In [1]:
```
!pip install --upgrade pip
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: pip in /usr/local/lib/python3.7/dist-packages (21.1.3)
Collecting pip
  Downloading pip-22.2.1-py3-none-any.whl (2.0 MB)
     |████████████████████████████████| 2.0 MB 4.2 MB/s
Installing collected packages: pip
  Attempting uninstall: pip
    Found existing installation: pip 21.1.3
    Uninstalling pip-21.1.3:
      Successfully uninstalled pip-21.1.3
Successfully installed pip-22.2.1
```

In [2]:
```
!pip3 install twint
!pip install --upgrade tweepy
!pip install -U textblob
!pip install emoji --upgrade emoji~=1.6.3
!pip install --upgrade pip
!pip install wordcloud
!pip install nest_asyncio
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting twint
  Downloading twint-2.1.20.tar.gz (31 kB)
  Preparing metadata (setup.py) ... done
Requirement already satisfied: aiohttp in /usr/local/lib/python3.7/dist-packages (from twint) (3.8.1)
Collecting aiodns
  Downloading aiodns-3.0.0-py3-none-any.whl (5.0 kB)
Requirement already satisfied: beautifulsoup4 in /usr/local/lib/python3.7/dist-packages (from twint) (4.6.3)
Collecting cchardet
  Downloading cchardet-2.1.7-cp37-cp37m-manylinux2010_x86_64.whl (263 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 263.7/263.7 kB 6.9 MB/s eta 0:00:00
Collecting elasticsearch
  Downloading elasticsearch-8.3.3-py3-none-any.whl (382 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 382.5/382.5 kB 23.8 MB/s eta 0:00:00
Requirement already satisfied: pysocks in /usr/local/lib/python3.7/dist-packages (from twint) (1.7.1)
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from twint) (1.3.5)
Collecting aiohttp_socks
  Downloading aiohttp_socks-0.7.1-py3-none-any.whl (9.3 kB)
Collecting schedule
  Downloading schedule-1.1.0-py2.py3-none-any.whl (10 kB)
Requirement already satisfied: geopy in /usr/local/lib/python3.7/dist-packages (from twint) (1.17.0)
Collecting fake-useragent
  Downloading fake-useragent-0.1.11.tar.gz (13 kB)
  Preparing metadata (setup.py) ... done
Collecting googletransx
  Downloading googletransx-2.4.2.tar.gz (13 kB)
  Preparing metadata (setup.py) ... done
Collecting pycares>=4.0.0
  Downloading pycares-4.2.1-cp37-cp37m-manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_12_x86_64.manylinux2010_x86
_64.whl (291 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 291.7/291.7 kB 27.7 MB/s eta 0:00:00
Requirement already satisfied: asynctest==0.13.0 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twint) (0.1
3.0)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twint) (22.1.0)
Requirement already satisfied: yarl<2.0,>=1.0 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twint) (1.7.2)
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twint)
 (6.0.2)
Requirement already satisfied: charset-normalizer<3.0,>=2.0 in /usr/local/lib/python3.7/dist-packages (from aiohttp->
twint) (2.1.0)
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twint) (1.
3.0)
Requirement already satisfied: async-timeout<5.0,>=4.0.0a3 in /usr/local/lib/python3.7/dist-packages (from aiohttp->t
wint) (4.0.2)
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twint) (1.2.
0)
Requirement already satisfied: typing-extensions>=3.7.4 in /usr/local/lib/python3.7/dist-packages (from aiohttp->twin
t) (4.1.1)
Collecting python-socks[asyncio]<3.0.0,>=2.0.0
  Downloading python_socks-2.0.3-py3-none-any.whl (49 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 49.2/49.2 kB 6.0 MB/s eta 0:00:00
Collecting elastic-transport<9,>=8
  Downloading elastic_transport-8.1.2-py3-none-any.whl (59 kB)
```

```
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 59.3/59.3 kB 7.4 MB/s eta 0:00:00
Requirement already satisfied: geographiclib<2,>=1.49 in /usr/local/lib/python3.7/dist-packages (from geopy->twint)
 (1.52)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from googletransx->twint) (2.23.0)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas->twint) (2022.1)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/dist-packages (from pandas->twint) (1.21.6)
Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dist-packages (from pandas->twint)
 (2.8.2)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from elastic-transport<9,>=8->elast
icsearch->twint) (2022.6.15)
Collecting urllib3<2,>=1.26.2
  Downloading urllib3-1.26.11-py2.py3-none-any.whl (139 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 139.9/139.9 kB 16.6 MB/s eta 0:00:00
Requirement already satisfied: cffi>=1.5.0 in /usr/local/lib/python3.7/dist-packages (from pycares>=4.0.0->aiodns->tw
int) (1.15.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.7.3->panda
s->twint) (1.15.0)
Requirement already satisfied: idna>=2.0 in /usr/local/lib/python3.7/dist-packages (from yarl<2.0,>=1.0->aiohttp->twi
nt) (2.10)
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests->googletran
sx->twint) (3.0.4)
Collecting requests
  Downloading requests-2.28.1-py3-none-any.whl (62 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 62.8/62.8 kB 7.6 MB/s eta 0:00:00
Requirement already satisfied: pycparser in /usr/local/lib/python3.7/dist-packages (from cffi>=1.5.0->pycares>=4.0.0-
>aiodns->twint) (2.21)
Building wheels for collected packages: twint, fake-useragent, googletransx
  Building wheel for twint (setup.py) ... done
  Created wheel for twint: filename=twint-2.1.20-py3-none-any.whl size=33929 sha256=cbba5d46cf1c60b08128a1e40c1021963
9f17afaf4eccbba60e029b96ef65d6f
  Stored in directory: /root/.cache/pip/wheels/44/fc/77/99887a36b5c265a87516158858697d1a0b8f32c4d4dbddbb24
  Building wheel for fake-useragent (setup.py) ... done
  Created wheel for fake-useragent: filename=fake_useragent-0.1.11-py3-none-any.whl size=13502 sha256=4d228dc5346117f
94478ba78267eb7562ebe397cfb326d74764a647c9254bb91
  Stored in directory: /root/.cache/pip/wheels/ed/f7/62/50ab6c9a0b5567267ab76a9daa9d06315704209b2c5d032031
  Building wheel for googletransx (setup.py) ... done
  Created wheel for googletransx: filename=googletransx-2.4.2-py3-none-any.whl size=15968 sha256=f32943cddb218a0fea9c
ecca81bc807f1a02de4648a272711390ef70cf94fcba
  Stored in directory: /root/.cache/pip/wheels/66/d5/b1/31104b338f7fd45aa8f7d22587765db06773b13df48a89735f
Successfully built twint fake-useragent googletransx
Installing collected packages: python-socks, fake-useragent, cchardet, urllib3, schedule, requests, pycares, elastic-
transport, googletransx, elasticsearch, aiohttp_socks, aiodns, twint
  Attempting uninstall: urllib3
    Found existing installation: urllib3 1.24.3
    Uninstalling urllib3-1.24.3:
      Successfully uninstalled urllib3-1.24.3
  Attempting uninstall: requests
    Found existing installation: requests 2.23.0
    Uninstalling requests-2.23.0:
      Successfully uninstalled requests-2.23.0
Successfully installed aiodns-3.0.0 aiohttp_socks-0.7.1 cchardet-2.1.7 elastic-transport-8.1.2 elasticsearch-8.3.3 fa
ke-useragent-0.1.11 googletransx-2.4.2 pycares-4.2.1 python-socks-2.0.3 requests-2.28.1 schedule-1.1.0 twint-2.1.20 u
rllib3-1.26.11
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: tweepy in /usr/local/lib/python3.7/dist-packages (3.10.0)
Collecting tweepy
  Downloading tweepy-4.10.0-py3-none-any.whl (94 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 94.4/94.4 kB 3.7 MB/s eta 0:00:00
Requirement already satisfied: requests<3,>=2.27.0 in /usr/local/lib/python3.7/dist-packages (from tweepy) (2.28.1)
Requirement already satisfied: oauthlib<4,>=3.2.0 in /usr/local/lib/python3.7/dist-packages (from tweepy) (3.2.0)
Requirement already satisfied: requests-oauthlib<2,>=1.2.0 in /usr/local/lib/python3.7/dist-packages (from tweepy)
 (1.3.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.27.0->twee
py) (2.10)
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=
2.27.0->tweepy) (2.1.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.27.0
->tweepy) (2022.6.15)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.7/dist-packages (from requests<3,>=2.2
7.0->tweepy) (1.26.11)
Installing collected packages: tweepy
  Attempting uninstall: tweepy
    Found existing installation: tweepy 3.10.0
    Uninstalling tweepy-3.10.0:
      Successfully uninstalled tweepy-3.10.0
```

```
Successfully installed tweepy-4.10.0
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: textblob in /usr/local/lib/python3.7/dist-packages (0.15.3)
Collecting textblob
  Downloading textblob-0.17.1-py2.py3-none-any.whl (636 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 636.8/636.8 kB 9.5 MB/s eta 0:00:00
Requirement already satisfied: nltk>=3.1 in /usr/local/lib/python3.7/dist-packages (from textblob) (3.7)
Requirement already satisfied: click in /usr/local/lib/python3.7/dist-packages (from nltk>=3.1->textblob) (7.1.2)
Requirement already satisfied: regex>=2021.8.3 in /usr/local/lib/python3.7/dist-packages (from nltk>=3.1->textblob)
 (2022.6.2)
Requirement already satisfied: joblib in /usr/local/lib/python3.7/dist-packages (from nltk>=3.1->textblob) (1.1.0)
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from nltk>=3.1->textblob) (4.64.0)
Installing collected packages: textblob
  Attempting uninstall: textblob
    Found existing installation: textblob 0.15.3
    Uninstalling textblob-0.15.3:
      Successfully uninstalled textblob-0.15.3
Successfully installed textblob-0.17.1
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting emoji
  Downloading emoji-2.0.0.tar.gz (197 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 197.3/197.3 kB 5.1 MB/s eta 0:00:00
  Preparing metadata (setup.py) ... done
  Downloading emoji-1.6.3.tar.gz (174 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 174.2/174.2 kB 17.5 MB/s eta 0:00:00
  Preparing metadata (setup.py) ... done
Building wheels for collected packages: emoji
  Building wheel for emoji (setup.py) ... done
  Created wheel for emoji: filename=emoji-1.6.3-py3-none-any.whl size=170298 sha256=9e552b3f1a13a6fd5b723fbd9c0ac38de
c002f54b81c76e5a3739dd59d8bc015
  Stored in directory: /root/.cache/pip/wheels/03/8b/d7/ad579fbef83c287215c0caab60fb0ae0f30c4d7ce5f580eade
Successfully built emoji
Installing collected packages: emoji
Successfully installed emoji-1.6.3
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: pip in /usr/local/lib/python3.7/dist-packages (22.2.1)
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: wordcloud in /usr/local/lib/python3.7/dist-packages (1.8.2.2)
Requirement already satisfied: numpy>=1.6.1 in /usr/local/lib/python3.7/dist-packages (from wordcloud) (1.21.6)
Requirement already satisfied: pillow in /usr/local/lib/python3.7/dist-packages (from wordcloud) (7.1.2)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-packages (from wordcloud) (3.2.2)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib->wordcloud)
 (0.11.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->wordclou
d) (1.4.4)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->wordc
loud) (2.8.2)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (fr
om matplotlib->wordcloud) (3.0.9)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-packages (from kiwisolver>=1.0.1->m
atplotlib->wordcloud) (4.1.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.1->matplot
lib->wordcloud) (1.15.0)
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: nest_asyncio in /usr/local/lib/python3.7/dist-packages (1.5.5)
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
```

In [3]:

```
import nest_asyncio
nest_asyncio.apply()
import pandas as pd
import tweepy
import json
import random
import os
from tqdm import tqdm, notebook
import numpy as np
```

In [4]:
```
from google.colab import files


uploaded = files.upload()
```

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving stock_market_crash_2022.csv to stock_market_crash_2022.csv
```

In [5]:
```
import io

stock_df = pd.read_csv(io.BytesIO(uploaded['stock_market_crash_2022.csv']))
```

In [6]:
```
stock_df.head()
```

Out[6]:

	id	text	text_sentiment	username	hashtags	created_at	user followers count	replycount	retwe
0	1538666561615015938	When will the #NYSE #stockmarketcrash happen?	Neutral	tradexlnc	['NYSE', 'stockmarketcrash']	2022-06-19 23:34:29+00:00	10669	0	
1	1538665013799489536	Aaj ka gyan:\n\nIf a company isn't a quality c...	Negative	niftymonday	['stockmarkets', 'stockmarketcrash', 'trading'...	2022-06-19 23:28:20+00:00	100	0	
2	1538660868027830274	The stock market needs to crash hard to make i...	Negative	kyle132313	['stockmarketcrash', 'economy', 'rich', 'Fed']	2022-06-19 23:11:52+00:00	0	0	
3	1538657239849836544	Those who are "Buying on DIP" will very soon b...	Neutral	ChintanRajput16	['stockmarketcrash', 'StocksToBuy', 'stockstow...	2022-06-19 22:57:27+00:00	54	0	
4	1538654339044196358	@rdrhwke I wish our so-called President were t...	Positive	DrPCJustice	['Bidenomics', 'inflation', 'recession', 'stoc...	2022-06-19 22:45:55+00:00	28	0	

In [7]:
```
stock_df.drop_duplicates(subset = ["username", "created_at", "text"], inplace=True)
print(f"all tweets: {stock_df.shape}")
```

```
all tweets: (33556, 18)
```

In [8]:
```
stock_df.columns
```

Out[8]:
```
Index(['id', 'text', 'text_sentiment', 'username', 'hashtags', 'created_at',
       'user followers count', 'replycount', 'retweetcount', 'likecount',
       'quotecount', 'language', 'media', 'retweetedTweet', 'quotedtweet',
       'inReplyToTweetId', 'inReplyToUser', 'mentionedUsers'],
      dtype='object')
```

In [34]:
```
tweets=stock_df.drop([ 'id','text_sentiment','username', 'hashtags','user followers count','replycount', 'retweetcoun
       'quotecount', 'language', 'media', 'retweetedTweet', 'quotedtweet',
       'inReplyToTweetId', 'inReplyToUser', 'mentionedUsers'], axis=1)
```

In [35]:
```
tweets.head()
```

Out[35]:

	text	created_at
0	When will the #NYSE #stockmarketcrash happen?	2022-06-19 23:34:29+00:00
1	Aaj ka gyan:\n\nIf a company isn't a quality c...	2022-06-19 23:28:20+00:00
2	The stock market needs to crash hard to make i...	2022-06-19 23:11:52+00:00

	text	created_at
3	Those who are "Buying on DIP" will very soon b...	2022-06-19 22:57:27+00:00
4	@rdrhwke I wish our so-called President were t...	2022-06-19 22:45:55+00:00

In [36]:
```
tweets.tail()
```

Out[36]:

	text	created_at
33941	Hey #btc maxis!!\n\nDo you know what a Fibonac...	2022-01-02 14:20:28+00:00
33942	@cryptolifemama #XRP and #HBAR will be resista...	2022-01-02 13:31:46+00:00
33943	SPYSPX\nNotes From a #Market #Degenerate: \...	2022-01-02 06:54:24+00:00
33944	@chip82many @GarethSoloway Depends if you thin...	2022-01-02 02:51:48+00:00
33945	It looks like the market wants to fully enter ...	2022-01-01 22:09:52+00:00

In [37]:
```
tweets['text'].nunique()
```

Out[37]:
```
33164
```

In [15]:
```
# Load library
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize

# download the set of stop words the first time
import nltk
nltk.download('stopwords')
```

Out[15]:
```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
True
```

In [16]:
```
# Load stop words
stop_words = stopwords.words('english')

# Show stop words
stop_words[:10]
```

Out[16]:
```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're"]
```

In [17]:
```
#Cleaning Tweets
import re
from textblob import TextBlob
import emoji

def clean_tweet(text):
    text = re.sub(r'@[A-Za-z0-9]+', '', str(text)) # remove @mentions
    text = re.sub(r'#', '',  str(text)) # remove the '#' symbol
    text = re.sub(r'RT[\s]+', '',  str(text)) # remove RT
    text = re.sub(r'https?\/\/S+', '',  str(text)) # remove the hyperlink
    text = re.sub(r'http\S+', '',  str(text)) # remove the hyperlink
    text = re.sub(r'www\S+', '',  str(text)) # remove the www
    text = re.sub(r'twitter+', '',  str(text)) # remove the twiiter
    text = re.sub(r'pic+', '',  str(text)) # remove the pic
    text = re.sub(r'com', '',  str(text)) # remove the pic

    return text

def remove_emoji(text):
    return emoji.get_emoji_regexp().sub(u'', text)
```

In [38]:
```
tweets['cleaned_text']=tweets['text'].apply(clean_tweet)
tweets['cleaned_text']=tweets['cleaned_text'].apply(remove_emoji)
```

In [39]:
```
# Remove stop words
tweets['cleaned_text']=tweets['cleaned_text'].apply(lambda words: ' '.join(word.lower() for word in words.split() if
```

In [40]:
```
tweets.head()
```

Out[40]:

	text	created_at	cleaned_text
0	When will the #NYSE #stockmarketcrash happen?	2022-06-19 23:34:29+00:00	when nyse stockmarketcrash happen?
1	Aaj ka gyan:\n\nIf a company isn't a quality c...	2022-06-19 23:28:20+00:00	aaj ka gyan: if pany quality pany, buy price l...
2	The stock market needs to crash hard to make i...	2022-06-19 23:11:52+00:00	the stock market needs crash hard make realist...
3	Those who are "Buying on DIP" will very soon b...	2022-06-19 22:57:27+00:00	those "buying dip" soon bee "promoters" pany s...
4	@rdrhwke I wish our so-called President were t...	2022-06-19 22:45:55+00:00	i wish so-called president transitory, too. i ...

Data Cleaning

In [21]:
```
from wordcloud import WordCloud,ImageColorGenerator
from PIL import Image
import urllib
import requests
from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator
import matplotlib.pyplot as plt
```

In [41]:
```
comment_words = ''
stopwords = set(STOPWORDS)

# iterate through the csv file
for val in tweets.cleaned_text:

    # typecaste each val to string
    val = str(val)

    # split the value
    tokens = val.split()

    # Converts each token into lowercase
    for i in range(len(tokens)):
        tokens[i] = tokens[i].lower()

    comment_words += " ".join(tokens)+" "

wordcloud = WordCloud(width = 1000, height = 800,
                background_color='white', colormap='Set2',
                collocations=False,
                stopwords = stopwords,
                min_font_size = 12).generate(comment_words)

# plot the WordCloud image
plt.figure(figsize = (10, 10), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

In [42]:
```
tweets.to_csv("Combined_Dataset.csv")
```

In [43]:
```
df=pd.read_csv("Combined_Dataset.csv")
```

Data Analysis

In [44]:
```
import pandas as pd
import numpy as np
import string
import re
import nltk
from textblob import TextBlob
from wordcloud import WordCloud
import matplotlib.pyplot as plt
```

In [45]:
```
def getSubjectivity(text):
    return TextBlob( str(text)).sentiment.subjectivity

def getPolarity(text):
    return TextBlob( str(text)).sentiment.polarity
```

In [46]:
```
tweets.dropna(subset=['cleaned_text'], inplace = True)
tweets.reset_index(drop=True, inplace=True)
```

In [47]:
```
tweets['Subjectivity'] = tweets['cleaned_text'].apply(getSubjectivity)
tweets['Polarity'] = tweets['cleaned_text'].apply(getPolarity)
tweets.head()
```

Out[47]:

	text	created_at	cleaned_text	Subjectivity	Polarity
0	When will the #NYSE #stockmarketcrash happen?	2022-06-19 23:34:29+00:00	when nyse stockmarketcrash happen?	0.00000	0.00000

	text	created_at	cleaned_text	Subjectivity	Polarity
1	Aaj ka gyan:\n\nIf a company isn't a quality c...	2022-06-19 23:28:20+00:00	aaj ka gyan: if pany quality pany, buy price l...	0.30000	0.00000
2	The stock market needs to crash hard to make i...	2022-06-19 23:11:52+00:00	the stock market needs crash hard make realist...	0.65625	-0.16250
3	Those who are "Buying on DIP" will very soon b...	2022-06-19 22:57:27+00:00	those "buying dip" soon bee "promoters" pany s...	0.00000	0.00000
4	@rdrhwke I wish our so-called President were t...	2022-06-19 22:45:55+00:00	i wish so-called president transitory, too. i ...	0.44375	-0.05625

In [48]:

```
# Create a function to compute negative (-1), neutral (0) and positive (+1) analysis
def get_Polarity_Analysis(score):
    if score < 0:
      return 'Negative'
    elif score == 0:
      return 'Neutral'
    else:
      return 'Positive'
def get_Subjectivity_Analysis(score):
    if score >  0:
      return 'Opinion'
    else:
      return 'Fact'

tweets['Analysis_Polarity'] = tweets['Polarity'].apply(get_Polarity_Analysis)

tweets['Analysis_Subjectivity'] = tweets['Subjectivity'].apply(get_Subjectivity_Analysis)

# Show the dataframe
tweets.head()
```

Out[48]:

	text	created_at	cleaned_text	Subjectivity	Polarity	Analysis_Polarity	Analysis_Subjectivity
0	When will the #NYSE #stockmarketcrash happen?	2022-06-19 23:34:29+00:00	when nyse stockmarketcrash happen?	0.00000	0.00000	Neutral	Fact
1	Aaj ka gyan:\n\nIf a company isn't a quality c...	2022-06-19 23:28:20+00:00	aaj ka gyan: if pany quality pany, buy price l...	0.30000	0.00000	Neutral	Opinion
2	The stock market needs to crash hard to make i...	2022-06-19 23:11:52+00:00	the stock market needs crash hard make realist...	0.65625	-0.16250	Negative	Opinion
3	Those who are "Buying on DIP" will very soon b...	2022-06-19 22:57:27+00:00	those "buying dip" soon bee "promoters" pany s...	0.00000	0.00000	Neutral	Fact
4	@rdrhwke I wish our so-called President were t...	2022-06-19 22:45:55+00:00	i wish so-called president transitory, too. i ...	0.44375	-0.05625	Negative	Opinion

In [49]:

```
tweets.to_csv("PolaritySubjectivityInnovation.csv")
```

In [50]:

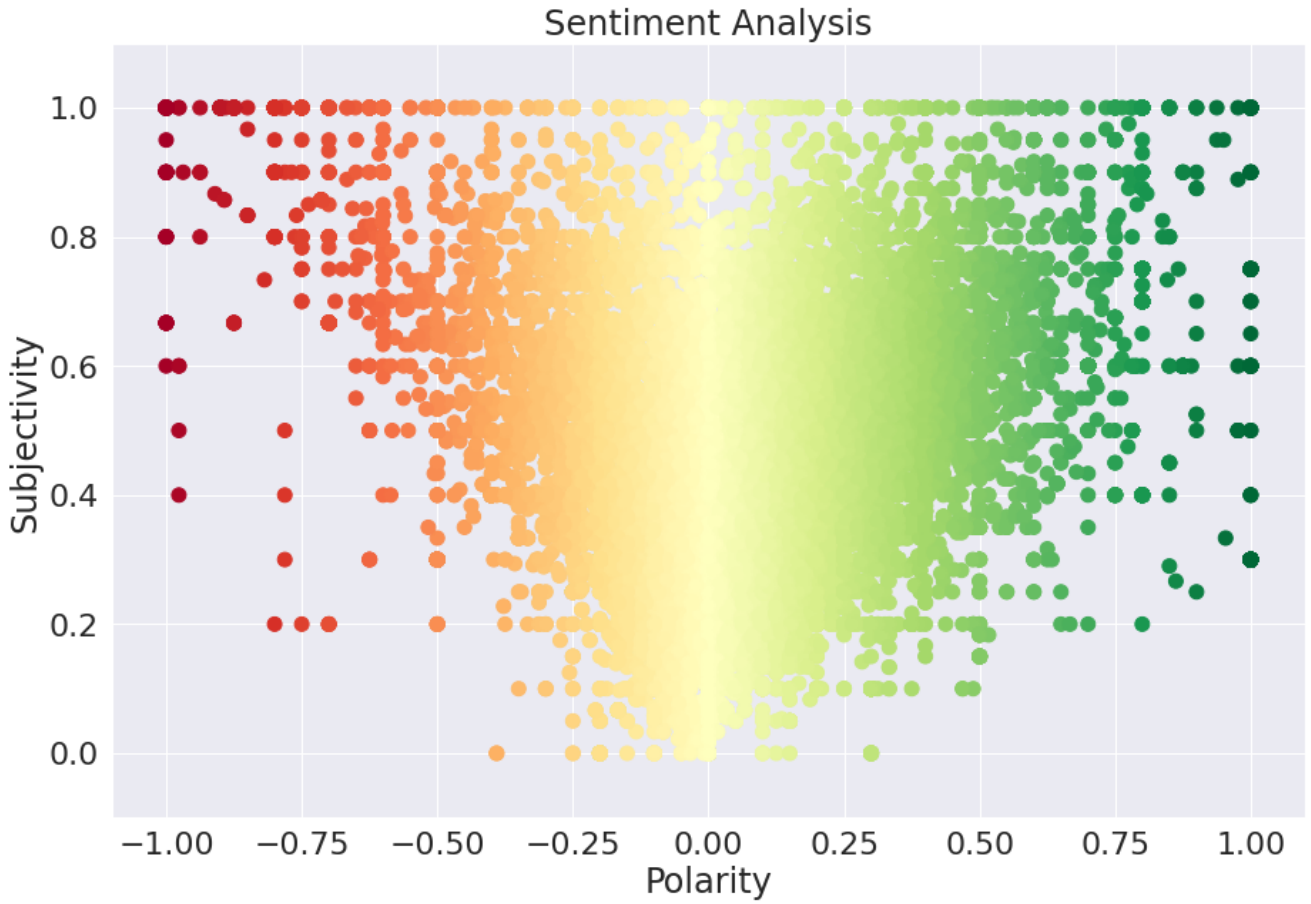
```
tweets.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 33556 entries, 0 to 33555
Data columns (total 7 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   text                  33556 non-null  object 
 1   created_at            33556 non-null  object 
 2   cleaned_text          33556 non-null  object 
 3   Subjectivity          33556 non-null  float64
 4   Polarity              33556 non-null  float64
 5   Analysis_Polarity     33556 non-null  object 
 6   Analysis_Subjectivity  33556 non-null  object 
dtypes: float64(2), object(5)
memory usage: 1.8+ MB
```

Sentiment Analysis

In [51]:
```
import seaborn as sns
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(font_scale=2)
```

In [52]:
```
plt.figure(figsize=(15,10))

# plt.style.use('seaborn-pastel')

plt.scatter(tweets['Polarity'], tweets['Subjectivity'], c=tweets['Polarity'], s=100, cmap='RdYlGn')

plt.xlim(-1.1, 1.1)
plt.ylim(-0.1, 1.1)
plt.title('Sentiment Analysis')
plt.xlabel('Polarity')
plt.ylabel('Subjectivity')
plt.show()
```



In [53]:
```
# Show the value counts
tweets['Analysis_Polarity'].value_counts()
```

Out[53]:
```
Neutral     15105
Positive    11869
Negative     6582
Name: Analysis_Polarity, dtype: int64
```

In [54]:
```
# Plotting and visualizing the counts
plt.figure(figsize=(15,10))

plt.title('Polarity Sentiment Analysis')
plt.xlabel('Sentiment')
plt.ylabel('Counts')
tweets['Analysis_Polarity'].value_counts().plot(kind = 'bar')
plt.show()
```

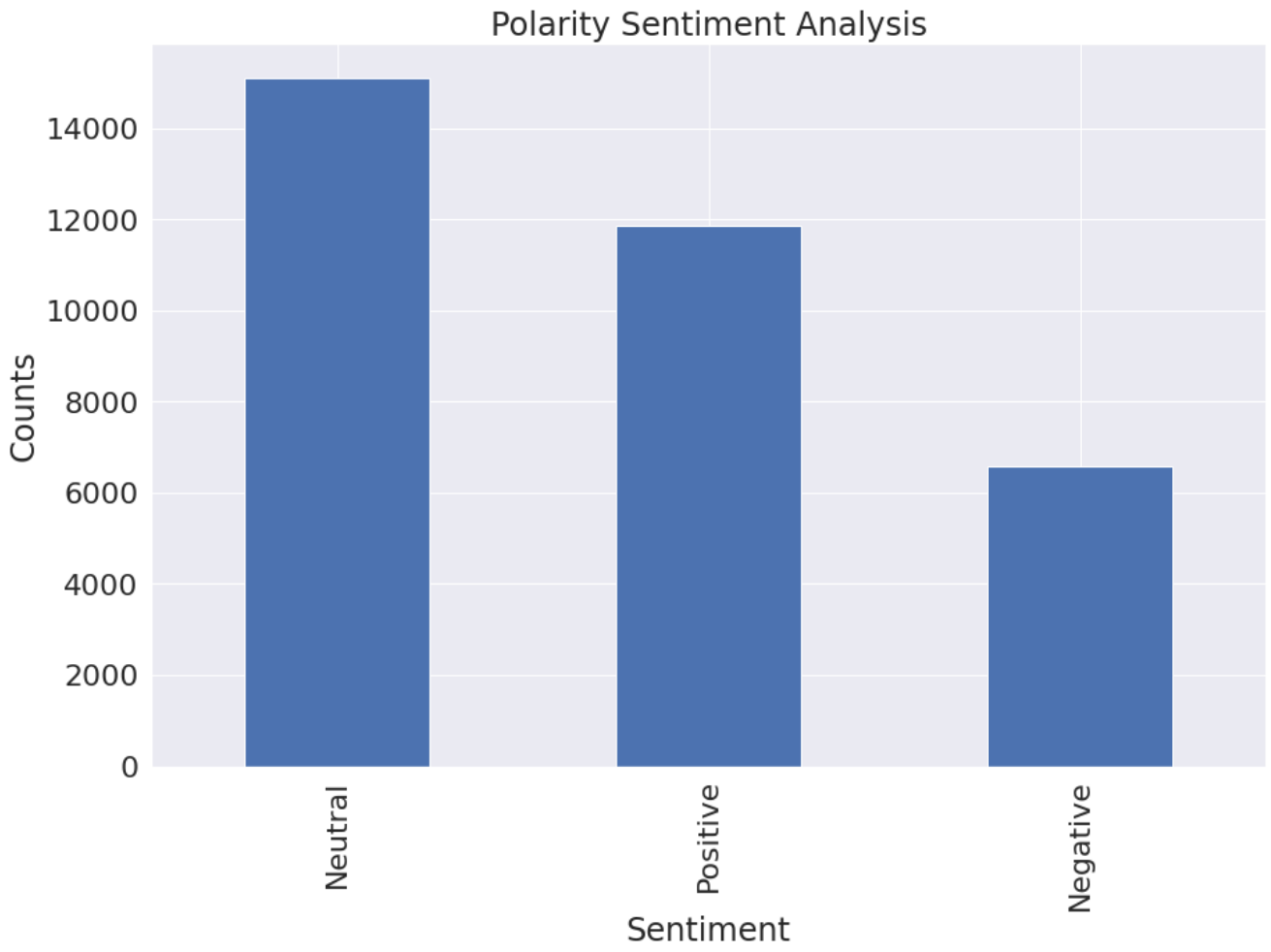
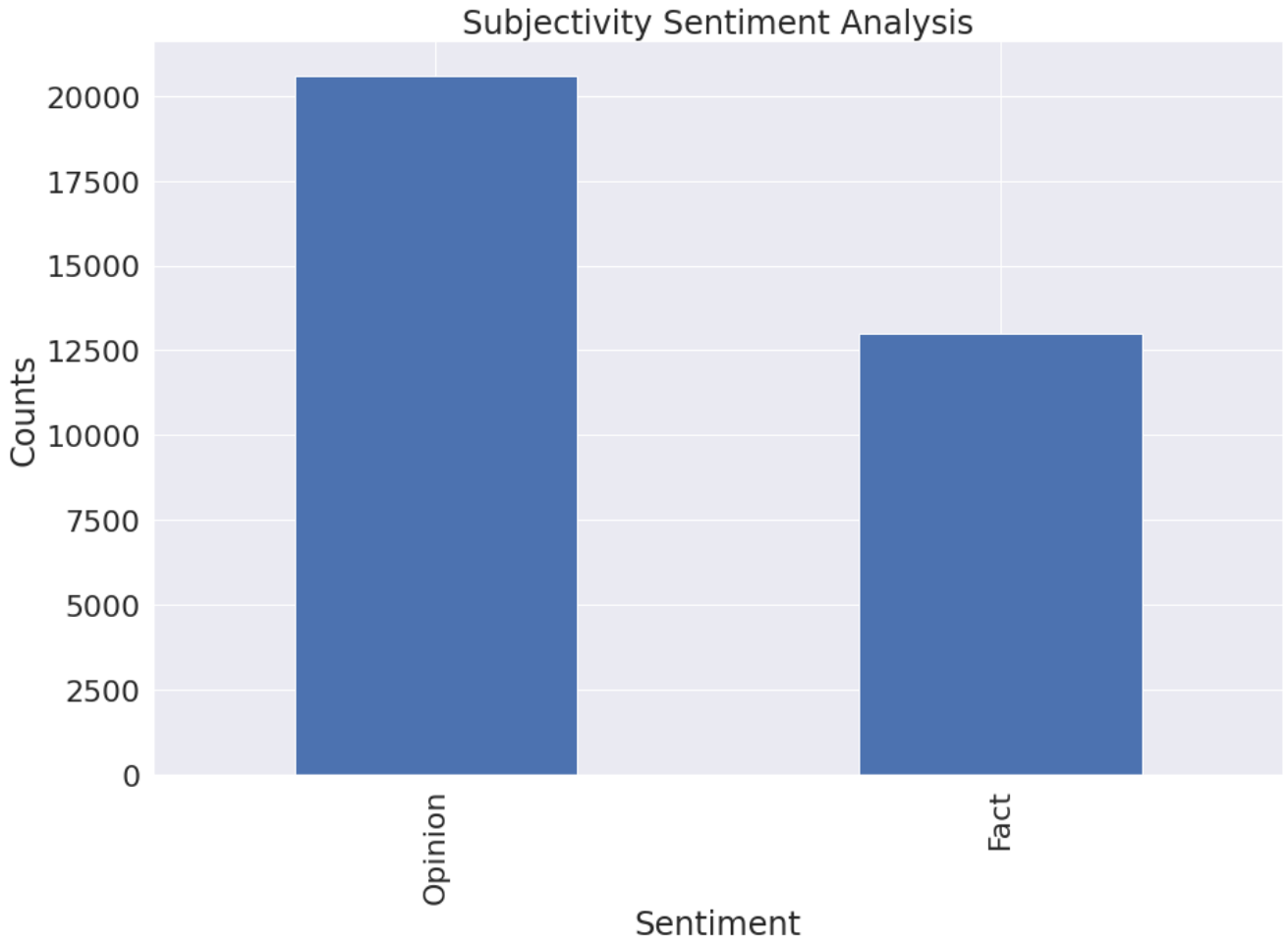


Chart Visual

In [55]:

```
# Plotting and visualizing the counts
plt.figure(figsize=(15,10))

plt.title('Subjectivity Sentiment Analysis')
plt.xlabel('Sentiment')
plt.ylabel('Counts')
tweets['Analysis_Subjectivity'].value_counts().plot(kind = 'bar')
plt.show()
```



In [56]:
```
# Show the value counts
tweets['Analysis_Subjectivity'].value_counts()
```

Out[56]:
```
Opinion    20578
Fact       12978
Name: Analysis_Subjectivity, dtype: int64
```

Topic Modelling

In [57]:
```
!pip install pyLDAvis
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting pyLDAvis
  Downloading pyLDAvis-3.3.1.tar.gz (1.7 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.7/1.7 MB 20.7 MB/s eta 0:00:00
  Installing build dependencies ... done
  Getting requirements to build wheel ... done
  Installing backend dependencies ... done
  Preparing metadata (pyproject.toml) ... done
Requirement already satisfied: numpy>=1.20.0 in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (1.21.6)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (2.11.3)
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (1.0.2)
Collecting funcy
  Downloading funcy-1.17-py2.py3-none-any.whl (33 kB)
Requirement already satisfied: joblib in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (1.1.0)
Requirement already satisfied: future in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (0.16.0)
Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (57.4.0)
Requirement already satisfied: numexpr in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (2.8.3)
Requirement already satisfied: gensim in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (3.6.0)
Requirement already satisfied: pandas>=1.2.0 in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (1.3.5)
Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (1.7.3)
Requirement already satisfied: sklearn in /usr/local/lib/python3.7/dist-packages (from pyLDAvis) (0.0)
Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dist-packages (from pandas>=1.2.0->
pyLDAvis) (2.8.2)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas>=1.2.0->pyLDAvis)
 (2022.1)
```

```
Requirement already satisfied: smart-open>=1.2.1 in /usr/local/lib/python3.7/dist-packages (from gensim->pyLDAvis)
 (5.2.1)
Requirement already satisfied: six>=1.5.0 in /usr/local/lib/python3.7/dist-packages (from gensim->pyLDAvis) (1.15.0)
Requirement already satisfied: MarkupSafe>=0.23 in /usr/local/lib/python3.7/dist-packages (from jinja2->pyLDAvis) (2.
0.1)
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages (from numexpr->pyLDAvis) (21.3)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from scikit-learn->pyL
DAvis) (3.1.0)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packaging->nu
mexpr->pyLDAvis) (3.0.9)
Building wheels for collected packages: pyLDAvis
  Building wheel for pyLDAvis (pyproject.toml) ... done
  Created wheel for pyLDAvis: filename=pyLDAvis-3.3.1-py2.py3-none-any.whl size=136898 sha256=d08617eec931c50f31fe735
56146d842ad162042e810001d20b30924e4258d72
  Stored in directory: /root/.cache/pip/wheels/c9/21/f6/17bcf2667e8a68532ba2fbf6d5c72fdf4c7f7d9abfa4852d2f
Successfully built pyLDAvis
Installing collected packages: funcy, pyLDAvis
Successfully installed funcy-1.17 pyLDAvis-3.3.1
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system pa
ckage manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
```

In [58]:

```
import pyLDAvis
import pyLDAvis.gensim_models as gensimvis
import pyLDAvis.sklearn
pyLDAvis.enable_notebook()

from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
from sklearn.decomposition import LatentDirichletAllocation
```

```
/usr/local/lib/python3.7/dist-packages/past/types/oldstr.py:5: DeprecationWarning: Using or importing the ABCs from
'collections' instead of from 'collections.abc' is deprecated since Python 3.3,and in 3.9 it will stop working
  from collections import Iterable
/usr/local/lib/python3.7/dist-packages/past/builtins/misc.py:4: DeprecationWarning: Using or importing the ABCs from
'collections' instead of from 'collections.abc' is deprecated since Python 3.3,and in 3.9 it will stop working
  from collections import Mapping
```

In [59]:

```
tf_vectorizer = CountVectorizer(strip_accents = 'unicode',
                                stop_words = 'english',
                                lowercase = True,
                                token_pattern = r'\b[a-zA-Z]{3,}\b',
                                max_df = 0.5,
                                min_df = 10)
dtm_tf = tf_vectorizer.fit_transform(tweets['cleaned_text'].values.astype('U'))
print(dtm_tf.shape)
```

```
(33556, 4103)
```

In [60]:

```
tfidf_vectorizer = TfidfVectorizer(**tf_vectorizer.get_params())
dtm_tfidf = tfidf_vectorizer.fit_transform(tweets['cleaned_text'].values.astype('U'))
print(dtm_tfidf.shape)
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/feature_extraction/text.py:2032: UserWarning: Only (<class 'numpy.floa
t64'>, <class 'numpy.float32'>, <class 'numpy.float16'>) 'dtype' should be used. <class 'numpy.int64'> 'dtype' will b
e converted to np.float64.
  UserWarning,
(33556, 4103)
```

In [61]:

```
# for TF DTM
lda_tf = LatentDirichletAllocation(n_components =8, random_state=50)
lda_tf.fit(dtm_tf)

# for TFIDF DTM
lda_tfidf = LatentDirichletAllocation(n_components =8, random_state=50)
lda_tfidf.fit(dtm_tfidf)
```

Out[61]:

```
LatentDirichletAllocation(n_components=8, random_state=50)
```

In [62]:

```
for i,topic in enumerate(lda_tf.components_):
    print(f'Top 10 words for topic #{i}:')
    print([tfidf_vectorizer.get_feature_names()[i] for i in topic.argsort()[-30:]])
    print('\n')
```

```
Top 10 words for topic #0:
['low', 'time', 'altcoin', 'cryptocurrencies', 'bullmarket', 'candle', 'day', 'cryptomarket', 'going', 'cryptos', 'bu
y', 'bear', 'cryptotrading', 'buythedip', 'think', 'dip', 'bullish', 'hodl', 'ethereum', 'altcoins', 'bitcoincrash',
'market', 'luna', 'eth', 'cryptocurrency', 'cryptocrash', 'btc', 'bitcoin', 'crypto', 'bearmarket']


Top 10 words for topic #1:
['stockstowatch', 'money', 'people', 'puts', 'day', 'buy', 'shares', 'know', 'calls', 'stockstobuy', 'think', 'shor
t', 'right', 'tsla', 'stockmarkets', 'gme', 'going', 'bearmarket', 'trending', 'like', 'today', 'qqq', 'crash', 'sp
x', 'stock', 'amc', 'market', 'stockmarket', 'spy', 'stocks']


Top 10 words for topic #2:
['people', 'march', 'new', 'stock', 'hike', 'crash', 'time', 'gas', 'oil', 'markets', 'years', 'rates', 'stocks', 'ye
ar', 'going', 'dow', 'market', 'high', 'rate', 'prices', 'dowjones', 'stockmarket', 'nasdaq', 'bearmarket', 'amp', 'b
iden', 'economy', 'fed', 'recession', 'inflation']


Top 10 words for topic #3:
/usr/local/lib/python3.7/dist-packages/sklearn/utils/deprecation.py:87: FutureWarning: Function get_feature_names is
deprecated; get_feature_names is deprecated in 1.0 and will be removed in 1.2. Please use get_feature_names_out inste
ad.
  warnings.warn(msg, category=FutureWarning)
['warren', 'crash', 'wall', 'god', 'aur', 'nifty', 'raha', 'tha', 'toh', 'green', 'thank', 'stockmarket', 'street',
'fearful', 'aaj', 'valentine', 'love', 'nahi', 'kya', 'greedy', 'bhi', 'stockmarketindia', 'stock', 'day', 'buy', 'po
rtfolio', 'dip', 'market', 'hai', 'red']


Top 10 words for topic #4:
['bearmarket', 'support', 'amp', 'closed', 'correction', 'time', 'crash', 'bse', 'days', 'like', 'sensex', 'news', 's
tockmarkets', 'nse', 'investing', 'bear', 'banknifty', 'week', 'fall', 'markets', 'points', 'good', 'today', 'tradin
g', 'stocks', 'stockmarketindia', 'stockmarket', 'nifty', 'stock', 'market']


Top 10 words for topic #5:
['target', 'sell', 'indian', 'traders', 'portfolio', 'banknifty', 'amp', 'india', 'world', 'putin', 'stockstobuy', 'b
uy', 'trading', 'investing', 'investors', 'sensex', 'war', 'markets', 'russiaukraineconflict', 'day', 'stock', 'toda
y', 'stockmarkets', 'market', 'stocks', 'russia', 'ukraine', 'stockmarket', 'stockmarketindia', 'nifty']


Top 10 words for topic #6:
['good', 'selling', 'trading', 'dip', 'stock', 'lose', 'investor', 'cash', 'investment', 'make', 'buying', 'opportuni
ty', 'investors', 'panic', 'que', 'amp', 'people', 'stockmarket', 'market', 'invest', 'time', 'don', 'term', 'sell',
'stocks', 'long', 'money', 'investing', 'buy', 'bearmarket']


Top 10 words for topic #7:
['new', 'run', 'cryptocurrency', 'stay', 'think', 'let', 'right', 'cryptocrash', 'best', 'eth', 'bullmarket', 'don',
'money', 'going', 'projects', 'nftcommunity', 'markets', 'good', 'know', 'people', 'make', 'bull', 'like', 'nfts', 't
ime', 'nft', 'crypto', 'bear', 'market', 'bearmarket']
```

In [63]:
```
pyLDAvis.sklearn.prepare(lda_tf, dtm_tf, tf_vectorizer)
```

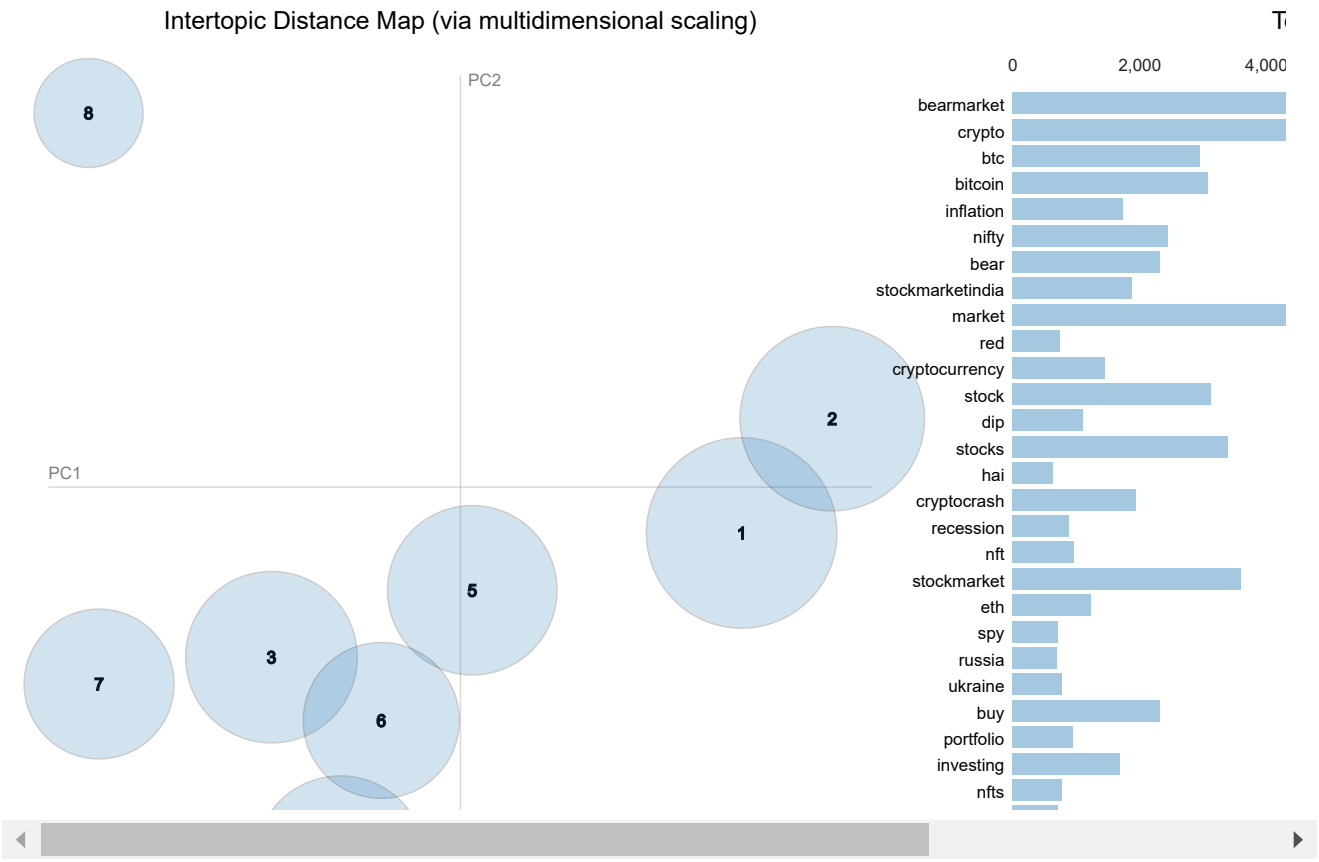
```
/usr/local/lib/python3.7/dist-packages/sklearn/utils/deprecation.py:87: FutureWarning: Function get_feature_names is
deprecated; get_feature_names is deprecated in 1.0 and will be removed in 1.2. Please use get_feature_names_out inste
ad.
  warnings.warn(msg, category=FutureWarning)
/usr/local/lib/python3.7/dist-packages/pyLDAvis/_prepare.py:247: FutureWarning: In a future version of pandas all arg
uments of DataFrame.drop except for the argument 'labels' will be keyword-only
  by='saliency', ascending=False).head(R).drop('saliency', 1)
```

Out[63]:

Selected Topic: 0 Previous Topic Next Topic Clear Topic

Slide to adjust relevance metric:(2)

λ = 1



In [64]:
```
topic_values = lda_tf.transform(dtm_tf)
topic_values.shape
```

Out[64]:
```
(33556, 8)
```

In [65]:
```
tweets.head()
```

Out[65]:

	text	created_at	cleaned_text	Subjectivity	Polarity	Analysis_Polarity	Analysis_Subjectivity
0	When will the #NYSE #stockmarketcrash happen?	2022-06-19 23:34:29+00:00	when nyse stockmarketcrash happen?	0.00000	0.00000	Neutral	Fact
1	Aaj ka gyan:\n\nIf a company isn't a quality c...	2022-06-19 23:28:20+00:00	aaj ka gyan: if pany quality pany, buy price l...	0.30000	0.00000	Neutral	Opinion
2	The stock market needs to crash hard to make i...	2022-06-19 23:11:52+00:00	the stock market needs crash hard make realist...	0.65625	-0.16250	Negative	Opinion
3	Those who are "Buying on DIP" will very soon b...	2022-06-19 22:57:27+00:00	those "buying dip" soon bee "promoters" pany s...	0.00000	0.00000	Neutral	Fact
4	@rdrhwke I wish our so-called President were t...	2022-06-19 22:45:55+00:00	i wish so-called president transitory, too. i ...	0.44375	-0.05625	Negative	Opinion

In [66]:
```
tweets.columns
```

Out[66]:
```
Index(['text', 'created_at', 'cleaned_text', 'Subjectivity', 'Polarity',
       'Analysis_Polarity', 'Analysis_Subjectivity'],
      dtype='object')
```

In [67]:
```
tweets_1=tweets.replace({0:'via',1:'Put',2:'Bee',3:'Attorney',4:'Saying',5:'Future',6:'lemoine',7:'blake'})

tweets_1['Topic'] = topic_values.argmax(axis=1)

tweets['Topic'] = topic_values.argmax(axis=1)

tweets_1.head()
```

Out[67]:

	text	created_at	cleaned_text	Subjectivity	Polarity	Analysis_Polarity	Analysis_Subjectivity	Topic
0	When will the #NYSE #stockmarketcrash happen?	2022-06-19 23:34:29+00:00	when nyse stockmarketcrash happen?	via	via	Neutral	Fact	1
1	Aaj ka gyan:\n\nIf a company isn't a quality c...	2022-06-19 23:28:20+00:00	aaj ka gyan: if pany quality pany, buy price l...	0.3	via	Neutral	Opinion	5
2	The stock market needs to crash hard to make i...	2022-06-19 23:11:52+00:00	the stock market needs crash hard make realist...	0.65625	-0.1625	Negative	Opinion	1
3	Those who are "Buying on DIP" will very soon b...	2022-06-19 22:57:27+00:00	those "buying dip" soon bee "promoters" pany s...	via	via	Neutral	Fact	5
4	@rdrhwke I wish our so-called President were t...	2022-06-19 22:45:55+00:00	i wish so-called president transitory, too. i ...	0.44375	-0.05625	Negative	Opinion	2

In [68]:
```
tweets_1.columns
```

Out[68]:
```
Index(['text', 'created_at', 'cleaned_text', 'Subjectivity', 'Polarity',
       'Analysis_Polarity', 'Analysis_Subjectivity', 'Topic'],
      dtype='object')
```

In [69]:
```
import seaborn as sns


plt.figure(figsize=(40,25))

g=sns.lmplot(x="Polarity", y="Subjectivity", hue='Topic', data=tweets, fit_reg=False, legend=False,palette="GnBu_d",

# # Move the legend to an empty part of the plot
# plt.legend(loc='lower right')

plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/regression.py:592: UserWarning: legend_out is deprecated from the `lmp
lot` function signature. Please update your code to pass it using `facet_kws`.
  warnings.warn(msg, UserWarning)
<Figure size 2880x1800 with 0 Axes>
```

In [70]:
```
tweets_2= tweets_1.groupby(['Topic'])['Analysis_Polarity'].value_counts().unstack('Topic').transpose()

tweets_2
```

Out[70]:

Analysis_Polarity	Negative	Neutral	Positive
Topic			
0	864	4117	1626
1	931	1427	1293
2	1062	1520	1437
3	302	1116	341
4	895	1800	1639
5	700	1754	934
6	725	1439	1747
7	1103	1932	2852

In [71]:

```
tweets_2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 8 entries, 0 to 7
Data columns (total 3 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   Negative  8 non-null      int64
 1   Neutral   8 non-null      int64
 2   Positive  8 non-null      int64
dtypes: int64(3)
memory usage: 256.0 bytes
```

In [72]:
```
tweets_2['Total'] = tweets_2.sum(axis=1)
```

In [73]:
```
tweets_2.columns
```

Out[73]:
```
Index(['Negative', 'Neutral', 'Positive', 'Total'], dtype='object', name='Analysis_Polarity')
```

In [74]:
```
for i in tweets_2:
    tweets_2[i] = round(tweets_2[i]*100/tweets_2.Total)

tweets_2
```

Out[74]:

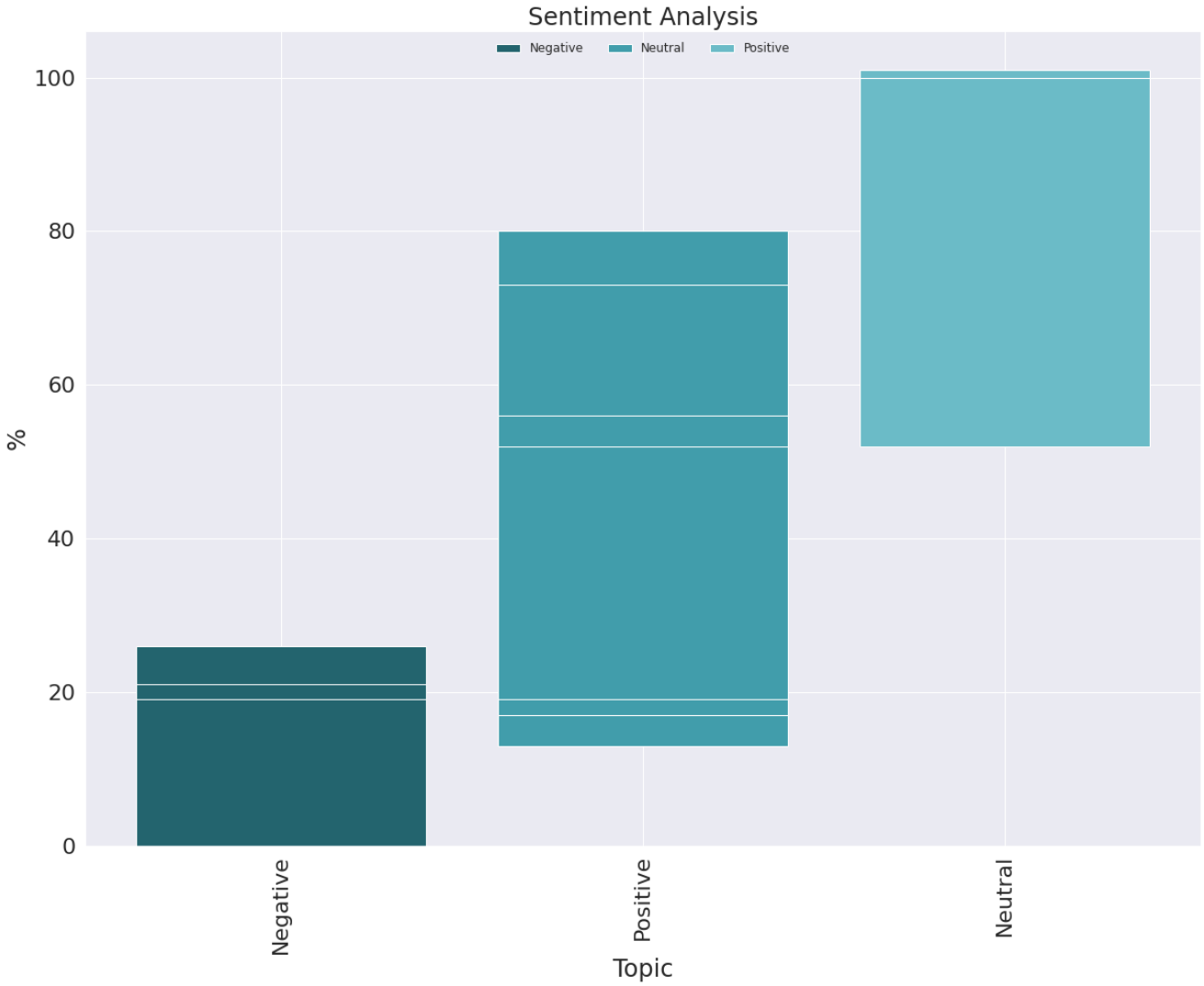
Analysis_Polarity	Negative	Neutral	Positive	Total
Topic				
0	13.0	62.0	25.0	100.0
1	25.0	39.0	35.0	100.0
2	26.0	38.0	36.0	100.0
3	17.0	63.0	19.0	100.0
4	21.0	42.0	38.0	100.0
5	21.0	52.0	28.0	100.0
6	19.0	37.0	45.0	100.0
7	19.0	33.0	48.0	100.0

In [75]:
```
tweets_2=tweets_2.fillna(0)
```

In [76]:
```
#Conduct Polarity Topic Analysis using Tableau

tweets_2.to_excel("Polarity_Topic_Modeling.xlsx")
```

In [77]:
```
tweets_2= tweets_2.drop(['Total'], axis=1)
```

In [78]:
```
#Plotting and visualizing the counts
plt.figure(figsize=(20,15))


sentiment = ['Negative', 'Neutral', 'Positive']
plt.title('Sentiment Analysis')
plt.xlabel('Sentiment')
plt.ylabel('%')
p1=plt.bar('Negative',tweets_2['Negative'], color='#23646e')
p2=plt.bar('Positive',tweets_2['Neutral'], color='#419dab', bottom=tweets_2['Negative'])
p3=plt.bar('Neutral',tweets_2['Positive'], color='#6bbbc7', bottom=tweets_2['Neutral']+tweets_2['Negative'])
plt.xticks(["Negative", "Neutral", "Positive"], rotation=90)
plt.xlabel("Topic")
plt.legend((p1[0], p2[0], p3[0]),('Negative', 'Neutral', 'Positive'),fontsize=12, ncol=4, framealpha=0, fancybox=True

plt.show()
```


Sentiment Analysis
Negative
Neutral
Positive
100
80
60
40
20
0
%
Negative
Positive
Neutral
Topic

In [78]: