DEVELOPING AN INTEGRATED MODEL-BASED ON MULTILAYER FEEDFORWARD NARX NEURAL NETWORK TO PREDICT THE STOCK PRICES LISTED IN NATIONAL STOCK EXCHANGE (NSE) OF INDIA

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ABSTRACT

In this paper, I have designed an artificial neural network model which helps to predict the closing price of the stock. As we know, in order to identify the hidden and unknown patterns in the data, Artificial Neural Network (ANN) is the best algorithm employed for classification and prediction. To predict the closing price of share listed in NSE, I have endeavoured to design a Multilayer feedforward NARX. The trading data of NTPC was taken as the technical parameter with moving average. The performance was predicted on the basis of data taken between 2017 and 2018.

I. INTRODUCTION

A financial exchange is an open market for the exchanging of organization stock and subordinates at a concurred cost. The financial exchange unites speculators for share purchase and sell. Share market prices are set on the basis of demand and supply. Stocks that are sought after will increase their cost, while stocks that are by and large intensely sold will diminish their cost. Securities exchange information is exceptionally time-variation and is regularly in a nonlinear example, which makes foreseeing the future cost of a stock profoundly trying for speculators and dealers [1]. In their journey to estimate the business sectors, they accept that future events are put together in any event to some extent with respect to present and past occasions and information. In any case, money related time arrangement is among the 'noisiest' and most troublesome signs to forecast [2].

Foreseeing stock or file costs in the capital market, by utilizing customary determining strategies like at least square relapse, are troublesome. This is on the grounds that capital markets are of a tumultuous sort. Then again, a few AI-based approaches have been proposed for better market forecasts [3]. Numerous scientists have proposed models utilizing different central, specialized and diagnostic methods to give a pretty much careful expectation. They have utilized diverse forecast models like ANNs, Support Vector Machine (SVM), Autoregressive coordinated moving normal (ARIMA), and so forth. The utilization of Artificial Neural Network (ANN) is a more precise procedure when contrasted with other nonlinear strategies as financial exchange returns are loud, unsure, confused and nonlinear in nature. The oddity of the ANN lies in their capacity to find the nonlinear relationship in the information informational collection without from the earlier supposition of the information on the connection between the information and the yield. The examination in the territory of Neural Network (NN) has demonstrated that NN can be utilized to foresee INDEX or stock cost. Everyday exchange information can be utilized to prepare the NN. The prepared NN then can be utilized to

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foresee the future estimation of share or Index. A neural system prepared to a specific information informational index relating to a specific domain; can be effortlessly retrained to another condition to foresee at a similar degree of the earth.

In this paper, we propose a forecast model dependent on Artificial Neural Network (ANN). Subsequent to contemplating the different highlights of a Multilayer Feed-Forward NARX organize, an ideal model is proposed to estimate.

II. LITERATURE SURVEY

Since unpredictable vacillations happen in financial market, it is hard to demonstrate its behaviour. Financial exchange can be considered as non-direct deterministic framework [4]. In any case, ANN has capacity to find non-linear relationship in input informational index without from the earlier suspicion of the information on connection among info and yield (Hagen et. al. 1996). Many specialists have proposed various kinds of models for forecast of an index or stock. The neural system model is one of the well-known models for grouping and expectation. A few analysts have taken a shot at consolidated expectation model dependent on PCA alongside NN or Support Vector Machine.

Nourishment Majumder et. al. (2007) has used various sets of information boundaries to prepare Multi-Layer Neural Network. They used previous recorded information of S&P CNX Nifty 50 – a file of 50 stock organizations recorded in Indian Stock Market. They utilized information from 2000 to 2005 to prepare the NN and anticipated future estimations of S&P CNX Nifty 50 file somewhere in the range of 2006 and 2009. They took a shot at six unique structures of model for various sources of info like information factors, concealed neurons, move capacity and preparing calculation. In all out they chipped away at 24 systems with various arrangement of information boundaries. They saw that three-layer feed-forward back engendering neural system with 10 info factors, 5 shrouded neurons, symmetric sigmoid exchange work in concealed layer, straight exchange work in yield layer was ideal system structure [5].

Mayank Kumar B Patel et. al. (2014) utilized Artificial Neural Network procedures to anticipate the stock cost of organizations recorded under LIX15 Index of National Stock Exchange (NSE). The organizations included were Axis Bank, State Bank of India, Tata Motors, Tata Steel, Hindalco and so forth. The information of organizations recorded in LIX15 file of NSE for three years, during Jan 2011 to Jan 2014, was utilized to prepare Multilayer Perceptron (MLP). The MLP with 6 information neurons and 1 yield neuron were planned with various concealed layers. The test accomplished Median Normalized Error of 0.05995, Median Correct Direction % of 51.06 and Median Standard Deviation of 6.39825 [6].

Luis Gonzaga Baca Ruiz et. al. (2016) utilized the information gave by a vitality utilization observing framework in a compound of resources and examination focus at the University of Granada and proposed a procedure to anticipate future vitality utilization utilizing nonlinear autoregressive (NAR) and the nonlinear autoregressive neural system with exogenous sources of info (NARX). The outcomes uncovered that both NAR and NARX neural systems are appropriate for anticipating vitality utilization. The analysis saw that exogenous information may assist with improving the exactness of expectation [7].

III. ARTIFICIAL NEURAL NETWORK

From the review, ANN can be developed to anticipate a future estimation of an Index or specific share. During the examination, an extraordinary class of ANN called Non-linear Autoregressive with External Input (NARX) model was thought to be appropriate. NARX systems are intermittent neural systems and are appropriate for displaying non-linear frameworks and extraordinarily time arrangement.

A. Network Architecture

The neural systems technique was initially enlivened by therapists and neurobiologists who needed to create and test computational proportionality of neurons. A neural system is a lot of associated input/yield units. This is one of the reasons that neural systems are additionally called as 'connectionist learning.' These associations have related loads. At first, these loads are of doled-out irregular qualities. Postulations loads at that point, during learning, are balanced so that the system predicts precise class name for new information tuples. Following Fig. 1 shows multilayer feed-forward neural system.
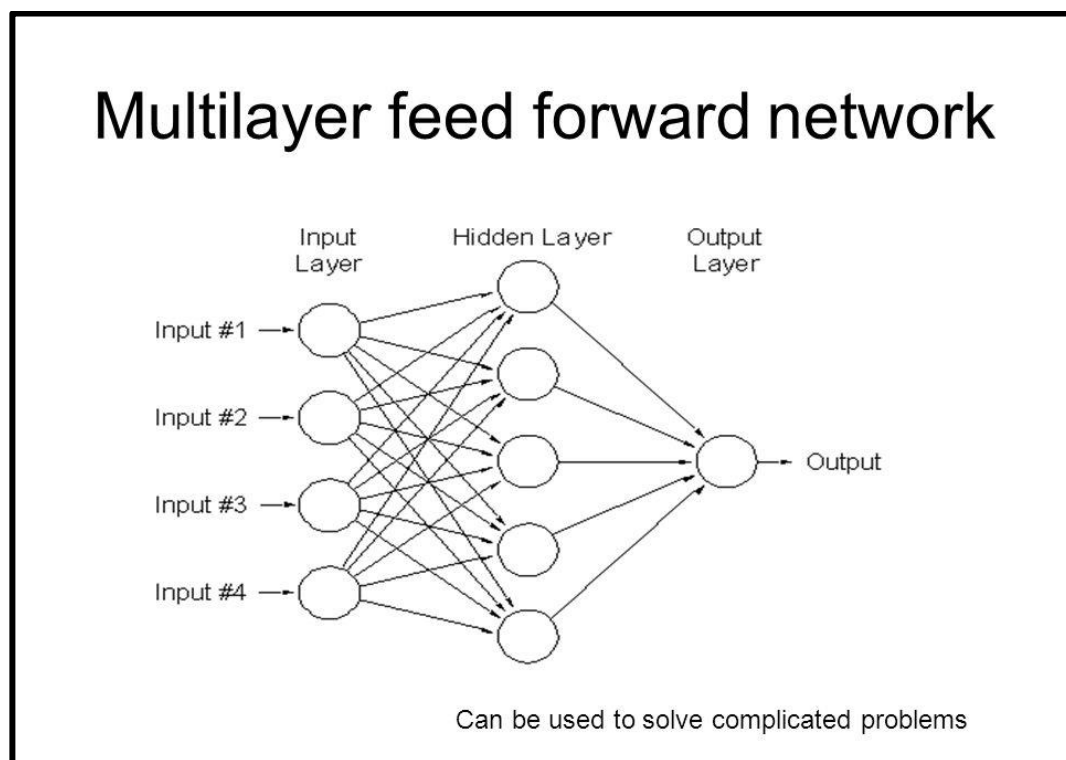

Fig 1: Multi-layered Fed Forward

As appeared in Fig. 1, a Multilayer Feed-Forward Neural Network has one 'info layer', at least one shrouded layer and one yield layer. The information sources are given to arrange through neurons in input layer. In the wake of going through info layer, these data sources are weighted and taken care of to first shrouded layer. The weighted yields of first shrouded layer are then given to second

concealed layer assuming any, and so and so forth. The weighted yields of last concealed layer are then given to yield layer. The yield layer at long last gives the system forecast for given information tuples.

The back-engendering technique is employed to prepare such neural systems. Back-spread learns by iteratively handling the informational index of preparing tuples. For each preparation tuples, the loads are altered with the goal that the expected qualities by organize are all the more near genuine objective qualities. The prediction is named as back-proliferation in light of the fact that these adjustments are made in reverse course from yield layer to shrouded layer [8]. The back-propagation technique will assist with getting the neural system with biased and enhanced weights. The acquired system at that point can be utilized for expectation.

IV. DATA AND METHODOLOGY

Many examination considers have seen that specialized boundaries are more helpful to anticipate share cost in the present moment than macroeconomic pointers. The everyday exchanging information alongside moving midpoints as specialized boundaries were employed to prepare the neural system. The organization under perception was NTPC Ltd., A Maharatna Company, and India's biggest force utility.

NTPC is India's biggest vitality aggregate with establishes planted route in 1975 to quicken power advancement in India. From that point forward it has built up itself as the predominant force major with nearness in the whole worth chain of the force age business. From petroleum products, it has forayed into creating power by means of hydro, atomic and sustainable power sources. This raid will assume a significant job in bringing down its carbon impression by decreasing ozone harming substance outflows. To reinforce its center business, the partnership has broadened into the fields of consultancy, power exchanging, preparing of intensity experts, rustic jolt, debris use and coal mining also.

NTPC turned into a Maharatna organization in May 2010, one of the main four organizations to be granted this status. NTPC was positioned 512th in the '2018, Forbes Global 2000' positioning of the World's greatest organizations [9].

In this examination, we utilized day-to-day exchange information like earlier day close cost of the share, open cost of the share on an exchanging day, the significant expense of share during the exchanging day, low cost of share during the exchanging day, turnover of share during the exchanging day and so forth. The moving midpoints were utilized as specialized boundaries. The five specialized boundaries like 10 days, 20 days, 50 days, 100 days and 200 days moving midpoints were utilized.

A. Data used for Data Mining

The NTPC information of the year 2017 was used to prepare and information of the year 2018 was employed to test the ANN. The day by day exchanging information of NTPC somewhere in the range of 2017 and 2018 is taken from National Stock Exchange site [10].

The day by day exchange information of NTPC remembers a nearby cost for the earlier day, day open value, day significant expense, day low value, day normal value, absolute exchanged amount, all out turnover and the end cost on exchanging day. From the end costs of the day, different moving midpoints like 10 days, 20 days, 50 days, 100 days and 200 days were determined. In this manner there are 13 traits, for example 8 characteristics and 5 moving midpoints. The end cost of the share on an exchanging day is utilized as the yield of the system. Out of 13 properties, one qualities are utilized as systems target and staying 12 characteristics were utilized as a contribution to the system. As trait all out exchanged amount and quality complete turnover were profoundly connected to one another, the previous property was overlooked. At long last, 11 properties were considered for organize info and characteristic shutting cost was utilized for arrange yield.

B. Network Training

At first an examination was acted so as to fix the mixes of different boundaries for ANN. Through that underlying investigation, it was seen that NARX connect with 12 data sources factors, 1 concealed layer with 10 neurons, 1 yield neuron, criticism deferral of 2, Gradient plunge versatile back-proliferation (GDA) preparing calculation, symmetric sigmoid exchange work in shrouded layer and unadulterated direct exchange work in yield layer is ideal system. During another examination, it was seen that system prepared with one-year information gave better forecasts when contrasted with organize prepared with over one year. System for preparing the information and anticipating the share worth is introduced beneath. In the calculation, one stride ahead methods tomorrow's worth in view of the present information. Accordingly, we foresee the share value a long time before the occasion occurs. This encourages the financial specialists to accept their call, at least a day prior to it.

C. Performance Measurement

To calculate the forecast precision of the model, the anticipated qualities were contrasted along real yields of test information. Standardized Mean Square Error (NMSE) is utilized to assess the forecast of the exactness of the model. The equation is used to ascertain NMSE, where t_P speaks to the real estimation of the pre-handled information arrangement. For example, the end cost of the share, t_o tells the anticipated- like, anticipated shutting cost of the share for the equivalent day and P_t is the mean of the genuine worth. So as to figure the blunder rate, real shutting cost and anticipated shutting cost were looked at.

Since P_t speaks to the real shutting cost and tells to anticipated shutting cost of the share, applying the same logic, obviously a system with less blunder % ought to be considered as the best system. The estimation of 0 for blunder % demonstrates that there are no mistakes in genuine and anticipated qualities which show flawless expectation.

V. EXPERIMENTAL RESULTS

Subsequent to foreseeing share costs of NTPC for the year 2018, the exhibition of the model was determined. Table 1 gives the exhibition subtleties of the model. Table 1: Performance measure subtleties of ANN structures.

From Table 1, it is seen that the model gave NMSE of 0.04 which is in the adequate range. The Average Error % was seen at 0.90% which is likewise very beneath the acknowledged range.

Table 1: Performance measure details of ANN structures used in study

Sr. No.	Parameter	Performance measures of ANN
1	Input variables & neurons	11
2	Neurons in hidden layer	10
3	Epochs	211
4	NMSE	0.04
5	Average Error %	0.90 %

Fig. 2 shows the plot between the genuine close cost of NTPC and close cost anticipated by the system for the whole year 2018. The plot in Fig. 2 is giving an away from about the expectation exactness of the ANN model. The plot infers that the anticipated qualities by the ANN model are in accordance with that of real shutting estimations of NTPC.
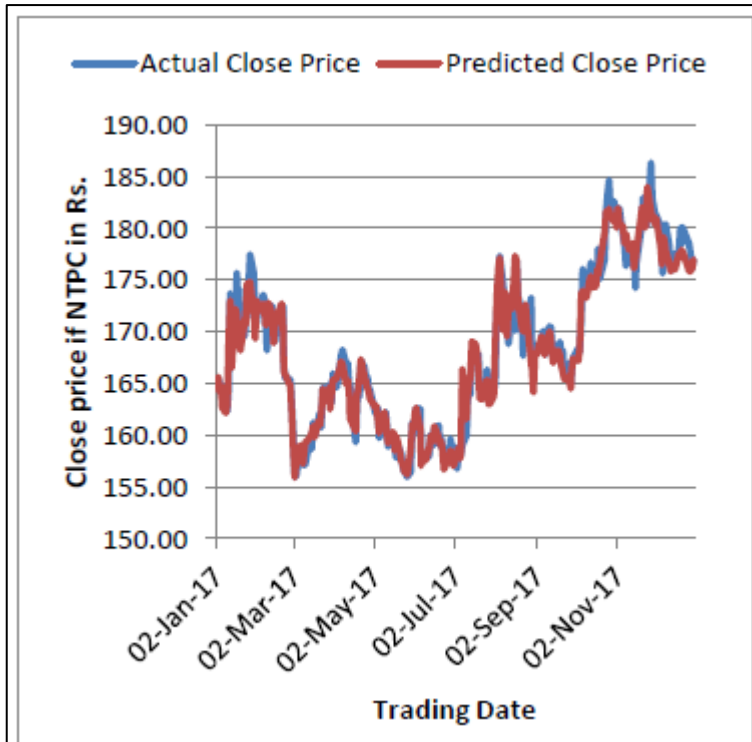
Fig. 2: Plot of closing price and network output during training phase.
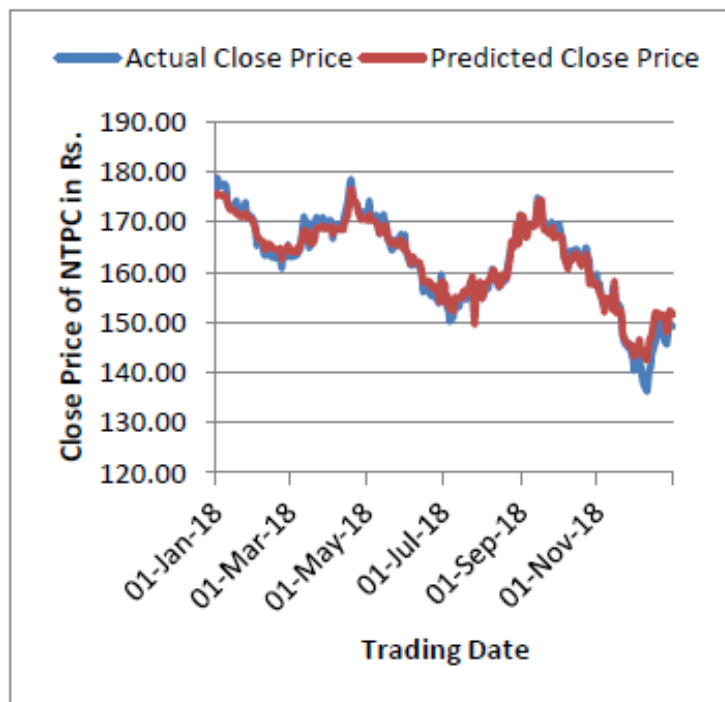
Fig. 3: Plot of actual and predicted closing prices of NTPC by ANN model for year 2018 data.

Fig. 4 shows the plot of the real shutting cost of NTPC and system anticipated costs for the year 2018 subsequent to disregarding a month ago information for example Dec 2018 information.

From the plot in *Fig. 4*, unmistakably the system execution is improved if a couple of last records are disregarded. This is because of the requirement for retraining the system after a specific time length. This will permit the system to learn new patterns in information.
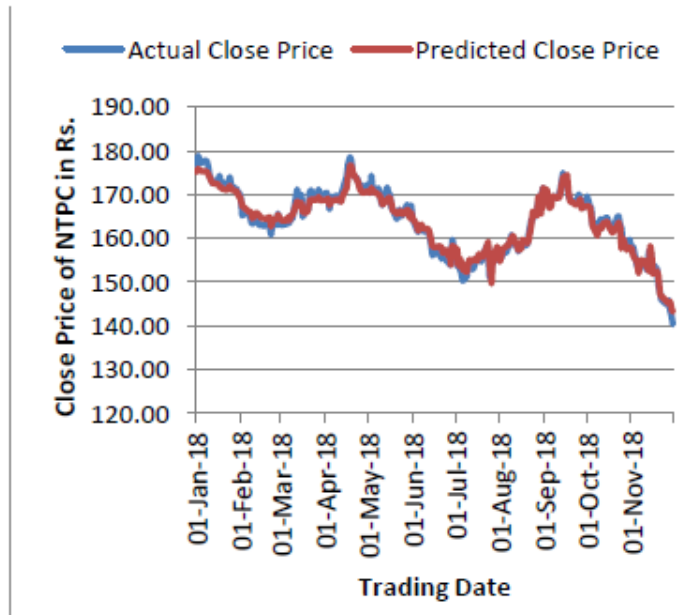
Fig. 4: Plot of actual and predicted closing prices of NTPC after ignoring Dec 2018 data

VI. CONCLUSION

In this paper, the ANN-based NARX model has been proposed for the forecast of the end cost of NTPC. During this examination, the forecast model gave NMSE of 0.04 and a normal blunder percentage of 0.90%. Along these lines, the exhibition of the ANN-based model is empowering. Unlike other AI applications, where model precision continues expanding with information size, the forecast model for specific share gave better outcomes for one-year information. This is because, in a specialized investigation, patterns are given more significance. Due to recent developments and patterns, the share cost is influenced in momentary patterns and the end share cost will proceed with its drawn-out pattern. Foreseeing following day cost of a share momentary pattern assumes a significant job. Likewise, in a limited ability to focus, costs are influenced via occasional variables like a rainstorm, Reserve Bank of India (RBI) strategies and so forth. So, as opposed to utilizing more information, the examination utilized only one-year information to prepare the system.

The investigation additionally saw that organized execution was improved if the last negligible records are disregarded. The system watched NMSE of 0.04 and normal blunder percentage of 0.90 for the whole year 2018. In any case, if December 2018 is disregarded, NMSE was same at 0.04 yet normal blunder percentage was improved to 0.76. This demonstrates the ANN-based systems need to retrained after a particular time with the goal that they can learn new patterns in information. The retraining procedure will improve the expectation exactness.