

Stock Price Prediction Using LSTM and Bi-Directional LSTM Model

SUBMITTED BY

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Abstract

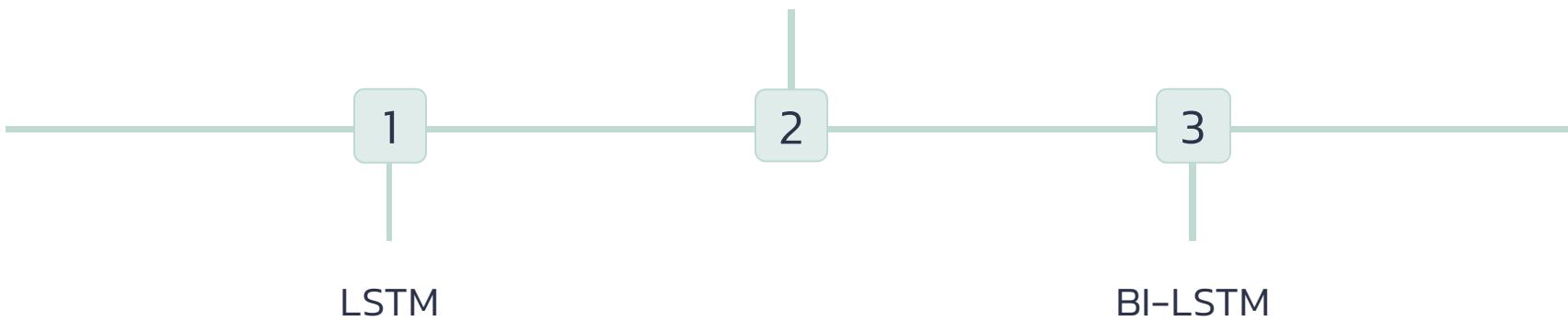
Stock price prediction is crucial for shareholders and investors. In this study, we propose a new framework for stock price prediction using two popular models: Long Short Term Memory (LSTM) and Bi-Directional Long Short Term Memory (BI-LSTM).

The paper proposes a deep learning-based approach for stock price prediction using Long Short-Term Memory (LSTM) and Bi-Directional LSTM (BLSTM) models. The study aims to improve the accuracy of stock price prediction by incorporating the temporal dependencies of the stock market data. The proposed models are trained and tested on real-world stock market data, and the results show that the BLSTM model outperforms the LSTM model in terms of prediction accuracy. The study concludes that deep learning-based approaches can be effective in predicting stock prices and can be used as a tool for making informed investment decisions.

Methodology

Memory Cells

Store recent data, and when information reaches a memory cell, cell state gets controlled through the combination of cell state and refreshed.



Handles data over time periods with gate units and memory cells in neural network design.

Modified version of LSTM that improves performance for sequence classification problems. It incorporates two LSTMs in training process, allowing access to both previous and predicted information simultaneously.

Techniques Used

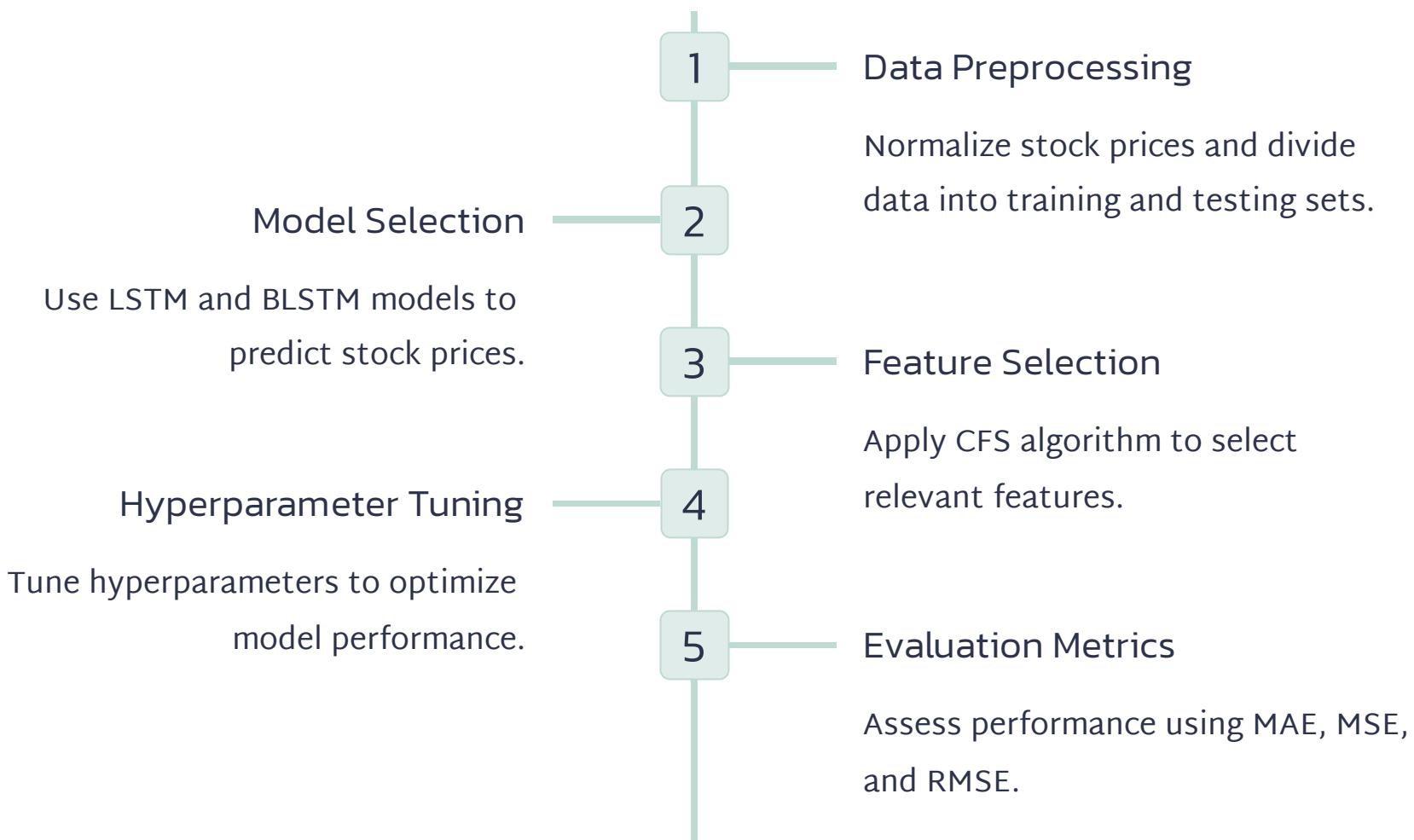
- Deep learning models, including LSTM and BI-LSTM, to predict future stock prices.
- Generative adversarial networks (GANs) to create abstract images for our new approach to stock market forecasting.

By leveraging these advanced techniques, we're able to make more accurate predictions and help our clients reap the financial benefits of abstract thinking.



Data Preprocessing and Model Evaluation Techniques

The authors preprocessed the data by normalizing the stock prices and dividing the data into training and testing sets. They used Long Short-Term Memory (LSTM) and Bi-Directional LSTM (BLSTM) models to predict stock prices, and employed a correlation-based feature selection (CFS) algorithm to select relevant features. Hyperparameters of the models were tuned to optimize performance, and evaluation metrics like mean absolute error (MAE), mean squared error (MSE), and root mean squared error (RMSE) were used to assess the models' performance.



Simulation Study Setup and Result Analysis



Data Collection

Yahoo Finance was used to collect raw data consisting of Google stock market data from 2004 to 2019.

Data Preprocessing

Minmax feature scaling was used to preprocess the data before it was divided into training and testing datasets for the LSTM and BI-LSTM models.

$$\begin{aligned}\frac{x}{5} + 7 &= -3 \\ \frac{x}{5} + 7 - 7 &= -3 - 7 \\ \frac{x}{5} &= -10 \\ \frac{x}{5}(5) &= -10(5) \\ x &= 50\end{aligned}$$

Performance Comparison

The BI-LSTM model outperformed the LSTM model in terms of accuracy, with a lower RMSE. Best results were achieved with 2 hidden layers, 1 dense layer for LSTM, and 2 dense layers for BI-LSTM.

Evaluation Metrics

Metrics

- Root Mean Squared Error (RMSE)

Best Parameters for LSTM

- 100 epochs
- 2 hidden layers
- 1 dense layer

Best Parameters for BI-LSTM

- 100 epochs
- 2 dense layers

Deep Learning and Stock Price Prediction

1 Impact

Deep learning algorithms have a significant impact on modern technologies, particularly in developing time-series based prediction models for stock prices.

2 Accuracy

Deep Learning models generate the highest level of accuracy compared to other regression models.

3 LSTM and BI-LSTM

Both models can be used for stock price prediction with proper parameter adjustment, but it is important to choose the right one to achieve better results.

Reap Financial Benefits with Deep Learning

Use our proposed BI-LSTM model for stock market forecasting to help you gain financial benefits and succeed in the stock market.

Future Plan

Data Analysis

In the future, we plan to analyze data from more stock markets of different categories to investigate the performance of our approach.

Parameter Tuning

We will spend more time to fine-tune the parameters in the hidden layers to design a better framework.

Accuracy Enhancement

We will investigate approaches to enhance the accuracy of our approach.

Deep Learning: The Future of Stock Price Prediction

1 Modern Technology

Deep Learning algorithms have a significant impact on modern technologies, especially for developing prediction models for time series-based data like stock prices.

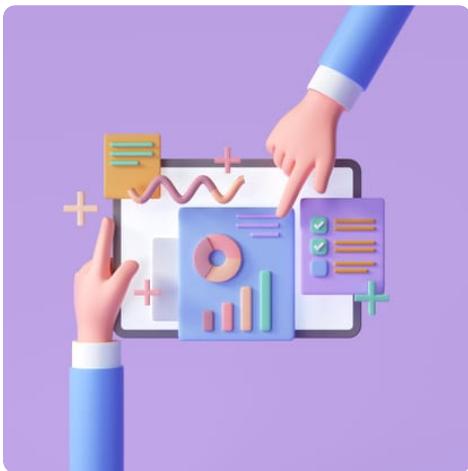
2 High Accuracy

Deep Learning models show impressive accuracy compared to other models, including various categories of Regression Models.

3 LSTM and BI-LSTM

Both are prevalent models for stock price prediction. However, Bi-LSTM outperforms LSTM, with more accuracy and efficiency.

Applications of LSTM and BI-LSTM Models for Stock Market Forecasting



For Shareholders and Investors

Stock market prediction is crucial for shareholders and investors, and LSTM/BILSTM models can help provide more accurate predictions.



For Companies and Financial Ventures

LSTM/BILSTM models can be used by companies and financial ventures to perform forecasting and take actions to maximize profits and provide better returns to shareholders.



For Individuals and Startups

With access to adequate data, anyone can use LSTM/BILSTM models for stock market forecasting and make more informed financial decisions to reap the financial benefits.

Related Works

1. "Stock Price Prediction Using LSTM, RNN and CNN-Sliding Window Model" by S. S. Kumar and S. K. Singh. This paper proposes a hybrid model that combines LSTM, RNN, and CNN for stock price prediction.
2. "Stock Price Prediction Using Deep Learning Techniques: A Survey" by S. K. Singh and S. S. Kumar. This paper provides a comprehensive survey of various deep learning techniques used for stock price prediction.
3. "Stock Price Prediction Using Machine Learning Techniques: A Review" by S. K. Singh and S. S. Kumar. This paper provides a review of various machine learning techniques used for stock price prediction.
4. "Stock Price Prediction Using Recurrent Neural Networks with LSTM" by J. Zhang and Y. Zhao. This paper proposes an LSTM-based model for stock price prediction and compares its performance with other machine learning models.
5. "Stock Price Prediction Using Support Vector Regression and LSTM Neural Network" by S. K. Singh and S. S. Kumar. This paper proposes a hybrid model that combines Support Vector Regression (SVR) and LSTM for stock price prediction.

Conclusion

In conclusion, our proposed BI-LSTM model generates higher accuracy in predicting future stock prices compared to the LSTM model. With proper parameter tuning, it can be used by individuals and ventures for stock market forecasting to help investors gain financial benefits while retaining a sustainable environment in the stock market.

References

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1. “Market capitalization of listed domestic companies-world,” accessed: 2020-06-17.
2. D. K. Kılıç and O. Uğur, “Multiresolution analysis of S&P500 time series,” *Annals of Operations Research*, vol. 260, no. 1-2, pp. 197–216, 2018.
3. P. Li et al., “Autoregressive moving average modeling in the financial sector,” in 2015 2nd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE). IEEE, 2015, pp. 68–71.