

## Real-Time Stock Market Analysis using LSTM

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### Abstract

**Introduction:** For financial participants, the National Stock Exchange of India Limited (NSE) offers an unpredictable playground. Its benchmark index, the Nifty 50, displays intricate patterns and shifting market dynamics. Historically, price-action methods and historical data have helped traders make sense of this unpredictable market. Nevertheless, these techniques frequently struggle to capture and quickly adjust to changing market conditions.

**Objectives:** Using the capabilities of Long Short-Term Memory (LSTM) networks, this study suggests a unique method for predicting Nifty 50 stock values. Our project helps people who are just starting with trading a helping hand so they can make more data-driven decisions with accuracy.

**Methods:** LSTMs are highly advanced neural networks that can recall and use historical data to forecast future occurrences. LSTMs examine past pricing data, finding recurring patterns and minute details that would escape conventional approaches, just as human memory recovers and applies collected experiences for well-informed decision-making. In our Prediction system, we have used technologies like LSTM, and Yahoo Finance API. We first took real-time data on the stock market from Yahoo Finance (YFinance) and loaded it onto our machine learning system. We analyzed and trained that data to predict the future condition of the stock market.

**Results:** With the help of yfinance and Long short-term memory (LSTM) the projected values of our model is at an error rate of 2.7%. This research also dives in the cases of uncertainty where the error rate if not applicable like sharp selling/buying.

**Conclusions:** This research using LSTM model with an error rate of 2.7% is better when it is compared to the other research that has been conducted on the financial markets. We see a decrease in error rate because of the use of Real-time data curated from yfinance as well as option chain analysis.

**Keywords:** nifty 50, stock forecasting, lstm (long short-term memory), national stock exchange, financial forecasting techniques.

### 1. Introduction

The research of the stock market predictions' prior goal is to investigate the data-driven methodology that is required to navigate the dynamic stock market, which is then represented by long-term investors; technical analysis solely relies on historical data to help make short-term decisions. Using these strategies helps in increasing accuracy. The paper demonstrates increased prediction performance and introduces a novel solution architecture. The focus is on altering investment rules, diversification, a long-term perspective, risk awareness, thorough research, and staying informed. Although this advice may not guarantee success, they do provide useful insight for making sound decisions in an unpredictable market. Now we will be discussing the

basic research one need to do before investing in financial markets

#### 1. Market Research: A Course for Changing Trading Conditions:

Characteristically, the Indian stock market is characterized by the inherent risks and gainful abilities of National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). Making enlightened decisions requires a process of data driven decision making. Majorly focusing on technical analysis and fundamental analysis as two major analytical methods, this research looks at market research as an essential element in efficient trading.

1.1 Analyzing Technical Data to Unmask Market Trends: Conversely, technical analysis is a technique that aims at predicting future price movements by identifying the

recurring trends from past prices and chart patterns. Considering volume swings, support and resistance levels, and technical indicators can help traders understand short term market behaviour. This strategy is very good in riding momentum and finding out when to get into a trade and when to exit it for quick profits. However, due to its reliance on historical data as well as ignoring fundamental problems, it cannot be said to offer any long-term investment solutions.[1]

#### 1.2 Fundamental Analysis:

Beyond the current market noise, fundamental analysis digs deeper to evaluate a company's inherent worth. Financial accounts, including income streams, profit margins, debt levels, and asset allocation, are carefully examined using this approach. It also examines competitive environments, management calibre, and industry trends to give a complete view of a business's present and future financial standing. Long-term investors may find inexpensive jewels and create robust portfolios that can withstand market volatility using this method, which makes it beneficial. [2]

#### 1.3 Integrating Technical and Fundamental Understanding in a Synergistic Way:

Technical and fundamental analysis, although providing insightful information on their own, are most useful when applied in tandem. Trading professionals may navigate the market more precisely by employing a comprehensive strategy that uses technical analysis for tactical timing and fundamental research for strategic positioning. [3]

#### 1.4 Observation and Solution architecture for prediction

Before training the prediction model, we identify the gaps in the previous works' observations and suggest a solution architecture that includes a thorough feature engineering process. The feature extension method's ability to work well with recursive feature removal algorithms makes it possible for many other machine learning algorithms to forecast short-term price trends with high accuracy scores. It demonstrated how well our suggested feature extension and feature engineering worked. We went on to present our modified LSTM model and saw an improvement in all assessment metrics' prediction scores. Incomparable earlier efforts, the suggested solution performed better than deep learning and machine learning-based models.

### **2. Rule of hand for investing in the stock market:**

When it comes to investing in the stock market there resides certain risks, and there is no one-strategy-fits-all approach in it. However, there are some general principles and rules that many investors find helpful. Here are some of the common rules of it:

2.1 Diversification: When investing, avoid putting all of your money in one place[4]. To disperse risk, diversify your investments over a range of markets, industries, and asset types.

2.2 Long-term Viewpoint: Stock market investments are most probably appropriate for long-term Viewpoints[5]. When investing, timing the market or making fast money are risky and speculative endeavours.

2.3 Risk Acceptance: Recognizing one's personal limit for risk and then making investments appropriately[6]. One should only consider investing money you can afford to lose because stocks can be very unstable.

2.4 Long-Term Perspective: Investors with a long-term horizon typically see returns from the stock market[5]. When considering equity investing, give yourself at least five to ten years' time.

2.5 Research: Before purchasing a stock, conduct in-depth research. Recognize the company's competitive landscape, growth potential, and financial standing.

2.6 Keep Up: Remain informed on news, economic indicators, and market movements that could affect your assets. Examine your portfolio on a regular basis.

### **2. Literature Review**

A large number of studies have been conducted on the same, Takeuchi, L., & Lee, Y. Y. A have used deep learning for the prediction of financial assets [7] [8]. Moritz, B., & Zimmermann, T. have used a tree-based model for the same [9]. Wang, S., and Y. Luo have used the ADaBoosting technique [10]. Paiva, F. D., Cardoso, R. T. N., Hanaoka, G. P., & Duarte, W. M., author of the paper [11] used a support vector machine (SVM) method and the Mean Variance (MV) method for portfolio selection. The author of [12] used an ensemble approach for creating a trading strategy using Reinforcement Learning. The work [13] covers the improvements in automated low-frequency quantitative stock trading with deep reinforcement learning [14]. The study [15] looks at the viability of developing an end-to-end daily stock trading system that uses Deep Q-networks (DQN) [16] and Deep Recurrent Q-networks (DRQN) [17] to automatically determine whether to buy or sell at each trading day.

To anticipate stock trends, in [18] a hybrid feature selection method with the support vector machine (SVM). The dataset used in this study is a subset of the Taiwan Economic Journal Database (TEJD)'s 2008 NASDAQ Index. A hybrid approach was used for the feature selection process, with sequential forward search (SSFS) acting as the wrapper. The fact that they created a thorough process for adjusting parameters and included performance under various parameter values is another benefit of their work. The feature selection model's well-defined structure serves as a heuristic for the first stage of model structuring. One drawback was that SVM's performance was only evaluated in relation to back-propagation neural networks (BPNNs); it was not evaluated in relation to other machine-learning techniques.

While going through all the mentioned research papers, we found that all the datasets were downloaded and not real-time. This project saw an increase in the accuracy of the prediction of the financial market by switching to real-time dataset.

### **3. Methods**

Performing sequential data analysis requires both LSTM and RNN. It is an excellent way to capture and use historical data for predictions with the help of LSTM, a kind of RNN. LSTMs are an effective tool in neural network architecture. LSTMs consist of an input layer of initial data entry, a hidden layer that serves as a memory bank that records long-term dependencies, and an output layer for processing hidden layer outputs. Technical analysis is based heavily on indicators that provide insights into market momentum, directional movement, and trend identification, respectively. We will also be discussing indicators like the Directional Movement Index (DMI), Relative Strength Index (RSI), and Simple Moving Average (SMA).

#### **1) Recurrent Neural Network (RNN) and Long Short-Term Memory (LSTM):**

LSTM is one of many types of RNN, it's also capable of catching data from past stages and using it for future predictions [19]. RNN consists of 3 main layers.

1. Input layer
2. Hidden layer
3. Output layer

##### **1.1 Input Layer**

a) **The Gateway:** This is the entry point of the data. The data should be sequential and in the initial data entry stage in the LSTM model

b) **Dimensionality:** The input layer defines the initial dimensionality of your data. It represents the number of features used to describe the element in sequential data. The right optimization of data is important to get the best neural network.

##### **1.2 Hidden Layer**

a) **The Memory Bank:** Unlike normal feedforward networks, the hidden layer in LSTM is based on recurrent.

b) **Long-Term Dependencies:** This layer captures the subtle relationships that span over multiple data points. Which is important for time series forecasting and sequence classification.

c) **More Layer, More Insights:** LSTM can have many stacked hidden layers. Each layer extracts more complex knowledge than the previous layer. The greater the number of hidden layers the more complex information extracted.

##### **1.3 Output Layer**

a) **The Translator:** This is the final output of the LSTM model; this layer is responsible for processing the output of the hidden layer and then transforming it into the desired output.

b) **Activation Functions Shape the Output:** This includes functions like sigmoid, softmax, or tanh, we can transform the data into the required format using internal functions.

#### **2) Indicators:**

The stock market has become more volatile and has fluctuated significantly. Therefore, the utilization of technical indicators that are commonly applied in the stock market to the housing markets to identify both bearish and bullish trends in the housing market.[20]

**2.1 RSI:** The Relative Strength Index (RSI) [21] is an indicator based on momentum used in technical analysis of the security. It is a chart with the lowest level at 0 and the highest level at 100. When RIS hits less than 30, it represents oversold conditions; when it hits about 70, it tells overbought conditions.

**2.2 Directional Movement Index:** Directional Movement Index (DMI) is a technical indicator that tells how strongly a security's price is moving. It is made up of 2 lines. [22] The negative directional indicator (-DI) and the positive directional indicator (+DI).

**2.3 SMA:** Simple moving average is a popular indicator it gives an average price of the security over a while, and it makes

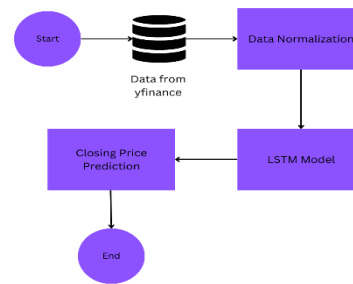
the data smooth, and less noisy. It helps to find trends more easily. [23]

**3) Yahoo Finance API:**

The Yahoo Finance API [24] is a range of libraries/APIs/methods to obtain historical and real time data for a variety of financial markets and products, as shown on Yahoo Finance-<https://finance.yahoo.com/>. Some of the offerings include market data on Cryptocurrencies, regular currencies, stocks and bonds, fundamental and options data, and market analysis and news. One good reason is because it can be completely free. However, there are also third-party APIs with more support that do charge for their higher usage plans, but even they tend to have free tier options. Impressive range of data. On-top of the core standard data, the Yahoo Finance API offers extras such as options and fundamentals data as well as market news and analysis, which alternatives such as IEX and Alpha Vantage don't always have. It's also easy to set yourself up. Depending on the avenue you pick, setup ranges from a couple of lines of code to install libraries, to creating an account to access personal API keys and then just calling an API with a specific URL (depending on the data you want) and these keys. It can be simple. Some of the libraries have documentation that fits on a single page whilst retaining functionality that is focused but sufficient for most normal use cases. While compact, it can still help you out by providing functions in the modules that do tedious legwork for you like automatically getting data into pandas data frames where appropriate.

**4) The flow of the project:**

- a. Data Retrieval: Collecting historical stock data from Yahoo Finance. We look at past prices, trading volumes, and other relevant information.
- b. Data Normalization: We adjust the scales so that features like price and volume are consistent and comparable.
- c. LSTM Model: LSTM can learn patterns from the historical data. LSTM studies the trends, remembers them, and predicts future prices.
- d. Closing Price Prediction: LSTM finally predicts the closing price for tomorrow will be and there we get the predicted stock market price.



**4. Results**

We performed Data Retrieval and Preparation using Python to obtain past stock price data from Yahoo Finance. Made sure the data was thoroughly cleaned and formatted properly, handling missing values or abnormalities.

- a) Qualitative Statistics: By calculating fundamental statistical measurements such as mean, median, and standard deviation of the stock's historical prices we obtained summary statistics for key metrics like daily returns and trading volume.
- b) Visualization: Created visualizations to help better understand the stock's performance. Common visualizations include line charts for stock price over time, candlestick charts, and histograms for daily returns.
- c) Trend Analysis: Identified and analyzed trends in the stock's price movements. Used technical indicators such as moving averages to identify potential trends and reversals.
- d) Volatility Analysis: Measured and analyzed the stock's volatility. Calculated metrics like the standard deviation of daily returns or the Average True Range (ATR).
- e) Correlation Analysis: Assessed the stock's correlation with relevant market indices or other assets. Understood how the stock moves concerning broader market trends.
- f) Fundamental Analysis: Incorporated fundamental data if available, such as earnings per share (EPS), price-to-earnings (P/E) ratio, and other financial metrics. Assess whether the stock is over- or under-valued. These are the values that were predicted by our model. The values in column 3 were predicted on 19th March 2024, the value of column 4 was the actual value of the stock on 20th March 2024

**Table -1: Predicted and actual value of our model**

SR NO.	Stock name	Predicted on 19 March	Actual	Difference	% Diff

		2024			
1	ADANI PORTS	1269.677	1243.2	5	-26.427 -2.13
2	ASIAN PAINT	2861.5	2835		-26.5 -0.94
3	AXIS BANK	1065	1038.2	5	-26.75 -2.58
4	BAJAJ-AUTO	8608	8611	3	0.04
5	BAJFINANCE	6411.8	6653	241.2	3.63
6	BAJAJFINSV	1572.6	1584	11.4	0.72
7	BPCL	572.8	566.6	-6.2	-1.1
8	BHARTIARTL	1263.566	1231.6	-31.966	-2.6
9	CIPLA	1468	1417.6	5	-50.35 -3.56
10	COALINDIA	423.7	420	-3.7	-0.89
11	DRREDDY	6291.75	6100	-191.75	-3.15
12	EICHERMOT	3725.2	3875	149.8	3.87
13	GAIL	179.0261	173.35	-5.6761	-3.28
14	GRASIM	2170.35	2179.9	9.55	0.44
15	HCLTECH	1655.9	1592	-63.9	-4.02
16	HDFCBANK	1480	1432	-48	-3.36
17	HEROMOTOCO	4684.44	4490	-194.44	-4.34
18	HINDALCO	579.6	526.45	-53.15	-10.1
19	HINDPETRO	483.9	456.15	-27.75	-6.09
20	HINDUNILVR	2334.67	2243.2	5	-91.42 -4.08
21	ITC	418.8	416	-2.8	-0.68
22	ICICIBANK	1081.5	1087	5.5	0.51
23	IBULHSGFIN	168.82	162.5	-6.32	-3.89
24	IOC	165.4	158.2	-7.2	-4.56
25	INDUSINDBK	1482.266	1443.8	5	-38.416 -2.67
26	INFY	1601.49	1555.8	-45.69	-2.94
27	KOTAKBANK	1726.5	1766.5	40	2.27
28	LT	3465.52	3513.2	47.68	1.36
29	LUPIN	1683.78	1565	-118.78	-7.59
30	M&M	1745.802	1847	101.19	5.48

				8	
31	MARUTI	11559.33	11925.	25	365.92 3.07
32	NTPC	330.4779			-17.477 -5.59
33	ONGC	260.68	263.25	2.57	0.98
34	POWERGRID	265.37	264.6	-0.77	-0.3
35	RELIANCE	2794.199	2886.2	5	92.051 3.19
36	SBIN	723.5359	736.6	1	13.064 1.78
37	SUNPHARMA	1551.93	1556.7	4.77	0.31
38	TCS	4120.844	3974.9	5	145.89 -3.68
39	TATAMOTORS	1004.875	944.3	-60.575	-6.42
40	TATASTEEL	145.2864	145.4	0.1136	0.08
41	TECHM	1258.859	1261.5	2.641	0.21
42	TITAN	3663.044	3592.7	-70.344	-1.96
43	UPL	465.1862	455	2	-10.186 -2.24
44	ULTRACEMCO	9608.963	9478	33	-130.96 -1.39
45	VEDL	258.9213	267.65	8.7287	3.27
46	WIPRO	507.775	497.1	-10.675	-2.15
47	YESBANK	22.90653	23	7	0.0934 0.41
48	ZEEL	141.7045	140.25	-1.4545	-1.04

### 5. Conclusion

In conclusion, by using the advanced machine learning concept of Long Short Term Memory and Yahoo Finance to retrieve data, The predicted values are 2.7% different from the actual value. Our research has highlighted the uncertainty of the stock market and while integrating indicators like the Relative strength index, Simple moving average, and Directional Movement Index, we have been able to capture the

movement of the market helping traders and investors to make more data-driven decision.

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