Data Vis Final Project Code

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```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import gensim
import re
import spacy
from wordcloud import WordCloud
from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer
```

```python
import en_core_web_sm
spacy_nlp   = en_core_web_sm.load()
#if you would like to replicate this on your own machine, you will have to install spaCy,
# in order to run this particular cell
```

```python
musktweets = pd.read_csv('cleandata.csv')
print(len(musktweets))
musktweets.head()
```

```
2668
```

	Tweets	Retweets	Likes	Date	Cleane
0	@PeterSchiff thanks	209	7021	2022-10-27 16:17:39	thanks
1	@ZubyMusic Absolutely	755	26737	2022-10-27 13:19:25	Absolu
2	Dear Twitter Advertisers https://t.co/GMwHmInPAS	55927	356623	2022-10-27 13:08:00	Dear T
3	Meeting a lot of cool people at Twitter today!	9366	195546	2022-10-26 21:39:32	Meetin

	Tweets	Retweets	Likes	Date	Cleane
4	Entering Twitter HQ – let that sink in! https:...	145520	1043592	2022-10-26 18:45:58	Enteri

We begin with word tokenization. We will extract words from the cleaned_tweets (thank you Marta!) after removing stop words (repeptive, meaningless words like "I", "we", "is"... etc) except domain specific ones (we care about these ones). Then, we tokenize them to gather the frequency of each respective word. The intended product is to create a wordcloud that displays the most talked about subjects/words used.

```
def clean_tweets(tweet):
    word_tokens = spacy_nlp(tweet)
    tokens      = []

    for w in word_tokens:
        if not w.is_stop:
            s   = w.text.lower()
            tokens += s.split()
    text = " ".join(tokens)

    word_tokens    = spacy_nlp(text)
    filtered_tweet = []
    for w in word_tokens:
        if not w.is_stop:
            if w.lemma_ != "-PRON-":
                s = w.lemma_.lower()
            else:
                s = w.lower_
            s = s.strip('-')
            if len(s) <= 1:
                continue
            if re.match(r'^[a-zA-Z_\.]+$', s):
                filtered_tweet.append(s)

    return filtered_tweet
```

```
for i in range(5):
    print(clean_tweets(musktweets['Cleaned_Tweets'][i]))
```

```
['thank']
['absolutely']
```

```
['dear', 'twitter', 'advertiser']
['meet', 'lot', 'cool', 'people', 'twitter', 'today']
['enter', 'twitter', 'hq', 'let', 'sink']
```

```
tweets = list(musktweets["Cleaned_Tweets"].values)
tweets[0:5]
```

```
[' thanks',
 'Absolutely',
 'Dear Twitter Advertisers',
 'Meeting a lot of cool people at Twitter today!',
 'Entering Twitter HQ - let that sink in!']
```

```
processed = []

for t in tweets: #most time intensive process on lower-spec machines. It took me ~1 minute
    try:
        processed.append(clean_tweets(t))
    except: pass

dictionary = gensim.corpora.Dictionary(processed)
dictionarywords = dict(dictionary)
bagowords = [dictionary.doc2bow(doc) for doc in processed]
```

```
flatowords = [i for tweet in bagowords for i in tweet]
flatowords = [tweet[0] for tweet in flatowords]
flatowords = [dictionarywords[word] for word in flatowords]
```

```
freq = {}
for word in flatowords:
    if (word in freq):
        freq[word] += 1
    else:
        freq[word] = 1
del freq['amp'] #amp is the shorthand for ampersand (&) symbol. This is for some reason no
```

```
len(flatowords)
```

```
14981
```

```
wc = WordCloud(background_color="white",
               max_words=350,
               width=1000,
               height=600,
               random_state=1).generate_from_frequencies(freq)
plt.figure(figsize = (15,15))
plt.imshow(wc, interpolation="bilinear")
plt.title("Word Cloud of Elon Musk Tweets", fontsize = 30)
plt.axis("off")
plt.savefig("muskwordcloud.png", dpi = 800)
```

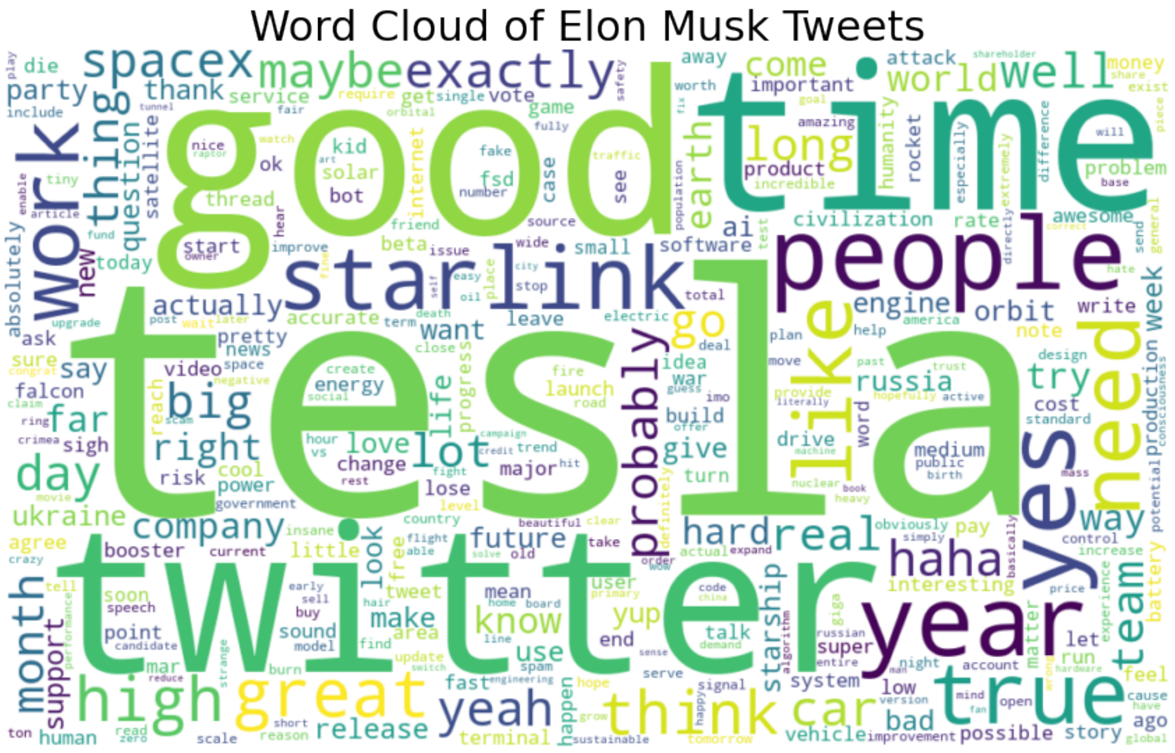


Figure 1: Wordcloud of Elon Musk's most commonly used words in tweets. Words like "Tesla", "Twitter", and "Good" are the most commonly used.

In order to visualize the data numerically, I have also created a bar chart of the top 20 most commonly used words.

```
wordDF = pd.DataFrame.from_dict(freq, orient = "index")
```

```
wordDF = wordDF.sort_values(by = 0, ascending = False)
top20 = wordDF.iloc[:20]
```

```
top20
```

	0
tesla	142
good	118
twitter	92
time	91
people	88
year	86
yes	82
starlink	81
true	76
work	74
need	73
like	69
great	67
high	60
think	56
car	55
exactly	55
spacex	52
yeah	51
day	50

```
plt.figure(figsize = (15,8))
plt.bar(range(len(top20)), list(top20[0]), tick_label = list(top20.index))
plt.title("Frequencies of Top 20 words in Elon Musk's Tweets", fontsize = 25)
plt.xlabel("Word", fontsize = 25)
plt.ylabel("Frequency", fontsize = 25)
plt.xticks(rotation = 60, fontsize = 20)
plt.yticks(fontsize = 20)
plt.savefig("wordbarchart.png",dpi = 400)
```

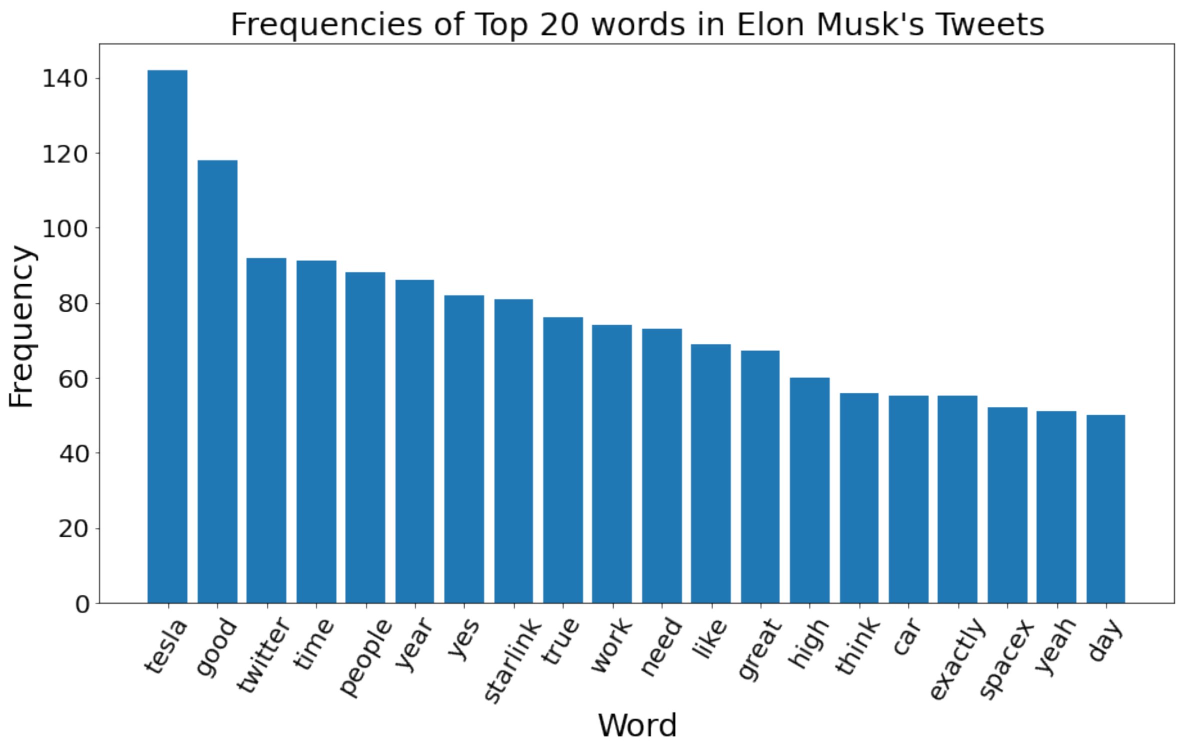


Figure: Bar chart of the top 20 most used words in Elon Musk's tweets. Just like the word cloud, "Tesla", "Good", and "Twitter" are the most common, with the former two dominating the space. The rest of the words are more or less uniform in their distribution.

Now we go on to sentiment analysis, with the vader Sentiment analysis library. Sentiment analysis looks at the words in a sentence and assigns a score for positive, negative, and neutral polarities, based on empirically created scores. For example, a word like "happy" would be calculated as having a positive score, while a word like "angry" would be defined as having a negative score. The final compound score is a normalization of the three polarity scores - thus, a negative compound score means the tweet was overall negative in sentiment, positive meaning the tweet was overall positive, and 0 being classified as "neutral". We are interested in examining the progression of Elon Musk's tweets to see if his tweets have gotten more positive, negative, or neutral as the year went on.

```
def sentiment_analyzer(tweetlist):

    analyser  = SentimentIntensityAnalyzer()
    pos, neg, neut  = [], [], []
    tweetlist = list(tweetlist['Cleaned_Tweets'])
    for tweet in tweetlist:
        score = analyser.polarity_scores(tweet)

        if score['compound']   >0: # positive comments
            pos.append(i)
        elif score['compound'] <0: # negative comments
            neg.append(i)
        else:
            neut.append(i)
    return (pos, neut, neg)
```

```
pos, neut, neg = sentiment_analyzer(musktweets)
print(len(pos), len(neg), len(neut))
```

```
1201 465 1002
```

```
from datetime import datetime

musktweets['Date']=musktweets['Date'].apply(lambda x: datetime.strptime(x, '%Y-%m-%d %H:%M
musktweets['Date'] = musktweets['Date'].apply(lambda x: x.date())
```

```
from datetime import date

jantweets = musktweets[musktweets.Date < date(2022,2,1)]
febtweets = musktweets[musktweets.Date >= date(2022,2,1)][musktweets.Date < date(2022,3,1)
marchtweets = musktweets[musktweets.Date >= date(2022,3,1)][musktweets.Date < date(2022,4,
apriltweets = musktweets[musktweets.Date >= date(2022,4,1)][musktweets.Date < date(2022,5,
maytweets = musktweets[musktweets.Date >= date(2022,5,1)][musktweets.Date < date(2022,6,1)
junetweets = musktweets[musktweets.Date >= date(2022,6,1)][musktweets.Date < date(2022,7,1
julytweets = musktweets[musktweets.Date >= date(2022,7,1)][musktweets.Date < date(2022,8,1
augusttweets = musktweets[musktweets.Date >= date(2022,8,1)][musktweets.Date < date(2022,9
septembertweets = musktweets[musktweets.Date >= date(2022,9,1)][musktweets.Date < date(202
octobertweets = musktweets[musktweets.Date >= date(2022,10,1)][musktweets.Date < date(2022

months = [jantweets,febtweets,marchtweets,apriltweets,maytweets,junetweets,julytweets,augu
```

```
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:4: UserWarning: Boolean Ser
```

```
  febtweets = musktweets[musktweets.Date >= date(2022,2,1)][musktweets.Date < date(2022,3,1)
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:5: UserWarning: Boolean Ser
  marchtweets = musktweets[musktweets.Date >= date(2022,3,1)][musktweets.Date < date(2022,4,
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:6: UserWarning: Boolean Ser
  apriltweets = musktweets[musktweets.Date >= date(2022,4,1)][musktweets.Date < date(2022,5,
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:7: UserWarning: Boolean Ser
  maytweets = musktweets[musktweets.Date >= date(2022,5,1)][musktweets.Date < date(2022,6,1)
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:8: UserWarning: Boolean Ser
  junetweets = musktweets[musktweets.Date >= date(2022,6,1)][musktweets.Date < date(2022,7,1
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:9: UserWarning: Boolean Ser
  julytweets = musktweets[musktweets.Date >= date(2022,7,1)][musktweets.Date < date(2022,8,1
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:10: UserWarning: Boolean Se
  augusttweets = musktweets[musktweets.Date >= date(2022,8,1)][musktweets.Date < date(2022,9
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:11: UserWarning: Boolean Se
  septembertweets = musktweets[musktweets.Date >= date(2022,9,1)][musktweets.Date < date(202
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/1036190498.py:12: UserWarning: Boolean Se
  octobertweets = musktweets[musktweets.Date >= date(2022,10,1)][musktweets.Date < date(2022
```

```
countlist = []
for month in months:
    pos, neut, neg = sentiment_analyzer(month)
    countlist.append((len(pos),len(neut),len(neg)))

countmat = np.array(countlist)
poscount = countmat[:,0]
neutcount = countmat[:,1]
negcount = countmat[:,2]
```

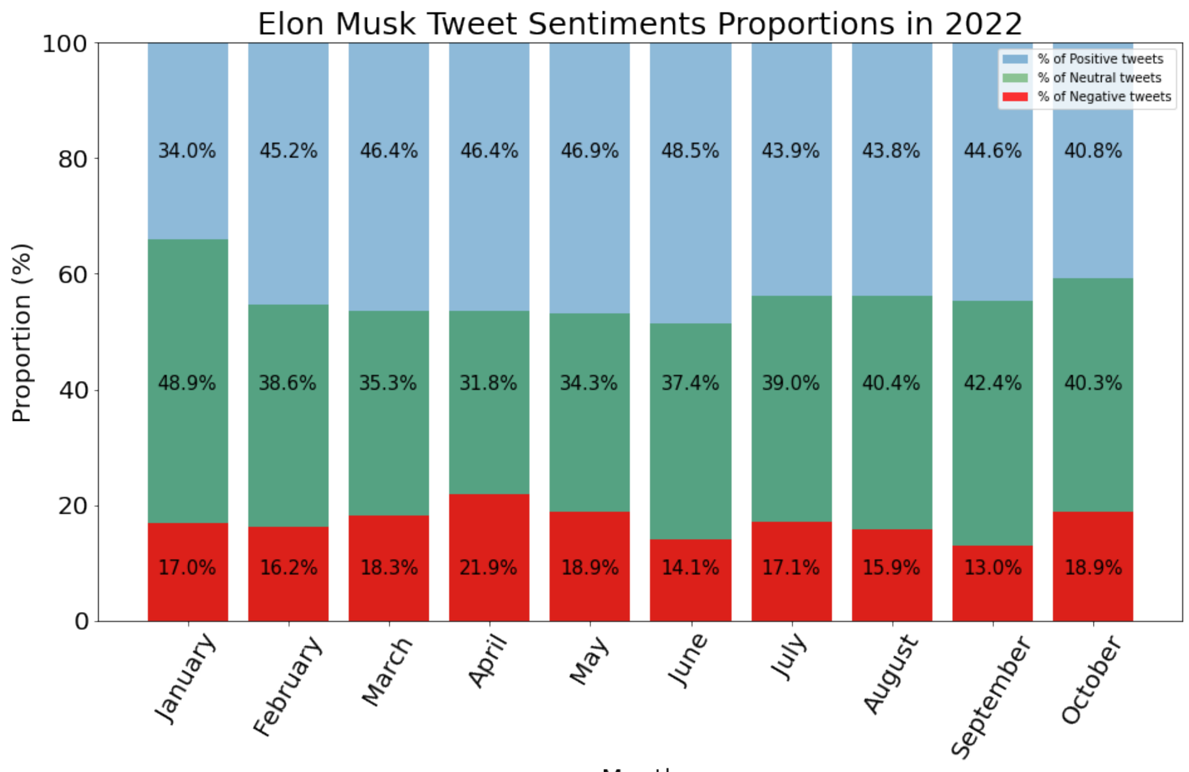
```
tweetsum = [i.sum() for i in countmat]
```

```
tweetsum
posprop = poscount/tweetsum *100
neutprop = neutcount/tweetsum *100
negprop = negcount/tweetsum *100
```

```
fig = plt.figure(figsize = (15,8))
months = ["January", "February", "March", "April", "May", "June", "July", "August", "Septe
ax = fig.add_axes([0.1, 0.1, 0.8, 0.8])
monthIDX = [0,1,2,3,4,5,6,7,8,9]
```

```
#plt.plot(posprop, label = "Positive Tweets", c = 'b')
#plt.plot(neutprop+negprop, label = "Neutral Tweets", c = 'g')
#plt.plot(negprop, label = "Negative Tweets", c = 'r')
plt.bar([0,1,2,3,4,5,6,7,8,9],[100,100,100,100,100,100,100,100,100,100], alpha = 0.5, labe
plt.bar(monthIDX, neutprop+negprop, alpha = 0.4, color = 'g', label = "% of Neutral tweets
plt.bar(monthIDX, negprop, alpha = 0.8, color = 'r', label = "% of Negative tweets")
ax.set_xticks([0,1,2,3,4,5,6,7,8,9])
ax.set_xticklabels(months)
plt.legend()
plt.title('Elon Musk Tweet Sentiments Proportions in 2022', fontsize = 25)
plt.ylim([0,100])
plt.xlabel('Month', fontsize = 20)
plt.ylabel('Proportion (%)',fontsize = 20)
plt.xticks(fontsize = 20, rotation = 60)
plt.yticks(fontsize = 20)
for i in monthIDX:
    plt.text(i-0.3, 8, str(np.round(negprop[i],1))+"%", fontsize = 15)
for i in monthIDX:
    plt.text(i-0.3, 40, str(np.round(neutprop[i],1))+"%", fontsize = 15)
for i in monthIDX:
    plt.text(i-0.3, 80, str(np.round(posprop[i],1))+"%", fontsize = 15)
plt.savefig("sentimentbarchartprop", dpi = 400, bbox_inches = "tight")
```

```
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/2611963713.py:26: UserWarning: Creating le
  plt.savefig("sentimentbarchartprop", dpi = 400, bbox_inches = "tight")
```



```
fig = plt.figure(figsize = (15,8))
months = ["January", "February", "March", "April", "May", "June", "July", "August", "Septe
ax = fig.add_axes([0.1, 0.1, 0.8, 0.8])
plt.plot(poscount, label = "Positive Tweets", c = 'b')
plt.plot(neutcount, label = "Neutral Tweets", c = 'g')
plt.plot(negcount, label = "Negative Tweets", c = 'r')
plt.bar([0,1,2,3,4,5,6,7,8,9],tweetsum, alpha = 0.3, label = "Total # of Tweets")
ax.set_xticks([0,1,2,3,4,5,6,7,8,9])
ax.set_xticklabels(months)
plt.legend()
plt.title('Elon Musk Tweet Sentiments and Totals in 2022', fontsize = 25)
plt.xlabel('Month', fontsize = 20)
plt.ylabel('Count',fontsize = 20)
plt.xticks(fontsize = 20, rotation = 60)
plt.yticks(fontsize = 20)
plt.savefig("sentimentbarchart", dpi = 400, bbox_inches = "tight")
```

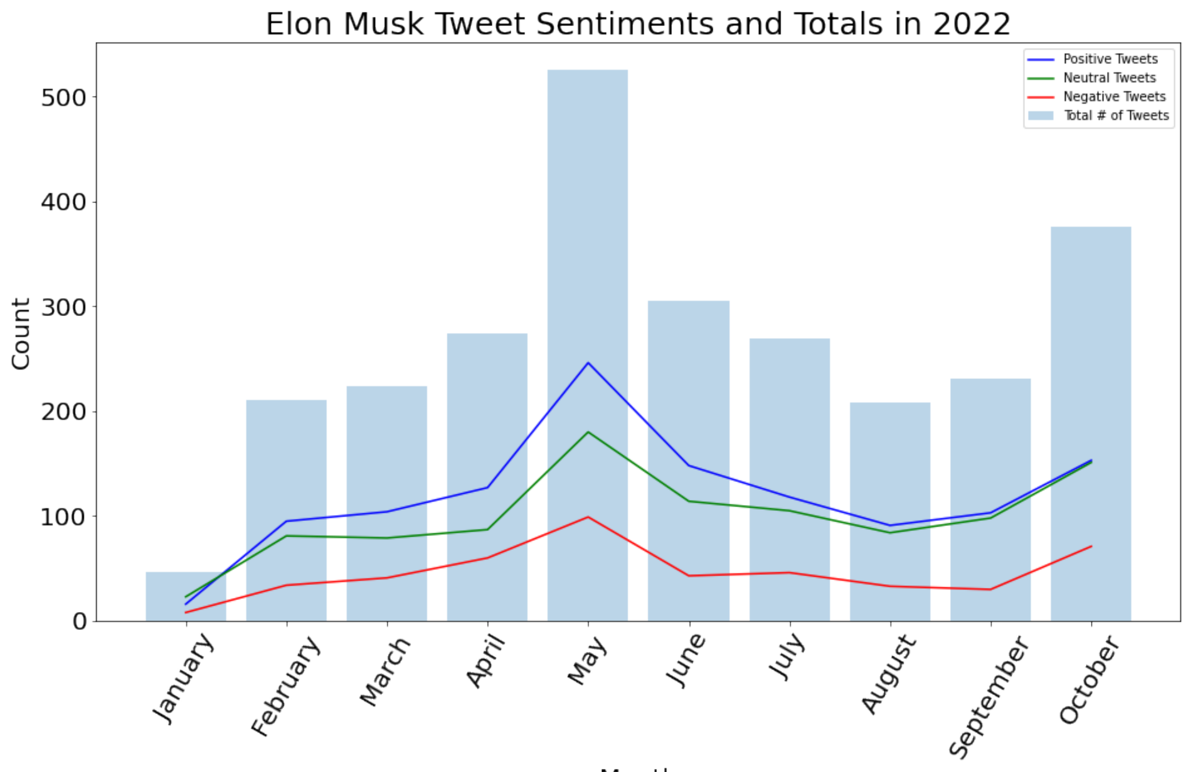


Figure: Line and bar chart representing the time series of Elon Musk's tweet sentiments in the year 2022. We can see that most of his tweets are positive in sentiment, and all three types of tweets follow roughly the same pattern. However, past May of 2022 the rate of change for his number of positive tweets begins to decrease, becoming closely in tandem with the number of neutral tweets, which implies that past May of 2022 he begins to tweet out less and less positive tweets.

(realistically, this section should be before sentiment analysis but I did the easy stuff first before moving on to this)

We are interested in what topics/words are most related in Elon Musk's tweets. In order to do this, we create a network graph to visualize and analyze the connections between words used in Musk's tweets.

We will calculate all the two-word combinations of Musk's tweets and generate their respective frequencies. Another popular method is to calculate all two-word n-grams (bigrams), which are only sequential words. We will prefer the combination method as it will incorporate the bigrams as a combination (due to how combinations are calculated), as well as its ability to capture more of the overall subjects of the tweets in case longer tweets discuss more than one topic. This may introduce soem false positives into the final calculation, but we can circumvent this by setting a threshold on the required number of hits.

```
processed
import itertools
list(itertools.combinations([1, 2, 3],2))
```

```
[(1, 2), (1, 3), (2, 3)]
```

```
combinations = []
for tweet in processed:
    combinations.append(list(itertools.combinations(tweet,2)))
combinations = [combination for combination in combinations if len(combination)>0]
combinations = [item for combination in combinations for item in combination]
combinations = [combination for combination in combinations if "amp" not in combination] #
combinations = [combination for combination in combinations if combination[0] != combinati
combfreq = {}
for tup in combinations:
    if (tup in combfreq):
        combfreq[tup] += 1
    else:
        combfreq[tup] = 1
```

```
combDF = pd.DataFrame.from_dict(combfreq, orient = "index")
combDF = combDF.sort_values(by = 0, ascending = False)
combDF = (combDF[combDF[0]>1])
combDF = combDF.reset_index()
combDF = combDF.rename(columns = {'index': "comb", 0: 'weight'})
combDF
```

	comb	weight
0	(russia, ukraine)	17
1	(russia, crimea)	16
2	(tesla, ai)	16
3	(tesla, company)	14
4	(free, speech)	14
...	...	...
7699	(lift, people)	2
7700	(attack, industry)	2

	comb	weight
7701	(crimea, nuclear)	2
7702	(broadly, inclusive)	2
7703	(global, world)	2

We can now process the combination into source -> target, and set a threshold value of "7" necessary hits before it can be considered in the graph.

```
combDF['source'] = combDF.comb.apply(lambda x: x[0])
combDF['target'] = combDF.comb.apply(lambda x: x[1])
combDF = combDF[combDF.weight >= 7]
combDF['weight'] = combDF['weight'] * 10
```

```
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/4214577488.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guid
  combDF['weight'] = combDF['weight'] * 10
```

```
combDF.source.values
```

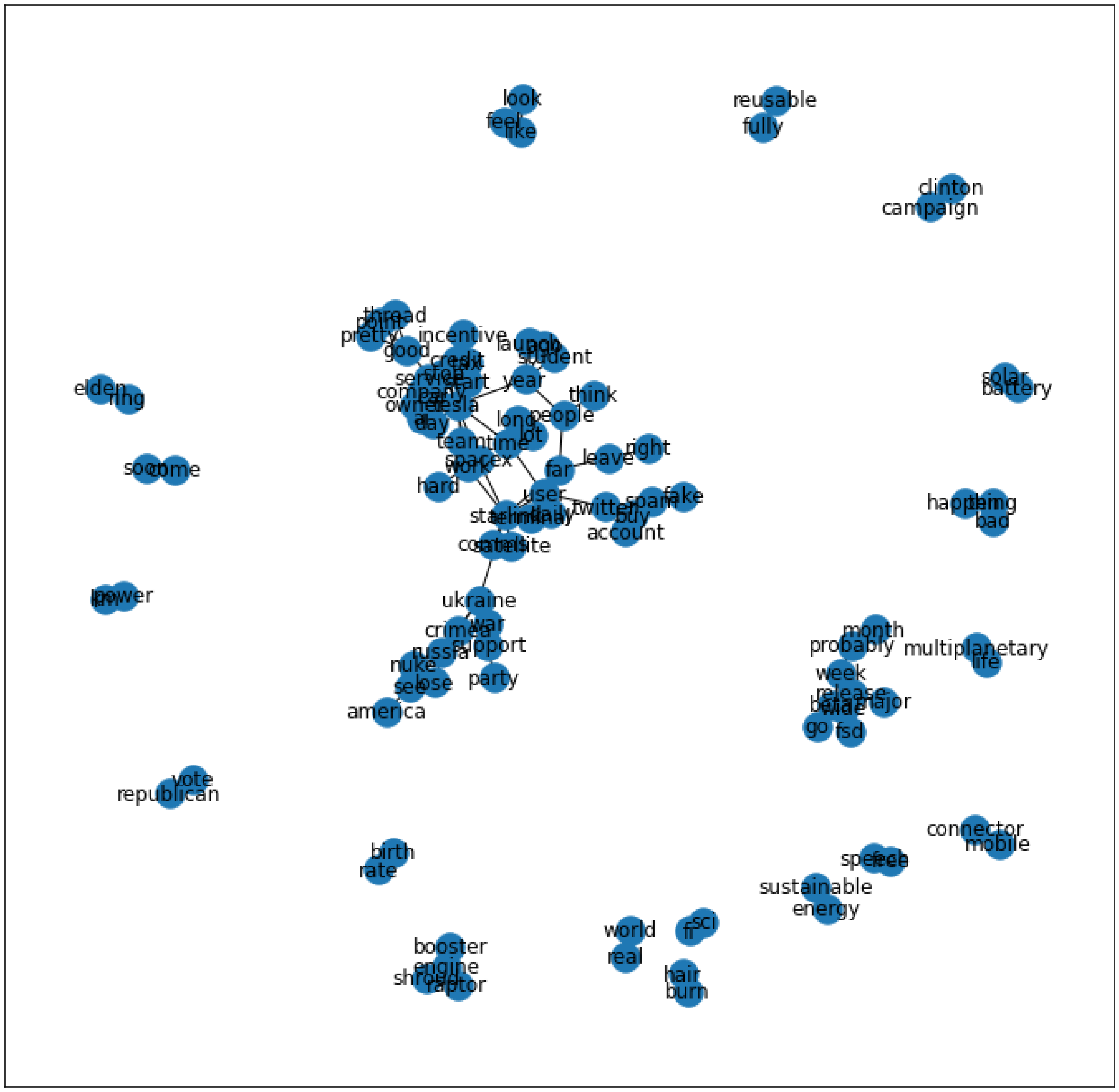
```
array(['russia', 'russia', 'tesla', 'tesla', 'free', 'tesla', 'tesla',
       'twitter', 'year', 'starlink', 'russia', 'birth', 'tesla',
       'release', 'team', 'fsd', 'work', 'crimea', 'tesla', 'starlink',
       'ai', 'starlink', 'tesla', 'good', 'ukraine', 'tesla', 'support',
       'booster', 'bad', 'sustainable', 'beta', 'leave', 'wide', 'russia',
       'starlink', 'come', 'tesla', 'tesla', 'comms', 'raptor',
       'starlink', 'incentive', 'incentive', 'fake', 'daily', 'solar',
       'fully', 'look', 'america', 'tesla', 'long', 'tesla', 'twitter',
       'people', 'user', 'spacex', 'vote', 'tax', 'car', 'release',
       'engine', 'mobile', 'starlink', 'elden', 'student', 'week',
       'major', 'burn', 'work', 'engine', 'start', 'power', 'real',
       'pretty', 'clinton', 'wide', 'lot', 'good', 'probably', 'war',
       'twitter', 'car', 'probably', 'user', 'feel', 'launch', 'go',
       'crimea', 'time', 'spacex', 'far', 'work', 'support', 'buy',
       'life', 'far', 'tesla', 'account', 'thing', 'sci', 'see', 'year',
       'tesla'], dtype=object)
```

```
combDF.target.values
```

```
array(['ukraine', 'crimea', 'ai', 'company', 'speech', 'spacex', 'car',
       'user', 'ago', 'satellite', 'nuke', 'rate', 'year', 'beta', 'work',
       'beta', 'tesla', 'russia', 'team', 'far', 'day', 'work', 'tax',
       'thread', 'russia', 'credit', 'ukraine', 'engine', 'thing',
       'energy', 'release', 'right', 'beta', 'lose', 'ukraine', 'soon',
       'work', 'day', 'starlink', 'engine', 'terminal', 'tax', 'credit',
       'spam', 'user', 'battery', 'reusable', 'like', 'see', 'service',
       'time', 'owner', 'spam', 'think', 'terminal', 'team', 'republican',
       'credit', 'tesla', 'week', 'booster', 'connector', 'user', 'ring',
       'year', 'beta', 'release', 'hair', 'hard', 'shroud', 'tesla', 'km',
       'world', 'good', 'campaign', 'release', 'time', 'point', 'month',
       'ukraine', 'account', 'company', 'week', 'time', 'like', 'year',
       'beta', 'ukraine', 'tesla', 'starlink', 'leave', 'starlink',
       'party', 'twitter', 'multiplanetary', 'people', 'good', 'twitter',
       'happen', 'fi', 'russia', 'people', 'stop'], dtype=object)
```

```
import networkx as nx

G = nx.from_pandas_edgelist(combDF, source="source", target="target")
plt.figure(figsize = (12,12))
nx.draw_networkx(G)
```



The above graph is incredibly ugly. The interactive graph visualizer (gravis) can help create an interactive html network graph with more understandable parameters.

```
import gravis as gv
fig = gv.d3(G, edge_size_data_source='weight', use_edge_size_normalization=True, use_node_
             zoom_factor=0.6, use_x_positioning_force = True, x_positioning_force_strength
             use_centering_force = True, many_body_force_strength = -66)
```

```
Func = open("graphhtml.html","w", encoding = 'utf-8')

Func.write(fig.to_html())

Func.close()
```

i hate html i hate html i hate html i hate html i hate html i hate html i hate html i hate html i hate html i hate html

i hate html i hate html i hate html i hate html i hate html i hate html i hate html i hate html i hate html i hate html

To Do: Scatter plot of Sentiment vs subjectivity vs Pseudo-engagement (retweets + likes), in order to see which tweets garner the most amount of engagements with twitter users.

Engagement on Twitter is calculated as a sum of the Likes, Retweets, Quote Retweets, and Replies on any given tweet. We do not have the latter two of the those statistics, so our best statistic is calculating a "pseudoengagement" by summing up retweets and likes.

We will modify our original sentiment analyzer function in order to produce an absolute number for sentiment (calculated on a scale of -1 to + 1).

```
def sentiment_analyzer_num(tweetlist):

    analyser  = SentimentIntensityAnalyzer()
    sent = []
    tweetlist = list(tweetlist['Cleaned_Tweets'])
    for tweet in tweetlist:
        score = analyser.polarity_scores(tweet)
        sent.append(score['compound'])
    return sent
```

```
musktweets['pengagement'] = musktweets['Retweets'] + musktweets['Likes']
musktweets.head()
```

	Tweets	Retweets	Likes	Date	Cleaned_Tweet
0	@PeterSchiff thanks	209	7021	2022-10-27	thanks
1	@ZubyMusic Absolutely	755	26737	2022-10-27	Absolutely
2	Dear Twitter Advertisers https://t.co/GMwHmInPAS	55927	356623	2022-10-27	Dear Twitter A
3	Meeting a lot of cool people at Twitter today!	9366	195546	2022-10-26	Meeting a lot o
4	Entering Twitter HQ – let that sink in! https:...	145520	1043592	2022-10-26	Entering Twitte

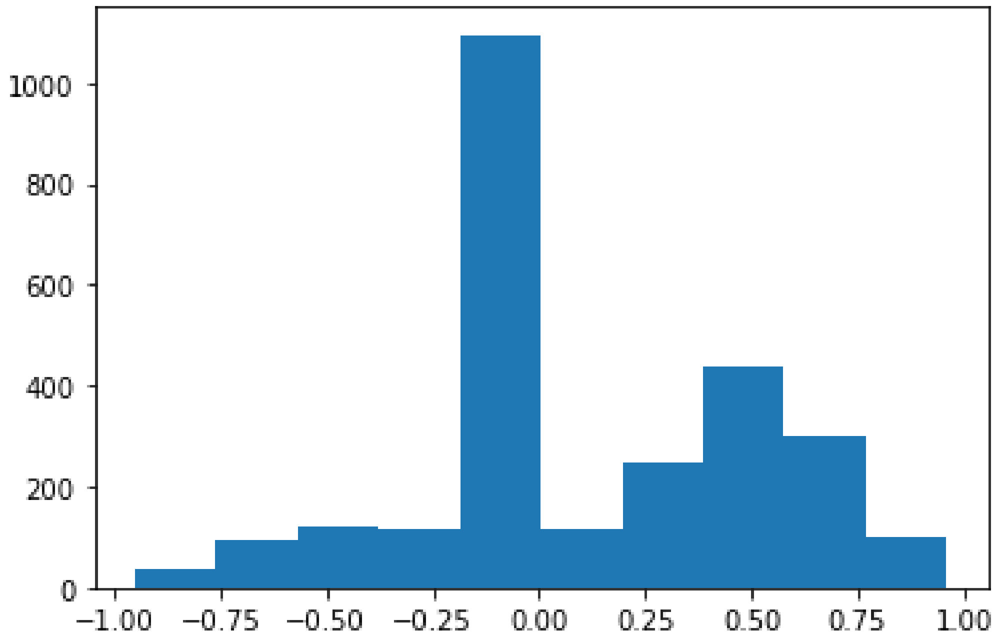
```
musktweets.sort_values(by = 'pengagement', ascending = False).head()
```

	Tweets	Retweets	Likes	Date	Cleaned_Tweet
1949	Next I'm buying Coca-Cola to put the cocaine b...	681707	4780787	2022-04-28	Next I'm buyin
1969	I hope that even my worst critics remain on Tw...	368279	3232772	2022-04-25	I hope that eve
1968	Yesss!!! https://t.co/0T9HzUHuh6	348158	2608578	2022-04-25	Yesss!!!
1946	Let's make Twitter maximum fun!	194742	2650644	2022-04-28	Let's make Twi
1945	Listen, I can't do miracles ok https://t.co/z7...	212854	2581112	2022-04-28	Listen, I can't c

```
sentiment = sentiment_analyzer_num(musktweets)
musktweets['sentiment'] = sentiment
```

```
plt.hist(sentiment)
```

```
(array([  38.,   96.,  120.,  118., 1096.,  114.,  247.,  436.,  303.,
         100.]),
 array([-0.9509 , -0.75986, -0.56882, -0.37778, -0.18674,  0.0043 ,
         0.19534,  0.38638,  0.57742,  0.76846,  0.9595 ]),
 <BarContainer object of 10 artists>)
```



```
musktweets[musktweets.sentiment < -0.9].iloc[1].Cleaned_Tweets
```

```
'Obviously many disagree with this logic, but what do they think is their probability of bei
```

```
musktweets[musktweets.sentiment > 0.9]
```

	Tweets	Retweets	Likes	Date	Cleaned_
33	@ChananBos @SquawkCNBC @Kasparov63 Yeah, I'm b...	281	5838	2022-10-24	Yeah, I'r
57	@stillgray @DavidSacks Switzerland &amp; Belgi...	107	2003	2022-10-22	Switzerla
441	@enn_nafnlaus @treygahigh @TaraBull808 @thelia...	81	1416	2022-09-21	Althougl
567	@BLKMDL3 @Apple @SpaceX We've had some promisi...	860	9832	2022-09-08	We've ha
678	2 main goals this year: \n\n- Starship to orbi...	5808	75713	2022-08-22	2 main g
1066	@TonyadeVitti @historydefined His success was ...	159	3085	2022-07-05	His succe
1185	@PPathole @teslaownersSV @TheTexanNews @MayraF...	1159	15823	2022-06-15	I suppor
1364	It is rare for me to endorse political candida...	7675	98299	2022-06-03	It is rare
1399	@PinballReed @crikey_news @ummjackson @cameron...	632	7259	2022-05-31	My kids
1705	@intelligent_eat Yes, the purpose of AI Day is...	503	7835	2022-05-17	Yes, the
1840	I strongly believe that all managers in a tech...	24645	266437	2022-05-06	I strongl
2170	Peace. Peace? I hate the word. Those who do c...	4285	68164	2022-04-03	Peace. P
2204	@BillyM2k @nichegamer Played some &amp; will c...	600	11849	2022-03-29	Played s
2284	Thank you for the offer, but such excellent tr...	22737	340651	2022-03-15	Thank y

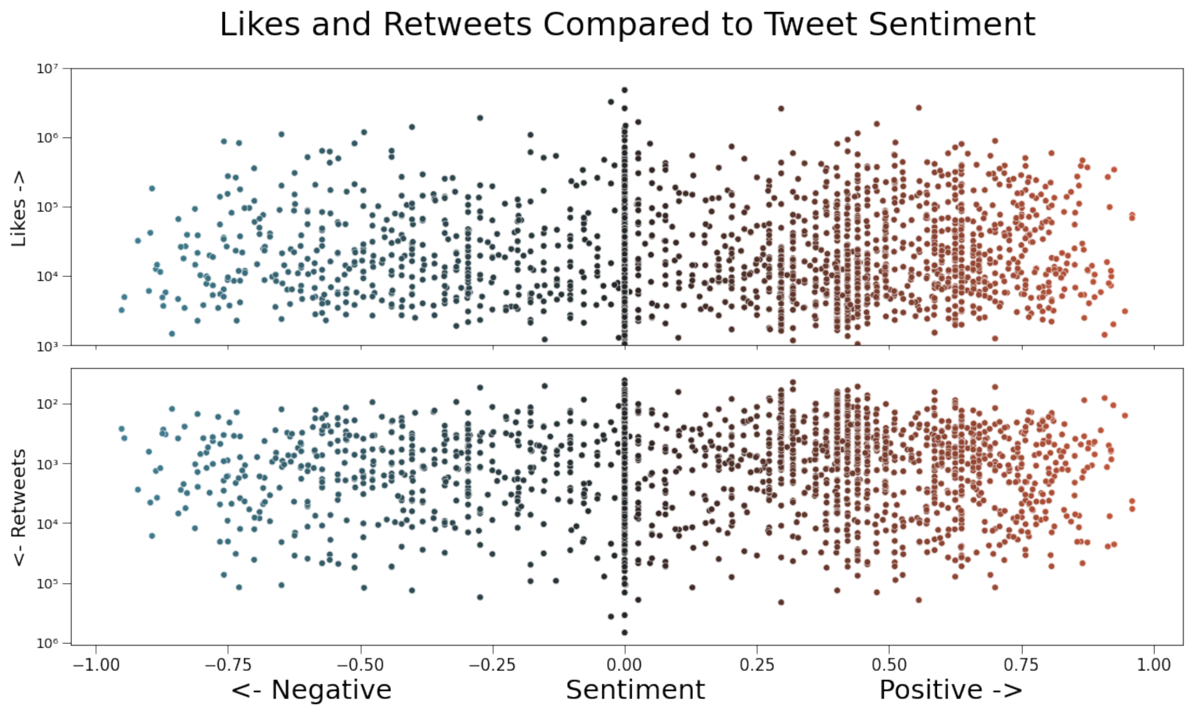
```
fig,(ax,ax2) = plt.subplots(2, 1, sharex=True, figsize = (15,8))
fig.tight_layout()

sns.scatterplot(data = musktweets, x = "sentiment", y = np.log10(musktweets.Likes), hue =
    palette = sns.diverging_palette(220, 20, center = "dark", as_cmap=True), legend = Fals
)
sns.scatterplot(data = musktweets, x = "sentiment", y = -1*np.log10(musktweets.Retweets),
    palette = sns.diverging_palette(220, 20, center = "dark", as_cmap=True), legend = Fals
)

ax.set_title("Likes and Retweets Compared to Tweet Sentiment", fontsize = 30,pad=30)
ax2.set_xlabel("<- Negative                    Sentiment                    Positive ->",
ax.set_ylim([3,7])
ax2.set_yticklabels(['10\u00b2','10\u2076','10\u2075','10\u2074','10\u00b3','10\u00b2'])
ax2.tick_params(axis = 'x', length = 8, labelsize = 15)
```

```
ax2.tick_params(axis = 'y', length = 8, labelsize = 13)
ax.set_yticks(ticks = [3.0,4.0,5.0,6.0,7.0])
ax.set_yticklabels(['10\u00b3','10\u2074','10\u2075','10\u2076','10\u2077'])
ax.tick_params(axis = 'y', length = 8, labelsize = 13)
ax.set_ylabel(ylabel = 'Likes ->',fontsize = 18)
ax2.set_ylabel(ylabel = '<- Retweets',fontsize = 18)
plt.savefig("lrtscatter.png", dpi = 400, bbox_inches = "tight")
```

```
C:\Users\RICHAR~1\AppData\Local\Temp/ipykernel_468/2579445189.py:14: UserWarning: FixedForma
  ax2.set_yticklabels(['10\u00b2','10\u2076','10\u2075','10\u2074','10\u00b3','10\u00b2'])
```



```
del(ax)
```