Stock Market Prediction Using LSTM

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Abstract

Forecasting stock prices has been a difficult task for researchers and analysts. For good and successful investment many investors, traders, and analysts are keen interested in future estimation of the stock price. For estimating the future price of stock good forecasting method should be implemented which will help the investor and traders to trade in markets and get good returns from the market. This report focuses on the usage of a type of recurrent neural network (RNN) which is known as Long Short Term Memory (LSTM) to predict stock values

1. Introduction

Financial markets are highly volatile and depend on a lot of financial indicators for price fluctuation. Also, external factors also play a vital role in the fluctuation of stock prices. However, as the technology is getting advanced, the opportunity to gain a steady fortune from the stock market is increased and it also helps experts to find out the most informative indicators to make a better prediction. The prediction of the market value is of great importance to help in maximizing the profit of stock option purchase while keeping the risk low.

Recurrent neural networks (RNN) have proved one of the most powerful models for processing sequential data.

Long Short-Term memory are a special kind of RNN, capable of learning long-term dependencies introduces the memory cell, a unit of computation that replaces traditional artificial neurons in the hidden layer of the network. With these memory cells, networks are able to effectively associate memories and input remote in time, hence suit to grasp the structure of data dynamically over time with high prediction capacity.

The report that I have presented, modeled, and predicted the stock price of Apple Stock using LSTM. I have collected 5 years of historical data of Apple Stock and used it for training and validation purposes. The next section of the report will be methodology where I will explain each process in detail. After that, I will have pictorial representations of the analysis that we have used, and I will reason about the results achieved for the training and testing data and also, I will predict the future 30 days for Apple Stock.

2. Methodology

For this experiment, I have considered Recurrent Neural Network and Long Short-Term Memory.

This section we will discuss the methodology of our system. Our system consists of several stages which are as follows: -

• **Stage 1**: Data Collection:
In this stage, the historical stock data is collected from https://api.tiingo.com API website and this historical data is used for the prediction of future stock prices.
The dataset consists of 1258 records and 8 features.

• **Stage 2:** Feature Selection:
In this layer, only the features which are to be fed to the neural network are chosen. We will choose the feature from the date and closing price of the stock.

• **Stage 3:** Data Preprocessing:
The pre-processing stage involves
a) Data integration: Integration of data files through the use of API.
b) Data cleaning: Fill in the missing values
c) Data discretization: Part of data reduction but with particular importance, especially for numerical data
d) Data transformation: Normalization of the data using min-max transformation.
After the dataset is transformed into a clean dataset, the dataset is divided into training and testing sets for evaluation. Here, the training values and the testing values are split based on the date function in the ratio of 3:1. Later converted the input vector and output vector based on the window frame of 100.

• **Stage 4:** Neural Network Architecture:
Our LSTM model is composed of a sequential input layer followed by 3 LSTM layers and then finally a dense output layer with linear activation function.
The architecture for our LSTM Model is:

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
lstm_3 (LSTM)                (None, 100, 200)          161600
_________________________________________________________________
lstm_4 (LSTM)                (None, 100, 200)          320800
_________________________________________________________________
lstm_5 (LSTM)                (None, 200)               320800
_________________________________________________________________
dense_1 (Dense)              (None, 1)                 201
=================================================================
Total params: 803,401
Trainable params: 803,401
Non-trainable params: 0
_________________________________________________________________
```

• **Stage 5:** Training Neural Network
In this stage, the data is fed to the neural network and trained for prediction assigning random biases and weights. For the training model, we used Adam optimizer and a batch size of 128 with 100 epochs.

• **Stage 6:** Output Generation:
In this layer, the output value generated by the output layer of the RNN is compared with the target value. The error or the difference between the target and the obtained output value is minimized by using back propagation algorithm which adjusts the weights and the biases of the network.

• **Stage 7**: Validation on testing and training data
Here, we measure the performance of the model using Root mean square error (RMSE) on both the data for validating model accuracy.

3. Analysis

For analyzing the efficiency of the system, we are used the Root Mean Square Error (RMSE). The error or the difference between the target and the obtained output value is minimized by using RMSE value. RMSE is the square root of the mean/average of the square of all of the error. The use of RMSE is highly common and it makes an excellent general purpose error metric for numerical predictions. Compared to the similar Mean Absolute Error, RMSE amplifies and severely punishes large error.

$$RMSE = \sqrt{\sum_{i=1}^{n} \frac{(\hat{y}_i - y_i)^2}{n}}$$

4. Experimental Results

a) Results for the testing and training data evaluation is

Parameters	Testing Evaluation using RMSE	Training Evaluation using RMSE
Close Price	245.56	167.75

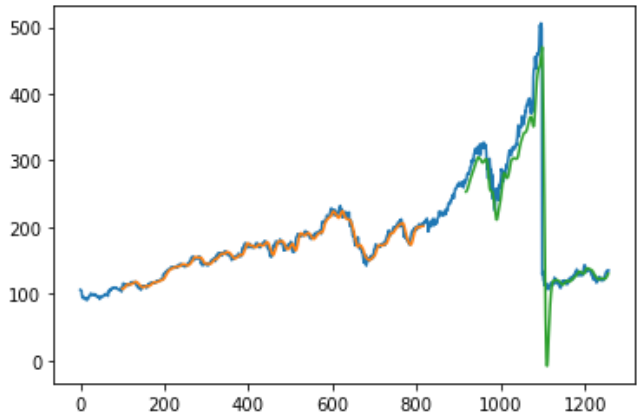

Fig. 1.1

The fig 1.1 shows plotting of training and testing data w.r.t the original data. Wherein, original line represents training data, green line is for training data and blue is the original data.

b) Results for Prediction of future 30 days

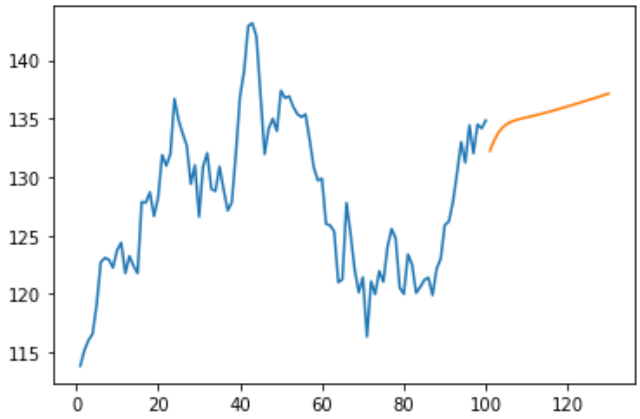

Fig 1.2

The fig 1.2 shows prediction of future 30 days which is highlighted using orange line. The prediction graph states that stock price for apple will go up to ~$138.

5. Conclusion

The popularity of Stock market trading is growing significantly which is encouraging researchers to find out new methods and techniques for forecasting as it helps investors and traders to trade in markets. In order to help investors and traders benefit from the stock market, a good forecasting model is required.

In this work, I have used one of the most sophisticated forecasting techniques using Recurrent Neural Network and Long Short-Term Memory unit which helps investors and traders, or any person interested in the stock market by providing them a future prediction of the returns they will get from the stocks.

6. References

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