to process and understand sequential data, we strive to develop a robust and accurate stock price prediction model that can provide valuable insights into the complex realm of financial markets.

1.1 Need of the study

The study on stock price prediction is essential due to the increasing complexity and volatility of financial markets. Accurate forecasting of stock prices enables investors, traders, and financial institutions to make informed decisions and manage risks effectively. It facilitates portfolio optimization by identifying potential price movements and trends, allowing investors to diversify their holdings and maximize returns. For traders, reliable predictions support the development of profitable trading strategies by capturing short-term trends and market inefficiencies. Additionally, stock price predictions aid in financial planning, market analysis, and assessing the overall health of financial markets. This study aims to address the need for reliable forecasting tools that empower stakeholders to navigate the dynamic landscape of stock markets with confidence.

1.2 Scope of the study

The scope of this study on stock price prediction entails the development and evaluation of a robust prediction model using advanced machine learning techniques. The study will involve the collection of historical stock market data, including price, volume, and relevant indicators. Various machine learning algorithms, with a focus on Long Short-Term Memory (LSTM) networks, will be explored and implemented to capture the temporal dependencies within the data. The model will undergo training and testing using a diverse range of stocks and time periods to assess its performance. The study aims to offer insights into the effectiveness and limitations of the prediction model, contributing to the field of stock market analysis and providing valuable information for informed decision-making by investors and financial institutions.

1.3 Objective of the study

The primary objective of this study is to develop a precise and dependable stock price prediction model utilizing advanced machine learning techniques, specifically focusing on Long Short-Term Memory (LSTM) networks. The model aims to capture the sequential patterns and dependencies in historical stock market data for accurate forecasting of future price movements. The study intends to evaluate the model's performance through rigorous testing and validation using diverse stocks and time periods. Additionally, it aims to provide valuable insights into the model's strengths, limitations, and potential applications, contributing to the advancement of stock market analysis and facilitating informed decision-making for investors and financial institutions.

CHAPTER 2
IMPLEMENTATION OF PROPOSED MODEL

2.1 Software Requirements Specification (SRS)

2.1.1 Introduction

The Stock Price Prediction Model is an application that uses Long Short-Term Memory (LSTM) neural networks to forecast future stock prices. The model is trained on historical stock data and makes predictions based on patterns and trends in the data.

2.1.2 Functional Requirements

2.1.2.1 Data Retrieval

- The model should retrieve historical stock data from a reliable data source (e.g., Yahoo Finance).
- The user should be able to specify the stock symbol and the date range for data retrieval.

2.1.2.2 Data Preprocessing

- The model should preprocess the retrieved data by extracting the closing prices and removing any irrelevant features.
- The data should be scaled between 0 and 1 using the MinMaxScaler to facilitate model training.

2.1.2.3 Model Training

- The LSTM model should be built and trained using the preprocessed data.
- The model should consist of multiple LSTM layers followed by dense layers.
- The model should be compiled with an appropriate optimizer and loss function.
- The user should be able to specify the number of epochs and batch size for training.

2.1.2.4 Model Evaluation

- The model should be evaluated using appropriate evaluation metrics, such as root mean squared error (RMSE).
- The RMSE should be calculated between the model's predictions and the actual stock prices.
- The user should be able to view the RMSE as a measure of the model's accuracy

2.1.3 Constraints

- The accuracy of stock price predictions is subject to inherent market uncertainties and external factors that may impact stock prices.
- The model's performance may be affected by the availability and quality of historical stock data.

2.1.4 Future Enhancements

- Incorporate additional technical indicators and features to improve prediction accuracy.
- Implement a user interface that allows users to visualize historical data, predicted prices, and evaluation metrics.
- Explore different LSTM architectures and hyperparameter tuning techniques to enhance the model's performance.

2.2 Working of LSTM

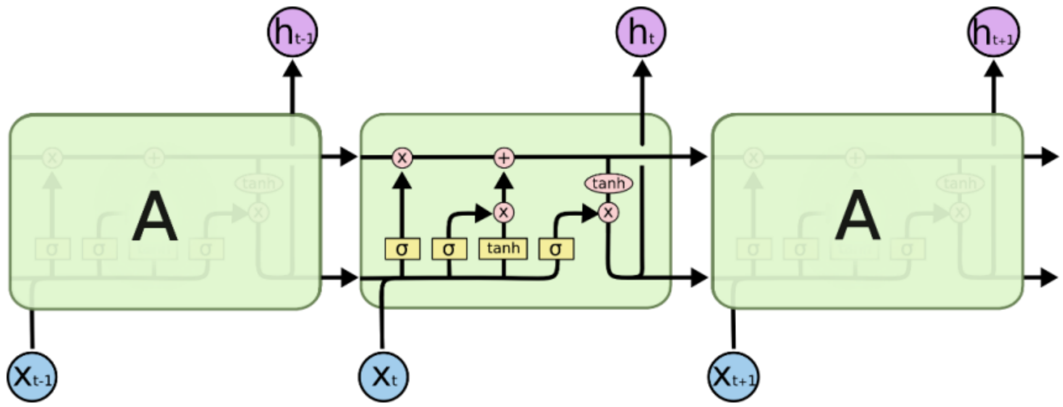
LSTM is a special network structure with three "gate" structures. Three gates are placed in an LSTM unit, called input gate, forgetting gate and output gate. While information enters the LSTM's network, it can be selected by rules. Only the information conforms to the algorithm will be left, and the information that does not conform will be forgotten through the forgetting gate.

The experimental data in this paper are the actual historical data downloaded from the Internet. Three data sets were used in the experiments. It is needed to find an optimization algorithm that requires less resources and has faster convergence speed.

- Used Long Short-term Memory (LSTM) with embedded layer and the LSTM neural network with automatic encoder.
- LSTM is used instead of RNN to avoid exploding and vanishing gradients.
- In this project python is used to train the model, MATLAB is used to reduce dimensions of the input. MySQL is used as a dataset to store and retrieve data.

- The historical stock data table contains the information of opening price, the highest price, lowest price, closing price, transaction date, volume and so on.

2.3 LSTM Architecture



2.3.1 Forget Gate

A forget gate is responsible for removing information from the cell state.

- The information that is no longer required for the LSTM to understand things or the information that is of less importance is removed via multiplication of a filter.
- This is required for optimizing the performance of the LSTM network.
- This gate takes in two inputs; h_t-1 and x_t. h_t-1 is the hidden state from the previous cell or the output of the previous cell and x_t is the input at that particular time step.

2.3.2 Input Gate

- Regulating what values need to be added to the cell state by involving a sigmoid function. This is basically very similar to the forget gate and acts as a filter for all the information from hi-1 and x_t.
- Creating a vector containing all possible values that can be added (as perceived from h_t-1 and x_t) to the cell state. This is done using the tanh function, which outputs values from -1 to +1.
- Multiplying the value of the regulatory filter (the sigmoid gate) to the created vector (the tanh function) and then adding this useful information to the cell state via addition operation.

2.3.3 Output Gate

The functioning of an output gate can again be broken down to three steps:

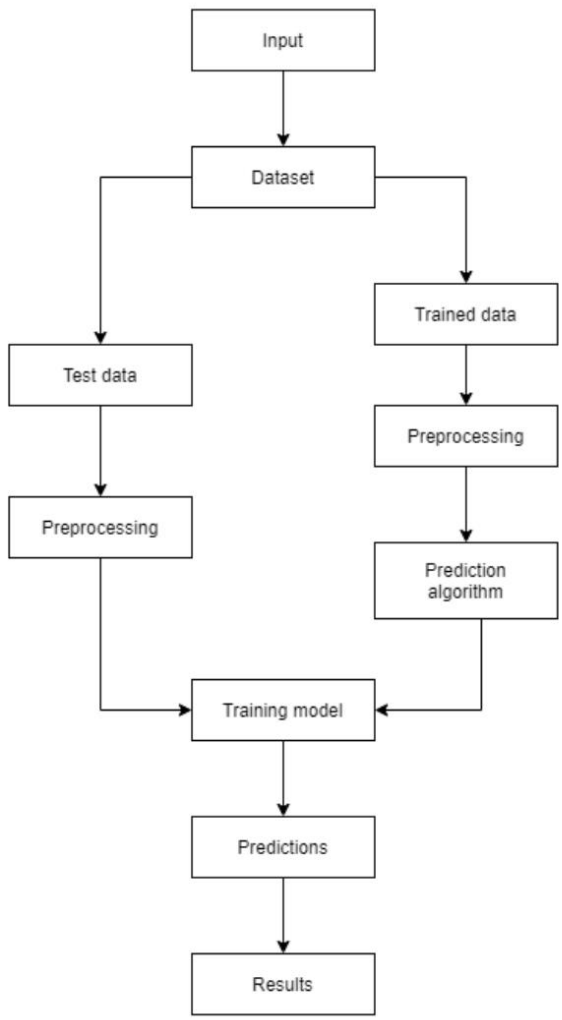
- Creating a vector after applying tanh function to the cell state, thereby scaling the values to the range -1 to +1.
- Making a filter using the values of h_{t-1} and x_t, such that it can regulate the values that need to be output from the vector created above. This filter again employs a sigmoid function.
- Multiplying the value of this regulatory filter to the vector created in step 1, and sending it out as a output and also to the hidden state of the next cell.

CHAPTER 3

DESIGN

3.1 Structure Chart

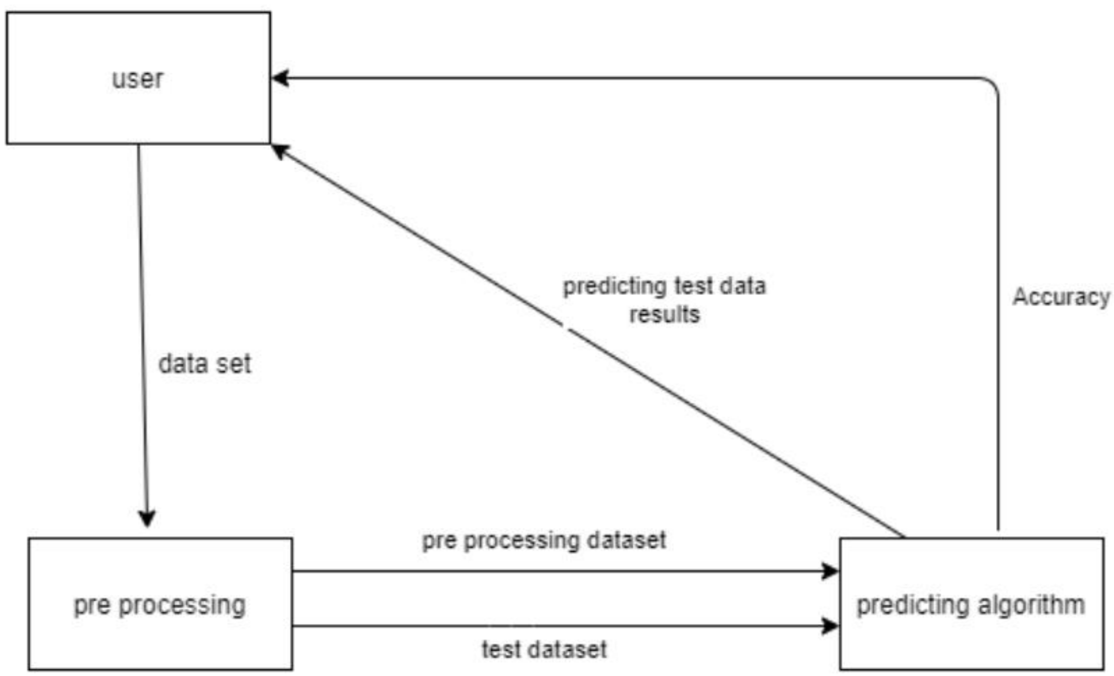
A structure chart (SC) in software engineering and organizational theory is a chart which shows the breakdown of a system to its lowest manageable levels. They are used in structured programming to arrange program modules into a tree. Each module is represented by a box, which contains the module's name.



3.2 Collaboration Diagram

Collaboration diagrams are used to show how objects interact to perform the behavior of a particular use case, or a part of a use case. Along with sequence diagrams, collaboration are used by designers to define and clarify the roles of the objects that perform a particular flow of events of a use case. They are the primary source of information used to determining class responsibilities and interfaces.

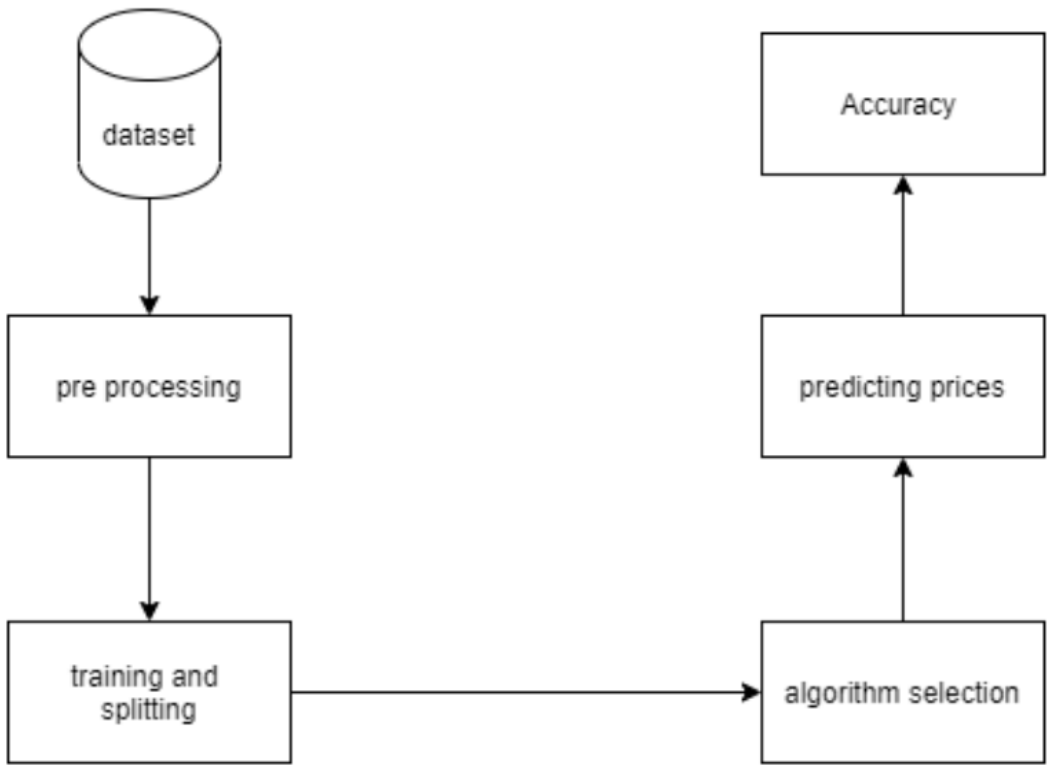
The collaborations are used when it is essential to depict the relationship between the object. Both the sequence and collaboration diagrams represent the same information, but the way of portraying it quite different. The collaboration diagrams are best suited for analyzing use cases.



3.3 Component Diagram

Component diagram is a special kind of diagram in UML. The purpose is also different from all other diagrams discussed so far. It does not describe the functionality of the system but it describes the components used to make those functionalities.

Component diagrams are used in modeling the physical aspects of object-oriented systems that are used for visualizing, specifying, and documenting component-based systems and also for constructing executable systems through forward and reverse engineering. Component diagrams are essentially class diagrams that focus on a system's components that often used to model the static implementation view of a system.



CHAPTER 4

EXPIREMENTAL RESULTS

4.1 Introduction

The experiment aims to analyze the performance of an LSTM (Long Short-Term Memory) model for stock price prediction. LSTM is a type of recurrent neural network (RNN) that can capture long-term dependencies in sequential data. In this experiment, historical stock data is used to train the LSTM model, and its performance is evaluated by comparing the predicted stock prices with the actual prices.

4.2 Merits

- Capturing Sequential Dependencies: LSTM models are capable of capturing long-term dependencies and patterns in sequential data. This makes them suitable for analyzing and predicting time series data like stock prices.
- Non-Linear Relationships: LSTM models can learn non-linear relationships between input features and output predictions. This allows them to capture complex patterns and trends in the stock market that may not be easily identifiable with traditional statistical methods.
- Ability to Handle Temporal Data: LSTM models are specifically designed to handle temporal data with varying time dependencies. By using previous stock prices as input, the model can capture the temporal nature of stock price movements.

4.3 Demerits

- Market Volatility and External Factors: The stock market is influenced by numerous external factors such as economic events, news, and investor sentiment. These factors can lead to sudden and unpredictable changes in stock prices. The model may struggle to accurately predict stock prices during periods of high volatility or when unexpected events occur.

- Data Quality and Preprocessing: The accuracy of the model heavily relies on the quality and cleanliness of the input data. Noisy or inconsistent data can negatively impact the model's performance and predictions.
- Limited Input Features: The current implementation only uses the historical closing prices as input features. However, stock prices can be influenced by various other factors such as volume, technical indicators, news sentiment, and macroeconomic data. Incorporating additional relevant features could potentially improve the model's predictive capabilities.

CHAPTER 5
CONCLUSION AND FUTURE WORK

5.1 Conclusion

The LSTM stock price prediction model implemented in this project demonstrates the ability to capture sequential dependencies and learn complex patterns in historical stock data. By utilizing LSTM neural networks, the model can make predictions on future stock prices based on past trends and behaviors. The model's performance is evaluated using metrics such as root mean squared error (RMSE), which provides an indication of its accuracy in predicting stock prices.

5.2 Future Work

- Feature Engineering: Incorporating additional relevant features, such as volume, technical indicators, news sentiment, or macroeconomic data, can enhance the model's predictive capabilities. These features can provide additional context and insights into stock price movements.
- Hybrid Models: Combining the strengths of multiple models, such as LSTM with other machine learning techniques or traditional statistical methods, may improve prediction accuracy. Hybrid models can leverage the strengths of different approaches to capture both long-term dependencies and short-term fluctuations in stock prices.
- Model Architecture Optimization: Experimenting with different LSTM architectures, such as varying the number of layers, units, or using bidirectional LSTMs, can potentially enhance the model's performance. Hyperparameter tuning techniques can also be employed to find optimal configurations.
- Regularization Techniques: To mitigate the risk of overfitting, incorporating regularization techniques like dropout or L1/L2 regularization can be explored. These techniques can help prevent the model from relying too heavily on specific patterns in the training data and improve its generalization capability.

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