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Articles

Analyzing Public Attitudes Toward COVID-19 Lockdown Measures Through Text Mining Twitter: São Paulo as a Case Study

Jane Han ^{a, *}

^a Hankuk University of Foreign Studies, South Korea

Abstract

With more people staying at home since the COVID-19 outbreak, there has been a growing number of digitally active users vocal about government responses to the pandemic, especially regarding lockdown measures. User-generated content on social networking sites (SNS) has served as a valuable source of information for exploring public attitudes toward the pandemic, as SNS users often reveal their perceptions of government actions through these platforms. SNS have allowed for large-scale data collection from citizens within a specific timeframe and location, making information readily available in real-time. Brazil presents a particularly interesting case, as it suffers from one of the highest mortality rates in Latin America despite having the highest Global Health Security Index (GHSI) in the region. This paper examines public attitudes in São Paulo, Brazil's hardest-hit city, using Twitter as the preferred platform for text mining. Because information on public sentiment toward government lockdown responses may help weigh in on future policy decisions under similar developments, sentiment analysis is then conducted on the data using the VADER model (Valence Aware Dictionary and sEntiment Reasoner) as a way to conceptualize the results.

Keywords: coronavirus, Covid-19, lockdown responses, natural language processing, sentiment analysis.

Introduction

In December 2019, a novel case of coronavirus pneumonia was discovered in Wuhan, China, where several patients reported flu-like symptoms and other respiratory difficulties. Some of these patients had previously been exposed to the Huanan Seafood Wholesale Market, where the outbreak presumably started. As the spread of the virus began to evolve rapidly into a global challenge, the pandemic called for several contingency plans, some of which took on increasingly restrictive policies. These included lockdown measures that limited not only human mobility between regional and international borders, but also social interactions, promoting closures of public spaces, such as schools and restaurants that would have otherwise resulted in large gatherings. Although the World Health Organization (WHO) initially denied evidence of human-to-human transmission during the earlier phase of the pandemic, the organization later recognized quarantine as an effective tool against the spread of the virus (WHO, 2020).

* Corresponding author
E-mail addresses: janehan96@hufs.ac.kr (J. Han)

With more countries resorting to lockdown as part of their integral response to the pandemic, several countries observed notable improvements in preventing additional deaths, as evidenced by cases in China, Italy, and Spain. Italy, one of Europe's hardest-hit regions during the pandemic, seemed to have averted nearly 200,000 hospitalizations by opting for a nation-wide quarantine (Gatto et al., 2020). Brazil pursued similar lockdown strategies when Sao Paulo declared a partial statewide quarantine in late March, closing all non-essential businesses, restaurants, schools, universities, and entertainment centers (Legislative Assembly of the State of São Paulo, 2020a). Much of this, however, was implemented at a provincial level as a result of local authorities responding differently to the federal government's lack of plans for a lockdown (Giraudy et al., 2020).

Brazil's less territorially uniform approach to national quarantine was due to many reasons, one of which accounted for President Jair Bolsonaro's pro-economic policies. A nationwide lockdown would have meant that many businesses would not fare well. While this may have proven favorable for proponents of anti-quarantine measures, who usually tend to be from the lower-income group, Brazil's growing coronavirus-related fatalities have also equally provoked protests against the administration's inaction toward a more comprehensive lockdown (Londoño et al., 2020). Citizens' responses as a result have varied in polarizing ways. With an intended goal of finding the most dominant public sentiment on quarantine, this research focuses on identifying and analyzing various citizens' reactions, taking the city of São Paulo as a case study.

With a population of about 12 million, São Paulo is not only Brazil's largest metropolitan area but also the most affected region. A successful lockdown would have meant that Brazil would be better able to contain the overall impact of the pandemic at a national level and, thus, flatten the curve sooner. São Paulo, as a result, became a national focus for counteracting the virus.

Related Work

Similar studies have been conducted using Natural Language Processing (NLP) as a way to examine the impacts of government policies on societies during an outbreak of an infectious disease or other public-health related issues. One particular study by Lazard et al. (2015) used live Twitter chat held at the Centers for Disease Control and Prevention to uncover major themes of public concerns about the presence of the Ebola virus in the U.S. during the 2014 outbreak in West Africa. A related work by Öztürk and Ayyaz (2018) looked into the Syrian refugee crisis by collecting relevant tweets written in Turkish and English as a way to determine public opinions about the crisis. Twitter has also helped predict outcomes of elections, as demonstrated by Wang et al. (2012), which employed a real-time sentiment analysis on the collected tweets regarding the 2012 U.S. presidential elections. The resulting analysis achieved 59% accuracy in predicting public sentiment toward the race.

Methodology

Twitter is a microblogging website that has become a major source of political commentaries and conversations. Although tweets were formerly limited to 140 characters, they are now permitted up to 280 characters, allowing for longer posts and content (Rosen, Ihara, 2017). With over 18 million users, Brazil has one of the largest Twitter accounts in the world (Export Entreprises, 2020). Presidents in the past have used Twitter not only also as a tool for political campaigns, but also as a way to reach larger audiences. Naturally serving as a platform to gauge public opinion on upcoming elections and other related issues, Twitter, for example, was a hotbed for political conversations during the impeachment of Dilma Rousseff in 2016 (Olivetti de França et al., 2018).

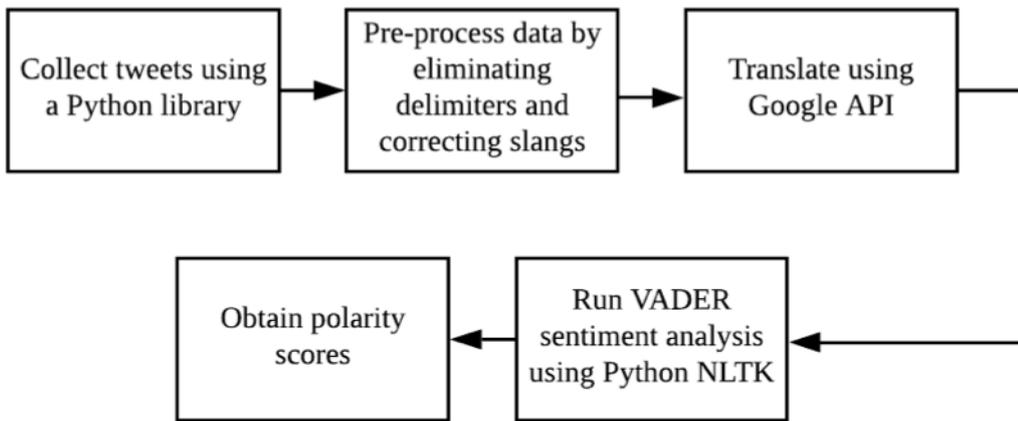
Text Mining and Acquisition

A large number of tweets were collected using a Python library in which the parameters were set as follows: taking São Paulo as a geographical point of reference, tweets written in Portuguese containing the keywords, were collected from anywhere within a radius of 24 km from the city's center, Diadema.

Table 1. Parameter details on text mining

Parameters	Details
Search terms	confinamento, distanciamento social, lockdown, quarentena, restrições
Geolocation	Diadema, São Paulo, Brazil
Radius	24 km
Language	Portuguese

The specified radius range was large enough to cover most areas of the state capital. Because João Doria, the Governor of São Paulo, declared a partial state lockdown on March 24, 2020, a week after the country's first coronavirus-related death, the tweets were gathered from the day when the mandate went into full effect until May 11, 2020, when the lockdown was set to end. See [Table 1](#) and [Figure 1](#) for details.

**Fig. 1.** Flowchart of the step-by-step process

Data Processing

Before the tweets were used for sentiment analysis, they were cleared of multiple delimiters, such as “, ”, and double line breaks. Some of the most popular slangs and abbreviations were also corrected for later translation work, which was done using the Google Translate API ([Plotkin, 2015](#)). A total of 55,418 tweets were processed and used for sentiment analysis.

Table 2. Corrected slangs and abbreviations

Slang	Correct Term	Slang	Correct Term	Slang	Correct Term
aq/aki	aqui	FDP	filho da puta	pf/pfvr	por favor
bj/bjo	beijo	gnt	gente	qdo/qnd/qndo	quando
cê/vc	você	ki	o quê	tmb/tb	também
ctg	contigo	n/ñ/naum	não	ves	vocês

d+	demais	nd	nada	vlw	valeu
dps	depois	neh	né	pqp	puta que pariu
eh	é	ngm	ninguém	pf	por favor

Sentiment Analysis

With over 9000 lexical features, VADER is a Natural Language Toolkit (NLTK) from an open-source Python library that analyzes sentiments specifically extracted from social media sources, including product reviews and news editorials. It returns a series of polarity scores based on the text's positive and negative aspects. Neutral sentiments typically have zero polarity if the texts have no identifiable sentiment; positive and negative sentiments will have polarity scores that are greater and less than zero, respectively (Sarkar et al., 2018). VADER is also based on a human-curated, gold-standard sentiment lexicon, and further provides popular dictionary terms such as slangs and acronyms (Ao et al., 2020).

Before settling on VADER, two other Python NLTK modules, such as the Naive Bayes classifier and TextBlob, were tested on a series of sample texts to identify the model that best represented the overall sentiment. A study by Hutto and Gilbert (2014) revealed that the VADER analysis performed highly, if not better, when compared to seven other well-established models, such as, but not limited to, Affective Norms for English Words (ANEW), General Inquirer (GI), Linguistic Inquiry Word Count (LIWC), and SentiWordNet (SWN).

Table 3. Sample tweets from São Paulo (originally in Portuguese) with polarity scores

Date	Replies	Retweets	Favorites	Tweets	Polarity
25/3/2020	1	0	7	leaving one confinement to another	0
18/4/2020	0	2	2	We have nothing left, being in quarantine, so let's laugh!	0.6334
10/5/2020	0	0	1	this quarantine sucks	-0.3612

Results and Discussion

The collected data was visualized according to its volume size and further categorized into positive, negative, and neutral polarities. When the lockdown went into effect in São Paulo, a large number of tweets relating to the mandate were shared online, suggesting popular interest in the subject. However, with time, the number of tweets relating to the lockdown went down, though there was another spike in counts just days leading up to the state's hopeful easing in May (see Figure 2).

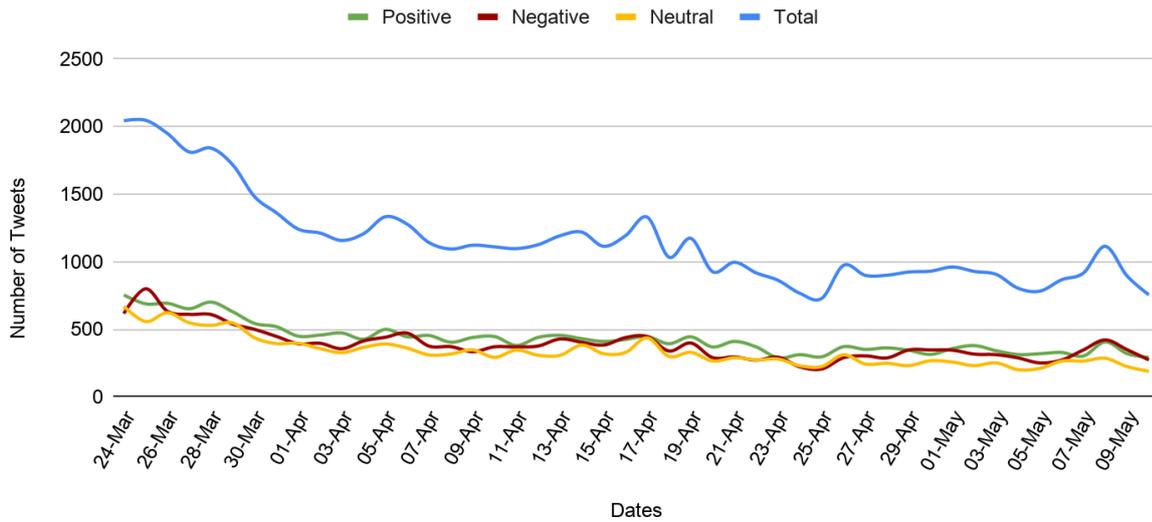


Fig. 2. Volume of tweets relating to the lockdown in São Paulo

The initial large volume of tweets that were observed during the earlier phase of the quarantine occurred just a day after the lockdown began and had a dominant presence of negative sentiments when compared to those with neutral and positive polarities. Similar trends were observed on April 29 and May 8, which coincided with the state’s formal announcements of making masks mandatory on public transports and extending the quarantine until the end of the month, respectively as depicted in [Figure 3](#) ([Legislative Assembly of the State of São Paulo, 2020b](#)).

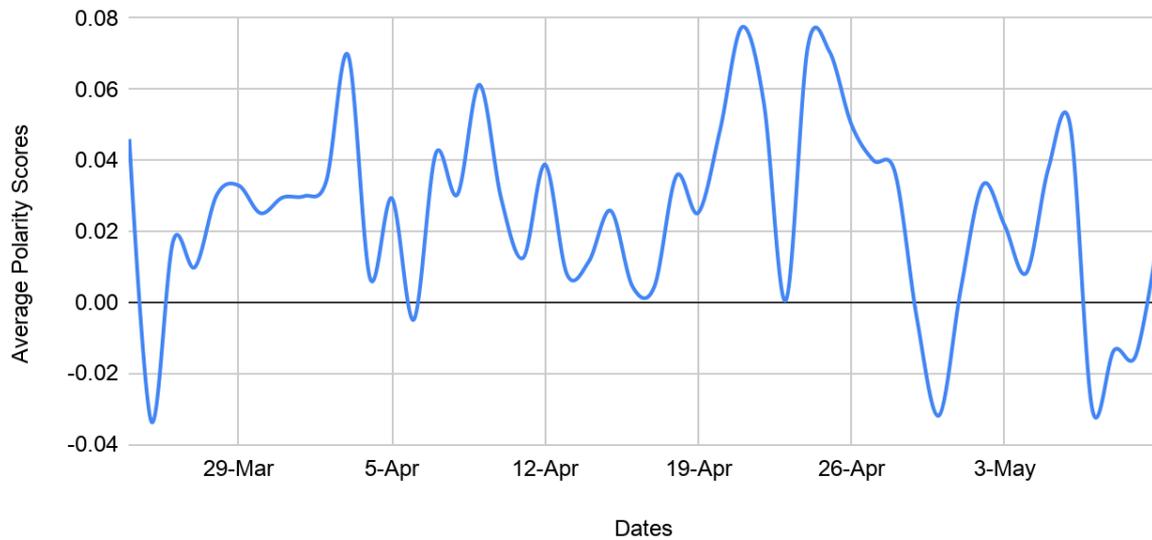


Fig. 3. The average polarity scores of daily tweets

The overall polarity scores revealed that a lot of tweets were positive, representing 37.3 % of all posts. As shown in [Figure 4](#), however, these positive polarities were much closer to zero than to 1, suggesting that they were more neutral-positive.

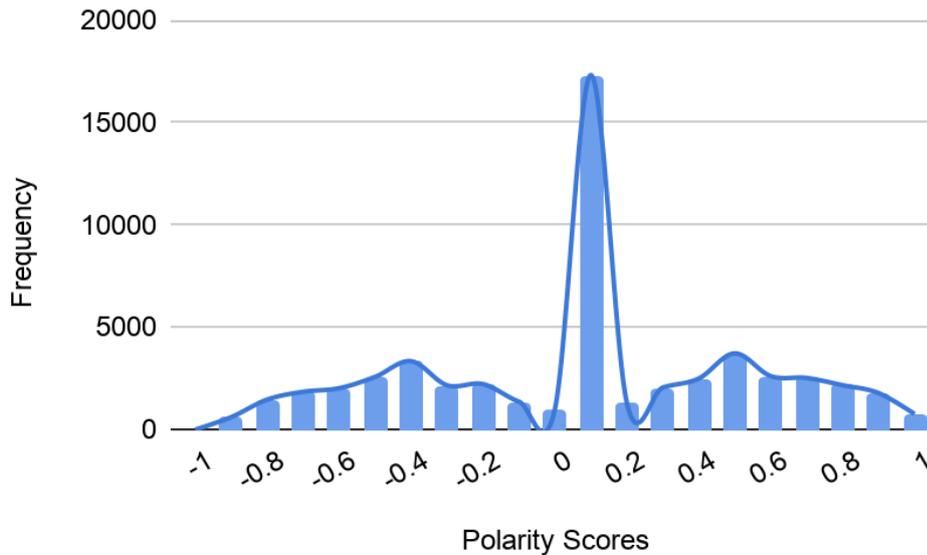


Fig. 4. A histogram showing the distribution of polarity scores

A couple of factors might have accounted for this result. Lockdown in São Paulo was mainly unsuccessful and had little significance to those employed in the informal sector, which absorbed 36.3 % of Brazil's workforce in 2019 (Saraiva, Renaux, 2019). A large number of these workers were also concentrated in the state capital, which consistently demonstrated isolation rates that were below the state's required minimum of 55 %.

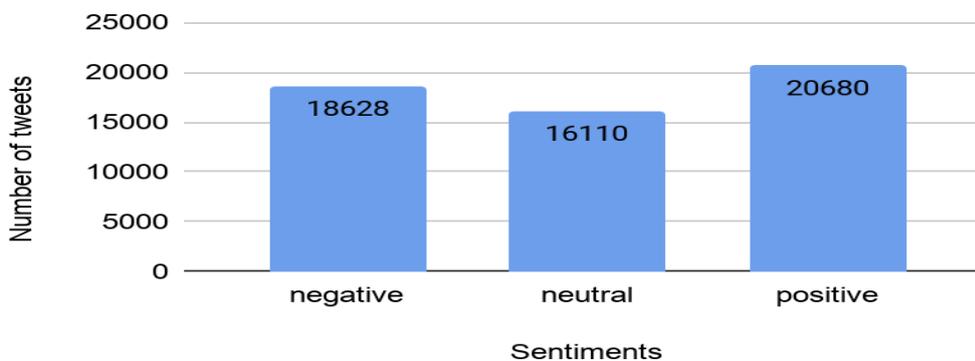


Fig. 5. A bar graph of tweets, classified by their degree of sentiments

Prominent political leaders in Brazil have moreover reacted varyingly to the pandemic, adding to the confusion and, thus, setting up for an unsuccessful lockdown endeavor. When Governor Doria actively worked toward promoting social isolation, President Bolsonaro downplayed the pandemic, encouraging people to return to work. With no coherent government's message toward the crisis, a statewide quarantine in São Paulo was perceived by the public as having low legitimacy.

Limitations and Conclusion

Using the state capital, São Paulo, as a case study, this research looked into Brazil's public attitude toward a statewide lockdown that took place between March 24 and May 11, 2020. Based on the sentiment analysis that was conducted, there were more positive tweets, followed by negative and neutral sentiments, respectively. These positive scores, however, were much closer to zero, a neutral polarity, than they were to 1.

Serving as a potential limitation, the tweets used for this study were translated from Portuguese to English, as the VADER analysis processed only English lexicons. The VADER model

also did not distinguish genuine positive texts from those with sarcastic undertones, which were a common feature of political commentaries.

Future works can include methods specifying tweets' emotions as a way of identifying more detailed patterns of public responses to the lockdown. The scope of the study could also extend to other parts of Brazil outside the state and analyze how they perceive the partial lockdown. The growing severity of the pandemic in São Paulo has opened up future possibilities for multiple revisions to former quarantine orders, creating opportunities for further studies on this subject around changing public attitudes. The implications of these new findings may perhaps reveal meaningful insights into whether or not Brazil as a country could successfully achieve a large-scale quarantine with desired effects.

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Conflict of Interest Statement

The author states that the study was conducted without any commercial or financial connections that could be interpreted as a possible conflict of interest.

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