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Study of Technical Indicators and Impact of World Markets on the Indian Stock Market

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Abstract

Stocks markets are place where people make as well as lose money, many scientists have tried predicting the behavior of stocks in order to make a fortune, one such science of stock market which arrived was technical analysis which tries to predict movement of stock based on price action, volume and past demand and supply zones. This paper tries to understand famous technical analysis indicators and back test their performance in Indian stock markets and also will try to understand impact of world markets on India's benchmark Index Nifty 50.

Index Terms **– Back Testing, Indicators, Technical Analysis, RSI, MACD, MA, EMA, US Bond Yield, SGX Nifty, Crude Oil Futures, ROI %.**

I. INTRODUCTION

In world of stock markets, 2 main analysis are used by traders and investors to gauge and understand the market structure and stocks of specific company, these 2 Types of Analysis are Technical analysis and Fundamental Analysis. In this paper we will keep the scope limited to technical analysis only. Technical analysis is an analysis strategy whose core is formed by price and volume of shares traded of a particular stock. This school of analysis is typically used by traders who are looking for short term opportunity in the market.

The technical Indicators which are foundation of technical analysis are the actual tool used by traders and investors to generate buy and sell signals. These indicators at core function based on statistical and mathematical formulas which tell us when to buy a stock and when to sell a stock. Some of the most interesting and popular indicators which are commonly used are RSI, MACD, Moving averages cross over and many more.

II. OBJECTIVE

The objective of the paper is to understand the famous technical indicators which are used in the markets and back test their performance in the Indian stock market and also to see how various Benchmarks of the world markets and Macroeconomic indicators impact the Indian stock market

III. LITRATURE REVIEW

Terence Tai-Leung Chong, Wing-Kam Ng, Venus Khim-Sen Liew(2014),"Revisiting the Performance of MACD and RSI Oscillators" stated MACD i.e. Moving average convergence and divergence and relative strength index work quite well globally in various market environments and phases of rally, in some cases both the indicators show fantastic outperformance[1].

"The Impact of Volatility on the Implementation of RSI," Renaud Beaupain, Lei Meng, and Romain Belair (2010). This paper is based on the Chinese stock markets in which impact of volatility was measured using Exponential moving averages and RSI in the shanghai stock markets. As per the observations of authors, technical indicators have no meaningful impact on returns but some indicators performed well in some phases [2].

Reena Baral, Abhishek Kumar Chintu (2013), in their study observed that Relative strength index which is very popular in the markets and other Technical analysis indicators helps High net investors, FIIs and DII's understand the short term view of the market and find opportunities to yield extra ROI on their Funds, the conventional RSI buy and sell signals work well and are profitable [3].

As per author Adrian Taran-Morosan (2011), "The relative strength index revisited." Performance of RSI was analysed in its traditional sense, the study also changes some of the parameters of the RSI calculation formula and found that indicator performs well in its traditional form but with minor variations performance of RSI can be enhanced [4].

According to study of Dr. Srinivas Gumparthi, Dr. Bhargavi. R, Anith.R (2017), they included stocks based on EPS and PE ratio between 2011 and 2013 and then based on the sample space they got tested the validity of RSI based trading strategy both in short and long term. The study observed that RSI in its traditional sense and be used to generate good returns and at the same time show us that PE is a better metric than EPS [5].

IV. METHEDOLOGY

With Literature Review of Various Research papers, we plan to address some of the shortcomings in their research at the same time, propose our model of comparatively study different indicators and try to gauge Impact of various Benchmarks such as Crude oil Prices, USD_INR exchange rate, Gold Price etc. on the Indian markets.

TOOLS AND RESOURCES:

Programming Language: python 3
IDE: Jupyter notebook, VS code
Python libraries/ Modules: Pandas, Numpy, Matplotlib, Plotly express, Scikit-learn, yfinance, streamlit

DATA SET:

Current all NIFTY 50 stocks historic data from yahoo finance website using yfinance library and the fetched data will be stored into data frames of each stock from 1st Jan 2010 to 1st April 2022.Crude oil Futures Close price, USD_INR exchange rate, SGX Nifty Futures open price, US 10 year Bond yield data, Gold Futures data all fetched from investing.com website in form of .csv file from date : 1st Jan 2010 to 1st April 2022.The data being fetched is EOD data having 1D OHLC (Open, High, Low, Close and Volumes) of each date.

List of all Stock Tickers in Nifty 50 part of the Study:

['ADANIPORTS','ASIANPAINT','AXISBANK','BAJAJ-AUTO','BAJFINANCE','BAJAJFINSV','BPCL','BHARTIARTL','BRITANNIA','CIPLA','COALINDIA','DIVISLAB','DRREDDY','EICHERMOT','GRASIM','HCLTECH','HDFCBANK','HDFCLIFE','HEROMOTOCO','HINDALCO','HINDUNILVR','HDFC','ICICIBANK','ITC','IOC','INDUSINDBK','INFY','JSWSTEEL','KOTAKBANK','LT','M&M','MARUTI','NTPC','NESTLEIND','ONGC','POWERGRID','RELIANCE','SBILIFE','SHREECEM','SBIN','SUNPHARMA','TCS','TATACONSUM','TATAMOTORS','TATASTEEL','TECHM','TITAN','UPL','ULTRACEMCO','WIPRO']

TECHNICAL INDICATORS:

The following technical indicators will be used to study in context to the Indian stock market specifically Nifty 50 stocks, the reason for choosing the following indicators is their popularity in the stock markets.
We will buy the stock when Buy signal is triggered and will sell the stock when sell signal is triggered, each indicator will different buy and sell triggers as per the calculation of each indicator

Relative strength Index (RSI):
Buy Signal: Buy when Stock trades below 30 RSI value
Sell Signal: Sell when Stock trades above 70 RSI value

Moving averages convergence divergence (MACD):
Buy Signal: Buy when MACD line crosses Signal line from bottom to top
Sell Signal: Sell when MACD line crosses Signal line from top to bottom

Moving averages 200-50 MA cross over
Buy Signal: Buy when 50MA line crosses 200MA line from bottom to top
Sell Signal: Sell when 50MA line crosses 200MA line from top to bottom

Exponential Moving averages (200-50 EMA) cross over
Buy Signal: Buy when 50EMA line crosses 200EMA line from bottom to top
Sell Signal: Sell when 50EMA line crosses 200EMA line from top to bottom

Moving averages (50-21 MA) cross over
Buy Signal: Buy when 21MA line crosses 50MA line from bottom to top
Sell Signal: Sell when 21MA line crosses 50MA line from top to bottom

Exponential Moving averages (50-21) EMA cross over
Buy Signal: Buy when 21EMA line crosses 50EMA line from bottom to top
Sell Signal: Sell when 21EMA line crosses 50EMA line from top to bottom

ANALYSIS

All the above indicator will be tested against data of each stock of Nifty 50 from 1st Jan 2010 to 1st April 2022. And the following parameters will be used to judge the performance of Indicator on a particular stock of the nifty 50 and the results will be visualized using matplotlib and Plotly library of python.

The performance of the above 6 indicators will be gauged based on the following Parameters:

1. Max profit in a single trade
2. Max loss in a single trade
3. Absolute Return on investment %
4. Total no of trading signals generated, win % and Average win %
5. Average ROI per trade.

The indicators who will we having the best Win rate and highest ROI will be the deemed as the best performing indicator on nifty 50 stock from 1st Jan 2010 to 1st April 2022

For **Understanding relation between World Markets and Indian Stock markets,** we will use statistics and basic supervised machine learning algorithm i.e. (Multiple linear regression) and we will try to find correlations between NIFTY 50 index movement and other parameters listed below:

1. Between NIFTY 50 and volatility index (India VIX)
2. Between Nifty 50 and Open of SGX Nifty
3. Between Nifty 50 and USD/INR exchange rate
4. Between Nifty 50 and Gold price
5. Between Nifty 50 and Crude oil price.
6. Between Nifty 50 and US 10 years Bond yield

Such a study will help us understand the movement of Nifty 50 w.r.t. to various other macro-Economic indicators and other international market forces.

With Understanding of Correlation between Nifty 50 and other Benchmarks like USDINR exchange rate, Crude Oil Futures price, Gold Price, SGX nifty open etc., **we will use Multiple Linear Regression via which we will try to predict Nifty 50's tomorrows Opening price** using yesterday's closing price of Crude oil, USDINR, US Bond yield, Gold Futures close price and SGX nifty's Open price of the same day.

Dependent Variable (Y): Next day Nifty 50 Open

Independent Variables (Xi): Yesterdays Crude Oil Futures Close, Yesterdays Gold Futures Close, Yesterdays USD_INR Close, Yesterdays US 10 years Bond Yield Close, Yesterdays Nifty 50 close, Yesterdays INDIAVIX value and Next day's SGX nifty open

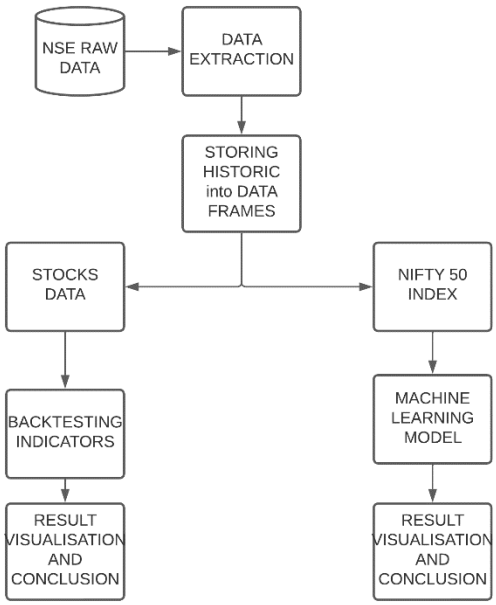


Fig 1: System Architecture

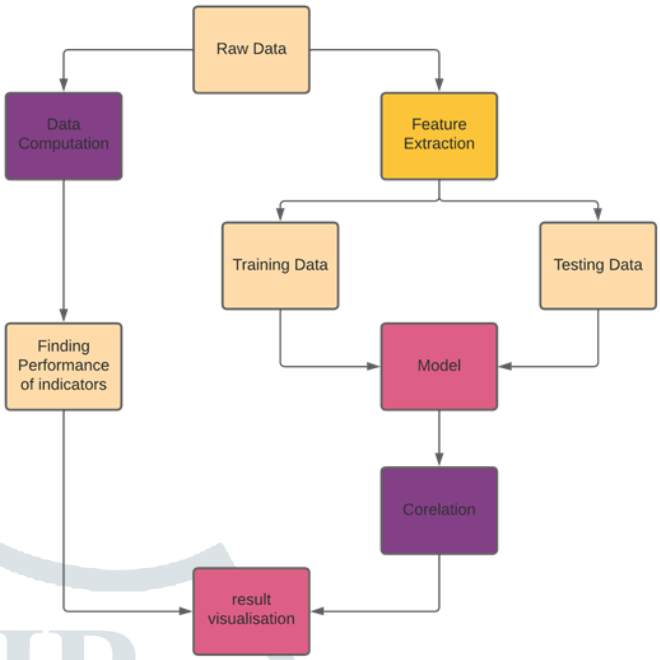


Fig 2: Data Flow Diagram

V. RESULTS

Based on the above methodology the results of the back testing of Indicators are as follows:

1. Relative Strength Index (RSI)

Metric	**Best Stock in Each Metric for RSI Indicator**
Absolute ROI %	TCS
Total Trades	HEROMOTOCO
Win %	TCS
Max Profit per trade	TCS
Least Loss per trade	HCLTECH
Average Profit per Trade	ADANIPORTS

2. Moving Average Convergence and Divergence (MACD)

Metric	**Best Stock in Each Metric for MACD Indicator**
Absolute ROI %	BAJFINANCE
Total Trades	JSWSTEEL
Win %	WIPRO
Max Profit per trade	HINDALCO
Least Loss per trade	NESTLEIND
Average Profit per Trade	BAJFINANCE

3. **Moving Average Cross Over (200-50 MA)**

Metric	**Best Stock in Each Metric for MA200-50 Indicator**
Absolute ROI %	BAJFINANCE
Total Trades	HDFC
Win %	ICICIBANK
Max Profit per trade	EICHERMOT
Least Loss per trade	SBILIFE
Average Profit per Trade	EICHERMOT

4. **Exponential Moving Average Cross Over (200-50 EMA)**

Metric	**Best Stock in Each Metric for EMA200-50 Indicator**
Absolute ROI %	BAJFINANCE
Total Trades	AXISBANK
Win %	ASIANPAINT
Max Profit per trade	BAJFINANCE
Least Loss per trade	HINDUNILVR
Average Profit per Trade	BAJFINANCE

5. **Moving Average Cross Over (50- 21MA)**

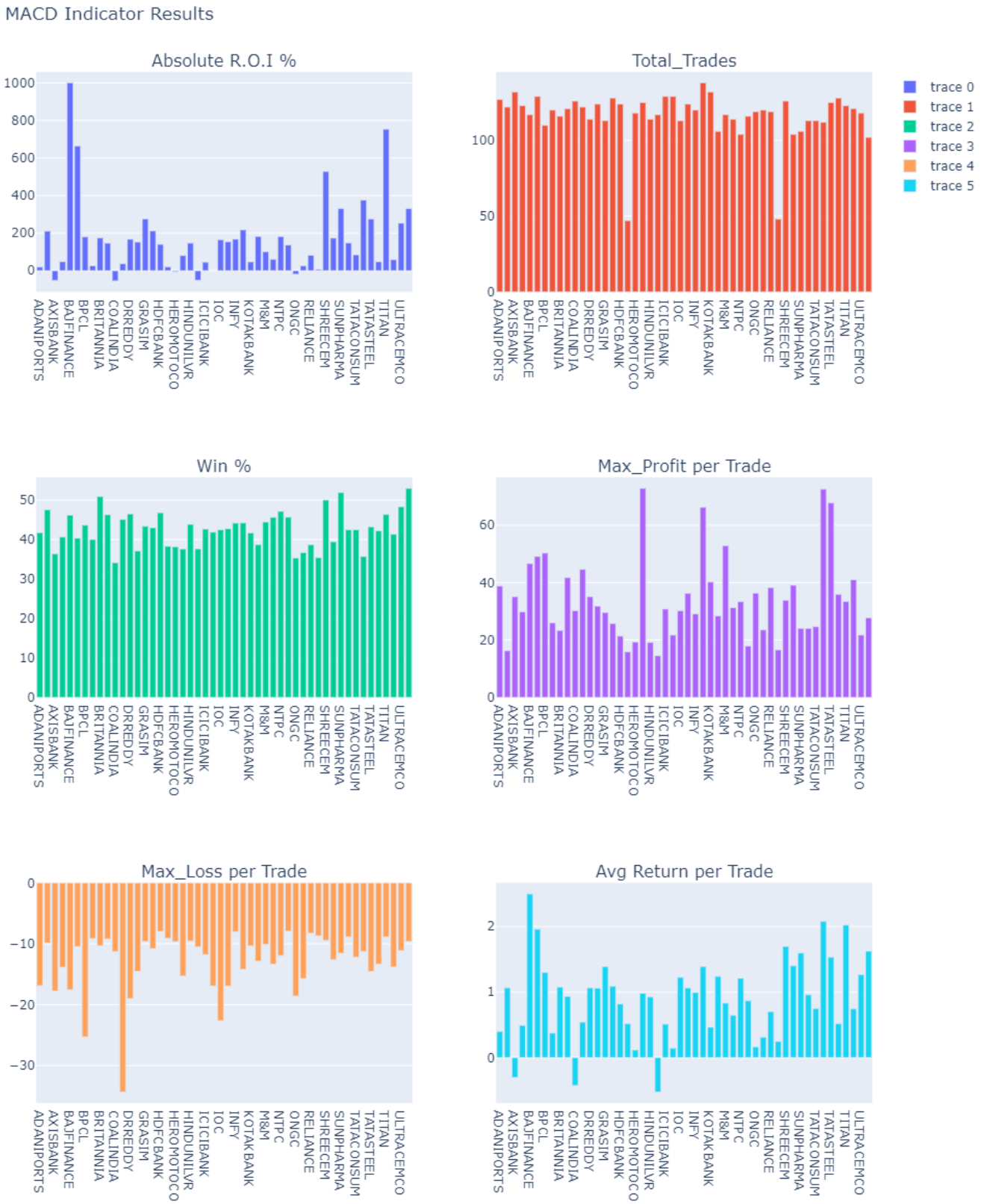
Metric	**Best Stock in Each Metric for MA50-21 Indicator**
Absolute ROI %	BAJFINANCE
Total Trades	TCS
Win %	EICHERMOT
Max Profit per trade	JSWSTEEL
Least Loss per trade	HDFCLIFE
Average Profit per Trade	BAJFINANCE

6. **Exponential Moving Average Cross Over (50-21 EMA)**

Metric	**Best Stock in Each Metric for EMA50-21 Indicator**
Absolute ROI %	BAJFINANCE
Total Trades	RELIANCE
Win %	BAJAJFINSV
Max Profit per trade	BAJFINANCE
Least Loss per trade	HDFCLIFE
Average Profit per Trade	BAJFINANCE

Complete Overview of Relative Strength Index (RSI) Indicator Performance on all 50 Stocks of Nifty 50

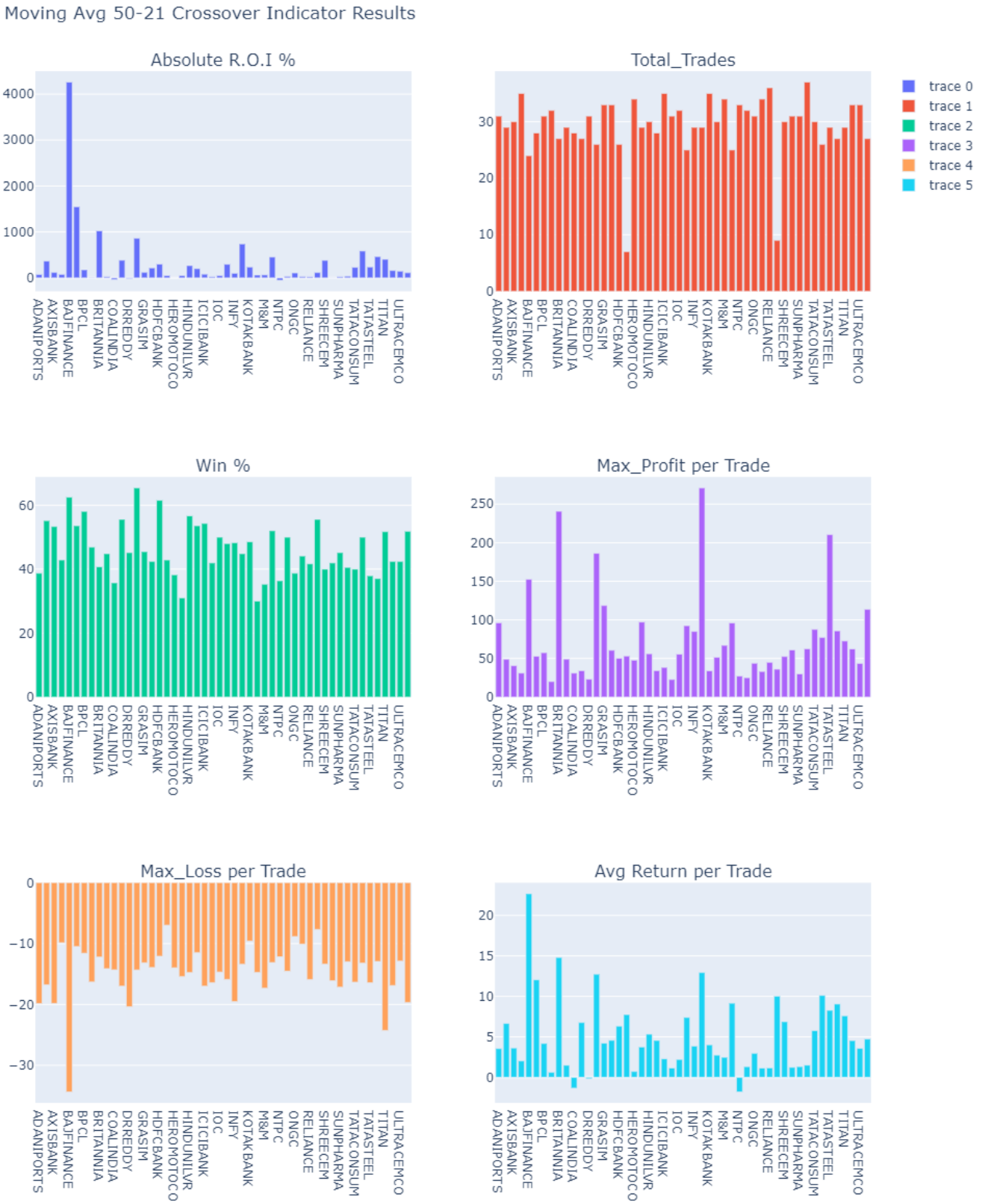
Complete Overview of Moving Average Convergence Divergence (MACD) Indicator Performance on all 50 Stocks of Nifty 50



Complete Overview of MA 200-50 Crossover Indicator Performance on all 50 Stocks of Nifty 50

Complete Overview of EMA 200-50 Crossover Indicator Performance on all 50 Stocks of Nifty 50

Complete Overview of MA 50-21 Crossover Indicator Performance on all 50 Stocks of Nifty 50



Complete Overview of EMA 50-21 Crossover Indicator Performance on all 50 Stocks of Nifty 50

Relation between World Markets and Indian Stock markets:

Using the above discussed parameters as independent and dependent variables in the methodology section, the results of the multiple linear regression model is below. The results clearly show strong correlation between the independent and dependent variables and hence the coefficient of determination values are quite good.

```
# evaluating
from sklearn.metrics import r2_score
r2_score(y_test,y_pred)
```

```
0.9996971091629309
```

```
from sklearn import metrics

print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pred))
print('Root Mean Squared Error:', np.sqrt(metrics.mean_squared_error(y_test, y_pred)))
```

```
Mean Absolute Error: 35.37280182319778
Mean Squared Error: 3510.7983514239704
Root Mean Squared Error: 59.25199027394751
```

```
final_data['nifty_nxtD_open_pred']=regressor.predict(x)
```

```
final_data
```

Date	Gold_close	US_Bond_Yield	Crude_Oil	USD_INR	INDIAVIX	Nifty_50_close	SGXnifty_close	SGX_nextD_open	nifty_50_nextD_open	nifty_nxtD_open_pred
2010-01-04	1117.699951	3.823	80.120003	46.287998	23.64	5232.200195	5243.0	5240.0	5277.149902	5236.910446
2010-01-05	1118.099976	3.763	80.589996	46.119999	22.27	5277.899902	5277.0	5287.0	5278.149902	5279.309857
2010-01-06	1135.900024	3.829	81.889999	45.720001	22.12	5281.799805	5291.5	5291.0	5281.799805	5286.492850
2010-01-07	1133.099976	3.827	81.510002	45.688000	22.50	5263.100098	5259.0	5264.5	5264.250000	5259.842549
2010-01-08	1138.199951	3.836	81.370003	45.518002	22.57	5244.750000	5258.5	5262.0	5263.799805	5255.540032
...	...	...	...	...	...	...	...	...	...	...
2022-03-24	1961.599976	2.370	119.029999	76.552399	23.93	17222.750000	17301.0	17221.5	17289.000000	17241.728213
2022-03-25	1953.800049	2.488	120.650002	76.323502	23.43	17153.000000	17244.5	17202.0	17181.849609	17204.202196
2022-03-28	1939.599976	2.466	112.480003	76.278503	22.61	17222.000000	17373.5	17388.0	17297.199219	17357.574788
2022-03-29	1912.000000	2.398	110.230003	76.034103	21.30	17325.300781	17577.5	17550.0	17468.150391	17519.800724
2022-03-30	1933.500000	2.358	113.449997	75.666702	20.61	17498.250000	17462.5	17500.0	17519.199219	17488.284522

2874 rows × 10 columns

The above Data frame shows independent, dependent variable and shows how close the next day's Nifty 50's open price was in comparison to the predicted next day's nifty 50 open.

Fig 4: Plot showing Y_pred vs Y_test

VI. DRAWBACKS AND CONCLUSION

As per the obtained results Different stocks perform differently for each indicators, but back testing does provide the evidence of positive returns if traded or invested based on particular indicators buy and sell signals.

At the same time it is very difficult to conclude regarding which indicators performs the best as each indicator performed differently on different stocks. Some stocks show cyclic price movement and some don't, and the results are mostly based on blue-chip low beta stocks where probability of complete wipe out of capital is low.
Also as per the study, World markets and Other Benchmark instruments do impact Indian Markets and hence the Machine Learning Model helped us understand how they impact the market and how we can capitalize from the situation by predicting the open of next day's nifty 50 based on previous day close value of different instruments.

VII. ACKNOWLEDGEMENT

We would like to thank Prof. P.R. Dongare Ma'am, Sinhgad Academy of Engineering, Kondhwa, Pune for the constant guidance and support she provided us throughout the research and Analysis phase of our project, without her it could not have been possible for us to get to the result, her inputs were very valuable at each and every juncture of our project.

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