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Artificial Intelligence in Stock Market Trading

(Market Prediction, Stock Recommendation, Candlestick Pattern Recognition)

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Abstract:- This document explains how artificial intelligence (AI) and the stock market can work together. Among the more important ones are stock pattern detection and stock prediction using AI. The goal of stock market prediction is to forecast the future value of a company's fiscal stocks. The application of machine literacy, which bases predictions on the values of current stock request indicators by training on their historical values, is a recent development in stock request vaticination technology.

Several models are used by machine learning itself to facilitate and authenticate vaccination. The study focuses on prognosticating stock values using LSTM based machine literacy. Considered factors are volume, low, high, open, and closed.

Transfer literacy was the model we used for the stock.

Keywords:- *Long-Short Term Memory(LSTM), Convolutional Neural Networks, Transfer Learning(VGG-16).*

I. INTRODUCTION

Introduction of Artificial Intelligence to the Finance industry has become more popular. The main advantage of Artificial Intelligence in Stock Market include the elimination of "mo- mentary irrationality" or decisions made based on emotions, ability to recognize and explore patterns that are looked over by humans, and immediate consumption of information in real-time. There are may ways that Artificial Intelligence can be used in stock market like Price Prediction, Sentiment analysis, portfolio management, Social media comments etc. This Document is about the Price Prediction and Automate the work during trading.

II. PATTERN RECOGNITION

A. Problem Statement

Seeing candlestick patterns while investing in the stock market will bore us, and identifying which pattern it is, is extremely difficult. Due to the fact that we are unable to observe the markets throughout the day, you run the risk of missing an excellent opportunity to invest in the stock market. Pattern recognition is performed by Artificial Intelligence in order to resolve this issue.

B. Patterns in Stock Market

In stock market, there will be a lot of patterns. For the purpose of creating a neural network, we will pick patterns that regularly occur.

- Hammer: Occurs when a stock opens then moves a lot

This pattern forms a handle-shaped candlestick, in which the lower shadow is at least twice the size of the real body.

- Inverted Hammer: Occurs after a prolonged sell-off when prices are near their lows for that period.
- Hanging Man: Occurs during an uptrend and warns that prices may start falling.
- Shooting Star: Occurs when the price of the security opens, rises significantly, but then closes near the open price.
- Dragonfly Doji: It is formed when the stock's high, open, and close prices are nearly same with a long lower shadow.
- Gravestone Doji: It is formed when the open, low, and closing prices are all near each other with a long upper shadow.
- Bullish Spinning Top: Occurs when the bulls send the price higher than the opening price, and the bears then push it back down before the market closes.
- Bearish Spinning Top: Occurs when the bears send the price lower than opening price and bulls push it back up before the market closes.

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Here we have identified some of the candlestick patterns like Hammer, Gravestone Doji, etc. Here in this chart we can observe a change in the trend after bullish spinning top pattern got occurred and the trend moves upwards and Inverted hammer occurred, therefore trend moves downwards. Thereafter we can see that hanging man pattern occured and the trend moves upwards, by this we can observe how candlestick patterns are impactful in trading and we also know that AI is very good at Identifying patterns. So to identify these patterns in a big chart we are going to build a VGG-16 model that can identify these patterns.

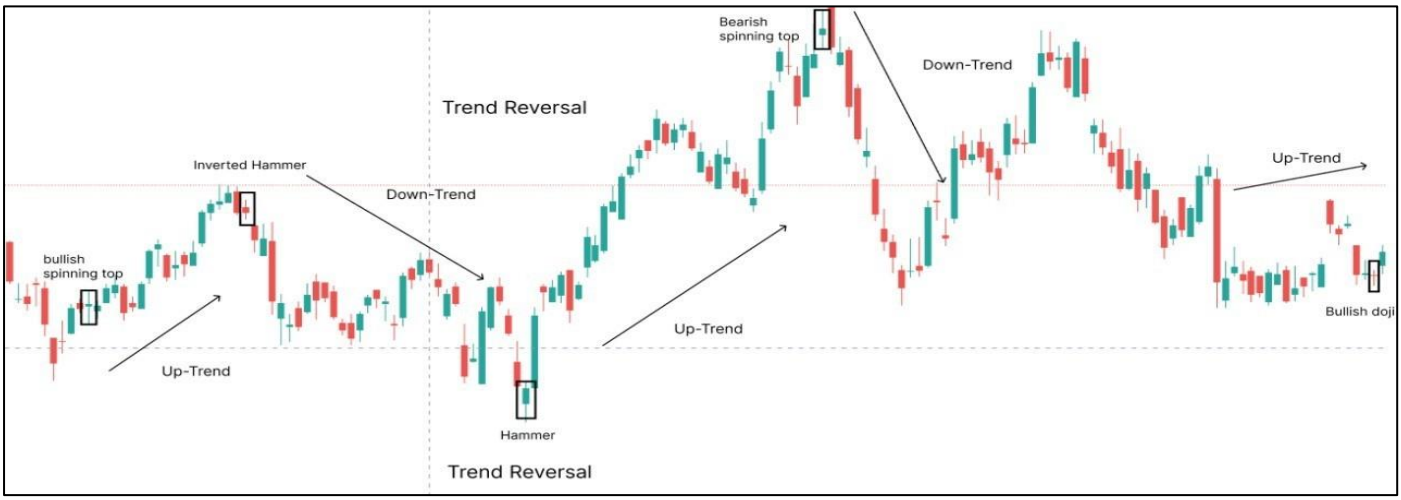

Fig 1 Chart taken from Trading View

C. Data Collection

We have manually taken screenshots of every pattern from Tradingview. For training purpose we we have taken 10 to 15 images of each pattern and for testing we took 5 images for each pattern.

D. Future trends of Candlestick Patterns

Table 1 Future trends of Candlestick Patterns

Pattern	Future Trend
Hammer	Upwards
Inverted Hammer	Upwards
Hanging Man	Downwards
Shooting Star	Downwards
Dragonfly Doji	Upwards
Gravestone Doji	Downwards
Bullish Spinning Top	Upwards
Bearish Spinning Top	Downwards

E. VGG-16 Model Building

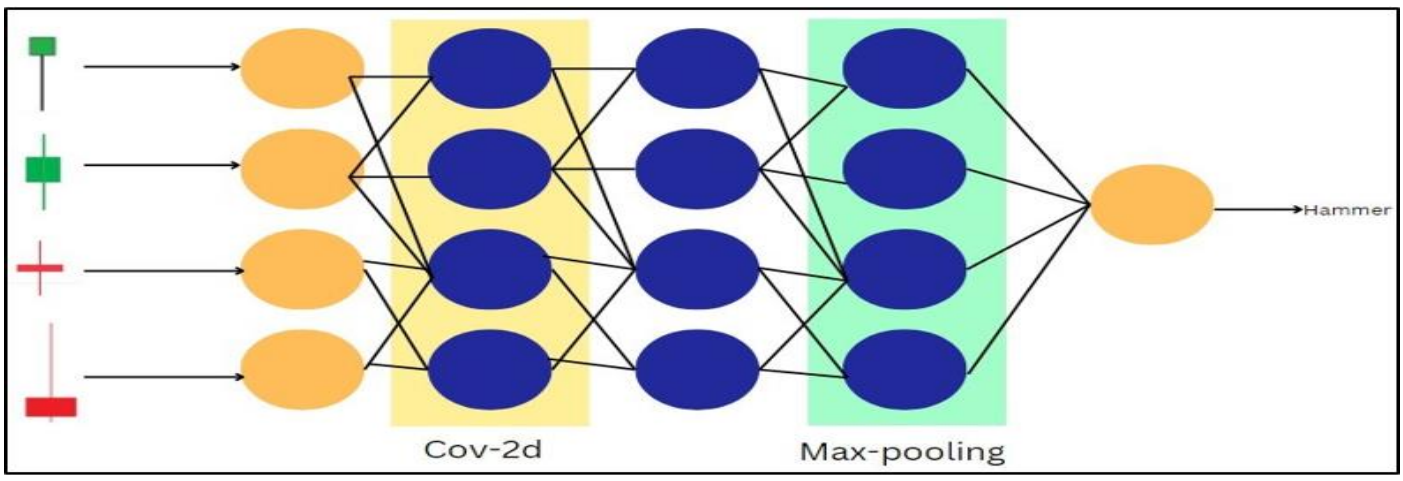

Fig 2 Model for Pattern Recognition

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We have taken the VGG-16 pre-trained model from image- net competition and removed the input and output layer. After that we inserted our input layer containing the eight candlestick patterns, the output will recognize any of the patterns that occurred. The model got trained for 7 Epochs and the Accuracy of the model was 97.2.

III. STOCK RECOMMENDATION

A. Data Collection

There is no proper data set for the recommendation of the stocks so we had created the dataset. The dataset consists of 2 main columns: The first column consists previous recom- mendations from big firms like Goldaman Sachs, Citigroup, Morgan Stanley, JP Morgan etc. And the other column con- tains news dataset. So we did sentiment analysis by taking news of the present market and thereafter we have done recommendation of stocks.

B. Data Preprocessing

Initially the dataset was divided into dependent and inde- pendent sets named x and y respectively. The independent set contains news and the dependent set contains recommenda- tions from the firms. We have applied basic NLP tasks on the news set i.e removing stopwords, stemming the words etc. Then we have done vectorization, for vectorization we used both Bag of words(BOG) and TF-IDF. We will use both these vectorization methods to check which gives the best accuracy.

C. Model Building for Stock Recommendation

After pre-processing, the immediate step is to build Stock Recommendation by using different Algorithms such as Decision Tree, Random Forest, Multinomial naive Bayes etc and we have to choose the model which gives best accuracy. For choosing the right model we can use K-fold cross validation. Let's take 2 folds and find the accuracies for the models. like Gaussian naive Bayes, Multinomial naive Bayes, Bernoulli naive Bayes, Random Forest ,Decision tree.

➢ *Model Accuracies for Bag of Words:*

- Gaussian na¨ıve Bayes : 49.4%
- Multinomial naive Bayes : 58.9%
- Bernoulli naive Bayes : 69.4%
- Random Forest : 62.45%
- Decision tree : 71%

➢ *Model Accuracies for TF-IDF:*

- Gaussian na¨ıve Bayes : 50.3%
- Multinomial naive Bayes : 60.1%
- Bernoulli naive Bayes : 60.1%
- Random Forest : 76.3%
- Decision tree : 69.3%

From seeing above accuracies we have considered Random Forest Model for Stock Recommendation and the vectorizer was TF-IDF.

IV. STOCK PRICE PREDICTION

Here we are using LSTM(Long Short-Term Memory) to predict future price of the stock.

➢ *Data Collection*

We got real time data from the yfinance library. Dataset contains prices(open, low, close, high), volume and no. of trades as columns. Out of these columns we have considered the closing price of the stock as targeted feature. We will be taking the data of 14 years(2007-2021) and the time frame is '1 day' i.e each price represents the price of 1 day.

➢ *Data Pre-Processing*

Data preprocessing is an important step that can have a significant impact on the performance of the model. Some common techniques we have used for pre-processing stock price data are:

- Normalization: It is important to scale the input data so that all features are on the same scale. This can be done using techniques such as Min-Max normalization or standardization.
- Feature engineering: You can extract relevant features from the raw data that may be useful for predicting stock prices. This might include technical indicators, such as moving averages or relative strength index or fundamental data such as company earnings or economic indicators.
- Time series splitting: It is common to split the time series data into a training set, a validation set, and a test set. This allows you to evaluate the performance of the model on unseen data and ensure that it is not overfitting to the training data.
- Data imputation: It is possible that some data points may be missing or corrupted. In such cases, you may need to input missing values or remove corrupted data points to ensure that the model has a complete and accurate dataset to work with.

➢ *Architecture of Stacked LSTM*

There are many types of architectures for the LSTM model. We used stacked LSTM model with 3 layers of LSTM and a dense layer for the output layer. First LSTM layer has 52 neurons, and the input shape is (45,1). Second layer has 64 neurons and the last layer contains 50 neurons.

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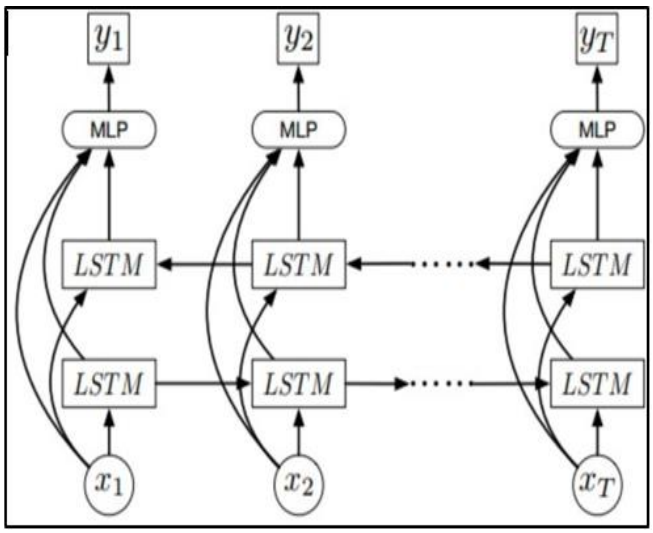

Fig 3 Structure of Stacked LSTM

➢ *Model Training*

Once we have prepared the data and chosen a model architecture, we can now begin training the model using an optimizer such as Adam. We will need to specify a loss function and a metric to evaluate the model's performance during training. So, we use 'Mean Squared Error' as loss function and 'Mean Absolute Error' as metrics.

After training the overall loss of the model is 0.044 that means the accuracy of the model is nearly 95.6%, which is the best accuracy for price prediction.

➢ *Make Predictions*

Here we will see how our model is performing by com- paring Original and Predicted charts of Nifty-50. During pre- processing we scaled down data. So, now we need to do inverse scaling of the values and then plot the charts.

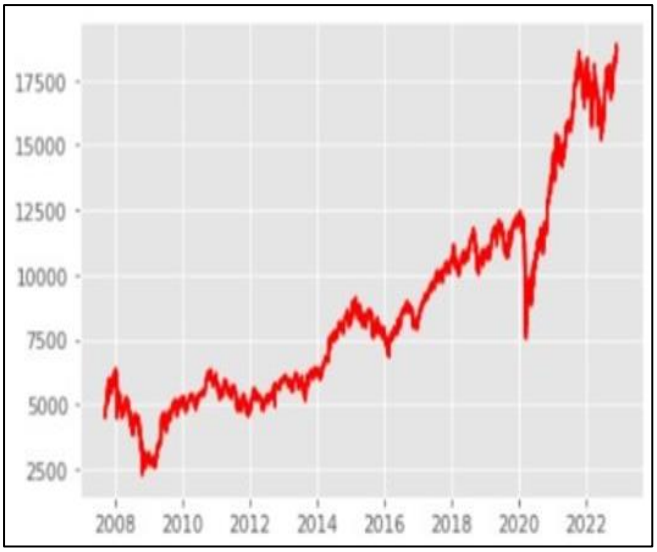

Fig 4 Original Chart of Nifty-50

Fig-4 is the original chart for Nifty-50. Now we will see whether the price will increase or not by comparing with predicted chart.

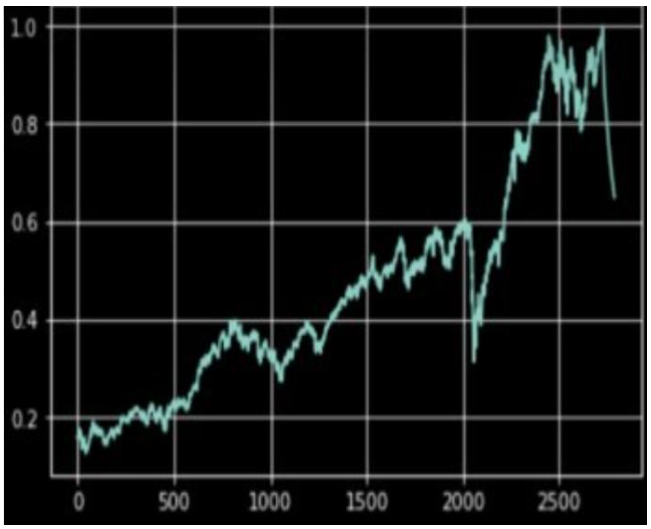

Fig 5 Predicted Chart of Nifty-50

As we can see from the above Fig-5 it shows that the future stock price of Nifty-50 will decrease.

V. CONCLUSION

This study investigated a number of AI-driven techniques for stock market analysis, such as price prediction using Long Short-Term Memory (LSTM) networks, stock pattern identification using VGG16, and news-driven stock recommendation using Naive Bayes and Random Forest, two fundamental machine learning models.

While LSTM models performed well in stock value predictions, traditional model recommendation methods and VGG16-based pattern recognition exhibited poorer accuracy. Furthermore, the performance of our recommendation system was constrained by the use of simple TF-IDF embeddings for news interpretation. In order to enhance overall prediction and recommendation accuracy, future work will concentrate on improving these techniques by integrating sophisticated embeddings, including OpenAI embeddings, and fine-tuning machine learning models. These developments should allow AI to be progressively utilized to produce more accurate and useful stock market data.

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