2022 International Conference on Innovative Computing, Intelligent Communication and Smart Electrical Systems (ICSES) | 978-1-6654-7413-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICSES55317.2022.9914347

Stock Price Prediction using Deep Learning and FLASK

A. Lakshmanarao[1], M. Raja Babu[1],Chabi Gupta[2]A S.Gani Lakshmi[3]

[1]Department of IT, Aditya Engineering College, Surampalem, India
[2]School of Commerce, Finance and Accountancy, Christ University,India
[3]Department of CSE, Mallareddy College of Engineering Maisammaguda,Dhulapally,Secunderabad

E-mail : laxman1216@gmail.com,raajababu.makineedi@gmail.com,chabi.gupta@christuniversity.in,lakshmi530.lalitha@gmail.com

Abstract-The forecasting of stock prices is one of the most explored issues, and it attracts the attention of both academics and business professionals. It is quite difficult to make predictions about the stock market, and it takes extensive research into the patterns of data. With the expansion of the internet and indeed the growth of social media, online media and opinions frequently mirror investor sentiment. The volatility and non-linear structure of the financial stock markets makes accurate forecasting difficult. One of the sophisticated analysis techniques that is being used by academics in a variety of fields is the neural network. In this paper, we proposed deep learning techniques for google stock price prediction. A dataset from Kaggle was collected and applied deep learning techniques RNN, LSTM variants. We achieved better results with Bidirectional LSTM. We also created a web app for stock prediction using Christ University python FLASK.

Keywords— Stock Prediction, Kaggle, RNN, LSTM, Deep Learning.

I.INTRODUCTION

Shares of publicly traded corporations can be issued and traded on the equity capital markets. Stocks, also known as shares, tackle fragmentary ownership of an organization, commodity, or assurance, and the stock market serves as a marketplace for investors to buy and sell accountability for investment grade resources or offers[1]. If a company wants to raise money to grow its business or pay off debt, it can make its business public and start selling shares of stock, which are then traded in online marketplaces, or "stock exchanges". The share price is usually employed as a sentiment gauge, and it has the potential to have an impact on the economy's growth. As opposed to obtaining money as in the form of cash, the company chooses to issue shares, thereby reducing the likelihood of the company generating losses, accruing debts, and suffering interest costs. Because the stock market is such a dynamic and unpredictable industry, stock market forecasting automatically becomes a major topic. It's difficult for empirical models to accounting for the influence of many other factors on stock price movements, and they make a lot of data assumptions that aren't always met. As a result, machine learning has been increasingly popular in stock price forecasting in recent years, and many more acceptable stock forecasting models have already been presented. In instance, forecasting the behavior of a finance stock only on the basis of its prior daily closing is also not a simple operation to undertake. Even more accurate algorithms have arisen throughout time to assist in identifying when to sell or purchase a commodity, and both financial institutions and publicly traded businesses now extensively rely on automated trading to choose how to behave on the financial market. A well-known difficulty in economic time series forecasting stems from the widely accepted semi-strong form of economic performance as well as the extremely high degree of noise in financial time series data. Because the stock price is continually changing to react to current notifications, stock price prediction is a sequence of ongoing projections. As a result, using artificial intelligence to forecast future market movements is extremely difficult for computer scientists. This research presents a novel stock price prediction approach based on deep learning technology.

II. PREVIOUS WORK

Yang Li [2] et. al proposed deep learning ensemble techniques for stock price prediction. They applied blending model with two RNNs to combine with Neural network model and achieved less error rates. M.Hiransha [3] et. al applied various deep learning techniques for stock prediction and achieved good outcomes. They applied Multi-layer Perceptron and

achieved better results for stock prediction. Later, they applied CNN and even achieved better results. The study's main goal in [4] is to apply machine-learning algorithms to estimate the Karachi Stock Exchange's (KSE) market performance on day close. The predictions model takes a number of qualities as input and anticipates the market as good or bad. The model's columns are price of oil, silver & gold, rate of interest, foreign-exchange-rates, news& and social media feeds. The techniques used in their experiments are Multi-Layer Perceptron, Radial Basis Function (RBF), and SVM. machine learning techniques are contrasted. When compared to other approaches, the MLP performed the best. The oil rate attribute was the most useful factor in anticipating the market. The findings of this study show that machine learning approaches may accurately anticipate stock market performance. Machine learning's Multi-Layer Perceptron algorithm correctly predicted 70% of market performance. In [5] authors applied RNN for stock prediction. The main aim of this work is to evaluate a strategy that combines RNNs with useful input variables to provide an enhanced and successful way for forecasting the next-day market. LSTM was used in the stock-prediction model. The case study is based on Standard & Poor's (S&P500) and NASDAQ. The final model outperforms the previous models in terms of predicting the stock closing price. This is the case study's most important finding. In [6], for predicting stock price, multi category news events are employed as features. The multi category_events are based on a feature word dictionary that has already been developed. We've also looked at the association between stock price fluctuations and particular multi-category news using both neural networks and SVM models. The predefined multi-category news events outperformed the baseline bag-of-words feature in predicting stock price trend in the experiments. According to this study, short term prediction is superior to long term prediction. In [7], the primary goal is to conduct a comparative analysis of three methods SVM, MLR, ANN. The prognosis for the future day's market price will be decided by the month-wise prediction and the day-wise prediction. Using the identified algorithm in conjunction with sentiment analysis, it is possible to anticipate the stock price. The MLR technique, which finds the relation among several volumes and stock prices is identified. According to the findings of the study, deep-learning techniques outperforms SVM. Alessio Staffini [8] proposed a deep GAN model for stock price prediction. For experiments they used FTSE MIB dataset. After conducting several experiments, they concluded that their proposed model outperforms previous models.

III. Research Methodology

We proposed deep learning techniques for stock price prediction. The proposed system was shown in Fig-1.

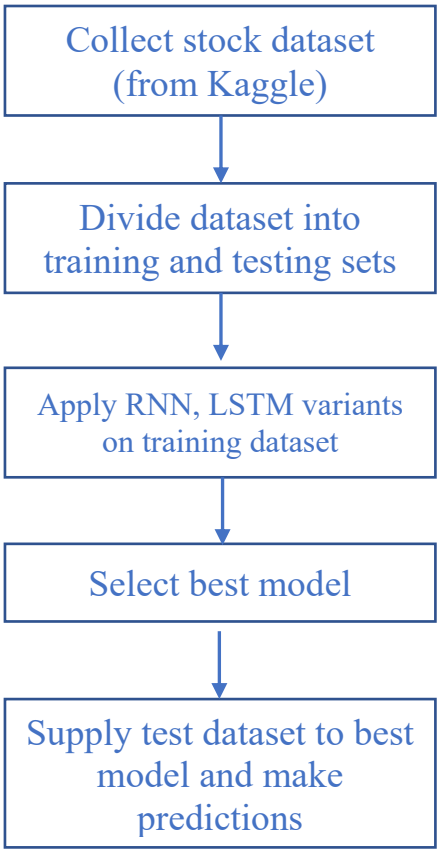

Fig. 1 Proposed Framework for stock price prediction

Stock price dataset was gathered from Kaggle [9]. The dataset consists of 1258 stock prices as train set and 20 stock prices in test set. We considered open stock process for our analysis. We applied RNN, LSTM for predictions. The reason for this is that RNN is more suitable for time series data. After applying RNN, we also tested with LSTM. We implemented RNN and LSTM with various time steps ranging from 10 to 60. The better results achieved with 60-time steps. Table-I shows information about dataset and its division.

TABLE 1 DATASET

Plant Name	No. of samples
Training samples	1258
Testing samples	20

Recurrent Neural Networks

RNN is a model which is well suited for sequential_data. As stock prices are saved as a sequence of values, RNN better suited for this regression problem. But there is a problem in RNN called as vanishing gradient which is addressed by LSTM.

LSTM

LSTM is advancement to RNN. The LSTM is indeed a kind of RNN that is particularly good at learning long-term sequences. Schmidhuber&Hochreiter first used them in 1997, when they were first introduced. In order to avoid lengthy dependency issues, it is expressly intended to do so. Its method of operation is to retain large sequences of information for an extended period of time. The Input Gate, Forget Gate, and Output Gate are the three gates that the LSTM employs as part of its operation. Using the forget gate, you may pick which information you should pay attention to and which should be discarded. The sigmoid function receives input from the current input X(t) and the hidden state h(t-1). Values between 0 and 1 are generated via sigmoid. The input gate is in charge of determining what goes into long-term memory. Input and short-term memory from the previous phase are the only sources of data for this algorithm. The outcome of the later hidden state is identified by the output gate. Output state is a record of what the user has previously done.

The vanishing gradient problem was solved by using memory to store previous data values. There are several variations in LSTM like Vanilla LSTM, Stacked LSTM, Bidirectional LSTM etc.

Stacked LSTM

An LSTM with more LSTM layers is known as Stacked LSTM. An LSTM top layer sending a value in sequences to LSTM in bottom layer. One output every input time step, as opposed to one outcome time step with all inputs time scales.

Bidirectional LSTM

Bidirectional LSTM is the ability to allow any neural network to store sequence data in both backwards and forward orientations. The Stacked LSTM architecture was shown in figure-2.

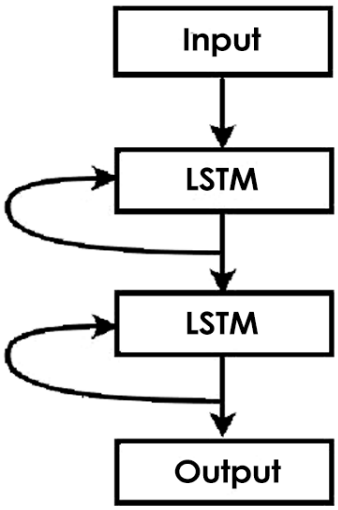

Fig. 2 Stacked LSTM Architecture

GRU

The GRU is similar to an LSTM having forget gate, but it has a smaller number of parameters because it does not have an output gate.

IV. EXPERIMENTS AND RESULTS

All the experiments in this work are conducted using python language. Python provides several packages for ML and DL tasks. Deep Learning techniques can be implemented using tensor flow, keras, pytorch etc. In this paper, we used keras package for conducting experiments. All the experiments are conducted in google Collaboratory. The Kaggle dataset is available as two sets namely training & Testing sets. Train set has 1258 samples where as test se has 20 samples. Predicting stock price is a supervised learning problem, because the dataset has both input and output. So, we can apply any supervised machine learning algorithms also. But the problem with ML algorithms is that, they are not more suitable for time series data. For time series data, we need more robust model which needs to store previous data samples also. So, we applied deep learning for stock prediction. First, we applied our proposed algorithms to train set and build a model. Then, that model is used for making predictions with testing dataset. For training, we have several options in making a decision for number of previous stock prices. We tried several time stamps like 10, 20, 30, 40, 50, 60. After doing all experiments, identified that the previous 60 stock values are better option for predicting the next stock price. For all the

experimentation, we used 'adam' as optimizer. We also tested other optimizers, but 'adam' performed better than other optimizers. We also added dropout layers to neural network models for reducing overfitting.

Applying RNN

The stock values are created as a datastructure such that every value is predicted based on the previous 60 stock values. Later prepared dataset was trained using RNN. The loss value (MSE) for this experiment is 0.0093. The number of epochs for this experiment is 30. We conducted experiments with several number of epochs 20,30,50,100. But after all experiments, we identified that 30 epochs are enough for selected dataset.

Applying Stacked LSTM

Next, the same dataset was trained using LSTM with multiple layers. The loss value (MSE) for this experiment is 0.0029. The number of epochs is 30. Applying Bidirectional LSTM

Next, the same dataset was trained using Bidirectional LSTM with multiple layers. The MSE loss value (MSE) for this experiment is 0.0016. The number of epochs is 30.

Applying GRU

Next, the same dataset was trained using GRU with multiple layers. The MSE loss value (Mean-Squared-value) for this experiment is 0.0026. The number of epochs is 30. GRU performed similar way as Staked LSTM.

Comparison of Model

All the applied models are compared with respect to mean squared error. The other possible measures for comparing regression models are "mean-absolute-error" and "root_meansquared_error" values. We used MSE because it is sufficient to use one error measure (like MSE or RMSE) for comparing various models. Table II shows the comparison of MSE values after applying several models for stock prediction. From the table-II, it is observed that all the four models performed very well for predictions. The Mean Squared Values are not having more difference for all algorithms. But Bidirectional LSTM has less mean-squared-error value among all four models. It has given MSE error value of 0.0016, which is lesser than all other models. Figure-3 shows the comparison chart for all models.

TABLE 2 COMPARISON OF MODELS

Model	Mean Squared Error
RNN	0.0093
Stacked LSTM	0.0029
Bidirectional LSTM	0.0016
GRU	0.0026

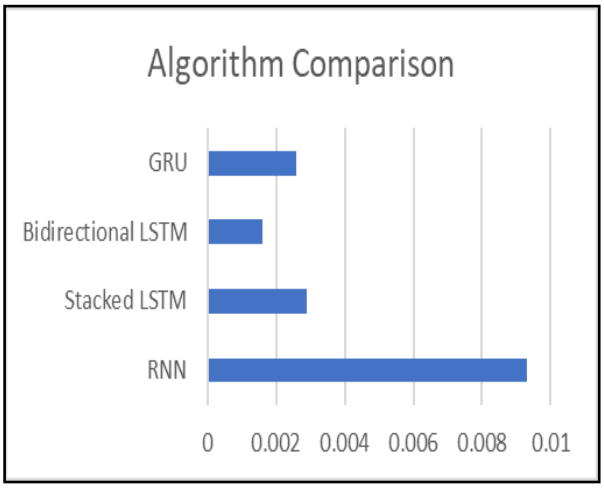

Fig.3 Model Comparison

Applying model for predicting stock prices

The best model is used for testing data for stock price prediction. Fig-4 shows the Predicted values and actual values. Although there is some variation between actual and predicted stock prices, but it shows how the prices are going on in near future. This prediction model is helpful for predicting the future stock estimation value for novice user who are not having much more knowledge on stock price values.

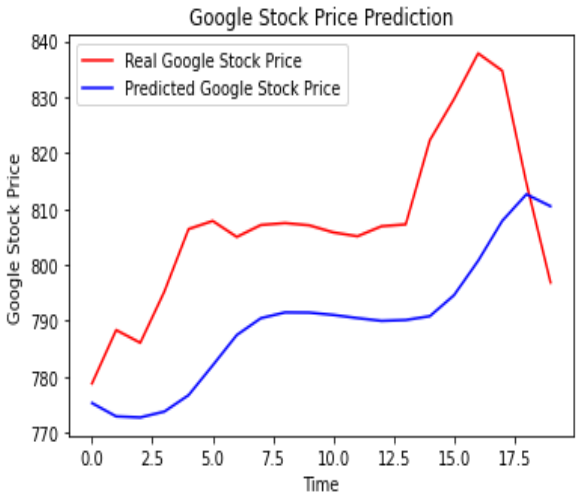

Fig. 4 Predcited Stock Prices

Stock Price Prediction WebApp

We build a web app for stock price prediction after finishing the encoding technology and deep learning algorithm. This was accomplished using Python Flask. This application was built based on the previous ten stock prices. The bidirectional LSTM model good results. So, this webapp was built based on that model only. The user enters ten stock prices in a sequence. After reading these 10 stock prices, the webapp reads these values and it applied pretrained deep learning model and finally returns predicted stock price. The final model with built with 60 previous stock prices. But entering 60 values to web app may be difficult for the users. So, we aerated a webapp for entering 10 previous stock price values only. However, we can change the number of previous stock values as per requirements The working process of stock price prediction app was shown in figure-5.

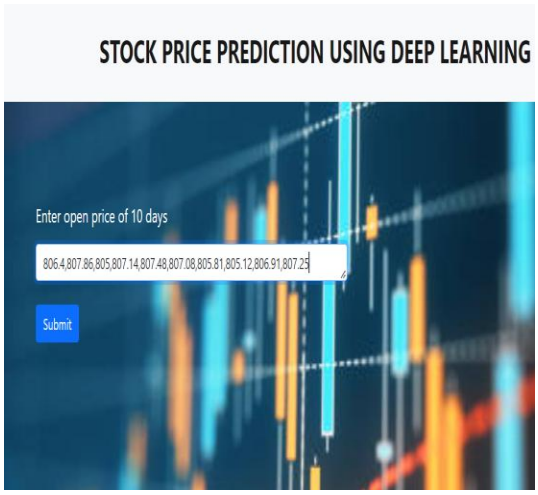

Fig. 5 Predicting Stock Price using webapp

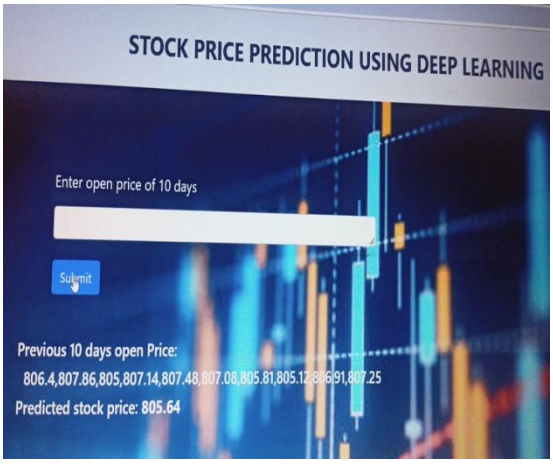

Fig. 6 Stock Price Prediction WebApp

V. Conclusion

We applied RNN techniques for stock price prediction. First, we downloaded a dataset from Kaggle, which contains google stock prices from 2012 to 2016. Dataset has 1258 samples of stock price values in training set. The test set is separately given for 2017 with 20 stock prices. We applied RNN, LSTM variants, GRU on training dataset and identified that Bidirectional LSTM performing better than remaining techniques. Bidirectional LSTM achieved less mean squared error values than other models. Later we build a webapp for stock price prediction with finalized model.

References

[1] D.Shah.,H.Isah,F.Zulkernine , "Stock market analysis: A review and taxonomy of prediction techniques," International Journal of Financial Studies, 7(2), p.26,2019.

[2] Yang Li,Y.Pan, "A novel ensemble deep learning model for stock prediction based on stock prices and news" Int J Data Sci Anal 13, 139–149,2022.

[3] M.Hiransha, Gopalakrishnan E.A., Vijay Krishna Menon, Soman K.P, "NSE Stock Market Prediction Using Deep-Learning Models," Procedia Computer Science,Volume 132,2018,Pages 1351-1362,ISSN 1877-0509.

[4] M. Usmani et.al, "Stock market prediction using machine learning techniques," International Conference on computer and Information Sciences,pages. 322–327, 2016,IEEE.

[5] T. Gao et.al, "Applying long-short-term-memory neural networks for predicting stock closing price," International Conference on Software Engineering and Service Science, 2017,IEEE.

[6] Y. Lei et.al, "Multi-Category Events Driven Stock Price Trends Prediction," International Conference on Cloud Computing and Intelligence Systems, Nanjing, China, (pages. 497–501), 2018.

[7] R. Y. Nivetha and C. Dhaya, "Developing a Prediction Model for Stock Analysis," in 2017 International Conference on Technical Advancements in Computers and Communications (ICTACC), Melmaurvathur, India,(pp: 1–3), Apr 2017.

[8] Alessio Staffini, "Stock Price Forecasting by a Deep Convolutional Generative Adversarial Network," Front. Artif. Intell., 04 February 2022.

[9] https://www.kaggle.com/medharawat/google-stock-price.