It's Time to Move: Surviving the Daily Grind of Commuting in Metro Manila

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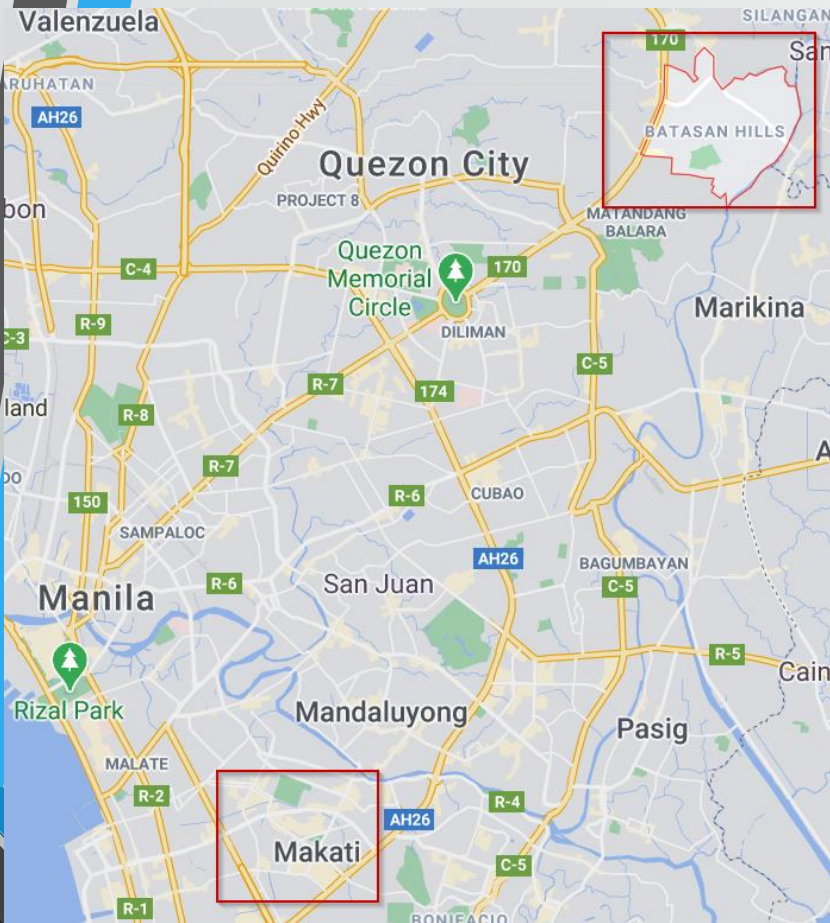
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Introduction of the Problem

- 2019 TomTom Traffic index listed Metro Manila as the second most congested city globally with a congestion rate of 71%

- To put this figure into perspective, a person who normally takes 30 mins to get to work will spend an additional 29 minutes on the road during morning rush hours and 38 more minutes during evening rush hours

- Public transportation in Manila such as buses, trains and cabs are unreliable and at times, health hazards

Introduction of the Problem

- On a "good" day, it takes an average of **2 hours** to get to the office in Makati City and another **2 hours** to go back home to Barangay Batasan Hills.

- A lot of time and energy wasted on commuting. Affects health and productivity.

- Leaving in Makati City is expensive as in the case of any other Central Business District.

- Solution: Live closer to Makati City. A viable option is Mandaluyong City. But which Barangay if you want to live in the same type of barangay as Batasan Hills?

What is a Barangay?

- Smallest administrative division in the Philippines and is the native Filipino term for a village, district, or ward.

- Also referred to as "Barrio"

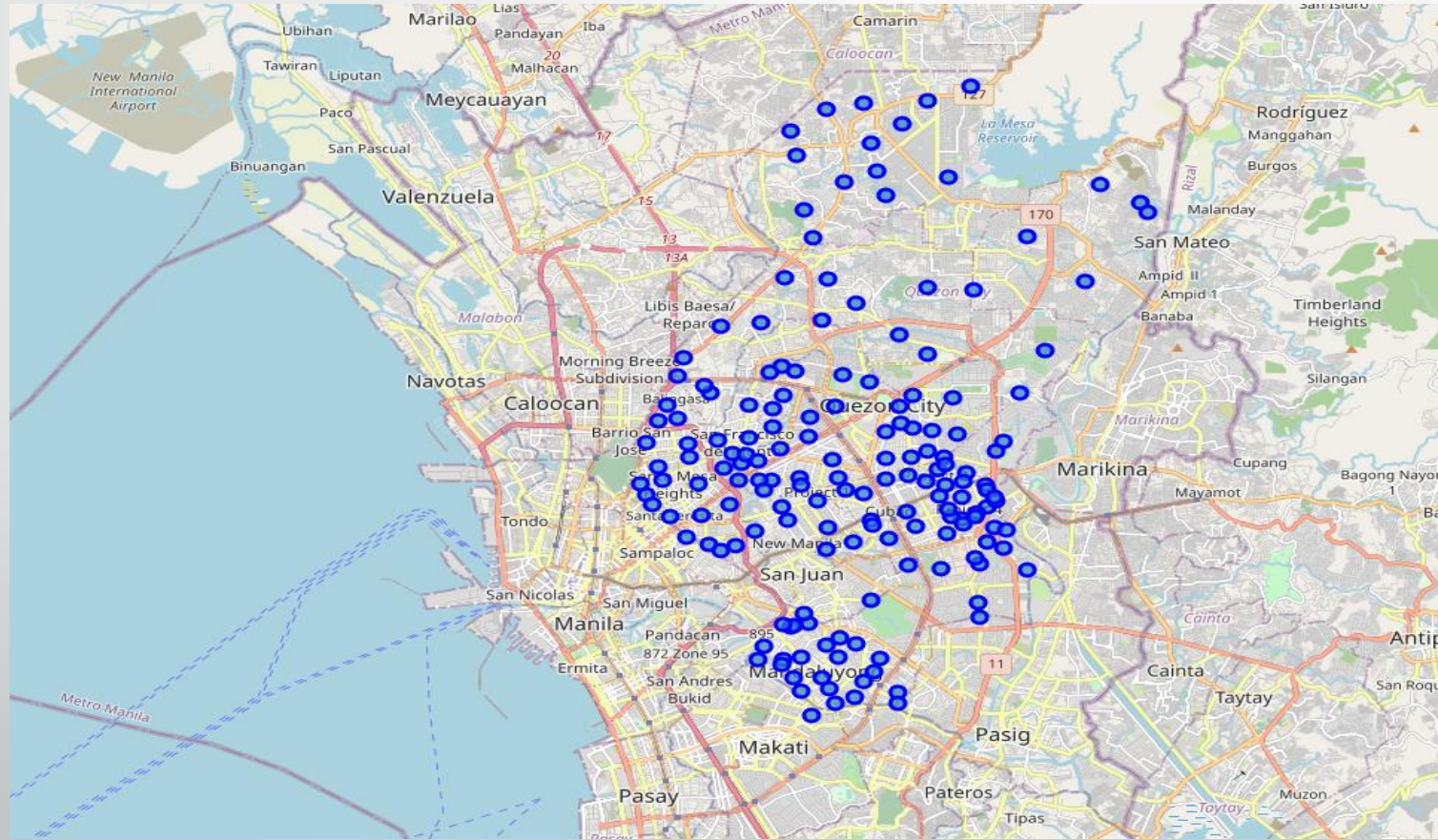- The Philippines has about ~42,000 barangays in total

Data Acquisition and Preparation

- Data Requirements
  - List of barangays in Mandaluyong and QC
  - Coordinates data for each barangay
  - Venue data within each barangay
- Data Sources:
  - Philippine Statistics Authority (PSA)
  - Geonames.org
  - Foursquare API

Data Acquisition and Preparation

- Challenges:
  - spellings of the barangays may differ due to a mix of typographical errors and differing naming conventions related to Spanish/Filipino names
    - Solution: . A manual check and renaming were done to ensure that the names are the same between the two files
  - can only download the full list which include all the barangays in the Philippines. It is common for barangays in the Philippines to have the same names
    - Solution: visualize the data points using folium multiple times to ensure that I am able to use the correct coordinates for the barangays I intend to use in the analysis.
  - not all the sought-after barangays are listed in Geonames
    - Solution: Fortunately, there were only a few missing and so searching the coordinates manually in the internet did not take too much effort.

Data Acquisition and Preparation

Foursquare API

- to gather venue data such as venue names, coordinates and category within the radius of 200 of each barangay.

- used a radius of 200 because anything higher will breach the limit to the number of calls set by Foursquare and the code will run into an error.

	Barangay	Barangay Latitude	Barangay Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Addition Hills	14.5816	121.0384	Worlwide Corporate Center Food Court	14.582606	121.038334	Food Court
1	Alicia	14.6614	121.0253	7-Eleven	14.660103	121.026284	Convenience Store
2	Alicia	14.6614	121.0253	7-Eleven	14.662062	121.025295	Convenience Store
3	Alicia	14.6614	121.0253	7-Eleven	14.660059	121.025606	Convenience Store
4	Amihan	14.6320	121.0680	Goolayan sa Batino	14.633251	121.069298	Convenience Store

Foursquare API

- The data was then grouped by Barangay followed by an application of one-hot encoding to transform the text data into indicator variables which makes it possible to perform calculations for each barangay characteristics.

- The data was again grouped by Barangay to list all the normalized variables coming from the same Barangay into one line.

	Barangay	American Restaurant	Arcade	Asian Restaurant	Athletics & Sports	BBQ Joint	Badminton Court	Bakery	Bank	Bar	Basketball Court	Bed & Breakfast	Beer Garden	Bookstore	Boutique	Bowling Alley	Boxing Gym	Breakfast Spot	Bridal Shop	Bubble Tea Shop	Buffet	Building	Burger Joint	Burrito Place	Bus Station	C
0	Addition Hills	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0000
1	Alicia	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0000
2	Amihan	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0000
3	Amoranto Senior Avenue	0.000000	0.0	0.000000	0.125000	0.000000	0.125000	0.000000	0.00	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.1250
4	Baesa	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0000
5	Bagbag	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.250000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0000
6	Bagong Lipunan ng Camp Crame	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.2	0.0000
7	Bagong Silang	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.200000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0000

Data Analysis

- Populated the top 5 venues per barangay based on their frequency

- Another table is generated which is quite similar to the first one but is showing the top 10 venues instead. Note that due to rounding, the order of establishments may differ between the two tables.

```
----Addition Hills----
           venue  freq
0      Food Court   1.0
1       Rest Area   0.0
2   Movie Theater   0.0
3     Music Store   0.0
4      Nail Salon   0.0


----Alicia----
                 venue  freq
0     Convenience Store   1.0
1   American Restaurant   0.0
2             Pet Store   0.0
3            Nail Salon   0.0
4             Nightclub   0.0


----Amihan----
                 venue  freq
0     Convenience Store   1.0
1   American Restaurant   0.0
2             Pet Store   0.0
3            Nail Salon   0.0
4             Nightclub   0.0
```
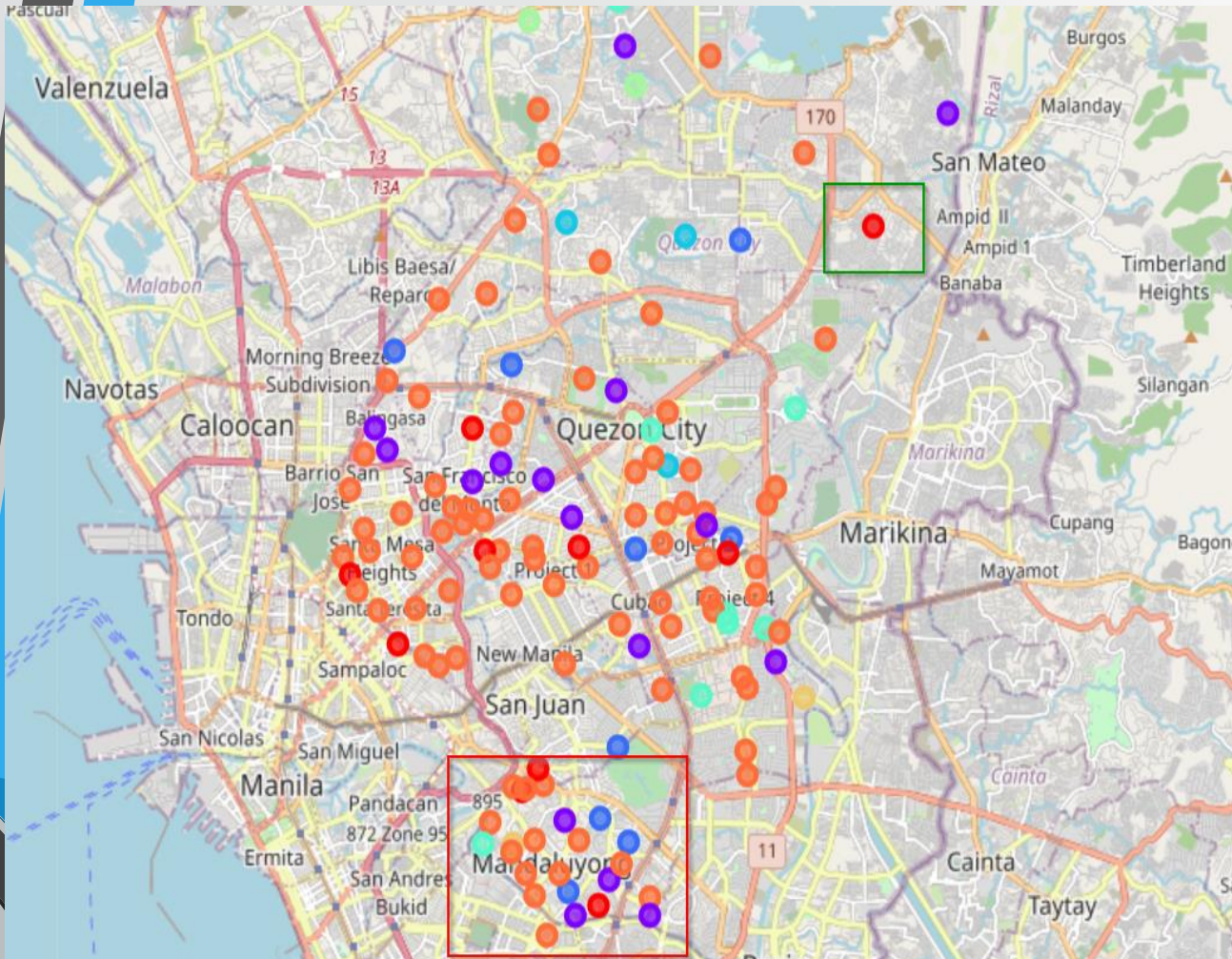
	Barangay	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Addition Hills	Food Court	Deli / Bodega	Flower Shop	Filipino Restaurant	Fast Food Restaurant	Farmers Market	Entertainment Service	English Restaurant	Empanada Restaurant	Electronics Store
1	Alicia	Convenience Store	Yoga Studio	Electronics Store	Filipino Restaurant	Fast Food Restaurant	Farmers Market	Entertainment Service	English Restaurant	Empanada Restaurant	Dumpling Restaurant
2	Amihan	Convenience Store	Yoga Studio	Electronics Store	Filipino Restaurant	Fast Food Restaurant	Farmers Market	Entertainment Service	English Restaurant	Empanada Restaurant	Dumpling Restaurant
3	Amoranto Senior Avenue	Filipino Restaurant	Plaza	Athletics & Sports	Badminton Court	Gym Pool	Gym / Fitness Center	Stadium	Café	Empanada Restaurant	Fast Food Restaurant

Modeling

- **K-Means Clustering**
- Started with k=5 but the results lacked differentiation as a huge number of barangays in Mandaluyong City are classified to one cluster. As a solution, I increased the value of k and set it to 8.

- Candiate Barangays
  - Barangka Itaas
  - Daang Bakal
  - Burol

Results

	Barangay	City	Latitude	Longitude	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
21	Barangka Itaas	Mandaluyong	14.5707	121.0423	0	Filipino Restaurant	Yoga Studio	Deli / Bodega	Flower Shop	Fast Food Restaurant	Farmers Market	Entertainment Service	English Restaurant	Empanada Restaurant	Electronics Store
22	Batasan Hills	Quezon City	14.68469	121.09547	0	Mountain	Filipino Restaurant	Yoga Studio	Deli / Bodega	Fast Food Restaurant	Farmers Market	Entertainment Service	English Restaurant	Empanada Restaurant	Electronics Store
29	Burol	Mandaluyong	14.5898	121.0276	0	Chinese Restaurant	Filipino Restaurant	Bookstore	Empanada Restaurant	Flower Shop	Fast Food Restaurant	Farmers Market	Entertainment Service	English Restaurant	Yoga Studio
36	Daang Bakal	Mandaluyong	14.5934	121.0304	0	Chinese Restaurant	Salon / Barbershop	Supermarket	Filipino Restaurant	Diner	Dim Sum Restaurant	Distillery	Donut Shop	Drugstore	Flower Shop

Conclusion

- By using data from Foursquare and PSA, we were able to apply the K-Means clustering methodology to be able to determine which barangays in Mandaluyong City closely resembles Batasan Hills in Quezon City in terms of the types of establishments surrounding the barangay. While there is no technically correct choice for the number of clusters, we can run the analysis multiple times with different choices for k to narrow down the number of barangays in each cluster and thus making it easier to choose the most suitable barangay in the list. In this paper, we were able to narrow down the choice into three barangays in Mandaluyong City. **No more 4-hour commute time!**