



**Alpa  
Sheladia**



**Will Turner**

# Arbetrade

Algoethmic Trading Platform

**Machine Learning Models To  
Predict Future Stock Movement**



# Algorithmic Trading

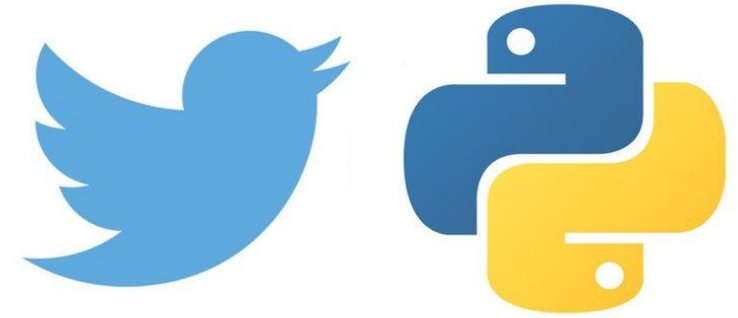
## Objective:

- Using NLP / Logistic Regression to Predict Future Stock Movement
- Program that allows a user to choose a stock from the S&P 500 or VIX to run a logistic regression model to predict the price movement of particular stock's on the future trade based on current sentiments of Reuters news articles related to that organization.
- This platform performs data training using various models to provide best analysis to help traders decide whether to buy or sell the stock or simply just hold on for now.

# News API



YAHOO!  
FINANCE



Google  
Finance



Bloomberg



iex  
cloud



REUTERS

VIX (Chicago Board Options Exchange), SPY S&P500 (The SPDR S&P 500 Trust ETF), news  
Articles from NewsAPI, and Tweets from twitter API

# Data Collections

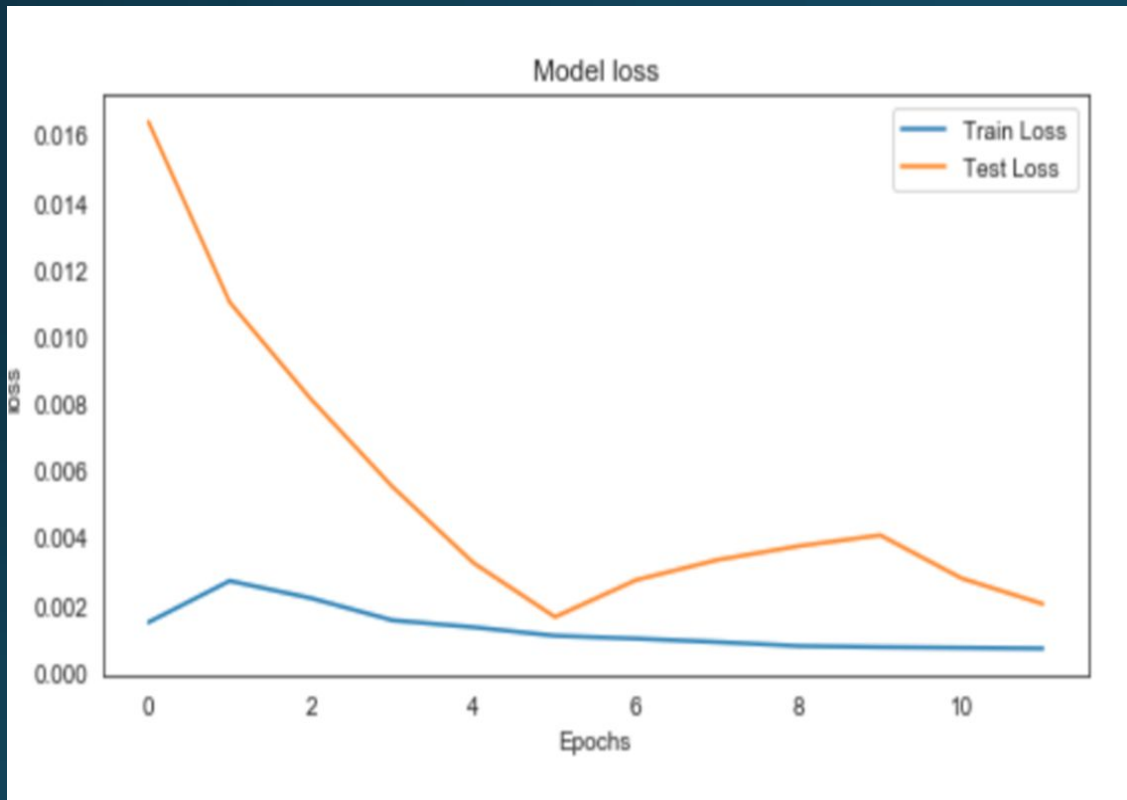


# Multi Model Utilization for Time Series Prediction ( SPY & VIX)

- Load Data.
- Define Keras Model.
- Compile Keras Model.
- Fit Keras Model.
- Evaluate Keras Model.
- Tie It All Together.
- Make Predictions
- Tune the Model
- Save the Model
- Summarize the Model
- Separate Train and Test Datasets
- Plot Learning Curves
- Learn a New Dataset
- Use Functional API



# Overfitting/Underfitting Goldilocks Model



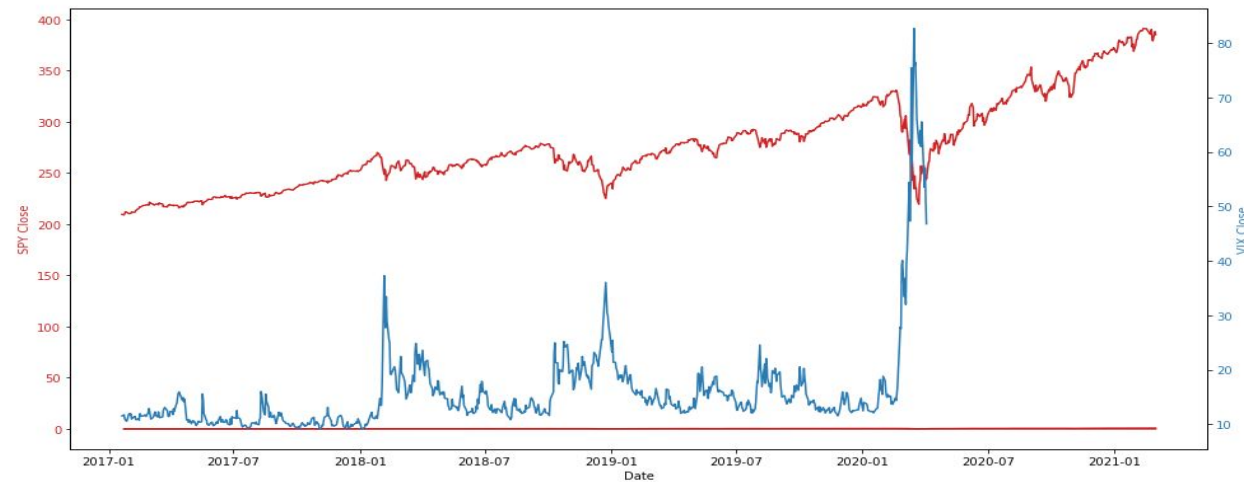
SPY Close	
SPY Close	1.000000
Daily Returns	0.016913
Cumulative Returns	1.000000
VIX Close	0.020031
SPX 1M 25DP Vol BVOL INDEX	0.055138
SPX 1M 25DC Vol BVOL INDEX	0.042125
SPX 1M 100 Vol BVOL INDEX	0.054247
P/C Ratio	0.095845
P/C Spread	0.078251
P/ATM Ratio	0.032382
P/ATM Spread	0.053968
ATM/C Ratio	0.119789
ATM/C Spread	0.095295
FICC_Spread	-0.417186
TEDSPREAD	-0.009074
Gold_Close	0.617284
Delta_10Y2Y	-0.892567
10Y_Yield	0.016433
Delta_10Y3M	-0.906892

# SPY and VIX Data Visualization

```
[11]: # Combine SPY & VIX Dataframes
all_data = pd.concat([spy_data, vix_data],axis="columns", join="inner")
all_data.head()
```

```
[11]:
```

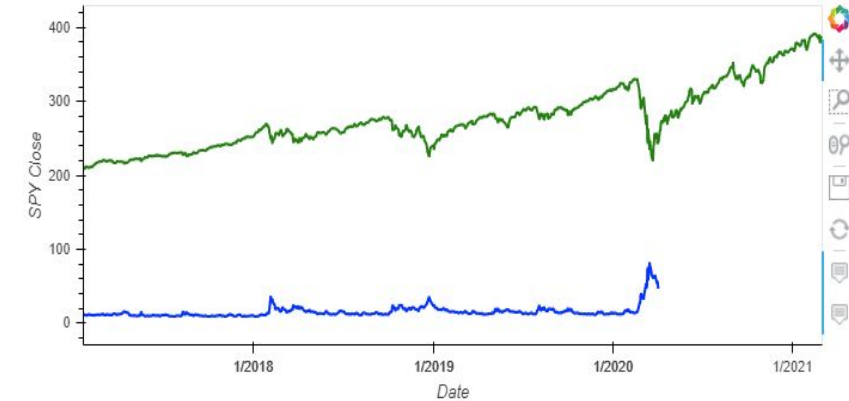
	SPY Close	Daily Returns	Cumulative Returns	VIX Close
Date				
2017-01-20	212.961365	NaN	NaN	11.54
2017-01-23	212.407181	-0.002602	-0.002602	11.77
2017-01-24	213.769119	0.006412	0.003793	11.07
2017-01-25	215.619400	0.008656	0.012481	10.81
2017-01-26	215.394012	-0.001045	0.011423	10.63



Overlay Chart of SPY and VIX

	SPY Close	Daily Returns	Cumulative Returns	VIX Close
Date				
2017-01-20	209.600113	NaN	NaN	11.54
2017-01-23	209.054703	-0.002602	-0.002602	11.77
2017-01-24	210.395096	0.006412	0.003793	11.07
2017-01-25	212.216156	0.008655	0.012481	10.81
2017-01-26	211.994339	-0.001045	0.011423	10.63

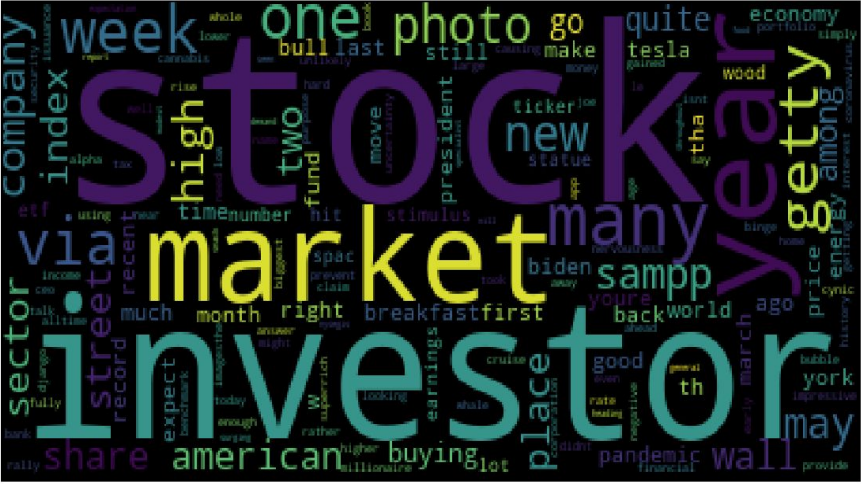
```
spy_data.hvplot.line(x='Date', y='SPY Close',
                    line_color="green") * vix_data.hvplot.line(
    x='Date', y='VIX Close', line_color="blue")
```



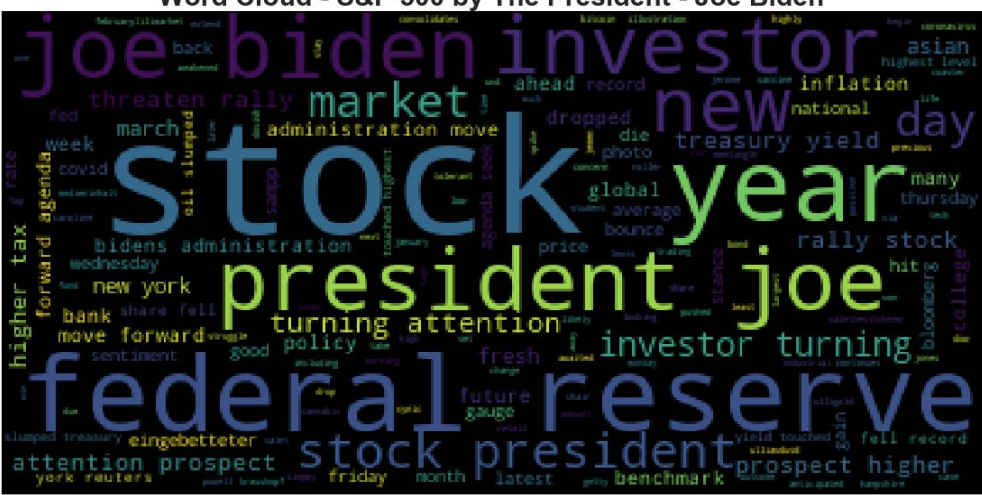
Closing data of SPY vs. VIX

# Sentiment Analysis

Word Cloud - S&P 500



Word Cloud - S&P 500 by The President - Joe Biden



SP500 Compound	SP500 Negative	SP500 Neutral	SP500 Positive
0.296	0.0	0.954	0.046
0.250	0.0	0.953	0.047
0.296	0.0	0.942	0.058
0.296	0.0	0.947	0.053
0.000	0.0	1.000	0.000

Date	Biden Compound	Biden Negative	Biden Neutral	Biden Positive	Biden Text	Biden Tokens
0 2021-03-20 13:21:46	-0.4588	0.081	0.919	0.000	blackrock ceo larry fink at a conference in ne...	[blackrock, ceo, larry, fink, conference, new, ...]
1 2021-03-20 13:21:46	-0.5106	0.178	0.777	0.045	on the whole, i would rather live in a society...	[whole, would, rather, live, society, run, cyn...
2 2021-03-20 12:45:00	0.4767	0.085	0.782	0.133	the year 2020 was a good one for cannabis stoc...	[year, good, one, cannabis, stock, looking, ev...
3 2021-03-20 10:45:00	-0.3252	0.062	0.938	0.000	it isn't a popular time to be buying up corona...	[isnt, popular, time, buying, coronavirus, sto...
4 2021-03-20 05:40:11	-0.1027	0.071	0.870	0.060	new york: investors are turning their attentio...	[new, york, investor, turning, attention, pros...

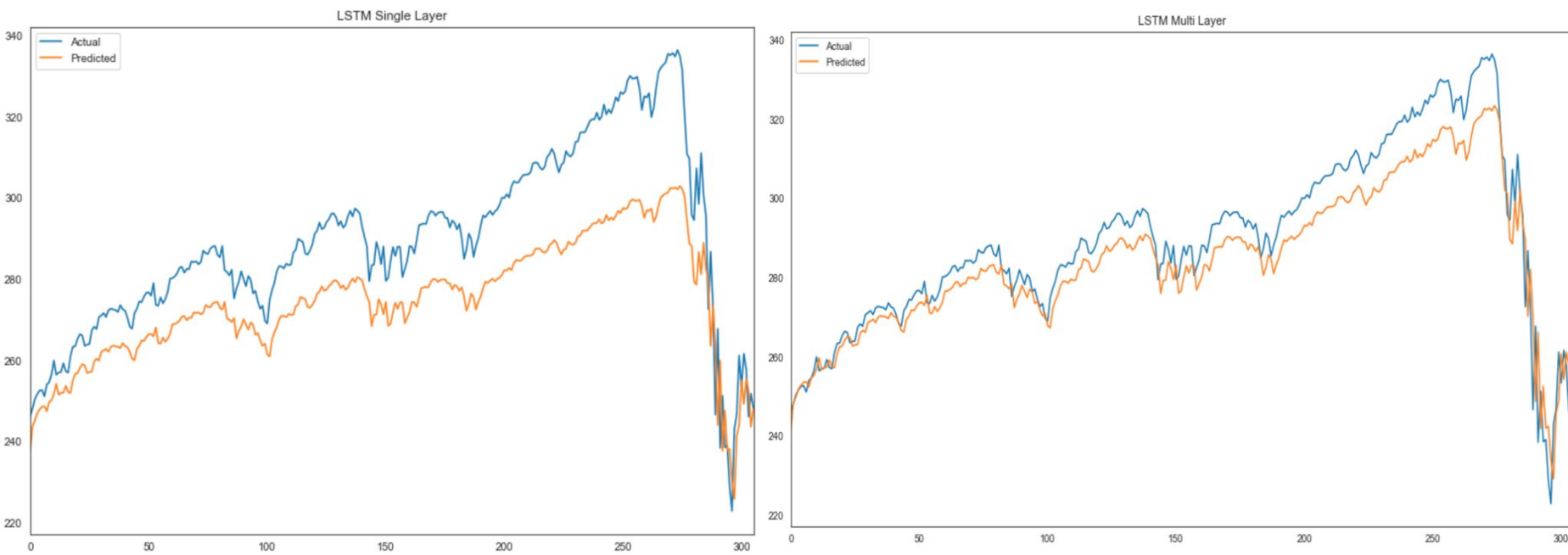
S&P 500 NER  
investors have modest expectations heading into general mills (nyse:gid) earnings report on  
pandemic. L... [3196 chars] photo by phonilaipphoto/stock via getty images  
there is a lot to celebrate in the real economy right now, president biden signed the \$1.9 trillion MONEY stimulus package, and the majority of AMERICAN NOOP how... [+6940 chars] wood expects tesla to  
hit \$ 3,000 MONEY a share in 2025 DATE , that means wood expects to earn  
about 50% PERCENT a year on average between now and 2025 DATE based on tesla (ticker: tsla) friday DATE  
closing price of \$ 654.87 MONEY a sha... [+2540 chars] the "fearless girl" statue faces wall street's charging bull statue in new york (ap photo/mark... [+1140 chars]  
associated press  
im sure you're familiar with the term spac - it's everywhere. in 2020 DATE ... [+5758 chars] numbers written with cistercian numerals, from left to right: 1 CARDINAL in units place, 2 CARDINAL in tens  
place ( 20 CARDINAL ), 3 CARDINAL in hundreds CARDINAL place ( 300 CARDINAL ), 4 CARDINAL in thousands CARDINAL place ( 4,000 CARDINAL ), then compound numbers 5,555  
CARDINAL , 6,789 CARDINAL , 9,39... [+6558 chars] the energy sector is on fire this year DATE , the energy select sector spdr etf, an exchange-traded fund (etf) that tracks 23 CARDINAL energy stocks  
in the s&amp;pp 500 CARDINAL index, is up (more than 35% PERCENT so far in 2021 DATE , tha... [+5456 chars] a little over two years ago, DATE , i first ORDINAL shared my list of  
"recommended funds" for my online readers. prior to that time, i presented a quarterly DATE model portfolio showing quite a few stock and bond funds ... [+13019 chars] photo by avosb/stock via getty  
images  
co-produced with beyond saving  
as income investors, our primary goal is to invest in companies that can provide us first ORDINAL with a reliable income today DATE , and se... [+9429 chars] the year 2020 DATE turned out to be  
quite impressive for most stock investors, especially so for passive investors. if you were fully invested simply in the s&amp;pp 500 CARDINAL , well, you did quite well. the fir... [+14592 chars] blackrock ceo  
larry fink at a conference in new york in 2017(lucas CARDINAL , jackson/reuters)  
the week of march 15 DATE , eigs new clothes, tax troubles ahead, inflation ahead (or not) and much, much more on the wh... [+45822 chars] on the whole, i would rather live in a society was run by cynics  
than by saintcynics tend to be less intrusive, however, when cynics pretend to be saints, they are playing a dangerous game. as many ... [+45103 chars] listen on the go l daily DATE podcast of wall street  
breakfast's alpha talks will be available this morning TIME on seeking alpha, tunes, etcher and spotify.

blackrock ceo larry fink at a conference in new york in 2017(lucas CARDINAL , jackson/reuters)  
the week of march 15 DATE , eigs new clothes, tax troubles ahead, inflation ahead (or not) and much, much more on the wh... [+45822 chars] on the whole, i would rather live in a society was run by cynics  
than by saintcynics tend to be less intrusive, however, when cynics pretend to be saints, they are playing a dangerous game. as many ... [+45103 chars] listen on the go l daily DATE podcast of wall street  
breakfast's alpha talks will be available this morning TIME on seeking alpha, tunes, etcher and spotify.  
... das lebensalter einer jemenitischen frau wie jemens alte ordnung die hoffnungen auslöschte können europäische rüstungsunternehmen für krieg... [+119228 chars] investors are turning their attention to  
prospects that higher taxes could threaten the rally in us stocks as president joe biden's administration moves forward with its agenda and seeks ways to pay ... [+4088 chars] alabama  
montgomery: two CARDINAL alabama national guard-staffed mobile vaccination units will begin canvassing counties in the black belt and wiregrass regions next week DATE in an effort to expand  
covid-19 PERSON inocu... [+63884 chars] by lewis krauskopf and caroline valatevitch  
new york (reuters) - investors are turning their attention to prospects that higher taxes could threaten the rally in us stocks as president joe biden... [+4151 chars] new york: investors are turning their  
attention to prospects that higher taxes could threaten the rally in us stocks as president joe biden's administration moves forward with its agenda and seeks ways to pay ... [+4088 chars] alabama  
montgomery: two CARDINAL alabama national guard-staffed mobile vaccination units will begin canvassing counties in the black belt and wiregrass regions next week DATE in an effort to expand  
covid-19 PERSON inocu... [+63884 chars] by lewis krauskopf and caroline valatevitch  
new york (reuters) - investors are turning their attention to prospects that higher taxes could threaten the rally in us stocks as president joe biden's administration moves forward with its agenda and seeks ways to pay ... [+4088 chars] alabama  
montgomery: two CARDINAL alabama national guard-staffed mobile vaccination units will begin canvassing counties in the black belt and wiregrass regions next week DATE in an effort to expand  
covid-19 PERSON inocu... [+63884 chars] by lewis krauskopf and caroline valatevitch

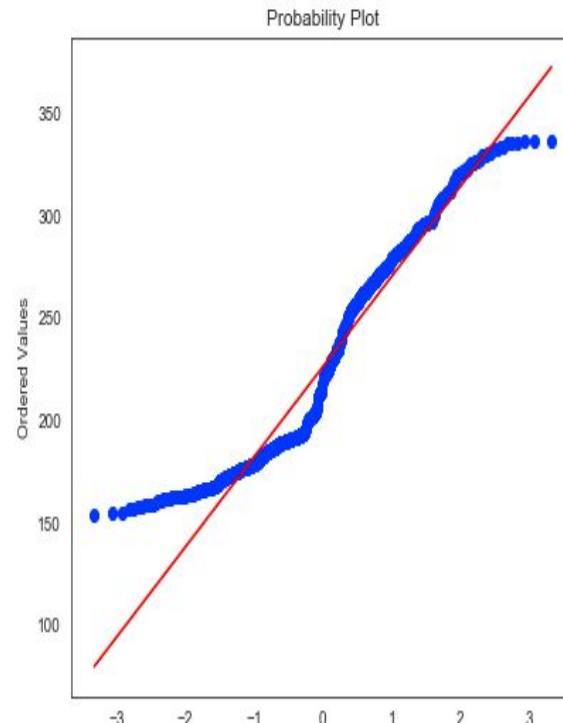
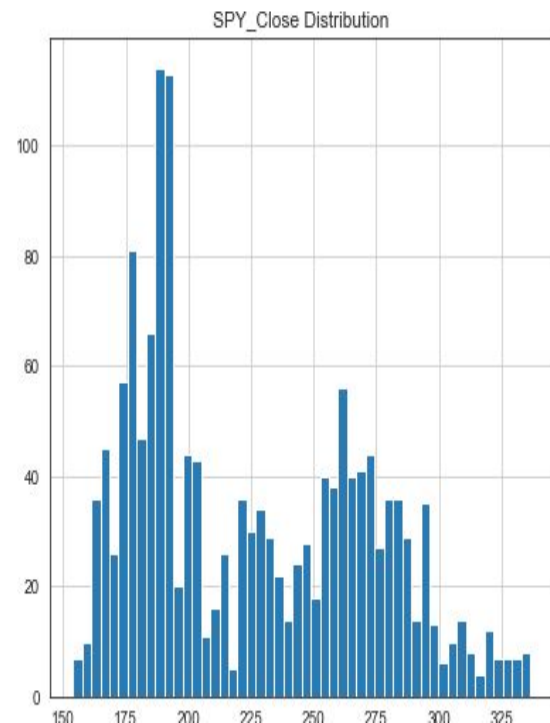
Word Cloud S&P 500

Word Cloud  
President Joe Biden





Single Layer – LSTM



	Actual	Predicted
0	186.141541	189.222046
1	186.802124	188.892502
2	188.449036	189.217590
3	186.177689	190.028595
4	185.752426	188.910294

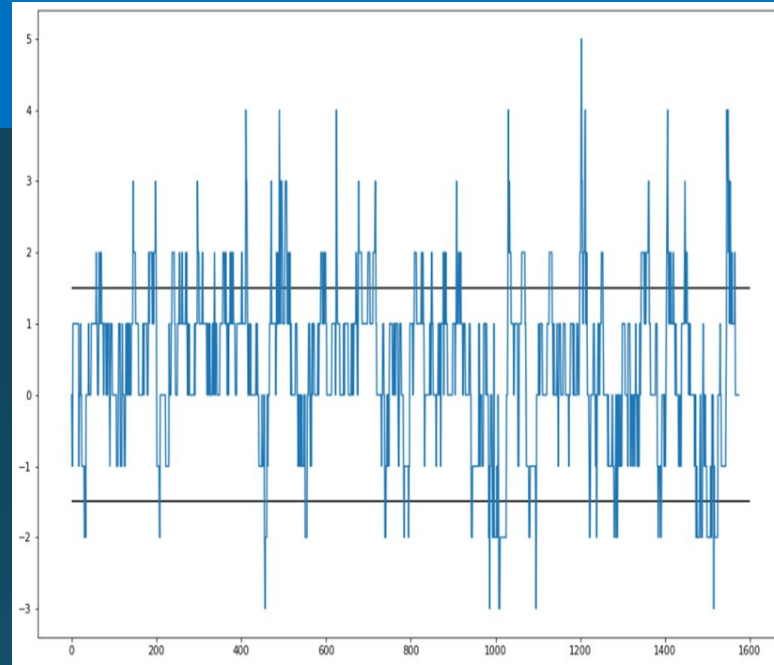
Multi- Layer - LSTM

# Trading Signals as Input Data

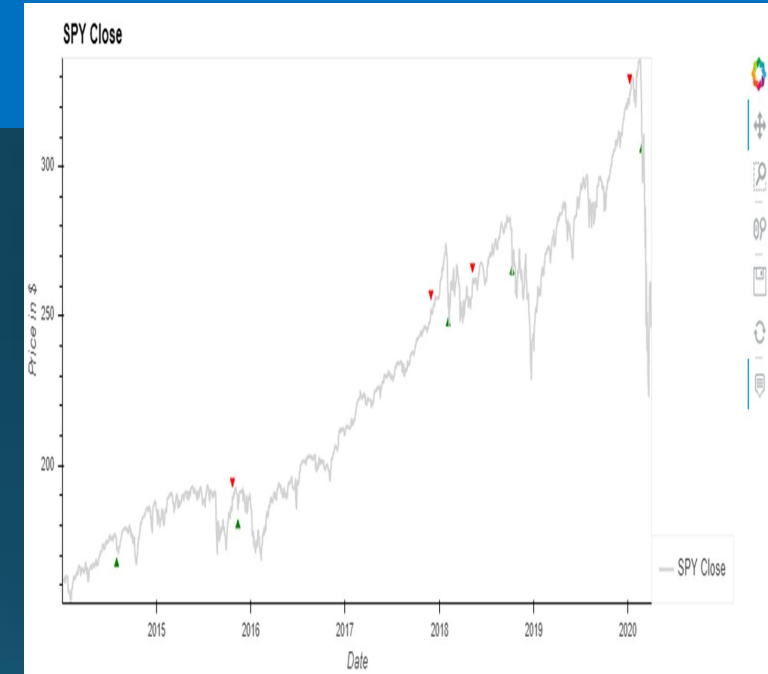
	RSI Signal	bollinger_signal	MACD Signal	SMA Signal	CCI Signal
0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	-1.0	0.0	0.0
2	0.0	0.0	-1.0	0.0	0.0
3	0.0	0.0	1.0	0.0	0.0
4	0.0	0.0	1.0	0.0	0.0
...	...	...	...	...	...
1570	0.0	0.0	-1.0	1.0	0.0
1571	0.0	0.0	-1.0	1.0	0.0
1572	0.0	0.0	-1.0	1.0	0.0
1573	0.0	0.0	-1.0	1.0	0.0
1574	0.0	0.0	-1.0	1.0	0.0

1575 rows × 5 columns

Signals

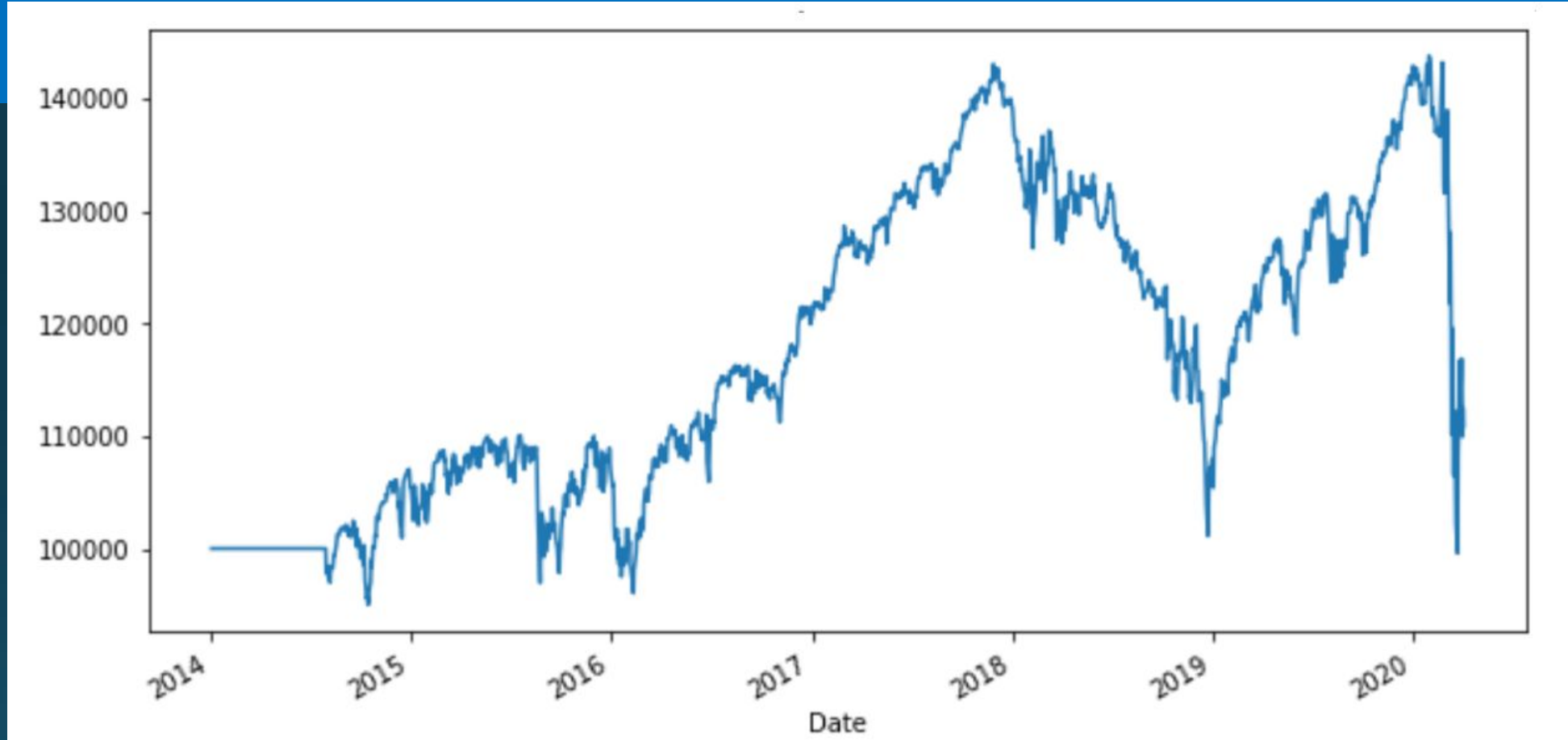


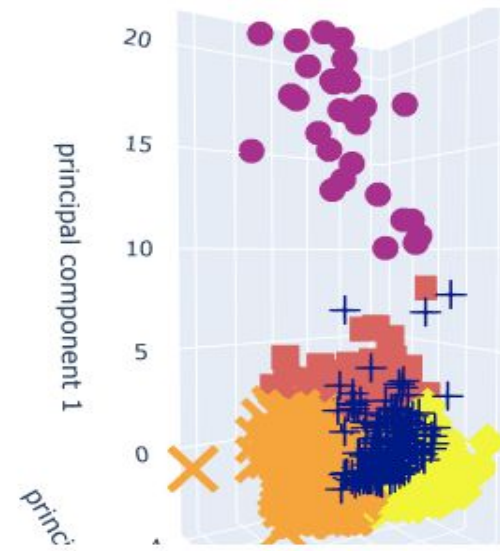
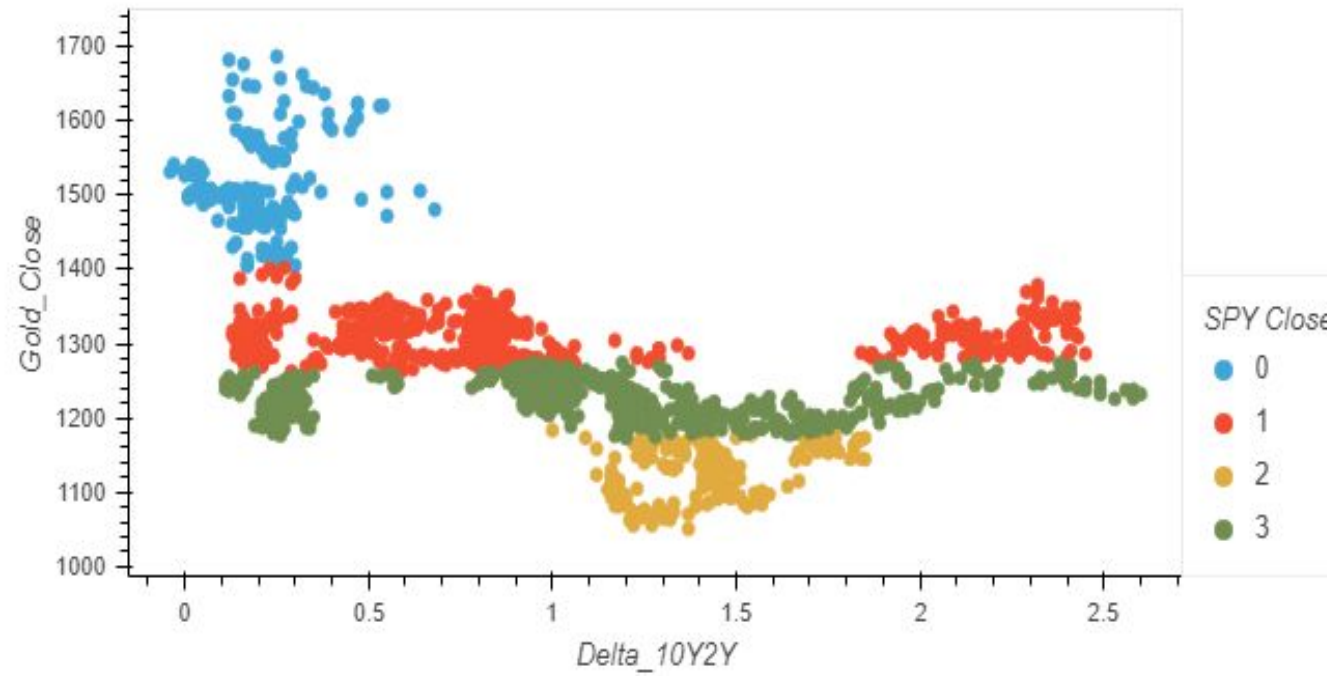
Generating  
Signals



Buy/Sells

# Profit & Loss

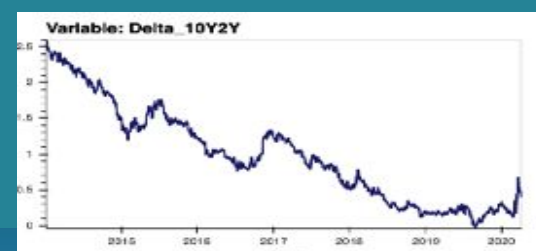
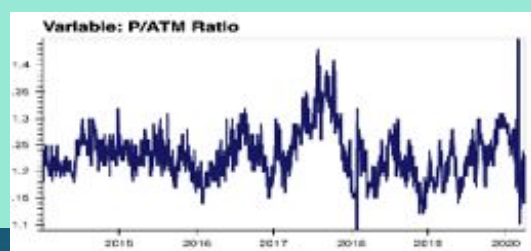
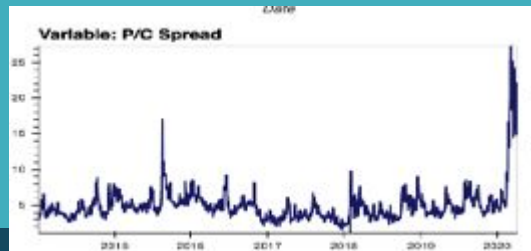
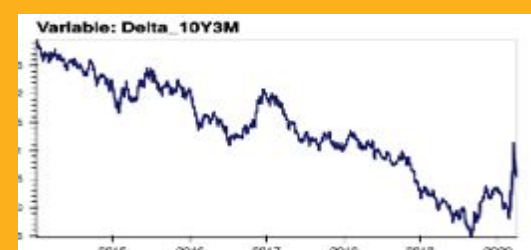
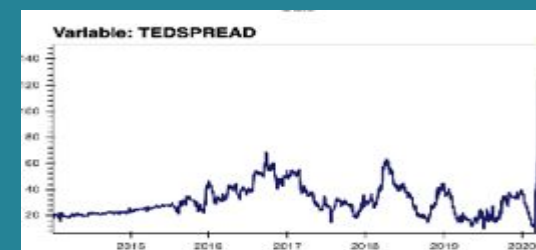
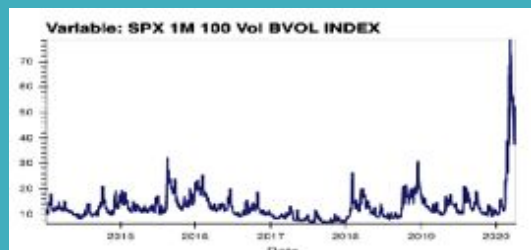
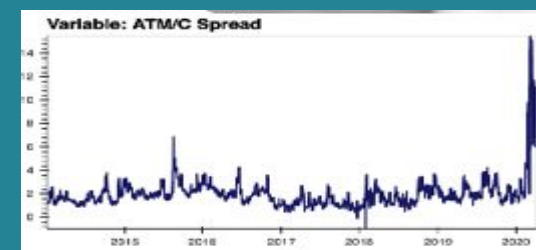
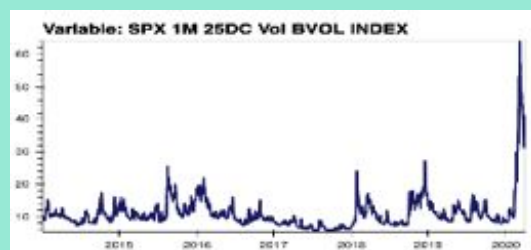
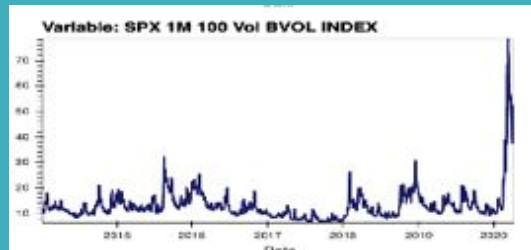
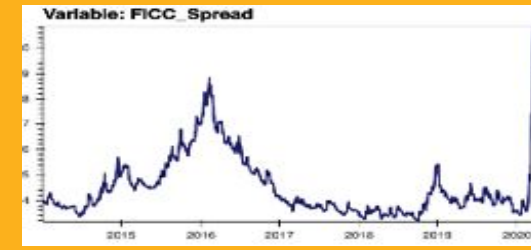
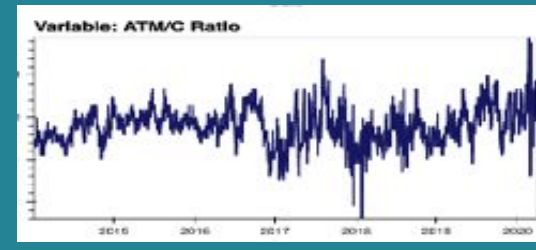
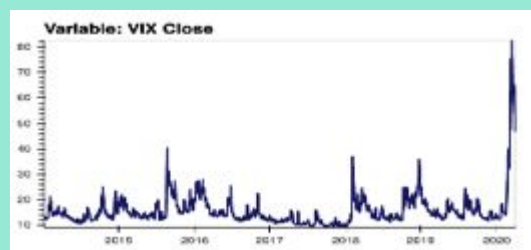
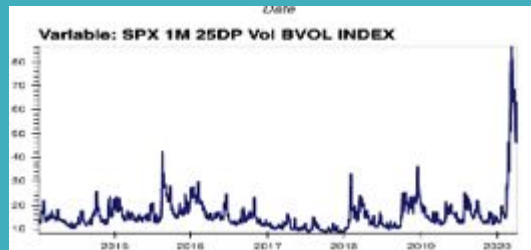




# K-means and Initialized 3D-Kmean



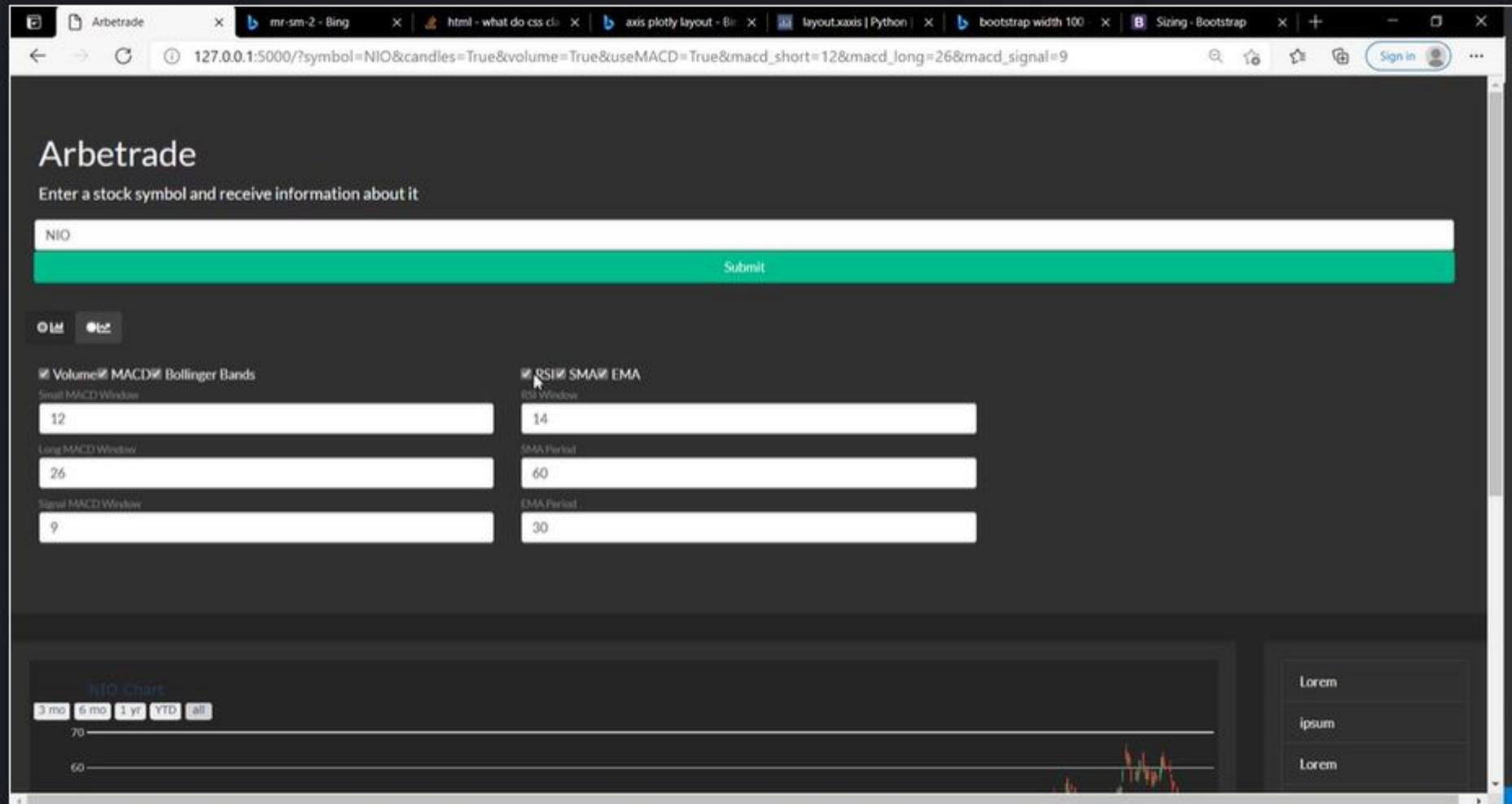
# Economic Data

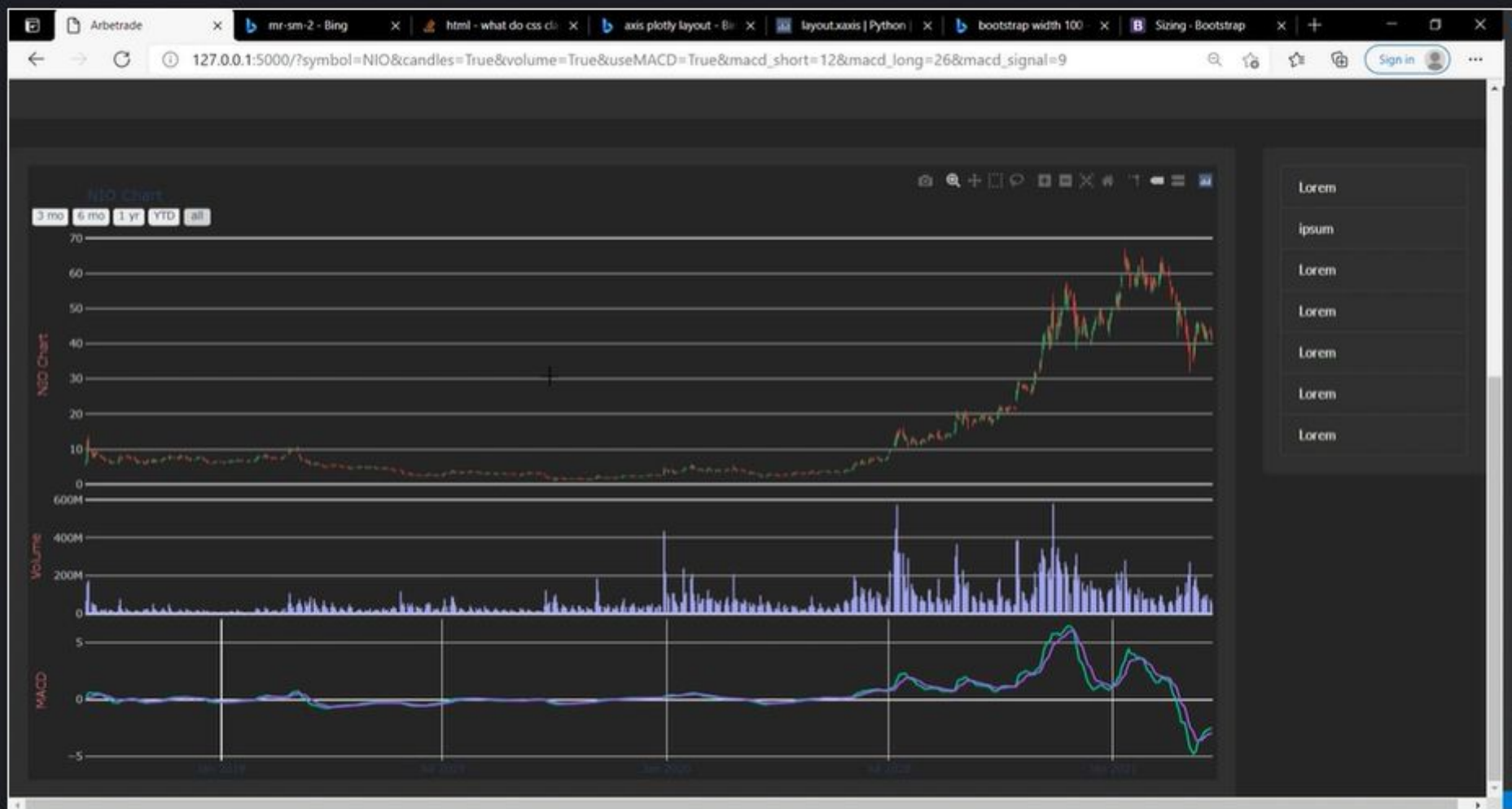


Web-Based Front End Dashboard

<http://britter.ml:5001>

# FrontEnd





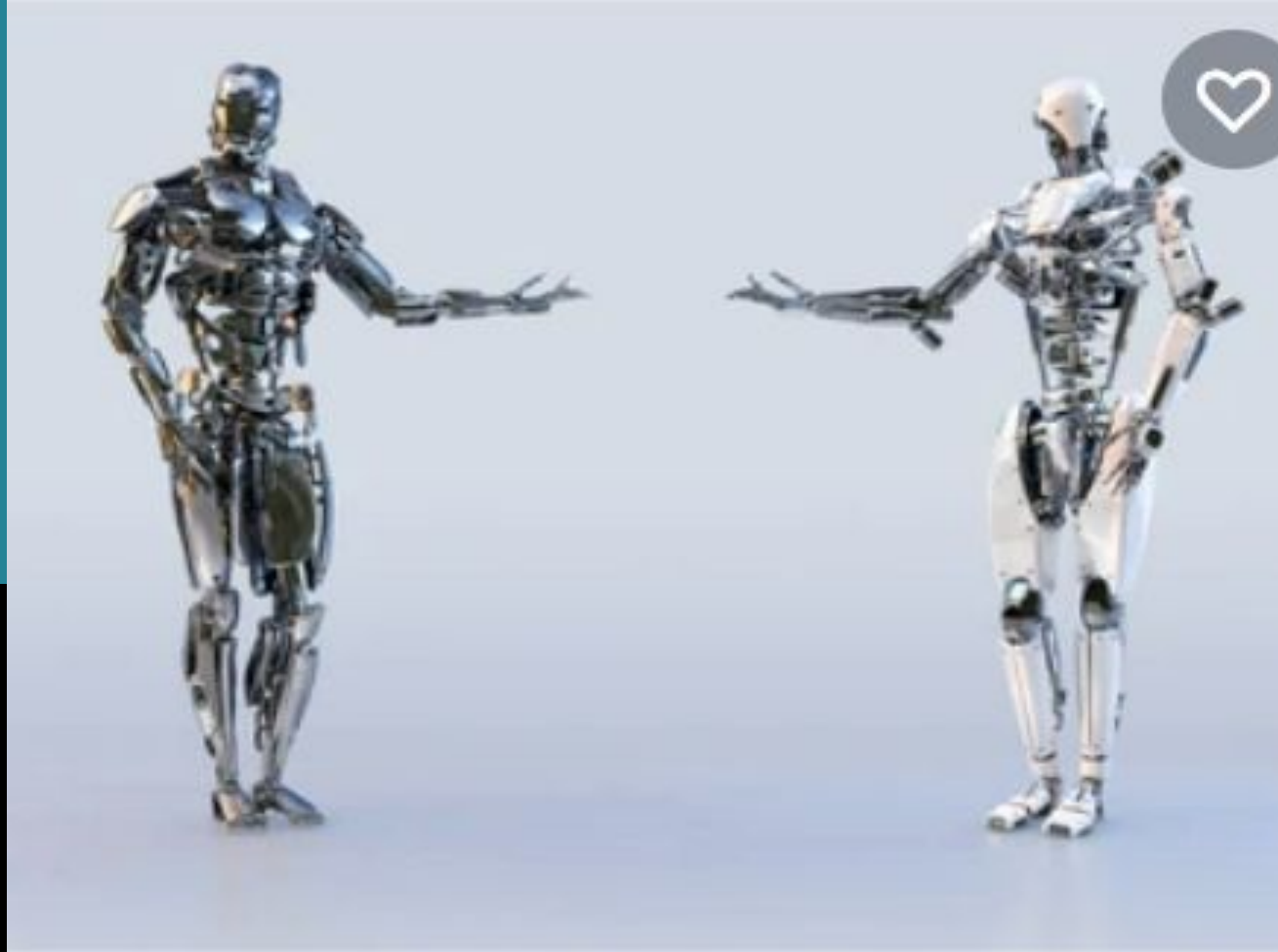


# Ideas

- Due to time constraints, the front-end dashboard is incomplete
- We wanted to be able to run our models on any security inputted in the dashboard
- Showing technical indicators signals to determine whether a stock would be a good buy and charting it (i.e if  $RSI > 70$  sell)
- Show news and sentiment
- Built-in backtesting

# Abridgment of Project

- User will see reliable accurate information regarding the acquisition of stock and use the data to determine whether a user should buy or sell stocks or simply hold on to them for now.
- **We used several features and academic research to figure out that media plays crucial role in market volatility. We redefine sentiment and multivariate to extract data from news articles to see the affect on future prices of stocks**
- News Media and Social Media's influence: Extreme events let to biased and unbiased media coverage which affects stock prices based on the financial sentiment analysis.
- **This supervised learning project provides future stock price prediction using parameters, closing prices, sentiments , VIX, volume and Convolutional neural network. In deep learning, a convolutional neural network is a class of deep neural networks, most commonly applied to analyzing visual imagery. They are also known as shift invariant or space invariant artificial neural networks, based on their shared-weights architecture and translation invariance characteristics. We repurposed it to multivarious signal to get readable result in order to incorporate the information from all features and identifies the features significant to predict the price for the next day.**
- Potential of this project is boundless, in addition to our future plans explained by Will, there is a possibility of using blockchain technology to make stock exchanges much more efficient through automation and decentralised.



Any Questions?

Thank You

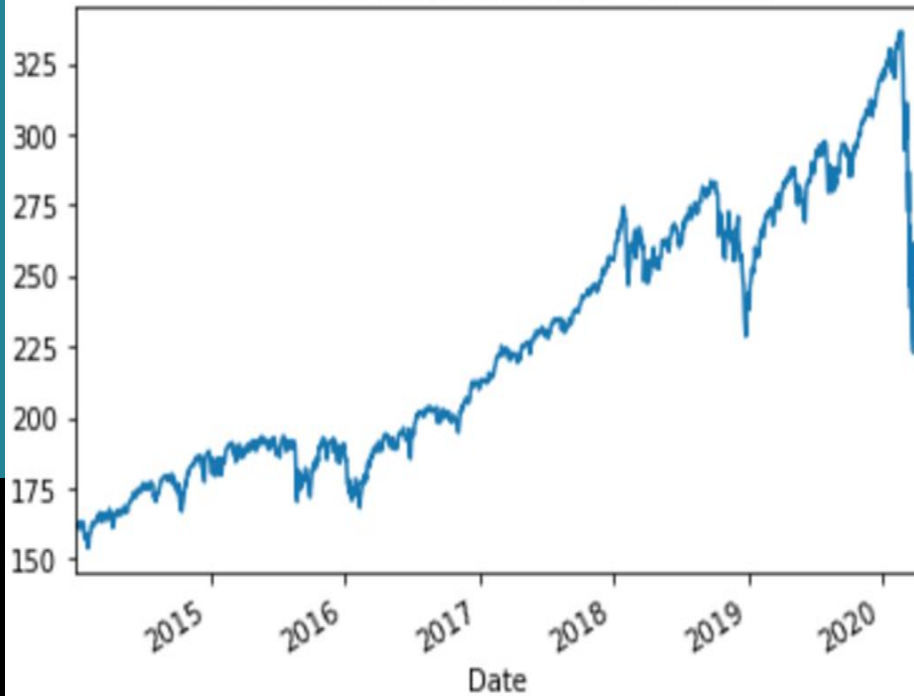
Arbetrade

Algoethmic Trading Platform

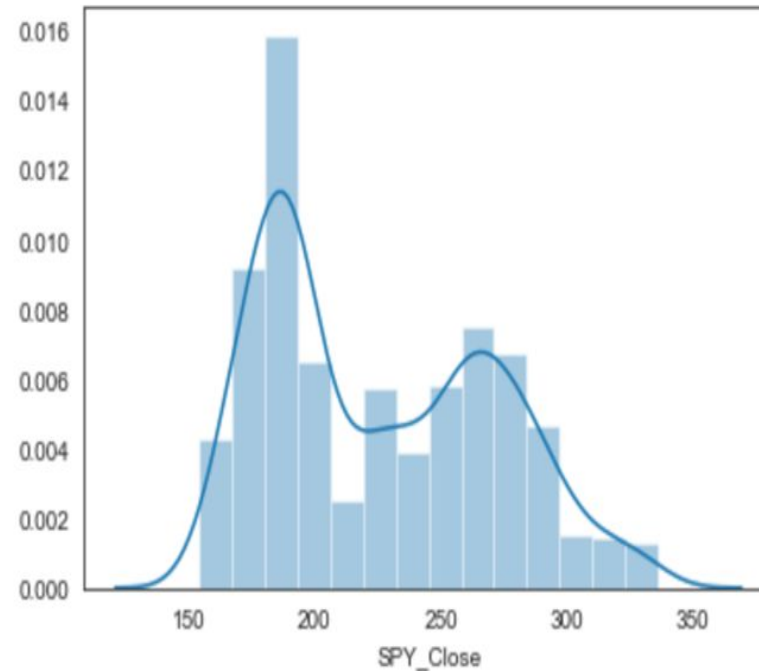




SPY Close Prices 1/1/2014 - 4/6/2020



Kurtosis of normal distribution: -1.0444479237649995  
 Skewness of normal distribution: 0.40424960145106437



**Annual Return** 0.0830824

**Cumulative Returns** 0.53551

**Annual Volatility** 0.169198

**Sharpe Ratio** 0.491035

**Sortino Ratio** 0.663934

# Visualizing S&P 500