Restaurants Data Analysis in Kuala Lumpur, Malaysia

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1. Introduction

1.1 Background

Kuala Lumpur is the cultural, financial, and economic center of Malaysia. It is also the most populous city in Malaysia, with a population density of 6,696 person per square kilometer. It is among the fastest growing metropolitan regions in Southeast Asia, in both population and economic development.

At the same time, Malaysia is a multi–ethnic, multicultural, and multilingual society, and the many ethnic groups in Malaysia maintain separate cultural identities. Kuala Lumpur in particular, its mixed populace includes the country's three major ethnic groups: the Malays, the Chinese and the Indians, together with other indigenous races from around Malaysia. Mixed cultures in such a highly populated area have lead to a great opportunity for stakeholders to try on new businesses with full possibilities. [1]

1.2 Problem

In this project we choose to focus on finding a suitable idea for what kind of restaurant should be opened at desired location. Specifically, this report will be targeted to stakeholders interested in opening a restaurant in Kuala Lumpur, Malaysia.

We will try to detect which geographical area has the majority ethnic group, and meanwhile are not already crowded with restaurants. We would also prefer locations as close to city center as possible.

We will use our data science powers to generate a few most promising neighborhoods based on this criteria. Advantages of each area will then be clearly expressed by maps and information charts so that best possible final location can be chosen by stakeholders.

[1] https://en.wikipedia.org/wiki/Kuala_Lumpur

2. Data

2.1 Influencing Factors on Data

Based on definition of our problem, factors that will influence our decision are:

- Majority ethnic group in the neighborhood
- Number of existing restaurants in the neighborhood (any type of restaurant)

2.2 Data Acquisition

Data sources are listed below:

- Demographic data of ethnic groups in Kuala Lumpur are found on TindakMalaysia Website[2]
- Coordinates of Kuala Lumpur center are obtained using Geocoders geocoding API of well known Kuala Lumpur location
- Neighborhood areas of Kuala Lumpur are found on TindakMalaysia Github Repository[3]
- Coordinates of centers of candidate areas are generated mathematically from the neighborhood areas of Kuala Lumpur
- Number of restaurants and their type and location in every neighborhood are obtained using Foursquare API[4]

2.3 Data Cleaning

Due to the lack of Malaysia's demographic data online, I have chosen to scrape the Kuala Lumpur voters' demographic information from TindakMalaysia website, which originally served for election purpose. This information is based on census data of Q4, Year 2017. Kuala Lumpur has totally 11 administrative districts. Ethnic groups are listed according to their percentage for each district (Table 1).

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[2] https://public.tableau.com/profile/danesh.prakash.chacko#!/vizhome/DEMOGRAFIPENGUNDIMALAYSIA/PecahanEtnik

[3] https://github.com/TindakMalaysia/Federal-Territories-Maps/tree/master/KL/KL_PAR_2015

[4] https://developer.foursquare.com/

	District	Chinese	Malay	India	Bumiputera Sabah	Bumiputera Sarawak	Orang Asli	Others
0	BANDAR TUN RAZAK	29.10	61.10	8.27	0.42	0.53	0.01	0.57
1	BATU	38.27	42.52	17.47	0.32	0.44	0.02	0.96
2	BUKIT BINTANG	75.13	12.53	10.95	0.37	0.28	0.02	0.73
3	CHERAS	82.93	9.66	6.74	0.22	0.06	0.01	0.38
4	KEPONG	88.74	4.56	6.03	0.30	0.05	NaN	0.32
5	LEMBAH PANTAI	18.91	62.11	16.26	0.67	0.48	0.02	1.55
6	SEGAMBUT	58.91	27.53	11.78	0.14	0.12	0.01	1.50
7	SEPUTEH	82.02	9.04	7.88	0.22	0.08	NaN	0.75
8	SETIAWANGSA	25.87	61.08	10.39	0.75	1.08	0.04	0.78
9	TITIWANGSA	17.31	70.48	9.42	0.49	0.37	0.01	1.91
10	WANGSA MAJU	29.57	59.81	8.19	0.45	0.59	0.04	1.36

Table 1: Table of Proportion of Ethnic Groups in Kuala Lumpur Districts

After that, the data is being cleaned up to show only the majority ethnic group, with other redundant information removed (Table 2).

	District	Majority Race	Percentage
0	BANDAR TUN RAZAK	Malay	61.10
1	BATU	Malay	42.52
2	BUKIT BINTANG	Chinese	75.13
3	CHERAS	Chinese	82.93
4	KEPONG	Chinese	88.74
5	LEMBAH PANTAI	Malay	62.11
6	SEGAMBUT	Chinese	58.91
7	SEPUTEH	Chinese	82.02
8	SETIAWANGSA	Malay	61.08
9	TITIWANGSA	Malay	70.48
10	WANGSA MAJU	Malay	59.81

Table 2: Table of The Majority Race in Kuala Lumpur Districts with Percentages

As we need to visualize the data using map, the majority race in each district area is represented as a number, so the choropleth map can display the areas with different colors based on their respective main ethnic group in stay. As from the previous table we know that there are only 2 major groups presented, therefore the Malays are labeled as 0, and Chinese are labeled as 1 (Table 3).

	District	Majority Race	Percentage	Majority Race No
0	BANDAR TUN RAZAK	Malay	61.10	0
1	BATU	Malay	42.52	0
2	BUKIT BINTANG	Chinese	75.13	1
3	CHERAS	Chinese	82.93	1
4	KEPONG	Chinese	88.74	1
5	LEMBAH PANTAI	Malay	62.11	0
6	SEGAMBUT	Chinese	58.91	1
7	SEPUTEH	Chinese	82.02	1
8	SETIAWANGSA	Malay	61.08	0
9	TITIWANGSA	Malay	70.48	0
10	WANGSA MAJU	Malay	59.81	0

Table 3: Extended Table with The Majority Race Shown In Numbers

In the meanwhile, the coordinates of neighborhoods in Kuala Lumpur is scraped from the TindakMalaysia Github Repository. The centers of each neighborhood are generated by simple calculation of mean method based on boundary points of each neighborhood. However, since some areas are in irregular shapes and therefore the calculated centers are placed far from the middle of their areas, therefore adjustments on some candidate centers have to be made accordingly (Table 4). Those coordinates used for correction are estimated using Google Map[5].

	District	Latitude	Longitude
0	LEMBAH PANTAI	3.109179	101.664066
1	TITIWANGSA	3.153691	101.736048
2	CHERAS	3.098256	101.734837
3	SETIAWANGSA	3.185183	101.733304
4	BUKIT BINTANG	3.139090	101.700725
5	BATU	3.202750	101.681007
6	KEPONG	3.207030	101.652003
7	SEPUTEH	3.088583	101.690155
8	SEGAMBUT	3.166146	101.657389
9	WANGSA MAJU	3.210742	101.720206
10	BANDAR TUN RAZAK	3.076840	101.713364

Table 4: Table of Kuala Lumpur Districts with Coordinates

[5] https://www.google.com/maps/

For the easy readability, both previous tables are merged together to provide a master table with complete information of coordinates and demographic information in Kuala Lumpur's districts (Table 5).

	District	Latitude	Longitude	Majority Race	Percentage	Majority Race No
0	LEMBAH PANTAI	3.109179	101.664066	Malay	62.11	0
1	TITIWANGSA	3.153691	101.736048	Malay	70.48	0
2	CHERAS	3.098256	101.734837	Chinese	82.93	1
3	SETIAWANGSA	3.185183	101.733304	Malay	61.08	0
4	BUKIT BINTANG	3.139090	101.700725	Chinese	75.13	1
5	BATU	3.202750	101.681007	Malay	42.52	0
6	KEPONG	3.207030	101.652003	Chinese	88.74	1
7	SEPUTEH	3.088583	101.690155	Chinese	82.02	1
8	SEGAMBUT	3.166146	101.657389	Chinese	58.91	1
9	WANGSA MAJU	3.210742	101.720206	Malay	59.81	0
10	BANDAR TUN RAZAK	3.076840	101.713364	Malay	61.10	0

Table 5: Master Table of Complete Information

Next, we will visualize the demographic information on the map using Folium library. The colors shown in the map are indicating the majority ethnic group, yellow region dominated by the Malays while red region dominated by the Chinese. Besides, since we will explore venues in each district area using Foursquare API, the magnitude of radius from the city center is determined by plotting it on the map and inspect it visually, such that the coverage is sufficient enough to cover most of the areas of districts in Kuala Lumpur. As a result, the magnitude is estimated as 1100 meter from the map (Figure 6).

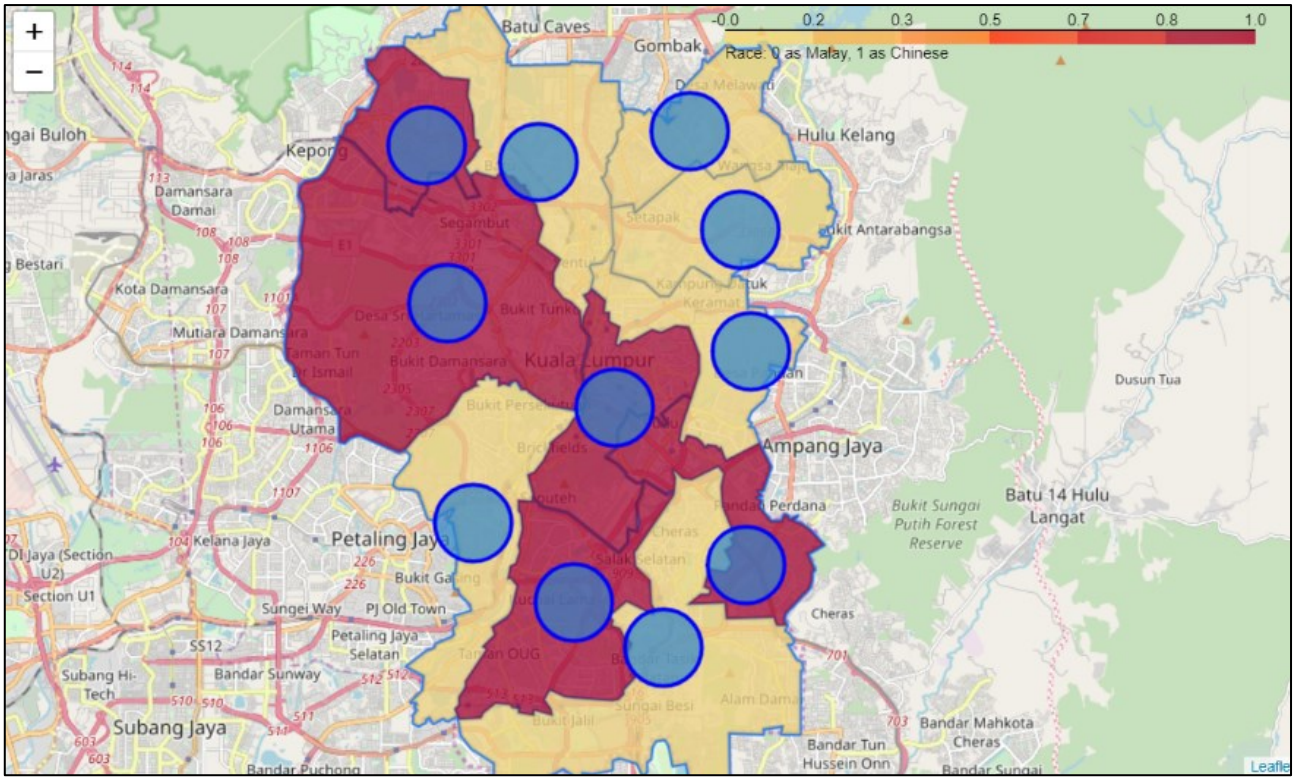

Figure 6: Map of Kuala Lumpur and its Demographics, together with 1200m Radius Coverage from Centers of Districts

After deciding the magnitude of radius, we would also request the result to be containing 'food' category only from Foursquare[6], as we are interested in restaurant only. Furthermore, we would want to search for those that are proper restaurants. So the list obtained from the result is filtered out to only include venues that have 'restaurant' in their category name (Table 7).

	District	Venue Name	Venue Category	Venue Coordinates	Venue Distance
0	LEMBAH PANTAI	明記家鄉小食	Chinese Restaurant	(3.1104848185266993, 101.678110759793)	271
1	LEMBAH PANTAI	Nihon Kai	Japanese Restaurant	(3.106273820844563, 101.67897077220967)	349
2	LEMBAH PANTAI	Sanuki Udon	Udon Restaurant	(3.110877105565396, 101.68498225960003)	566
3	LEMBAH PANTAI	BBQ Thai	Thai Restaurant	(3.108597763859346, 101.67889235460834)	156
4	LEMBAH PANTAI	Gyutaro Yakiniku	Japanese Restaurant	(3.1041169632637438, 101.6777439142475)	624

Table 7: Filtered Table of Restaurant Only Which Requested from Foursquare

[6] https://developer.foursquare.com/docs/resources/categories

3. Methodology

In first step we have collected the required data, which are location and type of every restaurant within Kuala Lumpur center. We have also identified the main ethnic group on each neighborhood.

Second step in our analysis will be calculation and exploration of 'restaurant density' across different areas of Kuala lumpur - we will use bar chart to identify promising areas that are close with centers with the number and the type of restaurants in general.

Next, we will present a map of all such locations but also create clusters (using k-means clustering) of those locations to identify general zones or neighborhoods which should be a starting point for final exploration and searching for optimal venue location by stakeholders.

3.1 Exploratory data analysis

The number of restaurants is counted and segmented based on the results returned from Foursquare for each district area (Figure 8).

	Number of Restaurants
District	
SEPUTEH	77
SETIAWANGSA	75
BANDAR TUN RAZAK	74
CHERAS	72
BATU	58
LEMBAH PANTAI	58
KEPONG	56
BUKIT BINTANG	47
WANGSA MAJU	40
TITIWANGSA	34
SEGAMBUT	7

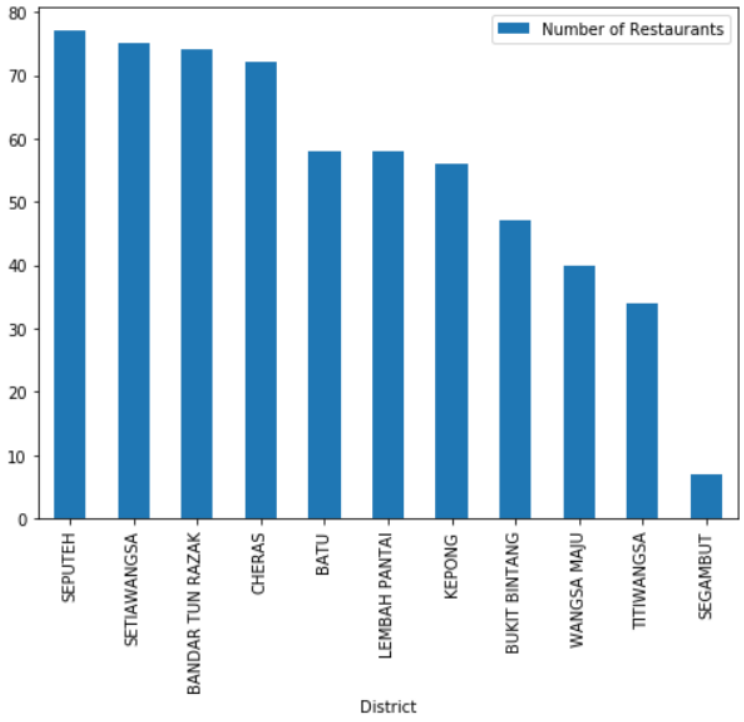

Figure 8: (a) Table & (b) Graph of Number of Restaurants Based On Districts

From the figure, we can see that Seputeh, Setiawangsa, Bandar Tun Razak, Cheras, Batu, Lembah Pantai, and Kepong have at least 55 restaurants. On the other hand, Bukit Bintang, Wangsa Maju and Titiwangsa has slightly less restaurants which is around 30 to 50 restaurants. Segambut has the least number of restaurants which is below 10.

However, the result doesn't mean that all the possible results are listed out for each area. It depends on given latitude and longitude information of the city centers which are merely estimated by calculation or visual adjustment for each borough. More possibilities with neighborhood information can be obtained with more coordinates information, or the actual information about locations of centers of neighborhoods.

In summary of this data, a total of 38 unique types of restaurants were returned by Foursquare. We then decided to find out the top ten common types of restaurants in each district area in Kuala Lumpur (Table 9).

	District	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
0	BANDAR TUN RAZAK	Chinese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Cantonese Restaurant	Restaurant	Malay Restaurant	Dim Sum Restaurant	English Restaurant	Indian Restaurant	Vietnamese Restaurant
1	BATU	Chinese Restaurant	Asian Restaurant	Malay Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Thai Restaurant	Seafood Restaurant	Indian Restaurant	Cantonese Restaurant	Comfort Food Restaurant
2	BUKIT BINTANG	Indian Restaurant	Malay Restaurant	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Restaurant	Thai Restaurant	South Indian Restaurant	French Restaurant	Korean Restaurant
3	CHERAS	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Thai Restaurant	Malay Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Korean Restaurant	Seafood Restaurant	Indian Restaurant
4	KEPONG	Chinese Restaurant	Asian Restaurant	Malay Restaurant	Restaurant	Vegetarian / Vegan Restaurant	Indian Restaurant	Halal Restaurant	Thai Restaurant	Cantonese Restaurant	Comfort Food Restaurant
5	LEMBAH PANTAI	Chinese Restaurant	Japanese Restaurant	Malay Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Thai Restaurant	Restaurant	Seafood Restaurant	Indian Restaurant	Cantonese Restaurant
6	SEGAMBUT	Malay Restaurant	Indian Restaurant	Asian Restaurant	Chinese Restaurant	Sushi Restaurant	Vietnamese Restaurant	Hakka Restaurant	Hunan Restaurant	Hotpot Restaurant	Hong Kong Restaurant
7	SEPUTEH	Chinese Restaurant	Asian Restaurant	Restaurant	Korean Restaurant	Japanese Restaurant	Hotpot Restaurant	Malay Restaurant	Dim Sum Restaurant	Fast Food Restaurant	Hong Kong Restaurant
8	SETIAWANGSA	Chinese Restaurant	Asian Restaurant	Indian Restaurant	Restaurant	Thai Restaurant	Malay Restaurant	Dim Sum Restaurant	Seafood Restaurant	Middle Eastern Restaurant	Vegetarian / Vegan Restaurant
9	TITIWANGSA	Malay Restaurant	Asian Restaurant	Korean Restaurant	Chinese Restaurant	Seafood Restaurant	Restaurant	Indian Restaurant	Vegetarian / Vegan Restaurant	French Restaurant	Middle Eastern Restaurant
10	WANGSA MAJU	Malay Restaurant	Asian Restaurant	Chinese Restaurant	Restaurant	Halal Restaurant	Thai Restaurant	Indonesian Restaurant	Comfort Food Restaurant	Seafood Restaurant	Latin American Restaurant

Table 9: Table of Top Ten Common Types of Restaurants Based On Districts

3.2 Clustering

As from Table 9, we can see that there are some common types of restaurants in districts. Therefore we decided to use K-means algorithm to cluster the districts, as it can group similar data points together and discover underlying patterns. K-means clustering is one of the simplest and popular unsupervised machine learning algorithms being used today.

First, to determine the appropriate number of clusters, we used to elbow method as a way to estimate the value k (Figure 10).

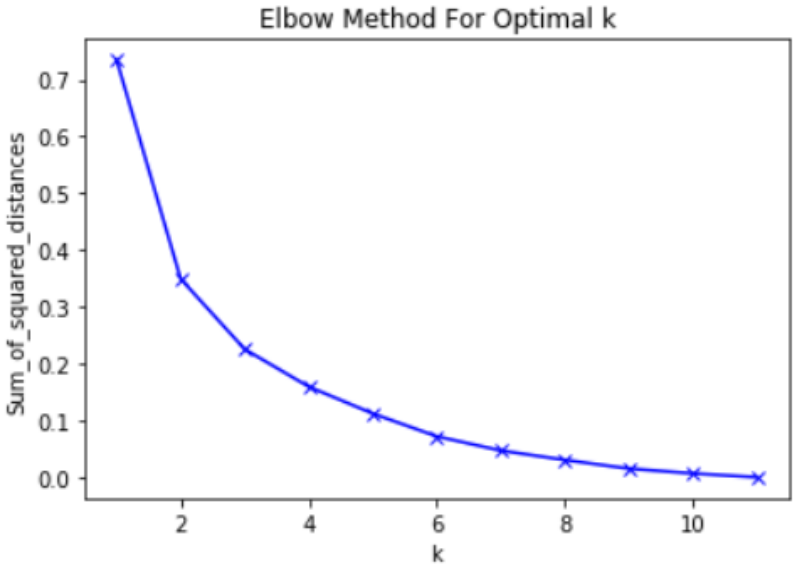

Figure 10: Elbow Method to Determine the Optimal Value of k for K-Means Algorithm

From Figure 10, we see a pretty clear elbow point at k = 2, indicating that 2 is the best number of clusters.

4. Results

A table is then merged from master table in Table 5 with cluster labels for each district and ten most common types of restaurants in Table 9 (Table 11).

	District	Latitude	Longitude	Majority Race	Percentage	Majority Race No	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant
0	LEMBAH PANTAI	3.109179	101.664066	Malay	62.11	0	0	Chinese Restaurant	Japanese Restaurant	Malay Restaurant
1	TITIWANGSA	3.153691	101.736048	Malay	70.48	0	1	Malay Restaurant	Asian Restaurant	Korean Restaurant
2	CHERAS	3.098256	101.734837	Chinese	82.93	1	0	Chinese Restaurant	Japanese Restaurant	Asian Restaurant
3	SETIAWANGSA	3.185183	101.733304	Malay	61.08	0	0	Chinese Restaurant	Asian Restaurant	Indian Restaurant
4	BUKIT BINTANG	3.139090	101.700725	Chinese	75.13	1	0	Indian Restaurant	Malay Restaurant	Chinese Restaurant

Table 11: (Part of) Merged Master Table with Cluster Labels and Ten Most Common Types of Restaurants for Kuala Lumpur Districts

Besides, a map also being plotted in order to visualize the clustered information of restaurants in district areas of Kuala Lumpur (Figure 12).

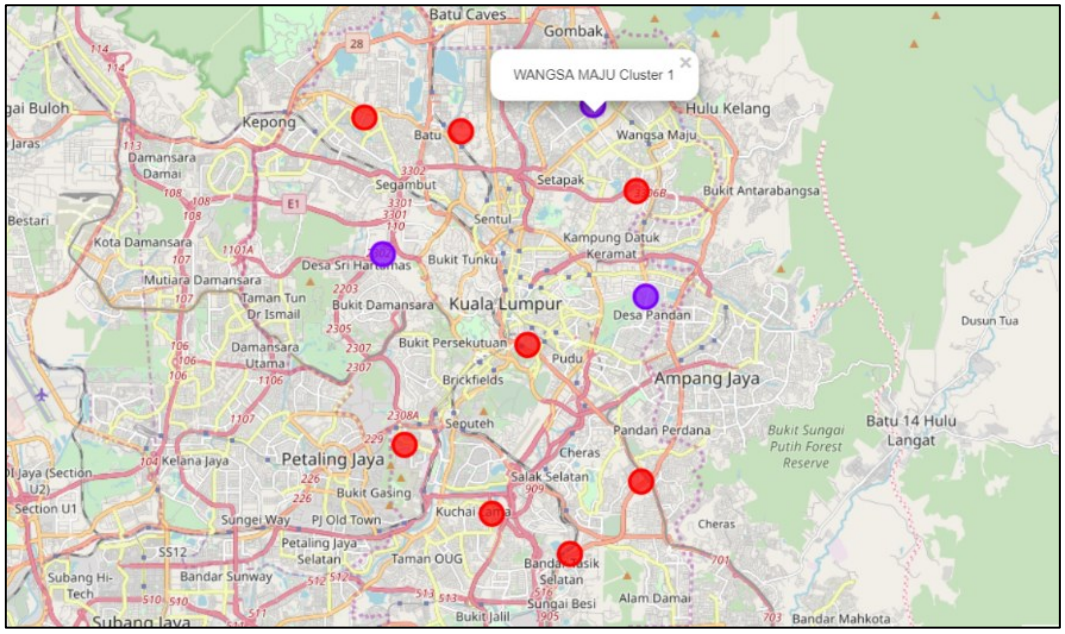

Figure 12: Map of Kuala Lumpur Districts with Clustered Information Superimposed on Top (Cluster 0 as Red Dots, Cluster 1 as Purple Dots).

For ease of comparison and analysis, we created separate tables for different clustered areas (Table 13 and 14).

	District	Majority Race	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant
0	LEMBAH PANTAI	Malay	0	Chinese Restaurant	Japanese Restaurant	Malay Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant
2	CHERAS	Chinese	0	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Thai Restaurant	Malay Restaurant
3	SETIAWANGSA	Malay	0	Chinese Restaurant	Asian Restaurant	Indian Restaurant	Restaurant	Thai Restaurant
4	BUKIT BINTANG	Chinese	0	Indian Restaurant	Malay Restaurant	Chinese Restaurant	Japanese Restaurant	Asian Restaurant
5	BATU	Malay	0	Chinese Restaurant	Asian Restaurant	Malay Restaurant	Vegetarian / Vegan Restaurant	Restaurant
6	KEPONG	Chinese	0	Chinese Restaurant	Asian Restaurant	Malay Restaurant	Restaurant	Vegetarian / Vegan Restaurant
7	SEPUTEH	Chinese	0	Chinese Restaurant	Asian Restaurant	Restaurant	Korean Restaurant	Japanese Restaurant
10	BANDAR TUN RAZAK	Malay	0	Chinese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Cantonese Restaurant	Restaurant

Table 13: (Part of) Table with Cluster Labeled Area 0 only

	District	Majority Race	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant
1	TITIWANGSA	Malay	1	Malay Restaurant	Asian Restaurant	Korean Restaurant	Chinese Restaurant	Seafood Restaurant
8	SEGAMBUT	Chinese	1	Malay Restaurant	Indian Restaurant	Asian Restaurant	Chinese Restaurant	Sushi Restaurant
9	WANGSA MAJU	Malay	1	Malay Restaurant	Asian Restaurant	Chinese Restaurant	Restaurant	Halal Restaurant

Table 14: (Part of) Table with Cluster Labeled Area 1 only

We also want to identify the number of the first most common restaurant in each cluster. Thus, we created a bar chart which may help us to find proper labels for each cluster (Figure 15).

Figure 15: Graph of Number of Restaurants in Each Cluster

When we examine above graph, we can label each cluster as follows:

Cluster 0 : Chinese Restaurants

Cluster 1 : Malay Restaurants

As the final wrap up, a map is created to visualize the clustered types of restaurants, together with demographic information in district areas of Kuala Lumpur (Figure 16).

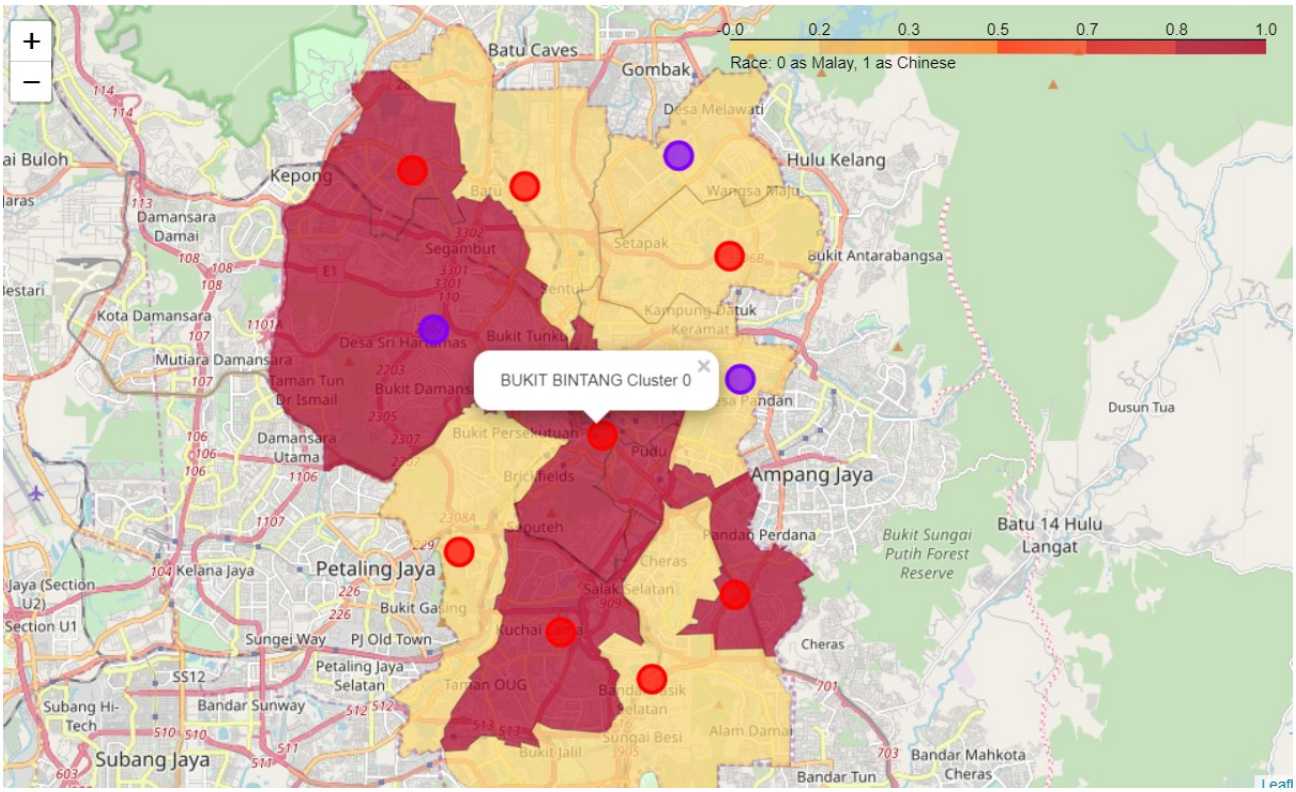

Figure 16: Map of Clustered Areas with Demographic Information in Kuala Lumpur

5. Discussion

As mentioned earlier, Kuala Lumpur is one of the cities with a high population density in a narrow area. Our analysis shows that although there are a great number of restaurants in Kuala Lumpur, there are pockets of low restaurant density fairly close to city center like areas of Titiwangsa and Segambut, for example.

As from the map above, we can observe that four out of the eight clustered areas labeled 0, which are having Chinese restaurants as the first common restaurant in their areas, are dominated by the Chinese group. Whereas in the clustered areas labeled 1, the majority race is the Malays group, therefore the first common type of restaurants is Malay restaurants. On the other hand, There are also a presence of Indian restaurants in smaller portion, which is reasonable too, as when we examine back the Table 1 about the proportion of ethnic groups in Kuala Lumpur, we can see that the Indians is the third largest group, after the Malays and Chinese group, in which we did not observed from the map directly. A more detailed analysis could be done to relate the demographic information and type of restaurant more precisely.

A more accurate information also can be obtained from government's actual demographic data to correctly show the proportion of ethic groups in Kuala Lumpur, as the data used in this project is scraped from a site served for election purpose and containing the demographic data about the voters only.

During the clustering process, K-means algorithm is used with a optimal value of 2. However, only 11 district coordinates are used. Moreover, the centers' coordinates are merely estimated by simple calculation of based on districts' boundaries. Therefore, for more detailed and accurate guidance, the data set can be expanded and the actual locations of district centers can be obtained by realistic approaches.

Purpose of this analysis is to only provide restaurant information on areas within Kuala Lumpur city (particularly their types) which may influenced by the ethnic groups stayed in Malaysia. The result shows that demography in Kuala Lumpur did influence the number of particular restaurants with some degree. Suggestion of type of a restaurant can be recommended as a starting point, and a more detailed analysis could be done to eventually result in location which has not only less nearby competition but also able to attract the attention of majority ethnic group in that area.

6. Conclusion

Purpose of this project was to identify Kuala Lumpur areas with information of restaurants in order to aid stakeholders in narrowing down the search for optimal location and a suitable type of restaurant. By calculating restaurant density distribution from Foursquare data we have first identified general boroughs with different types of restaurants. Clustering of those locations was then performed in order to create major zones of interest by particular ethnic group, and to be utilized as starting points for final exploration by stakeholders. Hence, final decision on optimal restaurant location is able to made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone.

7. References

7.1 https://en.wikipedia.org/wiki/Kuala_Lumpur

7.2 https://public.tableau.com/profile/danesh.prakash.chacko#!/vizhome/DEMOGRAFIPENGUNDIMALAYSIA/PecahanEtnik

7.3 https://github.com/TindakMalaysia/Federal-Territories-Maps/tree/master/KL/KL_PAR_2015

7.4 https://developer.foursquare.com/

7.5 https://www.google.com/maps/

7.6 https://developer.foursquare.com/docs/resources/categories

8. Appendix

(Please refer to next page.)

	District	Latitude	Longitude	Majority Race	Percentage	Majority Race No	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
0	LEMBAH PANTAI	3.109179	101.664066	Malay	62.11	0	0	Chinese Restaurant	Japanese Restaurant	Malay Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Thai Restaurant	Restaurant	Seafood Restaurant	Indian Restaurant	Cantonese Restaurant
1	TITIWANGSA	3.153691	101.736048	Malay	70.48	0	1	Malay Restaurant	Asian Restaurant	Korean Restaurant	Chinese Restaurant	Seafood Restaurant	Restaurant	Indian Restaurant	Vegetarian / Vegan Restaurant	French Restaurant	Middle Eastern Restaurant
2	CHERAS	3.098256	101.734837	Chinese	82.93	1	0	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Thai Restaurant	Malay Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Korean Restaurant	Seafood Restaurant	Indian Restaurant
3	SETIAWANGSA	3.185183	101.733304	Malay	61.08	0	0	Chinese Restaurant	Asian Restaurant	Indian Restaurant	Restaurant	Thai Restaurant	Malay Restaurant	Dim Sum Restaurant	Seafood Restaurant	Middle Eastern Restaurant	Vegetarian / Vegan Restaurant
4	BUKIT BINTANG	3.139090	101.700725	Chinese	75.13	1	0	Indian Restaurant	Malay Restaurant	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Restaurant	Thai Restaurant	South Indian Restaurant	French Restaurant	Korean Restaurant

Table 11b: (Full) Merged Master Table with Cluster Labels and Ten Most Common Types of Restaurants for Kuala Lumpur Districts

	District	Majority Race	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
0	LEMBAH PANTAI	Malay	0	Chinese Restaurant	Japanese Restaurant	Malay Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Thai Restaurant	Restaurant	Seafood Restaurant	Indian Restaurant	Cantonese Restaurant
2	CHERAS	Chinese	0	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Thai Restaurant	Malay Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Korean Restaurant	Seafood Restaurant	Indian Restaurant
3	SETIAWANGSA	Malay	0	Chinese Restaurant	Asian Restaurant	Indian Restaurant	Restaurant	Thai Restaurant	Malay Restaurant	Dim Sum Restaurant	Seafood Restaurant	Middle Eastern Restaurant	Vegetarian / Vegan Restaurant
4	BUKIT BINTANG	Chinese	0	Indian Restaurant	Malay Restaurant	Chinese Restaurant	Japanese Restaurant	Asian Restaurant	Restaurant	Thai Restaurant	South Indian Restaurant	French Restaurant	Korean Restaurant
5	BATU	Malay	0	Chinese Restaurant	Asian Restaurant	Malay Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Thai Restaurant	Seafood Restaurant	Indian Restaurant	Cantonese Restaurant	Comfort Food Restaurant
6	KEPONG	Chinese	0	Chinese Restaurant	Asian Restaurant	Malay Restaurant	Restaurant	Vegetarian / Vegan Restaurant	Indian Restaurant	Halal Restaurant	Thai Restaurant	Cantonese Restaurant	Comfort Food Restaurant
7	SEPUTEH	Chinese	0	Chinese Restaurant	Asian Restaurant	Restaurant	Korean Restaurant	Japanese Restaurant	Hotpot Restaurant	Malay Restaurant	Dim Sum Restaurant	Fast Food Restaurant	Hong Kong Restaurant
10	BANDAR TUN RAZAK	Malay	0	Chinese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Cantonese Restaurant	Restaurant	Malay Restaurant	Dim Sum Restaurant	English Restaurant	Indian Restaurant	Vietnamese Restaurant

Figure 13b: (Full) Table with Cluster Labeled Area 0 only

	District	Majority Race	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
1	TITIWANGSA	Malay	1	Malay Restaurant	Asian Restaurant	Korean Restaurant	Chinese Restaurant	Seafood Restaurant	Restaurant	Indian Restaurant	Vegetarian / Vegan Restaurant	French Restaurant	Middle Eastern Restaurant
8	SEGAMBUT	Chinese	1	Malay Restaurant	Indian Restaurant	Asian Restaurant	Chinese Restaurant	Sushi Restaurant	Vietnamese Restaurant	Hakka Restaurant	Hunan Restaurant	Hotpot Restaurant	Hong Kong Restaurant
9	WANGSA MAJU	Malay	1	Malay Restaurant	Asian Restaurant	Chinese Restaurant	Restaurant	Halal Restaurant	Thai Restaurant	Indonesian Restaurant	Comfort Food Restaurant	Seafood Restaurant	Latin American Restaurant

Figure 14b: (Full) Table with Cluster Labeled Area 1 only