

Stock Market Price Analysis Prediction Result Using a Hybrid Model Based on Long Short-Term Memory Algorithms

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Abstract

The purpose of this research is to develop a hybrid Deep Learning model capable of forecasting new stock price values based on stock market data. Textual analysis of public opinion from online news sources and blogs is being examined in addition to numerical analysis of stock movement. Using hybrid architecture for these algorithms, we take RMS value and median (along with 95% Confidence Interval) of the predictions from the algorithms.

Keywords — Artificial Intelligence, Cloud Computing, Deep Learning, LSTM, BiLSTM, GRU, Machine learning.

I. INTRODUCTION

Data for time series forecasting is captured at regular intervals. As a result, time will be an independent variable in any prediction model based on time series data. A model's output would be the projected value at a given moment. Machine learning and deep learning are the most effective approaches for dealing with this kind of problem.

1.1 Machine Learning Techniques

A fake neural system learning calculation can be clarified similar to a learning calculation which takes after natural neurons. Calculations are completed by first speaking to them in organized structure as an interconnected gathering of counterfeit neurons. These interconnected neurons at that point cycle the data and follows a connectionist approach to carrying out the computation. The Rule of Association in huge datasets, learning is a strategy for uncovering meaningful correlations between variables. Its goal is to combine a few intriguing quality proportions to find reliable suggestions found in data sources. It is a choice help instrument that utilizations tree-formed structures, for example, chart which speaks to the arrangement of choices and their potential results. Choice tree approaches include classification and regression trees, as well as Chi Square Automatic Interaction Detection (CHAID) (CART). Choice tree approaches like as Truck and CHAID are used to organize data. In profound learning, the fake neural system comprises of various concealed layers. This methodology attempts to demonstrate in a manner like how the human cerebrum measures light and sound into vision and hearing. The idea of profound learning had built up a great deal during the most recent couple of years in view of the scaled down equipment costs and

advances in graphical UI. Inductive Logic Programming (ILP) is a rule-learning approach that use reasoning programming as a standard format for input models, foundation data, and hypotheses. An ILP framework will infer a conjectured logic program that incorporates all sure and no negative models from an encoding of known foundation information. A similar issue is inductive programming, which examines any programming dialect for conveying hypotheses. Clustering is a method of allocating fresh information events to one of the bunches based on the perceptions derived from the preparing data. A Bayesian approach, for example, may be used to discuss the probability links between diseases and their symptoms. It's a heuristic for pursuing anything that seems like a common decision pattern. It is essentially used to produce valuable answers for enhancement and search issues.

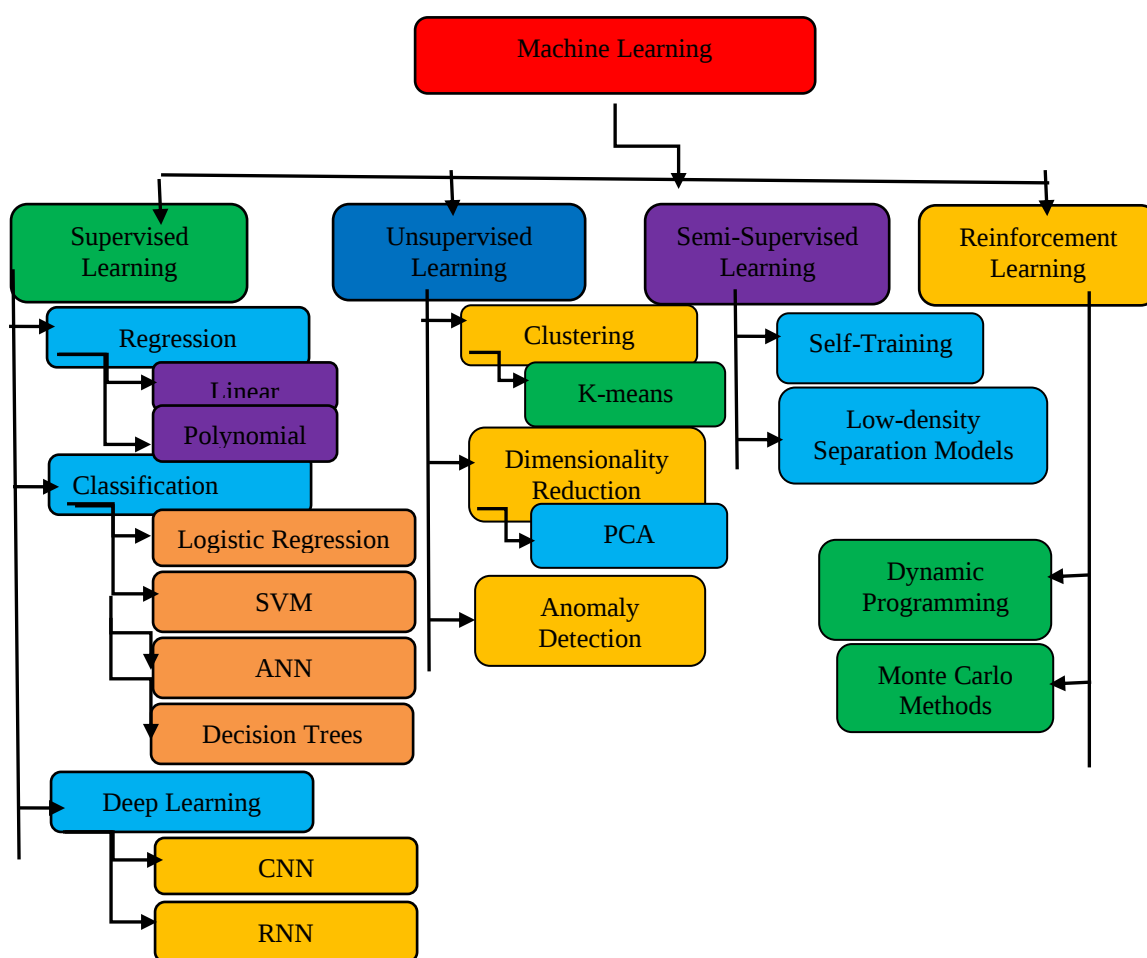


Figure 1. Types of Machine Learning Algorithm

II. LITERATURE REVIEW

LSTMs (Long Short-Term Memory) is a type of recurrent neural network that deals with long-term temporal interactions. They have a natural proclivity for remembering knowledge for lengthy periods of time and make no attempt to learn it. During back propagation, LSTMs also deal with the vanishing/exploding gradient issue - they overcome RNN's flaws in both areas. Time series analysis is a method for separating information from a sequence of data points.

Because data points closer in time are more correlated than data points separated by a greater time separation distance, a random model for time series forecasting would always be limited. We'll look at some of the most promising time series data forecasting techniques, as well as how LSTM, a sort of neural network, is revolutionizing the area. Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) models are used to develop a multivariate prediction model in this study. LSTM has good accuracy over a longer data period, whereas GRU performs better during a shorter time period. **Dr. M. Sangeetha and Dr. R. ManjuPriya et al. [2]** This research study will focus on the use of artificial intelligence in stock market modelling, sales forecasting, and market segmentation challenges, with a focus on convolution neural networks (CNN) and fuzzy logic. The first two issues were solved using back propagation techniques, while the third was solved using self-organizing maps. **Saurabh Gupta and Vaishali et. al. [3]** The extreme volatility of stock market data makes modelling difficult. For example, options on the NIFTY and BANKNIFTY account for 70% of all derivatives traded. We extracted several properties from the Option chain using Machine Learning and Deep Learning approaches.

III. METHODOLOGY

3.1 Research Methodology

The stock's performance is influenced by a number of things. We can get good prediction results if indicator variables are selected correctly. Recurrent Neural Networks are networks with circles that permit information to persevere. A circle might be utilized to pass on information starting with one organization stage then onto the next. Consider the case below: You want to classify the kind of events that happen in a movie at different points. It's muddled the way that a not unexpected neural organization may utilize past film occasions to impact future ones.

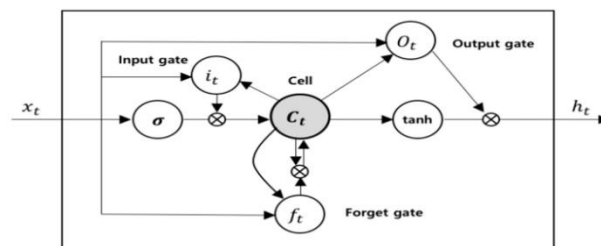


Figure 2. LSTM cell with gating units

Bidirectional LSTMs (BiLSTMs) are a sort of LSTM that might be utilized to build model execution in succession characterization issues. They have forward memory and recall in the future since they are taught on reversed information. By giving additional context and lowering training time, this can increase performance.

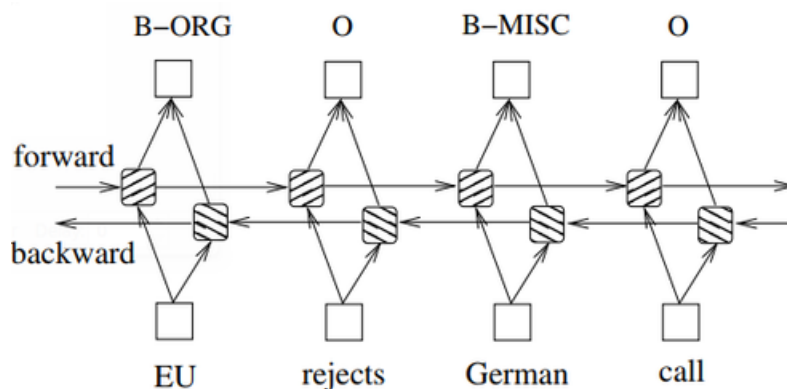


Figure 3. A bidirectional LSTM network

GRU: - GRU is an RNN design that uses reset and update gates to manage information flow, as seen in figure 4. The reset gate chooses which information to keep and which to discard, and it may thus be thought of as a hybrid of the LSTM forget and input gates [4].

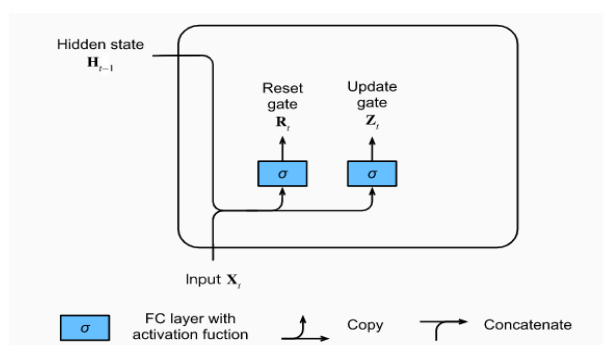


Figure 4. GRU Cell

3.2. Previous price trend prediction model

An LSTM model uses a conversion technique for stock price datasets, which shifts the input data frame according to the amount of time steps and turns the main components matrix into time series. The steps are as follows:

Step 1: Start

Step 2: Get the dataset yahoo finance website for stock.

Step 3: Select the csv file and paste it into the data structure you have established, then read the price by day.

Step 4: Scale the data using feature scaling, altering the data values between 0 and 1.

Step 5: Create a 40-timestamp data structure with a single output.

Step 6: Using the data from Step 5, create an RNN (Recurrent neural network) and use a sequential repressor to initialize it.

Step 7: Eliminating unwanted data using the first LSTM layer and some Dropout regularization.

Step 8: Finally, add the output layer to the mix.

Step 9: To get the RNN and the loss as mean squared error, combine the RNN and the loss as mean squared error.

Step 10: Compile your predictions and graph them.

3.3 Proposed Model

For those who aren't jargon addicts, one of the most well-known applications of machine learning research is in the stock market. For the greater part of the last 50 years, financial theorists and data scientists have been employed to help make sense of the marketplace and increase return on investment. On the other hand, the issue's complicated structure, system complexity, and system's intrinsic instability over time have made it an incredibly difficult problem for humans to address, even using traditional data analytics techniques. However, as machine learning applications have progressed, the discipline has extended to include non-deterministic ways to "learn" what is going on so that more exact projections may be made. The work on "tune" is discussed in this thesis.

The work done to "tune" the basic stock price prediction algorithm and how it effects the outcomes is presented in this thesis. Because this is an introduction, it is intended to be straightforward, so more seasoned readers may need to bear with me.

3.4 Model Diagram

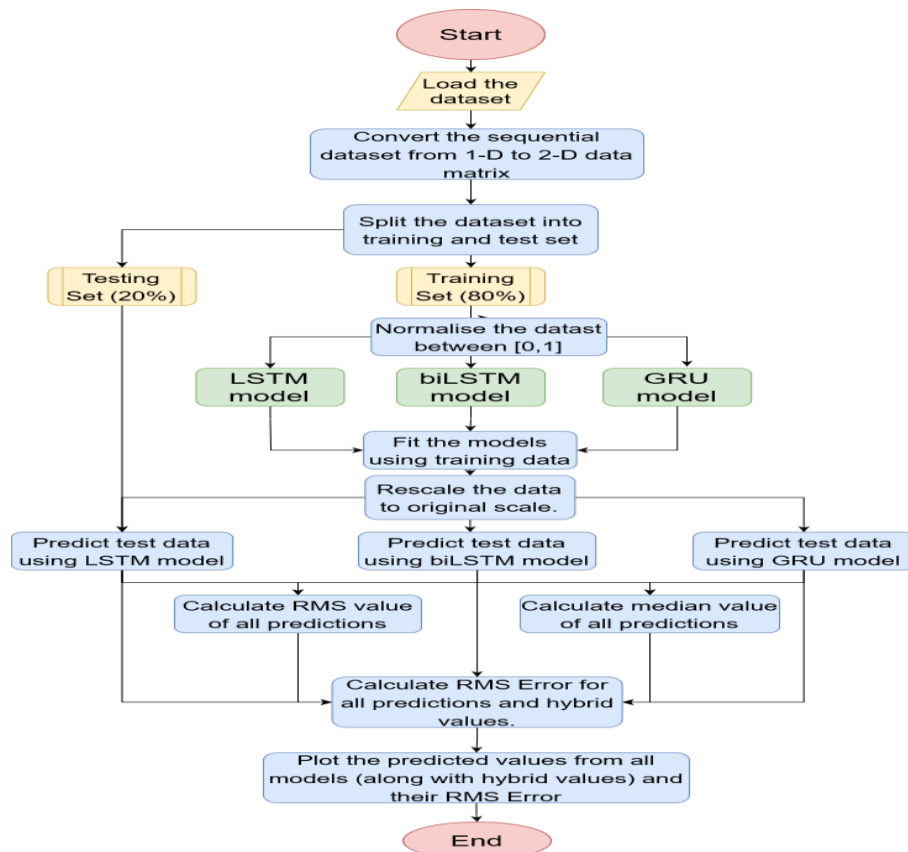


Figure 5. Proposed Model for Stock Price Prediction

3.5 Implementation steps:

- Step 1. Import all the necessary Machine Learning libraries along with Tensor Flow and RNN units.
- Step 2. Load the dataset.
- Step 3. Reshape the data from 1-D time series to 2-D data matrix using look back window.
- Step 4. Split the dataset into train and test set of size 80%-20% respectively.
- Step 5. Normalize/scale the dataset between [0,1] for better training of models.
- Step 6. Create LSTM, biLSTM and GRU models and compile them by providing hyper parameters like loss and optimization techniques.
- Step 7. Fit the model on the dataset by providing training set, and training steps.
- Step 8. Rescale the dataset into its original values.
- Step 9. Predict the training and testing set using the trained models and calculate the RMS errors.
- Step 10. Calculate RMS values of predicted values for both training and testing set.
- Step 11. Create Median of predicted values along with 95% Confidence Interval for the predicted values.
- Step 12. Calculate Mean Sq. Error (RMSE) for all the models as well as RMS and Median Values.
- Step 13. Plot the predicted values for training and test set for all models as well as RMS and Median Values.

Plot the bar chart depicting the RMSE for all models as well as RMS and Median

IV. RESULTS AND DISCUSSION

The numerical analysis model, textual analysis and integrated model experiments are summarized below. Historical data from Yahoo Finance is obtained using the y finance python package. According to the model's specifications, any fields that aren't essential to process have been eliminated. The data set is a multi-dimensional data collection with fields containing textual data as well as fields containing precise values.

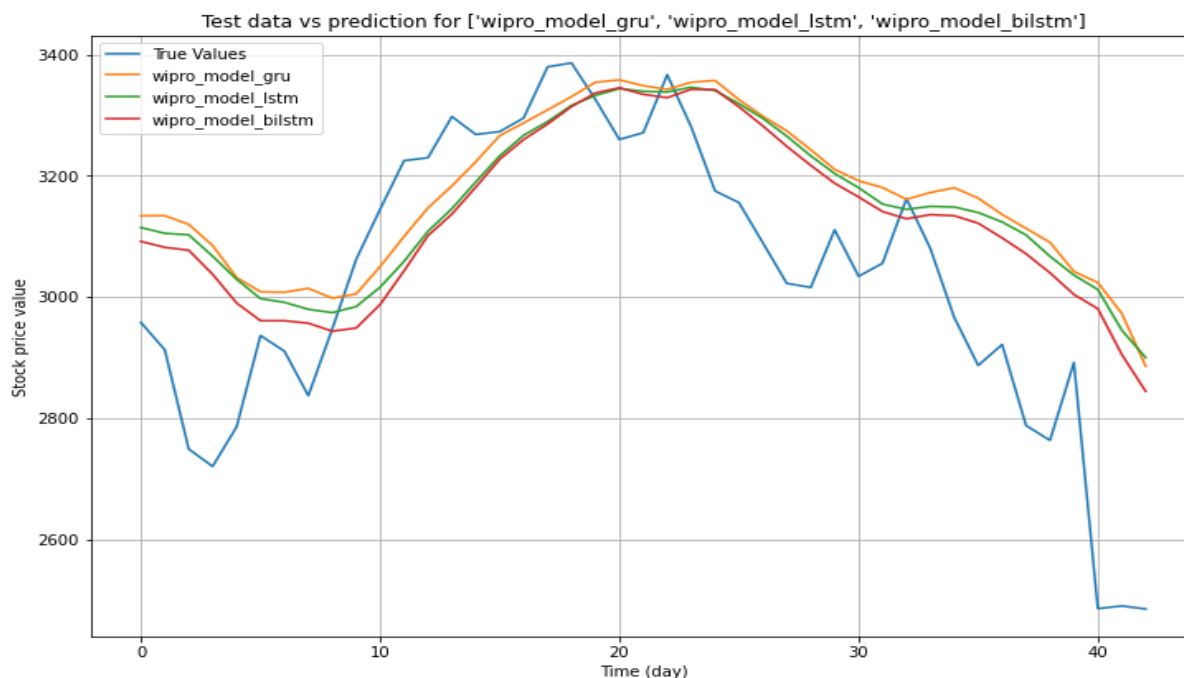


Figure 6. Result of Algorithms

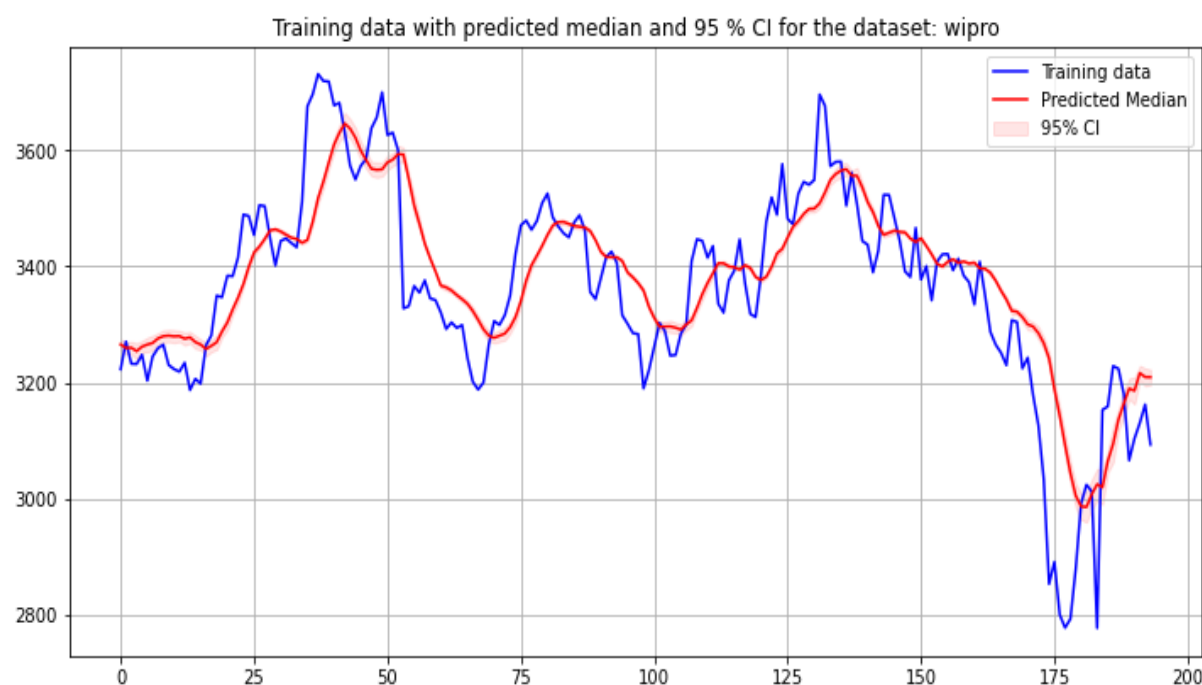


Figure 7. Result of Algorithms

V. CONCLUSION

Stock price prediction, as noted in previous chapters, has been a hot topic of research for a few decades. For data analysis and forecasting, a variety of methodologies are employed in stock price prediction. Hybrid approaches can be utilized, in which two or more techniques are merged to anticipate results more accurately. For example, in technical analysis, a neural network can be mixed with fuzzy logic, and feature identification can be done using a decision tree. This strategy is referred to as a hybrid model. Data for the study can be acquired from two or more locations, for example, in the stock market, we can collect data from the National Stock Exchange and the Bombay Stock Exchange to analyze price variations between the two

markets. Stock prices may be forecasted more correctly if emotional data analysis is combined with historical data obtained from social media sites such as Twitter, Facebook and Google Trends. All of these strategies are used solely to more correctly forecast future events in order to reduce the threshold value (the difference between the real and anticipated price, also known as Mispricing). Running a market simulation that simulates the behavior of investors using real-world data is one of the most effective techniques to test the dependability of a prediction system. Other areas of research include market simulations using the suggested prediction model (shares are bought and sold solely based on the content of news stories for a predetermined evaluation period) and the Buy-and-Hold Test (stocks are bought at the beginning and sold at the end of the evaluation period). Each simulation's rate of return would be determined and compared to the average.

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