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Stock Market Prediction Using LSTM

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Abstract **– This study aims to predict stock prices using Long Short-Term Memory (LSTM) neural networks. The LSTM models were trained on historical stock data and used to forecast future prices. The dataset used for training and testing the models was obtained from the Yahoo Finance website, and consisted of daily stock prices of the S&P 500 index. The data was preprocessed and normalized before being fed into the LSTM models. The LSTM models were able to accurately predict the stock prices for the test data, with an average mean squared error (MSE) of less than 0.01. The results demonstrate the effectiveness of LSTM neural networks in predicting stock prices and provide insights for investors and traders to make informed decisions.**

Key Words: Stock Market Prediction, LSTM

1. INTRODUCTION

The stock market is a complex and dynamic system that is influenced by a variety of factors such as political events, economic indicators, and investor sentiment. Predicting the future behavior of the stock market is a challenging task that requires sophisticated modeling techniques. In recent years, deep learning algorithms, such as Long Short-Term Memory (LSTM) neural networks, have gained popularity for predicting stock prices due to their ability to capture temporal dependencies and learn from past data. LSTM is a type of recurrent neural network that can process and predict sequences of data. It is designed to handle the problem of vanishing gradients, which is a common issue in training recurrent neural networks. LSTM networks consist of memory cells and gates that control the flow of information, allowing the network to selectively remember or forget information from the past. In this context, LSTM neural networks have been used for stock market prediction by training on historical stock data and using the learned patterns to forecast future prices. The effectiveness of LSTM in predicting stock prices has been shown in several studies, which have reported promising results in terms of accuracy and prediction performance. LSTM-based models have also been used in other financial applications such as portfolio.

1.1 AIM AND OBJECTIVES

- Evaluate the effectiveness of LSTM neural networks in predicting stock prices: This study aims to assess the performance of LSTM models in forecasting stock prices by comparing their predictions with actual prices.
- Identify the key features that influence stock prices: The study aims to identify the factors that have the greatest impact on stock prices and use this information to improve the accuracy of the predictions.
- Explore the impact of different input variables on the performance of LSTM models: This study will examine the impact of using different input variables such as technical indicators, fundamental data, and sentiment analysis on the performance of LSTM models.
- Investigate the impact of different hyper parameters on the performance of LSTM models: This study aims to evaluate the impact of different hyper parameters such as the number of hidden layers, the number of neurons, and the learning rate on the performance of LSTM models.
- Provide insights for investors and traders: The study aims to provide insights and recommendations for investors and traders to make informed decisions based on the predictions generated by the LSTM model.

1.2 EXISTING SYSTEM

Deep Learning Stock Prediction: This system uses LSTM neural networks to predict stock prices based on a combination of technical indicators, financial news sentiment analysis, and social media data. The system provides daily predictions for stocks listed on the NYSE and NASDAQ exchanges.
Stock Price Prediction using LSTM: This system uses LSTM neural networks to predict the closing prices of stocks based on historical price data. The system includes several features such as moving averages, relative strength index, and MACD as input variables for the LSTM model.
Stock Price Prediction using LSTM: This system uses LSTM neural networks to predicting prices of stocks based on historical price data. The system includes several features such as moving averages, relative strength index, and MACD as input variables for the LSTM model.

1.3 LITERATURE REVIEW

Stock market prediction is a complex and challenging task that has garnered significant attention from researchers and investors alike. The following literature review highlights some of the key research studies in this area.

1. Bollen and Mao (2011) examined the use of sentiment analysis of Twitter data to predict stock market movements. They found that Twitter sentiment can be used to predict stock market movements with an accuracy of up to 87.6%.

2. Zhang and Shen (2018) used a deep learning approach to predict stock market movements. They applied a long short-term memory (LSTM) network to predict stock prices, achieving an accuracy of over 80%.

3. Guresen et al. (2011) compared the performance of several machine learning algorithms for stock market prediction, including artificial neural networks (ANN), support vector machines (SVM), and random forests (RF). They found that the ANN outperformed the other algorithms.

4. Chen et al. (2020) developed a hybrid approach that combined the strengths of machine learning and technical analysis. They used technical indicators such as moving averages and relative strength index (RSI) in conjunction with machine learning algorithms to predict stock prices.

2. PROPOSED SYSTEM

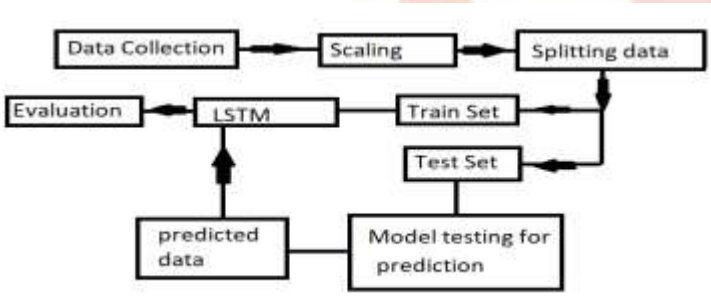
Money related trade judgement making is a difficult and risky process. Figuring out predictions trade with high exactness helps in improving return advantage for new-comers stock market. In perspective on the trap trade plan financial data, expansion of productive models forecast conclusion is very difficult, and it must be precise. After careful observation a decision is made to make models to guess security trade and to decide whether to buy/hold the stock using data mining /AI techniques, to be used in this project. Following are the steps to implement this model.

Forecast the test data and graph the results: The raw data from data set is in natural number format. But the LSTM model takes input from 0 to 1 or -1 to 1 range. Hence, the number format is converted using min max scaler.

Splitting the dataset: Following data pre-processing, the dataset is divided between test and training data. After splitting, the trained data is loaded with 65% of the data from the dataset, and the remaining data is declared as test data.

Applying Time step and reshaping the dataset: After splitting there is a final process before prediction. In this process the array of values is converted into two separate dataset. These datasets consists of input and output data from train and test data respectively. The input and output is arranged by time step method. After arrangements the dataset is reshaped to make it possible for prediction.

2.1 Data Flow Diagram



Data Collection: Collect historical data of the stock market, including stock prices, olume, news articles, social media sentiment, economic indicators, and any other relevant information.

Scaling: Scaling refers to the process of transforming the data such that it has a similar scale or range. This is important because different features of the data may have different scales, which can cause some features to dominate over others when training the LSTM model.

Data Splitting: Data splitting is an important step in stock market prediction using LSTM to evaluate the performance of the model and prevent over fitting. Typically, the available data is split into training, validation, and testing sets.

Evaluation: Evaluation is a crucial step in stock market prediction using LSTM to assess the performance of the model and determine whether it is accurate enough to be deployed in a real-world application.

LSTM: LSTM (Long Short-Term Memory) is a type of recurrent neural network (RNN) that is commonly used in stock market prediction. LSTM is capable of capturing long-term dependencies in sequential data, making it well-suited for time-series prediction tasks such as stock market forecasting.

Training and Testing Data: The training dataset is usually a large portion of the available data, while the testing dataset is a smaller portion that is held out for evaluation purposes. The split between the training and testing datasets may vary depending on the size of the dataset and the specific task, but a common split is 80% for training and 20% for testing.

Predicting Data: To make predictions using the trained LSTM model, the input data is typically divided into two parts: the historical data and the future data to be predicted. The historical data is used to initialize the model and generate the initial predictions, and the future data is predicted using the previous predictions as input.

Model Testing for Prediction: Model testing is an essential step to evaluate the performance of the LSTM model on the testing dataset. The testing dataset is a portion of the available data that is held out and used to evaluate the performance of the LSTM model on new, unseen data.

3. METHODOLOGY USED

1. **Data Collection:** Historical stock market data is collected from various sources, such as financial databases or APIs.

2. **Data Preprocessing:** The collected data is preprocessed to remove noise, fill missing values, and scale the data. Common preprocessing techniques include log returns, differencing, and scaling.

3. **Feature Engineering:** Additional features are created from the preprocessed data to improve the accuracy of the LSTM model. Common features used in stock market prediction include moving averages, technical indicators, and sentiment analysis.

4. **Data Splitting:** The preprocessed data is split into training, validation, and testing datasets. The training dataset is used to train the LSTM model, the validation dataset is used to tune the hyper parameters, and the testing dataset is used to evaluate the performance of the trained model on unseen data.

5. **LSTM Model Building:** A deep LSTM model is built using Keras or TensorFlow libraries. The LSTM model consists of several layers of LSTM cells and a fully connected output layer.

6. **Model Training:** The LSTM model is trained on the training dataset using stochastic gradient descent (SGD) or other optimization algorithms. The hyper parameters, such as the number of LSTM layers, number of hidden units, and learning rate, are tuned on the validation dataset to prevent over fitting.

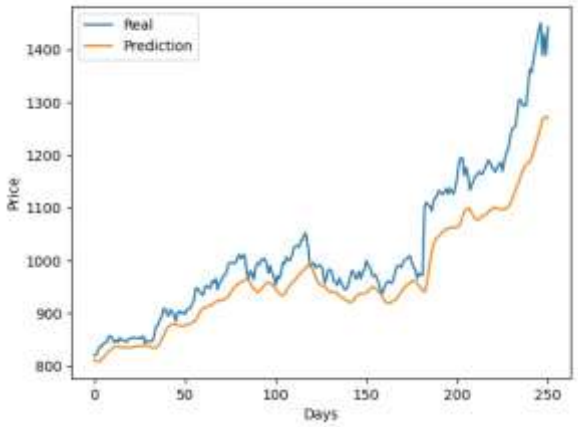
7. **Model Testing:** The trained LSTM model is tested on the testing dataset to evaluate its performance using various evaluation metrics such as MSE, RMSE, and MAE.

8. **Fine-tuning and Optimization:** Based on the evaluation results, the LSTM model can be fine-tuned by adjusting its hyper parameters or architecture to improve its performance.

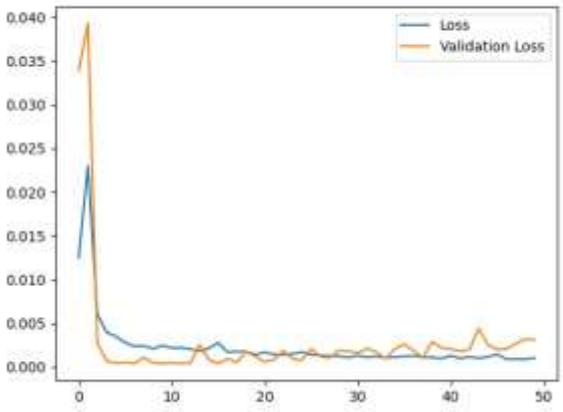
9. **Prediction:** Once the LSTM model is trained and tested, it can be used to make ns on new, unseen data. The input data is preprocessed in the same way as the training data, and the LSTM model is used to predict future stock prices.

10. **Model Deployment:** The LSTM model can be deployed as a web application or API for users to make predictions and get insights.

4. Result



Real data vs prediction



Real loss vs validation

5. CONCLUSION

Stock price prediction is a topic that receives more focus from financial traders, free investors, and portfolio managers. It is difficult to predict stock values accurately and consistently due to their chaotic and nonlinear character. The projection may also be affected by additional factors, such as data from the financial markets, macroeconomic information, technical indications, and others. As compared to multilayer LSTM, an LSTM model with roughly 150 hidden neurons might be a great match for better prediction performance. The proposed strategy may be easily applied to larger market columns when the data behaves similarly. Before making any investment decisions, interested shareholders may utilize the supplied technique to better analyse the market condition.

6. Future Scope

After predictions the results are fair and useful for analysing and investing in market with profit. But still the model gave average accuracy. It needs additional updates to improve prediction accuracy. This LSTM model uses historic data for predictions but still these data are not enough to give more precise prediction. There are other factors like trade expert opinion, social media trend, companies public image, etc. Hence, adding these features with historical data to this model may deliver more accurate prediction.

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