

Smart Data Analytics using Python – A Study on Stock Market

¹Arpita Vitthal Lipte, ²Dr.Satya Mohan Mishra

¹Student, Department of Business Administration and Research

Shri Sant Gajanan Maharaj College of Engineering Shegaon, Maharashtra, India

²Asst.Professor, Department of Business Administration and Research

Shri Sant Gajanan Maharaj College of Engineering Shegaon, Maharashtra, India

¹arpitalipte21@gmail.com, ²smmishra@gmail.com

Abstract: *This paper presents the application of Python in stock market analysis and prediction. The stock market involves large and complex datasets making it challenging for investors to identify trends and make accurate decisions. In this study uses Python along with libraries such as Pandas, NumPy and Matplotlib and machine learning models like Linear Regression and LSTM to analyze historical stock data and forecast future price movements.*

The study is based on secondary data collected from sources such as Yahoo Finance, NSE and BSE, focusing on selected companies across different sectors. Techniques like time-series analysis, technical indicators (RSI and Moving Averages) and data visualization are applied to understand market behaviour and trends.

The results show that Python-based analysis improves efficiency, reduces human error and supports improve investment decisions. However, due to market volatility and external factors, predictions are not fully accurate. Overall, the study highlights the importance of Python in financial analytics and its simply to understand stock market prediction for investors, beginners and student.

Keywords: Stock price prediction, Pandas, Matplotlib, NSE, Financial Market

I. INTRODUCTION

1.1 Introduction

The stock market is a complex and unpredictable financial analysis. The stock market is a platform where buyers and sellers together stocks and shares trade. In India, stock market exchanges such as the Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) in the equity market. Stock market prices move fast due to investor behaviour, economic data and market news making the market highly unpredictable. Stock market is a difficult to analysis a new investor to take right decision understand the price fluctuation, market movements and forecasting future price analysis. Stock market is a difficult to analysis for new investors, to understand trends and make informed decisions making. Forecasting future stock prices depends on historical data, market patterns, and predicting future price.

In recent years, Python is a popular programming and high-level language known for its simple and make it easy to use and learn for beginners. Python libraries are used to handle the data and perform complex tasks with a few lines code such as Pandas, NumPy, Matplotlib and Seaborn. Python libraries to help investors chart patterns, historical data, decision making and more improve accuracy future stock price data.

In this report aims to explore how Python and machine learning techniques can be used to analyze stock market data and predict future price movements, help investors to improve better decisions.

1.2 Research Gap

Most existing studies on stock market analysis on traditional methods such as financial ratios and basic statistical techniques. There is limited research on the use of Python for comprehensive analysis, including data collection, visualization and prediction. The studies focus specifically on the Indian stock market, such as the National Stock



Exchange and Bombay Stock Exchange. Therefore, a gap exists in developing a complete Python-based framework that improves prediction accuracy and supports better real-world investment decision-making.

1.3 Problem Statement

The stock market is complex and unpredictable price movements difficult to analysis. The stock market external factors like inherently volatile, unpredictable, economic policies, political events, investor behaviour company performance. Investor and traders need improve accuracy and predictive models to make informed decision and financial losses. To develop predict stock price movements for selected stock in real-time and provide data for investor, traders and financial analysis to more improve decisions.

1.4 Objectives of the Study

- To help investors estimate future stock market trends through predictive models.
- To apply Python and machine learning techniques for improving prediction accuracy.

1.5 Scope of the Study

This report focuses on a Python-based system for stock market analysis and prediction using data. It uses historical data to analyze price market trends, volatility, technical indicators and company performance. Python libraries such as Pandas, NumPy, Matplotlib, Seaborn, and TensorFlow are used for data analysis, visualization, and prediction. The report analysis technical indicators and machine learning models to forecast stock prices.

The system automates data collection and analysis to improve accuracy and reduce manual effort. However, it is limited to selected companies and does not include real-time trading. The aim is to support investors in understanding market trends and making better decisions.

II. REVIEW OF LITERATURE

2.1 Literature Review

Forecast Stock Price: This paper describes stock *forecasts* using technical analysis. technical analysis one of the well-known and widely followed analysis by traders worldwide(Swami et al., 2022). The technical methods used for complex and *dynamic* chart pattern the stock market data *movements*(Rathore & Kaushik, 2020). This report focused on various technical indicators strategy(Sandeep & Mtech, n.d.). *Stock market prediction* is very difficult analysis because of the intrinsic volatility and influences like *geopolitical and economic policies*.

Stock Market Prediction: The report analysis the stock market data analysis and predict future price used machine learning *models*. The historical stock market data include price trends and financial technical indicators in the machine learning *models*(Rathore & Kaushik, 2020) This research paper explores the use of the *Python programming* language in analyzing the stock market(Singh & Seth, n.d.). This report aims to provide a *comprehensive review* of the paper research related to the use of machine learning in the field of financial *market forecast* future price(Podduturi et al., 2022)

Stock Data Analysis: The report highlight the Python for advanced stock market analysis and the need for paper research to analysis the tool *functionalities* in this regard(Singh & Seth, n.d.). However it is not necessary that all investments offers a good return and this is mainly due to the have limited *knowledge and skills* for investors to predict stock market trends (Podduturi et al., 2022). Finance *real-time data*(Santhosh Kumar et al., 2024) In the Yahoo finance collect a data open source and fetch using a Python. The stock markets recent years have process investment decision - making, that traders cannot able to change market price and lose money(Sandeep & Mtech, n.d.)



III. RESEARCH METHODOLOGY

3.1 Research Design

This report includes quantitative data, historical stock prices, financial performance and machine learning models to compare actual and predicted stock prices. Python libraries such as NumPy, Pandas, Matplotlib, Seaborn, and Scikit-learn are used for data analysis and prediction.

Descriptive Design

The report focuses on explaining company performance, stock behavior, historical trends, and technical indicators to understand price movements.

Analytical Design:

The report analyses historical data, chart patterns and technical indicators to improve prediction accuracy using Python-based models.

3.2 Data Collection Method

This report uses only secondary data collected from reliable sources such as Yahoo Finance, National Stock Exchange, Bombay Stock Exchange and Screener. The data includes continuous and accurate historical stock market information used for analysis and forecasting.

Python libraries such as NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn, and TensorFlow are used for data processing and prediction.

a) Secondary Data:

Data is collected from existing published sources and not gathered directly. It includes Yahoo Finance and stock market data.

b) Data Collected:

Historical stock price data
Financial performance data
Technical indicators
NSE

c) Sample Size

Historical daily stock price data. The time period is 5-10 years data. The financial analysis selected on stock market price company is reliance industries ltd. 20 companies are selected from different sectors. (e.g., IT, Banking, Pharma, Automobile, FMCG).

IV. DATA ANALYSIS AND INTERPRETATION

4.1 Data Analysis

This report focuses on the analysis and interpretation of stock market data using Python-based tools. Historical stock prices market are analyze to identify trends, patterns and market behaviour through charts and technical indicators such as Relative Strength Index (RSI) and moving averages. Machine learning models like linear regression and random forest are used to predict the next day's closing price.

The report also includes sector-wise comparison of companies to evaluate performance within the same industry. Overall, this report helps to understanding stock market trends, data visualization and prediction techniques for improve investment decisions.

4.2 Price and Volume Chart

The chart represents the historical trend of stock closing prices along with trading volume over time. It shows analysis upward movement in stock prices with some fluctuations, indicating periods of growth and market corrections. A significant rise can be observed around 2020, followed by continued volatility and continuous growth in later years.



The trading volume also shows irregular spikes, reflecting increased market activity during certain periods. Overall, the chart highlights long-term growth trends, price volatility, and the relationship between price movement and trading volume, which are useful for market analysis and prediction.

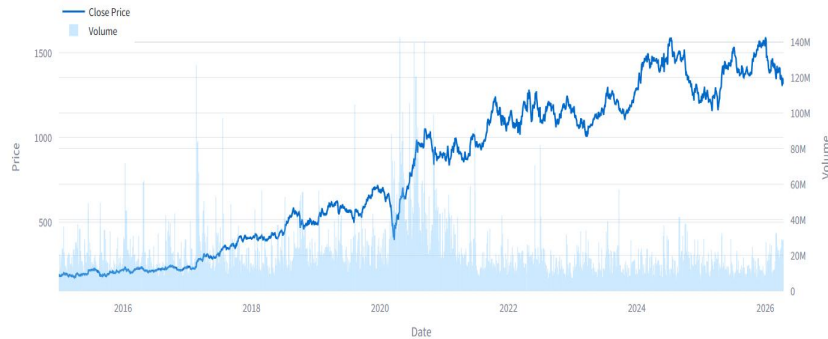


Fig.1 Price and Volume Chart

4.3 Peer Comparison

The chart compares stock price trends of multiple companies over time. Among them, Reliance Industries shows the highest growth with significant upward movement, indicating strong performance. Other companies like BPCL, IOC, and ONGC show moderate growth with fluctuations.

Overall, the chart highlights differences in company performance, market trends, and volatility, helping investors compare stocks within the same sector.



Fig.2 Peer Comparison

4.4 Industry -Wise Analysis

The table presents yearly stock price market data of selected companies along with the sector average from 2015 to 2024. It shows a general upward trend in stock prices over time, indicating overall sector growth. Some companies demonstrate higher growth compared to others, while a few show fluctuations in certain years.

The sector average also increases slowly, reflecting positive industry performance. Overall, the data helps to comparing company-wise performance and understanding long-term market trends within the sector.



Date	COFORGE.NS	HCLTECH.NS	INFY.NS	LTIM.NS	MPHASIS.NS	PERSISTENT.NS	TCS.NS	TECHM.NS	WIPRO.NS	Sector Avg
2015	100.6576	321.7569	421.8938	None	382.4812	284.7278	961.5128	376.4856	94.3459	367.9827
2016	75.3814	321.1384	394.3878	599.2972	451.0524	276.9224	950.3364	361.4509	80.8244	390.0879
2017	117.4235	352.0235	418.6592	1007.6682	595.8407	327.2479	1106.5477	381.4694	107.539	490.491
2018	211.6215	384.3697	548.3721	1583.1815	850.7433	287.3791	1574.0588	559.6973	113.5893	679.2236
2019	294.6304	456.2308	628.2534	1628.9567	793.0663	316.766	1861.0342	602.7756	112.837	743.8389
2020	507.907	770.3973	1105.5062	3448.5518	1378.963	725.6267	2511.7974	816.8507	178.0278	1271.5142
2021	1116.1306	1113.0427	1694.6439	6983.0674	3109.1169	2369.4419	3315.9297	1558.5546	330.4556	2398.9315
2022	745.6176	918.2945	1383.2114	4188.394	1843.8275	1885.3234	2928.5225	926.6778	183.239	1667.012
2023	1224.7592	1353.751	1452.6169	6138.5474	2629.2676	3637.9639	3532.8789	1203.5548	220.4284	2377.0853
2024	1910.457	1833.8762	1825.9618	5514.1763	2791.4224	6396.1255	3886.5005	1658.2222	282.9544	2899.9662

Download CSV

Fig.3 Year-wise Industry Data

4.5 Industry Performance

The bar chart shows the comparative performance of selected stocks. Co-forg appears as the best performer with the highest value, while Wipro shows the lowest performance among the selected companies. Other companies demonstrate moderate performance levels. Overall, the chart helps in identifying top and low-performing stocks, supporting better comparison and investment decisions.



🏆 Best Performer: COFORGE.NS

📉 Lowest Performer: WIPRO.NS

Fig.4 Bar Chart

4.6 Prediction Result

The model predicts the future stock price based on historical data and selected parameters. The results show that the predicted prices follow a similar trend to actual prices, indicating that the model is reasonably accurate. However, slight variations are observed due to market volatility. Overall, the prediction helps to understanding short-term price movement and supports improve investment decision-making.



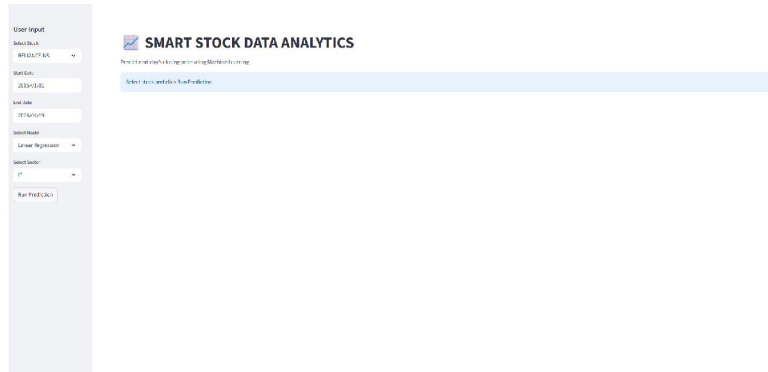


Fig.5 Prediction Result

Local URL: <http://localhost:8501>

Network URL: <http://10.106.86.87:8501>

V. FINDINGS

The report contains that Python-based data analytics plays an important role in stock market analysis by handling large datasets efficiently. The use of machine learning models such as Linear Regression and LSTM helps in predicting future stock prices with better accuracy. Technical indicators like RSI and Moving Averages are effective in identifying trends and market behaviour. However, stock market predictions are not fully accurate due to high volatility and external factors like economic conditions and investor sentiment. The report also finds that Python libraries make data analysis, visualization and decision-making faster and easier but results are mainly reliable on historical data rather than real-time conditions.

VI. SUGGESTIONS

The report suggests that future research should focus on integrating real-time data for more practical and accurate predictions. The use of advanced machine learning and hybrid models can further improve forecasting performance. It is also recommended to combine both technical and fundamental analysis for better investment decisions. Increasing the number of companies and sectors in the study can enhance the reliability of results. Additionally, developing interactive dashboards using tools like Python or Power BI can help investors understand data easily. Future studies can also include sentiment analysis using news and social media to improve prediction accuracy.

VII. CONCLUSION

The study indicates that Python-based data analytics is useful for analyzing and predicting stock market trends. Machine learning models and technical indicators help improve decision-making, but predictions are not fully accurate due to market volatility and external factors. Overall, Python makes stock analysis faster, easier, and more efficient for investors.

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