Helping the Authorities to Analyze Venues in Manila during COVID-19 Quarantine

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1. Introduction

1.1 Background

City of Manila in the Philippines is currently under Enhanced Community Quarantine (ECQ) as of August 2021 because of the rising cases of COVID-19 delta variant. During ECQ, strict guidelines must be implemented by the authorities.

1.2 Problem

Authorities needs help on where they should assign most of their men in order to make sure that guidelines and health safety protocols are being followed by all specially businesses and establishments owners within the city.

1.3 Interest

The Philippine National Police (PNP), The Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF) and Metro Manila Development Authority (MMDA) would be very interested in this project.

2. Data acquisition and cleaning

2.1 Data Sources

In order to retrieve the venues in Manila city, we used Foursquare APIs explore endpoint and created a list of city districts as input. Then the results from the requests in JSON format was converted into a pandas data frame.

2.2 Data Cleaning

Some venues returned from Foursquare API were in different countries thus filter was created to drop the following rows to make sure that our data only contains from the Philippines. Neighbourhood column also has been updated to Manila administrative districts (Binondo, Ermita, Intramuros, Malate, Paco, Pandacan, Port Area, Quiapo, Sampaloc, San Miguel, San Nicolas, Santa Ana, Santa Cruz, Santa Mesa and Tondo).

Next is dropping unimportant columns and removing rows that has null values were also executed during the data cleaning process. Lastly, other cities in the Philippines that are included in our dataset was also removed and since the remaining values are inside Manila City, we will update their values to Manila.

Table 1. Simple feature selection during data cleaning.

Dropped Features	Reason for dropping features
San Andres	San Andres is one of the administrative districts in Manila but since Foursquare API doesn't return any venues, we decided to not include it in the Districts list.
Columns (address, crossStreet, labeledLatLngs, cc, state, formattedAddress, postalCode)	These columns are either not important or has duplicate values in other columns such as cc = country.
Values under 'city' columns such as Makati City, Lucban, Luisiana, Quezon City, Mandaluyong City, and San Juan	As our scope is only limited within Manila City, venues in different cities were dropped.

3. Methodology and Data Analysis

3.1 Methodology

In this project, we will direct our efforts in making sure that no other cities/countries are included in our data. We will limit our analysis to area within Manila City.

In first step we have collected our data: name, location and category of every venues within Manila (according to Foursquare).

Second step, our analysis will be grouping rows by neighbourhood and by taking the mean of the frequency of occurrence of each category.

In third and final step, we will use a machine learning algorithm called K-Means clustering in creating clusters of categories to determine which part of Manila will the authorities dispatch most of their men. We will also present a map showing all the establishments in Manila with their cluster labels.

3.2 Analysis

Basic exploratory data analysis was performed in our dataset. First, we explored the unique values in **categories** column and showed the count per **neighbourhood**.

Figure 1. Count of venues per neighbourhood

neighborhood	name	categories	lat	lng	city	country
Binondo	95	95	95	95	95	95
Ermita, Manila	95	95	95	95	95	95
Intramuros	95	95	95	95	95	95
Malate	89	89	89	89	89	89
Paco	95	95	95	95	95	95
Pandacan	73	73	73	73	73	73
Port Area	94	94	94	94	94	94
Quiapo	97	97	97	97	97	97
San Miguel, Manila	86	86	86	86	86	86
San Nicolas, Manila	95	95	95	95	95	95
Santa Ana, Manila	29	29	29	29	29	29
Santa Cruz, Manila	97	97	97	97	97	97
Santa Mesa	18	18	18	18	18	18
Tondo	94	94	94	94	94	94

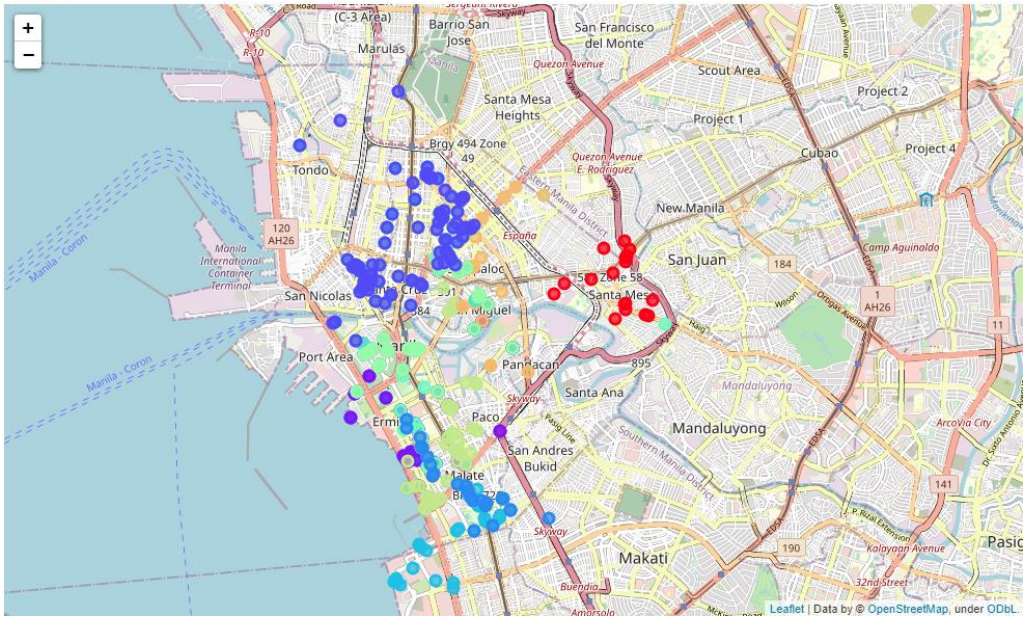
As shown in Figure 1, Quiapo and Santa Cruz has the most number of venues (97) followed by Binondo, Ermita, Intramuros, Paco, and San Nicolas (95) and neighbourhood with the least number of venues is Santa Mesa (18). Next is we one hot encode the categories for each neighbourhood and then get the mean to determine their most common venues.

Figure 2. Neighbourhoods and their top 10 most common venues

	neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Binondo	Coffee Shop	Filipino Restaurant	Chinese Restaurant	Bubble Tea Shop	Hotel	Diner	Church	Pizza Place	Bakery	Tea Room
1	Ermita, Manila	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
2	Intramuros	Coffee Shop	Chinese Restaurant	Filipino Restaurant	Bubble Tea Shop	Church	Japanese Restaurant	Snack Place	Pizza Place	Hotel	History Museum
3	Malate	Coffee Shop	Hotel	Japanese Restaurant	Spa	Filipino Restaurant	Bar	Café	Restaurant	Korean Restaurant	Steakhouse
4	Paco	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
5	Pandacan	Filipino Restaurant	Japanese Restaurant	Café	Coffee Shop	Korean Restaurant	Bar	Bakery	Chinese Restaurant	Spa	Hotel
6	Port Area	Hotel	Chinese Restaurant	Restaurant	Convenience Store	Filipino Restaurant	Coffee Shop	Church	Grocery Store	Japanese Restaurant	Pizza Place
7	Quiapo	Chinese Restaurant	Filipino Restaurant	Bakery	Coffee Shop	Ice Cream Shop	Bubble Tea Shop	Café	Hotel	Tea Room	Japanese Restaurant
8	San Miguel, Manila	Filipino Restaurant	Chinese Restaurant	Coffee Shop	Bubble Tea Shop	Church	Pizza Place	Snack Place	Café	Ice Cream Shop	Tea Room
9	San Nicolas, Manila	Coffee Shop	Filipino Restaurant	Chinese Restaurant	Bubble Tea Shop	Hotel	Diner	Church	Pizza Place	Bakery	Tea Room
10	Santa Ana, Manila	Filipino Restaurant	Bar	Japanese Restaurant	Coffee Shop	Fast Food Restaurant	Frozen Yogurt Shop	Clothing Store	Hotel	Gym / Fitness Center	Restaurant
11	Santa Cruz, Manila	Chinese Restaurant	Filipino Restaurant	Bakery	Coffee Shop	Ice Cream Shop	Bubble Tea Shop	Café	Hotel	Tea Room	Japanese Restaurant
12	Santa Mesa	Fast Food Restaurant	Convenience Store	Gym	Bookstore	Filipino Restaurant	Empanada Restaurant	Diner	Middle Eastern Restaurant	Pharmacy	Chinese Restaurant
13	Tondo	Chinese Restaurant	Coffee Shop	Filipino Restaurant	Bakery	Pizza Place	Japanese Restaurant	Ice Cream Shop	Bubble Tea Shop	Café	Fast Food Restaurant

Lastly, we cluster the venues per categories using K-Means and plot it using folium library to visualize the venues in Manila city.

Figure 3. Map of Manila City



4. Results and Discussion

The results of our analysis shows that:

- We have generated a total of 11 clusters based in the most common venues within Manila City
- 1st most common venue of clusters 1, 2, 3, 4, 5, 7, 8, and 10 is restaurant
- Cluster 8 has the large number of venues (194) composed of restaurants, bakeries and hotels.
- Cluster 1 has the least number of venues (18) composed of restaurants, gyms, bookstores, and pharmacies

By analysing each clusters, we recommend to the authorities (IATF, PNP, and MMDA) to dispatch most of their men in Cluster 2 around Ermita and Paco since the venues under it can accommodate a lot of people such as churches, hotels and restaurants and it has 190 venues.

Figure 4. Cluster 2

	categories	country	neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
101	Coffee Shop	Pilipinas	Ermita, Manila	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
102	History Museum	Pilipinas	Ermita, Manila	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
103	Seafood Restaurant	Pilipinas	Ermita, Manila	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
104	Bar	Pilipinas	Ermita, Manila	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
105	Antique Shop	Pilipinas	Ermita, Manila	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
496	History Museum	Pilipinas	Paco	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
497	Chinese Restaurant	Pilipinas	Paco	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
498	Chinese Restaurant	Pilipinas	Paco	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
499	Café	Pilipinas	Paco	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum
500	Café	Pilipinas	Paco	1	Chinese Restaurant	Japanese Restaurant	Café	Coffee Shop	Bakery	Hotel	Filipino Restaurant	Church	Pizza Place	History Museum

190 rows × 14 columns

5. Conclusion

The purpose of this project is to help the authorities on where they should assign most of their men in order to implement the law and the health safety protocols during the quarantine. Data scientist that has interest in continuing this project can achieve better outcomes if they can get data about the size of each venues, the max number of people they can accommodate and the number of COVID-19 cases for each districts.