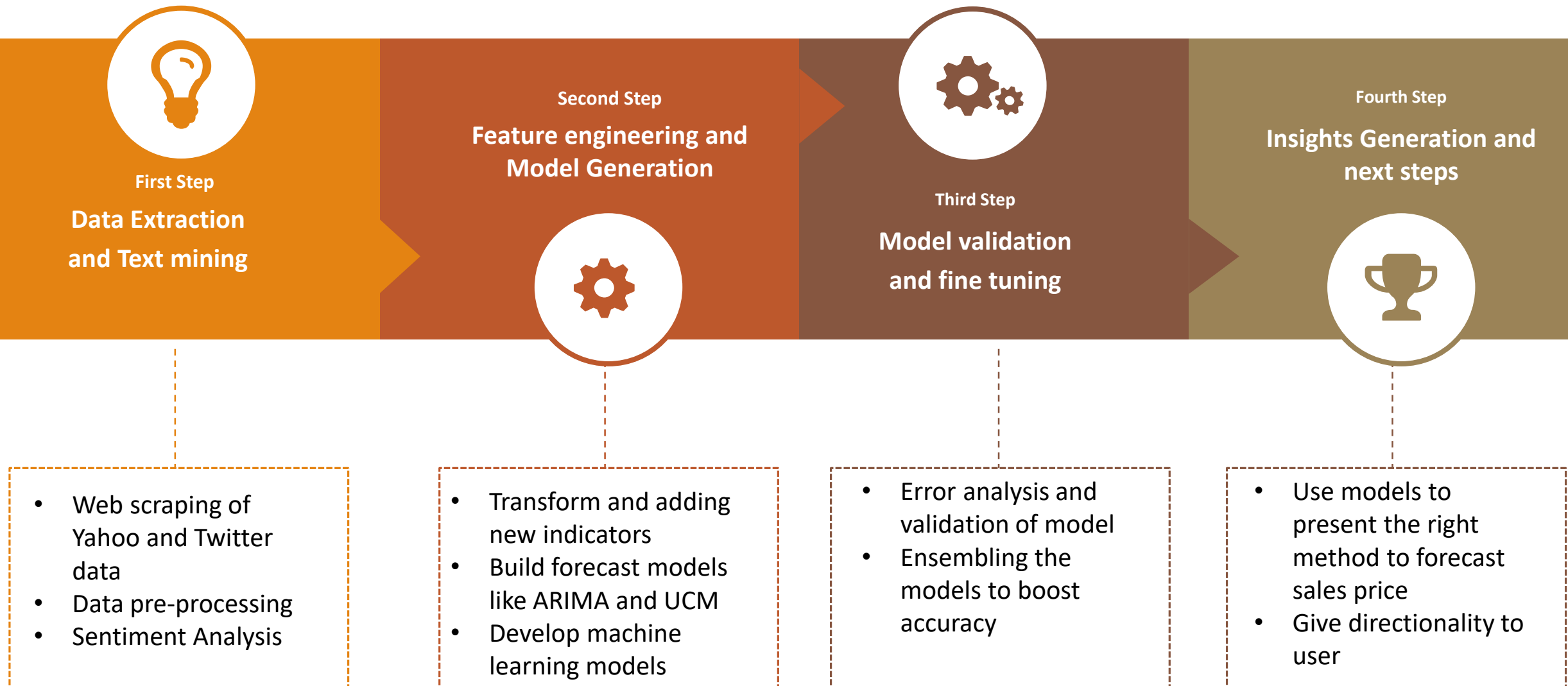


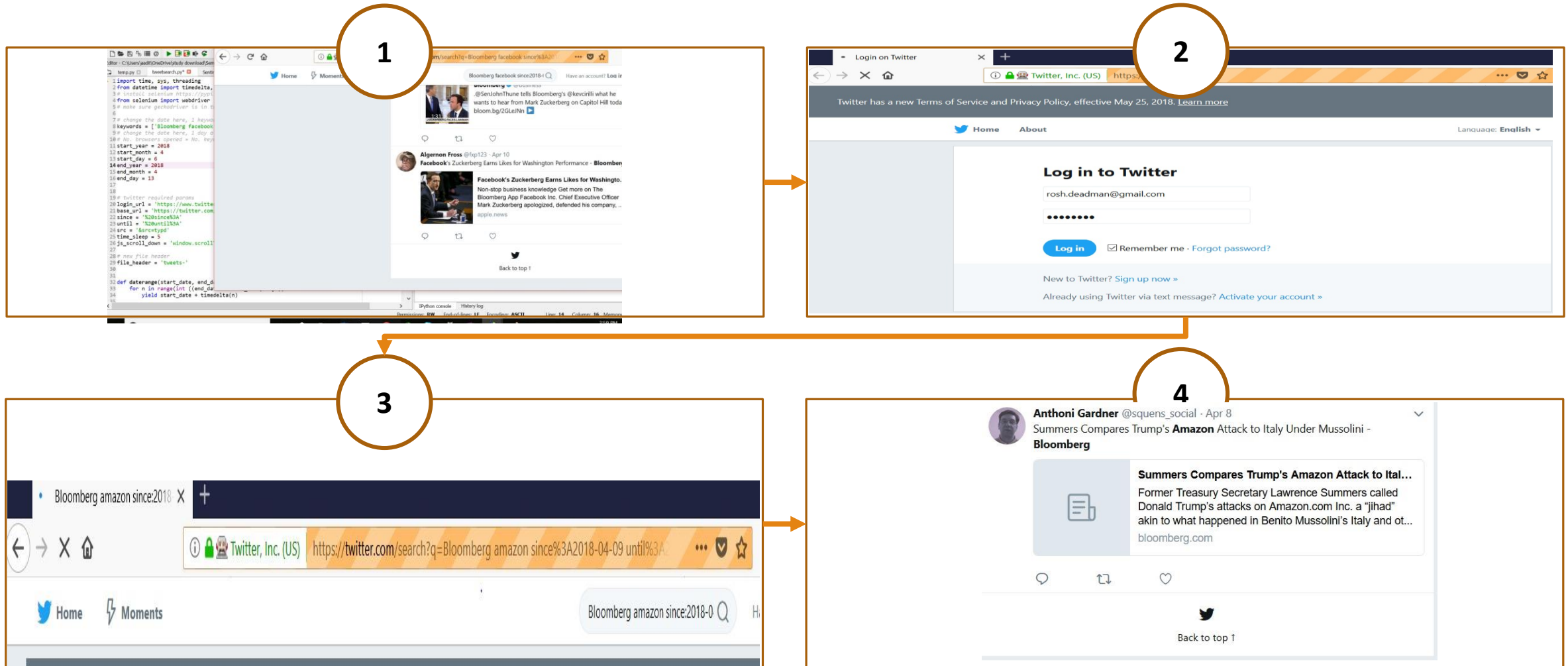
Stock Price Prediction

TEAM 8 – ADITI, SHWETA, ROSHAN

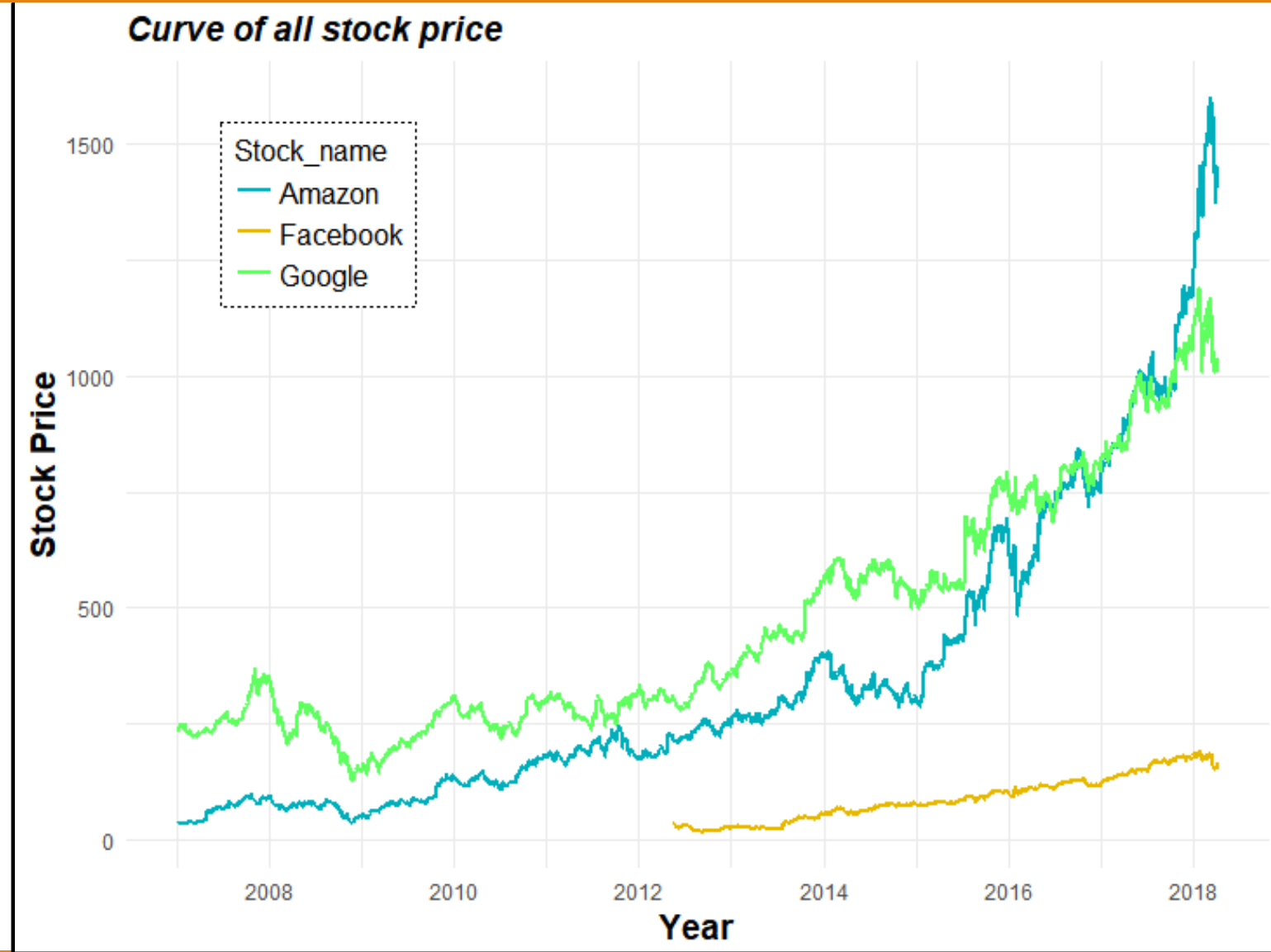
The steps involved in predicting stock price of Amazon , Facebook and Google has been conducted in the following way



Twitter data was extracted using a Python shell script for all the stocks going back to a time period of 4 months



Exploratory data analysis was conducted to come up with high level insights about the behavior of stocks over time



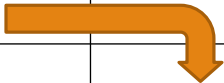
To predict stock price with trend and sentiment analysis we have to take certain scenarios into consideration

Problem

- We do not carry the tweets for the future, therefore forecasting stock prices with tweets is not possible

Assumption

Date	Open price	High Price	Low Price	Close Price	Volume	pos_tweet	neg_tweet	Tweet_lag
1/16/2018	1273.39	1305.76	1273.39	1305.2	5443700	92%	8%	
1/17/2018	1323	1339.94	1292.3	1304.86	7220700	83%	17%	8%



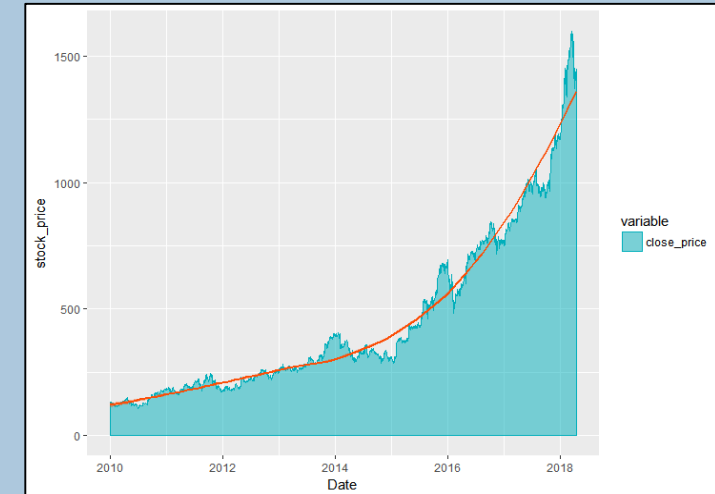
Solution

- Predict with lag of tweet – Memory = 1 . Forecast for next day
- Predict univariate timeseries. Forecast for the next 30 days

Before getting into the modelling aspect, there are some considerations that went behind the process

Modelling conditions

- Model has around 2083 points in last 7 years.
- Highly fluctuating and nonstationary
- To avoid generalization we build model on 3 months data and validate on 1 month



Modelling variables


Stock price

Trend

Lag 1
Lag 2
Lag 3
Lag 4
Lag 5



Seasonality

Jan
Feb
March



Other vars

Stock vol
Stock high
Stock low
Friday
Monday



Event

Positive tweet
Negative Tweet

Amazon stock price forecasting - A quick summary on all modelling results for both cases



Stock Price Forecasting

Model	Timeframe	Level	Forecast ahead	MAPE	RMSE
ARIMA	3 Months	Daily	1 month	96%	139
NN				95%	181
UCM				92%	163
LSTM				83%	212
Holt winters				74%	251

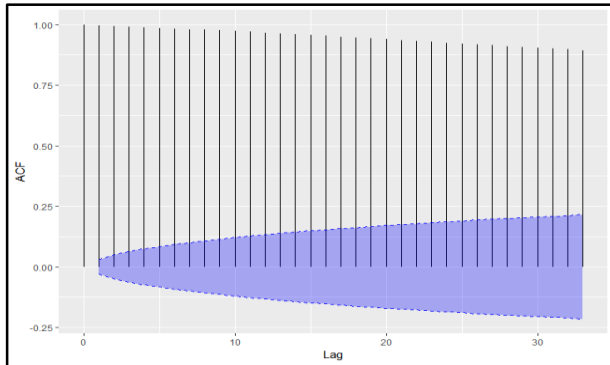


Stock Price Prediction

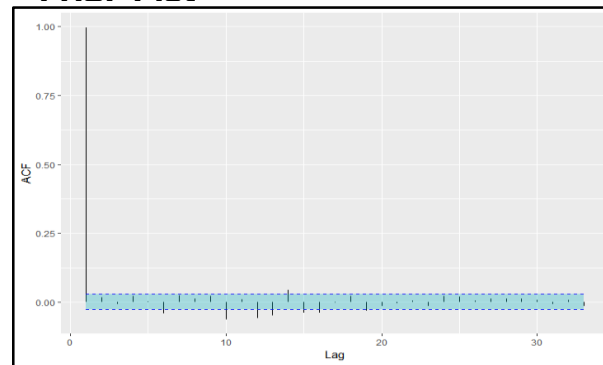
Model	Timeframe	Level	Forecast ahead	External Variable	Direction Accuracy
ARIMAX	3 Months	Daily	1 Day	Negative tweet	61%
NN					72%
UCM					66%
GBM					53%
SVM					41%

The Arima Model was built using the Auto Arima condition since the ACF and PACF plot did not show any clear indication of (P,D,Q)

ACF Plot

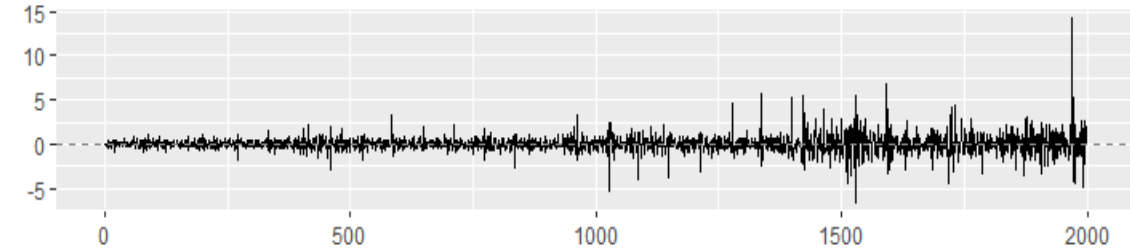


PACF Plot

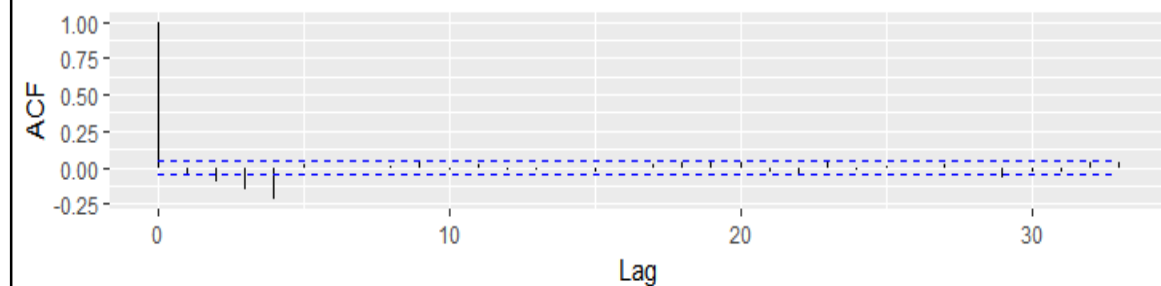


Residual Statistics

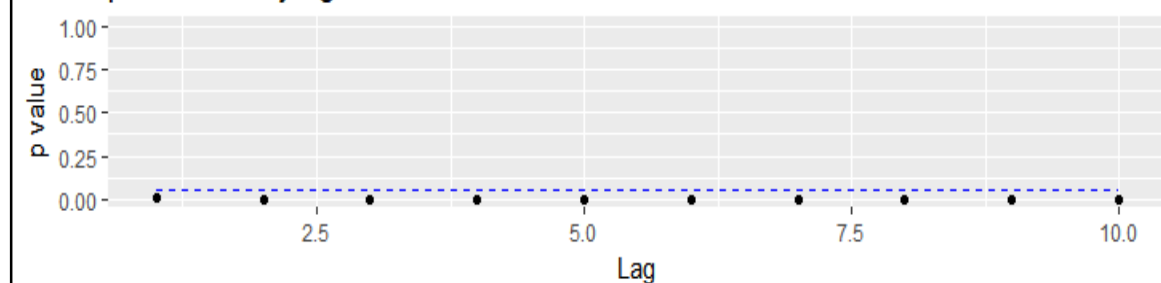
Standardized Residuals



ACF of Residuals



p values for Ljung-Box statistic

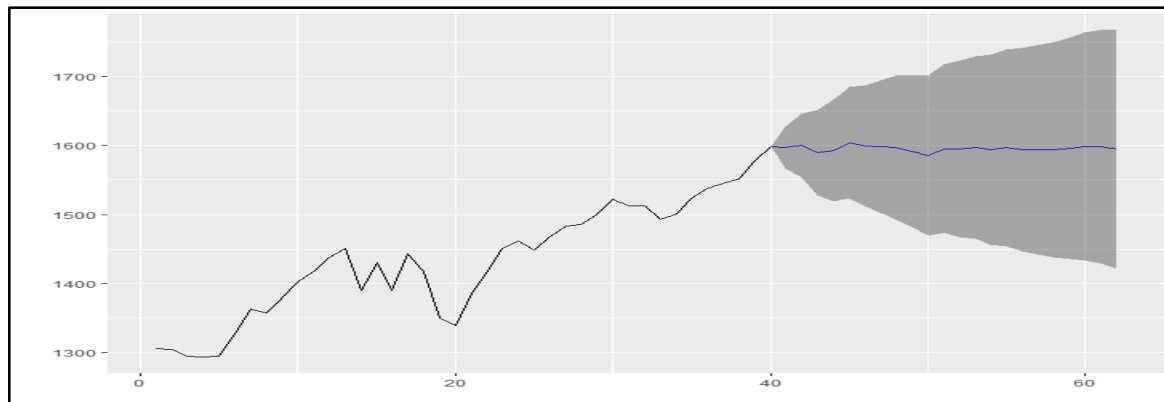


Model Equation

	ARIMA (2,1,2)				
	Series: Amazon stock				
	ar1	ar2	ma1	ma2	Neg tweet
Coefficients:	0.08	-0.73	0.06	1.00	-33.34
SE	0.21	0.15	0.14	0.12	16.20

Sigma^2	536.4
AIC	370.91
RMSE	129.3
MAPE	6.75%
MAE	105.2

Forecast Plot

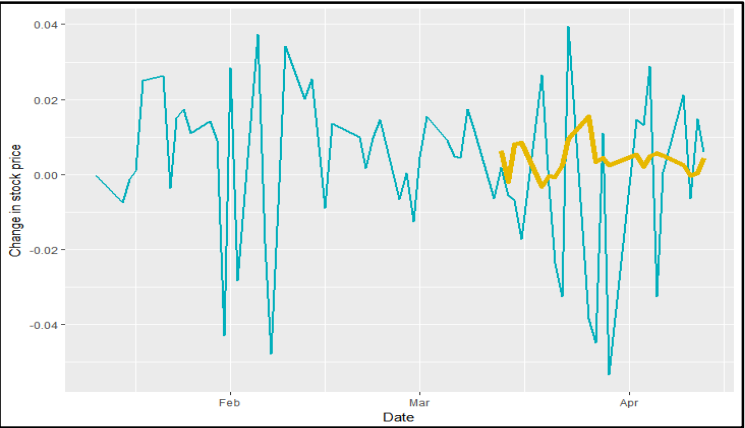


Time Series Forecasting for directionality is done with machine learning models that can better model the trend and has a good memory

Unobserved Component Model

A trend ,slope and irregular component model is considered for this exercise

	Actual State	Predicted State	# correct
Week 1	↑↓↓↓↑	↑↑↓↑↑	3
Week 2	↓↓↓↑↓	↓↓↑↑↑	3
Week 3	↓↑↓↑↑	↑↑↓↑↑	4
Week 4	↑↑↓↓↑	↑↑↑↓↑	4

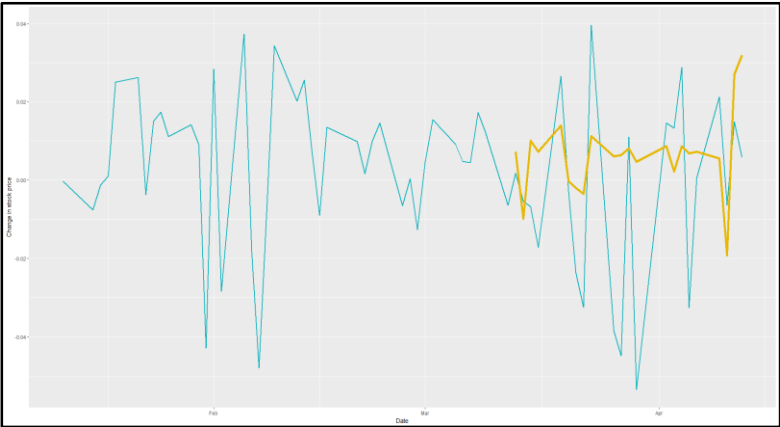


Accuracy	64%
Decision	Increase

Neural Network Model

Average of 20 networks, each of which is a 2-4-1 network with 17 weight with linear output units

	Actual State	Predicted State	# correct
Week 1	↑↓↓↓↑	↑↓↓↑↑	4
Week 2	↓↓↓↑↓	↓↓↑↓↓	3
Week 3	↓↑↓↑↑	↓↑↑↑↑	4
Week 4	↑↑↓↓↑	↑↑↑↓↑	4



Accuracy	72%
Decision	Increase

We run the entire activity for the other two stocks and come out with a model for predicting price and forecasting the trend

Time Series Forecasting

Stock	Model	Timeframe	Level	MAPE	Model
AMAZON	ARIMA	3 Months	Daily	96%	Arima
	NN			93%	
	UCM			92%	
FB	ARIMA	3 Months	Daily	84%	Arima
	NN			88%	
	UCM			89%	
GOOGLE	ARIMA	3 Months	Daily	86%	Arima
	NN			90%	
	UCM			92%	

Time Series Regression

Stock	Model	Timeframe	Level	Accuracy	Model
AMAZON	ARIMA	3 Months	Daily	63%	NN
	NN			72%	
	UCM			66%	
FB	ARIMA	3 Months	Daily	53%	NN
	NN			59%	
	UCM			55%	
GOOGLE	ARIMA	3 Months	Daily	48%	UCM
	NN			55%	
	UCM			59%	

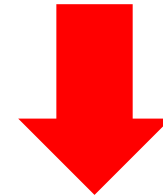
Recommendations – The predicted value and direction of the stocks are as follows



5 points



2 points



3 points

Thank You