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Statistical and Data Mining Methods - MUSA 500
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Assignment 6

A Twitter Analysis of Philadelphia's Indoor Dining Vaccine Mandate

Introduction

On December 13th, the city of Philadelphia introduced a Vaccine Mandate for indoor dining. Starting on January 3rd, 2022, all customers must present proof of vaccination to enter restaurants and "food venues" including the Wells Fargo Center, home of the 76ers and Flyers.[1] Philadelphia is not the first city to implement such a policy - New York City and San Francisco have enforced similar mandates since August, drawing support from some and protest from others. Although 75.8% of Philadelphia adult residents are fully vaccinated, case rates have increased since Thanksgiving, which Health Commissioner Dr. Cheryl Bettigole attributes to holiday gatherings and colder weather driving people indoors together.[2]

Vaccine Mandates are a controversial topic around the globe and especially in America as leaders attempt to manage the COVID public health crisis despite detractors who suggest the mandates infringe on their personal freedoms. Philadelphia's new policy is no exception to this controversy. This report will investigate twitter trends using the search term "Philadelphia vaccine mandate" and "Philly vaccine mandate". This term was searched using both R and Python on Dec 15th at 10 a.m. The resulting **1913** in R and **2114** in Python were cleaned then analyzed using word clouds and sentiment analysis.

Methods

In an attempt to understand the underlying attitudes and options between words, we need to clean the tweets and make it ready for analysis, so we first removed special characters like "@", "/", "]", or "$". And then, we removed punctuations such as ".", ",", etc. We also removed the non-ascii characters like "😊", as those characters or punctuations do not have specific meanings. Besides, we filtered the English stop words such as "is", "are", or "with". We also excluded our own stop words like "Philly", "Philadelphia", or "by", etc., because again, they don't express attitudes and are not helpful to the analysis. We also removed all the white space characters like "\n" or "\t". In addition, we removed the URL of tweets with ***gsup*** in R and ***re.sub*** in Python.

[1] https://www.inquirer.com/health/coronavirus/live/covid-philadelphia-vaccine-pa-nj-de-updates-20211213.html
[2] https://6abc.com/covid-19-vaccination-philadelphia-restaurants-indoor-dining-philly-vaccine-mandate/11334019/

```
# Remove special characters
toSpace <- content_transformer(function(x, pattern) gsub(pattern, " ", x))
myCorpus <- tm_map(myCorpus, toSpace, "@")
myCorpus <- tm_map(myCorpus, toSpace, "/")
myCorpus <- tm_map(myCorpus, toSpace, "]")
myCorpus <- tm_map(myCorpus, toSpace, "$")

# Remove Punctuation
myCorpus <- tm_map(myCorpus, removePunctuation)

# Remove non-ascii characters
myCorpus <- tm_map(myCorpus, function(x) iconv(x, "latin1", "ASCII", sub=""))

# Remove English stop words
myCorpus <- tm_map(myCorpus, removeWords, stopwords("english"))

# Remove our own stop words
myCorpus <- tm_map(myCorpus, removeWords,c("Philadelphia", "Philly", "By", "the", "may", "will", "ttp", "qhb...", "https", "http...", "for", "tco"))

# Look at first Corpus result
strwrap(myCorpus[[1]])

# Remove whitespace characters
myCorpus <- tm_map(myCorpus, stripWhitespace)
```

Figure 1 – Screen Shot of Cleaning Process in R

Results

a) Word Cloud Analysis

To distill the content of all 4,027 tweets and identify common words or phrases, word clouds were created for both sets of tweets.

Figure 2 – R Word Cloud

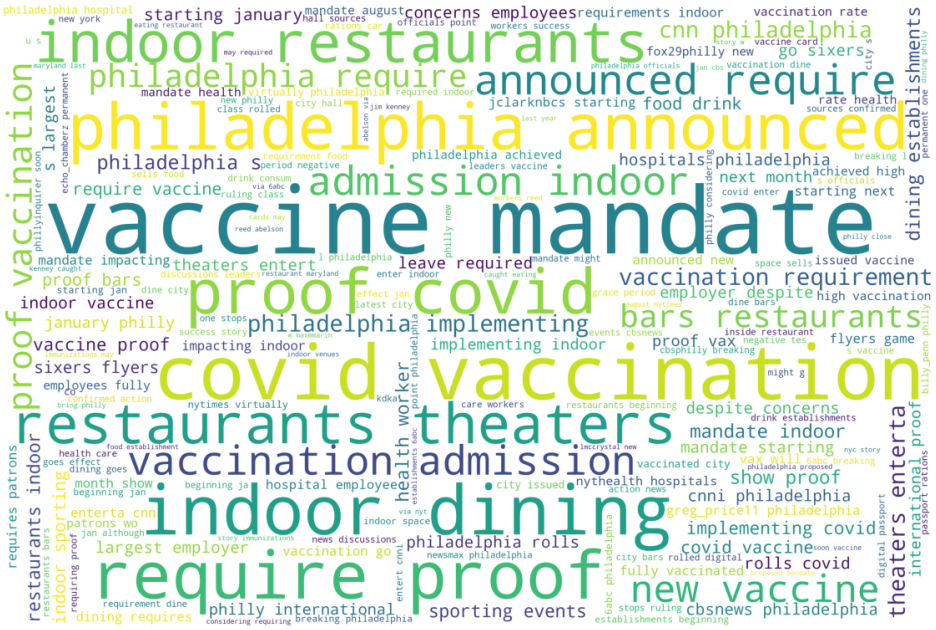

Figure 3 – Python Word Cloud

The clouds are generally very similar with variations of vaccine, mandate, covid, indoor, and dining appearing most frequent. These words are expected given the search terms. Several venues including restaurants, sixers and flyers (referring to their shared arena), Philadelphia international airport, and theaters appear as twitter users comment on where this policy will apply. Perhaps a more interesting frequent word is leave, which was used in several tweets suggesting Philadelphia residents should leave the city to boycott the policy.

b) Spatial Analysis

In an attempt to understand any spatial correlation of the tweets, the latitude and longitude columns were separated with the intention of plotting them on a map. Unfortunately, not a single tweet had latitude and longitude values, so plotting was not possible. If we had the coordinates of the tweets, it would have been interesting to compare the trends within the city of Philadelphia to tweets in the suburbs and beyond.

c) Sentiment Analysis

To get a sense of the perception of the mandate, a sentiment analysis was performed on the tweets in Python. Figure 4 shows the polarity of the tweets, with negative and positive values expressing positive and negative sentiment respectively.

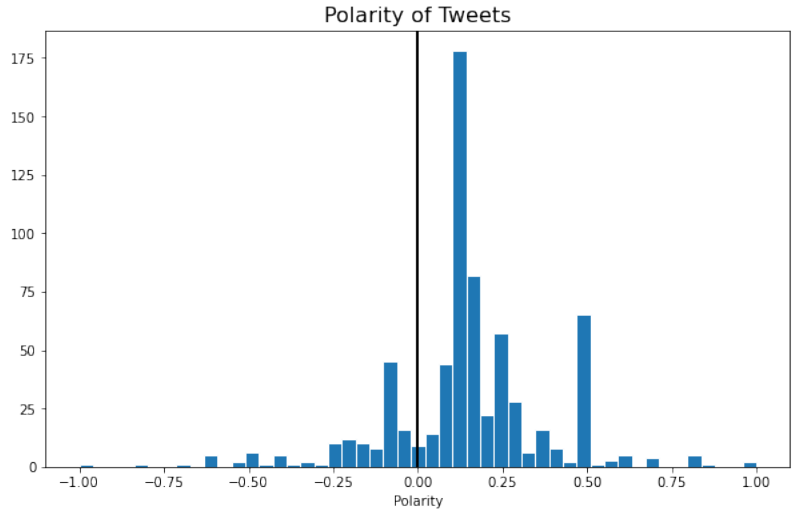

Figure 4 – Polarity of Tweets

The histogram shows that the majority of the tweets are deemed slightly positive, with the mode polarity around 0.10.

Next, the tweets with the highest and lowest polarity were collected and are displayed in Figures 5 and 6.

```
EVIL!! Philadelphia to Start Restaurant, Bar Vaccine Mandate
@DannCuellar @6abc Considering the homeless, drugs, and violent crime, the vaccine mandate is just another reason to
stay out of Philadelphia.
Another democratic hell hole takes more rights away. "shocked face"
I was told IDs are racist.
I guess @JimFKenney doesn't like minorities dining out in Philly. SAD!
Over 30 thousand people in Philadelphia have died from Covid and this asshat is mad at 500 deaths because he doesnt w
ant a vaccine mandate.
```

Figure 5 – 5 Tweets with Lowest Polarity

```
@Instigatorz889 @jsaquella Sounds like the restaurant owners (except one kook) are happy about it:
a philly cop came into my school today and proudly admitted they their precinct couldn't host an event at the filmore
because of the vaccine mandate but decided that they could host one in a school
make it make sense
Good for our city! #philly Great!!!!!
.@GovInslee It would be wonderful for Washington to implement this as well. It would take the compliance out of the h
ands of each restaurant.
```

Figure 6 – 5 Tweets with Highest Polarity

Unsurprisingly, these tweets show the extremes of opinions, on both ends of the spectrum. The negative tweets suggest the mandate is taking away rights and criticize the mayor responsible for the mandate. The positive tweets, on the other hand, appear to be celebrating the policy, even suggesting it should be implemented elsewhere.

Figure 7 below shows the subjectivity of the tweets.

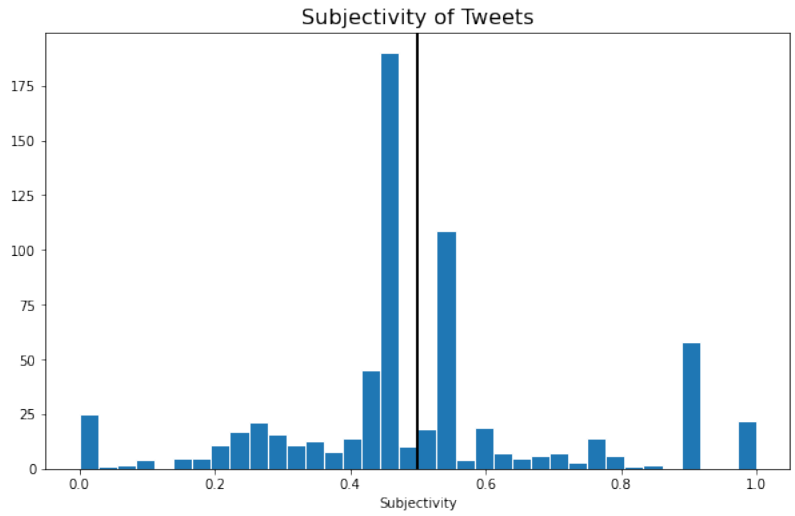

Figure 7 – Subjectivity of Tweets

The subjectivity plot runs from most objective at 0 to most subjective at 1. Most tweets land around 0.5 suggesting a mix of subjectivity and objectivity. The mode is slightly more objective than subjective. Tweets announcing the mandate without any opinion should be considered objective by this analysis and be close to 0. Conversely, when tweets use words like "favorite" that signify strong subjectivity they would be plotted close to 1.

Discussion

It is not surprising that people's attitudes towards indoor dinning vaccine mandate is mixed. In the results, some people welcomed the policy, while others had strong opposite opinions about it. Overall, the attitudes of the tweets are slightly positive, and the majority of citizens is positive or neutral towards it.

Given how recent this policy was introduced, these initial responses may change over the next few weeks as the city prepares for enforcement. The policy goes into effect on January 3rd; however, they city is allowing patrons to present a recent negative test result in place of a vaccine for the first two weeks. This same analysis would be interesting to perform again on January 3rd once the mandate starts, and finally on the 17th once restaurants are no longer accepting negative tests to see how public perception changes.