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Integrating Technical & Fundamental Analysis with Machine Learning for Stock Market Investment Decisions

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Abstract
This study explores the integration of technical and fundamental analysis with machine learning to enhance stock market investment decision. By combining these analytical methods, we aim to improve the accuracy of market predictions and investment strategies. The study compares two models based on recommendation system with different approaches. The first approach includes the integration of technical and fundamental analysis. Input data involves computation of 3 most popular technical parameters using data from google finance (LTP, 52WH and Fib Retracement) and financial ratios (PE Ratio, Intrinsic value and Growth rate). The second approach includes Support Vector Regression (SVR) model as a recommendation system to select stocks from the list of NIFTY-500 Index of Indian Equity market. The results indicates that the hybrid approach outperforms traditional methods, offering a more profitable framework for investors.

Keywords: Technical Analysis, Fundamental Analysis, Machine learning, Support Vector Regression

1. Introduction

The stock market described as a critical pivot in every growing and dynamic economy, since it requires investments to be made with the goal of increasing profit and minimizing the risks. To achieve this delicate balance, investors have long relied on two primary approaches: fundamental analysis and technical analysis[1]. These methods provide valuable insights into stock prices and guide investment decisions. In the traditional sense, investment strategies are either technical or fundamental. Yet, taking a step back and integrating these methods can reveal greater market insights[1], [2], [3]. While technical analysis focuses on historical data of the price patterns, fundamental analyses look at company financials and industry trends from a macroeconomic angle. This study examines the combination of technical and fundamental analysis using machine learning in stock market investment strategies[4]. Technical analysis focuses on past market data to predict future trends; Fundamental analysis considers economic factors and financial statements to accesses a stock's intrinsic value. The advent of machine learning introduces a new dimension to this process, leveraging algorithms that can improve with data over time[5].

By integrating technical and fundamental analysis with machine learning, investors can achieve a more accurate approach to market forecasting[2], [6]. The goal is to demonstrate that this integrated approach

can outperform traditional methods and provide a better recommendation system for making investment decisions.

1.1 Objectives

Our objectives include:

- Evaluating the predictive performance of the integrated model. The primary aim of this research is to explore the synergies between technical and fundamental analysis in evaluating stock market performance, within the context of project engineering and management. Investigating the impact of various features (fundamental ratios, technical patterns, etc.) on stock price predictions.
- Providing practical insights for investors and portfolio managers. Assess the effectiveness of combining technical and fundamental analysis for stock selection in project investment scenarios.
- Develop a framework for incorporating stock market analysis into project risk management strategies by using machine learning.

2. Literature Review

Layyinaturrobaniyah's (2016) study underscores the importance of a well-rounded analytical framework in navigating the complexities of the stock market. As financial markets continue to evolve, the synergy between fundamental and technical analyses will remain indispensable for investors seeking to make informed and strategic investment decisions. the comprehensive understanding and application of both fundamental and technical analyses are crucial for effective stock investment decision making. By leveraging the strengths of each approach, investors can achieve a balanced and informed perspective, ultimately leading to more successful investment outcomes[1].

Mamaysky's (2000) research highlights the critical role of computational algorithms in processing vast amounts of market data efficiently. These algorithms, ranging from simple moving averages to complex machine learning models, enhance the precision and reliability of technical indicators. By automating the analysis process, computational algorithms enable the rapid identification of trading opportunities and trends, thereby facilitating real-time decision-making. In conclusion, the foundations of technical analysis, encompassing computational algorithms, statistical inference, and empirical implementation, are essential for developing effective and adaptive trading strategies. By harnessing the power of these interdisciplinary methods, traders and investors can better navigate the complexities of financial markets and achieve more consistent and profitable outcomes[7].

Strader's (2020) work also identifies several promising research directions that could address these challenges. These include the development of hybrid models that combine different machine learning techniques, the integration of alternative data sources such as social media and news sentiment, and the application of transfer learning to leverage knowledge from related domains. Additionally, exploring the ethical and regulatory implications of ML-driven trading strategies is crucial to ensure fair and transparent market practices. Machine learning has revolutionized stock market prediction by offering tools that can process and analyse vast amounts of data with unprecedented speed and accuracy. Techniques such as neural networks, support vector machines, and ensemble methods have demonstrated significant potential in capturing complex patterns and relationships within financial data that traditional statistical methods might overlook[8].

Vasundhara’s (2024) research explores the intersection of technical and fundamental analysis with machine learning for stock market prediction. By integrating these approaches, the author aims to enhance decision-making in investment strategies. The machine learning model demonstrates promising results,

providing an alternative to traditional methods. The research emphasizes the importance of a holistic approach. Investors and analysts should consider both technical and fundamental signals while making investment decisions. Machine learning augments this process by identifying patterns and adapting to changing market dynamics[6].

Dr. K. Velmurugan's (2022) research provides valuable insights into the application of machine learning for stock market forecasting. The study evaluates various algorithms, including Linear Regression, SVM, Random Forests, and Neural Networks, to predict stock prices. Results indicate that certain algorithms perform better than others, depending on the dataset and features used. Additionally, Long Short-Term Memory (LSTM), a type of recurrent neural network (RNN), is explored for time series prediction. While no single algorithm is universally superior, understanding their strengths and limitations is crucial for data-driven investment decisions. Future research should focus on refining hybrid models, addressing data quality issues, and adapting to market dynamics[5].

Febrian Wahyu Christanto et al. (2024) investigates the role of financial statements in machine learning (ML)-based stock price prediction. The study reveals that integrating financial statements has a neutral impact on Support Vector Regression (SVR) predictions, while for Support Vector Machine (SVM), it positively affects accuracy. This research underscores the significance of considering financial data alongside technical indicators when developing robust ML models for stock market forecasting. The study uses Support Vector Regression (SVR) and Support Vector Machine (SVM) to predict stock prices. Parameters are grouped into three categories: technical only (TEC), financial statement only (FIN), and a combination of both (COM). Integrating financial statements has a neutral impact on SVR predictions. For SVM, integrating financial statements positively affects predictions[9].

3. Methodology

The flow chart of our research methodology begins with the data collection. The source of data for our research is secondary data taken from NSE (National Stock Exchange), the data source is then collected in MS Excel (version 2406). This is followed by the data cleaning stage. In data cleaning process all data with missing values are neglected and normalized to ensure uniformity. After data cleaning, we proceed to the stock recommendation system which integrates technical and fundamental analysis, utilizing indicators and fundamental ratios to generate a stock recommendation. The second system employs a Support Vector Machine (SVM) machine learning model, which is trained on historical data of 1 year to predict stock performance. In integration phase, we combine the insights from both systems to filter and refine the final stock recommendation. The integrated approach leverages the strength of both traditional financial analysis and advanced machine learning techniques, ensuring a strong and comprehensive methodology for making informed stock market investment decisions. Finally, the result interpretation and validation phase involve analysing the model's predictions, comparing the with actual market movement, and validating the model's effectiveness.

Figure 1. Momentum based analysis using 52WH line Indicator.

Source: Tradingview / Candlestick chart analysis on PRESTIGE ESTATE Share Price (weekly time frame)

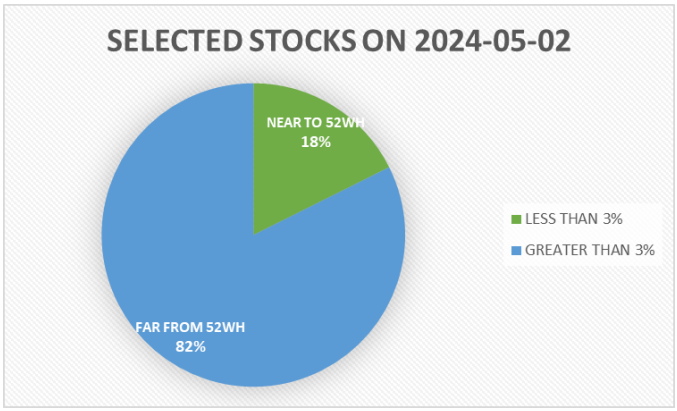

Figure 2. Pie Chart in percentage of selected stocks near to its 52-week high level.

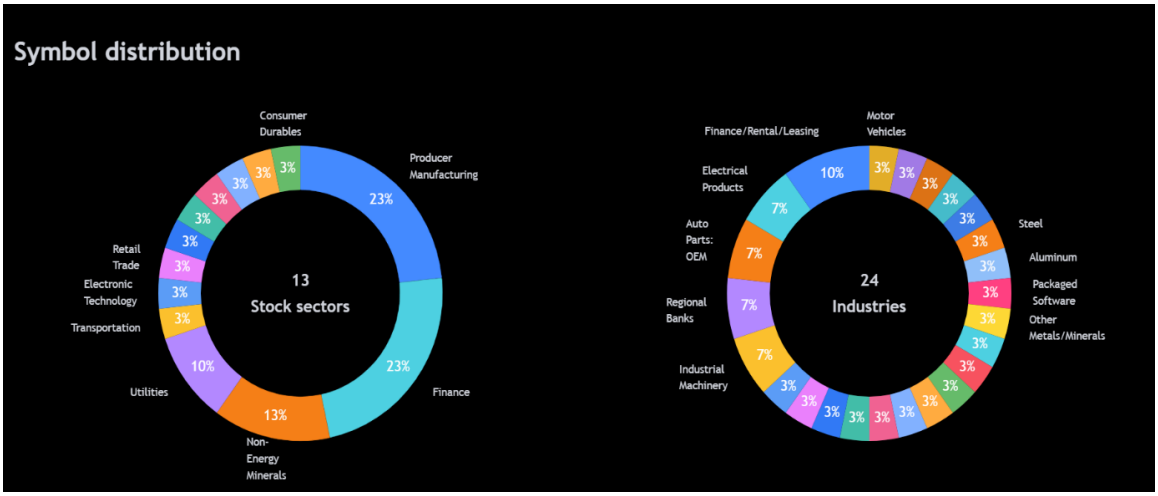

Figure 3. Sector wise distribution of selected stocks.

Source of Platform: Tradingview (https://in.tradingview.com)

Table 1. List of Stocks selected based on Technical & Fundamental analysis on 2024-05-02.

SYMBOL	3 MONTH PERFORMANCE (%)
POLYCAB	20.03
SOBHA	20
ASHOKLEY	33.3
INDIGO	22.15
PETRONET	15.45
APARINDS	15.39
CANBK	-1.83
ESCORTS	31.98
TATAPOWER	-2.84
SBIN	21.08
CHOLAFIN	27.98
TRENT	26.38
SRF	-6.11
CAMS	30.46
CUMMINSIND	13.9
GRASIM	23.56
SHRIRAMFIN	19.62
M&M	35.17
NMDC	-1.4
KFINTECH	17.61
WELCORP	18.94
VEDL	13.29
RECLTD	42.14
VOLTAS	15.7
ABB	19.64
JINDALSTEL	5.15
LEMONTREE	7.18
BIOCON	26.49
POWERGRID	19.45
QUESS	-4.01

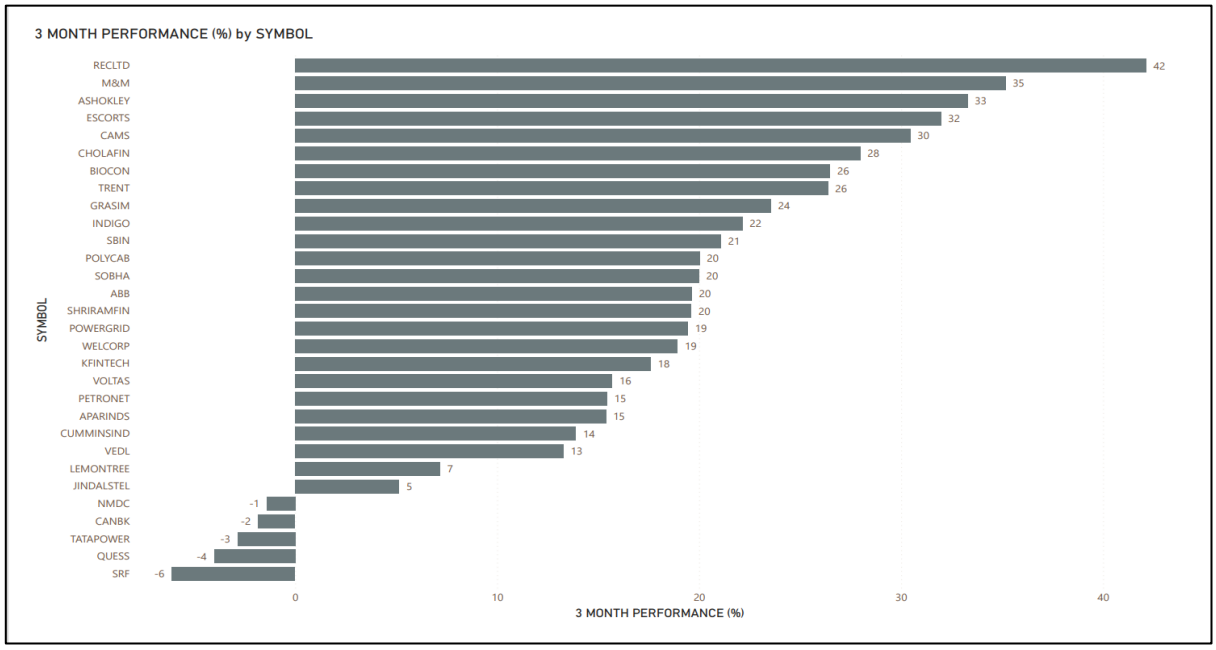

Figure 4. Performance Bar Graph in 3 months of time frame.

Table 2. Results of t-testing for 3-month performance on 2024-05-02.

	3 MONTH PERFORMANCE (%)
Mean	17.52833333
Variance	151.0750764
Observations	30
Hypothesized Mean	10
Df	29
t Stat	3.35477236
P(T<=t) one-tail	0.001113835
t Critical one-tail	1.699127027
P(T<=t) two-tail	0.002227669
t Critical two-tail	2.045229642

4. Results and discussion

In the results and discussion section, we present the performance evaluation of our Support Vector Machine (SVM) regression model with a Radial Basis Function (RBF) kernel, which achieved an accuracy of minimum 0.83 to maximum 0.93. This high level of accuracy demonstrates the model's effectiveness in predicting stock prices. Additionally, we provide a detailed Profit and Loss (P&L) statement for a one-month period, summarizing key financial metrics for each stock.

Table 1. Profit and Loss statement from Zerodha Demat Account.

				Client ID	JE1430				
P&L Statement for Equity from 2024-08-26 to 2024-09-24									
Summary	**Rs**			**Symbol**	**ISIN**	**Quantity**	**Buy Value**	**Sell Value**	**Realized P&L**	**Realized P&L Pct.**	**Previous Closing Price**
				BOSCHLTD	INE323A01026	1	31984.95	33720	1735.05	5.4246	36731.2
Charges	384.1649			FORTIS	INE061F01013	34	19165	20230	1065	5.557	595.15
Other Credit & Debit	-138.06			GOLDBEES-E	INF204KB17I5	144	8620.09	8678.88	58.79	0.682	62.99
Realized P&L	9483.97			GRAPHITE	INE371A01025	89	52673.2	54036.35	1363.15	2.5879	598.15
Unrealized P&L	-438.81			IEX	INE022Q01020	89	17466.25	18091.03	624.78	3.5771	211.61
Average Profit %	4.054356			INFY	INE009A01021	13	24323	25480	1157	4.7568	1898.6
				MARUTI	INE585B01010	5	62807.35	63775	967.65	1.5407	12738.6
Charges				SOBHA	INE671H01015	13	24148	26012.55	1864.55	7.7213	1995.5
				SUNPHARMA	INE044A01036	8	13960	14608	648	4.6418	1868.15
Account Head	Amount										
Brokerage - Z	0.05										
Exchange Transaction Charges - Z	12.1591										
Clearing Charges - Z	0										
Central GST - Z	0										
State GST - Z	0										
Integrated GST - Z	2.3133										
Securities Transaction Tax - Z	354										
SEBI Turnover Fees - Z	0.3637										
Stamp Duty - Z	15										
IPFT	0.2789										

SOBHA (svr_rbf accuracy: 0.8882048802108524)

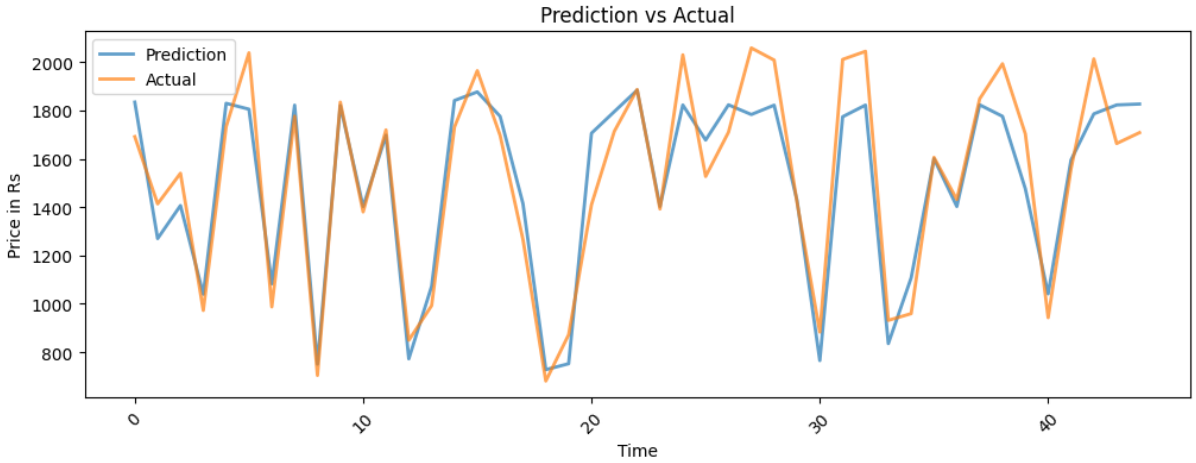

Figure 5. SOBHA Stock with actual and predicted price accuracy report

Final Result from profit & loss statement, tested in live market for 1-month of time period. The recommended stocks revealed an average profit of 4.05%. This indicates a positive return on investment, demonstrating the effectiveness of the integrated approach combining technical & fundamental analysis with machine learning techniques.

5. Conclusions

This study is to identify direction for future approaches which integrate machine learning techniques with other methods for stock recommendation research based upon a review of current literature. The stock recommendation system used in this paper are best used for predicting short term investment decisions, the integration of technical and fundamental analysis with machine learning, specifically through the use of an SVM regression model with an RBF kernel, has demonstrated significant potential in enhancing stock market investment decisions. The model's high accuracy of 0.73 to 0.93 underscores its predictive power, while the detailed sector-wise distribution and 3-month performance evaluations provide comprehensive insights into market trends and stock behaviour.

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