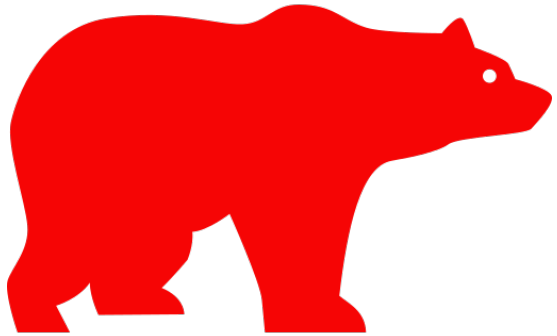
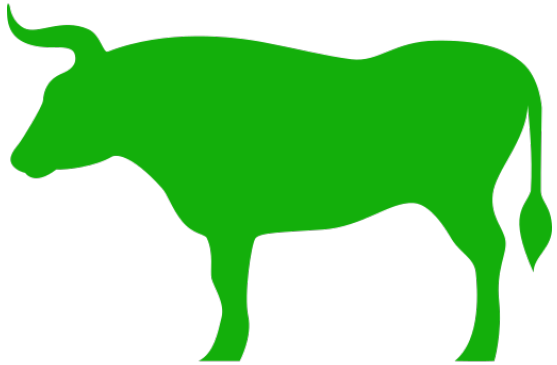


BULL AND BEAR



A SYSTEM FOR COMPARATIVE ANALYSIS OF DIFFERENT STOCK PREDICTION METHODOLOGIES FOR BEGINNER INVESTORS

Team: Ishan Jain, Tanmay Goel, Mohibul Hassan, Nimisha Goyal
Advised by - Professor David Rossiter

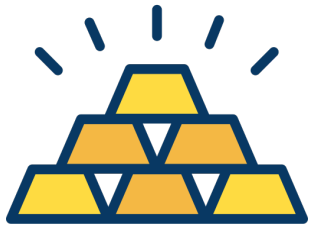
WHAT IS INVESTING?

'Investing is the act of committing money or capital to an endeavour (a business, project, real estate, etc.), with the expectation of obtaining an additional income or profit.

- Investopedia

MOST POPULAR INVESTING PRACTICES

BONDS



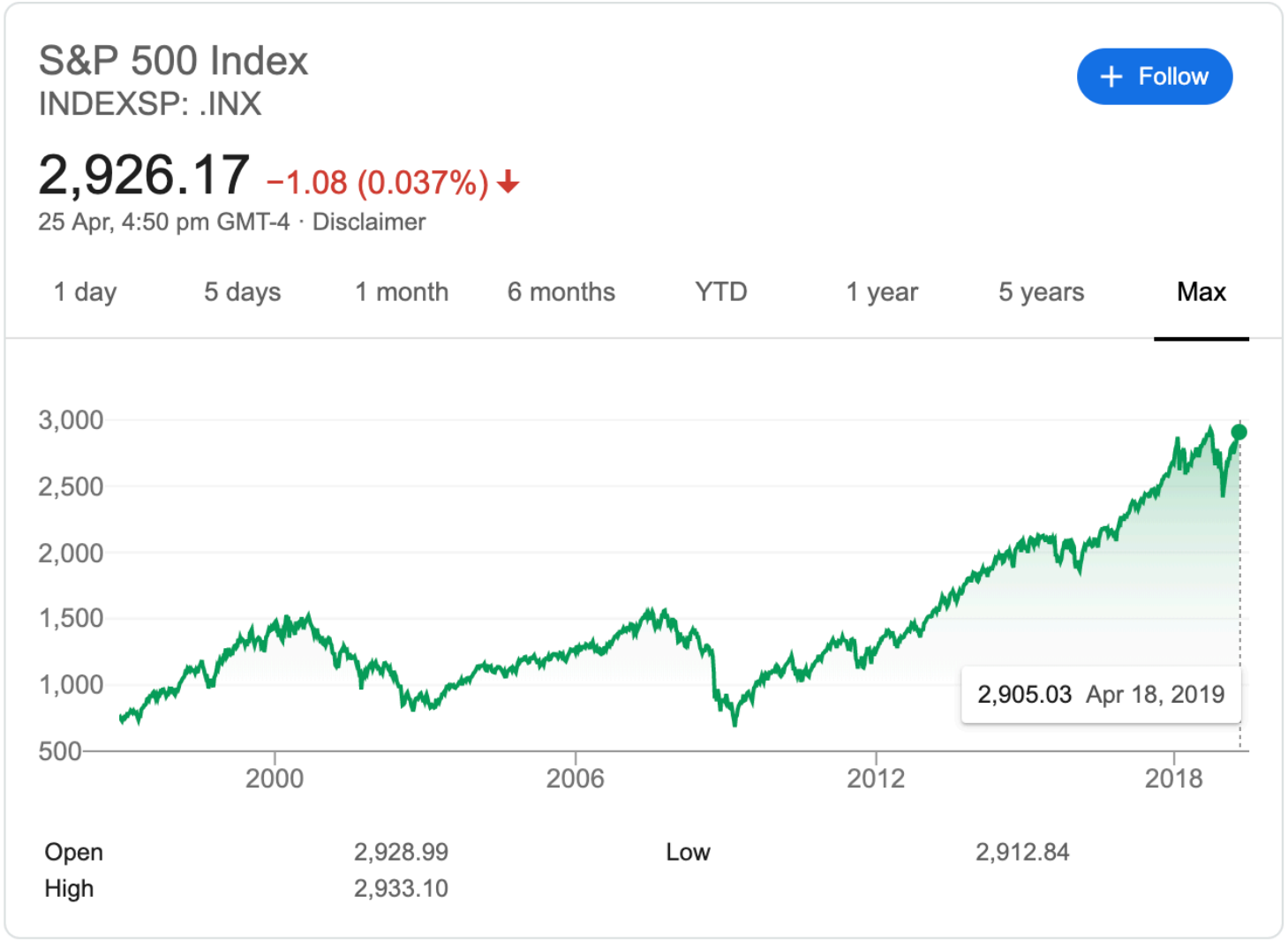
GOLD

STOCKS

REAL ESTATE

MUTUAL FUNDS

INVESTING IN STOCKS IS A GOOD IDEA!



S&P 500 rose 300% since the 2008-09 financial crisis.

BARRIERS OF ENTRY FOR BEGINNERS

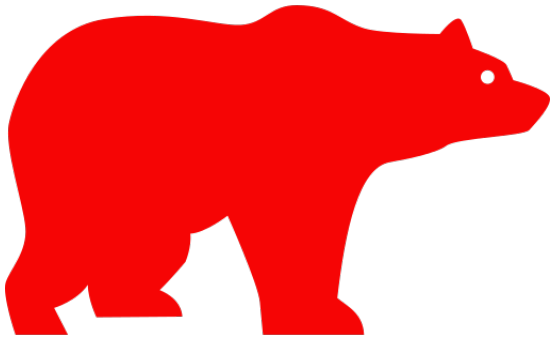
1. Overwhelming and confusing information

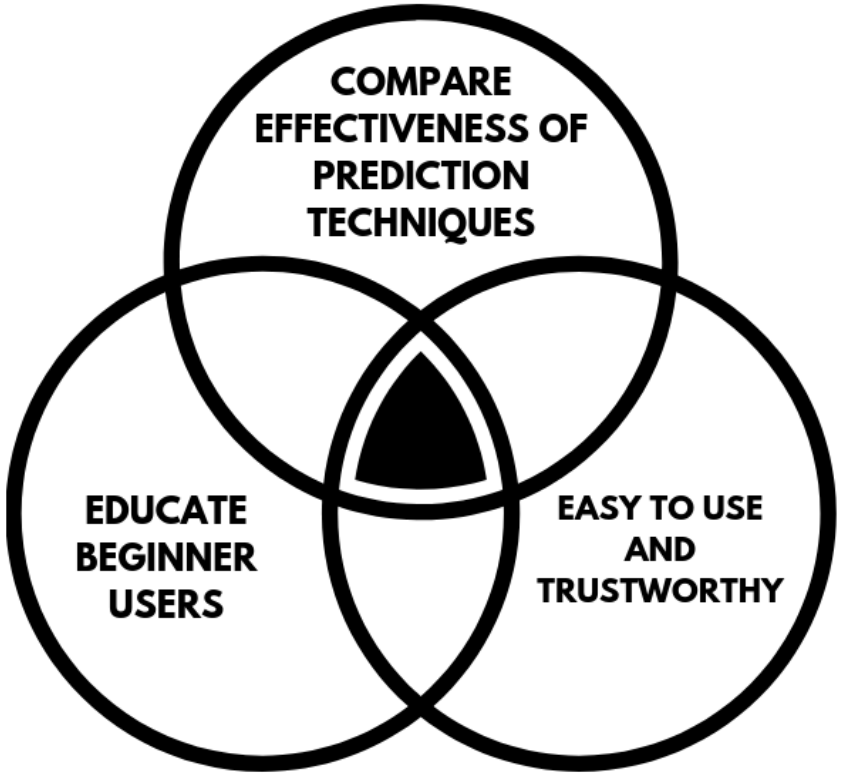
2. Paid services (websites, wealth managers etc.)

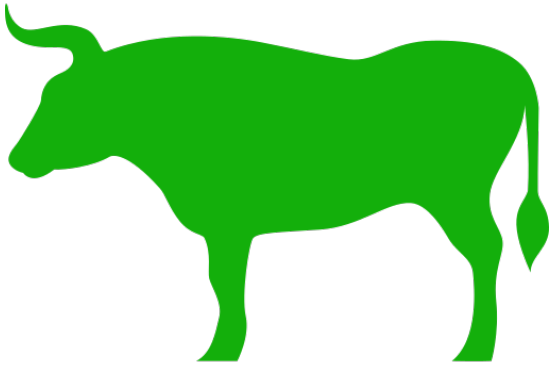
3. Predictions are not verified with data

4. Low level understanding of analyzing news and public sentiment

BULL AND BEAR







OUR OBJECTIVES

1. Providing predictions made by different indicators within Technical Analysis

EMA

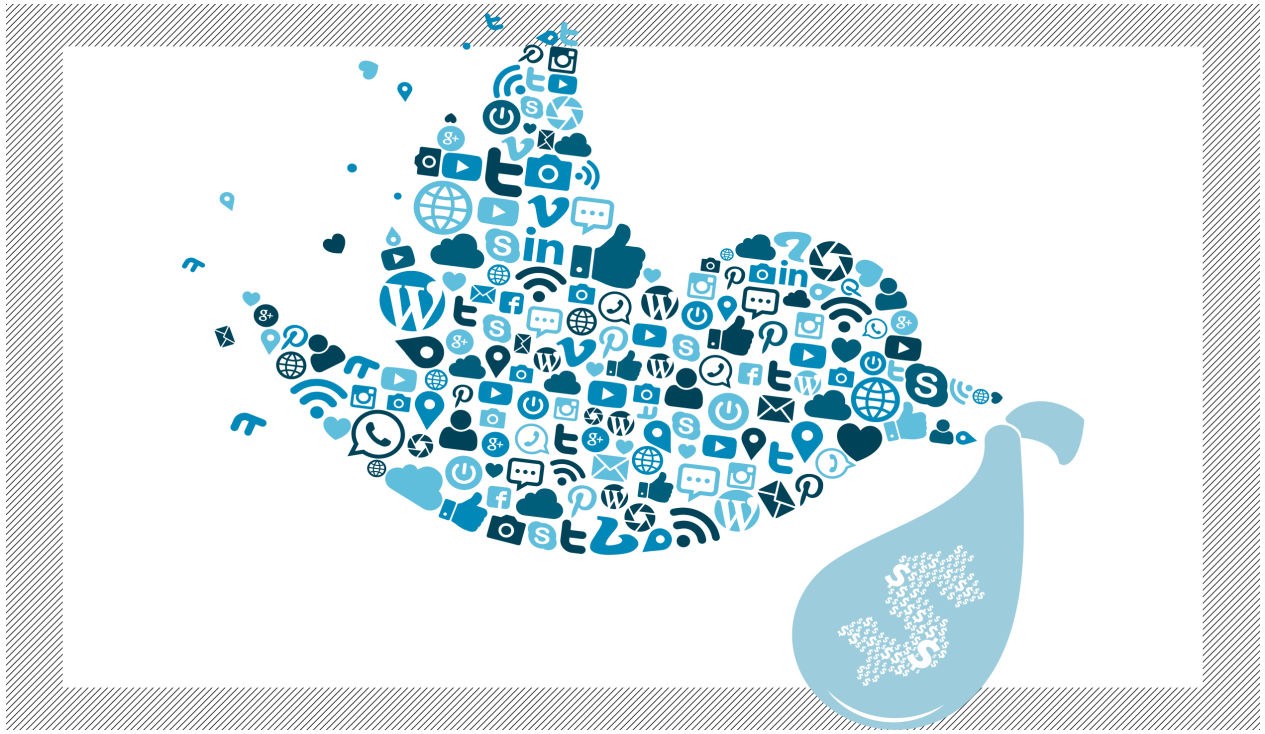
RSI

BOLLINGER BANDS

MACD

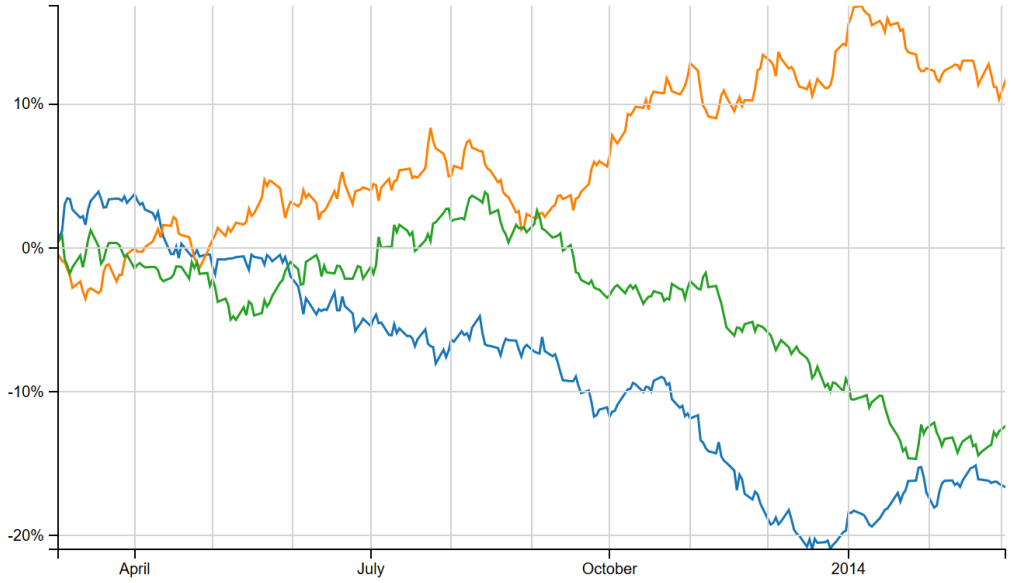
OUR OBJECTIVES

2. Performing Sentiment Analysis on financial news and tweets related to the stocks



OUR OBJECTIVES

3. Comparing these techniques with each other and informing the user about the effectiveness of each prediction technique over a period of time



OUR OBJECTIVES

4. Encompassing all the above features in an aesthetically pleasing and intuitive user interface

TECHNICAL ANALYSIS

Financial analysis that uses patterns in market data to identify trends and make predictions

TYPES OF TECHNICAL INDICATORS

TREND

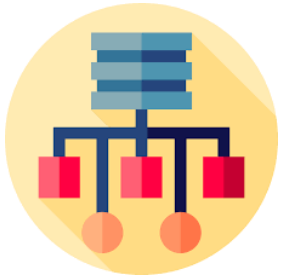
MOMENTUM

VOLATILITY

VOLUME

CHOOSING THE TECHNICAL INDICATORS

CRITERIA USED



Variety

Popularity

Effectiveness

BOLLINGER BANDS

EXPONENTIAL MOVING AVERAGE

RELATIVE STRENGTH INDEX

MOVING AVERAGE CONVERGENCE DIVERGENCE

BACKTESTING

Aim: To find the parameters that give the highest returns for each indicator

FOR EACH INDICATOR

Data for past 13 years for the 30 stocks in Dow Jones

Pre-determined range of parameters

Find returns for each parameter

backtrader

Store to an excel file

period	deviation	gain
5	1.1	215462.718
5	1.2	205877.898
5	1.3	205941.493
5	1.4	193697
5	1.5	206536.207
5	1.6	177359.596
5	1.7	167700.662
5	1.8	142840.485
5	1.9	109996.559

BACKTESTING

Aim: To find the parameters that give the highest returns for each indicator

FOR EACH INDICATOR

Take the top 10% returns → Calculate median → Use this best parameter in the web app

period	deviation	gain
5	1.1	215462.718
5	1.2	205877.898
5	1.3	205941.493
5	1.4	193697
5	1.5	206536.207
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5	1.7	167700.662
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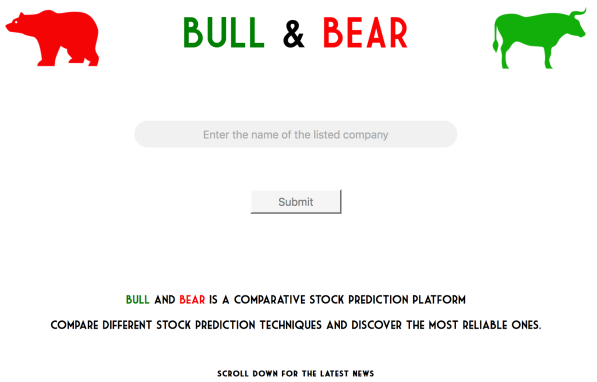
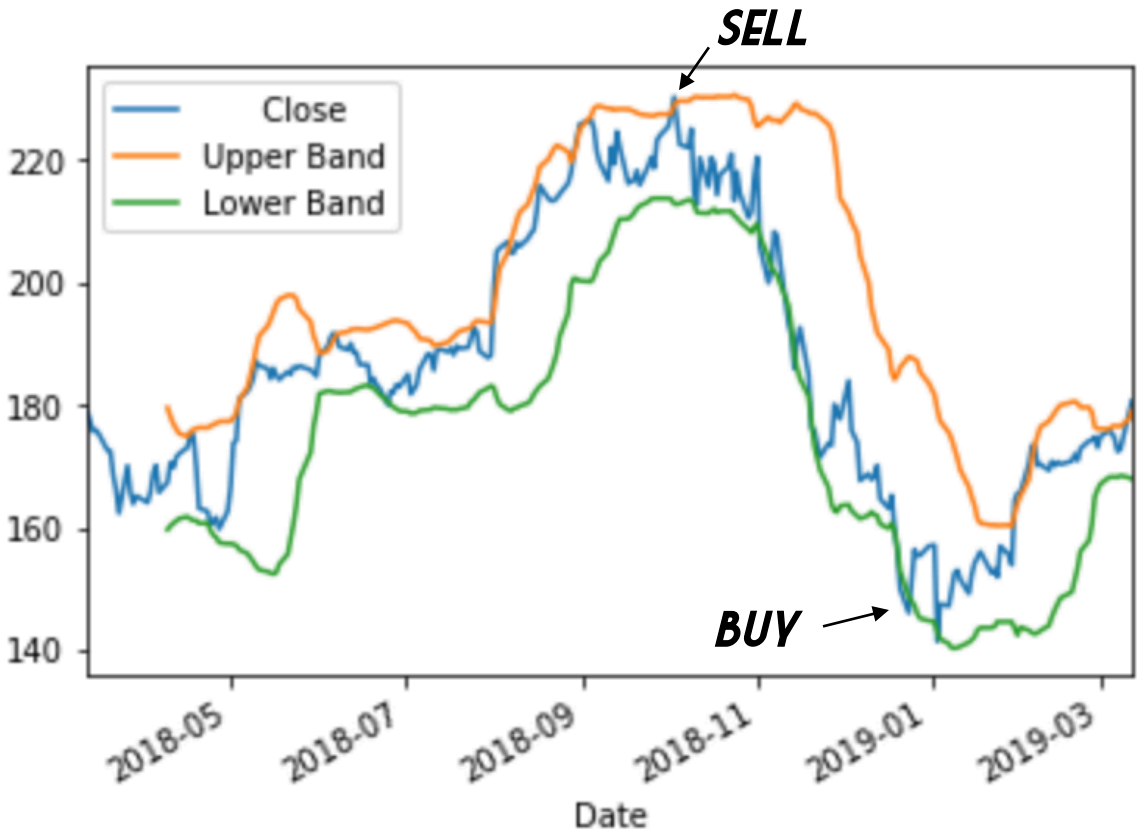


BOLLINGER BANDS

Consists of an SMA line and two lines plotted 2 standard deviations (+ and -) away



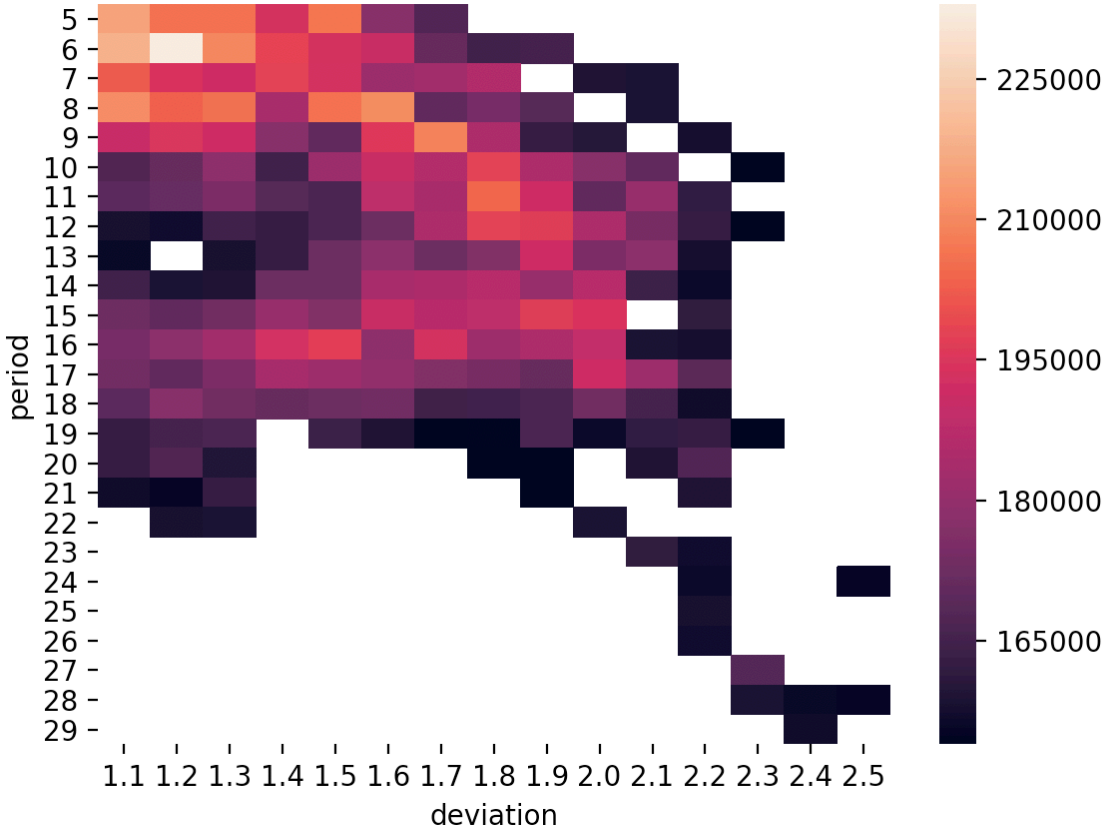
STRATEGY

BUY	SELL
Close line crosses below the Lower Band	Close line crosses over the Upper Band

PARAMETER SELECTION FOR BOLLINGER BANDS

VARIABLES

1. Time Period
2. Standard Deviation



RESULT

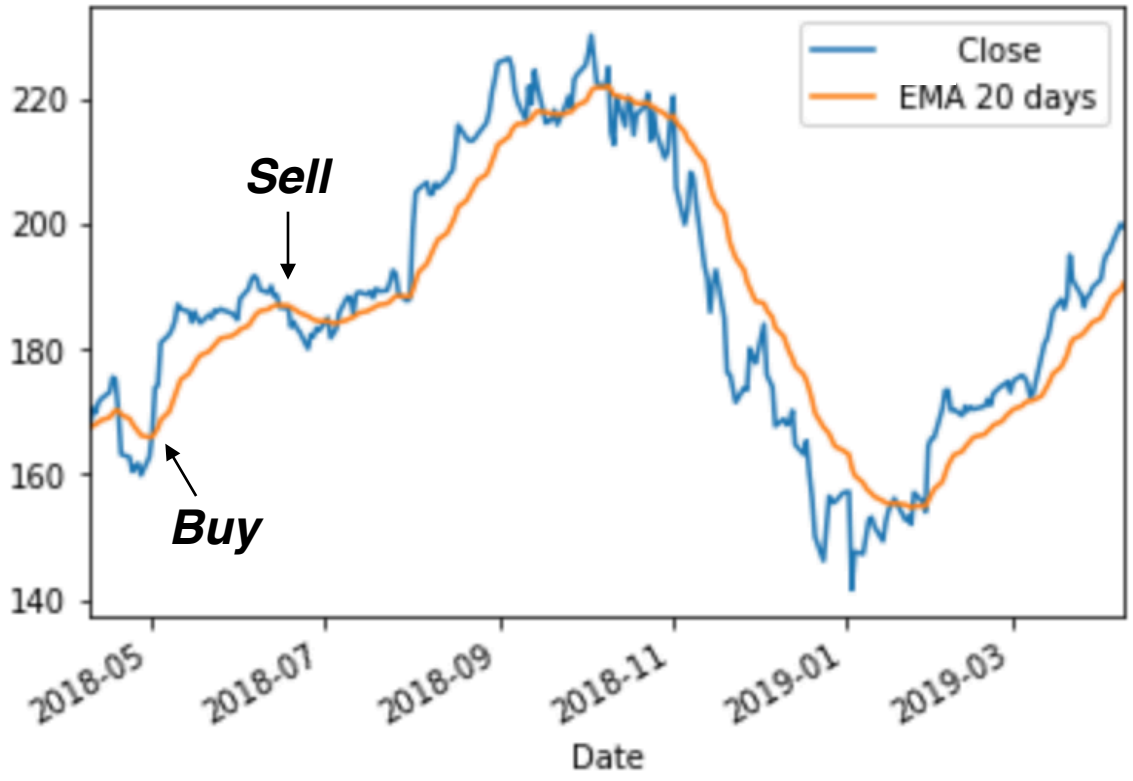
Best Parameter
14 days, 1.7 SD
Return per year
8.39%

VS

Standard Parameter
20 days, 2 SD
Return per year
7.07%

EXPONENTIAL MOVING AVERAGE (EMA)

A moving average that places greater weight on the most recent data points



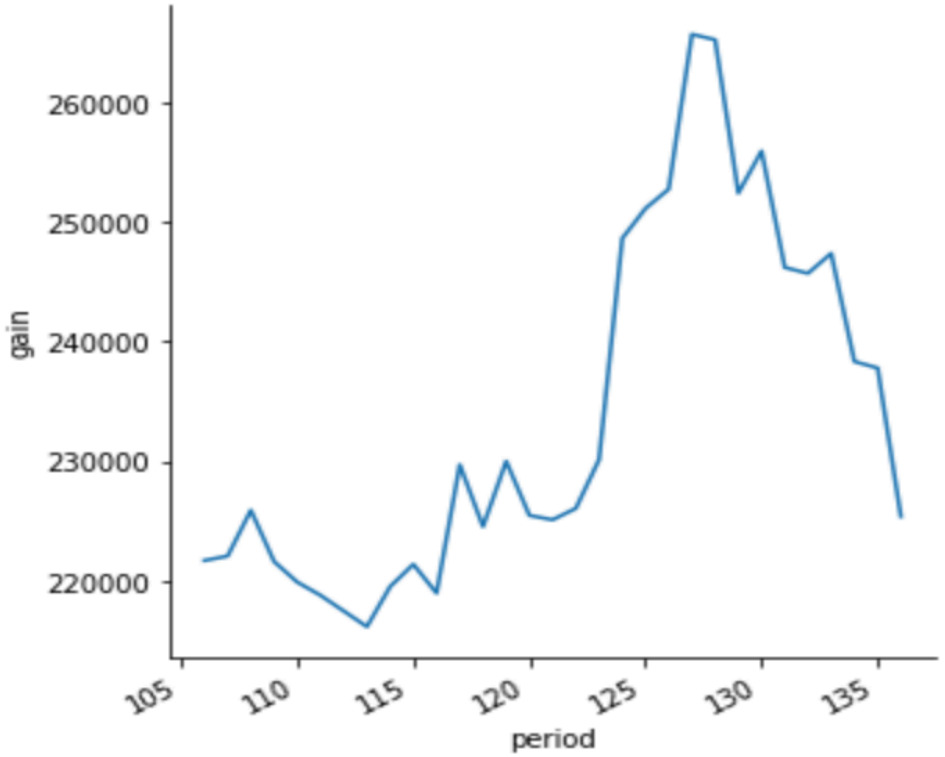
STRATEGY

BUY	SELL
EMA line crosses over the Close line from above	EMA line crosses over the Close line from below

PARAMETER SELECTION FOR EMA

VARIABLES

1. Time Period



RESULT

Best parameter
128 days
Return per year
10.48%

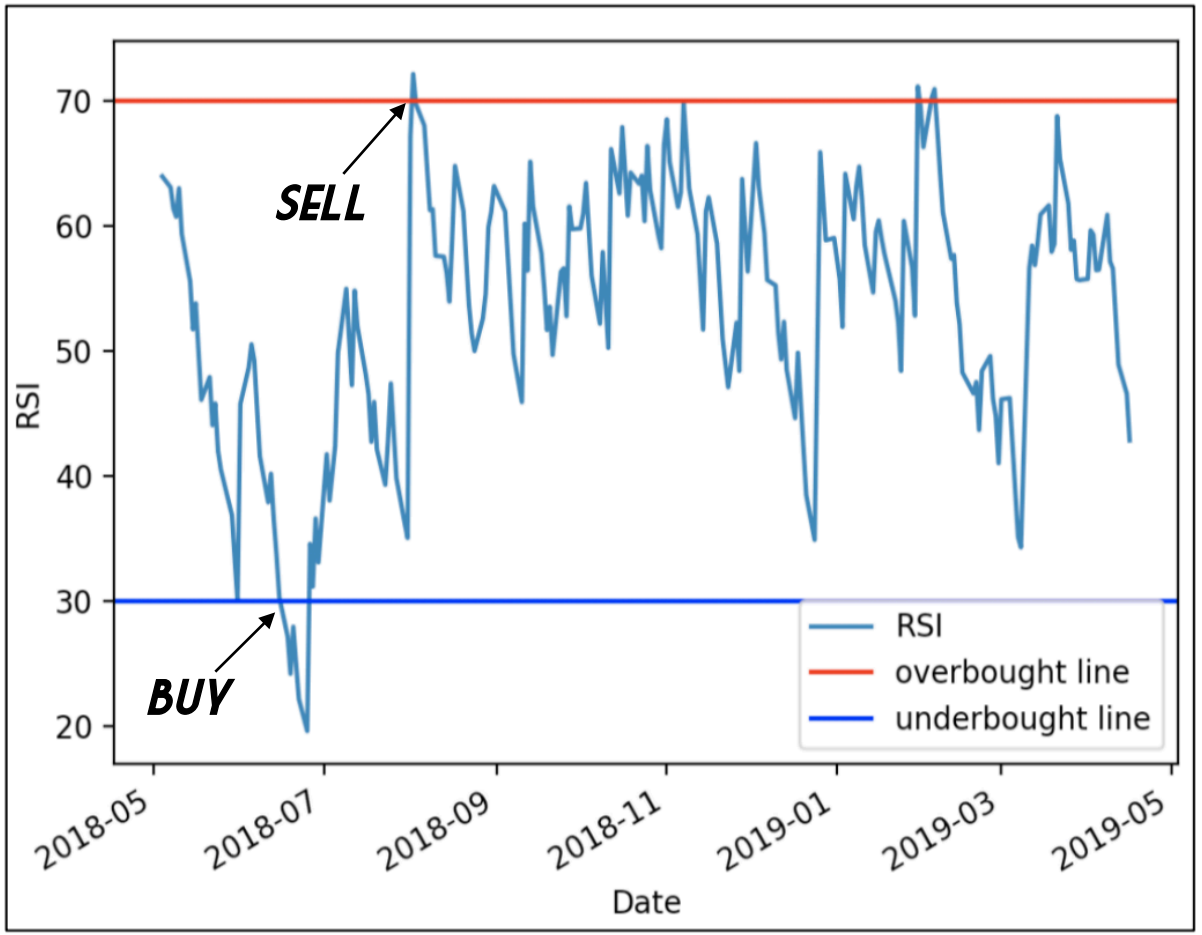
VS

Standard parameter
20 days
Return per year
6.17%

RELATIVE STRENGTH INDEX (RSI)

- Momentum indicator
- Ranges between 0-100
- Measures the magnitude of recent price changes to analyse whether the stock is overbought or oversold

STRATEGY	
BUY	**SELL**
RSI crosses the underbought line	RSI crosses the overbought line

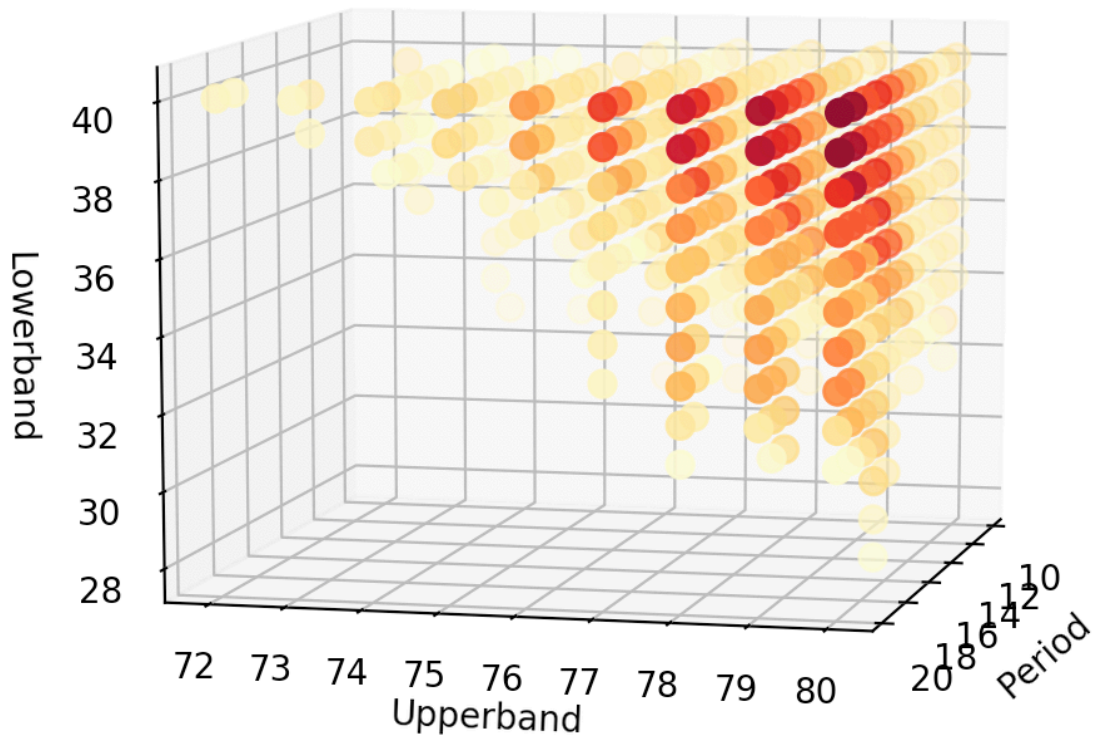


An example of RSI graph for Apple stock with standard parameters

PARAMETER SELECTION FOR RSI

VARIABLES

1. Time Period
2. Upper Band
3. Lower Band



RESULT

Best parameters
15 days, 78 Upper Band, 37 Lower Band
Return per year
9.69%

VS

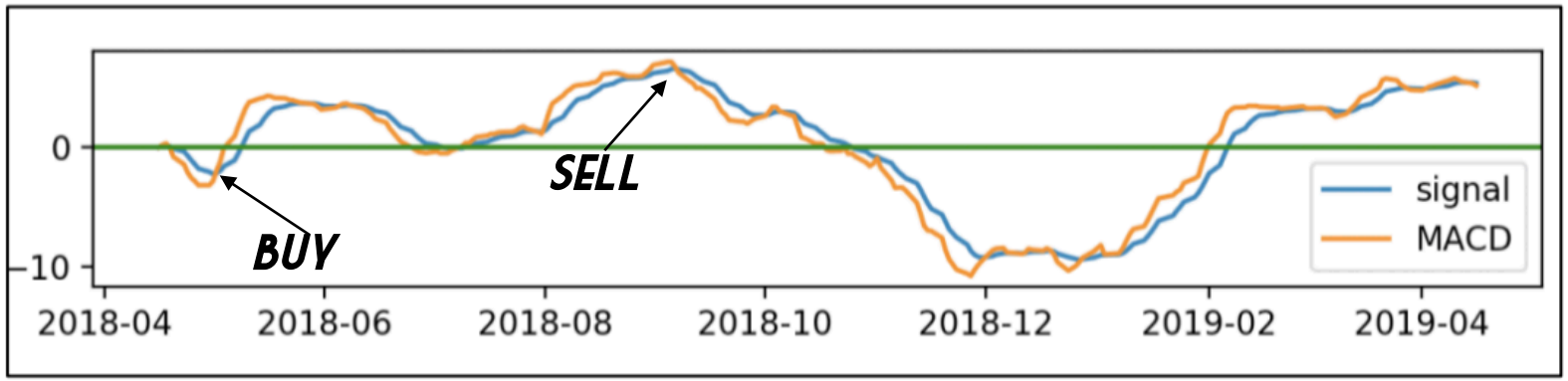
Standard parameters
14 days, 70 Upper Band, 30 Lower Band
Return per year
6.73%

MOVING AVERAGE CONVERGENCE DIVERGENCE (MACD)

- Trend following indicator
- The MACD shows the relationship between two moving averages
- MACD = 12 period EMA – 26 period EMA
- Signal = 9 Day EMA of MACD

STRATEGY

BUY	SELL
MACD line crosses above the signal line	MACD line crosses below the signal line

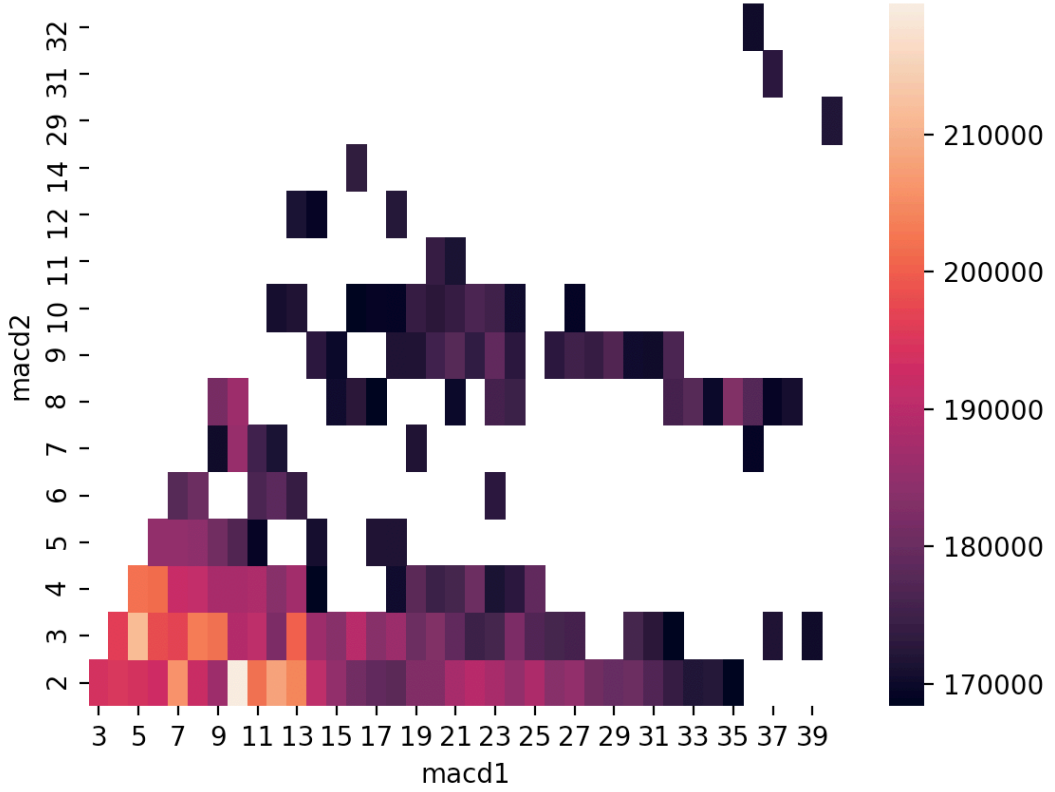


MACD graph for Apple stock for the past year with standard parameters

PARAMETER SELECTION FOR MACD

VARIABLES

1. 1st EMA Period
2. 2nd EMA Period



RESULT

Best parameters
1st EMA Period = 18
2nd EMA Period = 4
Return per year
7.94%

VS

Standard parameters
1st EMA Period = 12
2nd EMA Period = 26
Return per year
4.82%

SENTIMENT ANALYSIS: FINANCIAL NEWS – WHAT DOES IT MEAN?

CNBC MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV

For bull market doubters, this relatively safe dividend strategy has provided big returns

7 Hours Ago

For investors who believe the rally is just the decadelong bull run's last hurrah, here's how to play safe when the market gets choppy again.

Hot first-quarter economic growth number challenges Fed as it meets next week

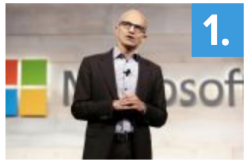
11 Hours Ago

Hotter-than-expected first-quarter growth is likely to revive the debate within the Fed about the direction of policy.

Kudlow says White House will be 'very aggressive' in China trade talks with US economy doing so well

14 Hours Ago

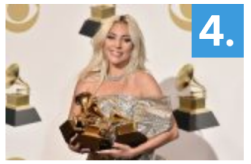
National Economic Council Director Larry Kudlow said Friday that the strength of the U.S. economy gives it leverage over China as the two countries try to iron out a trade deal.



1. If you invested $1,000 in Microsoft in 2009, here's how much money you'd have now

2. Daimler says it has no idea how Kim Jong Un got his limos

3. Walmart, Target shares tumble as Amazon announces one-day shipping for Prime members

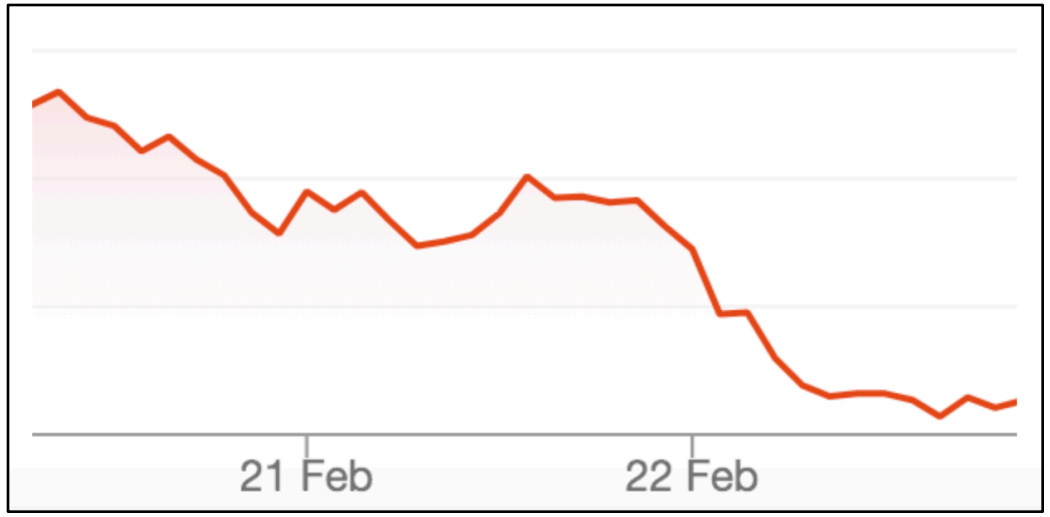


4. 9-time Grammy winner Lady Gaga went bankrupt and was $3 million in debt after her Monster Ball tour

5. Elon Musk makes deal with SEC not to discuss Tesla's

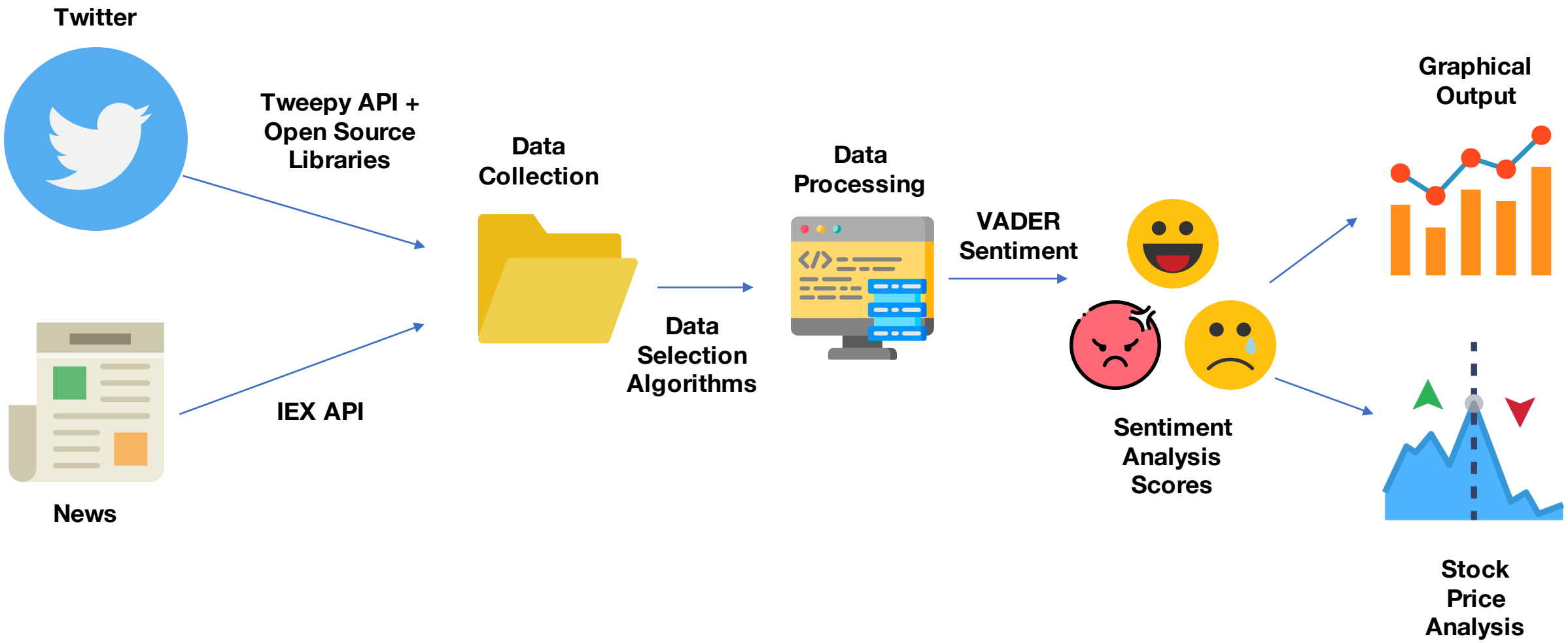
SENTIMENT ANALYSIS - A NEW AVENUE TO PREDICT STOCK PRICES?

-$1.3B



-$5.8B

SENTIMENT ANALYSIS WORKFLOW

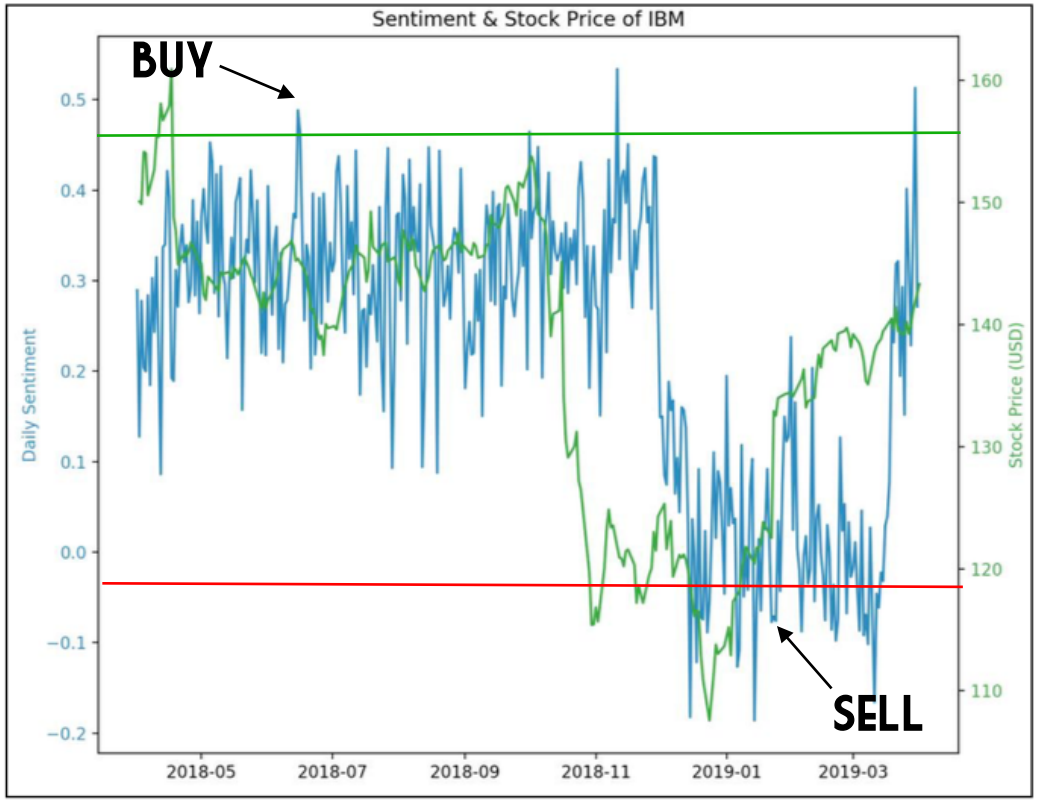


TWITTER ANALYSIS

Making predictions based on market sentiment derived from tweets

1. Collect tweets for all stocks
2. Process the data
3. Quantify the sentiment for each tweet to a value in the range -1 and 1
4. Calculate the average sentiment for each day
5. Compare today's sentiment to the Buy/ Sell thresholds for that stock
6. Make a suggestion based on the comparison

SENTIMENT ANALYSIS (TWITTER)



Representation of Twitter Sentiment and Stock Value for IBM Between 04/2018 and 04/2019

STRATEGY

BUY

Average Daily Sentiment is Greater than a Certain Threshold

SELL

Average Daily Sentiment is Smaller than a Certain Threshold

IBM Buy Threshold

0.46

IBM Sell Threshold

-0.02

PARAMETER SELECTION FOR TWITTER

VARIABLES

1. Buy Threshold
2. Sell Threshold

RANGE DETERMINATION

Average Tweet Sentiment = 0.0682
Standard Deviation = 0.1675
Positive Range = [0.1, 0.5]
Negative Range = [-0.22, 0.2]

(with Increments of 0.04)

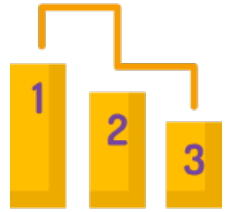
RESULT

Best threshold
Individual
Return per year
8.49%

COMPARATIVE ANALYSIS

To compare the effectiveness of indicators with each other for every stock in Dow Jones Index

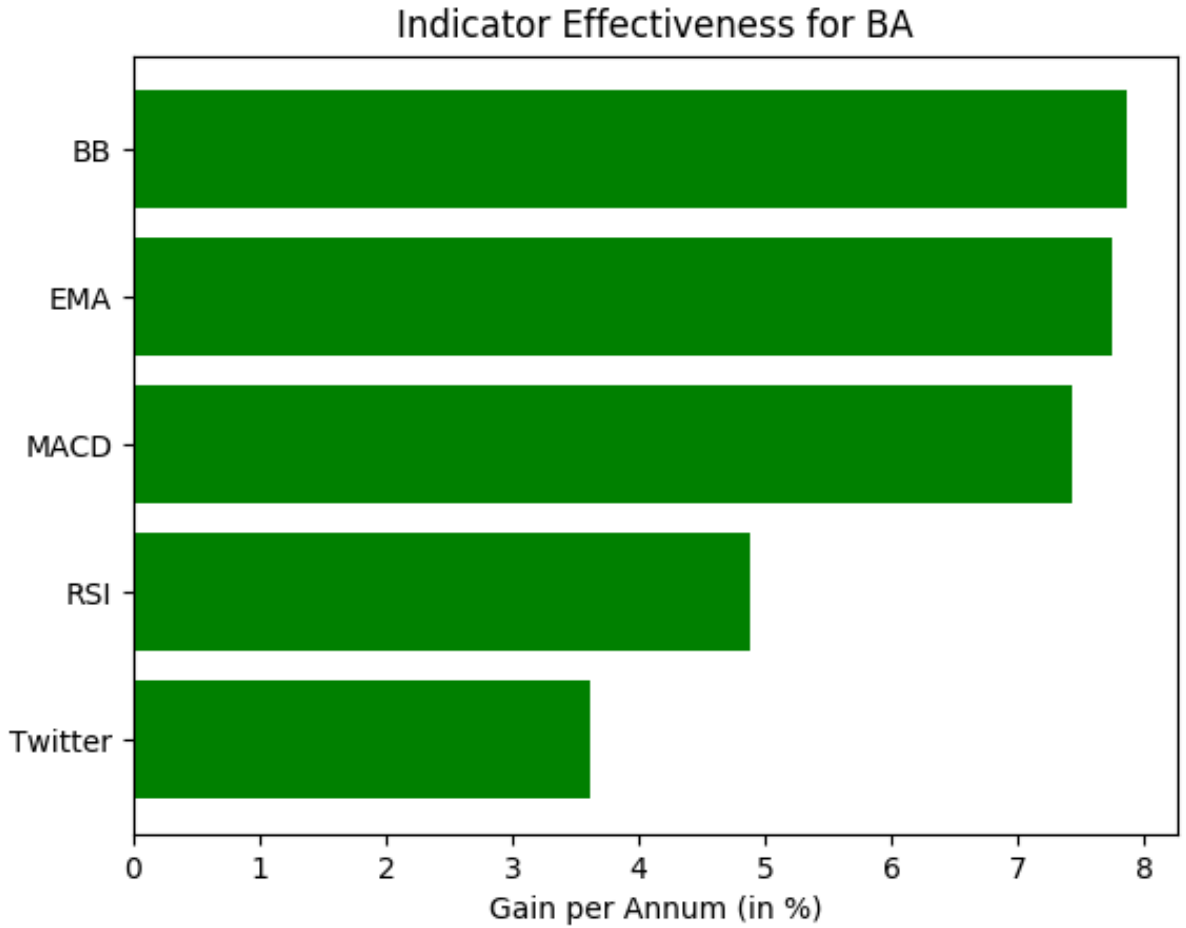
30 Stocks in Dow Jones → Calculate returns given by EMA, RSI, MACD, Bollinger Bands, and Twitter → Compare the returns and rank the indicators in descending order of returns → Ranking of indicators



COMPARATIVE ANALYSIS

Comparative analysis chart for **Boeing**:

- Bollinger Bands perform the best
- Marginal difference among top 3
- Twitter analysis performed the worst

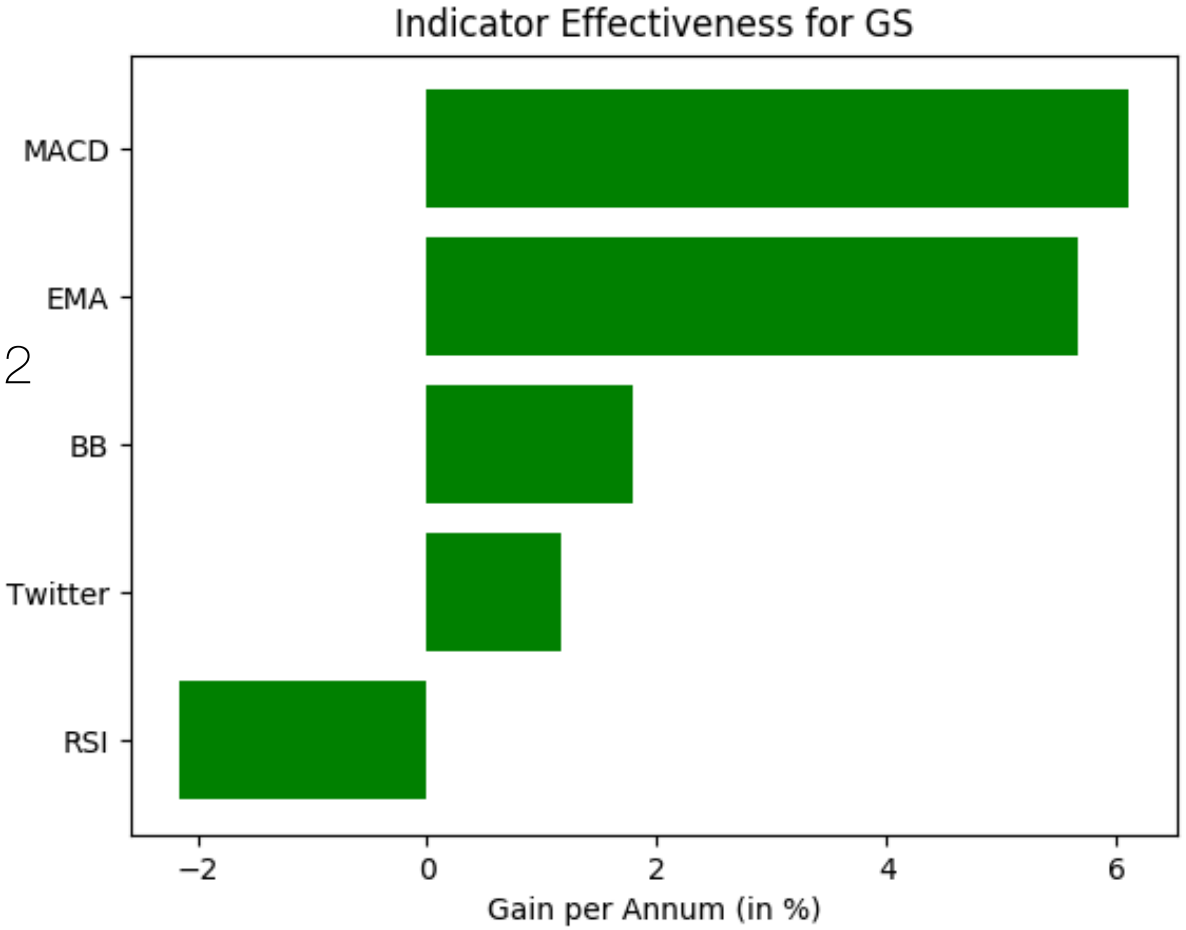


COMPARATIVE ANALYSIS

Comparative analysis chart for

Goldman Sachs:

- MACD perform the best
- Marginal difference between the top 2
- RSI gives negative return

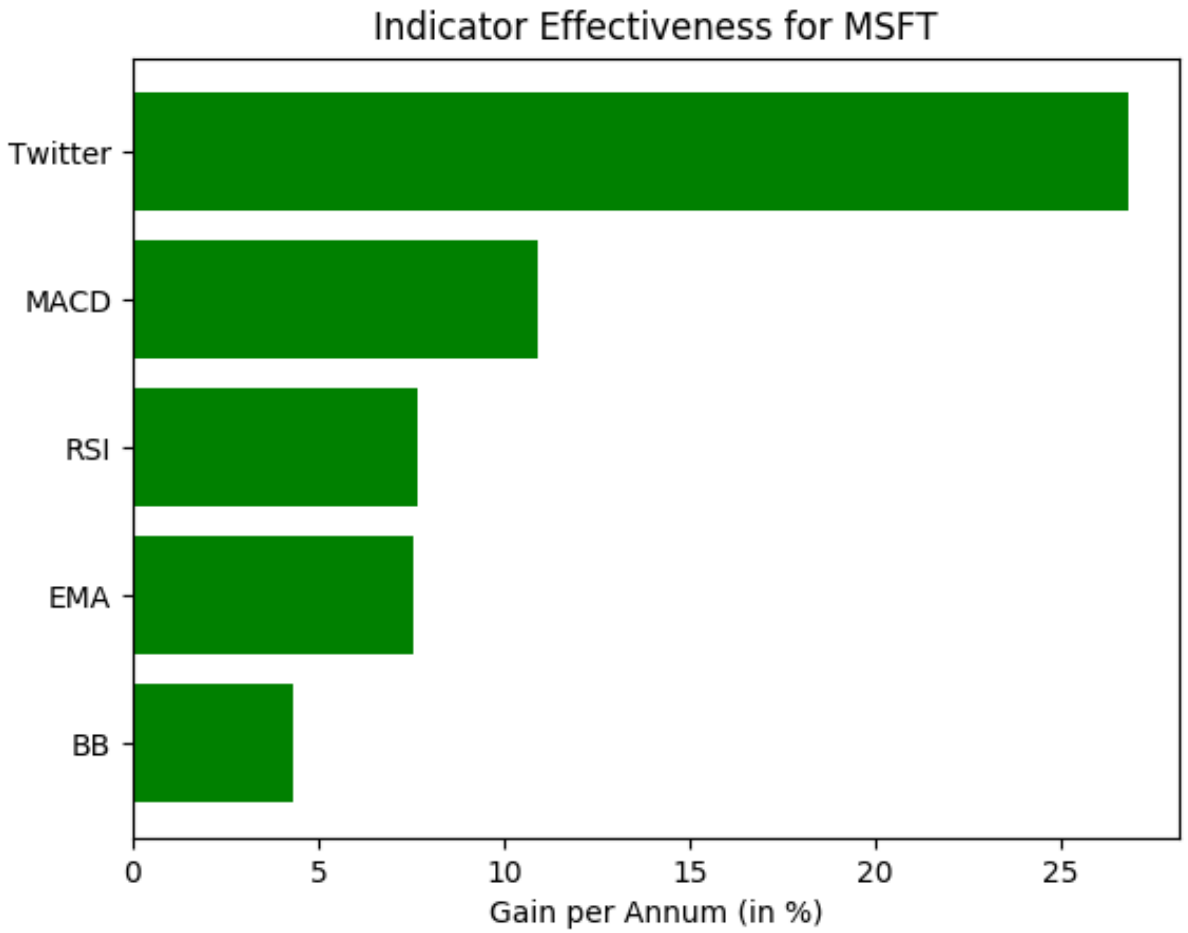


COMPARATIVE ANALYSIS

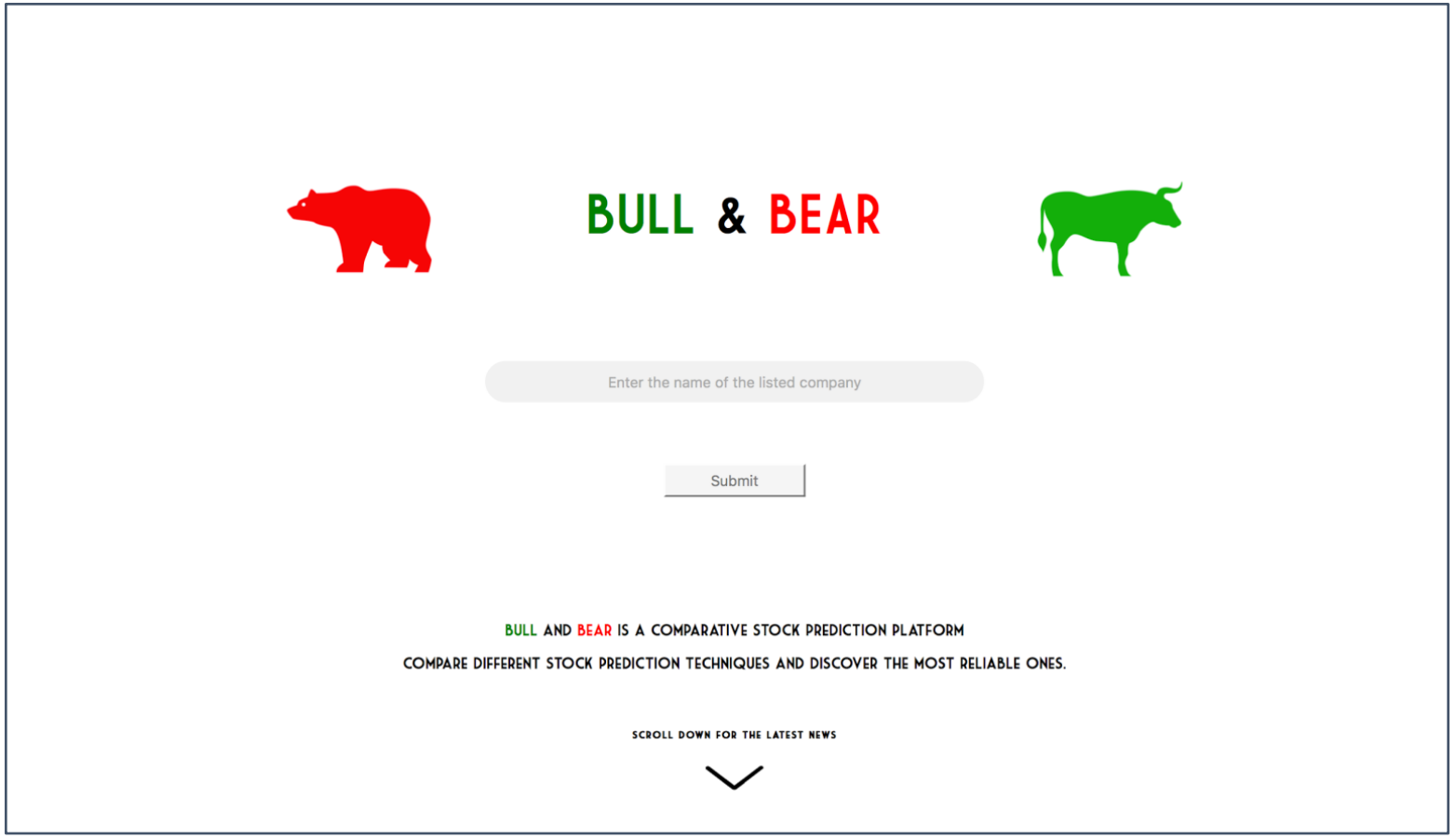
Comparative analysis chart for

Microsoft:

- Twitter analysis perform the best, way better than all the technical indicators
- Bollinger bands performed the worst



DEMO

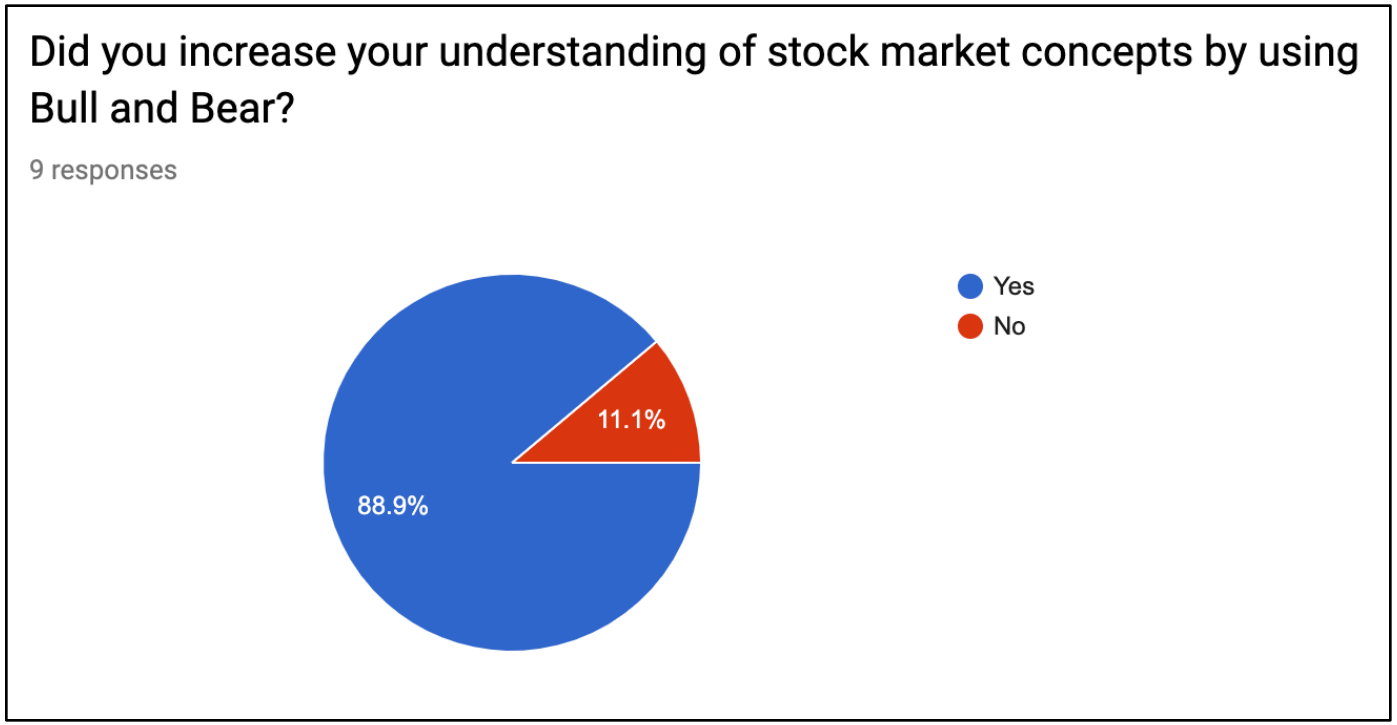

BULL & BEAR
Enter the name of the listed company
Submit
BULL AND BEAR IS A COMPARATIVE STOCK PREDICTION PLATFORM
COMPARE DIFFERENT STOCK PREDICTION TECHNIQUES AND DISCOVER THE MOST RELIABLE ONES.
SCROLL DOWN FOR THE LATEST NEWS

USER TESTING AND RESULTS

45% Respondents had never invested in the stock market

77% Respondents were not confident in making investment decisions

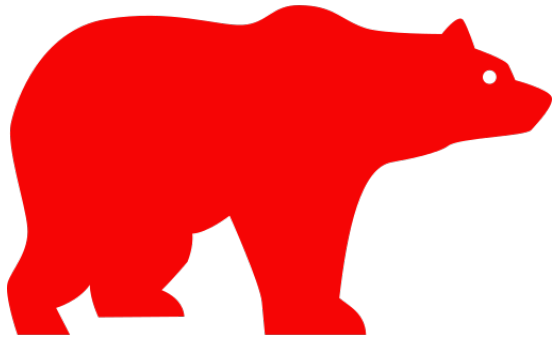
Majority response towards design - **GREAT** - Majority response towards ease of use

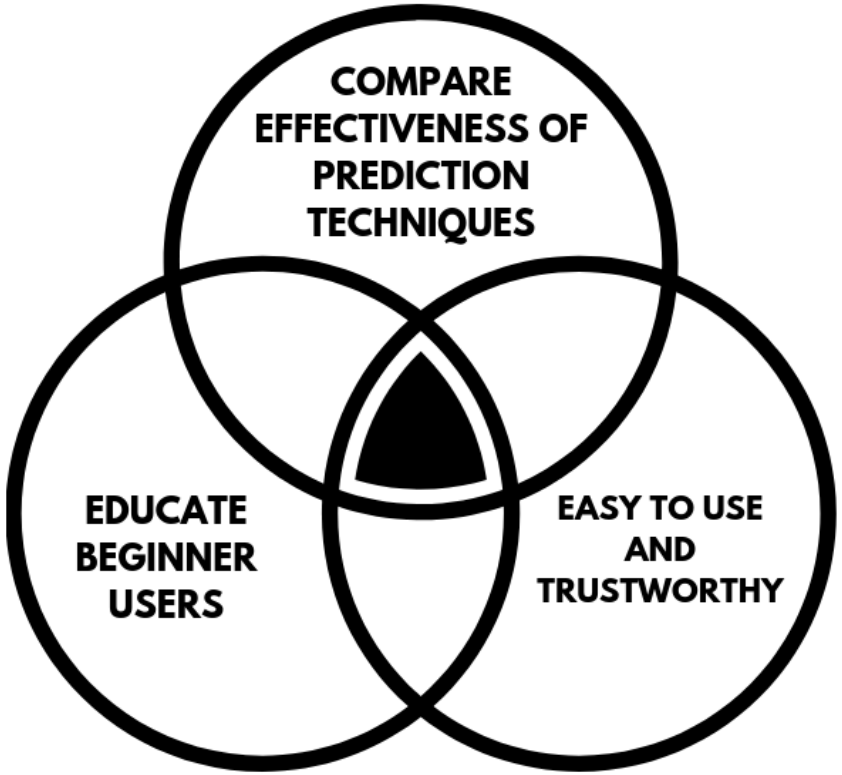


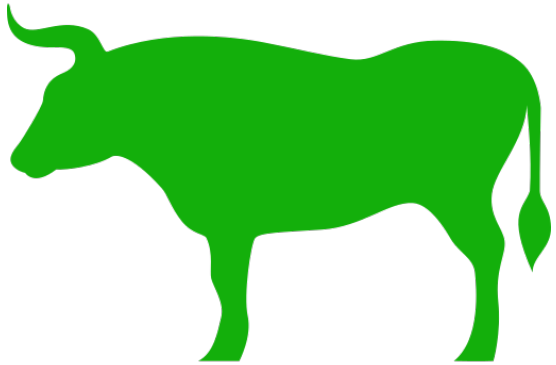
KEY TAKEAWAYS

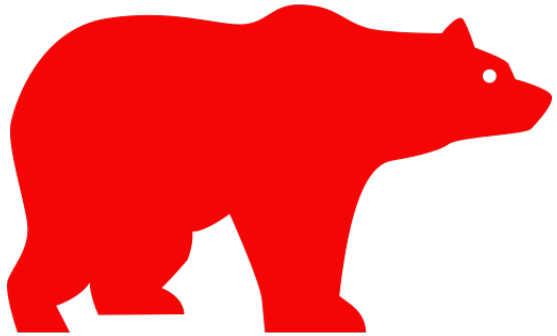
- Parameters for indicators can be customized to improve returns
- Effectiveness of each indicator is different for different stocks
- Sentiment analysis proves to be a new and exciting way to predict prices in the future
- Simple design interface makes the user more confident in understanding difficult concepts

BULL AND BEAR

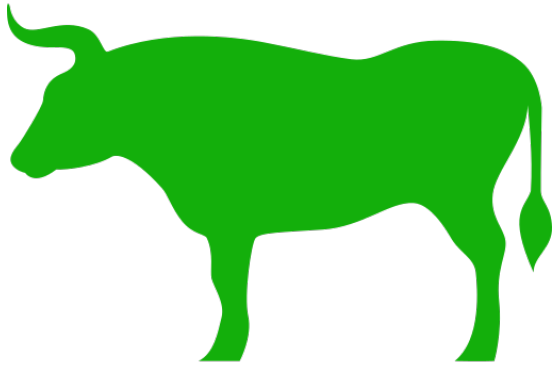








BULL AND BEAR



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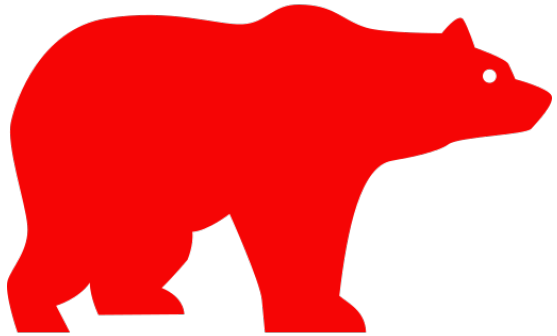
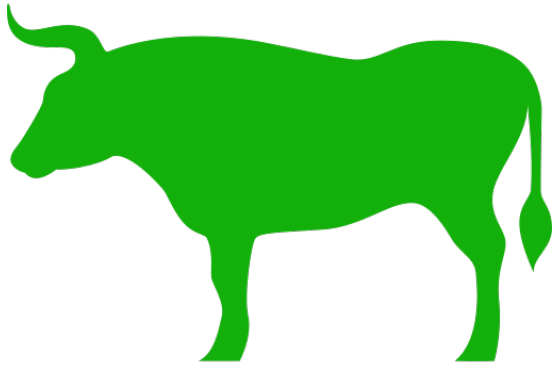


BULL AND BEAR



APPENDIX

EMA RESULTS BACKTEST RESULTS

Period of Time	Average Return over 13 years	Percentage Return Per Year
20 days	$117,889.98	6.17%
50 days	$157,707.95	7.55%
100 days	$209,758.22	9.09%

BOLLINGER BANDS BACKTEST RESULTS

Period of time	Standard Deviation	Average return over 13 years	Percentage return per year
20 days	2	$143,155.40	7.07%
50 days	2	$104,196.06	5.65%

RSI CALCULATION

- **RSI = 100 – 100 / (1 + RS)**
- RS = Relative Strength = AvgU / AvgD
- AvgU = average of all up moves in the last N price bars
- AvgD = average of all down moves in the last N price bars
- N = the period of RSI

SENTIMENT ANALYSIS TWITTER - HYPOTHESIS

An Analysis Method that uses Backtested Parameters in order to Maximise Gains

Stock	Correlation 1	Correlation 2
IBM	-0.0319	-0.0593
BA	0.0057	-0.0156
MSFT	0.0343	0.0016
GS	-0.0411	0.0389
CSCO	0.0187	0.0326
CAT	-0.0155	-0.0151
CVX	-0.0164	-0.032
DOW	-0.0451	0.0538
XOM	0.0402	-0.0045
HD	-0.0035	0.0017
INTC	0.0082	-0.0093
JPM	-0.0135	-0.02055
MCD	0.0383	0.0099
MRK	-0.0427	0.01524
PFE	0.0053	0.0518
PG	0.0272	-0.0014
TRV	0.0302	-0.0304
UNH	0.0427	-0.0047
WBA	-0.0156	0.0246
AVE	0.001342105263	0.001962631579

Correlation Table
Correlation 1: Sentiment Difference vs Stock Price
Correlation 2: Average Sentiment vs Stock Price

STRATEGY

$$Suggestion_{today} = (\overline{Sentiment}_{yesterday} - \overline{Sentiment}_{today})$$

REVISED STRATEGY

Suggestion Based on Daily Average Sentiment

STOCK EXCLUSION FOR TWITTER

Excluded Stock	Reason
COCA COLA	- Irrelevant Tweets - Extremely Large Dataset - Slows Down Program
NIKE	
APPLE	
WALMART	
VERIZON	
AMERICAN EXPRESS	Less than 10K tweets, not enough to make qualitative analysis
UNITED TECH	
JNJ	
3M	Confused with '3 Million'
VISA	Confused with 'Travel Visa'

CHALLENGES FACED

- Finding suitable tweets for sentiment analysis
- Finding enough news articles for sentiment analysis
- Realistic back testing of technical indicators

LIMITATIONS

- Transaction charges ignored while backtesting the indicators
- Past performance does not guarantee future returns
- Sentiment Analysis as of today is unable to detect sarcasm, idioms etc.
- Tweets for sentiment analysis are not completely reliable

COMPARISON WITH OTHER APPS