# Technical analysis and Predictive modelling of financial markets

Submitted in fulfillment of the requirements
of the degree of

**Bachelor of Engineering**

by

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# Certificate

This is to certify that the project entitled ***"Technical Analysis and Predictive Modelling of Financial Markets"*** is a bonafide work of ***Amey Joshi (60001180008), Harsh Shah (60001180018), Yash Pawar (60001180063)*** have submitted to the University of Mumbai in fulfillment of the requirement for the award of the degree of "Bachelor Of Engineering" in Electronics Engineering.

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Examiners

1. .....

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# Abstract

Investing in the Financial Market has always been a daunting task for many and others have apprehension to invest due to the lack of knowledge. When we hear the word stock market, our mind immediately goes towards the risks and the loss involved in trading. But there is a method to the madness and once we gain enough rudimentary knowledge about the Financial Markets we can really benefit from the experience.

When a novice investor starts thinking about the idea of investing he gets bombarded with various sources, books and website links to study the markets from. On the other hand if you do not want to study them yourself you have to give your money to a stranger to do your work for you. This poses a number of problems. Lack of knowledge makes the investor feel anxious towards the trends of the Markets. Not having control over your own money can get frustrating especially if there is a downward trend happening in the current market.

In this project we are trying to explain and make observations about the most important aspects of the Stock market and give tabular and graphical analysis of the same using a visualization tool. With this Project we are also trying to give the best predictive modelling of the price of a particular stock using Neural networks and Learning. This will help the investor decide upon the stocks and options he wants to invest in.

# Acknowledgments

It gives us immense pleasure to present this project report on “Technical Analysis and Predictive Modelling of Financial Markets” carried out at partial fulfillment of the requirements of the institute.

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# Chapter 1

# Introduction

## 1.1 What are the Financial Markets?

Financial Markets allude extensively to any commercial center where the exchanging of protections happens, including the security market, forex market, and subsidiaries market, etc. Financial Markets are fundamental to the smooth activity of entrepreneur driven economies.

Financial Markets make protection items that give a re-visitation of the individuals who have overabundant reserves (Investors/loan specialists) and make these assets accessible to the people who need extra cash (borrowers). Financial Markets assume a crucial part in working with the smooth activity of industrialist economies by dispensing assets and making liquidity for organizations and business visionaries. The business sectors make it simple for purchasers and vendors to exchange their monetary property.

Maybe the most omnipresent of Financial Markets are securities exchanges. Their organizations list their shares and they are traded by dealers and financial backers. Securities exchanges, or value markets, are utilized by organizations to raise capital through a first sale of stock (IPO), with shares consequently exchanged among different purchasers and merchants in what is known as an auxiliary market.

Run of the mill members in a securities exchange incorporate (both retail and institutional) financial backers and merchants, as well as market producers (MMs) and experts who keep up with liquidity and give two-sided markets. Agents are outsiders that work with exchanges among purchasers and dealers however who don't take a genuine situation in a stock.

## 1.2 Current Statistics on Investors

According to data from the country's two main depositories, active investor accounts increased by a record 10.4 million in 2020. In the third quarter of 2020, retail ownership in more than 1,500 companies listed on the National Stock Exchange of India reached 9%, the highest level since March 2018.

Angel Broking, a 1987-founded securities firm, claims that 72% of the 510,000 new users it gained between October and December had never traded stocks before. Only roughly 3.7 percent of India's 1.36 billion people invest in shares, compared to about 12.7 percent in China.

As in different regions of the planet, India's retail exchanging blast has been filled by pandemic-driven limitations and employment misfortunes that passed on large number of individuals at home with little to do. The determined financial exchange rally since March 2020 has attracted more financial backers.

What's more, innovation, including the ascent of modest exchanging applications and virtual entertainment — YouTube powerhouses, Twitter, and Telegram stock-tipping talk gatherings — has drawn in crowds of informal investors into markdown dealers, for example, Zerodha Broking. Be that as it may, not at all like during the past retail financial planning blast, a large number of the new participants live beyond Mumbai and New Delhi, the greatest urban communities.

# Chapter 2

# Review of Literature

Researchers have regularly employed sequence prediction algorithms to solve forecasting difficulties. Sequence prediction is a problem in which the next value or values in the sequence are predicted using historical sequence knowledge. Different sequence prediction challenges include product recommendation, weather forecasting, stock market prediction, and so forth. Many mathematical models have been established in the past, but their performance has been lacking. Stock prices are changed depending on firm-specific information, according to Fama. The Efficient Market Hypothesis (EMH) and Random Walk Theory were the foundations of most earlier stock market analysis methods.

Sequence prediction can be used in the stock market, which is a specific application area. Because of their great accuracy and utilisation of current and past stock data indexes to estimate future values, ANN-based models are the newest trend. In financial time series analysis, such as stock market prediction, which is a sequence prediction method, recent research suggest that neural network models outperform other machine learning models. In stock market prediction, the effects of ANN models have been studied. Deep learning algorithms are extremely useful for stock market forecasting.A comparison of the performance of LSTM and RNN methods with traditional methods was done by ( D. P. Kingma and J. Ba, "Adam: A method for stochastic optimization", 2014. )

In this study, the Adaptive Moment Estimation (Adam) optimization approach is applied. Sengupta et al. employed time series forecasting to estimate the future activity of information about previous values and associated patterns. Stock market forecasting is another type of time series forecasting problem. Deep learning algorithms may be used to accurately anticipate stock prices, as shown in. Recurrent neural networks (RNN) and long short-term memory are two deep learning techniques employed in this setting (LSTM).

# Chapter 3

# Technical analysis of Financial Markets

## 3.1 What is technical analysis?

Technical analysis is a study technique that uses market participants' behaviour to find trading opportunities in the market. A stock chart can be used to visualise market players' activity. Patterns emerge over time in these graphs, and each pattern conveys a distinct message. These patterns can be examined to form a viewpoint. The sections of this technical analysis are as follows:

### 3.1.1 Candlestick patterns:

A candlestick is a form of technical analysis price chart that shows the high, low, open, and closing prices of a securities over time. Trading patterns are identified using candlesticks. Patterns assist the technical analyst in making a trade or a transaction of stocks. This candlestick sequence is created by arranging the candles in a specific order. Moreover, a single candlestick pattern can sometimes identify potent trading indications.


*Fig 3.1 Demo Candlestick Graph*

Learning about different patterns incorporated by single candlesticks-

**Marobozu:**

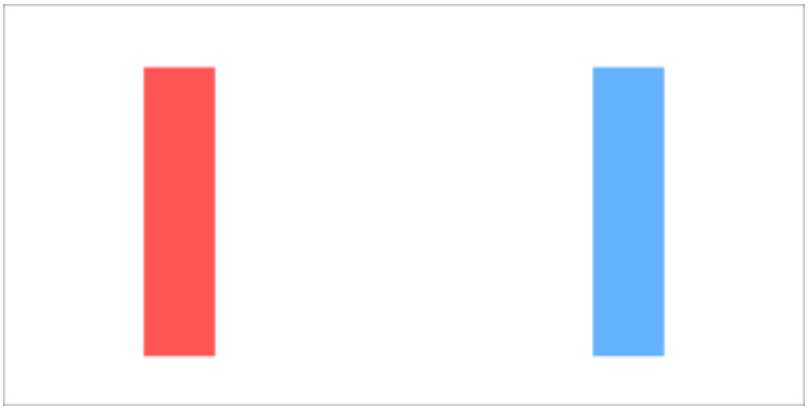

*Fig 3.2 Bearish and Bullish Graph*

**Bullish Marobozu-**

In a bullish marubozu, the absence of an upper and lower shadow indicates that the low is equal to the open and the high is equal to the close. As a result, a bullish marubozu is created anytime the Open = Low and the High = Close.

A bullish marubozu suggests that there is so much buying interest in the stock that market players were willing to buy it at any price point during the day, to the point where the stock ended the day around its high point. Regardless of the previous trend, the behaviour on the marubozu day indicates that sentiment has shifted and the stock is now positive.

**Bearish Marobozu-**

Extreme bearishness is indicated by bullish Marubozu. The open is the same as the high, and the close is the same as the low. Open denotes a high value, whereas Close denotes a low value.

A bearish marubozu signifies that the stock is under such much selling pressure that market participants sold at every price point throughout the day, causing the stock to close at its day's low point. Regardless of the previous trend, the behaviour on the marubozu day indicates that sentiment has shifted and the stock is now bearish.

**Spinning tops:**

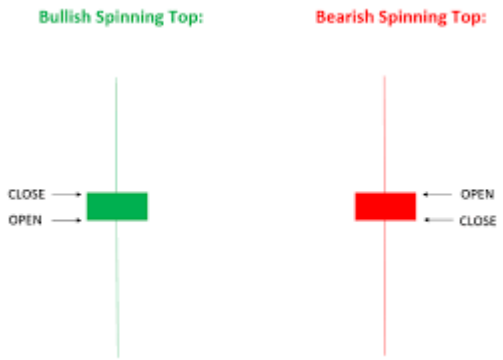


*Fig 3.3 Candlestick Spinning Tops*

The real body of a spinning top is quite small. The lengths of the upper and lower shadows are about equal. It makes no difference what colour the spinning top is. The fact that the open and close prices are so close to each other is what matters. Spinning tops represent market indecision, with bulls and bears in equal control. At the height of the rally, a spinning top suggests that either the bulls are pausing before continuing the uptrend or the bears are prepared to break the trend. In either instance, the trader must maintain a cautious posture. If the trader wants to buy, he should buy half the amount and wait for the markets to move in his favour. A spinning top at the bottom of the rally implies that either the bears are taking a breather before continuing their decline, or the bulls are getting ready to break the trend and push the markets higher. In either instance, the trader must maintain a cautious posture. If the traders intend to buy, he/she should buy half the amount and wait for the markets to move before proceeding.

## Paper Umbrella and shooting star-


*Fig 3.4 Paper Umbrella*

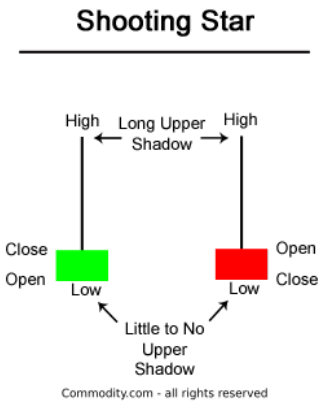


*Fig 3.5 Shooting star*

A paper umbrella features a small body and a large lower shadow. The 'shadow to real body' ratio should be maintained between the lower shadow and the real body. The lowest shadow of the paper umbrella should be at least twice the length of the real body. Because the open and close prices are so close, the colour of the paper umbrella shouldn't matter. The 'hammer' is a paper umbrella that appears at the bottom of a downtrend. The hanging guy is a term used to describe a paper umbrella that appears at the top of an uptrend. When the hammer appears, it is a bullish pattern, and it should be used to look for purchasing opportunities.The hammer's low serves as a stop-loss price trade.

The hanging man is a bearish pattern that comes at the top of a trend and should be used to look for selling opportunities.The peak of the hanging guy serves as the trade's stop loss price.A bearish pattern that arises at the top of a trend is the shooting star. When a shooting star appears, one should consider shorting chances.The stop loss price for the trade will be the shooting star's high

### 3.1.2 Moving Averages:

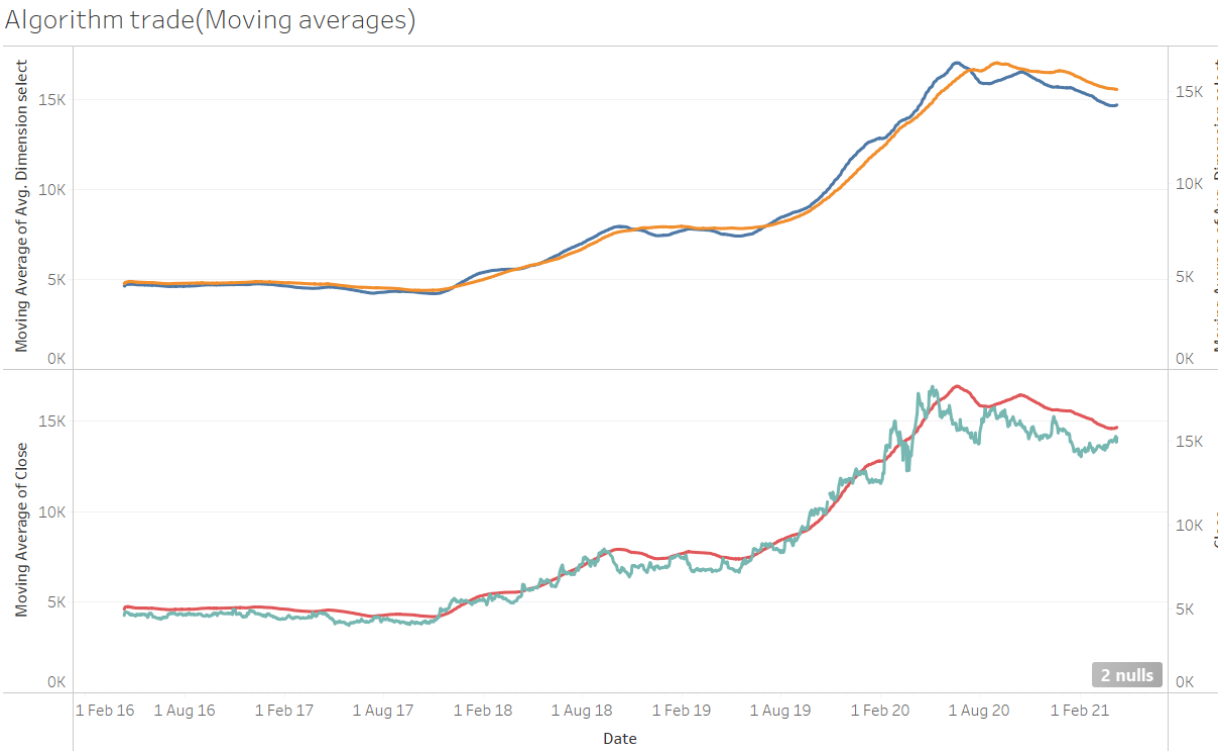


*Fig 3.6 Two types of Moving Averages*

The analysis of moving averages can be used to pin out the suitable moment to make buy and sell calls. The share price floating above the average price denotes that investors or traders are ready to pay a higher price for the stock. This indicates investors' confidence that the stock price will follow an ascent. As a result, one should consider purchasing opportunities. Similarly, when the stock price trades below its average price, it indicates that traders are eager to sell the shares at a lower price. This indicates that traders are bearish on the stock market. As a result, one should consider selling options.

Remember that a good trading system will give you a signal to enter a trade and another signal to exit it. The following rules can be used to define the moving average trading system:

**Rule 1) When the present market price moves above the 50 days MA, buy or go long. After purchase, you should stay hold till the necessary sell condition is matched.**

**Rule 2) Sell (square off) when the present stock price moves below the 50 days MA.**

**Golden crossover and Death crossover-**

A golden cross is a chart pattern in which a relatively short-term moving average crosses above a long-term moving average. The golden cross is a bullish breakout pattern formed from a crossover involving a security's short-term moving average (such as the 15-day moving average) breaking above its long-term moving average (such as the 50-day moving average) or resistance level. As long-term indicators carry more weight, the golden cross indicates a bull market on the horizon and is reinforced by high trading volumes.

Conversely, a similar downside moving average crossover constitutes the death cross and is understood to signal a decisive downturn in a market.

### 3.1.3 Volume :

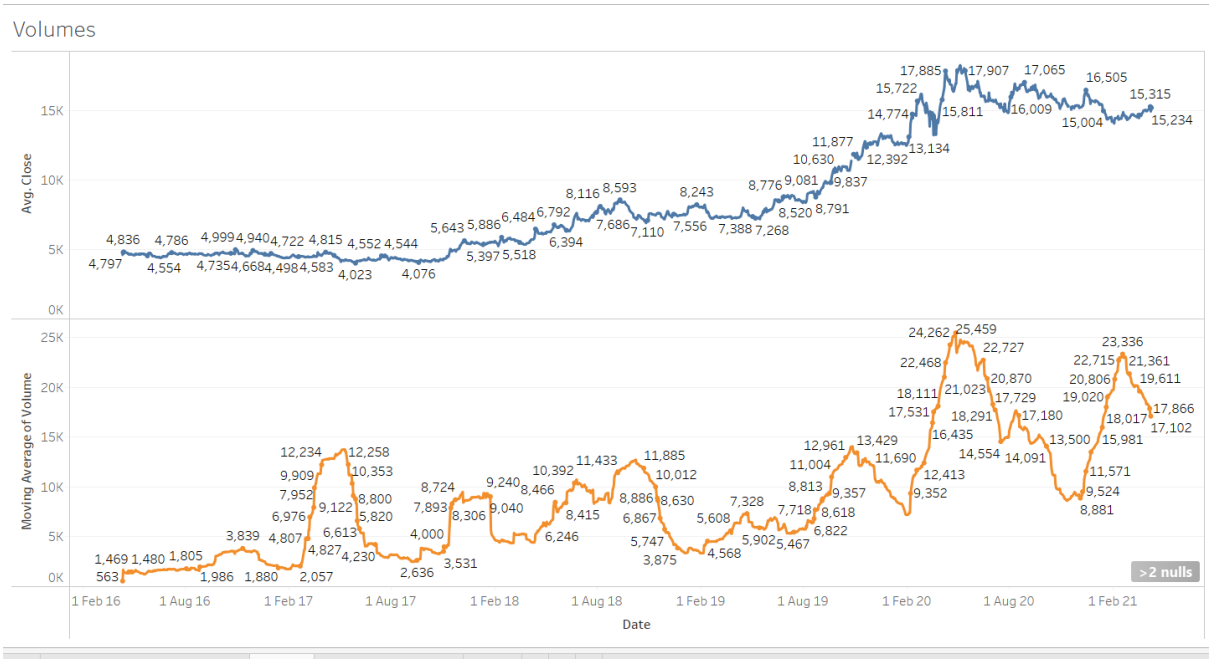


*Fig 3.7 Moving Averages and Volumes*

In technical analysis, volume is quite important since it allows us to confirm trends and patterns. Consider volumes as a way to learn how other market participants see the market.

If a stock's trading volume is increasing, it indicates that there is purchasing pressure, as investor demand drives the stock's price higher and higher. If the price of a stock with a large trading volume falls, it indicates that more investors are selling their investment.

Volume should rise in a rising market. In order to keep pushing prices upward, buyers must increase their numbers and excitement. Increasing price and declining volume could indicate a lack of interest, which could signal a reversal.

### 3.1.4 Resistance and Support :

Identifying the support and resistance points is the best technique to determine the goal price. Support and resistance (S&R) are price areas on a chart that are likely to attract the most buying or selling activity. The support price is the price at which more buyers than sellers are expected. Similarly, the resistance price is the point at which more sellers than buyers are expected. Traders can utilise S&R to discover trade entry points on their own as well.

**Resistance -**

The name is self-explanatory —**it forbids the stock price from soaring any higher. The resistance level is a cost on the graph where brokers anticipate the stock/record to get the most supplies (with regards to selling).** The degree of resistance is always greater than the present-day stock value.

Almost certainly, the cost will ascend to the resistance level, combine, retain all supplies, and afterward fall. In a rising business sector, one of the main specialized examination apparatuses for market members is resistance. Resistance is considered as a sell signal.

**Support -**

The name is self-explanatory**—it forbids the stock price from falling any further. The support level is a cost on the graph where brokers anticipate the stock/record to get the most demand (with regards to buying).** The degree of support is always below the present-day stock value.

The cost is probably going to decline until it arrives at support, merge, retain all interest, and afterward begin rising upwards. In a declining market, perhaps the main specialized level to search for is support. The support is frequently considered as a purchase indication.

### 3.1.5 Relative Strength Index:

J.Welles Wilder invented the Relative Strength Index (RSI), which is a popular indicator. The RSI is a leading momentum indicator that can be used to spot a trend reversal. The RSI indicator oscillates between 0 and 100, and market expectations are set based on the most recent indicator reading.

The phrase "Relative Strength Index" is a little deceptive because it does not measure the relative strength of two securities, but rather shows the security's internal strength. The most widely used leading indicator, the RSI, provides the greatest indications during sideways and non-trending areas. The formula to calculate the RSI is as follows:

$$RSI = 100 - \frac{100}{1 + RS}$$

$$RS = \text{Average Gain} / \text{Average Loss}$$

Let us understand this indicator with the help of the following example:

*Table 3.1 Basic Analysis Table*

| Day | Closing Price | Points Gain | Points Lost |
|---|---|---|---|
| 1 | 500 | 0 | 0 |
| 2 | 503 | 3 | 0 |
| 3 | 506 | 3 | 0 |
| 4 | 508 | 2 | 0 |
| 5 | 504 | 0 | 4 |
| 6 | 501 | 0 | 3 |
| 7 | 499 | 0 | 2 |
| 8 | 497 | 0 | 2 |
| 9 | 500 | 3 | 0 |
| 10 | 504 | 4 | 0 |
| 11 | 508 | 4 | 0 |
| 12 | 511 | 3 | 0 |
| 13 | 513 | 2 | 0 |
| 14 | 517 | 4 | 0 |
| **Total** | | **28** | **11** |

Considering the aforementioned table, points gained/lost signify the number of points gained/lost with respect to the earlier day close price. Please note that the loses are computed as positive values.
The initial step is to ascertain 'RS' additionally called the RSI factor

Avg Gained Points = 28/14

= 2

Average Lost Points = 11/14

= 0.785

RS = 2/0.785

= 2.547

Plugging in the value of RS in RSI formula,

= 100 – [100/ (1+2.547)]

= 100 – [100/3.547]

= 100 – 28.192

RSI = 71.807

At the point when the RSI perusing is somewhere in the range of 0 and 30, the security is oversold and should prepared for an ascending amendment.
At the point when the security perusing is somewhere in the range of 70 and 100, the security is expected to be intensely purchased and should prepared for a descending amendment.

# Chapter 4

# Predictive Modelling of Financial Markets

## 4.1 CNN

### 4.1.1 Theoretical Explanation

A convolutional neural network (CNN, or ConvNet) is a type of artificial neural network used to interpret visual imagery in deep learning. Multilayer perceptrons are CNN versions that have been regularised. Multilayer perceptrons are typically fully connected networks, with each neuron in one layer coupled to all neurons in the next layer. Because of their "full interconnectivity," these networks are susceptible to data overfitting. Regularization, or the prevention of overfitting, can be achieved in a variety of ways, including as punishing parameters during training (such as weight loss) or lowering connectivity (skipped connections, dropout, etc.) CNNs adopt a different method to regularisation: they take advantage of the hierarchical pattern in data and assemble patterns of increasing complexity using smaller and simpler patterns imprinted in their filters. As a result, CNNs are on the bottom end of the scale of connection and complexity. The connectivity pattern between neurons in convolutional networks is similar to the organisation of the animal visual cortex, which was inspired by biological processes. Individual cortical neurons respond to stimuli exclusively in the receptive field, which is a narrow part of the visual field. The receptive fields of different neurons partially overlap, allowing them to cover the whole visual field. CNNs require very little pre-processing in compared to other image categorization algorithms. This means that the network automatically learns to optimise the filters (or kernels). As comparison to older approaches' hand-engineered filters. This absence of reliance on previous knowledge.In feature extraction, information or human intervention is a substantial benefit.

### Major Parts of the Algorithm:

- Convolutional layers :

They concatenate the data and send the result to the next layer. This is analogous to a neuron's response to a single stimulus in the visual cortex. Each receptive field of a convolutional neural processes data separately. Although fully connected feedforward neural networks can be used to learn features and categorise data, bigger inputs, such as high-resolution photos, are often unfeasible for this design.

- Pooling Layers :

Convolutional networks may include local and/or global pooling layers in addition to conventional convolutional layers. Pooling layers reduce the dimensionality of data by combining the outputs of neuron clusters at one layer into a single neuron at the next layer. Local pooling, which commonly uses tiling sizes of 2 × 2, is used to merge small clusters. Global pooling affects all of the neurons in the feature map. Maximum and average pooling are the two most prevalent types of pooling. In max pooling, the maximum value of each local cluster of neurons in the feature map is used, whereas in average pooling, the average value is used.

- Connected Layers :

Every neuron in one layer is coupled to every neuron in another layer in fully connected layers. It works in the same way as a multi-layer perceptron neural network (MLP). To categorise the photos, the flattened matrix passes through a fully linked layer..

- Receptive Layers :

Each neuron in a neural network receives information from multiple sites in the preceding layer. Each neuron in a convolutional layer receives information from only a small portion of the previous layer, known as the neuron's receptive field. The area is usually square (e.g. 5 by 5 neurons).

The receptive field in a fully linked layer, on the other hand, is the entire prior layer. As a result, each neuron in each convolutional layer accepts information from a greater area in the input than in prior levels. This is due to the repeated use of the convolution, which considers the value of a pixel as well as its surrounding pixels. The number of pixels in the receptive field remains constant while utilising dilated layers, but the field becomes increasingly sparsely populated as the dimensions of the field rise.

- Weights :

In a neural network, each neuron computes an output value by applying a specified function to the input values received from the previous layer's receptive field. A vector of weights and a bias decide the function that is applied to the input values (typically real numbers). Iteratively modifying these biases and weights is what learning is all about.

## 4.2 Linear Regression

### 4.2.1 Theoretical Explanation

Linear regression is an algorithm (belonging to both statistics and machine learning) that models the relationship between two or more variables by fitting a linear equation to a dataset. Independent variables are the features (input data) and dependent variables are the target (what you are trying to predict).

The technique is very simple and can be represented by this familiar equation:

$$y = mx + b$$

However, this is typically written slightly differently in machine learning:

$$y = b + w_1 x_1$$

Or for a more advanced model with multiple features:

$$y = b + w_1 x_1 + w_2 x_2 + w_3 x_3$$

Where:

*y* is the predicted label

*b* is the bias (the intercept)

*w1* is the coefficient or weight of the first feature (weight = *m* or slope)

*X1* is the input

Assumptions Involved:

- No autocorrelation: The error words should not be related to one another. The Durbin Watson test can be used to determine autocorrelation. The null hypothesis states that no autocorrelation exists. The test's result ranges from 0 to 4. There is no autocorrelation if the value of the test is 2.
- The error terms should be normally distributed. Q-Q plots and Histograms can be used to check the distribution of error terms.

- Independence/No Multicollinearity: The variables should be independent of one another, i.e. there should be no connection between them. A correlation matrix or VIF score can be used to test the assumption. The variables are highly connected if the VIF score is more than 5.
- Homoscedasticity: For all values of X, the variance of the error terms should be constant, i.e. the spread of residuals should be constant. A residual plot can be used to test this assumption. The points will create a funnel shape if the assumption is violated; else, they will remain constant.
- Normality: The X and Y variables should be normally distributed. Histograms, KDE plots, Q-Q plots can be used to check the Normality assumption.
- Linearity: It states that the dependent variable Y should be linearly related to independent variables. This assumption can be checked by plotting a scatter plot between both variables.

## 4.3 LSTM

### 4.3.1 Theoretical Explanation

Long-short Term Memory networks, often known as LSTMs, have been determined to be the most effective solution for practically all of these sequence prediction challenges, thanks to recent discoveries in data science. In many areas, LSTMs outperform traditional feed-forward neural networks and RNNs. This is due to their ability to memorise patterns selectively for long periods of time. This article's goal is to explain LSTM and show you how to apply it to real-world problems. Multiplications and additions are used by LSTMs to make little changes to the data. Information travels through a mechanism known as cell states in LSTMs.The information at a particular cell state has three different dependencies.

These dependencies can be generalized to any problem as:

➔ The previous cell state *(i.e. the information that was present in the memory after the previous time step)*

➔ The previous hidden state *(i.e. this is the same as the output of the previous cell)*

➔ The input at the current time step *(i.e. the new information that is being fed in at that moment)*

## ❖ LSTM architecture -

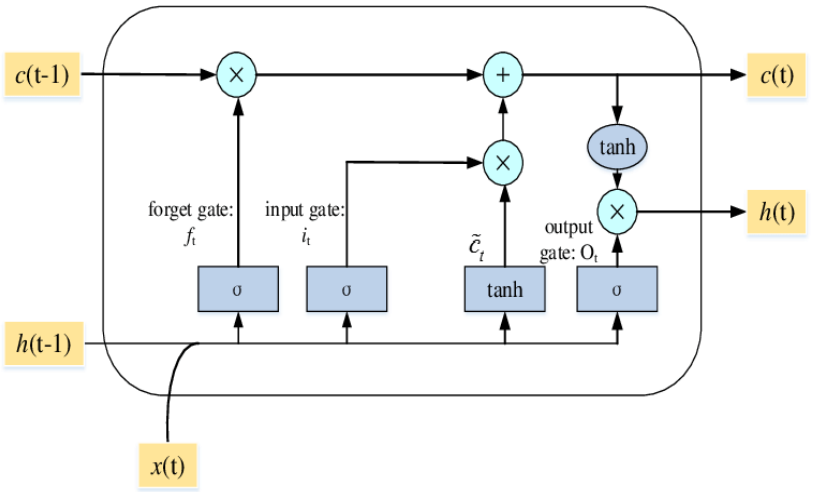


*Fig 4.1 LSTM Architrcture*

### Forget gate:

A forget gate is in charge of erasing data from the cell state. This gate takes in two inputs; h_t-1 and x_t. h_t-1 is the hidden state from the previous cell or the output of the previous cell and x_t is the input at that particular time step. The weight matrices are multiplied by the provided inputs, and a bias is added. This value is then subjected to the sigmoid function. The sigmoid function returns a vector with values ranging from 0 to 1, one for each cell state number. The sigmoid function is in charge of determining which data should be kept and which should be discarded. When the forget gate outputs a '0' for a specific value in the cell state, it signifies that the forget gate wants the cell state to fully forget that piece of information. A '1', on the other hand, indicates that the forget gate wishes to remember the complete piece of data. The cell state is multiplied by the sigmoid function's output vector.

### Input gate:

➔ The input gate is in charge of adding information to the current state of the cell. As shown in the graphic above, adding information is essentially a three-step procedure.

➔ Regulating what values need to be added to the cell state by involving a sigmoid function. This is basically very similar to the forget gate and acts as a filter for all the information from h_t-1 and x_t.

➔ Creating a vector containing all possible values that can be added (as perceived from h_t-1 and x_t) to the cell state. This is done using the tanh function, which outputs values from -1 to +1.

➔ Multiplying the value of the regulatory filter (the sigmoid gate) by the produced vector (the tanh function), then adding this beneficial information to the cell state via addition.4r

## Output Gate:

➔ The output gate is responsible for picking valuable information from the current cell state and displaying it as output.

➔ An output gate's operation can be broken down into three parts once more:

➔ After applying the tanh function to the cell state, the values are scaled to the range -1 to +1, resulting in a vector.

➔ Making a filter using the values of h_t-1 and x_t, such that it can regulate the values that need to be output from the vector created above. This filter again employs a sigmoid function.

➔ Multiplying the value of this regulatory filter by the vector formed in step 1 and sending it out as an output as well as to the next cell's concealed state.

# Chapter 5

# Results and Discussions

## 5.1 Results of technical analysis

Here we will comprehend the technical analysis of TCS (Tata Consultancy Services), which is one of the 15 stocks we have considered for analysis

### 5.1.1 Short term moving average

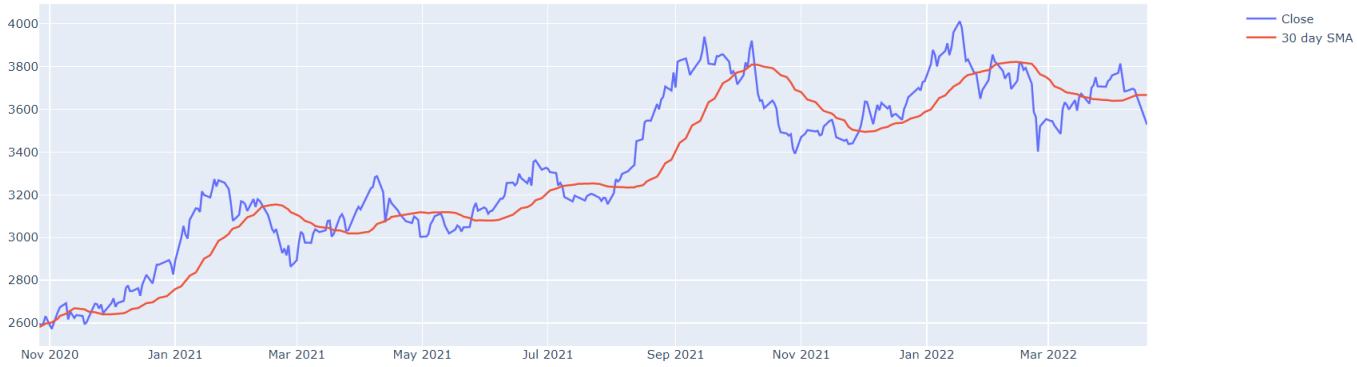


*Fig. 5.1 Closing and 30 day moving average crossover*

The point where the blue graph(Close price) crosses the red graph(30 day moving average) from below is the golden crossover i.e. the indicator to buy and the point where the blue graph(Close price) crosses the red graph(30 day moving average) from above is the death crossover i.e. the indicator to sell.

Analysis of the above graph for past 1 year-

*Table 5.1*

| Buy Date | Sell Date | Buy price | Sell price | Profit/share |
|---|---|---|---|---|
| Dec 9th 2020 | Feb 15th 2021 | 2658 | 3150 | 500 |
| March 19th 2021 | April 20th 2021 | 3032 | 3106 | 74 |
| May 24 | July 07 | 3091 | 3237 | 146 |
| August 2 | Sept 29 | 3236 | 3759 | 523 |
| Oct 4 | Oct 11 | 3779 | 3808 | 29 |
| Nov 29 | Jan 24 | 3495 | 3776 | 281 |
| Feb 1 | Feb 7 | 3791 | 3815 | 24 |
| March 21 | April 13 | 3623 | 3667 | 38 |

Following the above analysis of short term moving average, one could have generated a profit of Rs.1615 per share.

### 5.1.2 Long term moving average

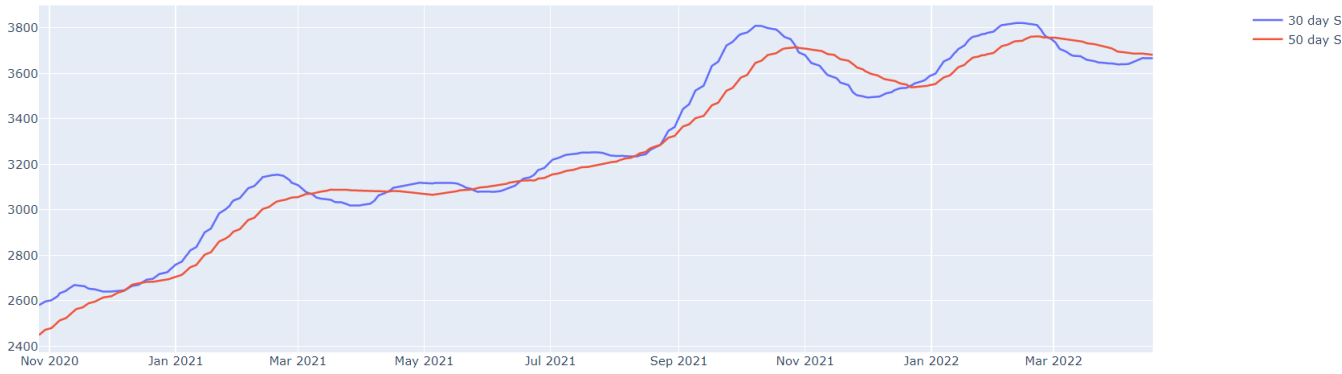


*Fig 5.2 30days and 50days MA's crossover*

The point where the blue graph(Close priae) crosses the red graph(30 day moving average) from below is the golden crossover i.e. the indicator to buy and the point where the blue graph(Close price) crosses the red graph(30 day moving average) from above is the death crossover i.e. the indicator to sell.

Analysis of the above graph for past 1 year-

*Table 5.2*

| Buy Date | Sell Date | Buy price | Sell price | Profit/share |
|---|---|---|---|---|
| Nov 23rd 2020 | March 8th 2021 | 2650 | 3071 | 421 |
| April 13th | May 21st 2021 | 3076 | 3088 | 12 |
| June 17 | August 13 | 3128 | 3247 | 119 |
| August 23 | October 28 | 3284 | 3715 | 431 |
| Dec 23 | Feb 25 | 3539 | 3757 | 218 |

Following the above analysis of long term moving average, one could have generated a profit of Rs.1201 per share.

-

### 5.1.3 Candlestick pattern


*Fig 5.3 Candlestick graph*

Candlestick chart is used for short-term decision making various types of candlestick indicators explained previously are discernible in this graph.
For example, a bearish marobozu is visible on Jan 19th, 2022 which indicates a bearish upcoming trend. This can be validated too in the above graph.

### 5.1.4 Volumes

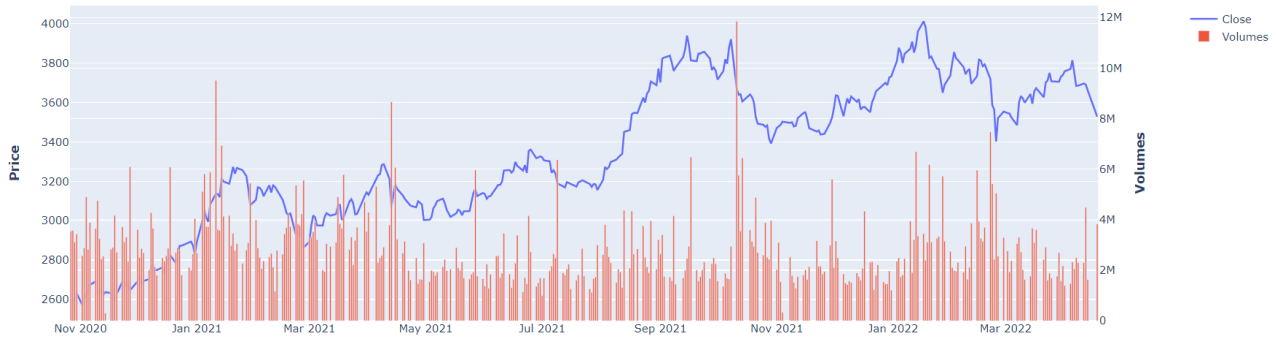


*Fig 5.4 Share price and Volume traded dual-axis representation*

I have mentioned a few postulates that explain how the day-to-day trading volumes of a share are related to the share price.
For example, on February 24, TCS share price was low(3400) but volumes were high. According to one of the postulates, the price should increase and the price on February 25th was 3550 rs per share and it went on following an upper circuit.

## 5.2 Results and discussions of predictive modelling
### 5.2.1 Optimizer loss

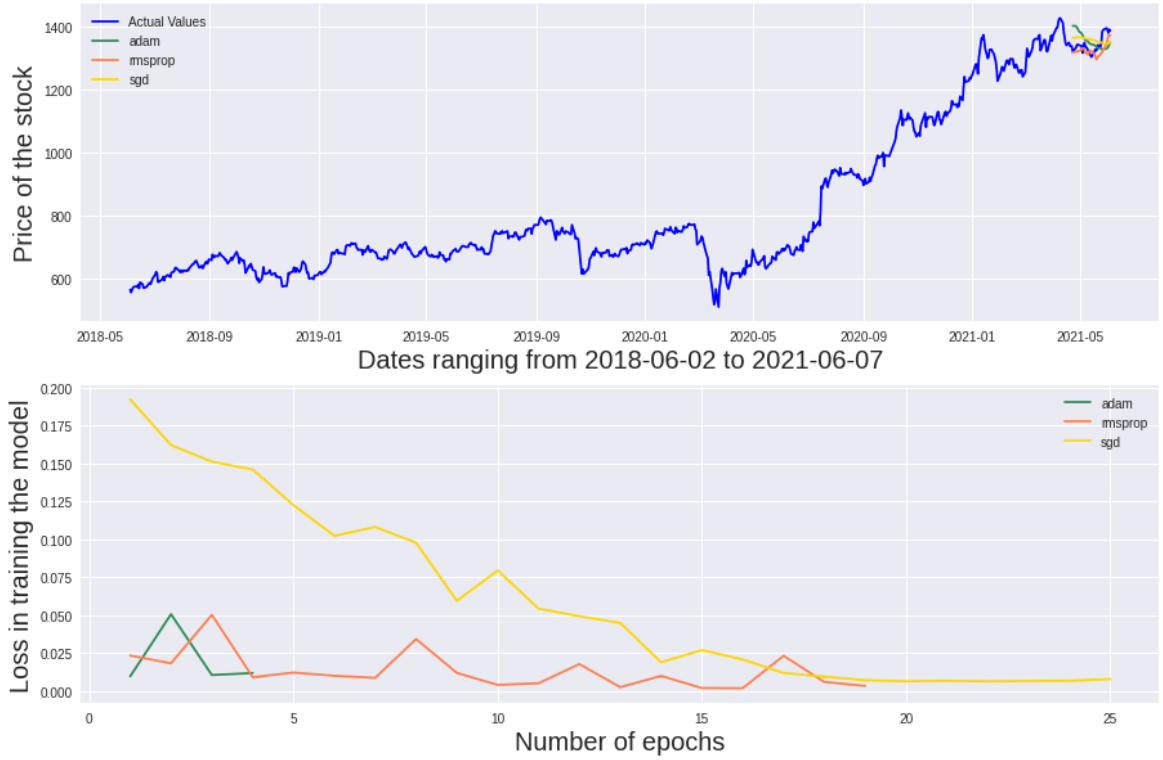


*Fig 5.5 Prediction with optimizers and its efficiency*

Here we applied the three optimizers (adam, rmsprop, sgd) together while training our model and traced the 30 days predicted graphs with the actual one.
In the second window we compare the loss of the three optimizers and we see Adam proved to be the best as it had the least loss.

### 5.2.2 Model Output Graphs

- CNN

*Fig 5.6 CNN actual and predicted graph*

- Linear Regression


*Fig 5.7 Linear Regression actual and predicted graph*

- LSTM


*Fig 5.8 LSTM actual and predicted graph*

### 5.2.3 Accuracy Table

*Table 5.3*

| Model | Accuracy |
|---|---|
| CNN | 94.68402679027772% |
| Linear Regression | 99.55715640366112% |
| LSTM | 84.08133683195806% |

- **Predicted Graph**

Here we will comprehend the technical analysis of INFOSYS, which is one of the 15 stocks we have considered for analysis.

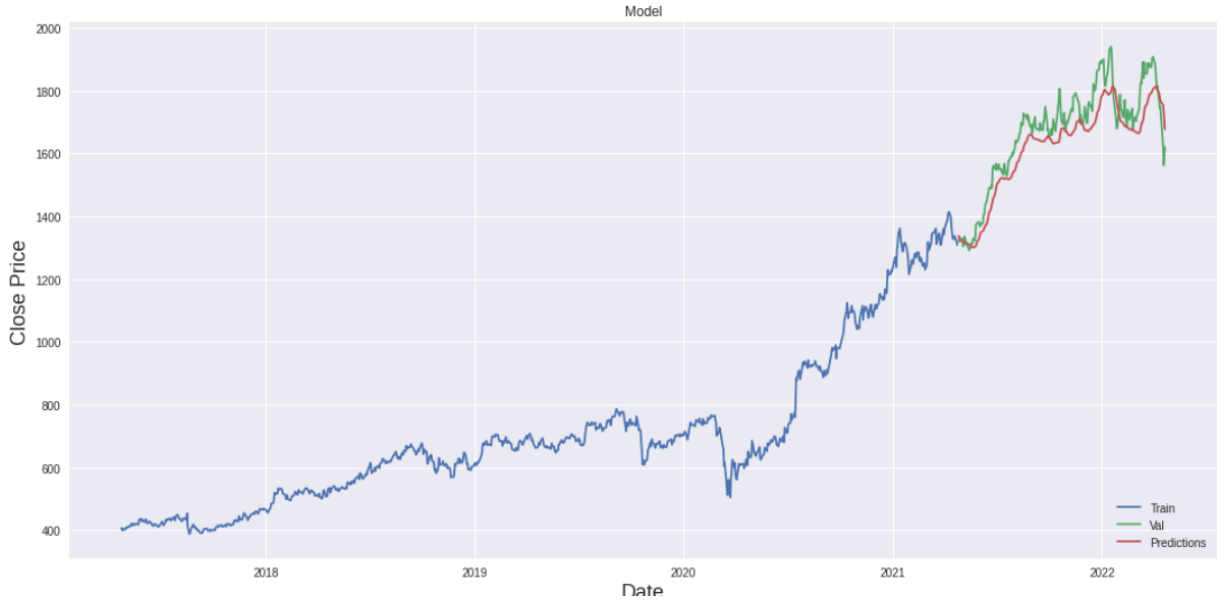


*Fig 5.9 Prediction graph of Infosys*

- Actual Closing and Predictions table

| Date | Close | Predictions |
|---|---|---|
| 2021-04-26 | 1317.530029 | 1336.660278 |
| 2021-04-27 | 1322.384277 | 1330.400024 |
| 2021-04-28 | 1329.739014 | 1325.455566 |
| 2021-04-29 | 1330.082153 | 1322.181152 |
| 2021-04-30 | 1328.120972 | 1320.130249 |
| ... | ... | ... |
| 2022-04-13 | 1748.550049 | 1766.947998 |
| 2022-04-18 | 1621.400024 | 1753.507446 |
| 2022-04-19 | 1562.000000 | 1732.139648 |
| 2022-04-20 | 1587.699951 | 1704.178955 |
| 2022-04-21 | 1618.800049 | 1676.677002 |

*Fig 5.10 Snippet of actual and predicted values of infosys*

- Tomorrow's Predicted Value

```
[[1653.6764]]
```

*Fig 5.11 Tomorrow's predicted value*

## 5.3 Website results

The Website is going to act as the GUI that the end user can use to access the code. The Website has been made in a simple manner and using HTML (Hyper Text Markup Language), CSS (Cascading Style Sheets) and JavaScript. As explained before, the backend and the main part of the coding has been done in Python.

As far as the Frontend of the Website is concerned, the user interface was designed to be extremely easy to use and understand. There are multiple gateways to each and every company and all the graphs are also interactive.

The aim of the website is for the end consumer to get a very basic understanding of technical analysis and predictive modelling. The Technical Analysis gives you the data from the past which you can use as per your need and put out various investments and have a general idea of the particular stock over the past few months. When it comes to the Predictive Modelling, there is an option to predict three modelling patterns and there you can see given the current market conditions where the stock will go in, for example, a month. You can plan your investment based on the combination of Technical Analysis and Predictive Modelling.

**Home Page:**

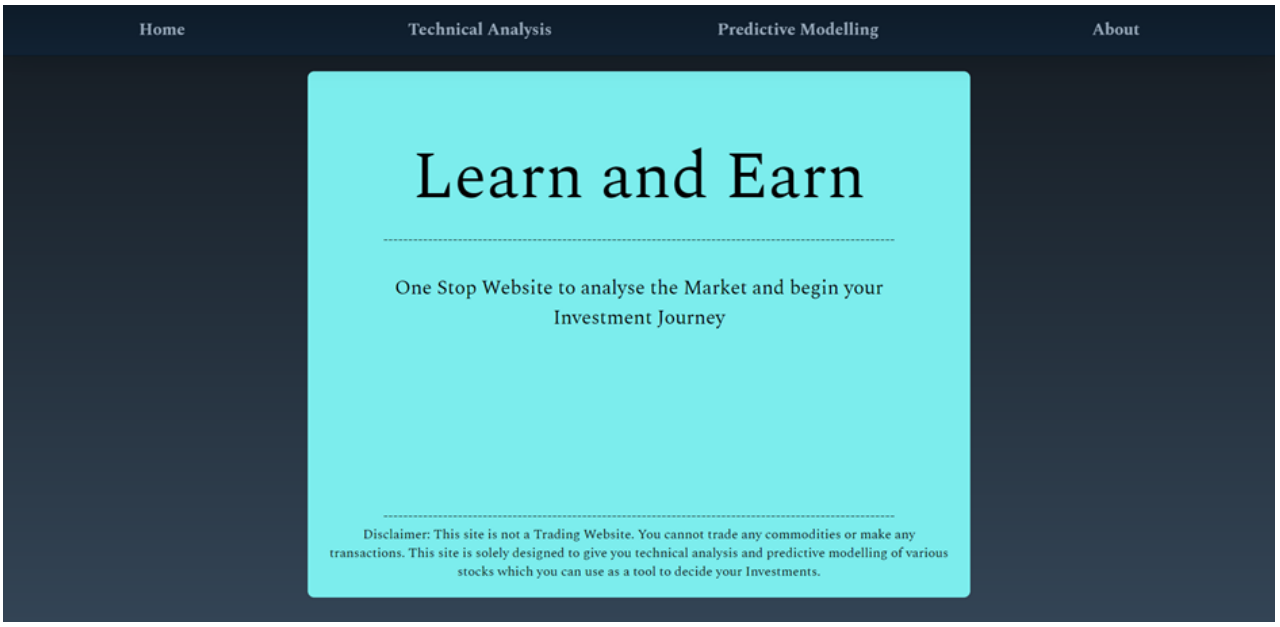


*Fig 5.12 Home Page*

This is the Home Page or the default page that is essentially the cover page for the website. Here, it is a simple design created using HTML and CSS. The HTML acts like a targeting or organising tool whereas the CSS Stylesheet gives the different styles in which every element looks like. The Navigation Bar up top gives quick links to the important parts of the project namely, Technical Analysis and Predictive Modelling. The Disclaimer is a necessary note that needs to accompany any financial related page.

The Home Page is the main linker when you host the website to the general public. This acts as the anchor point between all the other pages connected with it and must be named "index.html". This tells the computer that this is the main webpage and shall be defaulted to in case anything wrong takes place and it needs to get back to the checkpoint in a sense.

Using CSS, you can arrange the way you want your objects to appear on the webpage and it keeps on changing dynamically every time you add something before or after it. This quality makes CSS the best tool for designing Websites.

**Technical Analysis:**

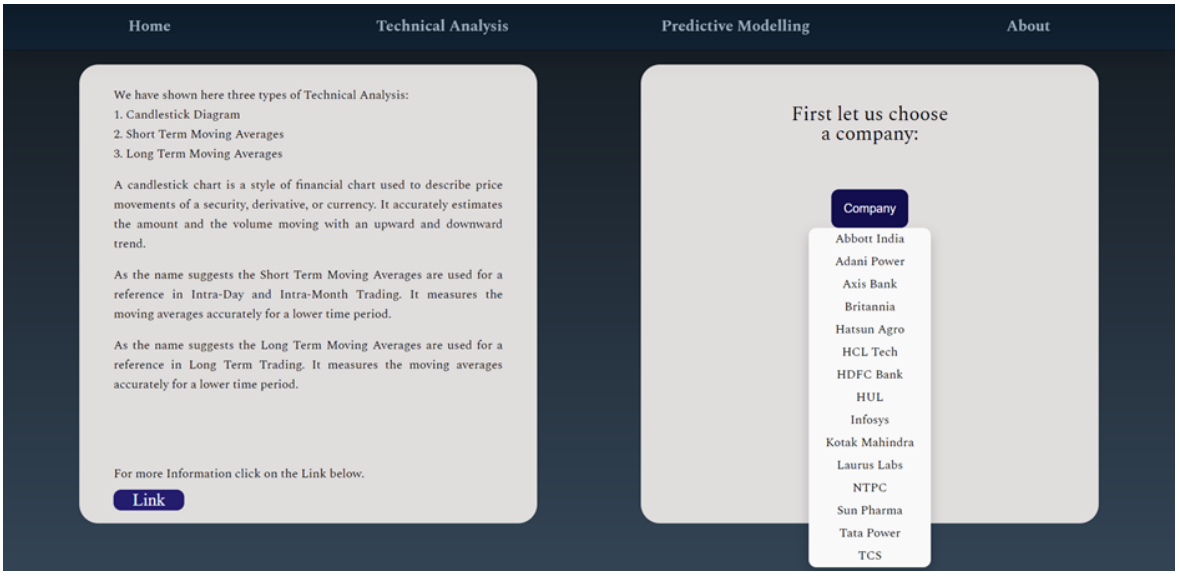


*Fig 5.13 Main Technical Analysis Page*

This is the Technical Analysis page. Here you can have a quick read as to what will be displayed or click on the Link Button Below which will give you an in-depth explanation regarding various skills and techniques involved in Technical Analysis. This is the main important point of including Technical Analysis in our Website. Novice Investors normally overlook the importance of Technical Analysis and jump to conclusions and believe any kind of Predictive Algorithm causing them to sometimes lose large sums of money. Here it is highlighted so that the user will read the theory behind Technical Analysis and will have to

understand it clearly. The next part of the site allows the user to choose a particular company in order to look at its various Technical Analysis.

Here the integration of various sites has been done as per their own page in order to facilitate the coding process. This means that a new page opens up for each company. The page opens up in the same tab but can be opened in a different tab as it is fundamentally the same as a site.

**Company Page:**

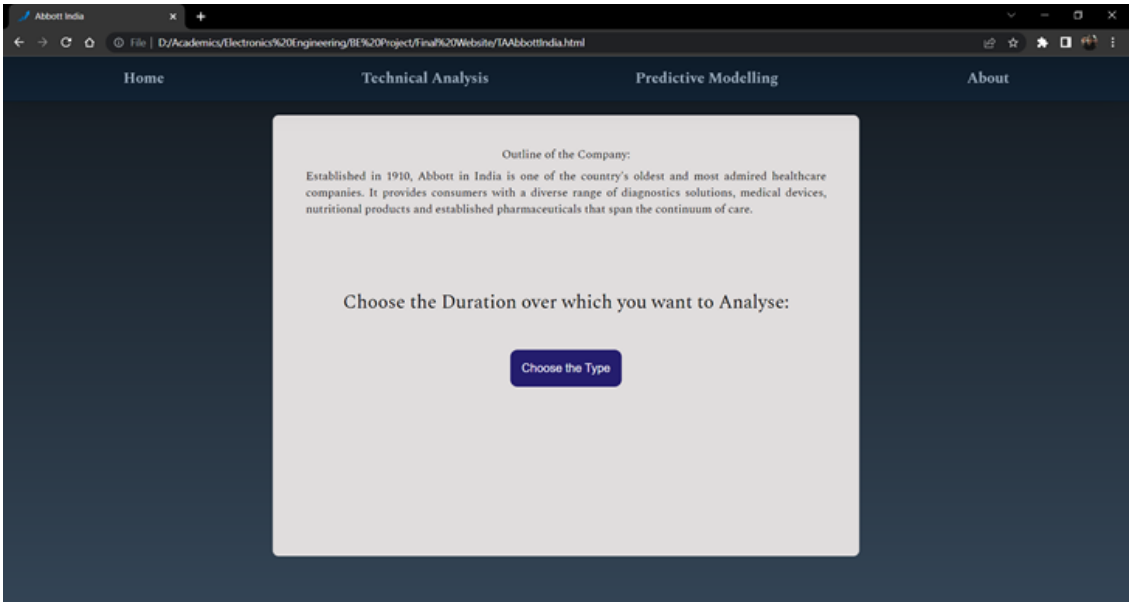


*Fig 5.14 Company Startup Page*

Here you can choose which type of Technical Analysis parameter you want to pass along and get the graph for. We have included the four fundamental aspects which are Volumes and Close, STMA (Short-Term Moving Averages), LTMA (Long-Term Moving Averages) and Candle Stick Diagram. All these are the basics of the Technical Analysis of the Stocks included.

**Technical Analysis Graph for a Company:**


*Fig 5.15Company Analysed Candlestick Graph*


*Fig 5.16 Company Analysed STMA*

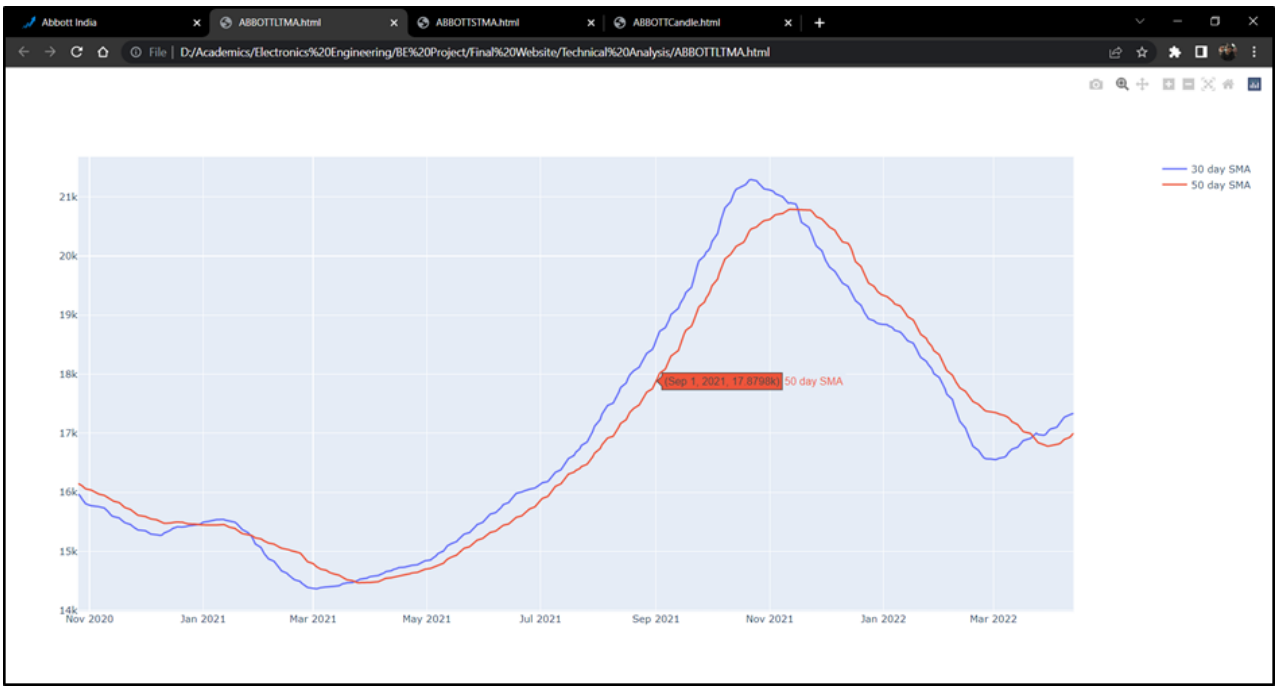


*FIg 5.17 Company Analysed LTMA*

These are the various graphs which are included in the Website which the end user can use and check the graphs for. The explanation for how to evaluate the graphs is given in the Theory Link on the previous Page. The user can check these graphs and charts and then implement the particular strategies thought by him/her into their own portfolio.

**Predictive Analysis:**

The interface for the Predictive Modelling is quite similar to that of the Technical Analysis. The main change is the links have been changed to direct the user to the Predictive Modelling pages of the company. Here after choosing a company the page that the user will reach is:

In the same way as Technical Analysis after choosing the button for Prediction you will get the graph for the time period already decided. After that it redirects you to a different page where you check out the graph.

**About Page:**

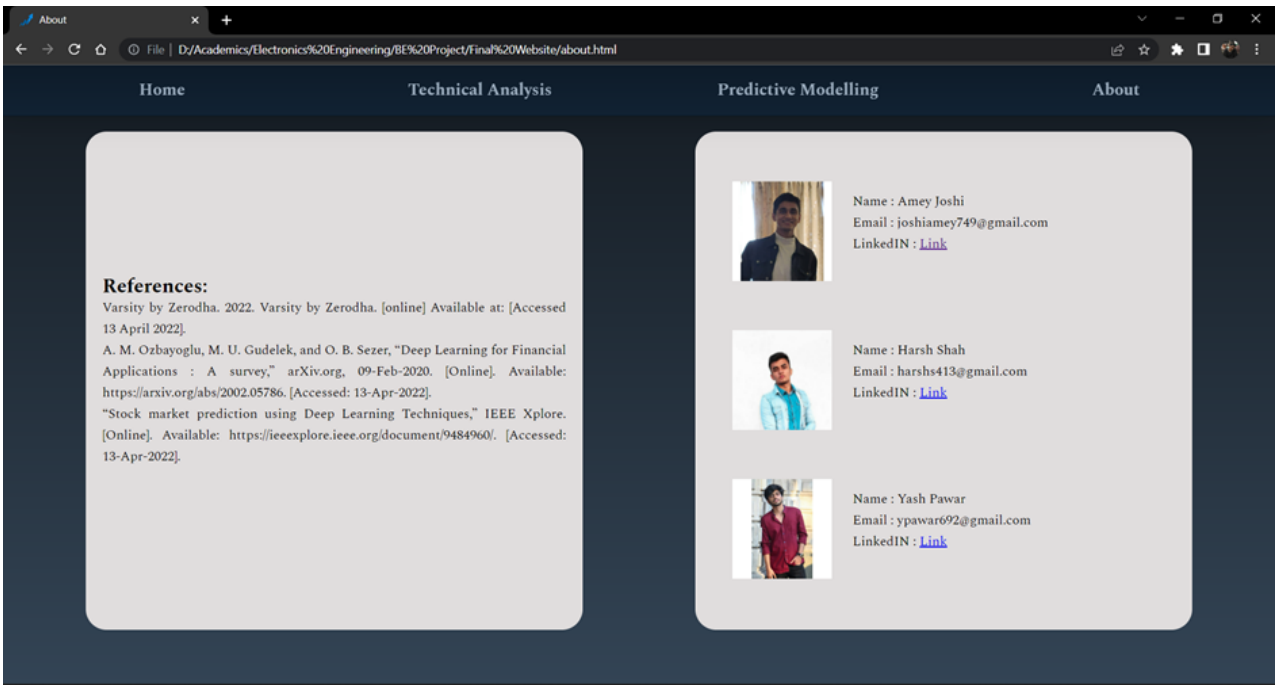


*Fig 5.18 About Us Page*

This is just the general References and About Page in order to show the exact references and places which are used to create this site. This is just a customary page for the completion of the project.

# Conclusion and Scope

## 6.1 Conclusion

The project was divided into three parts:

Technical analysis

The granular understanding of the aspects of candlesticks is apt for intraday and short term traders as it provides numerous invaluable insights. The two types of moving average crossovers exhibit perfect points and durations to enter, exit and hold positions for a particular stock. The trends of volumes juxtaposed with the stock price portray the rising plummeting and reversals of a stock price. The aspects of resistance and support provide an estimation of the target and the stop loss for a specific stock. Lastly, the concept of relative strength index to estimate the corrections or consistencies expected from an explicit stock.

Predictive analysis

Diving deep into the predictive analysis and techniques used, we can conclude that “adam” is the best optimiser compared to “rmsprop” and “sgd” for prediction particularly for stock markets owing to its minimum validation loss. Considering the three models (CNN, LSTM and Linear regression) implemented for the predictive modelling, LSTM is the best fit for efficacious prediction as CNN and linear regression result in overfitting when the data size increases.

As discussed, the last phase of the project is concentrated on depicting the project on a Graphical User Interface (GUI). The Website has various filters that can be used for personal analysis depending on the users’ preference. The website has two tabs mainly to portray the technical and predictive analysis. Under the technical analysis, the user can read about various types of technical analysis and use the insights gained to analyse the graphs curated for technical analysis for 15 selected companies provided. Under the predictive analytics part, the user can perceive the predicted or future values of the selected company stock.

## 6.2 Scope

Hit - is if the ratio of the predicted value to the actual value (r) lies between 0.75 and 1.25

i.e $0.75 \leq r \geq 1.25$

Miss - is if the ratio of the predicted value to the actual value (r) fails to lie between 0.75 and 1.25

i.e $r \leq 7.5$ or $r \geq 1.25$

This difference of +-25% is from the accuracy of the model i.e 84% (+-16%) in addition to a window of +-9% as a buffer

$$\frac{No.\ of\ Hits}{No.\ of\ Miss} \geq 1.5$$

This ratio of greater than or equal that 1.5 is considered to be ideal because, if we consider the ratio to be 1 i.e equal no. of hits and misses doesn't imply no profit no loss.

This is because of some fundamental factors-

1. Brokerage to be paid on every transaction
2. CAGR Value of the portfolio
3. Inflation

Thence, this ratio value should be greater that 1.

Future Scope-

So with this one next day's prediction this model can be taken ahead and used for granular predictions i.e for intraday where it would be working on a real time and give an indication for next 15 minutes with a range of 3 predicted targets (T1, T2, T3) and simultaneously 3 stoplossed (SL1, SL2, SL3). Which could be incorporated on a software as a multi-user (client) service.

Lastly an auto algorithmic trading model can also be made on the basis of this where if the client is busy the model will trade on its own for the user on which the user has given its inputs and risk values.

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Summary