Mood Analysis during the COVID-19 Pandemic in Brazil through Music

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Abstract

In this paper, we investigate the oscillation in the general feelings of the Brazilian population during the Pandemic through the songs consumed. We analyze Brazilian streaming musical consumption between 2019 and 2021. In special, we focus on special dates that have changed history, such as the beginning of the pandemic in the country, the dates of increase in cases, milestone dates in deaths, the beginning of vaccination, among others. Data was collected through Spotify API and made publicly available. Our results show people have preferred more danceable and positive songs during the period analyzed.

Keywords: mood analysis, COVID-19, Brazil, music

1 Introduction

The COVID-19 pandemic[1] started in 2019 in China and spread rapidly worldwide, causing a global health crisis and impacting both the economy and society. The first case of the disease in Brazil was confirmed on February 27, 2020[2], and, since then, we have gone through many stressful situations. Indeed, to study the impacts of the Pandemic on mental health and citizens' behavior, several monitoring surveys were made available. Among them, the COVID Research Behavior,[3] carried out by Oswaldo Cruz Foundation (Fiocruz) in partnership with Universidade Federal de Minas Gerais (UFMG) and Universidade Federal de Campinas (UNICAMP). The survey interviewed more than 40 thousand people after the beginning of the Pandemic and Quarantine in the country. The results indicated an increase in cigarette use and alcohol consumption, as well as a decrease in the practice of physical activities and healthy eating. It also reported that among those interviewed, 40.4% had feelings of sadness or depression and 52.6% had constant anxiety. In such a scenario, people usually search for options to improve their mood, and music is one of them.

Music is one of the most enjoyed cultural expressions, being present in every social construction. It is part of everyday life for people in different contexts. Clearly, people generally select the songs they want to listen to according to their mood [5], and daily events influence such a mood [3]. Therefore, music can reflect the population's individual and even collective feelings. Brazilians love listening to music, which is evident in the wealth of Brazilian musical genres and when considering the country's status within the top three countries that most consume music via streaming in the world.[4] Note also that Spotify is the most used platform among Brazilians today.[5]

In such a complex scenario, we investigate whether it is possible to observe any oscillation in the Brazilians' general feelings during the Pandemic through the consumed songs. We do so by analyzing the feelings through musical consumption during the period 2019-2021. In addition, we focus on notable dates, such as the beginning of the Pandemic in the country, the dates of increase in cases, milestone dates in deaths, and the beginning of vaccination, among others.

Our methodology starts with data acquisition by collecting music consumption (by Brazilians) through Spotify's API, as detailed in Section 3.1. Then, we carry out a study on techniques of sentiment analyses over song lyrics, as explained in Section 3.2. Analyses and their results are presented in Section 4 and conclusion in Section 5.

2 Related Work

The link between global events and feelings has been studied for decades [2, 4, 9]. For example, Stone and Neale [12] showed that a person's daily context defines their mood. Moreover, there is clear evidence of the association between pleasurable events and positive mood, including physical exercise [6] and leisure time [12]. Likewise, bad situations such as frustrations, disasters, and losses are also associated with negative mood [1].

Furthermore, Schedl et al. [11] pointed out a possible correlation between music consumption and the occurrence

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[1]History of the COVID-19 Pandemic: https://www.paho.org/pt/covid19/historico-da-pandemia-covid-19

[2]Coronavirus: Brazil confirms the first case of the disease: https://www.unasus.gov.br/noticia/coronavirus-brasil-confirma-primeiro-caso-da-doenca

[3]ConVid Research Behavior: https://convid.fiocruz.br/

[4]https://olhardigital.com.br/2018/10/10/noticias/brasil-e-um-dos-tres-paises-que-mais-consumem-musica-por-streaming-no-mundo/

[5]ABMI: https://bit.ly/reportABMI

of real events. This association became more evident with the study by Liu et al. [8], which focused on the context of the COVID-19 pandemic. Such a study discovered that the songs heard by a population became more damaging from the beginning of the pandemic. There was also a negative correlation between the increase in weekly cases and the mood of the songs heard by this population. The study considered the data available from the LMF-1b dataset [10], based on Last.fm radio users.

Still, there is no knowledge of any work on sentiment analysis specific to Brazil during the COVID-19 pandemic using one of the most widespread sources of music consumption among Brazilians: the streaming platform Spotify.

3 Methodology

The methodology is mainly divided into data acquisition and mood analyses, as explained next.

3.1 Data Acquisition

To analyze the Brazilian mood through music, we have collected data from Spotify Charts.[6] The streaming service lists the Top 100 most listened to songs weekly and daily in different countries and cities. The weekly charts of Brazil were collected considering the period 2019-2021. Furthermore, we have also collected the daily charts for February, March, April, June, July, August, and December 2020, plus January and February 2021. The Charts were collected in *.csv* files, which inform the rank position, the song identifier, the artist name, the song name, the label name, the highest position ever reached in the rank, the previous position in the rank, days the song was on the chart and the number of streams.

Using the song identifiers enables to query of the Spotify API for Developers.[7] The API provides a huge amount of data, including some *features* of the songs. Among many features, we focus on those referring to the *mood* of the songs, i.e., features that manage to capture the feelings generated by a song. Such features include: *danceability*, *valence*, *energy* and *tempo*, which are defined by Spotify as follows.

- *danceability* measures how danceable a song is and ranges from 0.0 to 1.0; higher values indicate greater danceability.
- *valence* measures the positivity of the track, ranging from 0.0 to 1.0, where high values indicate songs that generate feelings of joy and low values indicate a song that generates sadness or anger in listeners.
- *energy* is a metric for the percentage of activity and intensity of the music, ranging from 0.0 to 1.0.
- *tempo* represents the estimated time in beats per minute.

Finally, we use the Genius[8] API to collect the lyrics. It is easy to use, with an extensive collection that includes Brazilian songs, song lyrics, and information about the artists.

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[6]Spotify Charts: https://spotifycharts.com/home/
[7]Spotify API: https://developer.spotify.com/documentation/web-api/
[8]Genius: https://docs.genius.com/

3.2 Mood Analyses over Features and Lyrics

There are different ways to analyze music in order to extract mood. First, we analyze the features provided by Spotify, evaluating their value changes over time. Then, we execute a sentiment analysis algorithm on the songs. Specifically, we use the Genius library to collect the lyrics of the songs and run the VADER (*Valence Aware Dictionary for Sentiment Reasoning*) algorithm [7] over the collected lyrics.

VADER is used for text sentiment analysis that is sensitive to both polarity (positive/negative) and intensity (strength) of emotion. It relies on a dictionary that maps lexical features to intensities of emotion known as sentiment scores. The sentiment score of a text can be obtained by adding the intensity of each word in the text. For example, words like 'love', 'enjoy', 'happy', 'like' convey a positive feeling. Furthermore, VADER manages to understand the basic context of these words, such as "I don't love" as a negative statement. It also understands capitalization and punctuation emphasis, such as "ENJOY". VADER algorithm takes a string and returns a dictionary of scores in each of four categories (all in percentage): negative, positive, neutral, and composite (computed by normalizing the three previous scores): -1 (extremely negative) - 1 (extremely positive).

4 Results and Discussion

This section presents the main results of our work. First, we analyze specific acoustic features obtained from Spotify that can express the mood of songs that reached the charts (Section 4.1). Then, we deepen our analyses by using the songs' lyrics as the input of VADER algorithm (Section 4.2).

4.1 Mood by Acoustic Features

Figure 1 presents the evolution of *danceability*, *energy*, and *valence* over time. Whereas danceability and energy remain stable during most of 2019 and 2020, we observe a high variation in valence values, which may indicate a change in the listeners' mood over time. For instance, after a peak in December 2019, the average valence falls until July 2020. We can correlate such a result to the pandemic situation in Brazil (note that correlation does not imply causality). The beginning of 2020 had the first cases of COVID-19 in the country, and the significant increase in cases and deaths culminated in the first wave of the disease in Brazil in July.

After this period, the valence values start to rise again until the end of 2020, coinciding with the improvement in the disease indicators and again with the end-of-year festivities. This high level was maintained for most of 2021, with a small oscillation in May and June. Although Brazil experienced the second wave of COVID-19 (the biggest and most serious so far), the start of vaccination (in January of that year) may have contributed to maintaining a feeling of optimism in the population, which may have reflected the most listened to songs in that period.
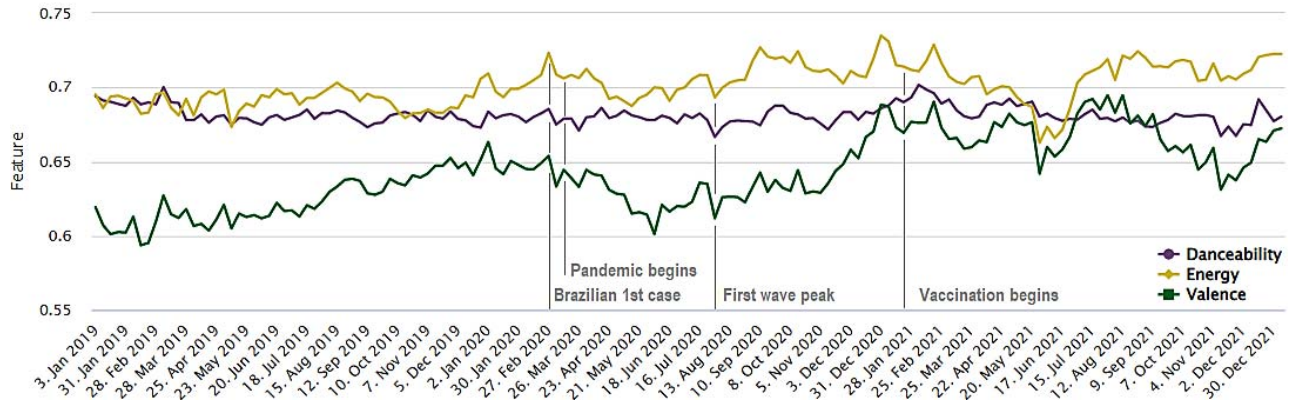
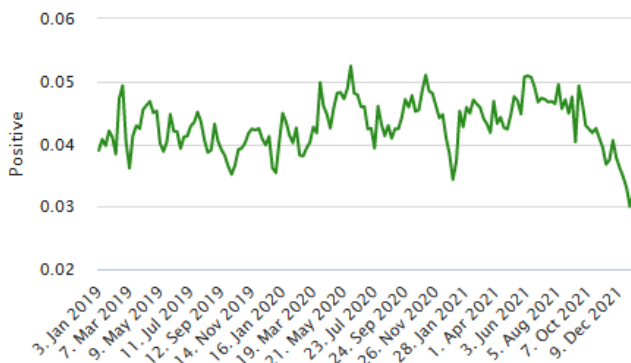**Figure 1.** Danceability, energy and valence from 2019-2021.
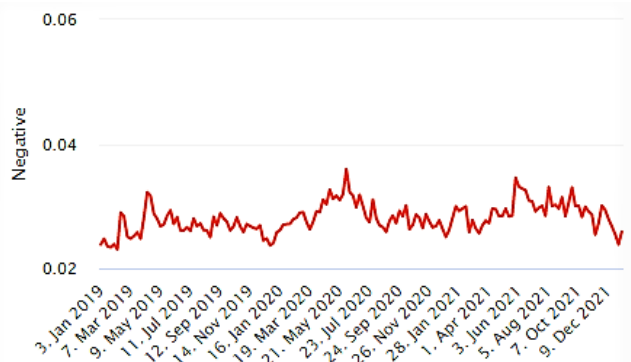

Figure 2. Positivity in lyrics over time.

Figure 3. Negativity in lyrics over time.

4.2 Sentiment Analysis by Lyrics

Figures 2 and 3 show the time distribution of average positivity and negativity per week, respectively. We only present the average since median values are similar. Again, the variations seem small; still, there are higher values of negativity during the First Wave Peak in July-August 2020, and a concentration of positivity during the beginning of 2021.

Then, Figure 4 shows a small case study of the five most listened songs in each year: 2019, 2020 and 2021. Most songs received a high percentage of neutrality, which may jeopardize useful insights from the previous analyses; i.e., considering only the lyrics, they are mostly neutral. The themes of love, party and joy easily mix with human problems such as betrayal, loneliness, rancor, among others. However, it is interesting to see how the percentage of negativity has increased a little among the most listened to songs in 2020. The average values of the observed features are: positive - 3.6%; neutral - 90%; negative - 5.5%; composite - 0.14.

Figure 5 shows a scatter plot that relates Spotify features to lyrics. There is a slightly positive linear correlation between danceability and the compound ($r = 0.05$). In contrast, valence and energy show a more negative correlation with the compound, with the Pearson coefficient being -0.42 and -0.56, respectively. In other words, there seems to be no relationship between the positivity of a song and its lyrics.

5 Conclusion

This work presented a mood analysis to investigate the oscillation in the Brazilian population's feelings during the COVID-19 pandemic. We explored acoustic features and lyrics over time using data collected from Spotify and Genius. Our results show that the changes were more evident in acoustic features. Overall, by performing sentiment analysis, we found that the most listened to songs in Brazil have rhythms that vary a lot, but that in general have high values of danceability and positivity, although have neutral and even negative lyrics. Regarding computational applications, our results may be useful in recommendation tasks, e.g. recommending songs to playlists according to their mood.

Our results did not indicate whether the lyrics of the songs that Brazilians heard during the Pandemic were affected by the general feeling of the population. Also, it is important to consider that, for songs, perhaps the rhythm influences feelings more than the lyrics themselves. It is also necessary
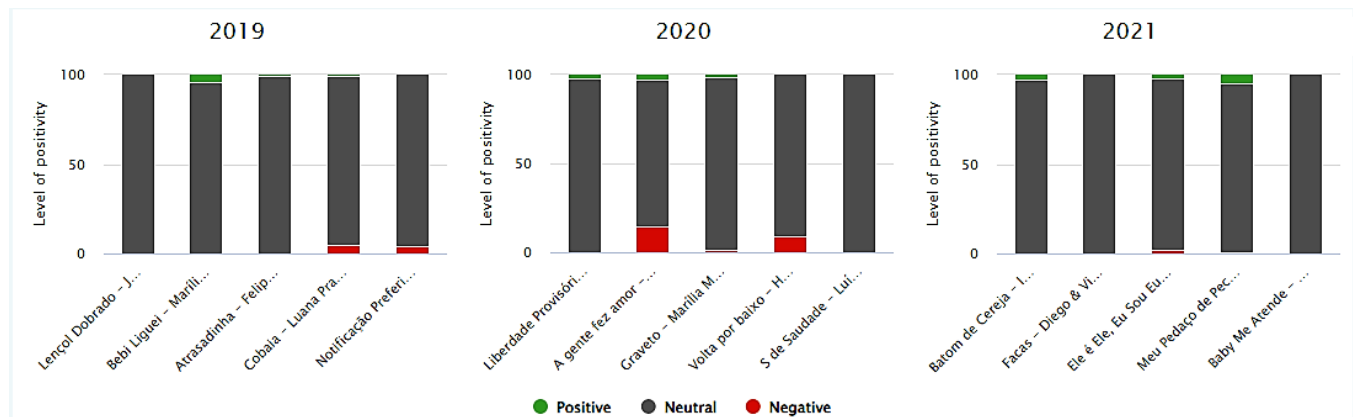
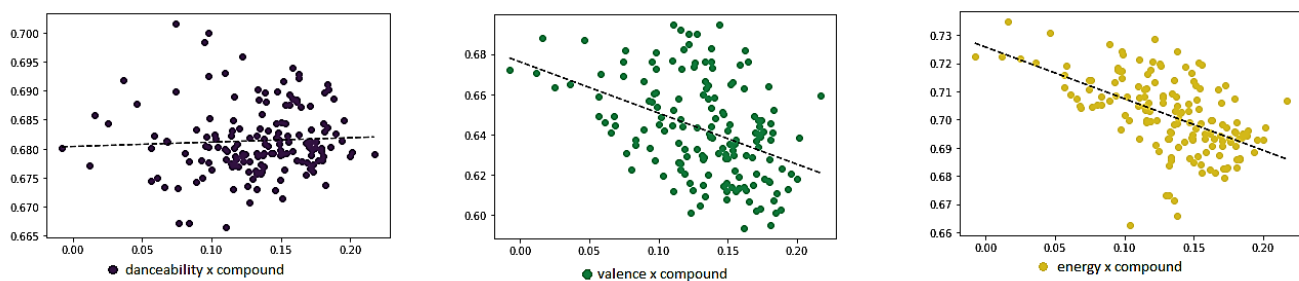**Figure 4.** Top-5 most listened songs in each year.

Figure 5. Scatter plots relating Spotify features to lyrics.

to point out a possible increase in positive music because of social networks such as TikTok that grew during the pandemic, as well as an increase in the consumption of children's music, as children were at home and away from school.

These and other results (including interactive ones) are publicly available in https://brunacmelo.github.io/POC.

Future Work. We plan to use other sentiment analysis algorithms in our dataset to compare with VADER results. Also, we plan to analyze music consumption by genres and extend the analysis to events other than the COVID-19 pandemic. Another extension is to analyze other data sources (e.g., Twitter) to better capture people's mood and over a longer period of time, since the pandemic is not over yet.

Acknowledgments

References

[1] Glenn Affleck et al. 1994. Person and contextual features of daily stress reactivity: individual differences in relations of undesirable daily events with mood disturbance and chronic pain intensity. *Journal of personality and social psychology* 66 2 (1994), 329–40.

[2] Pedro Rego Ballona et al. 2015. Analyzing The Influence Of Pope's Tweets On His Followers' Mood. In *WebMedia*. ACM, 93–100. https://doi.org/10.1145/2820426.2820441

[3] L. A. Clark and D. Watson. 1988. Mood and the mundane: relations between daily life events and self-reported mood. *Journal of personality and social psychology* 54 (1988), 296–308.

[4] Arthur Emanuel de Oliveira Carosia et al. 2019. The influence of tweets and news on the brazilian stock market through sentiment analysis. In *WebMedia*. ACM, 385–392. https://doi.org/10.1145/3323503.3349564

[5] J. S. Downie and Sally Jo Cunningham. 2002. Toward a Theory of Music Information Retrieval Queries: System Design Implications. In *ISMIR*. Paris, France.

[6] K. M. Fritz and P. J O'Connor. 2016. Acute Exercise Improves Mood and Motivation in Young Men with ADHD Symptoms. *Medicine and science in sports and exercise,* (2016).

[7] Clayton J. Hutto and Eric Gilbert. 2014. VADER: A Parsimonious Rule-Based Model for Sentiment Analysis of Social Media Text. In *ICWSM*.

[8] Meijun Liu et al. 2020. Pandemics, Music, and Collective Sentiment: Evidence from the Outbreak of COVID-19. In *ISMIR*. Montréal, Canada.

[9] Igor Maffei Libonati Maia et al. 2021. A Sentiment-Based Multimodal Method to Detect Fake News. In *WebMedia*. ACM, 213–216. https://doi.org/10.1145/3470482.3479467

[10] Markus Schedl. 2016. The LFM-1b Dataset for Music Retrieval and Recommendation. In *ICMR*. ACM, 103–110. https://doi.org/10.1145/2911996.2912004

[11] Markus Schedl et al. 2018. The Effects of Real-world Events on Music Listening Behavior: An Intervention Time Series Analysis. In *Companion Procs of the WWW*. 75–76. https://doi.org/10.1145/3184558.3186936

[12] A. A. Stone and J. M. Neale. 1984. Effects of severe daily events on mood. *Journal of personality and social psychology* (1984).