

# **Singapore business analysis**

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# 1. Background

Singapore has a highly developed market economy, based historically on extended entrepôt trade. Along with Hong Kong, South Korea, and Taiwan, Singapore is one of the original Four Asian Tigers, but has surpassed its peers in terms of GDP per capita. Between 1965 and 1995, growth rates averaged around 6 per cent per annum, transforming the living standards of the population.

The Singaporean economy is known as one of the freest, most innovative, most competitive, most dynamic and most business friendly. The 2015 Index of Economic Freedom ranks Singapore as the second freest economy in the world and the Ease of doing business index has also ranked Singapore as the easiest place to do business for the past decade. In 2016, Singapore is rated the world's most expensive city for the third consecutive year by the Economist Intelligence Unit.

Recently, more and more investors are exploring the opportunities to set up business in Singapore. In this report, we are focusing on food and beverage type of business, especially the area and type of restaurant selections.

# 2. Data and methodology

In this exercise, I will explore, segment, and cluster the areas in Singapore. For the Singapore area data, a Wikipedia page exists that has all the information I need to explore and cluster. The link is as following: [https://en.wikipedia.org/wiki/Planning\\_Areas\\_of\\_Singapore](https://en.wikipedia.org/wiki/Planning_Areas_of_Singapore). I am going to scrape the Wikipedia page and wrangle the data, clean it, and then read it into a pandas dataframe so that it is in a structured format. Of course, foursquare location data will be extracted to visualize Singapore areas and venues. Once the data is in a structured format, I am going to conduct the segmenting and clustering analysis to explore the areas in Singapore. k-means clustering algorithm is going to be used in this analysis. Furthermore, the Folium library is applied to visualize the areas.

# 3. Data Analysis

## 3.1 Original Data

The data sourcing from Wikipedia include key information related to areas, regions, size, population and density of each area. Key statistics are as following:

Areas:	55 areas
Regions:	5 regions

Total Area: 677 km<sup>2</sup>  
 Total population: 4 million  
 Average Density: around 5900 per km<sup>2</sup>

Table 1 shows the statistics for each region.

**Table 1: Statistic of different regions in Singapore**

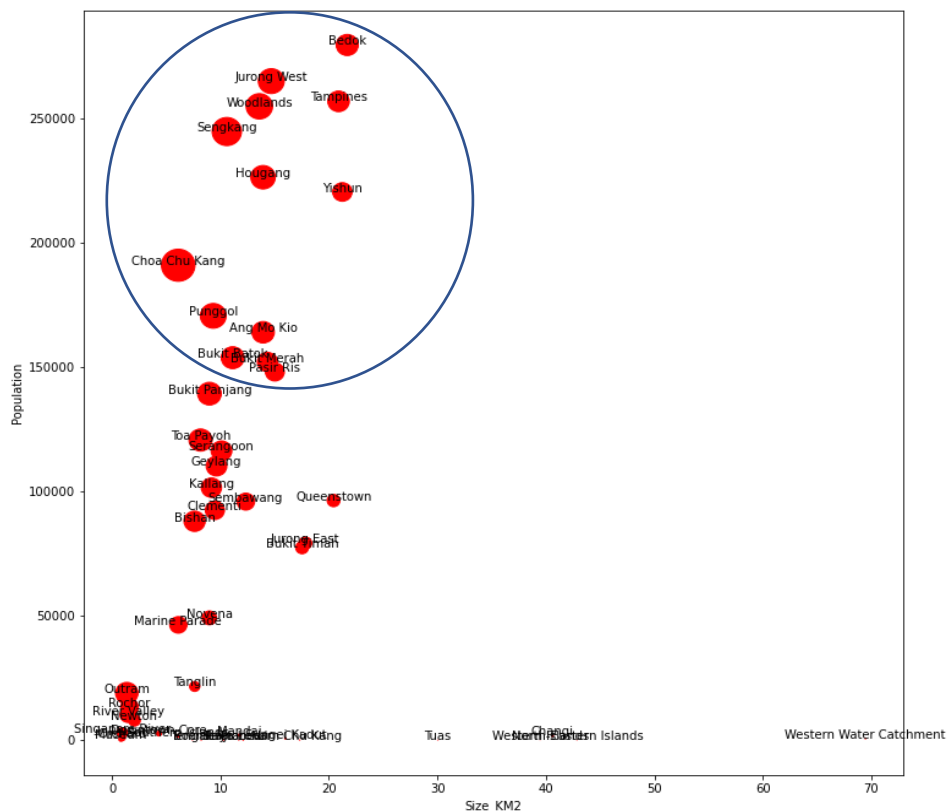
Region	Areas*	Size (km <sup>2</sup> )	Population	Density
Central	19	129	922,940	7,136
East	5	110	686,000	6,242
North	6	92	573,950	6,223
North-East	7	111	921,960	8,304
West	12	235	921,360	3,922
<b>Total</b>	<b>49</b>	<b>677</b>	<b>4,026,210</b>	<b>5,943</b>

\*Six areas are excluded from this summary due to minimal size and zero population. They are Changi Bay – East, Marina East – Central, Marina South – Central, Straits View – Central, Central Water Catchment - North, Simpang – North.

## 3.2 Population and density analysis

I plotted the areas of Singapore. The figure 1 shows that most of the areas are located at the area with size less than 20 km<sup>2</sup> and population of more than 100 thousands. Our selection of areas for the restaurant business, we should also locate in these areas, especially the one circled out.

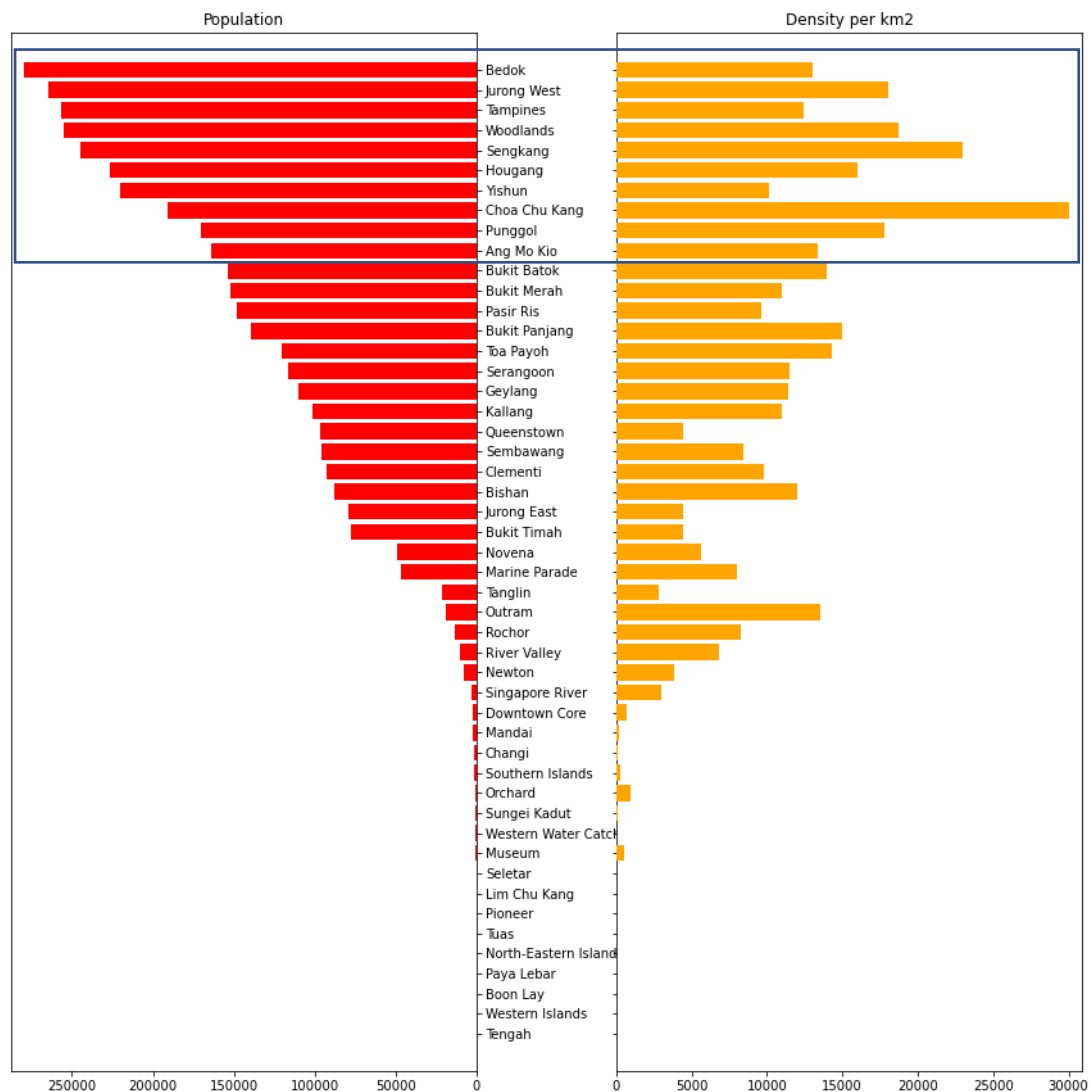
**Figure 1: Bubble analysis around size, population and density**



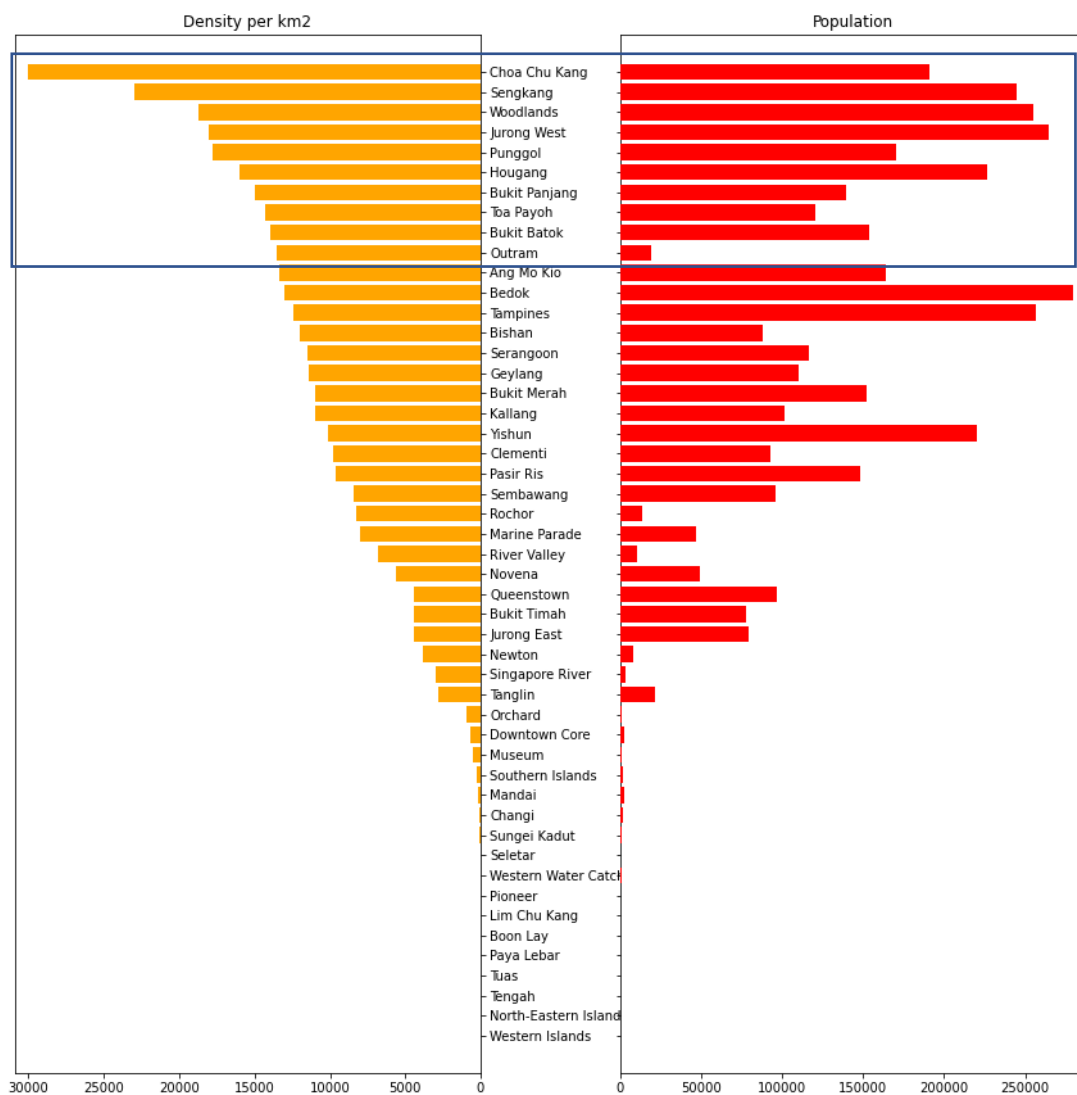
Note: the size of bubble is the density of related area.

Further analysis on the population and density shows in figures 2 and 3 that some areas jumped out, such as Bedok, Jurong West, Hougang, Tampines, Choa Chu Kang, Sengkang, Yishun, Woodlands, and Punggol. Those areas have relatively higher population as well as density, which means higher demanding of diversified services, including restaurants.

**Figure 2: Analysis on population and density 1**



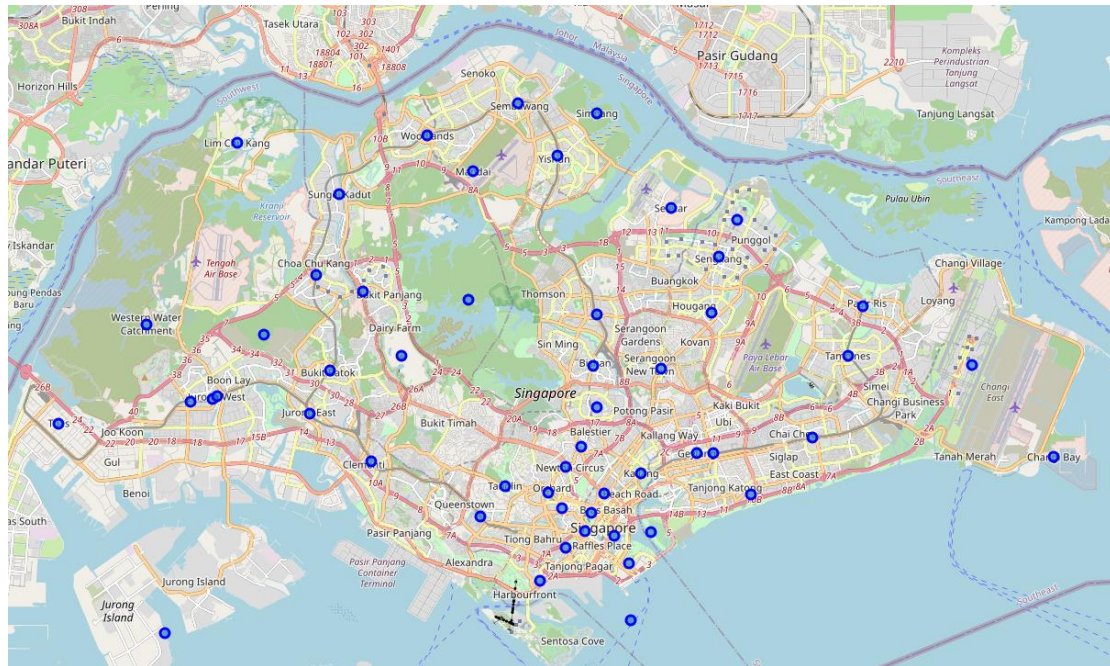
**Figure 3: Analysis on population and density 2**



### 3.3 Analysis on venues in each area

I extracted location information for Singapore, as well as each area based on Google Map API. And then visualized them in map for the readers to understand Singapore further. Please see figure 4 below.

**Figure 4: Visualization of Singapore and Areas**



With foursquare API, I further located venues of each area with radius of 500 meter. There are 226 categories of venues in Singapore. In total there are 1731 venues addressed. The top ten areas for number of venues are as table 2 below.

**Table 2: Statistic of Venues of Top Areas**

Area	Region	Venues
Singapore River	Central	100
Orchard	Central	100
Downtown Core	Central	100
Tampines	East	82
Boon Lay	West	78
Paya Lebar	East	77
Jurong East	West	77
Jurong West	West	69
Clementi	West	66
Novena	Central	65
Bedok	East	60
Woodlands	North	51
Others	-	806
<b>Total</b>	-	<b>1731</b>

The total venues of top 12 areas are more than 50% of total venues in Singapore. And it is no surprising that four areas in Central have more venues given they are designed to be CBD. And more venues are located in West and East regions.

In order to understand more about each area venues, top 10 venues for each area is further analyzed. For example, table 3 shows that Chinese Restaurants and other Asian Restaurants might be opportunities without fierce competitions.

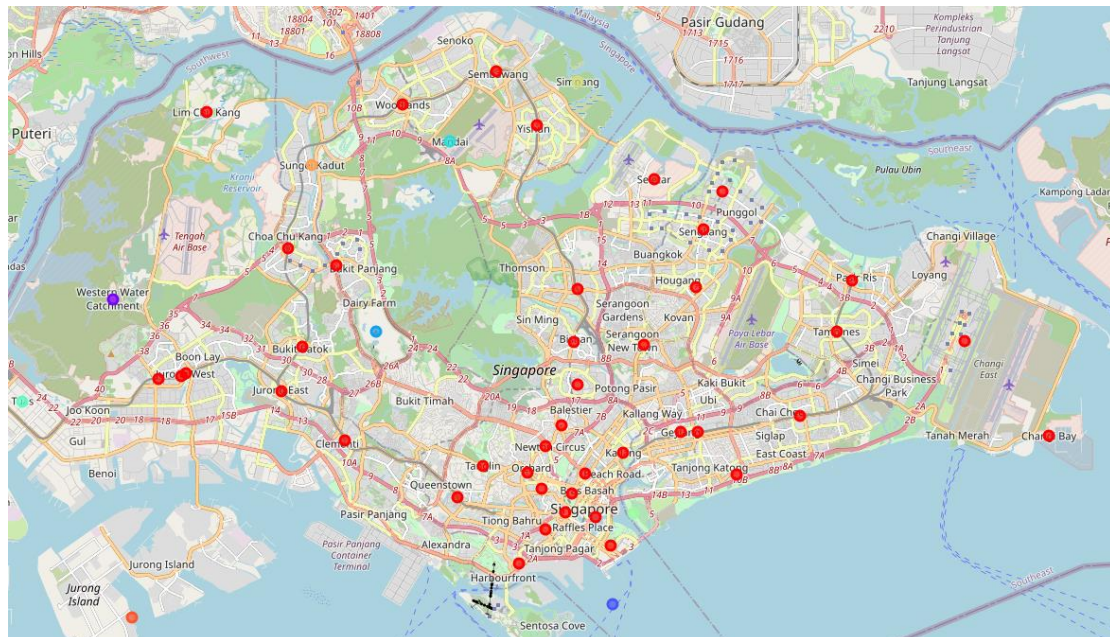
**Table 3:** Venues in Bedok

venue	freq
Coffee Shop	0.07
Sandwich Place	0.05
Japanese Restaurant	0.05
Food Court	0.05
Noodle House	0.05
Asian Restaurant	0.05
Chinese Restaurant	0.05
Supermarket	0.03
Café	0.03
Sushi Restaurant	0.03

### 3.4 Segmentation and Clustering analysis

The most common venues are analyzed for each area further. And then k-mean clustering is applied to support our decisions.

**Figure 5:** Clustering analysis on different Areas



The key observation is that most of the areas are fallen to same cluster (42 of 55 areas), which means that k-means clustering did not work well for our analysis.



## 4. Recommendation and Conclusion

In this exercise, I analyzed different areas in Singapore on their different status of population, density, as well as venues to support business decisions on opening restaurants in Singapore. Two angles of analysis are conducted, including demanding and supply. Although k-mean clustering approach does not give us useful insights, this research pointed out the directions to look into further. It is recommended to select the area for the business in the top 10 list of areas in terms of population/density.

# Appendix: Clustering results

## Cluster 1:

	Area	Region	Size_KM2	Population	Density	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
0	Ang Mo Kio	North-East	13.94	163,950	13,400	1.370073	103.849516	0	Coffee Shop	Dessert Shop	Food Court	Supermarket	Japanese Restaurant	Sandwich Place	Fast Food Restaurant	Bubble Tea Shop	Snack Place	Gym / Fitness Center
1	Bedok	East	21.69	279,380	13,000	1.323976	103.930216	0	Coffee Shop	Chinese Restaurant	Food Court	Sandwich Place	Japanese Restaurant	Asian Restaurant	Noodle House	Supermarket	Café	Sushi Restaurant
2	Bishan	Central	7.62	88,010	12,000	1.350986	103.848255	0	Food Court	Coffee Shop	Chinese Restaurant	Cosmetics Shop	Bubble Tea Shop	Supermarket	Japanese Restaurant	Ice Cream Shop	Café	Shaanxi Restaurant
3	Boon Lay	West	8.23	30	3.6	1.338575	103.705848	0	Japanese Restaurant	Asian Restaurant	Fast Food Restaurant	Chinese Restaurant	Dessert Shop	Café	Coffee Shop	Indian Restaurant	Boutique	Playground
4	Bukit Batok	West	11.13	153,740	14,000	1.349057	103.749591	0	Coffee Shop	Chinese Restaurant	Food Court	Department Store	Bowling Alley	Sandwich Place	Fast Food Restaurant	Track	Malay Restaurant	Multiplex
5	Bukit Merah	Central	14.34	151,980	11,000	1.270439	103.828318	0	Juice Bar	Cafeteria	Playground	Harbor / Marina	Park	Zoo Exhibit	Flea Market	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store
6	Bukit Panjang	West	8.99	139,280	15,000	1.378629	103.762136	0	Fast Food Restaurant	Coffee Shop	Café	Asian Restaurant	Sushi Restaurant	Shopping Mall	Bakery	Noodle House	Japanese Restaurant	Boutique
9	Changi	East	40.61	1,830	80.62	1.351080	103.990064	0	Airport	Rest Area	Food Court	Hotel	Zoo Exhibit	Filipino Restaurant	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store
10	Changi Bay	East	1.7	*	*	1.316850	104.020649	0	Boat or Ferry	Smoke Shop	Gym Pool	Pizza Place	History Museum	Zoo Exhibit	Flea Market	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store
11	Choa Chu Kang	West	6.11	190,890	30,000	1.384749	103.744534	0	Asian Restaurant	Fast Food Restaurant	Coffee Shop	Bubble Tea Shop	Bakery	Furniture / Home Store	Portuguese Restaurant	Café	Shop & Service	Supermarket
12	Clementi	West	9.49	92,420	9,800	1.315100	103.765231	0	Coffee Shop	Bus Station	Food Court	Noodle House	Chinese Restaurant	Dim Sum Restaurant	Dessert Shop	Asian Restaurant	Shopping Mall	Fried Chicken Joint
13	Downtown Core	Central	4.34	2,720	680	1.287475	103.856033	0	Boutique	Theater	Italian Restaurant	Event Space	Bistro	Concert Hall	Waterfront	Japanese Restaurant	Hotel	Coffee Shop
14	Geylang	Central	9.64	110,200	11,400	1.318186	103.887056	0	Chinese Restaurant	Noodle House	Food Court	Vegetarian / Vegan Restaurant	Dim Sum Restaurant	Asian Restaurant	Grocery Store	Fast Food Restaurant	Bakery	Organic Grocery
15	Hougang	North-East	13.93	226,240	16,000	1.370682	103.892545	0	Fast Food Restaurant	Chinese Restaurant	Coffee Shop	Food Court	Shopping Mall	Café	Supermarket	Gym	Metro Station	Sushi Restaurant
16	Jurong East	West	17.83	79,240	4,400	1.333115	103.742297	0	Coffee Shop	Chinese Restaurant	Japanese Restaurant	Café	Food Court	Steakhouse	Shopping Mall	Clothing Store	Supermarket	Multiplex
17	Jurong West	West	14.69	264,860	18,000	1.339636	103.707339	0	Asian Restaurant	Japanese Restaurant	Fast Food Restaurant	Chinese Restaurant	Dessert Shop	Café	Coffee Shop	Electronics Store	Boutique	Indian Restaurant
18	Kallang	Central	9.17	101,520	11,000	1.310759	103.866262	0	Dessert Shop	Restaurant	Supermarket	Coffee Shop	Hostel	Filipino Restaurant	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop
19	Lim Chu Kang	North	17.3	110	5.2	1.434217	103.714987	0	Zoo Exhibit	Farm	Flea Market	General Entertainment	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop
22	Marina South	Central	1.62	*	*	1.276998	103.861500	0	Garden	Public Art	Bus Line	Park	Zoo Exhibit	Flea Market	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop
23	Marine Parade	Central	6.12	48,390	8,000	1.302689	103.907395	0	Hotel	Multiplex	Japanese Restaurant	Massage Studio	Indian Restaurant	Chinese Restaurant	Salad Place	Dim Sum Restaurant	Dessert Shop	Pizza Place
24	Museum	Central	0.83	420	480	1.296052	103.847599	0	Hotel	Café	Dessert Shop	Karaoke Bar	Cosmetics Shop	Movie Theater	French Restaurant	Optical Shop	Clothing Store	Concert Hall
25	Newton	Central	2.07	8,030	3,800	1.313183	103.838040	0	Chinese Restaurant	Seafood Restaurant	Hotel Bar	Italian Restaurant	Food Court	Movie Theater	Thai Restaurant	Grocery Store	Convenience Store	Hotel
27	Novena	Central	8.98	49,210	5,600	1.320526	103.843881	0	Café	Coffee Shop	Italian Restaurant	Hotel	Ramen Restaurant	Asian Restaurant	Japanese Restaurant	Supermarket	Restaurant	Thai Restaurant
28	Orchard	Central	0.96	990	960.3	1.303427	103.831342	0	Boutique	Sushi Restaurant	Bakery	Hotel	Cosmetics Shop	Shopping Mall	Japanese Restaurant	Asian Restaurant	Bubble Tea Shop	Department Store
29	Outram	Central	1.37	18,960	13,500	1.282870	103.837860	0	Hotel	Farmers Market	Café	Gastropub	Coffee Shop	Bakery	Chinese Restaurant	Seafood Restaurant	Nail Salon	Grocery Store
30	Pasir Ris	East	15.02	148,020	9,600	1.373031	103.949255	0	Food Court	Fast Food Restaurant	Coffee Shop	Bus Line	Sandwich Place	Supermarket	Italian Restaurant	Recreation Center	Bubble Tea Shop	Gym
31	Paya Lebar	East	11.69	40	3.4	1.318218	103.893235	0	Shopping Mall	Asian Restaurant	Fast Food Restaurant	Coffee Shop	Food Court	Supermarket	Snack Place	Hotpot Restaurant	Ramen Restaurant	Fried Chicken Joint
32	Pioneer	West	12.1	90	8.3	1.337588	103.697410	0	Stadium	Shopping Mall	Fast Food Restaurant	Bakery	Gym / Fitness Center	Supermarket	Seafood Restaurant	Food Court	Pool	Bus Stop
33	Punggol	North-East	9.34	170,560	17,800	1.405258	103.902330	0	Juice Bar	Supermarket	Discount Store	Fast Food Restaurant	Electronics Store	Asian Restaurant	Japanese Restaurant	Café	Toy / Game Store	Chinese Restaurant
34	Queenstown	Central	20.43	96,340	4,400	1.294623	103.806045	0	Food Court	Chinese Restaurant	Noodle House	Train Station	Stadium	Café	Supermarket	Seafood Restaurant	Thai Restaurant	Spa
35	River Valley	Central	1.48	10,250	6,800	1.297582	103.836514	0	Shopping Mall	Hotel	Shoe Store	Clothing Store	Ramen Restaurant	Discount Store	Café	Chinese Restaurant	Coffee Shop	Cosmetics Shop
36	Rochor	Central	1.62	13,340	8,300	1.303266	103.852426	0	Indian Restaurant	Café	Art Gallery	Chinese Restaurant	Vegetarian / Vegan Restaurant	Ramen Restaurant	Playground	Food Court	Middle Eastern Restaurant	Restaurant
37	Seletar	North-East	10.25	250	26.3	1.409849	103.877379	0	Snack Place	Café	Harbor / Marina	Food Court	Zoo Exhibit	Flea Market	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store
38	Sembawang	North	12.34	95,920	8,400	1.449093	103.820055	0	Coffee Shop	Fast Food Restaurant	Asian Restaurant	Supermarket	Chinese Restaurant	Pet Store	Bakery	BBQ Joint	Food Court	Bistro
39	Sengkang	North-East	10.59	244,600	23,000	1.391654	103.895364	0	Asian Restaurant	Fast Food Restaurant	Food Court	Coffee Shop	Restaurant	Bus Station	Café	Bubble Tea Shop	Sculpture Garden	Bus Line
40	Serangoon	North-East	10.1	116,310	11,500	1.349862	103.873729	0	Chinese Restaurant	Clothing Store	Coffee Shop	Fast Food Restaurant	Korean Restaurant	Noodle House	Ice Cream Shop	Cosmetics Shop	Portuguese Restaurant	Dessert Shop
42	Singapore River	Central	0.96	3,070	3,000	1.289178	103.845154	0	Japanese Restaurant	Hotel	Nightclub	Thai Restaurant	Vegetarian / Vegan Restaurant	Italian Restaurant	Bar	Café	Food Court	Seafood Restaurant
46	Tampines	East	20.89	256,730	12,400	1.354653	103.943571	0	Café	Bakery	Coffee Shop	Bubble Tea Shop	Japanese Restaurant	Shopping Mall	Gym	Fried Chicken Joint	Supermarket	Sushi Restaurant
47	Tanglin	Central	7.63	21,630	2,800	1.306044	103.815280	0	Park	Thai Restaurant	French Restaurant	Lake	Garden	Tourist Information Center	Café	Museum	Brewery	Seafood Restaurant
49	Toa Payoh	Central	8.17	120,650	14,300	1.335391	103.849741	0	Noodle House	Chinese Restaurant	Coffee Shop	Food Court	Snack Place	Asian Restaurant	Café	Steakhouse	Thai Restaurant	Bus Station
53	Woodlands	North	13.59	254,730	18,700	1.436897	103.786216	0	Café	Japanese Restaurant	Coffee Shop	Shopping Mall	Snack Place	Electronics Store	Indian Restaurant	Asian Restaurant	Fast Food Restaurant	Clothing Store
54	Yishun	North	21.24	220,320	10,100	1.429384	103.835028	0	Chinese Restaurant	Food Court	Supermarket	Italian Restaurant	Hainan Restaurant	Coffee Shop	Bus Line	Fried Chicken Joint	Indian Restaurant	Seafood Restaurant

## Cluster 2:

	Area	Region	Size_KM2	Population	Density	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
52	Western Water Catchment	West	69.46	720	13	1.366452	103.681031	1	Gun Range	Zoo Exhibit	German Restaurant	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint

## Cluster 3:

	Area	Region	Size_KM2	Population	Density	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
44	Straits View	Central	0.77	*	*	1.255708	103.862228	2	Boat or Ferry	Zoo Exhibit	Flea Market	General Entertainment	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop

## Cluster 4:

	Area	Region	Size_KM2	Population	Density	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
7	Bukit Timah	Central	17.53	77,430	4,400	1.35469	103.776372	3	Trail	Rest Area	Mountain	Scenic Lookout	Zoo Exhibit	Filipino Restaurant	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop

## Cluster 5:

	Area	Region	Size_KM2	Population	Density	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
20	Mandai	North	11.77	2,090	180.2	1.423535	103.80335	4	Asian Restaurant	Zoo Exhibit	Fish & Chips Shop	General Entertainment	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop

## Cluster 6:

	Area	Region	Size_KM2	Population	Density	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
50	Tuas	West	30.04	70	2.3	1.329372	103.648236	5	Outdoor Supply Store	Coffee Shop	Zoo Exhibit	Fish & Chips Shop	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint

## Cluster 7:

	Area	Region	Size_KM2	Population	Density	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	Marina East	Central	1.82	*	*	1.288624	103.869827	6	Park	Lake	Café	Zoo Exhibit	Flea Market	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store

## Cluster 8:

	Area	Region	Size_KM2	Population	Density	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
41	Simpang	North	5.13	*	*	1.445295	103.849743	7	Platform	Zoo Exhibit	Fish & Chips Shop	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint

## Cluster 9:

	Area	Region	Size_KM2	Population	Density	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
45	Sungei Kadut	North	15.99	780	53.2	1.414997	103.753311	8	Office	Art Gallery	Bus Station	Flea Market	General Entertainment	Gastropub	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store

## Cluster 10:

	Area	Region	Size_KM2	Population	Density	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
51	Western Islands	West	39.47	10	0.25	1.250883	103.687883	9	Harbor / Marina	Arts & Crafts Store	Boat or Ferry	Zoo Exhibit	Food Court	General Entertainment	Gastropub	Garden	Gaming Cafe	Furniture / Home Store