Monitoring and Training Stock Prediction System For Historical & Live Dataset using Lstm & Cnn

Omveer Singh Deora, Pawan Jha, S.T. Sawant Patil, T.B. Patil, S. D. Joshi

Abstract : ***A country development and stability are directly associated with its economy and today's economy is profoundly dependent on the Stock market. Stock market indexes are subject to continuous change with respect to time, a hype or fall in the stock market has a crucial role in deciding the investor's profit. Due to the economical ups & down and rapid growth in profit from the stock market, there required a need of developing a software application which continuously monitor the stock index's and a prediction algorithm which can predict the possible change in stock index as for where it can go in future. Prediction of stock market does not follow any rules or predefined guidelines, hence prediction of stock market is difficult to achieve and the data-set for stock market prediction is also non-linear in nature which requires an efficient approach to resolve the time-series dependency of non-linear data. In our proposed system we are using the LSTM (long short-term memory) for efficiently predicting the stock index on historical data and the sudden change in stock market due to number of un-controllable factors is analysed by CNN model. As per the noise in the data-set we are employing wavelet denoising technique. If any changes in stock index with more than 10% of its initial value is analysed by monitoring module, then the system will notify the user with the change and also aggregating the result of predicting algorithm on that specific stock. Using our model Moneypred the accuracy in stock prediction is more than 70%.***

IndexTerms - Monitoring of stock market; Prediction of stock market; RNN (recurrent neural network); LSTM (long short-term memory neural network); CNN (convolutional neural network); Denoising of data using wavelet transform.

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I. INTRODUCTION

The stock market because of its high rate of returns (profit) has always attracted investors and investment institution. Apart from its high returns, the stock market is very complex, risky & havoc, these characteristics of stock market is resultant of many combining factors, those factors are economic as well as political situation, psychology of investor, market need vs market supply ratio, company current conditions, etc. Between 2008 – 2009 there were 3.7 million new Demat accounts were open surpassing previous record of 3 million [15]. The annual growth of Demat account in 2013 was 5.26% with a total of 21.01 million accounts. In 2018 the total growth rose to 13.5% with a total of 31.5 million of Demat accounts [15]. In spite of high risk associated with the stock market, 83% of investors tends to pick stock trading [16]. Because of the excessive interest of investors (both large and small) in the stock market, makes the need to develop an effective prediction models for analysing the next day stock trend.

Predicting of stock index is difficult to achieve as traditional prediction models like CBR (case-based reasoning), ARIMA (autoregressive integrated moving average), AR (autoregressive), etc, work on linear data but stock market dataset is highly non-linear in nature. For solving this non-linear dependency, Deep neural networks can be used, as deep neural network work with functions which are of non-linear in nature & has the capability to predict the outcome from non-linear data-set [1], [2]. These Deep neural networks include Recursive Neural Networks (RNN), multilayer perceptron's (MLP), CNN (Convolutional Neural Network), LSTM (long short-term memory), etc [3]. Here a novel hybrid model is proposed call Moneypred which work on LSTM architecture for historical data prediction and CNN architecture of Deep neural network which is independent from history of data and does its prediction from current data. Currently there are 28 official stock exchange working throughout the country among its NSE and BSE are the most dominated ones. We are working on the NSE data-set in our proposed model as almost every variance of (large/middle or small) Indian firm are listed on NSE.

As there are sudden falls and rise in stock price due to changing market trend, the data-set for predicting the stock market is very fuggy and unstructured. Hence, data should be denoise before sending for prediction as denoised data is required for effectively analysing the market trend and improve the performance of prediction.

Therefore, for bringing the even structure for better calculation in our data-set, wavelet transform has been used as a data denoising approach in our proposed system. Once we done with the denoising of data-set, LSTM (long-short-term-memory) neural network are used in stock trend forecasting, it is one of the most efficient models of RNN (recurrent neural network) and has successfully used in numerous engineering areas such as [9-10]. For training the historical data we are using the LSTM model because of its efficiency in defining the unseen relations between the values present in the data-set & because LSTM has been successfully used in many areas of data having time-series nature (in our case data-set of stock market). And, for the sudden changes happening in the market which are responsible for the data-trend, can be predicted using CNN because the prediction process for CNN doesn't depend upon the history of the stock, it more focus on current factor scenarios like political influence, change in policies, etc.

And, as the user is un-aware of these change in stock trends/prices, we also proposed an online monitoring system which continuously monitor the stock indexes and if any change occur in the stock indexes with an alteration rate more than 10% of its initial buying price, it will automatically notify the user about the change with the aggregate results of both prediction models i.e. LSTM and CNN, predicting whether the stock price are going to rise or fall on the next opening day.

II. Literature Survey

In forecasting the stock trends various approaches like statistics algorithms, earlier machine learning algorithms like decision tree, random forest, etc, have been employed but the efficiencies of this approaches were not unto the mark. Earlier approaches fail because it is very hard and challenging to predict as stock market does not follow any predefined rule or pattern. The prices of shares in stock market can be changed due to numbers of factor like politics, global market crises, brand image, etc.

Before prediction denoising of data is required, the simplest way is to use a moving average method in which we calculate the average of a particular stock and then train the data-set for its prediction. But the moving average method fails when the data size is increased and when there are sudden gaps (null values) between the data and sometimes the stock price suddenly decreases or increase due to external factors like political results or change in companies' policies, Frauds, etc. Hence, because of those external factor stock market prediction missuses the actual trends followed in its data-set [4]. Alternative approach for denoising the data is to adopt Fourier transform, but in the stock market the data collected for denoising is arranged accordingly to time/day hence this alternative approach fail to deal with time-series data and also lack to denoise the non-linear data-set [5][6], but the data collected for prediction of stock market is highly non-linear in nature and also present in time-series format, because of its Fourier transform was unable to denoise the data. For overcoming this disadvantage wavelet transformation has been adopted because wavelet transform can express any functions which contain breaks & peaks (which are sharp), and it also work on data which are of non-linear in nature [7,8].

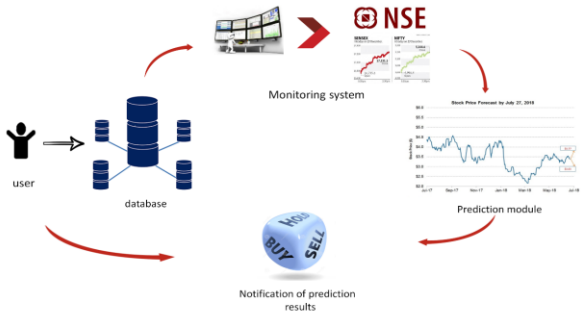
Early in the studies on stock market analysing, various approaches of machine learning have been used, one of them was SVM (support vector machine), as the SVM has shown positive results but also the process itself was complex, the model fail to decide its optimum features as to what exactly it should use for processing (mathematical formulas), fail to decide whether the problem is of regression nature or classification nature and also fail to efficiently carry the prediction in optimized manner. To overcome the issues of SVM, two enhanced novel approaches were introduced, PCASVM (principal component analysis - SVM) & GASVM (genetic algorithm - SVM). Using PCASVM we first analysis the data-set under normal condition and then errors were found using SPE (Squared Prediction Error) and finally SVM architecture is used for prediction. In GASVM we use GA (Genetic Algorithm) for deciding the parameters by which the SVM going to predict. When parameters are decided the model performance is increased, by Radu Jacomin [11]

Study on cultural influence i.e. linguistic of a region, has played a vital role deciding the stock market trend, using Apriori model we can distinguish the relation between closing and opening prices of given stock even from un-structured data. It is found that using Apriori architecture, regular pattern presents in the data-set can be found, model was able to find frequent item sets in a dataset for Boolean association rule. Apriori model is applied because it uses prior knowledge of frequent itemset properties. This study is given by Bhaskar Pant & Priti Saxena [12].

Various Artificial Neural Networks can be used in stock market forecasting, ANN architecture such as RBF (radial basis function), MLP (multi-layer perceptron), SLP (single layer perceptron) & DBN (deep belief network) shown successful results in forecasting the next opening day prices for fuel and concluded that ANN can be used for analysing the stock market, by Prof. K. Raza [13].

LSTM (Long-Short-Term-Memory) is enhanced version of RNN (Recurrent Neural Network), earlier in RNN architecture it has a memory cell which only work/remember information for short period of time, hence result is composed of both past and present state of operation. But when the processes required more time it fails to give accurate results. Hence LSTM is introduced which is capable of remembering the information for long time and was able to find accurate results in time series data, by Jurgen Schmidhuber & Sepp Hochreiter [14].

III. Proposed System



3.1 Monitoring & Database unit

In the proposed system Moneypred, our database stores the information of every individual's user who are connected with Moneypred, it contains the information like stock index names, the date on which the stock has been purchased, cost at which stock is purchased, buyer/user contact information, etc. The stock prices which are stored in our database are under continuous monitoring with reference to NSE stock indexes for comparison and if any changes observed in the stock prices with difference rate more than 10%, it will automatically notify the user about the changes. For monitoring, the system fetches live quotes of the given stock indexes from the NSE and compare it with the initial price at which the user has purchased that particular stock whose values are stored in our database. The fetching part is done by using python inbuilt library Nsetools which collect the current values of the given stock at that particular time from the website of NSE (National Stock Exchange). It also collects huge data-set for future data prediction & analytics. The fetch data-sets of stocks whose change is more than 10% will be transfer to prediction unit.

3.2 Data denoising unit

Before sending the data for prediction, data denoising is necessary as the data collected for prediction has a lot of gasps (null values) and the data also present with some sudden ups and falls having extremely big difference which decreases the prediction accuracy. Hence, the range at which the data are present in our data-set must be transfer into an optimize range for better prediction. For converting data into optimize range data denoising is used, we are using Wavelet transform to denoise our data, wavelet transform will be filtering out the null values and un-predictable fluctuation. For filtering it uses the wavelet equation: -

$$f(a) = x(a) + y(a),$$

where, f(a) is our data-set, x(a) is the null values to filter- out and y(a) is the un-predictable fluctuation (in our case values with big difference). The results of denoised unit will be given to prediction unit for further operation.

3.3 Prediction unit

The denoised data-set is again sub divided into two parts i.e. historical denoised data and current denoised data for individual prediction. Hence, the prediction module work in two parts, in first part the prediction is done on historical data using LSTM which work on Recurrent Neural Network approach of the Artificial Neural Networks. And secondly prediction is done on current data using Convolutional Neural Network (CNN).

3.3.1 Prediction based on historical data

The data-set on historical prediction is taken under 80-20 ratio for training and testing purpose respectively. In training set 80% of denoised historical data is used to train the prediction model LSTM about how exactly the stock prices are changed and learn if there exist any pattern in the dataset, the training of LSTM is done for 100 epochs (100 iterations), at every iteration we are altering the weight of the hidden layer so that for each iteration the accuracy of prediction increases. And, if its value i.e. current epoch value is lower (accuracy index) than the previous value, weight associated with that lower epoch is used as reference for next iteration. This process is continued till all epoch's cycles are complete. And the results obtained from the training set is used for testing the remaining 20% denoised historical data for checking the accuracy of LSTM model about how effectively the model is able to predict the stock prices in the testing set.

3.3.2 Prediction based on current data

The accuracy of stock prices prediction depends upon both, prediction made on historical data and prediction made on current data. LSTM efficiency for prediction decreases when the model is used for current data with no reference of historical events. So, for current data prediction we are using CNN, they are capable of handling the information which are present in mesh-type structure i.e. where all nodes are connected with every adjacent node, hence providing more power for analysing current data. CNNs network employs a mathematical operation i.e. linear operation. In CNN model we also divide the current denoised data into 80-20 ratio, where 80% is used for training the model, here CNN also train for 100 epoch and the result obtained is used to check the efficiency of the CNN model on remaining 20% of current denoised data in testing set.

The purpose for applying these two models is simply because, first to find if there exist any relations in the data available for prediction, LSTM models are skilled to find any relations in the data-set and uses these relations to predict the upcoming prices in stock market. But stock market forecasting also depend upon current market trend, this trend can be identified using CNN model which primarily emphasis on current data for its prediction, not using any information related to the history of the data-set.

Finally, an email notification process is called which again send the notification to the user about the change in stock index with the aggregate results of both the prediction models, about where the share can go in future, based on those results user can decide whether to sell or hold the share.

IV. CONCLUSION

This study introduced a hybrid algorithm for prediction of stock market, we observed that neural networks system is capable in identifying the unseen relation in the data-sets and can be used for reliable forecasting. LSTM is used for prediction based on historical data as this model is appropriate for time series data which are of non- linear in nature. For prediction on current data CNN is used, it can effectively recognize any changes in the market trends, analysing these trends investors profit can be increased. The model also monitors the share price continuously and notify user if any changes are observed with more than 10% of its initial buying price. The combined result of monitoring and prediction help in decision making process for user, the prediction accuracy can be achieved more than 70%. The aim of our research study is to help the user/investors for investing money in the stock market.

V. FUTURE WORK

Currently we are using this model for a limited size data-set, in future we will increase the size of the data-set and also see whether this model is capable of predicting other valuable information such as fuel price, election outcome, etc.

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