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STOCK MARKET PREDICTION USING CNN AND LSTM

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Abstract

Stock markets price prediction is a difficult undertaking that has historically required substantial human-computer cooperation. Because stock prices are interrelated, traditional batch processing techniques cannot be used effectively for stock market research. It is practically impossible to estimate stock prices to the penny due to the unpredictability of the factors that affect price movement. However, an informed estimate of pricing is attainable. The data is provided in the form of corporate stock data, which will be evaluated in real-time. The system produces an output in a graphical form that depicts the predicted future stock price. Hence we have proposed a solution to predict the stock market prices using the machine learning algorithm.

Keywords: stock market,price prediction,stock market research,machine learning algorithm.

INTRODUCTION

Stock market price modeling is a constant challenge for many company analysts and academics. Estimating stock market prices is both a fascinating and difficult subject of study. The share market is extremely difficult to predict accurately since it is greatly affected by external factors, including social, mental, geopolitical, and economic considerations.

The primary characteristics of stock market data are typically time-variant and nonlinear.In the realm of stock trading, making predictions about the stock market is extremely important.Investors who are insufficiently informed and knowledgeable run the biggest risk of losing their money.

To make large gains, traders must correctly forecast the stock value of firms in the future. To accurately make predictions on the financial markets, numerous prediction algorithms have been created. When there were no computational tools for risk assessments, there have been two extensively used conventional methods. There are numerous traditional techniques for forecasting stock values.

1.1 Analysis of The Stock Market

There are two methods of analysis in the Stock Market: Fundamental Analysis and Technical Analysis. We will discuss each one in detail below:

1.2 Fundamental Analysis

A type of analysis that has proven to be highly advantageous throughout the history of the stock market is fundamental analysis. A security's inherent worth is

assessed utilizing economic, financial, qualitative, and quantitative variables in fundamental analysis. Both macroeconomic and microeconomic factors are thought to have an impact on the value of a share.

These variables may include the state of the economy, business environment, financial situation, and management skills. The main objective of conducting a fundamental analysis is to assess whether a stock is priced too high or too low by evaluating its intrinsic value and comparing it to its current market value.

Process For Fundamental Analysis of a Stock

The steps for Fundamental Analysis are:

Knowing the organization

Understanding the industry in which you intend to invest is essential. You will get more understanding of the business's operations if it is making the best choices for its long-term objectives, and whether you should keep or sell the shares. A smart way to gather such knowledge is by visiting its website and learning about the business, its administration, its supporters, and its merchandise.

Review the company's financial reports.

As soon as you are certain, you should start looking at the company's financial records, including the balance sheet, profit-loss accounts, cash flow statements, operating costs, revenues, and expenses, among others. If the company's net profit has been rising over the past five years, it might be viewed as a positive indication for the business. You can assess its compound annual growth rate (CAGR), sales, and other factors.

Verify the debt

Debt is a significant aspect that might negatively impact a company's profitability. If an asset has a sizable debt by itself, it could function well and pay you back. It is advised that you steer clear of businesses with significant debt. Always look for a debt-laden company to invest in a debt-to-equity ratio that is lower than 1.

Locate the company's rivals

To make a successful investment, it is essential to choose a company that outperforms its competitors. The selected company should have a positive outlook for the future, such as upcoming projects or new facilities, and stronger growth potential.

Examine the potential outcomes.

Fundamental analysis is most effective when considering long-term investments that will be made on a recurring basis. It is advisable to invest in companies whose products or services will remain significant 15 to 25 years into the future.

Review each aspect periodically.

Don't invest in a business and then ignore it. Keep yourself informed about the business you have invested in. You ought to be informed of all company news and financial results. In the event of an issue with the corporation, sell the share.

1.3 Qualitative and Quantitative Fundamental Analysis

Defining the term "fundamentals" can be challenging since it encompasses all factors that influence a company's financial well-being. This can include a company's market position, the quality of its management team, and financial metrics such as revenue and profits.Quantitative and qualitative fundamental components might be combined into one category. These terms' definitions according to finance aren't all that different from the well meanings:

Qualitative Factors:

Qualitative measurements as opposed to the quantity measure caliber, character, and nature of things. These include four things: The Business Model, The Comparative Advantage, Management, and Corporate Governance.

Quantitative Factors:

Quantitative measurements measure figures, numbers, formulas, and ratios. These comprise a statement of cash flows, an income statement, and a balance sheet.

1.4 Technical Analysis

Technical analysis is the process of studying past price and volume data in the market to predict future market trends. It draws upon knowledge from quantitative research, behavioral economics, and market psychology. Technical analysis includes a wide range of methodologies, including statistical indicators and chart analysis. Technical analysts utilize a number of tools, including trendlines, candlestick patterns, and mathematical visualization approaches, to find probable entry and exit points since their main goal is to anticipate whether a trend will continue or reverse. Analysts often use a combination of tools to make trading decisions.

The basic tenet of technical analysis is that market prices already reflect all relevant data, making it unnecessary to consider economic, fundamental, or new developments. Technical analysts believe that prices in the market tend to move in trends and that historical patterns often repeat themselves, reflecting the market's psychology.

As a sort of discretionary technical analysis, technical analysts employ chart patterns to pinpoint areas of support and resistance on a chart. These patterns aim to forecast price changes that will occur after a breakout or breakdown from a specific price and period, and they are supported by psychological variables. Technical indicators, which are a statistical subset of technical analysis, are produced by technical analysts using mathematical formulae on prices and quantities. Trading strategies are developed based on these evaluation metrics by using technical indicators like moving averages, which smooth price data to make trend identification easier, and the more sophisticated moving average convergence divergence (MACD), which looks at how different moving averages interact.

1.5 How Does the Stock Market Work?

Buying stock means purchasing a small portion of a publicly traded company, which can be done through stock exchanges. An initial public offering (IPO) allows companies to list their shares on an exchange and sell them to investors to raise capital for business expansion. These shares can be traded among investors. The term "bid-ask spread" refers to the variation between the greatest price a buyer is ready to pay (the "bid") and the lowest price a seller is willing to accept (the "ask"). Computer algorithms typically perform price computations, and bid, ask, and bid-ask spreads can be viewed on a broker's website. Stock trades are now conducted electronically due to the internet and online stockbrokers. Various factors such as news, political events, and economic reports can affect stock prices.

1.6 Stock Market Predictions Using LSTM

Due to the volatility of tick market prices, accurately estimating stock prices is challenging. Time series modeling, such as the use of LSTM neural network architecture, can aid in forecasting future values. A set of predictors, including fundamental market data and technical indicators, is used to represent stock market behavior. Single and multilayer LSTM models are created using the selected input variables, and their performance is compared using RMSE, MAPE, and Correlation Coefficient. Empirical findings indicate that the single-layer LSTM model outperforms the multilayer LSTM model in terms of fit and prediction accuracy.

II. Literature Survey

PAPER TITLE WITH PUBLISHED INFORMATION	METHODOLOGY
[1] Jimmy Ming-Tai Wu, Jerry Chun-Wei Lin, "A graph-based CNN-LSTM stock price prediction algorithm with leading indicators," 2021, Springer Open Access, Multimedia Systems	Data preprocessing: The authors preprocess the stock data by extracting technical indicators as features and constructing a graph representation of the market based on correlation coefficients between stocks.
[2] Pratheeth S, Vishnu Prasad R, "Stock Price Prediction using Machine Learning and Deep Learning", 2021 IEEE Mysore Sub Section International Conference (MysuruCon).	Explains the purpose of this study is to forecast and predict stock values in real-time using machine learning and data mining methods. The purpose of this project is to utilize the ARIMA model to forecast the price of Reliance Industries Limited (RELIANCE.NS) stock for up to two years, and to use Random Forest and LSTM to forecast the stock price for the following day for test data.

PAPER TITLE WITH PUBLISHED INFORMATION	METHODOLOGY
[3] Xiongwen Pang, Yanqiang Zhou, Pan Wang, Weiwei Lin, "An innovative neural network approach for stock market prediction", 2020, The Journal of Supercomputing volume 76, pages 2098–2118	An unique neural network technique for enhancing stock market forecasting is developed. Data from the cattle market was obtained for real-time and off-line examination, as well as the results of visualisations and analyses, to demonstrate the Internet of Multimedia of Things for stock analysis.
[4] Adil Moghar, "Stock Market Prediction Using LSTM Recurrent Neural Network," 2020, Procedia Computer Science, Volume 170, pg no. 1168- 1173	Machine learning, or teaching computers to perform tasks that would normally need human intelligence, is a prominent issue in scientific research right now. Using Recurrent Neural Networks (RNN) and, the 18 Long-Short Term Memory model, this article attempts to construct a model for predicting future stock market values (LSTM).

PAPER TITLE WITH PUBLISHED INFORMATION	METHODOLOGY
[5] Ishita Parmar, Navanshu Agarwal, Sheirsh Saxena,"Stock Market Prediction Using Machine Learning," 2018 First International Conference on Secure Cyber Computing and Communication (ICSCCC)	The methodology of the paper involves the use of several machine learning algorithms such as Linear Regression, Support Vector Machines (SVM), Random Forest, and Artificial Neural Networks (ANN) for predicting stock prices
[6] Samuel Olusegun Ojo; Juliana Adeola Adisa; Pius Adewale Owolawi; Chunling T. Du; "Stock Market Behaviour Prediction using Long ShortTerm Memory Network and Gated Recurrent Unit",2020 International Conference on Computational Science and Computational Intelligence (CSCI). 50	Machine learning, or teaching computers to perform tasks that would normally need human intelligence, is a prominent issue in scientific research right now. Using Recurrent Neural Networks (RNN) and, the Long-Short Term Memory model, this article attempts to construct a model for predicting future stock market values (LSTM).

PAPER TITLE WITH PUBLISHED INFORMATION	METHODOLOGY
[7] Mehrnaz Faraz; Hamid Khaloozadeh; Milad Abbasi,"Stock Market Prediction-by-Prediction Based on Autoencoder Long Short-Term Memory Networks", 2020, 28th Iranian Conference on Electrical Engineering (ICEE).	The methodology of the paper involves using an autoencoder LSTM approach for stock market prediction. The authors used historical stock market data as inputs to the model and trained it to predict future stock prices by predicting each future stock price one-by-one, rather than predicting the entire future trend at once.
[8] Agustinus Bimo Gumelar; Haryati Setyorini; Derry Pramono Adi; Sengguruh Nilowardon, "Boosting the Accuracy of Stock Market Prediction using XGBoost and Long Short-Term Memory", 2020, International Seminar on Application for Technology of Information and Communication (iSemantic).	They experimented with predicting the final stock price for 25 firms in this study. The shortlisted companies are enlisted on the Indonesia Stock Exchange to assure data dependability and regional notion (IDX). The Long Short-Term Memory (LSTM) and Extreme Gradient Boosting (XGBoost) ML algorithms were utilised in this experiment, and both are known for their great accuracy.

PAPER TITLE WITH PUBLISHED INFORMATION	METHODOLOGY
[9] R. Shanmuga Priya & C. Sruthi, "Stock Price Prediction Based on Deep Learning Using Long Short-Term Memory",2020, Part of the Lecture Notes in Electrical Engineering book series (LNEE,volume 792), Springer	The authors used the Long Short-Term Memory (LSTM) model to predict the stock prices of three Indian companies: Reliance Industries Limited, Tata Consultancy Services Limited, and Infosys Limited. The dataset used for the study consisted of daily stock prices and volumes for the period from January 1, 2010, to December 31, 2019.
[10] Xukuan Zhan, Yuhua Li, Ruixuan Li, Xiwu Gu, Olivier Habimana & Haozhao Wang, "Stock Price Prediction Using Time Convolution Long Short-Term Memory Network", 2018, Part of the Lecture Notes in Computer Science book series (LNAI,volume 11061), Springer	Time Convolution LSTM (TCLSTM) Model: The TCLSTM model is proposed, which combines the advantages of both Convolutional Neural Networks (CNN) and LSTM networks. The CNN layers are used to extract high-level features from the input data, while the LSTM layers are used to capture the temporal dependencie

3.MODULE DESCRIPTION

MODULE 1: DATA ACQUISITION AND PRE-PROCESSING

Stock market prediction aims to predict a company's financial stock value in the future. Machine learning has emerged as a popular approach for predicting stock values by training on prior stock market indices. Multiple machine learning models are used for accurate stock price prediction. This paper specifically examines the use of LSTM-based machine learning and regression for stock value prediction. The date format is changed to

slash format (16/09/22) to better represent the time-series nature of stock prices.

The Python feature below will be used for this.Despite the fact that dates have a standard representation, you could want to publish them in another manner. In that case, you can use the various format codes to get a customized string representation. strftime() uses a number of industry-standard directives to represent a DateTime in a string format. The list of directives used by the strptime() and strftime() methods is the same.

Finding Null Values

The current Kaggle dataset is deficient in a number of areas. This can be the result of insufficient data collection methods or a dearth of relevant information. NaN (not a number) or None are used to represent these values in the dataset. Whatever the origins, this complicates and distorts our computing. As a result, we track down the missing information and replace it with fully operational parts.

Replacing Null Values

Once the null values have been identified, the null values' rows and columns can be removed or converted to the mean, median, and mode. We used the dropna() function to eliminate every null value from a dataset. This operation can be used to remove null values from table columns and rows. The mean or median value can be used to replace the missing data if the relevant columns have integer or float data types.

The value or mode that occurs most frequently could be used in place of another value in the absence of specific information. This can use both floating-point numbers and integers. But if the relevant columns also have strings, the usefulness rises. The fillna() function loops through our data collection, inserting the median, mode, and average values into any empty rows. For categorical data, the mode will be used in place of any missing values. In the absence of sufficient empty rows, the median will be applied.

None and NaN are both considered comparable representations of missing or null values by Pandas. Numerous helpful functions in Pandas DataFrame make it simpler to identify, remove, and alter null values. Pandas DataFrame uses the functions isnull() and notnull to recognize null values (). You can use any one of these procedures to determine whether a number is NaN. Finding the missing numbers in a series is another potential application of these methods when working with Pandas Series.

Normalization of data

Normalization is a scaling method used in machine learning to adjust numerical values to a standard scale. It is necessary only when the feature ranges vary. Data is centered around the mean with a unit standard deviation using standardization scaling or Z-score normalization.

3.2. MODULE 2:

MODEL IMPLEMENTATION

a. Model

GridSearchCV is an automated method used to find the best hyperparameter settings for a specific model. This method helps to improve the model's performance by iterating over a range of hyperparameters. Scikit Learn's GridSearchCV function evaluates the model for each combination of hyperparameters, allowing us to select the best-performing combination. This function is useful for constructing an ensemble model that combines predictions from different models to enhance prediction accuracy.

b. Splitting The Dataset

Splitting the dataset into two distinct subsets—the training dataset and the test dataset—is a typical way for assessing a model's performance. To find out how effectively the model generalizes to fresh, untested data, it is first trained on the training dataset, and then its performance is evaluated on the test dataset. These two programs, Sklearn and Pandas, are frequently used to divide the dataset into these two subgroups. The dataset is split with a test size of 0.3 and a random state of 0 to ensure a fair allocation of records between the two subsets.

c. Dataset Training

Deep learning is especially well suited to GPUs since it necessitates the same kinds of calculations that GPUs were designed to perform. We really apply a mathematical transformation to a matrix, which is how images, movies, and other visuals are captured, when we do any operation, such as a zoom-in effect or a camera rotation.

In this work, a CNN-LSTM approach that considers the sequential features of the stock data is suggested for predicting the closing price of stocks for the next day. To extract the characteristics, the approach employs a variety of data inputs, including the starting price, highest price, lowest price, closing price, volume, turnover, ups and downs, and change of stock data. The LSTM model is trained using the features that were extracted using the CNN. The relevant data from the experiment are used as an example to validate the findings using the Shanghai Composite Index.

In terms of performance and accuracy, CNN-LSTM performs better than CNN-RNN, MLP, RNN, LSTM, and CNN. It has the lowest MAE and RMSE values, and R2 is close to 1. Investors can benefit from using CNN-LSTM for stock price forecasting, and it provides valuable real-world experience for financial time series researchers.

The correct code is conda install numba & conda install cudatoolkit. Then, using the training dataset, we execute the standard CPU function. Then, we create a function that is enhanced for GPU performance. We ultimately receive the outcomes of time spent with a GPU and without one. Our model benefits from faster, more efficient, and more effective GPU training.

Thanks to NVIDIA's CUDA parallel computing technology, the software may utilize both the CPU and GPU simultaneously. NVIDIA is now the most well-liked GPU supplier for cloud computing and machine learning, thus we use them. Additionally, the majority of Python languages that support GPUs can be used with NVIDIA GPUs.

Then we train our model after loading the data onto the CUDA GPU. Since our system uses CUDA, we want to transfer our data from the CPU to the GPU RAM during the training phase. As a result, enabling pin memory=True will cause the data to be transferred into page-locked memory, accelerating training. The data are now ready for training; that's all there is to it. The data is then loaded in batches.

d. Saving The Best Model

The system proposed in this study was able to identify some relationships within the data, showcasing its potential. The results indicate that the CNN architecture used in the methodology is effective in detecting changes in trends. Despite being commonly used in other time-dependent data processing, the CNN architecture outperformed other models in predicting stock market behavior using current data due to the unpredictable nature of the market's abrupt shifts. It is possible that stock market fluctuations may not always follow a predictable pattern or cycle.

Fig 1.2 compares the classification accuracy of the machine learning models used such as CNN, DNN and LSTM. We can infer that the LSTM model is found to have the highest accuracy compared to the other two models.

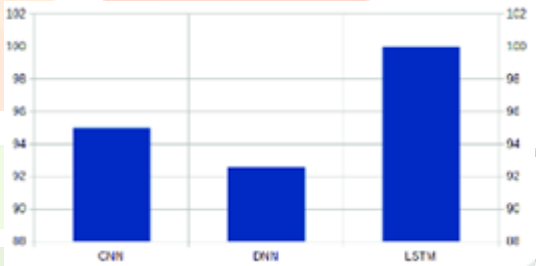


Fig 1.2 Classification Accuracy

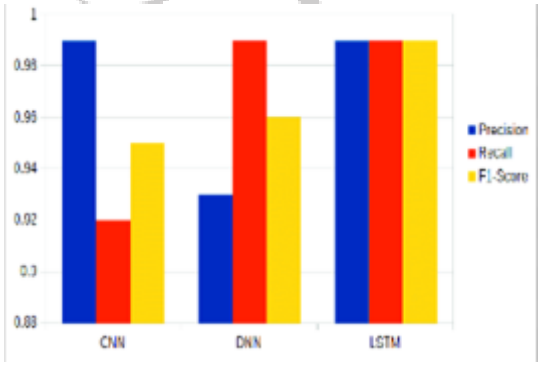


Fig 1.3 Precision, Recall and F1 Score

Figure 1.3 illustrates a comparison of other variables like Precision, Recall, and F1 score that were obtained from different Machine Learning models, including CNN, DNN, and LSTM. The chart demonstrates that the LSTM model has equally distributed values for Precision, Recall, and F1 Score, which is unlike neural networks such as CNN and DNN.

MODULE 3: IMPLEMENTING WEBAPP

Creating a Webapp Using STREAMLIT

We will write programming to handle the server side processing. We'll send requests to our code. It will choose the topic and kind of the requests. It will also choose the type of response to send to the user. For all of this, Flask will be used. The procedure for designing web applications is made simpler. With the help of Flask, we can focus on the questions that customers have and the best way to respond.

Within the directory that will house the project files, we will create a virtual environment for the project. Install virtualenv first using pip Install virtualenv, then create and activate a virtual environment before installing Flask with the pip install command. The main goal of this project is to precisely predict the stock's closing price over an extended period of time. Dash html components and dash core components were used in this project to create the website's framework and enhance its user interface.

4.1 SYSTEM DESIGN

This illustration depicts the integration of different entities in the system, offering a clear and concise overview of their interrelationships. It displays the connections between various actions and decisions, presenting the entire process as a visual representation. The diagram portrays the functional links between different entities.

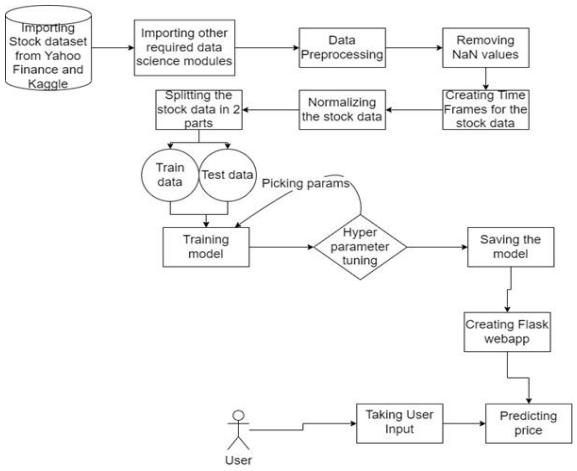


Fig 4.1 – Architecture Diagram

Data Flow Diagram

The whole system is shown as a single process in a level DFD. Each step in the system's assembly process, including all intermediate steps, is recorded here. The "basic system model" consists of this and 2-level data flow diagrams.

Fig 4.2 – Data Flow Diagram Level 0

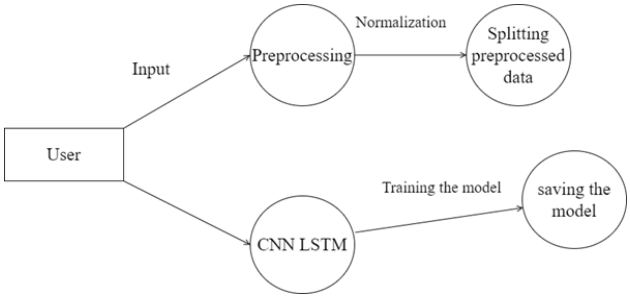
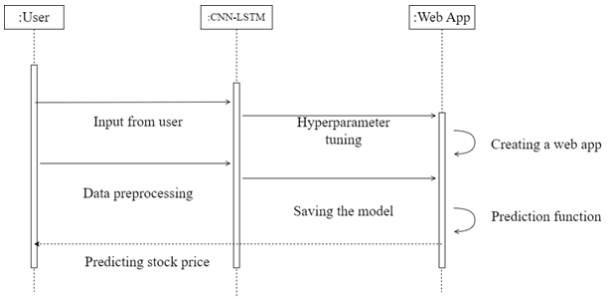


Fig 4.3 – Data Flow Diagram Level 1

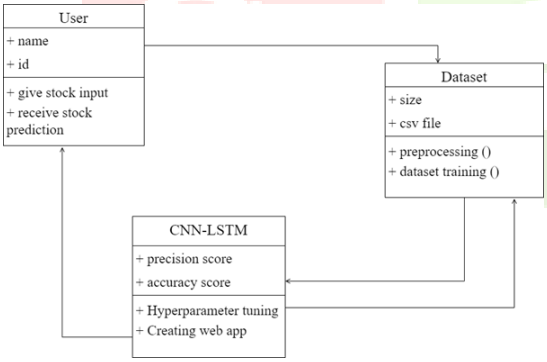
Sequence Diagram

These are another type of interaction-based diagram used to display the workings of the system. They record the conditions under which objects and processes cooperate



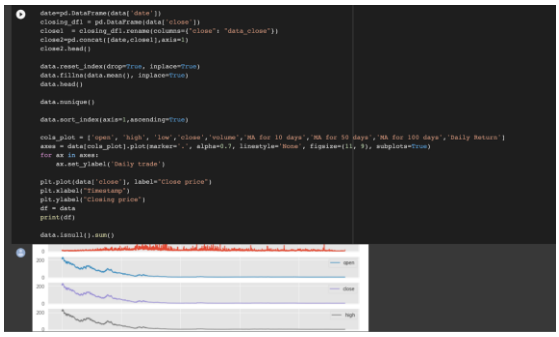
Class Diagram

In essence, this is a "context diagram," another name for a contextual diagram. It simply stands for the very highest point, the 0 Level, of the procedure. As a whole, the system is shown as a single process, and the connection to externalities is shown in an abstract manner.

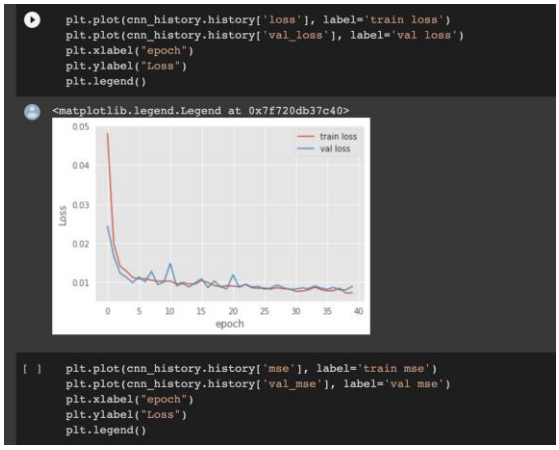


5.TESTING

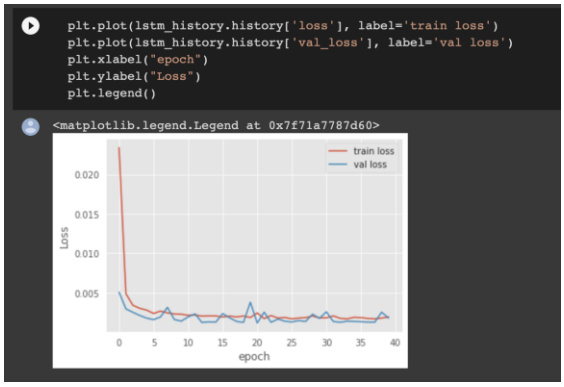
1. THE DATASET



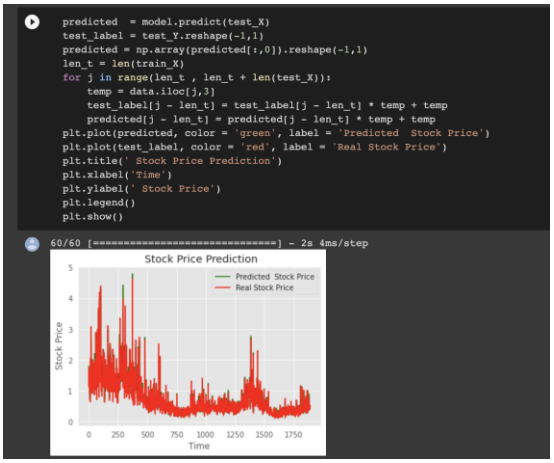
2. CNN



3. LSTM



4 CNN+LSTM



6. RESULT

We are using python for our entire model which involves Data Cleaning, Data Modeling and Testing Data using CNN-LSTM which provides a high accuracy and it is quite compatible with Artificial Intelligence and Machine Learning, and Streamlit is used to create a website for final running and displaying of data and graph.We used Google colab to train the model, Cleaning data, testing, and training the model. Visual Studio Code is used for collecting model for each technique and finally, all models are put together, combined, and rendered into a web page.

7. CONCLUSION

The most important steps in the data pretreatment process are data cleansing and data visualisation, which are crucial for increased stock market forecast accuracy. Due to overfitting brought on by improper input parameter utilisation, the current system exhibits subpar accuracy. The proposed model has been used as a technique for developing special feature sets and getting accurate predictions. the experiment were carried out with a non-linear RBF kernel, which gave us incredibly accurate results. Most importantly, the evaluation indicated above helped us predict the outcome and gave us insightful information about the kind of data that might be used in the future to train our differentiators in the most efficient way.

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