E-ISSN 2581 – 7957
P-ISSN 2277 – 3916
CVR Journal of Science and Technology, Volume 20, June 2021
DOI: 10.32377/cvrjst2006

Analysis of Stock Market Price Prediction of Indian Finance Companies using Artificial Neural Network Approaches

Dr. D. Durga Bhavani[1] and Ch. Sarada[2]
[1]Professor, CVR College of Engineering/CSE Department, Hyderabad, India
Email: drddurgabhavani@gmail.com
[2]Asst. Professor, CVR College of Engineering/CSE Department, Hyderabad, India
Email: sharada.ch@gmail.com

Abstract: **Organizations get their capital by giving portions of stock; these are the units into which partnerships partition their possession. Shares are commonly called stocks. A solitary portion of the stock addresses fragmentary responsibility for enterprise in relation to the absolute number of offers. Preference shares are the shares that promise the holder a fixed dividend, whose payment takes priority over that of the ordinary share dividends.**

The stock market prediction has attracted much attention from academia as well as business. However, it is a challenging research topic in which many advanced computational methods have been proposed but they have not yet been attained a desirable and reliable performance. In this paper, stock market prediction analysis done specially on Indian finance companies' market. Analysis accomplished using three approaches Simple RNN, Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU).

Index Terms: **Simple RNN, Long Short-Term Memory, Gated Recurrent Unit.**

I. INTRODUCTION

``A stock market is an establishment where people and computers purchase and sell portions of organizations. It is a conglomeration of purchasers and venders of stocks (additionally called shares). Shares are a little piece of an organization, which address proprietorship claims on organizations; these may incorporate protections recorded on a public stock trade just as those just exchanged secretly. Examples of the latter include portions of privately owned businesses offered to financial specialists through value crowd funding stages. Stock exchanges list common equity and other security types, e.g., corporate bonds and convertible bonds. The reason that affects the price is the balance between supply and demand. If many buyers want to buy a stock, the price goes up. On the off chance that there are bigger number of dealers than purchasers, the cost goes down. Popular stock exchanges are NSE–National Stock Exchange and BSE-Bombay Stock Exchange.

In the past a few decades, predicting of the financial exchange is acquiring consideration as the productivity of speculators in the financial exchange fundamentally relies upon consistency. If the prediction of the market's direction is successful, the investors can yield enough profits out of the market using projection. Complex connections among sources of info and yields may not generally permit us to discover designs. The ANN is gaining much attention these days because of its capability of solving such problems. It has a robust ability to discover the relationship in the input dataset without a priori assumption of the relation between the input and the output data. It is also beneficial as it can construct a model that distinguishes obscure, shrouded designs in the information, which can be useful for the purpose of prediction. In a chaotic system, like the stock market, in which many the known and the unknown factors affect the stock price, there is no significant mathematical relation between the characteristics and the cost can be found. There is no law exists which governs the stock prices using the underlying factors. Taking this into consideration, the application of neural networks would be very beneficial in predicting the stock market [1]. In this paper, market price prediction is analyzed using Artificial neural network approaches Recurrent Neural Network (RNN), Long Short-Term Memory (LSTM), and Gated Recurrent Unit (GRU).

II. RELATED WORK

The prediction of stock market movement is an important area of financial forecasting. Notwithstanding years of study and the newest technology, it seems that no technique continually works. Fundamental analysis frequently works the best over extended periods, where technical analysis is more appropriate for short term trading. Researchers have made many attempts to predict the performance of the financial market. Many models or approaches like artificial intelligence techniques such as Neural Network [8] and Fuzzy [14] Systems and data mining techniques such as random walk theory is proposed. However, it isn't easy to interpret their results. They are unable to view the nature of interactions between technical indicators and stock market fluctuations. The traditional techniques cover not all the possible relation of the stock price fluctuations. There are new approaches to known in-depth analysis of stock price variations like RNN [2], LSTM [3], and GRU [4]. In this paper, analysis is done on stock market prediction using Simple RNN [2], Long Short-Term Memory (LSTM) [3] and Gated Recurrent Unit (GRU) [4].

Stock market prediction using Artificial Neural Network is one approach to predict the stock market. In one of the analysis, NASDAQ's stock market predicted using ANNs. It shows a good performance for NASDAQ stock market prediction [10]. The advantage of these networks is that it eases an approximation of any input or output and the major disadvantage is that they train very slow and requires lots of training data.

Many things like global and local economy, political news and unusual events like COVID-19 pandemic impact the stock market. In one of the analysis, Traditional Machine Learning algorithms and Deep Learning algorithms are used to predict the stock market using news headlines [7]. In this analysis, Deep Leaning approach gave better results than Machine Learning approach [7].

Stock market is highly sentiment based. Lot of analysis done on the impact of sentiment on stock market prediction. One such approach is based on Naïve Bayes [6].

Aparna Nayak, M. M. Manohara Pai and Radhika M. Pai [15] have attempted to the proposed two stock market prediction models, one for daily and the other for monthly prediction. Historical data is combined with sentiments in daily prediction model. In monthly prediction approach, monthly trends are compared and observed less correlation among monthly trends. Decision tree and SVM [9] algorithms used in daily prediction and decision tree gave better result.

Guizhu Shena, Qingping Tana, Haoyu Zhanga, Ping Zenga, Jianjun Xua [16] have replaced the last layer of GRU with SVM to predict HIS, DAX and S&P 500 index. Results proved that the modified GRU works effectively for index prediction [12]. However, this approach is to be explored on multiclass classifiers to check its efficiency.

Mohammad Obaidur Rahman, Md. Sabir Hossain, Ta-Seen Junaid, Md. Shafiul Alam Forhad, Muhammad Kamal Hossen [4] have made an attempt to improve the stock market prediction accuracy by modifying the GRU structure. In this approach, GRU is modified to eliminate local minimum problem, stochastic gradient descent problem. Results are promising. However, this system gave bad results in some cases. Further analysis is required to know its consistency.

Hiransha Ma, Gopalakrishnan E.Ab, Vijay Krishna Menonab, Soman K.P. [17] have worked with four deep learning approaches MLP, RNN, LSTM and CNN [18] for the prediction of NSE and NYSE. It shows that DL models are more efficient than Linear models like ARIMA because linear models are not capable of identifying underlying dynamics within various time series. CNN performed better among all four models as it can catch the unexcepted changes in the system.

Many approaches are being used in stock market prediction. The proposed system is purely analysis based and stock market prediction analysis is done on certain Indian finance companies like Power Finance Corporation Ltd., Mahindra and Mahindra Financial Services Ltd., Bajaj Finance Ltd.

III. Proposed System

The proposed system analyses recurrent neural network (RNN), Long Short-Term Memory (LSTM), and Gated Recurrent Unit (GRU) neural network approaches for stock market prediction. The three different cells RNN, LSTM and GRU have been compared and found GRU with better result. Analysis has been done on certain Indian finance companies' stock.

The proposed system is developed in Python. Power Finance Corporation Ltd., Mahindra and Mahindra Financial Services Ltd., Bajaj Finance Limited stock prices are used for the analysis.

Fig. 1 shows the operating procedure of the proposed System. In this paper, analysis has been done on three top Indian private finance companies dataset named, Power Finance Corporation Ltd., Mahindra & Mahindra Financial Services Ltd., Bajaj Finance Limited. Models were created and tested using three approaches: Recurrent Neural Network (RNN), GRU, and Long short-term memory (LSTM).

In the proposed approach, Models trained based on closing stock feature. The following algorithm describes steps followed in the proposed approach.

Algorithm: Stock Market Prediction
Input: Stock Dataset
1. Import Stock Dataset
2. Divide Stock Dataset into Training set and Test set
3. Data normalization
   3.1. Scale Training set features using Min Max Scaler technique.
4. Incorporate Timesteps into Data
   Create data in 60 timesteps and then convert it into an array. Then, create 3D array with X_train samples and 60 timestamps.
5. Create simple RNN, LSTM and GRU Models.
6. Make predictions on Test Dataset with all three models.
7. Plot the results.
8. Repeat 1 through 7 for every Dataset.
9. Finally, compare results of all three Models.

After the dataset is imported, Normalization to be done. Normalization of data improves performance of the model. In this development, data is normalized using Min Max Scaler method and the resultant is given as the input to the models.

MinMaxScaler transforms all the features into the range [0,1] where 0 is the minimum and 1 is the maximum value of a feature. Scaling improves model performance.

Every approach used in this analysis needs to give 3D array data as input to form the model. To create a 3D array, data created in 60 timesteps, then it is converted into an array. Finally, the data converted into a 3D array with X_train samples, 60time stamps and given as an input to form the model.

Once the model is trained, it is tested with test data and resultant is plotted. All three models' comparison result is also visualized.

The Root-Mean-Square Error (RMSE), Mean Absolute Percentage Error (MAPE) and Mean Absolute Error (MAE), measures are used to evaluate Models.

The Root-Mean-Square Error (RMSE) is a regularly used metric to determine the variances between predicted rate and actual rate of stock.

The Mean Absolute Error (MAE) is another commonly used metric in stock market prediction. It measures the absolute average difference between predicted and actual stock market rates.

Mean Absolute Percentage Error (MAPE) is another popular measure for stock market prediction analysis and the best measure if there are no extremes to the data. The MAPE represents the error in the form of percentage, so it is easy for people to use this metric.

A. RNN

A Recurrent Neural Network (RNN) [2] is a class of artificial neural networks where links between units structure a directed graph along a chain, allowing it to show dynamic temporal conduct for the time sequence. In contrast, to feedforward neural networks, RNNs can utilize their inside state (memory) to deal with the series of inputs that makes them suitable for applications, for example, unsegmented, connected handwriting recognition, or speech recognition. The RNNs are called repetitive because they play out a similar assignment for each component of a grouping. The RNN has a "memory" which remembers all information about what has been calculated.

B. LSTM

Long Short Term Memory (LSTM)[3] units (or squares) are a structure unit for layers of a Repetitive Neural Network organization(RNN). An RNN made from LSTM units is regularly called as LSTM organization. A common LSTM unit is made from a cell, an information passage, a yield entryway, and a memorable neglect entrance. The phone is liable for "recalling" values throughout subjective periods. Every one of the three gates can be considered an "ordinary" counterfeit neuron, as in a multi-layer (or feedforward) neural organization. That is, they process an initiation (utilizing an enactment work) of a weighted aggregate. Instinctively, they can be thought of as controllers of the progression of qualities that experience the LSTM, hence the denotation "gate." There are links between these gates and the cell.

LSTMs made to deal with the exploding and vanishing gradient issue while planning conventional RNNs [5]. The long articulation transient refers to how LSTM is a model for short-term memory that can keep going for a significant period. An LSTM is appropriate to classify, process, and foresee time series given delays of obscure size and length between significant events.

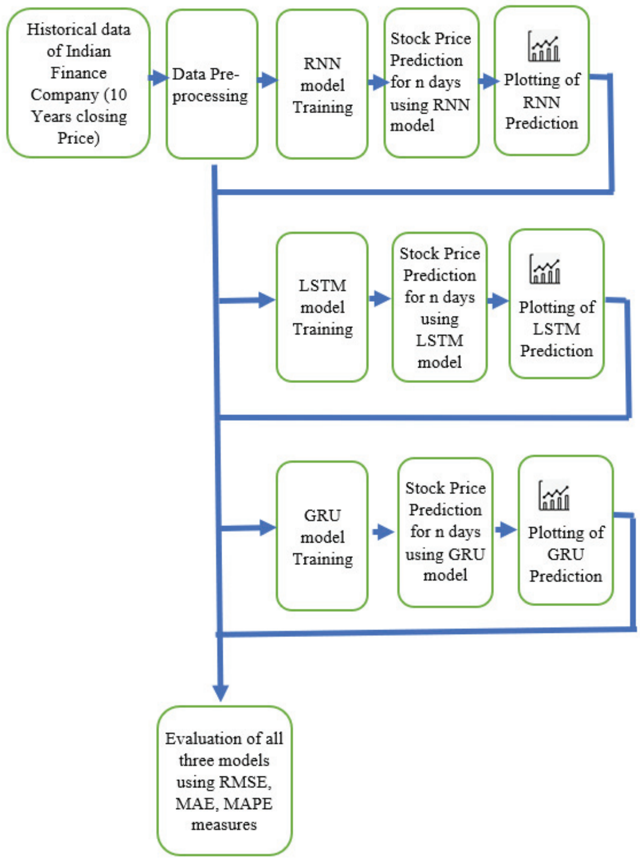

Figure 1. Proposed System Architecture.

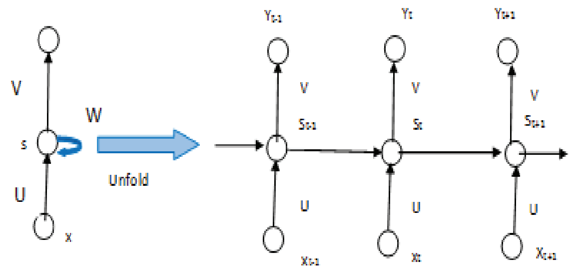

Figure 2. RNN being unrolled (or unfolded) into a full network.

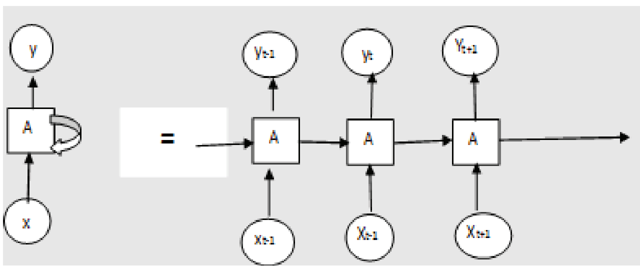

Figure 3. LSTM being *unrolled* (or unfolded) into a full network.

C. GRU

Gated Recurrent Unit (GRU) [4] Neural Networks is a particular sort of the standard recurrent neural organization. They enormously deal with a vast type of challenging problems. The unprecedented thing about them is that they can be set up to keep information from previously, without washing it through time or eliminate data that is superfluous to the forecast. The GRUs are the most fashionable, powerful, and practical neural networks.

E-ISSN 2581 – 7957 CVR Journal of Science and Technology, Volume 20, June 2021
P-ISSN 2277 – 3916 DOI: 10.32377/cvrjst2006

It is explicitly intended to avoid long-term dependency [16]. The GRU has fewer parameters than LSTM, thus prepares a model somewhat faster, and also prediction accuracy is more. Examination indicated that the GRU beat the LSTM on the stock forecast.

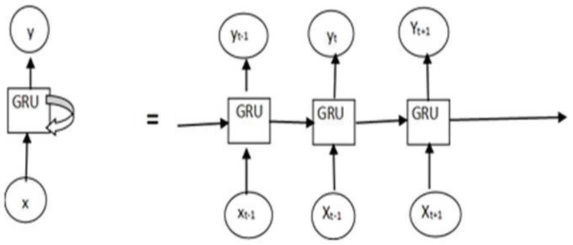

Figure 4. GRU being *unrolled* (or unfolded) into a full network.

IV. RESULT ANALYSIS

Result analysis has been done on Power Finance Corporation Ltd., Mahindra and Mahindra Financial Services Ltd., Bajaj Finance Limited stock prices.

A. Power Finance Corporation Ltd. Stock

Power Finance Corporation Ltd. is a Schedule-A Navratna CPSE and is a leading Non-Banking Financial Corporation in the country Incorporated on July 16, 1986. The PFCs enlisted office is situated in New Delhi, and provincial workplaces are located at Mumbai and Chennai [17].

The PFC is under the regulatory control of the Ministry of Power. The PFC has presented the title of a 'Navratna CPSE' in June 2007 and was named Infrastructure Finance Company by the RBI on July 28, 2010.

The Power Finance Corporation Ltd. [11], stock price data, has been downloaded from the following web page https://in.finance.yahoo.com/quote/PFC.NS/history/

TABLE I.
SNAPSHOT OF POWER FINANCE CORPORATION LTD. STOCK PRICE DATA.

	A	B	C	D	E	F	G
1	Date	Open	High	Low	closeprice	Adj Close	Volume
2	26-02-2007	56	58.85	52.375	57.650002	24.87602	40321302
3	27-02-2007	60	60	57.424999	58.700001	25.329094	33494710
4	28-02-2007	56	57.9	51.5	55.525002	23.959076	20756868
5	01-03-2007	56.025	56.95	54.25	55.275002	23.8512	8789572
6	02-03-2007	55.7	56.7	54	54.5	23.516792	8015884
7	05-03-2007	52.85	54.25	50.599998	51.025002	22.017324	7689574
8	06-03-2007	51.75	53.85	51	52.549999	22.67536	4394762
9	07-03-2007	53.625	53.75	50.75	52.125	22.491974	3675434
10	08-03-2007	52.375	55.5	51.625	55	23.73254	4454868
11	09-03-2007	55	56.2	51	51.650002	22.287016	2840580
12	12-03-2007	51.725	52.7	50.849998	51.450001	22.200714	3893220
13	13-03-2007	52.175	53.75	51.5	53.349998	23.020565	2893574
14	14-03-2007	52.1	52.4	51	51.525002	22.233076	1129814
15	15-03-2007	52.4	53.4	51.549999	51.799999	22.351738	2199790
16	16-03-2007	52	52.35	51.200001	51.450001	22.200714	818560
17	19-03-2007	52.2	53.225	51.525002	53.025002	22.880327	1068868
18	20-03-2007	53.95	54.05	52.75	53.075001	22.901903	1774888
19	21-03-2007	53.5	53.5	52.474998	52.75	22.761658	789156
20	22-03-2007	53.5	53.5	52.5	52.674999	22.729301	1610870
21	23-03-2007	53	56.6	52.375	55.599998	23.99144	4453394
22	26-03-2007	55	56.45	53	53.375	23.031355	1945202
23	28-03-2007	52.1	53	51.625	51.974998	22.427248	1882584
24	29-03-2007	52.3	53.35	51.325001	51.625	22.276224	2662504

B. Mahindra & Mahindra Financial Services Limited stock

Mahindra & Mahindra Financial Services Limited is a rustic NBFC settled in Mumbai, India. It is among the top farm truck financers in India and offers a wide scope of monetary items to address fluctuated client necessities. The Mahindra & Mahindra Financial Services Limited stock price data has been downloaded from the following web page.

https://in.finance.yahoo.com/quote/M%26MFIN.NS/history/

TABLE II.
SNAPSHOT OF MAHINDRA & MAHINDRA FINANCIAL SERVICES.

	A	B	C	D	E	F	G
1	Date	Open	High	Low	closeprice	Adj Close	Volume
234	26-02-2007	44	44.78	43.59	43.98	22.933615	18325
235	27-02-2007	44.46	45.4	44.21	45.07	23.502003	25945
236	28-02-2007	43.4	46.4	42.36	45.459999	23.70537	35845
237	01-03-2007	45.12	46.76	45	45.439999	23.694939	18730
238	02-03-2007	45.16	46.98	45.07	46.419998	24.205965	28920
239	05-03-2007	40.02	46.38	40.02	45.009998	23.470715	84290
240	06-03-2007	45.4	45.4	44.55	45	23.465508	58910
241	07-03-2007	45.03	45.76	45	45	23.465508	38530
242	08-03-2007	45.03	45.1	44.41	44.959999	23.444639	145265
243	09-03-2007	45.01	45.5	45	45	23.465508	57705
244	12-03-2007	46.7	46.7	44.92	45	23.465508	271920
245	13-03-2007	45.03	45.79	44.86	45.060001	23.496788	266745
246	14-03-2007	45	45.19	44.82	45.060001	23.496788	160545
247	15-03-2007	45	46.98	45	46.439999	24.216396	120370
248	16-03-2007	46.88	48	45.02	45.98	23.976526	74440
249	19-03-2007	46	46	44.92	45.150002	23.543716	75375
250	20-03-2007	45.3	46.25	45.05	46.200001	24.091251	144325
251	21-03-2007	46.1	46.2	46	46	23.986956	27850
252	22-03-2007	46.4	46.4	46	46	23.986956	32995
253	23-03-2007	46.04	46.57	46	46.02	23.997387	72460
254	26-03-2007	46.01	46.4	46	46	25.076777	22930
255	28-03-2007	46.53	46.53	45.6	46	25.076777	187245
256	29-03-2007	46.2	46.2	46	46	25.076777	60055
257	30-03-2007	46	46.96	46	46.799999	25.512896	68710

C. Bajaj Finance Limited Stock

Bajaj Finance Limited is the most broadened and beneficial non-bank in the country with a wide arrangement of items spread across Consumer, SME and Commercial Lending, and Wealth Management. The Bajaj Finance Limited stock price data has been downloaded from the following web page.

https://in.finance.yahoo.com/quote/BAJFINANCE.BO/history/

TABLE III.
SNAPSHOT OF BAJAJ FINANCE LIMITED.

	A	B	C	D	E	F	G
1	Date	Open	High	Low	closeprice	Adj Close	Volume
285	26-02-2007	42.6524	42.6524	40.8064	41.4525	14.873087	37238
286	27-02-2007	40.4518	41.5788	40.4518	41.3942	14.852165	36127
287	28-02-2007	38.8633	40.8064	38.0957	39.179	14.05736	57072
288	01-03-2007	38.8633	39.83	37.4059	38.5038	13.815098	61076
289	02-03-2007	39.3539	40.3886	37.5613	40.2866	14.454763	41396
290	05-03-2007	37.8917	38.8633	36.444	38.4406	13.792422	199572
291	06-03-2007	37.4059	39.349	37.4059	39.0284	14.003323	103450
292	07-03-2007	38.9604	39.0576	35.2247	36.9249	13.24859	36477
293	08-03-2007	36.4392	38.8633	36.4392	38.6252	13.858657	26987
294	09-03-2007	38.7661	39.83	37.1436	39.1547	14.048638	94351
295	12-03-2007	39.349	39.7377	36.9298	39.3636	14.123593	63422
296	13-03-2007	39.8154	39.8154	38.6689	39.5191	14.179384	26256
297	14-03-2007	40.0291	40.0291	38.6203	39.7231	14.25258	47809
298	15-03-2007	39.1256	39.349	38.1054	38.6495	13.867374	23992
299	16-03-2007	38.2803	39.932	38.2803	39.5579	14.193306	32967
300	19-03-2007	38.3775	40.1263	38.3775	39.7134	14.249101	16880
301	20-03-2007	39.1547	42.2589	39.0673	41.2922	14.815573	92447
302	21-03-2007	41.2922	41.9723	39.8203	41.3262	14.827769	49167
303	22-03-2007	40.5149	40.9036	40.0291	40.4858	14.526236	13411
304	23-03-2007	40.3449	40.8064	39.8348	40.4712	14.520998	27234
305	26-03-2007	40.3206	40.9036	39.5482	40.272	14.449524	42374
306	28-03-2007	40.1263	41.2048	40.0291	40.8599	14.660462	207116
307	29-03-2007	40.3206	41.5837	40.1263	40.9764	14.702262	62167
308	30-03-2007	40.8064	41.778	40.8064	41.2971	14.817327	53624

In the analysis, the prediction is made based on the closing price as the changed shutting value utilizes the end cost as a beginning stage. It considers factors, for example, profits, stock parts, and new stock contributions. The information has been part into preparing and testing sets. The training set is used to train the given deep learning models about the data, and the testing set is used to evaluate the predicted data.

Models are trained with Nearly 12 years of data sets, i.e., from 2007 to 2019. Model tested with the first 11 months dataset of the year 2020. The data is feature scaled using the sci-kit-learn Pre-processing package from which the Min Max Scalar function was used to scale the data set from 0 to 1. The featured scaled data is further transformed into a 3D array structured with 60-time steps. The 1st value to the 60th value are predictors for the 61st value. Then from the 2nd value to the 61st values are treated as predictors to the predicted 62nd value and so on.

D. Output

The output is the prediction of the future stock price. After the data is trained in the neural network, the inputs are passed to predict the future stock price.

The inputs of the test set are again featured scaled using Min Max Scalar function and transformed into a 2D array containing 60-time steps. Hence, every 60 predictors of the test set were used to predict the next value.

The losses at each epoch are taken into consideration as the loss functions and objective is that the model will try to minimize error. It can be the string identifier of an existing loss function or it can be an objective function. Mean Squared Error uses predicted and actual values to calculate the loss. The result was then transferred into an excel file sheet for comparing all the existing RNN cells and then plotted into a graph using matplotlib.pyplot functions.

The RNN, which has been built, was a regressor. To foresee a consistent, the best approach to assess the model presentation is with a measurement called the RMSE (Root Mean Squared Error). It is determined the base of the mean of the squared contrasts between the forecasts and the genuine qualities. Following is the formula for root mean squared error:

$$RMSE = \sqrt{\sum \frac{(y_{pred} - y_{ref})^2}{N}}$$

Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE) are also used as metrics for analysis.

Formula for Mean Absolute Error (MAE):

$$MAE = \frac{1}{N}\sum_{k=1}^{N} |y_k - \hat{y}_k|$$

Formula for Mean Absolute Percentage Error (MAPE):

$$MAPE = \frac{1}{N}\sum_{k=1}^{N} \left|\frac{y_k - \hat{y}_k}{y_k}\right| \times 100$$

The following plot shows the prediction variations of RNN, LSTM, and GRU on Power Finance Corporation Ltd stock test data.

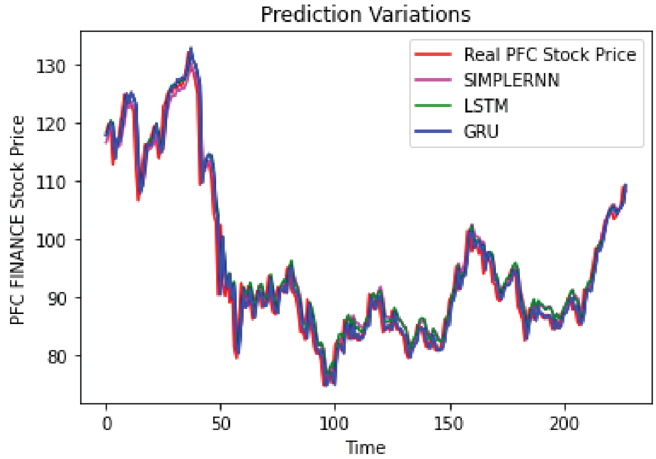

Figure 5. PFC FINANCE Stock Prediction.

The RMSE results of Power Finance Corporation Ltd stock test data:
The RNN root mean square error –3.226869766481196
The LSTM root mean square error –3.2983331407376313
The GRU root mean square error – 3.1240981601345066

The MAE results of Power Finance Corporation Ltd stock test data:
The RNN mean absolute error - 3.231540784440961
The LSTM mean absolute error -2.325531096075761
The GRU mean absolute error -2.150225893070689

The MAPE results of Power Finance Corporation Ltd stock test data:
The RNN mean absolute percentage error - 3%
The LSTM mean absolute percentage error - 2%
The GRU mean absolute percentage error - 2%

The following plot shows the prediction variations of RNN, LSTM, and GRU on Mahindra & Mahindra Financial Services Limited stock test data.

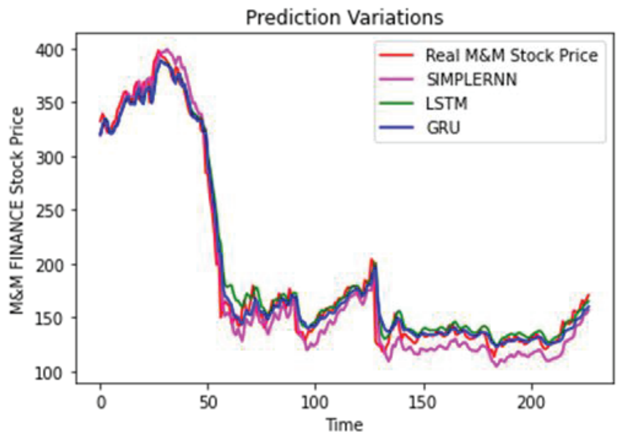

Figure 6. M&M FINANCE Stock Price Prediction.

The RMSE results of Mahindra & Mahindra Financial Services Limited:
The RNN root mean square error – 15.106372423237318
The LSTM root mean square error – 13.271180686022484

The GRU root mean square error –11.457300710539837

The MAE results of Mahindra & Mahindra Financial Services Limited:
The RNN mean absolute error – 7.699981631180612
The LSTM mean absolute error – 9.29527681228798
The GRU mean absolute error -- 7.56549102039003

The MAPE results of Mahindra & Mahindra Financial Services Limited:
The RNN mean absolute percentage error – 4%
The LSTM mean absolute percentage error – 5%
The GRU mean absolute percentage error -- 4%

The following plot shows the prediction variations of RNN, LSTM, and GRU on Bajaj Finance Limited stock test data.

The RMSE results of Bajaj Finance Limited test data set:
The RNN root mean square error – 268.52724642086730
The LSTM root mean square error –294.69706199541935
The GRU root mean square error – 208.65468713394836

The MAE results of Bajaj Finance Limited test data set:
The RNN mean absolute error – 188.36491205948468
The LSTM mean absolute error – 204.89706199541990
The GRU mean absolute error -- 145.94797986506302

The MAPE results of Bajaj Finance Limited test data set:
The RNN mean absolute percentage error – 5%
The LSTM mean absolute percentage error – 6%
The GRU mean absolute percentage error --4%

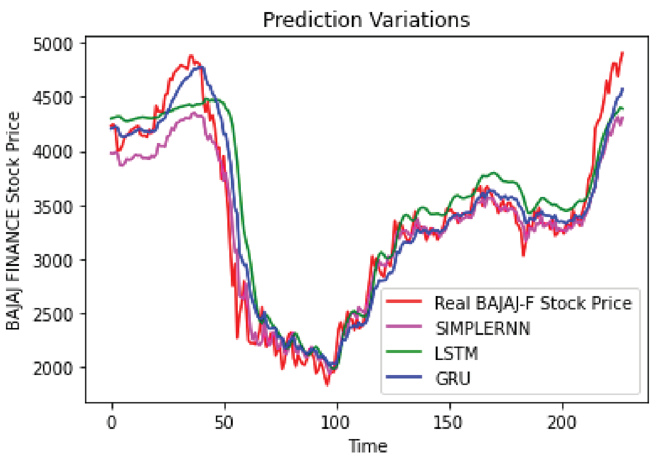

Figure 7. BAJAJ FINANCE Stock Price Prediction.

V. Conclusions

While forecasting economic variables would be a critical activity for many economists, forecasting exchange rates are equally crucial for borrowers, corporate treasurers, fund managers, and specialist traders. The empirical literature reveals that exchange rates are mostly unpredictable due to the difficulties involved in forecasting—recurrent neural networks to forecast foreign exchange rates. From a statistical perspective, neural networks are analogous to the nonparametric, nonlinear regression model. So, neural network suits better than other models in predicting the stock market returns. Artificial neural networks have demonstrated to be productive and beneficial in determining financial time series. Specifically, recurrent networks in which movement designs go through the organization more than once prior to producing a yield example can adapt too complex transient groupings. Three recurrent architectures are looked at regarding the prediction accuracy of future forecast. The Simple standard RNN, LSTM, GRU methods were evaluated on Power Finance Corporation Ltd., Mahindra & Mahindra Financial Services Limited, and Bajaj Finance Limited stock price data. The results confirmed the utility of the three variants with reduced parameters, which at reasonable learning rates could achieve a performance comparable to each other. This work represents a preliminary study, and further work is needed to evaluate the three LSTM variants on more extensive datasets of varied sequence length. Finally, while comparing the predictions made by all the methods, GRU gave better results.

Root Mean Square Error (RMSE), Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE) are the three metrics used in this analysis. GRU gave better performance in all three measures. A major reason for behind GRU better performance is its number of parameters. GRU model preparation also takes less time because of a smaller number of parameters.

References

[1] Ramit Sawhney,Netaji Subhas ,Shivam Agarwal,Arnav Wadhwa,Rajiv Ratn Shah "Deep Attentive Learning for Stock Movement Prediction From Social Media Text and Co mpany Correlations" "Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing", pages 8415–8426,November 16–20, 2020.

[2] 0network Jinghua Zhao1 Dalin Zeng2 ·Shuang Liang1·Huilin Kang3·Qinming Liu1, "Prediction model for stock price trend based on recurrent neural networks" "Journal of Ambient Intelligence and Humanized Computing" Pages:745–753 (2021).

[3] Adil MOGHARa, Mhamed HAMICHEb "Stock Market Prediction Using LSTM Recurrent Neural Network" Procedia Computer Science, Volume 170, 2020, Pages 1168-1173

[4] Mohammad Obaidur Rahman, Md. Sabir Hossain, Ta-Seen Junaid, Md. Shafiul Alam Forhad, Muhammad Kamal Hossen." Predicting Prices of Stock Market usingGated Recurrent Units (GRUs) Neural Networks" "IJCSNS International Journal of Computer Science and Network Security". VOL.19 No.1, January 2019

[5] Denny Britz: "Recurrent Neural Network Tutorial, Part 4 – Implementing a GRU/LSTM RNN with Python and Theano – WildML". Wildml.com.Retrieved May 18, 2016.

[6] Jiahong Li, Hui Bu, Junjie Wu" Sentiment-aware stock market prediction: A deep learning method". International Conference on Service Systems and Service Management (2017)".

[7] Yang Liu; Jelena Trajkovic; Hen-Geul Henry Yeh; Wenlu Zhang "Machine Learning for Predicting Stock Market Movement using News Headlines" Published in 2020 IEEE Green Energy and Smart Systems Conference (IGESSC)Date of Conference: 2-3 Nov. 2020

[8] Refenes, A. N., Zapranis, A., & Francis, G. "Stock performance modeling using neural networks: A comparative study with regression models", Neural Networks, vol. 7, no. 2, pp. 375-388, 1994.

[9] Yuling LIN, Haixiang GUO and Jinglu HU "An SVM-based Approach for Stock Market Trend Prediction" The 2013 International Joint Conference on Neural Networks (IJCNN)" ,Date of Conference:August 2013

[10] Yunus YETISl, Halid KAPLAN2, and Mo JAMSHIDI3, "Stock Market Prediction by Using Artificial Neural Network", Published in: 2014 World Automation Congress (WAC). Date of Conference: 3-7 Aug. 2014.

[11] https://www.pfcindia.com/

[12] Penglei Gao,Rui Zhang , andXi Yang "The Application of Stock Index Price Prediction with Neural Network" Open access Article, Published: 18 August 2020

[13] https:// www.mahindra.com/ careers/businesses/financial services

[14] WEI YANG "Stock Price Prediction Based on Fuzzy Logic", "Sixth International Conference on Machine Learning and Cybernetics", Hong Kong, Date of Conference: 19-22 August 2007.

[15] Aparna Nayak, M. M. Manohara Pai∗ and Radhika M. Pai "Prediction Models for Indian Stock Market". "Procedia Computer Science" Volume 89 (2016) pages:441 – 449.

[16] Guizhu Shena, Qingping Tana, Haoyu Zhanga, Ping Zenga,Jianjun Xua "Deep Learning with Gated Recurrent Unit Networks for Financial Sequence Predictions", Procedia Computer Science Volume 131 (2018) Pages:895–903.

[17] Hiransha Ma, Gopalakrishnan E.Ab , Vijay Krishna Menonab , Soman K.P " NSE Stock Market Prediction Using Deep-Learning Models",Procedia Computer Science, Volume 132(2018) Pages:1351–1362.

[18] Dr. D. Durga Bhavani, Mir Habeebullah Shah Quadri,Y. Ram Reddy "Dog Breed Identification Using Convolutional Neural Networks on Android" "CVR Journal of Science and Technology" Issue: Vol 17 No 1 (2019).