

# Artificial Intelligence based Stock Market Prediction Model using Technical Indicators

Ketan Bagade, Varsha Bhosale



**Abstract:** The Indian stock market is highly volatile and complex by nature. However, notion of stock price predictability is typical, many researchers suggest that the Buy & Sell prices are predictable and investor can make above-average profits using efficient Technical Analysis (TA). Most of the earlier prediction models predict individual stocks and the results are mostly influenced by company's reputation, news, sentiments and other fundamental issues while stock indices are less affected by these issues. In this work, architecture of project is given. As a part of prediction model the Long Short-Term Memory (LSTM), Support Vector Machine (SVM) are used to predict future prices. Stock Technical Indicators (STIs) are used to generate a buy sell signals. The project will be carried on National Stock Exchange (NSE) Stocks of India.

**Keywords:** Stock Technical Indicators (STIs), Long Short-Term memory (LSTM), Support Vector Machine (SVM), Moving Averages (MA), Moving Average Convergence Divergence (MACD), Relative Strength Index (RSI)

## I. INTRODUCTION

The analysis and prediction of stock market data has significant role in today's economy. The prediction models are based on various algorithms and can be categorized into linear models such as Auto-Regressive Integrated Moving Average (ARIMA) and non-linear models like Machine learning, Neural Network (NN) and Deep Learning.

Numerous researchers have attempted to construct an efficient model for prediction of Stock market for the individual stocks and indices.

The methods of stock price prediction and buy/sell signals, are generally classified into four categories

- Fundamental Analysis (FA): uses news, profits and other economic factors for forecasting.
- Technical Analysis (TA): Utilizes technical indicators like Simple Moving Averages (MA), Moving Average Convergence Divergence (MACD), Relative Strength Index (RSI) for generating Buy Sell Signals.
- Hybrid Method: Uses combination of both of the above methods.

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➤ Time series analysis: Uses analysis of time series data.

The stock indices are generally not much affected by fundamental issues, so technical analysis is a good option for indices prediction. STIs are mathematical calculations based on the price. STIs does not depend on fundamentals of a business, like earnings, revenue, or profit margins. The TA is useful while predicting the future prices of stocks. The TA anticipates what is likely to happen to prices over time, while the Artificial intelligence give strength to such anticipations by improving accuracy.

## II. LITERATURE REVIEW

STIs are mathematical calculations based on the price, volume. These does not depend on fundamentals of a business, like earnings, revenue, or profit margins. The stock traders and technical analysts use STI's to analyze stock movements and to identify entry and exit points. Technical indicators can be useful while predicting the Buy & Sell decisions of stocks, trends of stock. M. Nabipour [1] Collected 10 years historical data of stocks. The value predictions are created for 1, 2, 5, 10, 15, 20, 25 and 30 days in advance. Many machine learning algorithms were utilized for prediction of future values of stock market groups. He used decision tree, bagging, random forest, gradient boosting, and eXtreme gradient boosting (XGBoost), and artificial neural networks (ANN), recurrent neural network (RNN) and long short-term memory (LSTM). Technical indicators were selected as the inputs for each of the prediction models. Of all algorithms used in this paper, LSTM shows more accurate results with the highest accuracy. Can Yang [2] used a deep learning algorithm to predict price movement direction based on historical information in financial time series. The framework is combination a convolutional neural network (CNN) for feature extraction with a long short-term memory (LSTM) network for prediction. He used a three-dimensional CNN for data input in the framework, including the information on time series, technical indicators, and the correlation between stock indices. And in the three-dimensional input tensor, the stock technical indicators are converted into trend signals and the stocks are ranked by Pearson product-moment correlation coefficient (PPMCC). while training, a fully connected network is used to run the CNN to learn a feature vector, which acts as the main input of concatenated LSTM. After both the CNN and the LSTM are trained completely, they are finally used for prediction in the testing set. Manish Agrawal [3] predicted the prices of stocks by Using Stock Technical Indicators (STIs) which in turn helps to take buy-sell decision over long and short term.



Two different models are made, one for future price trend prediction of stocks and other for taking buy-sell decision for that day. As a part of prediction model the optimized Long Short Term Memory model is merged with highly correlated STIs. Dongdong Lv[4], analysed large-scale stock datasets. He evaluated various ML algorithms and observe the daily trading performance of stocks under transaction cost and no transaction cost. He used two datasets of 424 S&P 500 index component stocks (SPICS) and 185 CSI 300 index component stocks (CSICS) from 2011 to 2017 and compare six machine learning algorithms and six deep neural network (DNN) models on these two datasets, respectively. According to this paper ML algorithm has better performance for technical indicators. Hyun Sik Sim[5] developed a stock price prediction model using convolutional neural network (CNN) to validate the applicability of new learning methods in stock markets. When using CNN, technical indicators were used as predictors of the forecasting model, and the technical indicators were converted to images of the time series graph. Mojtaba Nabipour[6] compared eight machine learning models (Decision Tree, Random Forest, Adaptive Boosting (Adaboost), eXtreme Gradient Boosting (XGBoost), Support Vector Classifier (SVC), Naïve Bayes, K-Nearest Neighbors (KNN) and Artificial Neural Network (ANN) and two deep learning models (Recurrent Neural Network (RNN) and Long short-term memory (LSTM)). Technical indicators from five years of historical data are our input values, and two ways are supposed for employing them. He, calculated the indicators by stock trading values as continues data, and secondly converting indicators to binary data before using. Each prediction model is tested by three metrics based on the input ways. The evaluation results indicate that for the continues data, LSTM and RNN perform better than other prediction models with a considerable difference. Results show that in the binary data evaluation, those deep learning methods are the best.

### III. STOCK TECHNICAL INDICATORS

STIs are Mathematical calculations based on the price, volume. STIs does not depend on fundamentals of a business, like earnings, revenue, or profit margins. The stock traders commonly use STIs to analyze short-term and long term price movements and to identify entry and exit points. Technical indicators are useful while predicting the Buy/Sell Signals of stocks. There are two types of technical indicators: Oscillators and Overlays. In this work, we use SMA STI as it is one among the most widely used STI. It removes out the noise which occurs due to random price variations and helps to smooth out price. It is a trend following indicator or simply lagging as it depends on past prices. Formulae for calculating the Stock Technical Indicators (STIs) is presented in Table 1.

**Table 1: Stock Technical Indicators**

Stock Technical Indicators (STIs)	Mathematical Formula
Simple Moving Averages (SMA)	$\frac{C_t + C_{t-1} + \dots + C_{t-n+1}}{n}$
Moving Average Convergence Divergence (MACD)	13 Period EMA – 26 Period EMA

Relative Strength Index (RSI)	$RSI = 100 - \left[ \frac{100}{1 + \frac{n_{up}}{n_{down}}} \right]$
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### Detail of Technical Indicators

#### A. Moving Average (MA)

Moving Average (MA) are average values for a given time frame and they reflect mood of market. It's a simple average of the past closing.eg.,50 day SMA is nothing but average of previous 50 days closing prices.

Formula for Moving Average is

$$\frac{C_t + C_{t-1} + \dots + C_{t-n+1}}{n}$$

C<sub>n</sub> = Closing price of an stock at period n.

n = The number of total periods.

#### B. Moving Average Convergence Divergence (MACD)

Moving Average Convergence Divergence (MACD) is a trading indicator used in technical analysis. It is called as Trend indicator. MACD indicator has 3 components in it. MACD Line is blue line in the MACD indicators. It is calculation result of subtracting 26-period EMA from 12-Period EMA. Signal Line is the Red line which is plotted on the top of the MACD line. It is basically 9-Period EMA of the MACD line. When MACD line crosses the signal line in upward direction it triggers a Buy signal. When MACD line crossing the signal line in downward direction triggers a SELL Signal. Histogram are vertical lines/bars.

Formula for Moving Average Convergence Divergence is  
12 period EMA – 26 Period EMA

#### C. Relative Strength Index (RSI)

Relative Strength Index (RSI) is a momentum oscillator. The RSI indicators gives traders signals about bearish and bullish price moment and it is often plotted beneath the graph of an asset's price. An stock is considered overbought when the RSI is above 70% and oversold when it is below 30%.

Formula for Relative Strength Index is

$$RSI = 100 - \left[ \frac{100}{1 + \frac{n_{up}}{n_{down}}} \right]$$

### IV. PROBLEM STATEMENT

The investors usually take the decisions of buying or selling the stock by evaluating a company's performance and other unexpected global, national & social events. Although, such events eventually affect stock prices instantaneously in a negative or positive way, these effects are not permanent most of the time. So, it is not viable to predict the stock prices and trends on the basis of Fundamental Analysis. Investors usually "buy low, sell high" but this does not provide enough context to make proper investment decisions. Investor before investing in any stock, he needs to be know how the stock market behaves.



Investing in a good stock but at a bad time can have negative results, while investment in a mediocre stock at the right time can generate profits for investor. Stock investors of today are facing this problem of trading as they do not properly understand as to which stocks to buy or which stocks to sell in order to get optimum profits. Also this research predict future prices Using Price Action Using LSTM and SVM Algorithm

**A. Problem Definition**

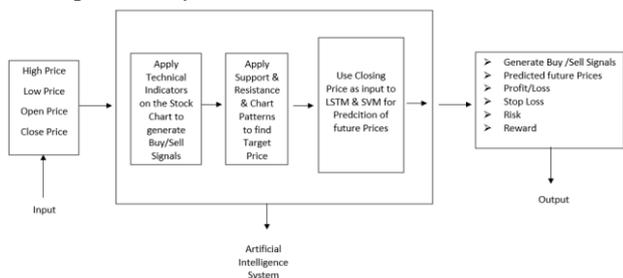
The objective of our project is to develop a Artificial Intelligence System Using Technical indicators to predict Stock trends. There are various technical indicators like Simple Moving Averages(SMA), Moving Average Convergence Divergence (MACD), Relative Strength Index (RSI),Stochastic Oscillator(SO), are calculated on basis of closing price, opening price, High price, low price. We will use this technical indicators as input to generate buy sell signal. Our AI algorithms i.e., support vector machine (SVM) & Long Short Term Memory(LSTM) will be used to predict future prices. Our System will give buy & sell decisions, trends of the Stock, Predicted future price. On this basis trader can take decision of buying and selling of stock.

**B. Objective**

- The system must be able to load a list of stock prices. It must calculate the STI based on the historical data. It must also provide an instantaneous visualization of the market index.As a consequence, an automated system or model, to analyses the stock market and upcoming stock trends based on historical prices and STIs, is needed.
- Two versions of prediction system will be implemented; one using Support Vector Machines and other using Long Short Term Memory (LSTM). The experimental objective will be to compare the forecasting ability of SVM with LSTM. We will test both the systems with same test data to find their prediction accuracy.

**C. Suggested System Architecture**

we are proposing new model for the Stock Market Prediction. Our system will consists of different modules working together to achieve robust and more accurate system than its previous system.

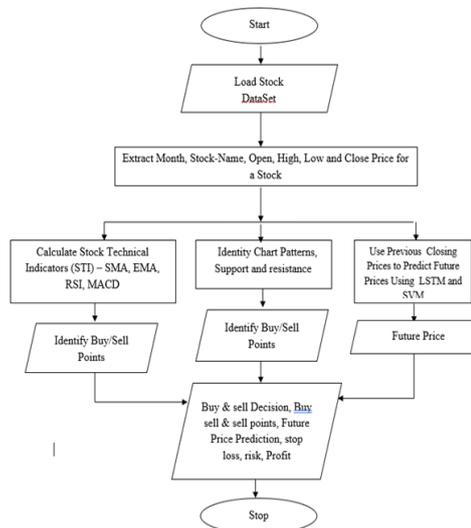


**Fig.1 System Architecture of Stock Price Prediction**

The stock data is captured through APIs. The values of Stock i.e., Date, Time, stock-name, Volume, Open, High, Low and Close (OHLC) prices are extracted from the dataset. A new input features, which are known as STIs are calculated by applying stock prices and will be used to generate buy/Sell

signals. Chart Patterns, Support and resistance will be detected on the selected Stock. They will be used to detect buy/sell prices, stop loss. LSTM and SVM Algorithms will be used to predict future prices.The Output to the system will be Buy/Sell Signal, Predicted future price, Profit, Loss ,Stop loss,risk and reward.

**D.FlowChart**



**Fig.2 Flowchart of Stock Market Prediction System**

**E. System Architecture**

**Table 2: Hardware & Software Requirement**

Hardware	Software
Processor: Pentium-i5	Operating System: Windows10
RAM: 4GB (min)	Visual Studio Code
Hard disk: 20GB	Python Programming
Monitor: VGA	AI Algorithm & Libraries, Python Libraries Keras &Tensor Flow

**V. ARTIFICAIL INTELLIGENCE ALGORITHM**

Support Vector Machine(SVM) and Long Short Term Memory (LSTM) will be used for prediction. SVM is a supervised machine learning algorithm and LSTM is a deep learning algorithm.

**A. Support Vector Machine(SVM)**

Support Vector Machine is a supervised machine learning algorithm used for both classification or regression problems. The support vector machine used for classification, is called as support vector classification, and if it is used for regression, it is referred to as support vector regression. Regression analysis is a statistical procedure that is used for type of a connection between one dependent variable Y and independent variables X.

**Kernel**

Kernel is function for converting a lower-dimensional data set to a higher-dimensional data set. A kernel helps ito find hyperplane in higher-dimensional. When we are unable to identify a separating hyperplane in a particular dimension and then shift to a higher dimension.



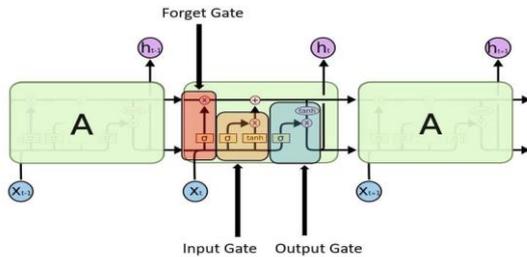
# Artificial Intelligence based Stock Market Prediction Model using Technical Indicators

## Hyper Plane

HyperPlane is the separating line between the data classes in SVM. In SVR, hyperplane is line that will assist us in predicting a continuous value or goal value.

## B. Long short-term Memory(LSTM)

Long short-term Memory is a type of Recurrent neural network, which is a famous deep learning algorithm that is well suited for making predictions and classification with a flavour of the time. LSTM has feedback connections.



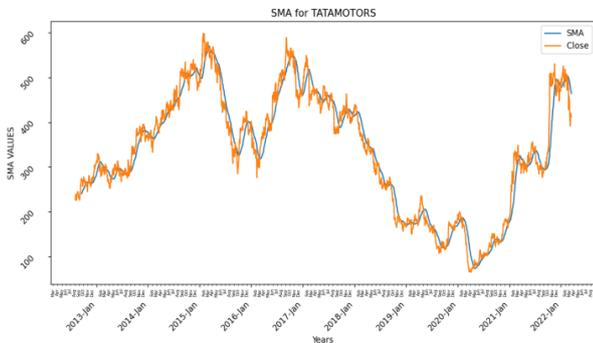
**Fig.4 Long short-term Memory(LSTM) Cell**

A LSTM unit consist of an input gate, an output gate, a cell, and a forget gate. The LSTM cell remembers values over arbitrary time intervals, and three gates regulate the flow of information into and out of the cell.

## VI. RESULTS

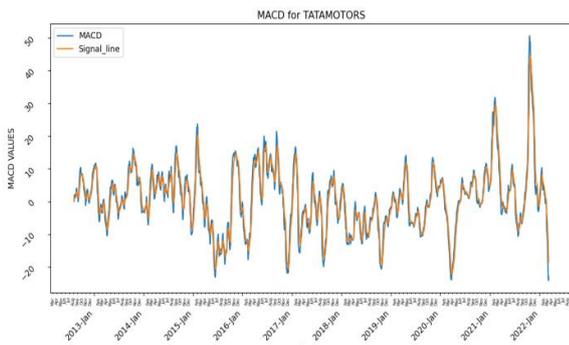
### A.Prediction of Tatamotors Stock

Simple moving average(SMA) is a input technical indicator used as input to generate buy/Sell Signal



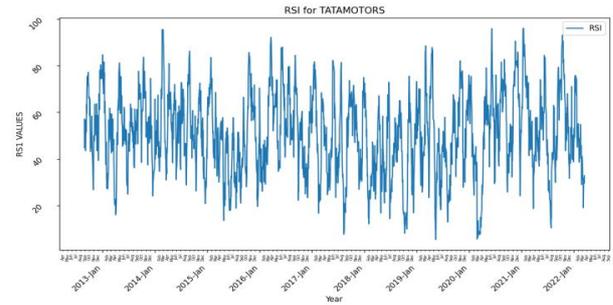
**Fig.5 SMA for Tatamotors**

Moving Average Convergence Divergence (MACD) is a input technical indicator used as input to generate buy/Sell Signal



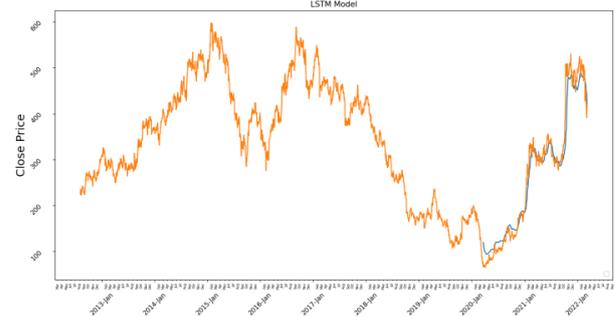
**Fig.6 MACD for Tatamotors**

Relative Strength Indicator (RSI) is a input technical indicator used as input to generate buy/Sell Signal



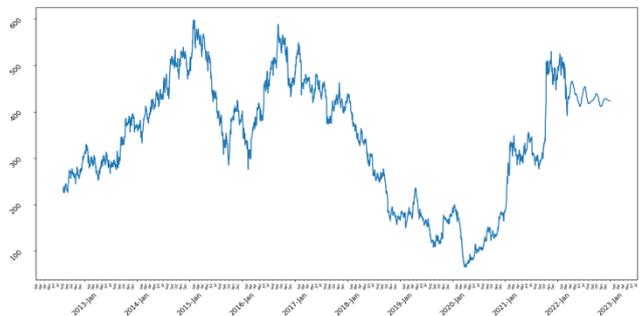
**Fig.7 RSI for Tatamotors**

Below is output of prediction of prices from 2020 Year.



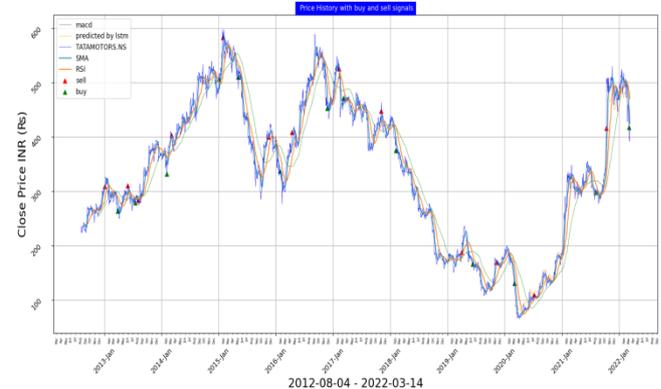
**Fig.8 Prediction for Tatamotors from 2020 Year**

Below is output of prediction of prices from March 2022 Year up to Dec 2023.



**Fig.9 Prediction of Tatamotors from March 2022 up to Dec 2023**

Below is output of Buy/Sell Signal generated upto till date on graph .



**Fig.10 Buy/Sell Signals for Tatamotors**

Below is output of Double Top Generated on tata motors with Buy Price, Sell Price, Stop Loss



Fig.11 Double Top Chart Patterns for Tatamotors

Below is output chart of Support and resistance chart of Tatamotors. It show Buy price and target price.



Fig.12 Support and resistance chart of Tatamotors

Below is Prediction Over screen of Tatamotors



Fig.13: Prediction Over

**B. Prediction of ITC Stock**

Simple moving average(SMA) is a input technical indicator used as input to generate buy/Sell Signal



Fig. 14 SMA for ITC

Moving Average Convergence Divergence (MACD) is a input technical indicator used as input to generate buy/Sell Signal

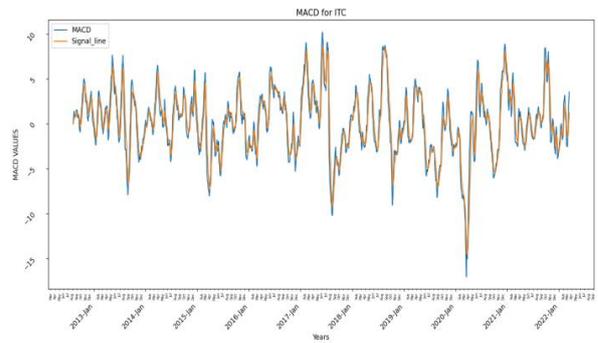


Fig 15 MACD for ITC

Relative Strength Indicator (RSI) is a input technical indicator used as input to generate buy/Sell Signal

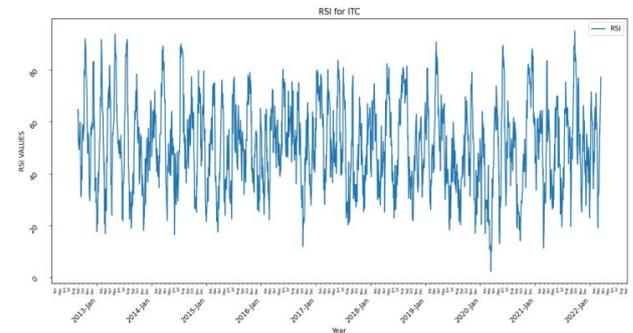


Fig.16 RSI for ITC

Below is output of prediction of prices from 2020 Year.

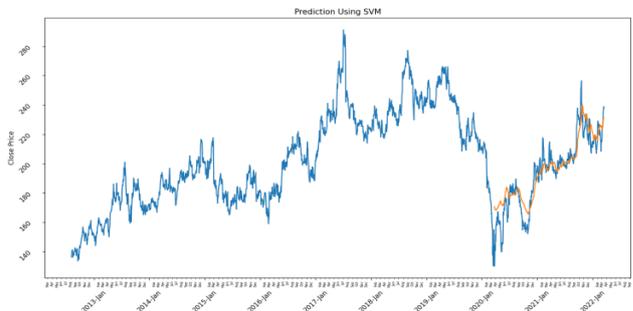


Fig.8 Prediction for ITC from 2020 Year

Below is output of prediction of prices from March 2022 Year.

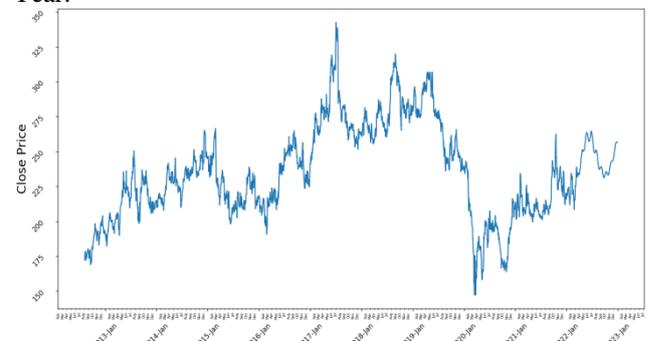
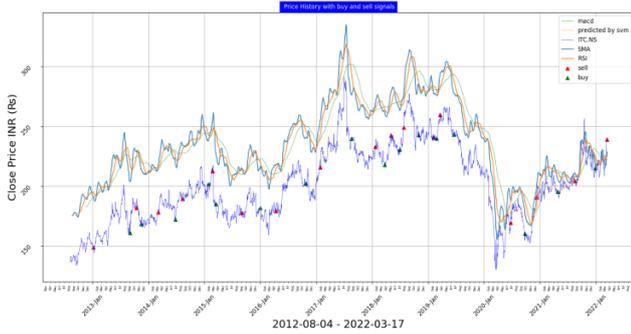


Fig 17 Prediction of ITC from March 2022 till Dec 2023

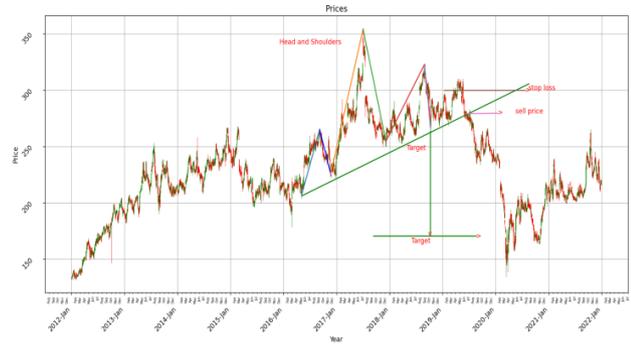
# Artificial Intelligence based Stock Market Prediction Model using Technical Indicators

Below is output of Buy/Sell Signal generated upto till date on graph.



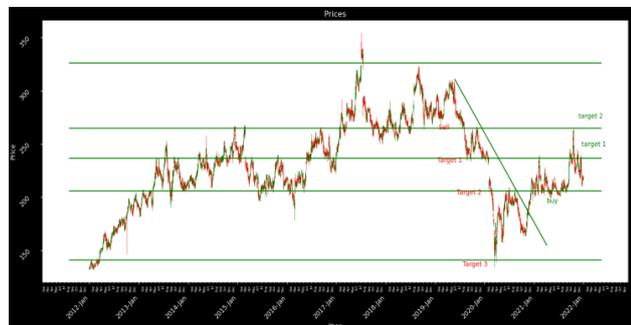
**Fig 18 Buy/Sell Signals for ITC**

Below is output of Head & Shoulder Pattern Generated on ITC with Buy Price, Sell Price, Stop Loss



**Fig 19 Head & Shoulder for ITC**

Below is output chart of Support and resistance chart of ITC. It show Buy price and target price



**Fig 20. Support & Resistance for ITC**

Below is Prediction Over screen of Tatamotors



**Fig 21. Prediction Over**

## VII. CONCLUSION

We studied the existing Stock Prediction System. To predict Stock Prediction we used Long Short Term Memory (LSTM) deep learning model and Support Virtual Machine (SVM) machine learning AI models for prediction of future prices. We have used SMA, MACD, RSI for prediction of Buy/Sell Signals. We are using double top Chart Pattern in tatamotors stock to generate buy/sell, stop loss Signals. We are using Head & Shoulder Chart Pattern in ITC stock to generate buy/sell, stop loss Signals. We are using Support & resistance to generate buy Signal, Target 1 & 2. The models proposed in

this Work will decide the stock trends as well as generate of selling or buying signals for the stock.

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