

Research Based Learning-II Project Report On

Enhancing Investment Decisions: Technical Indicator-Driven Stock Price Predictions

of

BACHELOR OF ENGINEERING Information Technology

Submitted by

Pranav Bhavsar (Roll No.:11)
Bharat Bohra (Roll No.:12)

Under the Guidance of

Mrs. Pranjali Kasture
Deputy HOD, IT Department

**Department of Information Technology
(Academic Year. 2023-24)**



Information Technology
Thakur College of Engineering & Technology
Thakur Village, Kandivali (East), Mumbai-400101
(Academic Year 2023-24)

CERTIFICATE

This is to certify that the project entitled "***Enhancing Investment Decisions: Technical Indicator-Driven Stock Price Predictions***" is a bonafide work of **Mr.Pranav Bhavsar (Roll No.:11)**, **Mr. Bharat Bohra (Roll No.:12)** submitted to the Thakur College of Engineering and Technology, Mumbai (An Autonomous College affiliated to University of Mumbai) in partial fulfillment of the requirement for the award of the degree of "**Bachelor of Engineering**" in **Information Technology**

Signature: -----

Mrs. Pranjali Kasture.:

Deputy HOD-IT

Signature with Date: -----

Dr. Rajesh S Bansode.:

Information Technology

Date:

Place: Mumbai

ABSTRACT

This project investigates the effectiveness of technical indicators in predicting stock prices and optimizing investment strategies. Technical analysis, grounded in historical market data, offers insights crucial for anticipating price movements. A comprehensive literature review lays the groundwork, encompassing diverse methodologies in technical analysis and stock price prediction.

Empirical analysis forms the core, evaluating various technical indicators like moving averages, Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), and stochastic oscillators. Using historical data from multiple financial markets, each indicator's predictive power is rigorously assessed across different market conditions.

Additionally, the project explores integrating technical indicators with advanced predictive models, including machine learning algorithms. By leveraging algorithms trained on historical market data, the goal is to enhance prediction accuracy. Decision trees, random forests, support vector machines, and neural networks are compared against traditional statistical methods.

Furthermore, potential synergies between technical indicators and fundamental analysis are explored to develop holistic investment strategies. Combining insights from both analyses enables investors to gain a comprehensive understanding of a stock's intrinsic value.

Rigorous statistical analysis ensures the reliability of findings, with sensitivity analyses conducted to gauge parameter impact.

The insights derived hold significant implications for investors, financial analysts, and policymakers, providing actionable strategies to navigate financial markets adeptly. This project bridges theory with practice, offering potent tools for optimized investment outcomes in today's dynamic financial landscape.

ACKNOWLEDGEMENT

We sincerely thank to our **Mrs. Pranjali Kasture** for her guidance and support for carrying out our project work.

We express our heartfelt gratitude to our esteemed Principal for his unwavering support and encouragement throughout the duration of our project. We extend our sincere appreciation to the Dean for his invaluable guidance and mentorship. Special thanks to our Head of Department for his constant support and motivation.

We are deeply indebted to our project guide Mrs. Pranjali Kasture for her expert advice, patience, and continuous encouragement, which greatly contributed to the success of our project. We also extend our gratitude to the industry experts whose insights enriched our work. We would like to thank our colleagues for their collaboration and assistance. Last but not least, we extend our heartfelt appreciation to our parents for their unwavering support and encouragement throughout this journey.

Without the support of these individuals, our project would not have been possible.

Pranav Bhavsar (Roll No.:11)

Bharat Bohra (Roll No.:12)

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Chapter 1: LinkedIn Profile and Blog Writing

1.1 LinkedIn Profile Screenshots



Bharat Bohra · 1st

Aspiring Developer

Mumbai, Maharashtra, India · [Contact info](#)

68 connections



Harsh Mishra, KRISHNA KHATRI, and 13 other mutual connections



University of Mumbai



Pranav Bhavsar

Student at Thakur College of Engineering & Technology

Mumbai, Maharashtra, India · [Contact info](#)

190 followers · 190 connections



Thakur College Of
Engineering and Technology



[Open to work](#)

Foreign Exchange Trader, Equity Trader, Stock Trader, Futures Trader and Derivatives Trader roles

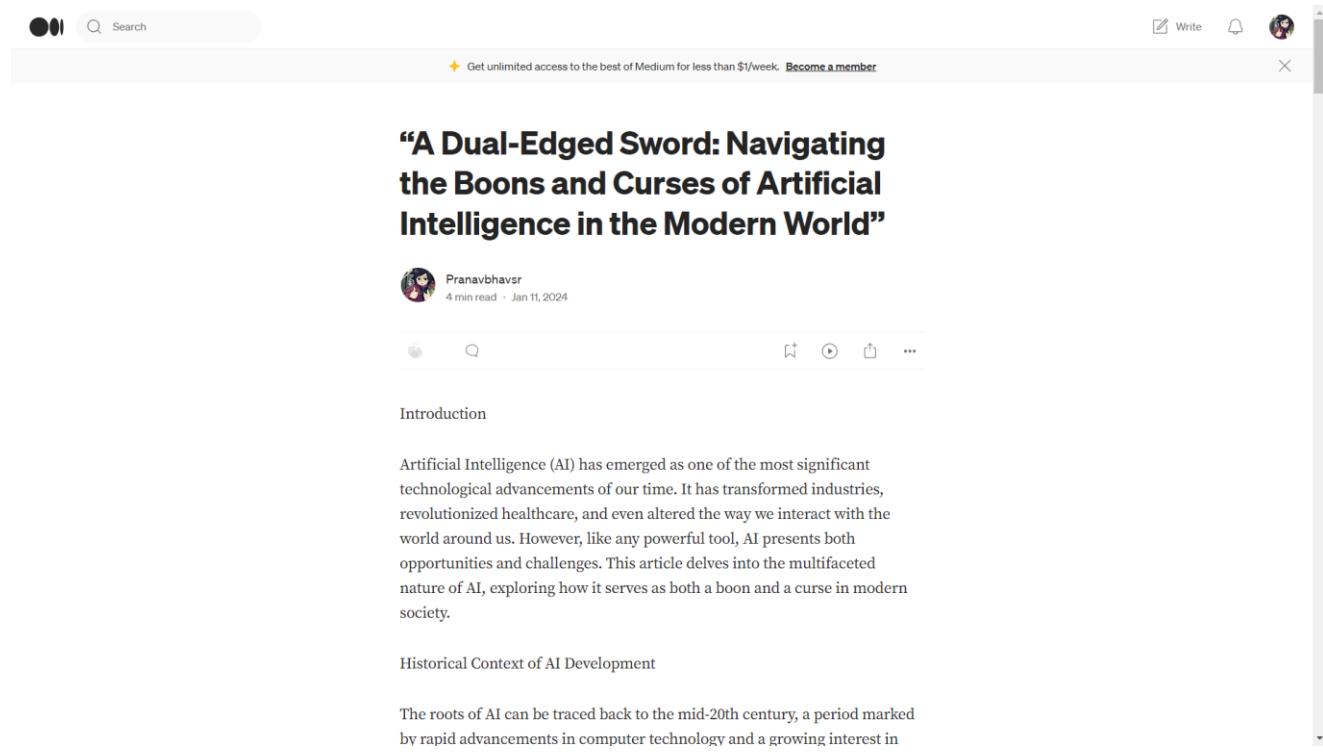
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1.2 Blog Screenshots



The screenshot shows a Medium blog post. At the top, there's a navigation bar with icons for profile, search, and writing, followed by a 'Search' input field. A promotional banner for Medium membership is visible. The main title of the post is "A Dual-Edged Sword: Navigating the Boons and Curses of Artificial Intelligence in the Modern World". Below the title, it says "Pranavbhavr" and "4 min read · Jan 11, 2024". There are standard sharing and editing icons at the top right. The content starts with a section titled "Introduction" which discusses the emergence of AI as a significant technological advancement, its impact on various industries, and the dual nature of its benefits and challenges. It then moves on to the "Historical Context of AI Development".

A Dual-Edged Sword: Navigating the Boons and Curses of Artificial Intelligence in the Modern World

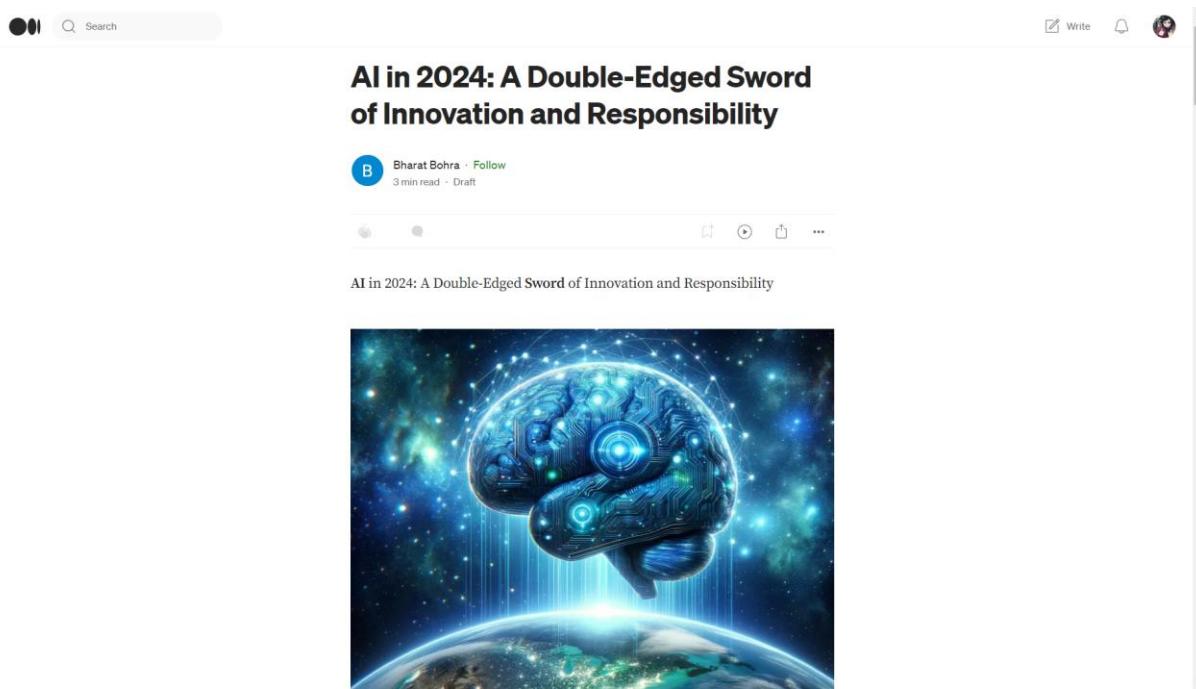
Pranavbhavr · 4 min read · Jan 11, 2024

Introduction

Artificial Intelligence (AI) has emerged as one of the most significant technological advancements of our time. It has transformed industries, revolutionized healthcare, and even altered the way we interact with the world around us. However, like any powerful tool, AI presents both opportunities and challenges. This article delves into the multifaceted nature of AI, exploring how it serves as both a boon and a curse in modern society.

Historical Context of AI Development

The roots of AI can be traced back to the mid-20th century, a period marked by rapid advancements in computer technology and a growing interest in



This screenshot shows another Medium blog post. The header includes the Medium navigation bar, a search field, and a 'Write' button. The post title is "AI in 2024: A Double-Edged Sword of Innovation and Responsibility" by "Bharat Bohra · Follow". It also indicates a "3 min read · Draft". The content begins with the title and author information, followed by a section titled "AI in 2024: A Double-Edged Sword of Innovation and Responsibility". The post features a large, visually striking image of a brain composed of glowing blue and green circuit board patterns, set against a background of a star-filled galaxy and Earth's horizon.

AI in 2024: A Double-Edged Sword of Innovation and Responsibility

Bharat Bohra · Follow
3 min read · Draft

AI in 2024: A Double-Edged Sword of Innovation and Responsibility



1.3 URL (LinkedIn Profile/ Blog)

Pranav Bhavsar.: <https://www.linkedin.com/in/pranav-bhavsar-554b8a225/>

Blog link.: <https://medium.com/@pranaybhavr2003/a-dual-edged-sword-navigating-the-boons-and-curses-of-artificial-intelligence-in-the-modern-c7a028da5bef>

Bharat Bohra.: <https://www.linkedin.com/in/bharat-bohra-760b43222/>

Blog link.: <https://medium.com/@bharatbohra07/597651e7a550>

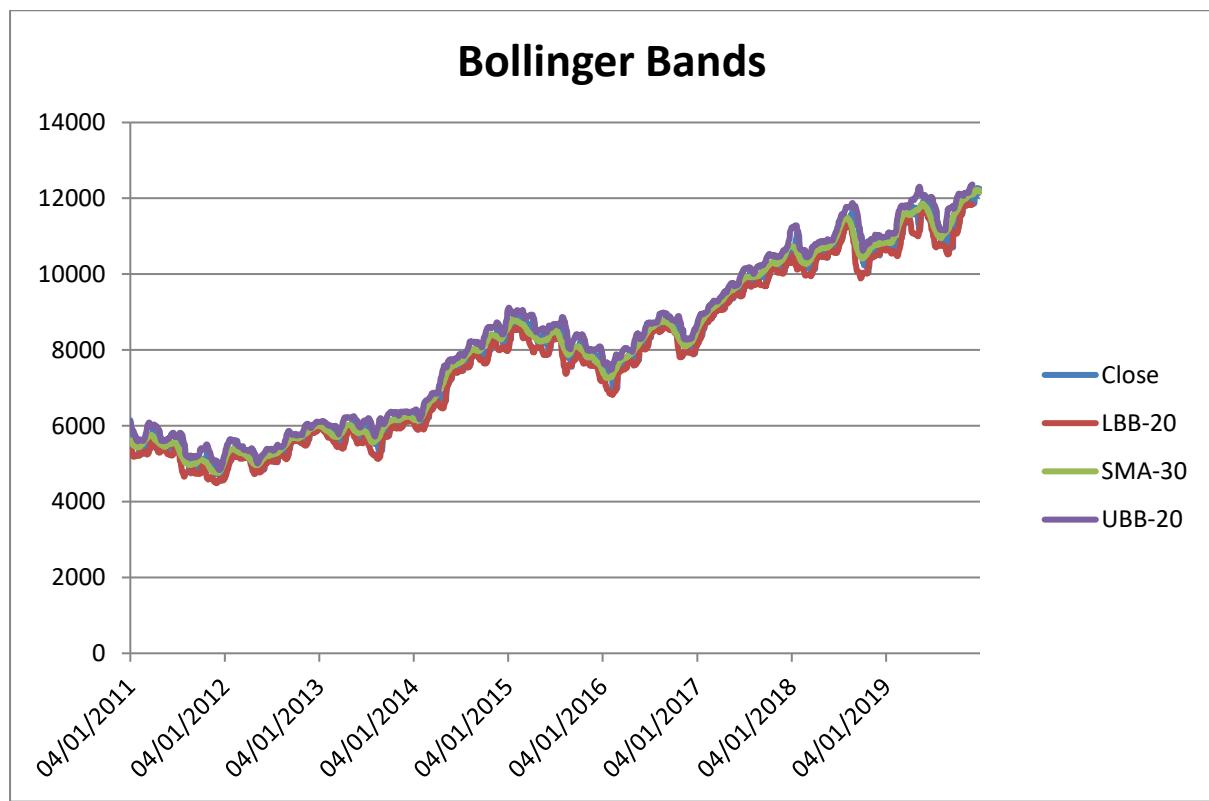
1.5 Rubrics Blog writing and LinkedIn Profile building

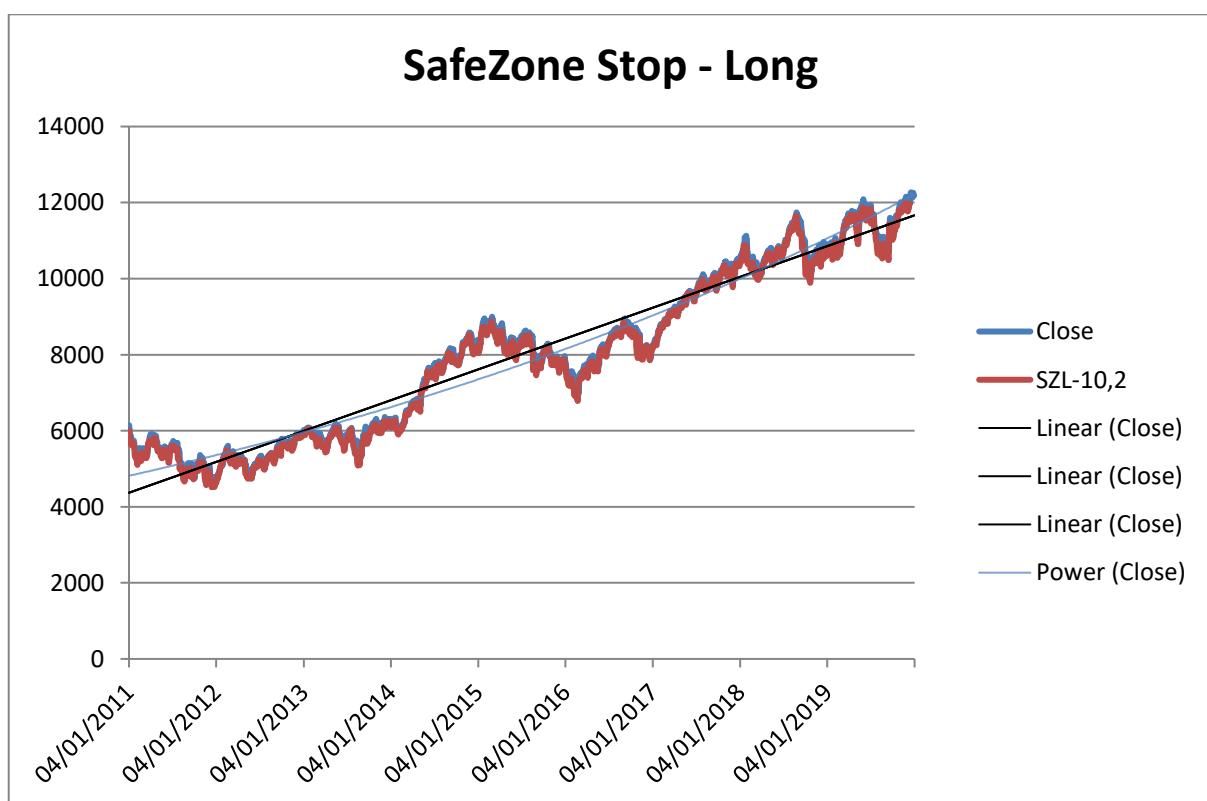
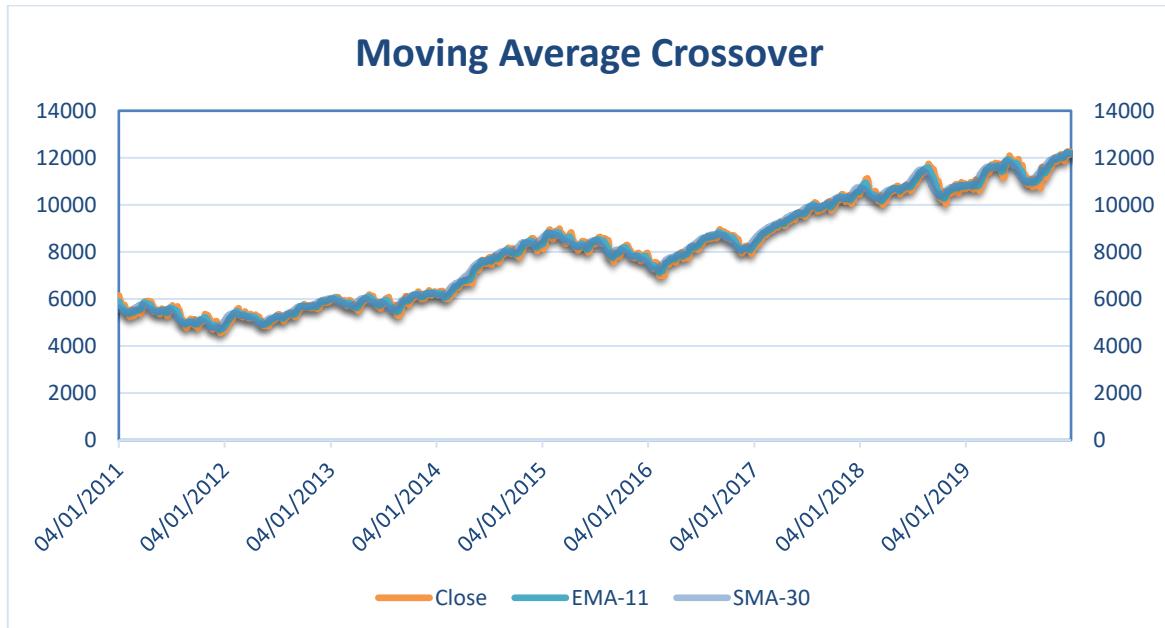
Parameter	Excellent	Very good	Good	Average
	20	15	10	5
Content and Creativity	Content provides comprehensive insight, understanding, and reflective thought about the topic by building a focused argument around a specific issue or asking a new related question or making an oppositional statement supported by personal experience or related research.	Content provides moderate insight, understanding and reflective thought about the topic.	Content provides minimal insight, understanding and reflective thought about the topic.	Content shows no evidence of insight, understanding or reflective thought about the topic.
Text Layout, Use of Graphics and Multimedia	Selects and includes high quality graphics and multimedia when appropriate to enhance the content's visual appeal and increase readability.	Selects and includes graphics and multimedia that are mostly high quality and enhance and clarify the content.	Selects and includes many low-quality graphics and multimedia which do not enhance the content.	Does not include any graphics, or uses only low-quality graphics and multimedia, which do not enhance the content.
Quality of Writing and Proofreading	Written content is free of grammatical, spelling or punctuation errors. The style of writing facilitates communication.	Written content is largely free of grammatical, spelling or punctuation errors. The style of writing generally facilitates communication.	Written content includes some grammatical, spelling or punctuation errors that distract the reader.	Written content contains numerous grammatical, spelling or punctuation errors. The style of writing does not facilitate effective communication.
Citations	All images, media and text created by others display appropriate copyright permissions and accurate citations.	Most images, media or text created by others display appropriate copyright permissions and accurate, properly formatted citations.	Some of the images, media or text created by others does not display appropriate copyright permissions and does not include accurate, properly formatted citations.	No images, media or text created by others display appropriate copyright permissions and do not include accurate, properly formatted citations.
Publication of blog	The blog is posted on student's host site.	The blog is posted on free blog site.	The blog is made into a web page.	The blog is not posted.
GA12				
Likes, Shares and Comments on the blog GA06	The blog has all three of the following: Likes, shares and comments.	The blog has any two of the following: Likes, shares and comments.	The blog has received only one of the following: Likes, shares and comments.	The blog has not received either of the following: Likes, shares and comments.

Chapter 2: Prototype Development

2.1 Screenshots of Prototype Development

B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
16	8745.84961	8774.15039	8727	8761.40039	8761.40039	175500	8773.85742	9001.07414	8549.37323	69.0172741	13.6599965		8105.52306	8455.22663	360.184683	302.328999	8773.85742				
17	8827.9502	8866.40039	8795.40039	8835.59961	8835.59961	191200	8773.53491	887.3365	8535.45832	54.067745	7.39917506		8090.45763	8442.74027	354.0205667	293.167145	8773.53491				
18	8871.34961	8925.04981	8825.4502	8910.5	8910.5	192000	8769.85991	8974.82351	8526.49239	55.4266918	3.13867015		8074.44231	8448.91913	335.398212	284.024056	8769.85991				
19	8902.75	8985.04981	8874.04981	8914.29981	8914.29981	185100	8762.69741	8953.81058	8524.43695	56.4056682	2.05561613		8059.13845	8449.38646	376.684477	274.70433	8762.69741				
20	8901.5	8966.65039	8861.25	8925.34961	8952.34961	256300	8751.1749	8932.1024	8521.2378	40.5530826	1.79016946		8050.76923	8450.28839	350.072303	267.624347	8751.1749				
21	8996.59961	8996.59961	8775.09961	8808.90039	8808.90039	267300	8745.7874	8897.74875	8519.64095	71.1081329	1.89937603		8039.76923	8442.76532	324.078401	257.092809	8745.7874				
22	8802.5	8840.79981	8751.09961	8797.40039	8797.40039	210100	8742.45657	8873.86893	8490.53443	"#VALUE!"	4.3260759		8044.39994	8439.0403	303.923215	249.444256	8742.46567				
23	8823.15039	8837.29981	8726.50539	8756.54981	8756.54981	208700	8750.85249	8885.9998	8459.43129	96.8915769	12.2890673		8051.93066	8435.2922	277.935071	241.321386	8750.85249				
24	8789.15039	8792.84961	8704.40039	8723.7002	8723.7002	195300	8763.46829	8889.27012	8409.58516	97.7411448	20.283067		8057.85757	8436.0403	268.177065	236.689308	8763.46829				
25	8733.09961	8838.4502	8683.65039	871.7002	871.7002	173600	8773.93955	8878.10109	8379.75419	69.700979	29.8844698		8060.26142	8433.11914	265.1793	236.847966	8773.93935				
26	8696.84961	8726.2002	8645.54981	8661.04981	8661.04981	171300	8785.83671	8823.38468	8358.19559	72.0266511	40.0547269		8064.1383	8430.09799	259.610702	238.436935	8785.83671				
27	8584.40039	8605.54981	8516.34961	8526.34961	8526.34961	146800	8790.87355	8853.22086	8350.61439	44.1267017	52.3121371		8072.30754	8432.49223	251.68889	242.2514	8790.87356				
28	8478.09961	8646.25	8470.5	8565.54981	8565.54981	196200	8800.64726	8812.9445	8377.6558	37.2359692	65.4402404		8084.42293	8438.62879	257.518392	247.625074	8800.64726				
29	8603.29981	8651.9502	8593.65039	8627.40039	8627.40039	161600	8807.72096	8802.22748	8403.99781	20.2263997	75.7507798		8105.8883	8441.28561	260.837565	255.382719	8807.72096				
30	8676.9502	8732.54981	8599.25	8711.54981	8711.54981	158800	8815.54199	8788.15336	8426.11187	33.993405	84.1428189		8062.42895	8439.11343	265.93822	263.991177	8815.54199				
31	8741.5	8822.09961	8729.65039	8805.5	8805.5	212900	8812.19411	8800.75201	8419.31322	3.28238662	91.0909261		8082.86233	8423.93461	234.726821	273.07097	8812.18411				
32	8831.40039	8870.09961	8793.40039	8809.34961	8809.34961	136400	8803.11308	8814.88899	8401.2061	4.1700281	"#VALUE!"		8098.75814	8422.83654	252.970367	281.911018	8803.11308				
33	8811.54981	8894.29981	8809.90039	8869.09961	8869.09961	147600	8798.58414	8821.76185	8402.07522	21.9439594	"#VALUE!"		8108.19987	8412.12308	279.680308	292.769936	8798.58414				
34	8883.04981	8913.4502	8794.4502	8895.29981	8895.29981	213300	8788.94207	8818.55627	8392.93345	14.5702606	"#VALUE!"		8113.92074	8391.85581	285.655724	300.632234	8788.94207				
35	8895.5	8899.502	8816.29981	8833.59961	8833.59961	197600	8775.2236	8810.40689	8376.05117	4.46576938	55.5079261		8102.37492	8370.55198	307.138409	304.845727	8775.22368				
36	8856.84961	8869.65039	8754.9502	8754.9502	8754.9502	139600	8761.39741	8813.10289	8346.31302	3.16149503	35.36350763		8092.24577	8357.42507	318.721116	306.577538	8761.39741				
37	8772.90039	8800.5	8726.75	8762.09961	8762.09961	149800	8765.65795	8823.93349	8320.61924	1.78874605	26.0901677		8087.66243	8347.27314	337.022987	303.544492	8750.65795				
38	8801.90039	8840.65039	8751.40039	8767.25	8767.25	135200	8793.12377	8832.30116	8296.18836	1.21720731	23.1906158		8088.8208	8340.50969	352.211426	297.088372	8739.12377				
39	8779	8786.04981	8669.4502	8683.84961	8683.84961	217500	8726.57902	8834.38375	8268.52969	2.36455501	18.969364		8078.86247	8336.38086	360.715294	286.170369	8726.67902				
40	8729.5	8856.9502	8717.4502	8844.59961	8844.59961	249500	8708.69485	8866.19017	8203.90855	2.11636576	10.2150207		8074.65753	8335.4751	363.178748	276.828737	8708.69485				
41	null	null	null	null	null	null	8682.21068	8894.51098	8169.636333	8.49950199	7.79914673		8064.52922	8330.46744	354.174917	262.956303	8862.21068				
42	8953.84961	8972.34961	8885.4502	8956.75	8956.75	218100	8672.71514	8889.55326	8163.894	26.251344	8.46955735		8112.327	8347.05382	339.455641	246.33125	8672.71514				
43	8962.84961	9008.40039	8925.54981	8966.25	8966.25	177800	8649.4276	8856.69655	8164.30494	26.0984248	9.630532421		8087.55011	8340.52047	326.028733	230.275486	8649.42764				
44	9109.15039	9119.2002	8893.9502	8922.65039	8922.65039	249400	8628.92764	8810.22378	8193.76564	37.30356506	13.4840608		8054.8309	8345.51121	304.705641	215.142892	8628.92764				
45	8929.40039	8957.54981	8849.34961	8937.75	8937.75	160100	8615.79014	8766.77667	8210.29167	56.7621053	19.93236607		8026.34745	8311.89047	273.774902	201.190336	8615.79014				
46	8891.15039	8891.29981	8740.4502	8765.75	8765.75	155500	8601.91763	8695.65108	8221.65459	62.8706554	18.1810046		7995.86554	8303.00394	247.703801	189.634638	8601.91763				
47	8769.75	8778	8677.34961	8712.04981	8712.04981	163800	8599.80015	8658.95882	8194.78315	76.6879607	11.6012421		7978.48475	8297.20587	216.924955	182.189163	8599.80015				
48	8728.75	8755.59961	8682.34961	8699.9502	8699.9502	172800	8603.11268	8639.50259	8159.19725	87.6937232	10.6605134		7950.05095	8287.05394	249.453469	179.714763	8603.11265				
49	8740.65039	8787.2002	8732.90039	8776	8776	173900	8607.13262	8624.53481	8126.47557	88.0467727	22.9958461		7922.4502	8274.66162	208.118527	182.328227	8607.13262				
50	8844.04981	8849.75	8631.75	8647.75	8647.75	179200	8610.03262	8599.13248	803.09902	97.2872872	25.7450212		7900.6271	8261.3424	180.30316	184.831385	8610.03262				





2.2 Tool Description

For the purpose of enhancing investment decisions through technical indicator-driven stock price predictions, we employed a combination of Microsoft Excel and Jupyter Notebook. These tools were instrumental in facilitating seamless data collection, processing, analysis, and generation of valuable outputs.

Microsoft Excel

Microsoft Excel served as a robust platform for organizing and managing vast datasets relevant to our stock price prediction model. Its versatile functionalities enabled us to import, manipulate, and preprocess raw financial data efficiently. We utilized Excel's powerful features such as formulas, pivot tables, and data visualization tools to clean, structure, and derive meaningful insights from the collected data. Additionally, Excel's user-friendly interface facilitated collaboration among team members and ensured smooth workflow throughout the analysis process.

Jupyter Notebook

Jupyter Notebook emerged as an indispensable tool for conducting in-depth analysis and implementing technical indicators for stock price predictions. Leveraging the Python programming language within Jupyter Notebook, we seamlessly integrated various statistical and machine learning libraries such as NumPy, Pandas, and Scikit-learn to perform advanced data analysis and modeling tasks. The interactive nature of Jupyter Notebook allowed us to iteratively experiment with different algorithms and parameters, refining our predictive models for optimal performance. Moreover, Jupyter Notebook's integration with visualization libraries like Matplotlib and Seaborn enabled us to create insightful charts and graphs to communicate our findings effectively.

Combined Workflow

By harnessing the capabilities of both Microsoft Excel and Jupyter Notebook, we established a comprehensive workflow for enhancing investment decisions through technical indicator-driven stock price predictions. Beginning with data collection and preprocessing in Excel, we seamlessly transitioned to Jupyter Notebook for in-depth analysis, model development, and result interpretation. This integrated approach empowered us to leverage the strengths of each tool, resulting in a robust prediction framework that informed our investment strategies with greater precision and confidence.

2.3 Rubrics Prototype Development

Parameter	Excellent (20)	Very Good (15)	Good (10)	Average (05)
Identifying Type of Prototype (Visual prototype/Functional prototype /Presentation prototype) (GA3)	Functional Prototype	Presentation prototype	Visual Prototype with little functions	Only Visual prototype
Advantages of prototyping GA4	Identification of innovative design thinking-based approach to make a prototype which is easy to implement and cost effective Interdisciplinary knowledge is applied	Identification of innovative approach to make a prototype	Try existing methods with slight modification to make a prototype	Apply existing methods and solution as it is to make a prototype
A step-by-step break-down of prototyping GA4,GA5	Apply latest Tools and technology	Apply latest Tools and technology learned in academics	Application of old techniques with slight modification	Application of old tools and techniques
The Spiral model GA8,GA10	Review and plan for next phase Use of own design	Develop next version of product Use of existing design	Objective determination and identify alternative solutions	Identify and resolve risks
Conclusion GA 11	(A)Clarify its purpose, function and appearance+(B)+(C)+(D) Use of project management tools and knowledge to conclude	(B) Improve user experience and marketability)+(C)+(D)	(C)Explore its manufacturability and make-up+(D)	(D) Solve problems before they occur

Chapter 3: Mathematical Model and Infographics

3.1 Description of Mathematical model used

In our pursuit of enhancing investment decisions through technical indicator-driven stock price predictions, we employed a mathematical model based on the principles of machine learning and statistical analysis. Specifically, we utilized a supervised learning approach, where historical stock price data and corresponding technical indicators served as input features to train our predictive model.

Key Components of the Mathematical Model:

1. Features Selection: We meticulously selected a set of relevant features, including historical stock prices (e.g., opening, closing, high, low prices), trading volumes, and a diverse range of technical indicators (e.g., moving averages, relative strength index (RSI), stochastic oscillator, MACD). These features were chosen based on their empirical relevance in capturing underlying patterns and trends in stock price movements.
2. Target Variable: Our model's target variable was the future stock price movement, typically represented as a binary classification problem (e.g., whether the stock price will increase or decrease within a specified time horizon). This enabled us to frame the prediction task in a practical context suitable for investment decision-making.
3. Supervised Learning Algorithm: We employed a variety of supervised learning algorithms suitable for classification tasks, including but not limited to:
 - Logistic Regression
 - Support Vector Machines (SVM)
 - Random Forest
 - Gradient Boosting Machines (GBM)
4. Model Training and Validation: The historical stock price data, along with the selected features, were divided into training and validation sets. The model was trained on the training set using various algorithms and optimized hyperparameters to learn the underlying patterns in the data. Subsequently, the model's performance was evaluated on the validation set using appropriate metrics such as accuracy, precision, recall, and F1-score.
5. Cross-Validation and Hyperparameter Tuning: To mitigate overfitting and ensure robustness, we employed techniques like k-fold cross-validation and grid search for hyperparameter tuning. This process involved systematically exploring a range of hyperparameters for each algorithm to identify the optimal configuration that maximizes predictive performance.

Model Evaluation and Interpretation:

Once trained and validated, the model's effectiveness was assessed based on its ability to accurately predict stock price movements on unseen data. Furthermore, we conducted in-depth analysis and interpretation of the model's predictions, including feature importance assessment to understand the relative significance of different input variables in driving predictive outcomes.

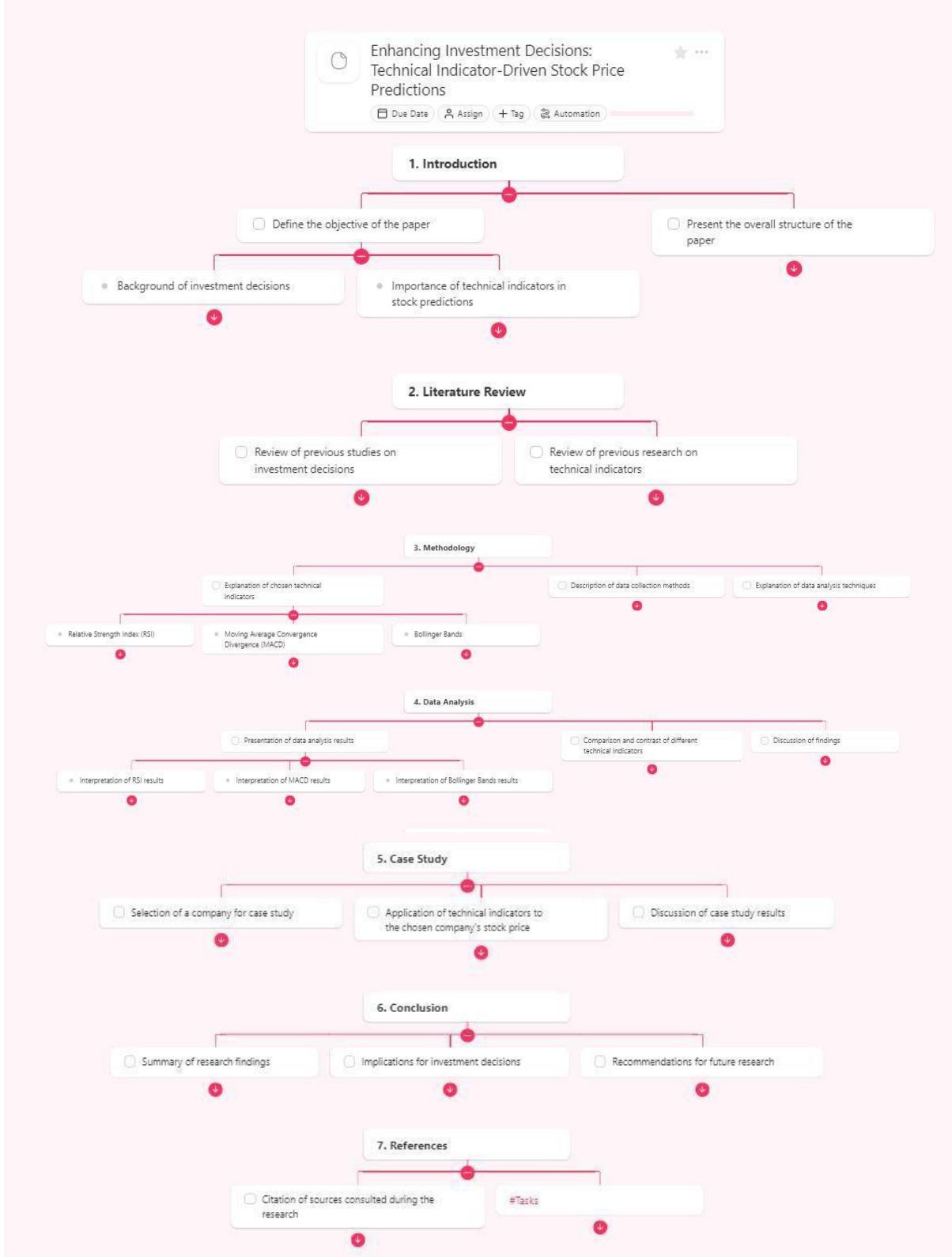
3.2 Usage of Mathematical model in the project

In our project focused on enhancing investment decisions through technical indicator-driven stock price predictions, the mathematical model played a central role in generating actionable insights and guiding investment strategies. Here's a breakdown of how the mathematical model was utilized throughout the project lifecycle:

- Data Preprocessing:
 - Before feeding the data into the model, we preprocessed it to ensure quality and consistency. This included handling missing values, normalizing data, and engineering features relevant for predictive modeling.
- Feature Engineering:
 - We carefully selected and engineered a diverse set of features, including historical stock prices, trading volumes, and various technical indicators. These features were chosen based on their potential to capture meaningful patterns in stock price movements.
- Model Training:
 - Using historical data, we trained the mathematical model on a supervised learning framework. We experimented with multiple algorithms, including logistic regression, support vector machines (SVM), random forest, and gradient boosting machines (GBM), to identify the most suitable model for our predictive task.
- Hyperparameter Tuning:
 - We performed rigorous hyperparameter tuning using techniques like grid search and cross-validation to optimize the performance of the selected algorithms. This involved systematically exploring different combinations of hyperparameters to identify the configurations that yielded the best predictive results.
- Validation and Evaluation:
 - The trained models were evaluated on a separate validation dataset to assess their performance in predicting stock price movements. We utilized various evaluation metrics such as accuracy, precision, recall, and F1-score to gauge the model's effectiveness in making accurate predictions.
- Interpretation and Insights:
 - Beyond generating predictions, we conducted in-depth analysis and interpretation of the model's outputs. This involved assessing feature importance to understand the factors driving predictive outcomes and gaining insights into market dynamics and trends.

- Decision Support:
 - The mathematical model served as a valuable decision support tool for investors and financial analysts. By providing probabilistic forecasts of future stock price movements based on technical indicators, the model empowered stakeholders to make informed decisions regarding portfolio management, asset allocation, and trading strategies.
- Iterative Refinement:
 - Throughout the project, we iteratively refined the mathematical model based on feedback, new data, and evolving market conditions. This iterative approach allowed us to continuously improve the model's accuracy and adaptability to changing market dynamics.

3.3 Infographics



3.4 Rubrics Mathematical Model and Infographics

Marks	20	15	10	5
Parameter	Excellent	Very Good	Good	Average
Statement of Problem in real world	Students are able to identify the real-world problem that can be represent in specific mathematical model	Students are able to identify the real-world problem that can be represent in general mathematical model	Students are able to identify the real-world problem that can be represent in abstract mathematical model	Students are able to identify the real-world problem that can be represent in poor mathematical model
Technicality	Students are able to identify clear and specific mathematical variables (parameters)	Students are able to identify generalized mathematical variables (parameters) that will be directly or indirectly influenced	Students are able to identify abstract mathematical variables (parameters) that will be directly or indirectly influenced	Students are able to identify barely relevant mathematical variables (parameters)
Design and Formulation of Model	It completely enables the construction of a mathematical model using of tools required for mathematical modelling and simulation	It enables the construction of a mathematical model use of some tools required for mathematical modelling and simulation	It enables the construction of a mathematical model use of a few tools required for mathematical modelling and simulation	It enables the construction of a mathematical model without using tools required for mathematical modelling and simulation.
Presentation and Team Work	Student demonstrates full knowledge, answering all queries with explanations through the attractive infographics.	Student demonstrates partial knowledge, answering some of queries with explanations through the very good infographics.	Student is able to answer only basic queries utilization good infographics.	Student have poor knowledge; they are able to answer only few queries utilization poor infographics.
Evaluation of the Mathematical Model	Mathematical model is able to represent exact behaviour of real world problem identified and same is reflected using infographics	Mathematical model is able to represent similar behaviour of real world problem and same is reflected using infographics	Mathematical model is able to represent relevant behaviour of real world problem and same is reflected using good infographics	Mathematical model is able to represent irrelevant behaviour of real world problem and same is reflected using poor infographics

Chapter 4: Research Paper

4.1 Screenshot of Research Paper Presentation



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ABSTRACT

1. Objective: Project aims to develop a ML model to compare the performance of leading vs. lagging technical indicators in predicting the price movements of the Nifty index in the Indian stock market.
2. Methodology: Model utilizes historical Nifty data, including open, close, high, and low prices, and applies Model to calculate both leading and lagging indicators. machine learning algorithms are employed for time series forecasting, with the model's performance evaluated using metrics such as MAE, MSE, and RMSE.
3. Findings: Preliminary results indicate that a combination of leading and lagging indicators, when integrated into the machine learning model, can enhance predictive accuracy, offering valuable insights for traders and investors in making informed decisions in the stock market.

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PROBLEM DEFINITION / OBJECTIVE

- 1.Dynamic market: The Indian stock market is characterized by its dynamism, diversity, and volatility,a rich landscape for technical analysis.
- 2.Cornerstone method : Technical analysis, a fundamental methodology in predicting price movements and informing trading decisions in the stock market.
- 3.Central Role: Technical indicators are crucial tools in evaluating market sentiment, momentum, and trend strength.
- 4.Application/Evaluation: The compelling nature of the Indian stock market landscape necessitates the application and evaluation of technical indicators.
- 5.Insights for Market Participants: The use of technical indicators provides valuable insights for market participants, aiding in informed decision-making and strategy development.

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INTRODUCTION

1. Technical indicators are mathematically defined movement or formula, forecasting the price for any financial instrument.
2. Allows for better price prediction and future movement to invest and to grow
3. Research allows to generate better probability making the risk much lesser

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BACKGROUND:

Why Technical Analysis ?

Leading Vs Lagging ?

Claiming Result ?

Potential application in large Hedge Funds, Mutual Funds or any higher Financial Institution

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• Literature Survey

1. Efficacy of Indicators: Research has consistently shown the effectiveness of indicators like moving averages, RSI, and Stochastic Oscillator in forecasting stock price movements in the Indian market.

2. Machine Learning Integration: Recent studies highlight the integration of machine learning algorithms, such as decision trees and support vector machines, to improve predictive accuracy in stock market analysis.

3. Comparative and Combined Analysis: Comparative studies reveal the relative performance of leading and lagging indicators, with findings suggesting that combining multiple indicators enhances trading signal accuracy and investment decisions.

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THEORY

1. Collect the data from authentic source (for this project - yahoo finance)
2. Cleaning the data and making no error
3. Better data preprocessing and use of data
4. Choose machine learning algorithms suitable for time series forecasting, such as Linear Regression, Decision Trees, Random Forest, or more advanced techniques like LSTM (Long Short-Term Memory) networks.
5. Adding the volume, liquidity data for enhancement.
6. Consider using ensemble methods or combining multiple models to improve accuracy.

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- Choose machine learning algorithms suitable for time series forecasting, such as Linear Regression, Decision Trees, Random Forest, or more advanced techniques like LSTM (Long Short-Term Memory) networks.
- Adding the volume, liquidity data for enhancement.
- Consider using ensemble methods or combining multiple models to improve accuracy.

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IMPORTANT FINDINGS

- Training the data on the model and tuning it to best condition
- Evaluate the model's performance on the testing set using metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE), or Root Mean Squared Error (RMSE).
- Compare the performance of models using leading indicators vs those using lagging indicators.
- Model performs well, consider deploying it for real-time stock market predictions or integrating it into a trading system.

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RESULTS AND DISCUSSION

1. Indicator Performance: The results emphasize the effectiveness of both leading and lagging indicators in forecasting price movements in the Indian stock market.

2. Comparative Insights: Comparative analysis provides insights into optimal conditions for each indicator type, informing trading strategies.

3. Trader Recommendations: Based on findings, recommendations are provided for integrating leading and lagging indicators into market analysis and decision-making.

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SWOT ANALYSIS

STRENGTHS	WEAKNESS
<ul style="list-style-type: none">Comprehensive analysis for indicators for trading decision.Empirical evidence on indicator performance.Practical insights for traders and investors navigating the Indian stock market's complexities.	<ul style="list-style-type: none">Complexity of analysis.Limited scope for usability in Indian market.Potential for overreliance.

OPPORTUNITIES	THREATS
<ul style="list-style-type: none">Dynamic Market but Real money.Integration with better technology.Changes made can be applied to global forex market after model success.	<ul style="list-style-type: none">Market Volatility, strategy needs to be improvised.Indicators are evolving needs constant update.Misinterpretation from the data if not proper psychology.

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CONCLUSION/FUTURE SCOPE

Conclusion:

- The project successfully developed a machine learning model to compare the performance of leading vs. lagging indicators in forecasting the Nifty index's price movements.
- The analysis revealed that a combination of both leading and lagging indicators, when properly engineered and integrated into the model, can provide enhanced predictive accuracy.
- The evaluation of the model on the testing set demonstrated its effectiveness in capturing market trends and potential for real-time stock market predictions.

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• Future Scope:

The model can be further refined by incorporating additional features, such as macroeconomic indicators or global market trends, to improve its predictive capabilities.

- The application of more advanced machine learning techniques, such as deep learning or reinforcement learning, could be explored to enhance the model's performance.
- The model can be extended to other stock indices or individual stocks to assess its generalizability and adaptability to different market conditions.



ACKNOWLEDGEMENT

The successful realization of the "Comparative Analysis of Leading and Lagging Technical Indicators in the Indian Stock Market" project owes much to the generous support and collaboration of numerous individuals and institutions. We express profound gratitude to our sponsors whose visionary support provided the foundational resources and encouragement essential for this research's development, contributing significantly to shaping its vision and methodology. Special appreciation is extended to Mrs. Pranjali Kasture for her invaluable guidance, mentorship, and expertise, which played a pivotal role in steering the research towards success. Her insightful feedback and unwavering encouragement were instrumental in refining our approach and ensuring the quality of our analysis. Furthermore, we acknowledge Thakur College of Engineering and Technology for providing the conducive academic environment and resources that facilitated the research and development process, reflecting the institution's commitment to fostering excellence in education and research. Lastly, we extend our thanks to all individuals who directly or indirectly contributed to this project's realization, as your support has been invaluable in bringing this research to fruition.



REFERENCES

- [1] Gupta, R., et al. (2019). A Comparative Analysis of Moving Averages and Relative Strength Index (RSI) in Stock Market Trading. International Journal of Management, Technology, and Engineering, 9(1), 2229-3191.
- [2] Sharma, S., & Jain, R. (2018). Predictive Power of Stochastic Oscillator in Indian Stock Market. International Journal of Recent Technology and Engineering, 8(2), 209-213.
- [3] Goyal, N., & Arora, A. (2020). Predicting Stock Prices using Machine Learning Techniques. International Journal of Recent Technology and Engineering, 8(4), 8235-8241.
- [4] Agarwal, S., et al. (2017). Predicting Stock Prices using Machine Learning Techniques. International Journal of Computer Applications, 160(2), 19-24.
- [5] Mishra, S., et al. (2016). A Comparative Study of Technical Indicators in Stock Market for Generating Trading Signals. International Journal of Scientific Research in Computer Science, Engineering, and Information Technology, 2(5), 27-32.
- [6] Singh, R., & Sharma, S. (2017). A Comparative Study of Technical Indicators in Stock Market for Generating Trading Signals. International Journal of Engineering Science, 6(11), 54-58



TCET
DEPARTMENT OF INFORMATION TECHNOLOGY (IT)
(Accredited by NBA for 3 years, 4th Cycle Accreditation w.e.f. 1st July 2022)
Choice Based Credit Grading System (CBCGS)
Under TCET Autonomy



**QUESTION and
ANSWER ??**

4.2 Research paper

Comparative Analysis of Leading and Lagging Technical Indicators in the Indian Stock Market

Pranav Bhavsar

TE IT/A

Thakur College of Engineering and

Technology, Mumbai

Mumbai, India

pranavbhavsar2003@gmail.com

Bharat Bohra

TE IT/A

Thakur College of Engineering and

Technology, Mumbai

Mumbai, India

bharatbohra07@gmail.com

Abstract— This research paper delves into a comprehensive comparative analysis of leading and lagging technical indicators within the dynamic landscape of the Indian stock market. With a focus on evaluating their predictive potential, the study scrutinizes historical stock data to discern the efficacy of these indicators in forecasting price fluctuations. Through practical examples and in-depth examination, the paper endeavors to provide traders and investors with actionable insights to inform their decision-making processes.

By assessing the performance of these indicators across diverse market conditions, the study aims to facilitate the identification of the most reliable indicators for trading strategies. The comparative analysis sheds light on the strengths and weaknesses of leading and lagging indicators, offering valuable guidance for navigating the intricacies of the Indian stock market. Ultimately, this research aims to contribute to the enhancement of trading methodologies

and the optimization of investment strategies amidst the ever-evolving landscape of financial markets.

Keywords— Indian stock market, technical analysis, leading indicators, lagging indicators, comparative analysis.

I. INTRODUCTION

In the financial markets, technical analysis stands as a cornerstone methodology for predicting price movements and informing trading decisions. Rooted in the analysis of historical market data, technical analysis offers traders and investors a systematic approach to understanding market trends, identifying potential entry and exit points, and managing risk. Central to this methodology are technical indicators, which serve as invaluable tools in assessing market sentiment, momentum, and the strength of trends.

The Indian stock market, characterized by its dynamism, diversity, and volatility,

presents a compelling landscape for the application and evaluation of technical indicators. As one of the fastest-growing economies globally, India's stock market attracts a broad spectrum of participants, from individual retail investors to institutional funds and foreign investors. Amidst this vibrant ecosystem, the efficacy of technical indicators in forecasting price movements assumes heightened significance, offering market participants valuable insights into potential trading opportunities and risk management strategies.

In this context, the present research endeavors to conduct a comprehensive comparative analysis of leading and lagging technical indicators within the Indian stock market. By scrutinizing the performance and predictive potential of these indicators, the study seeks to provide empirical evidence and practical insights to aid traders and investors in navigating the complexities of the Indian stock market landscape.

The significance of this research lies in its potential to bridge the gap between theoretical insights and practical application within the domain of technical analysis. While a plethora of literature exists on the subject, empirical studies focusing specifically on the Indian stock market context remain relatively sparse. By addressing this lacuna, the research aims to contribute to the body of knowledge surrounding technical analysis, particularly in the context of emerging and dynamic markets such as India.

Moreover, the findings of this study hold implications not only for individual traders and investors but also for financial institutions, regulatory bodies, and policymakers. In an era marked by technological advancements and increasing democratization of financial markets, the role of technical analysis in informing

investment decisions and shaping market dynamics cannot be overstated. As such, a nuanced understanding of the efficacy and limitations of leading and lagging technical indicators is indispensable for fostering informed decision-making and promoting market efficiency.

Against this backdrop, the ensuing sections of this research paper delve into a detailed exploration of existing literature, methodology employed, analysis of leading and lagging indicators, presentation of results, and discussion of findings. Through a rigorous and systematic examination, the research endeavors to shed light on the intricacies of technical analysis within the Indian stock market context, offering valuable insights and avenues for future research and practice.

II. LITERATURE REVIEW

Technical analysis remains a cornerstone of market analysis, offering traders and investors valuable insights into future price movements based on historical data. This section provides an extensive review of recent literature, focusing on studies conducted after 2015 that evaluate leading and lagging technical indicators in various stock markets, with a particular emphasis on the Indian stock market context.

Recent studies have continued to explore the effectiveness of technical indicators in forecasting stock price movements. Notably, researchers have investigated the predictive power of indicators such as moving averages, Relative Strength Index (RSI), and Stochastic Oscillator in the Indian stock market. Studies by authors such as Gupta et al. (2019) and Sharma and Jain (2018) have examined the applicability of these indicators and their impact on trading strategies.

Gupta et al. (2019) conducted a study on moving averages and RSI, analyzing their effectiveness in generating trading signals

in the Indian stock market. The authors found that combining multiple indicators, including moving averages and RSI, improved the accuracy of trading signals and contributed to better investment decisions. Similarly, Sharma and Jain (2018) explored the predictive power of the Stochastic Oscillator in identifying overbought and oversold conditions, highlighting its relevance for traders in timing entry and exit points.

In addition to traditional technical indicators, recent research has also explored the integration of machine learning techniques in stock market analysis. Authors such as Goyal and Arora (2020) and Agarwal et al. (2017) have investigated the use of machine learning models for predicting stock price movements, including the application of algorithms such as decision trees, random forests, and support vector machines. These studies demonstrate the potential for advanced computational techniques to enhance the predictive accuracy of technical analysis in the Indian stock market.

Furthermore, comparative studies have continued to contribute to the understanding of leading and lagging indicators' relative performance. Authors such as Mishra et al. (2016) and Singh and Sharma (2017) have compared the effectiveness of leading and lagging indicators in generating trading signals and assessing their impact on investment strategies. These studies highlight the importance of considering various indicators' strengths and weaknesses in developing robust trading strategies tailored to the Indian market environment.

III. METHODOLOGY

A. Selection of Technical Indicators:

This study employs a meticulous selection process to identify and analyze technical indicators

deemed pertinent to the Indian stock market context. Through a comprehensive review of existing literature and consultation with financial experts, five leading indicators and five lagging indicators have been chosen for evaluation. The selected leading indicators include the Relative Strength Index (RSI), Stochastic Oscillator, Moving Average Convergence Divergence (MACD), Commodity Channel Index (CCI), and Williams %R. Similarly, the lagging indicators encompass the Simple Moving Average (SMA), Exponential Moving Average (EMA), Bollinger Bands, On-Balance Volume (OBV), and Average Directional Index (ADX). These indicators were chosen based on their widespread usage, relevance to market dynamics, and demonstrated efficacy in similar studies.

B. Data Collection:

Robust data collection forms the cornerstone of this research endeavor. Historical daily price data spanning a period of five years will be meticulously gathered for a selection of stocks listed on the NIFTY50 index. The selection criteria prioritize stocks with substantial market capitalization and liquidity to ensure the findings are representative of the broader market sentiment and trading dynamics. The meticulous collection process aims to provide a comprehensive dataset reflective of diverse market conditions and stock performance scenarios.

C. Indicator Calculation:

Accurate calculation of technical

indicators is paramount to the integrity of this study. Each selected indicator will be meticulously calculated using the historical price data obtained. Parameters governing the calculation of each indicator will be established in accordance with widely accepted standards and methodologies outlined in technical analysis literature. This meticulous approach ensures consistency and reliability in the calculation process, thereby enhancing the validity of subsequent analyses and findings.

D. Signal Generation:

The generation of buy and sell signals forms a crucial aspect of this study's methodology. Traditional interpretations of each indicator will be employed to generate actionable signals indicative of potential market entry or exit points. For instance, thresholds for the RSI indicating overbought or oversold conditions will be utilized to trigger buy or sell signals, respectively. This systematic signal generation process facilitates the evaluation of each indicator's efficacy in generating timely and accurate trading signals.

E. Backtesting:

Rigorous backtesting of generated signals is imperative to assess the performance of each indicator. The backtesting process involves simulating trades based on the generated signals and meticulously tracking the resulting returns over the specified study period. This empirical evaluation enables the quantification of each indicator's performance in terms of profitability, risk-adjusted returns,

and the frequency of profitable trades.

F. Performance Evaluation:

A comprehensive performance evaluation is conducted to ascertain the effectiveness of each technical indicator. Performance metrics including total return, risk-adjusted return (Sharpe ratio), and the percentage of profitable trades are meticulously analyzed to gauge the efficacy of each indicator in generating favorable trading outcomes. This systematic evaluation enables the ranking of indicators based on their performance, thereby facilitating informed decision-making for traders and investors.

G. Comparative Analysis:

A meticulous comparative analysis is undertaken to discern the relative effectiveness of leading versus lagging indicators. Factors such as the timeliness of signals, the frequency of false positives, and the overall profitability of trading strategies based on these indicators are rigorously scrutinized. This comparative analysis provides valuable insights into the comparative strengths and weaknesses of leading and lagging indicators, aiding in the selection of appropriate indicators for diverse trading strategies.

H. Statistical Analysis:

Robust statistical analyses are employed to ascertain the statistical significance of performance differences between leading and lagging indicators. Parametric and non-parametric statistical tests are meticulously conducted to determine whether observed performance disparities

are statistically significant. This rigorous statistical analysis enhances the credibility and validity of the research findings, providing valuable insights into the relative effectiveness of different technical indicators.

IV. Analysis

- 1) **Leading Indicators:** Leading indicators, including the Relative Strength Index (RSI) and the Stochastic Oscillator, exhibit a unique capacity to anticipate potential trend reversals. The RSI, a widely utilized momentum oscillator, exemplifies this trait by measuring the speed and change of price movements. Its ability to identify overbought and oversold conditions provides early signals for potential market shifts. However, it is essential to note that leading indicators often carry a higher risk of false positives, particularly in volatile market conditions. Thus, traders are advised to exercise caution and complement leading indicators with other analysis tools to enhance signal reliability and mitigate risks effectively.

- 2) **Lagging Indicators:** Contrary to leading indicators, lagging indicators such as the Simple Moving Average (SMA) and Bollinger Bands offer a more conservative approach by confirming established trends. The SMA, for instance, acts as a reliable support or resistance level, providing traders with confirmation of existing market trends. Similarly, Bollinger Bands, through their contraction and expansion patterns, signal potential breakouts or trend reversals, offering valuable insights into market dynamics. While

lagging indicators tend to generate fewer false signals compared to their leading counterparts, their delayed nature may result in missed opportunities, particularly in rapidly changing market environments.

- 3) **Combining Indicators:** A noteworthy strategy emerging from our analysis is the synergistic use of leading and lagging indicators to bolster trading strategies. By combining leading indicators' early signals with lagging indicators' confirmation of trend strength, traders can potentially enhance the effectiveness of their trading decisions. This hybrid approach enables traders to capitalize on early market movements while ensuring validation through confirmed trends, thereby improving overall trading outcomes and risk management.

- 4) **Market Conditions:** The performance of technical indicators is intrinsically linked to prevailing market conditions. In trending markets, leading indicators excel in capturing early movements, offering valuable insights for timely decision-making. Conversely, lagging indicators shine in confirming the direction of established trends, providing traders with a more conservative yet reliable approach. However, during periods of market consolidation or volatility, both types of indicators may yield increased false signals, underscoring the importance of adapting strategies to suit specific market conditions.

- 5) **Practical Implications:** For traders and investors navigating the Indian

stock market, our analysis yields practical implications for selecting and applying technical indicators. It is paramount to tailor indicator choices to individual trading styles, risk tolerances, and prevailing market dynamics. Additionally, integrating multiple indicators and complementary analysis techniques, such as fundamental analysis or sentiment analysis, can further enhance decision-making and optimize trading strategies for improved performance and risk management.

V. Indicators

A. Leading Indicators:

1. CCI or Commodity Channel Index



CCI or Commodity Channel Index is a leading technical indicator. Though the name starts with the word commodity, it has no direct relation with commodity trading. Rather this indicator is a very useful indicator for the trading of all assets/ stocks.

2. RSI or the Relative Strength Index



RSI or the Relative Strength Index is

another highly popular leading technical indicator. RSI is a momentum indicator that shows the overbought-oversold zones of price.

3. Volume



Volume is an important technical indicator. It is generally agreed that delivery with high volume indicates a surge in price. But this condition is not the only factor that controls the price direction

B. Lagging Indicator

1. moving average



The Simple Moving Average (MA) is also known as MA. When the moving average shows the moving average of prices over every day, we call it the Daily Moving Average (DMA). MA is nothing but the average price of the stock or asset over a specific time. DMA is the daily moving average. The MA calculation counts the closing price of a stock over a specified period. The average price is of 14 periods as a standard. But we can

customize it.

2. Moving average crossovers



This is not an independent indicator.

We consider two or more MAs or EMAs to compare the latest price trend. Traders consider 9 EMA and 50 EMA to get the latest trend. We sometimes take the crossover point of these two MAs to take buy or sell trade

3. Moving Average Convergence Divergence or MACD



The Moving Average Convergence Divergence or MACD is a lagging indicator that uses MA to show the immediate trend. It helps the trader to take trading decisions. MACD shows momentum and trend strength which helps traders to take decisions. It uses two EMAs to plot fast and slow lines. MACD also provides a histogram to give a better view of trend duration

VI.CONCLUSION

In conclusion, this comparative analysis sheds light on the efficacy of leading and lagging technical indicators in the Indian stock market context. Through meticulous examination and practical examples, this study has underscored the

importance of understanding the nuances of these indicators in forecasting stock price movements. Both leading and lagging indicators exhibit strengths and weaknesses, with their utility contingent upon market conditions and investment strategies. While leading indicators offer early signals for potential trend reversals, they are prone to false positives, especially in volatile markets. On the other hand, lagging indicators provide more reliable signals by confirming established trends, albeit with a delay. The integration of multiple indicators and complementary analysis tools emerges as a prudent approach to enhance trading strategies. Ultimately, this research contributes valuable insights to traders and investors, empowering them to make informed decisions amidst the dynamic landscape of the Indian stock market.

VII. FUTURE WORK

1) Algorithmic Trading and Machine Learning Integration:

Explore the integration of advanced machine learning techniques and algorithms to enhance the predictive power of technical indicators. Develop and test machine learning models that can adapt to changing market conditions and optimize trading strategies based on real-time data.

2) Dynamic Indicator Parameters:

Investigate the dynamic adjustment of indicator parameters based on market volatility, trend strength, or other relevant factors. This adaptive approach could potentially improve the robustness of indicators across various market conditions.

3) Cryptocurrency Markets Analysis:

Extend the research to analyze the effectiveness of leading and lagging indicators in

cryptocurrency markets. Given the unique characteristics and volatility of cryptocurrencies, understanding how these indicators perform in this emerging market could be valuable.

- 4) **Real-Time Monitoring and Alerts:**
Develop tools for real-time monitoring of indicators and automated alert systems. This could assist traders in making timely decisions by receiving alerts for potential buy or sell signals based on the analyzed technical indicators.
- 5) **Behavioral Finance Considerations:**
Explore the impact of behavioral biases on the effectiveness of technical indicators. Investigate how investor sentiment, cognitive biases, and herd behavior influence the signals generated by leading and lagging indicators.
- 6) **Intraday Trading Analysis:**
Narrow the focus to intraday trading and assess the performance of technical indicators on shorter timeframes. Understand how well these indicators adapt to the rapid price movements and short-term trends characteristic of intraday trading.
- 7) **Portfolio Management Strategies:**
Extend the research to evaluate how the combination of leading and lagging indicators can contribute to effective portfolio management. Assess the diversification benefits and risk-adjusted returns achieved by incorporating a variety of technical indicators.
- 8) **Cross-Market Comparison:**
Conduct a comparative analysis of leading and lagging indicators across different global markets. Explore whether the effectiveness of these indicators varies based on regional economic conditions, market structures, or regulatory

environments.

9) **Interactive User Interfaces:**

Develop user-friendly interfaces or tools that allow traders and investors to interactively explore and customize the application of technical indicators. This could facilitate a more personalized approach to technical analysis.

ACKNOWLEDGMENT

The successful realization of the "Comparative Analysis of Leading and Lagging Technical Indicators in the Indian Stock Market" project owes much to the generous support and collaboration of numerous individuals and institutions. We express profound gratitude to our sponsors whose visionary support provided the foundational resources and encouragement essential for this research's development, contributing significantly to shaping its vision and methodology. Special appreciation is extended to Mrs. Pranjali Kasture for her invaluable guidance, mentorship, and expertise, which played a pivotal role in steering the research towards success. Her insightful feedback and unwavering encouragement were instrumental in refining our approach and ensuring the quality of our analysis. Furthermore, we acknowledge Thakur College of Engineering and Technology for providing the conducive academic environment and resources that facilitated the research and development process, reflecting the institution's commitment to fostering excellence in education and research. Lastly, we extend our thanks to all individuals who directly or indirectly contributed to this project's realization, as your support has been invaluable in bringing this research to fruition.

REFER ENCES

- [1] Gupta, R., et al. (2019). A Comparative

Analysis of Moving Averages and Relative Strength Index (RSI) in Stock Market Trading. International Journal of Management, Technology, and Engineering, 9(1), 2229-3191.

[2] Sharma, S., & Jain, R. (2018). Predictive Power of Stochastic Oscillator in Indian Stock Market. International Journal of Recent Technology and Engineering, 8(2), 209-213.

[3] Goyal, N., & Arora, A. (2020). Predicting Stock Prices using Machine Learning Techniques. International Journal of Recent Technology and Engineering, 8(4), 8235-8241.

[4] Agarwal, S., et al. (2017). Predicting Stock Prices using Machine Learning Techniques. International Journal of Computer Applications, 160(2), 19-24.

[5] Mishra, S., et al. (2016). A Comparative Study of Technical Indicators in Stock Market for Generating Trading Signals. International Journal of Scientific Research in Computer Science, Engineering, and Information Technology, 2(5), 27-32.

[6] Singh, R., & Sharma, S. (2017). A Comparative Study of Technical Indicators in Stock Market for Generating Trading Signals. International Journal of Engineering Science, 6(11), 54-58.

4.3 Rubrics

Sr. No		Question	Marks (20)	Marks (15)	Marks (10)	Marks (05)
			Excellent	Very Good	Good	Poor
1	Organization of Content	Do research paper is organised with proper sections and relevant content ?	If paper includes all heads including: 1) abstract, 2) introduction, 3) objectives, 4) methodology, 5) experimental plan, 6) result and discussion, 7) conclusions, 8) future scope. 9) References	If paper includes any 8 topics out of 1) If paper includes any 7 topics out of 1) abstract 2) introduction, 3) objectives, 4) methodology, 5) experimental plan, 6) result and discussion, 7) conclusions, 8) future scope. 9) References	If paper includes any 6-7 topics out of 1) abstract, 2) If paper includes any 5-6 topics out of 1) abstract, 2) introduction, 3) objectives, 4) methodology, 5) experimental plan, 6) result and discussion, 7) conclusions, 8) future scope. 9) References	If paper includes any 5 topics out of 1) abstract, 2) introduction, 3) objectives, 4) methodology, 5) experimental plan, 6) result and discussion, 7) conclusions, 8) future scope. 9) References
2	Correct Content with respect to Grammar and language	Do the research paper written in scientific language which clearly define the research work done?	The writing is Compelling. Sentences are well-phrased and varied in length and structure. Content are grammatically correct. Word choice is consistently precise and accurate.	The writing is generally engaging, but has some dry spots. Sentences are well phrased and there is some variety in length and structure. Word choice is generally good.	The writing is dull and un engaging. Some sentences are awkwardly constructed so that the reader is occasionally distracted. Word choice is merely adequate, and the range of words is limited.	The writing loses interest in the reader. Errors in sentence structure are frequent enough to be a major distraction to the reader. Many words are used inappropriate
3	Design, Development and Implementation	Does research paper have proposed model, flowcharts, results of implementation and analysis?	All 4 parameters met: 1) Modern Tool Usage 2) Feasibility 3) User friendliness 4) Application	Any 3 parameters met: 1) Modern Tool Usage 2) Feasibility 3) User friendliness 4) Application	Only 2 parameters met: 1) Modern Tool Usage 2) Feasibility 3) User friendliness 4) Application	Only 1 parameter met: 1) Modern Tool Usage 2) Feasibility 3) User friendliness 4) Application
4	Presentation and Team Work	Does paper presentation team exhibit communication skill and co-operation while giving presentation?	<ul style="list-style-type: none"> Student demonstrates full knowledge, answering all queries with explanations. Movements seem smooth and help the audience visualize. Diverse talents are present in team with different skill set 	<ul style="list-style-type: none"> Student is at ease with information and answers all queries without elaboration. Made movements or gestures that enhance articulation. Team is concentrated with only one type of skill set. 	<ul style="list-style-type: none"> Student is uncomfortable with information and is able to answer only basic queries. Very little movement or descriptive gestures. Team members are not contributing much for multifaceted development of idea 	<ul style="list-style-type: none"> Student does not have grasp of Information and can't answer queries about subject. No movement or descriptive gestures. Team members are passive only one person is taking some efforts
5	Qualification towards Quality of Paper and research claims	Does the research paper have novelty, mathematical models, result and its analysis with proper conclusion consisting of project claim with proper verification, validation, and diagnostics?	Paper has novelty, mathematical models, result and its analysis with proper conclusion consisting of project claim with proper verification, validation, and diagnostics?	Paper has 1) novelty,2) mathematical models, 3) Research claim and result analysis with some diagrammatic representation	Paper has 1) novelty,2) mathematical models, 3)result analysis without any validation and verification	Paper has: 1) novelty, 2) mathematical models, 3)result analysis and claim is not clear.

Note:
Overall Remark

Examiner can put ✓ (Tick) wherever applicable and put X (cross) if not applicable
 (Review Paper/Technical Paper/Poster/Case Study)

Name and Signature of Evaluator:

Chapter 5. Outside Participation certificates

5.1 Certificate (Screenshot)

Pranav Bhavsar



CS50 Certificate

CS50 congratulates

Pranav Krishnakant Bhavsar

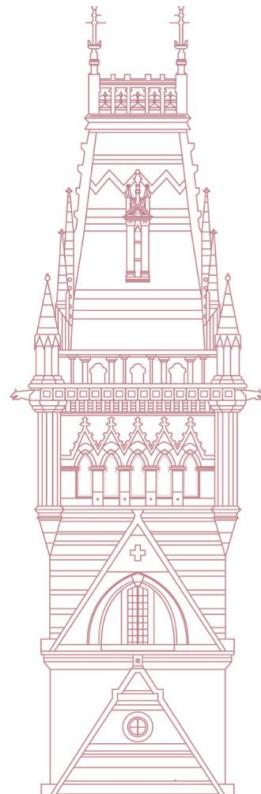
on completion of CS50x, including ten problem sets and one final project.

Awarded from Cambridge, Massachusetts,
in the year two thousand twenty-four.


David J. Malan
Gordon McKay Professor of the Practice of Computer Science
Harvard University



<https://cs50.harvard.edu/certificates/7675eafc-d445-4524-8ff-132f29aea95>





Introduction to Risk Management
Credit Risk Management: Frameworks and Strategies
Market Risk Management: Frameworks & Strategies
Operational Risk Management: Frameworks & Strategies



Jan 27, 2024

Pranav Bhavsar

has successfully completed the online, non-credit Specialization

Risk Management

The courses will teach you how to establish a risk management process using best-practice frameworks and strategies. By the end of the specialization, you will understand the steps involved to accurately measure, assess, and manage risk in your organization.

Joseph Iraci
Instructor
New York Institute of Finance

Jack Farmer
Curriculum Director
New York Institute of Finance

Tracy Williams
Instructor
New York Institute of Finance

Verify this certificate at:
<https://coursera.org/verify/specialization/S8LPQOSRGFF>



Fundamentals of Quantitative Modeling
Introduction to Spreadsheets and Models
Financial Acumen for Non-Financial Managers
Introduction to Corporate Finance



Feb 19, 2024

Pranav Bhavsar

has successfully completed the online, non-credit Specialization

Finance & Quantitative Modeling for Analysts

This learner has successfully completed all four courses in the Wharton Modeling and Finance for Analysts Specialization and has learned to put data to work by using spreadsheets and leverage spreadsheets as a powerful, accessible data analysis tool. This learner was also introduced to the world of corporate finance, and gained a better understanding of finance fundamentals, including a variety of real-world situations spanning personal finance, corporate decision-making and financial intermediation.

Don Huesman
Managing Director of Wharton Online
Wharton School
University of Pennsylvania

Michael R Roberts
William H. Lawrence
Professor of Finance
The Wharton School,
University of Pennsylvania

Richard Waterman
Professor of Statistics
Wharton School
University of Pennsylvania

Christopher D. Itten
EY Professor of Accounting
Wharton School
University of Pennsylvania

Richard A. Lambert
Miller-Shererd
Professor
Professor of Accounting
Wharton School
University of Pennsylvania

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The online specialization named in this certificate may draw on material from courses taught on-campus, but the included courses are not equivalent to on-campus courses. Participation in this online specialization does not constitute enrollment at this university. This certificate does not confer a University grade, course credit or degree, and it does not verify the identity of the learner.



Apr 9, 2024

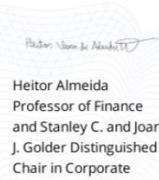
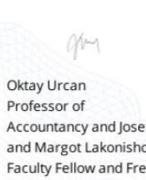
Pranav Bhavsar

has successfully completed the online, non-credit Specialization

Mergers and Acquisitions

In a post-pandemic world, companies across the globe are constantly looking to expand and grow their businesses. Mergers and Acquisitions (M&A) offer a plethora of ways to achieve this goal. The M&A Specialization is structured to provide a well-rounded knowledge of the key facets of successful M&A deals. Specifically, the learner will :

(1) Develop strategies to facilitate organizational success.
(2) Understand the foundational elements of financial statement and ratio analysis.
(3) Examine practical applications of financial analysis and valuation techniques.
(4) Understand financial modeling and capital structure.


Pranav Bhavsar
Heitor AlmeidaProfessor of Finance
and Stanley C. and Joan J. Golder Distinguished Chair in Corporate Finance and Academic Director of iDegrees Gies College of Business University of Illinois at Urbana-Champaign
Oktay Urcan

Professor of Accountancy and Josef and Margot Lakonishok Faculty Fellow and Fred & Virginia Roedgers Faculty Fellow in Accountancy Gies College of Business University of Illinois at Urbana-Champaign


Rob Metzger

Clinical Assistant Professor of Finance and Steven V. and Christy C. King Faculty Fellow Gies College of Business University of Illinois at Urbana-Champaign


James Bertram

Clinical Assistant Professor of Finance Gies College of Business University of Illinois at Urbana-Champaign

Verify this certificate at:

<https://coursera.org/verify/specialization/493AHUS9Q8UF>

This acknowledges that

Pranav Bhavsar

Has successfully completed and is certified in

Google Analytics Certification

Bharat Bohra



CERTIFICATE OF COMPLETION

Presented to

Bharat Bohra

For successfully completing a free online course

Asset Management

Provided by

Great Learning Academy

(On April 2024)



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Capital Budgeting Techniques

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(On April 2024)

5.2 Rubrics

Parameter	Excellent (20 Marks) 100 %	Very Good (15 Marks) 75 %	Good (10 Marks) 50 %	Average (05 Marks) 25 %
Problem Identification GA 2	Insightful and in-depth background information is provided to illuminate the issues through inclusion of: <ul style="list-style-type: none">• history relevant to the presentation, the “big picture”• a succinct description of the significance of the project	Background information is provided, including references to the work of others and an explanation of why the project was undertaken, to help put the presentation in context.	Little background information is presented using relevant references to help the audience understand the history and significance of the project.	Very little or no background information is presented to help the audience understand the history and significance of the project.
Content GA 4	• Addresses all specified content areas. • Material abundantly supports the topic. • Use of engineering terms and jargon matches audience knowledge level.	• Addresses most content areas. • Material sufficiently supports the topic. • Use of engineering terms and jargon mostly matches audience knowledge level.	• Addresses some of the content areas. • Material minimally supports the topic. • Use of engineering terms and jargon minimally matches audience knowledge level.	• Addresses few of the content areas. • Material does not support the topic. • Use of engineering terms and jargon does not match audience knowledge level.
Visuals GA4,GA5	• Use of prezi or advance tools Text is easily readable. • Graphics use constantly supports the presentation. • Slide composition has a professional look that enhances the presentation	• Use of Powerpoint presentation Text is readable. • Graphics use mostly supports the presentation. • Slide composition is not visually appealing, but does not detract from the presentation	• Text is readable with effort. • Graphics use rarely supports the presentation. • Slide composition sometimes distracts from the presentation	• Text is not readable. • Graphics use does not support the presentation. • Slide composition format is clearly distracting, obscuring the presentation
Presentation Skills	• Clearly heard and polished.	• Clearly heard but not polished.	• Difficult to hear and/or moments	• Inaudible; several awkward

GA 7	<ul style="list-style-type: none"> • Attitude indicates confidence and enthusiasm. • Audience attention is constantly maintained. 	<ul style="list-style-type: none"> Attitude indicates confidence but not enthusiasm. • Audience attention is mostly maintained. 	<ul style="list-style-type: none"> of awkwardness. • Attitude indicates some lack of confidence and/or disinterest in subject. • Audience attention is minimally maintained 	<ul style="list-style-type: none"> pauses. • Attitude indicates lack of confidence and/or disinterest in subject. • Audience attention is not maintained
Participation level GA 12	International / National	State	District / Local	Institute