Battle of the Neighborhoods Capstone Project:
Full Report

1. INTRODUCTION

1.1 Background

Singapore may be one of the world's smallest countries, but it is also one of the world's best cities to live in, ranked #1 in Asia and #25 in the world in Mercer's 2019 Quality of Living Index. This thriving "City in a Garden" attracts many expats due to the excellent quality of living and ample job opportunities in sectors such as financial services, manufacturing, and oil and gas. As individuals from around the world relocate to Singapore, many may find it difficult to know which neighborhood to select, though.

1.2 Problem Statement

This report aims to provide expats moving to Singapore with information about the city-state's neighborhoods so that they can choose a suitable home based on their preferences and budget. We will leverage several data sources about the neighborhoods of Singapore to (1) cluster neighborhoods according to what types of venues can be found within, and (2) rank the typical price of housing within each cluster.

1.3 Impact

Ultimately, we hope this report can serve as a helpful resource to inform expats who are considering relocating to Singapore. Better understanding what types of venues can be found in each neighborhood as well as how much to budget for housing will benefit those looking for a suitable neighborhood to call home in Singapore.

2. DATA

2.1 Data Sources and Relevance

2.1.1 General Information

The first data source provides basic information about the neighborhoods[1] of Singapore scraped from Wikipedia (here), including:

- Neighborhood name
- Total area (km2)
- Residential area (km2)
- Number of dwelling units
- Projected ultimate number of dwelling units
- Population

2.1.2 Location Data

The second data source provides each neighborhood's name along with its latitude and longitude coordinates pulled from geographic data (here), including:

- Neighborhood name
- Latitude
- Longitude

2.1.3 Home Rental Pricing

The third data source provides the median monthly rent (in Singapore dollars, as of Q1 2020) for several different sizes of flat[2,3] pulled from the Housing Development Board (HDB) website (here), including:

- Neighborhood name
- Median monthly rent for a 3-room flat
- Median monthly rent for a 4-room flat
- Median monthly rent for a 5-room flat

2.1.4 Venues Nearby

The fourth dataset is produced using the Foursquare API (here) to find all venues within a 500 meter radius of each neighborhood and examine what categories of venue are most common in each neighborhood; additional details about this dataset can be found in **Section 2.2 Data Cleaning**.

[1] It is worth noting that we will use Housing Development Board (HDB) Towns to constitute our neighborhoods as opposed to Districts or Planning Areas.

[2] Here we focus on Housing Development Board (HDB) flats as opposed to pricier private condos.

[3] Note that there are some missing values in this dataset; no value is provided when there are less than 20 rental transactions in the quarter for that particular town and flat type.

2.2 Data Acquisition and Cleaning

2.1.1 General Information Dataset

First, we import some general information about each neighborhood ("Total area (km2)," "Population," etc.) that is scraped from Wikipedia (here) using BeautifulSoup. The Wikipedia page includes two tables of neighborhoods that we must import and then append together in order to get our final dataset, which is now clean and ready to use.

	Name (English/Malay)	Chinese	Pinyin	Tamil	Total area (km2)	Residential area (km2)	Dwelling units	Projected ultimate	Population
0	Ang Mo Kio	宏茂桥	hóngmàoqiáo	ஆங் மோ கியோ	6.38	2.83	49169	58000	149800
1	Bedok	勿洛	wùluò	பிடோ	9.37	4.18	60115	79000	204300
2	Bishan	碧山	bìshān	பீஷான்	6.90	1.72	19664	34000	65700
3	Bukit Batok	武吉巴督	wǔjíbādū	புக்கிட் பாத்தோக்	7.85	2.91	32275	53000	113800
4	Bukit Merah	红山	hóngshān	புக்கிட் மேரா	8.58	3.12	51885	68000	147000

Figure 1.General information about neighborhoods (first 5 rows)

	Name (English/Malay)	Chinese	Pinyin	Tamil	Dwelling units	Population
0	Bukit Timah	武吉知马	–	புக்கித் திமா	2423	88000
1	Marine Parade	马林百列	–	மரின் பரேட்	6537	34300
2	Central Area	新加坡中區	–	சிங்கப்பூர் மாவட்டம்	9459	23300

Figure 2. Additional table to append to the first

2.1.2 Location Dataset

Second, we import our location data, which includes each neighborhood ("Town") along with its corresponding latitude and longitude. This dataset is already clean and ready to use.

	Town	Latitude	Longitude
0	Ang Mo Kio	1.369115	103.845436
1	Bedok	1.323604	103.927338
2	Bishan	1.351197	103.847578
3	Bukit Batok	1.348971	103.749896
4	Bukit Merah	1.281900	103.823900

Figure 3. Location data (first 5 rows)

2.1.3 Home Rental Pricing Dataset

Third, we import our home rental pricing data, which includes median monthly rent for three different sizes of apartment ("3-Room," "4-Room," and "5-Room") within each neighborhood ("Town").

	Town	3-Room	4-Room	5-Room
0	Ang Mo Kio	1700.0	2100.0	2400.0
1	Bedok	1700.0	2000.0	2300.0
2	Bishan	1900.0	2200.0	2500.0
3	Bukit Batok	1600.0	1900.0	2100.0
4	Bukit Merah	1900.0	2500.0	2720.0

Figure 4. Home rental pricing data (first 5 rows)

This dataset include a few missing values. As a result, we use mean imputation to replace each missing value with the average rent price for the given size of apartment (e.g., 3-Room). Now the dataset is clean and ready to use.

2.1.4 Venues Nearby Dataset

Fourth, we acquire data from Foursquare API (here) to construct our "venues nearby" dataset. The steps in the process are detailed below.

2.1.4.1 Getting Data from Foursquare API

Using our Location Dataset, which includes the latitude and longitude of each neighborhood, we connect to the Foursquare API to find all venues within a 500 meter radius of each neighborhood center. This returns a json file containing the venues in each neighborhood, including their coordinates and categories (Park, Café, Supermarket, etc.), which we then convert into a pandas dataframe. Figure 5 depicts the first 5 rows of the resulting dataframe.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Ang Mo Kio	1.369115	103.845436	Kam Jia Zhuang Restaurant	1.368167	103.844118	Asian Restaurant
1	Ang Mo Kio	1.369115	103.845436	Old Chang Kee	1.369094	103.848389	Snack Place
2	Ang Mo Kio	1.369115	103.845436	MOS Burger	1.369170	103.847831	Burger Joint
3	Ang Mo Kio	1.369115	103.845436	FairPrice Xtra	1.369279	103.848886	Supermarket
4	Ang Mo Kio	1.369115	103.845436	NTUC FairPrice	1.371507	103.847082	Supermarket

Figure 5. Venue data returned by Foursquare API (first 5 rows)

2.1.4.2 Using One-Hot Encoding to Restructure the Dataset

One-hot encoding allows us to restructure the data such that instead of having a single "Venue Category" feature (column) specifying the category of each venue (row), we now have one feature per category of venue ("Wine Bar," "Yoga Studio," etc.). Each of these new features is coded dichotomously: 0 means the venue does not fall into the given category; 1 means the venue does fall into the given category. Figure 6 shows the first 5 rows of our one-hot encoded dataset.

	Neighborhood	Accessories Store	American Restaurant	Arcade	Art Gallery	Arts & Crafts Store	Asian Restaurant	Auto Garage	BBQ Joint	Bagel Shop	...	Theme Restaurant	Track Stadium	Trail	Vegetarian / Vegan Restaurant	Video Game Store	Vietnamese Restaurant	Waterfront	Wine Bar	Wings Joint	Yoga Studio
0	Ang Mo Kio	0	0	0	0	0	1	0	0	0	...	0	0	0	0	0	0	0	0	0	0
1	Ang Mo Kio	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
2	Ang Mo Kio	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	Ang Mo Kio	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	Ang Mo Kio	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

Figure 6. One-hot encoded venue data (first 5 rows)

2.1.4.3 Grouping by Neighborhood to Restructure the Dataset

Next, we group our dataset by neighborhood. In our one-hot encoded dataset, each row corresponds to one venue, but we want each row to correspond to one neighborhood. Grouping by neighborhood and calculating each feature as "sum of the frequency of occurrence of each category" will show each neighborhood along with how many venues it has in each category.

	Neighborhood	Accessories Store	American Restaurant	Arcade	Art Gallery	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	BBQ Joint	Bakery	...	Toy / Game Store	Track Stadium	Trail	Vegetarian / Vegan Restaurant	Video Game Store	Video Store	Vietnamese Restaurant	Waterfront	Wings Joint	Yoga Studio
0	Ang Mo Kio	0	1	0	0	0	2	0	0	1	...	0	0	0	1	0	0	0	0	0	0
1	Bedok	0	2	0	0	0	3	0	0	2	...	0	0	0	1	0	0	0	0	1	0
2	Bishan	0	0	0	0	0	2	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	Bukit Batok	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	Bukit Merah	0	0	0	0	0	1	0	0	0	...	0	0	0	0	0	0	0	0	0	0

Figure 7. Venue data, grouped by neighborhood (first 5 rows)

3. METHODOLOGY

3.1 Exploratory Data Analysis

3.1.1 Mapping Neighborhoods

Using folium, we first visualize the neighborhoods of Singapore on a map.

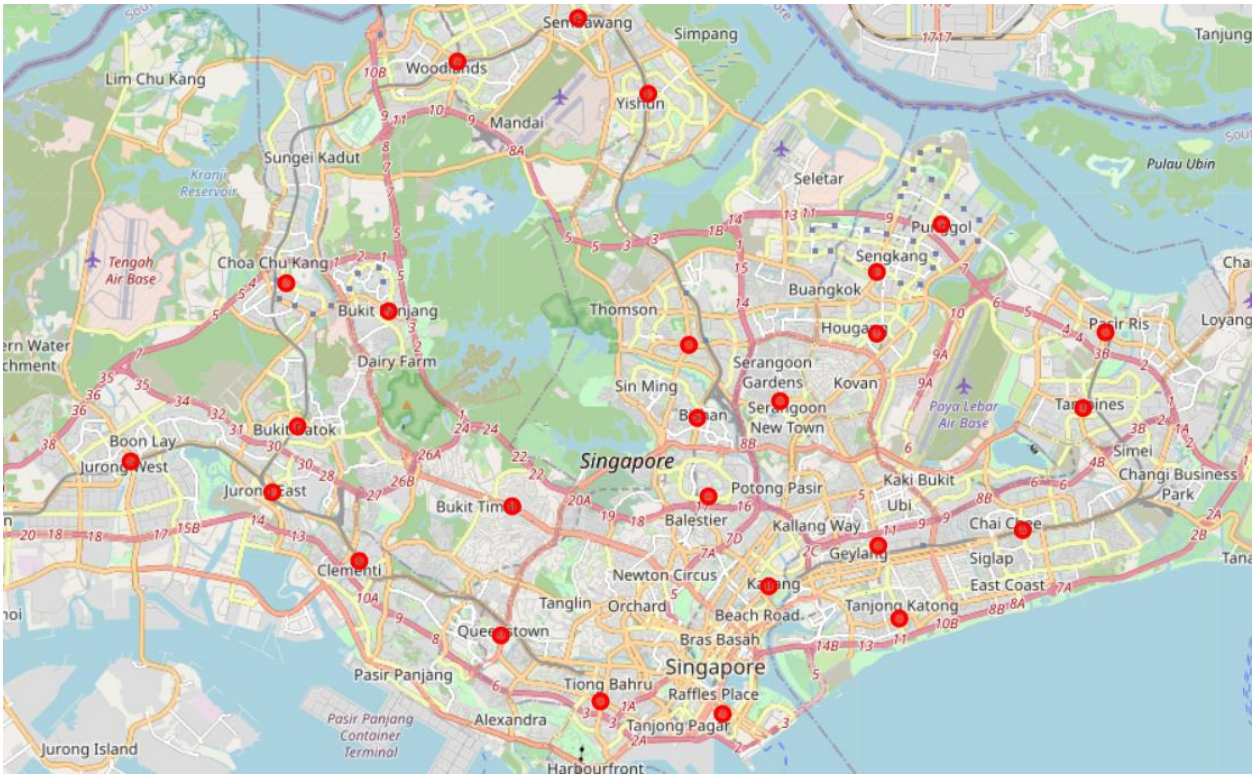

Figure 8. Map of Singapore neighborhoods

3.1.2 Size and Population of Neighborhoods

Using data from our general information dataset scraped from Wikipedia, we can plot the size of each neighborhood as well as the population of each neighborhood. In terms of size, we see that the biggest neighborhoods are Hougang and Tampines, whereas the smallest neighborhoods are Jurong East and Clementi (see Figure 9). In terms of population, we see that the most populous neighborhoods are Jurong West and Woodlands, whereas the least populous neighborhoods are Central and Marine Parade (see Figure 10).

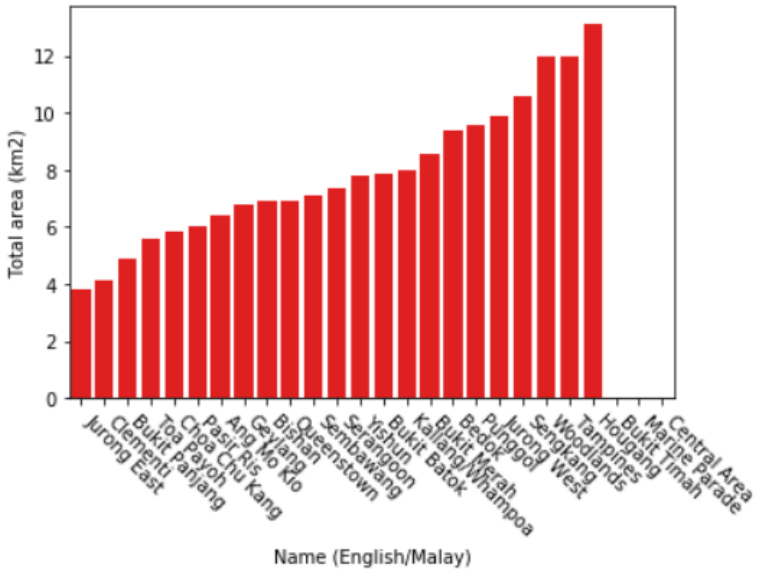

Figure 9. Neighborhood sizes (in square kilometers)

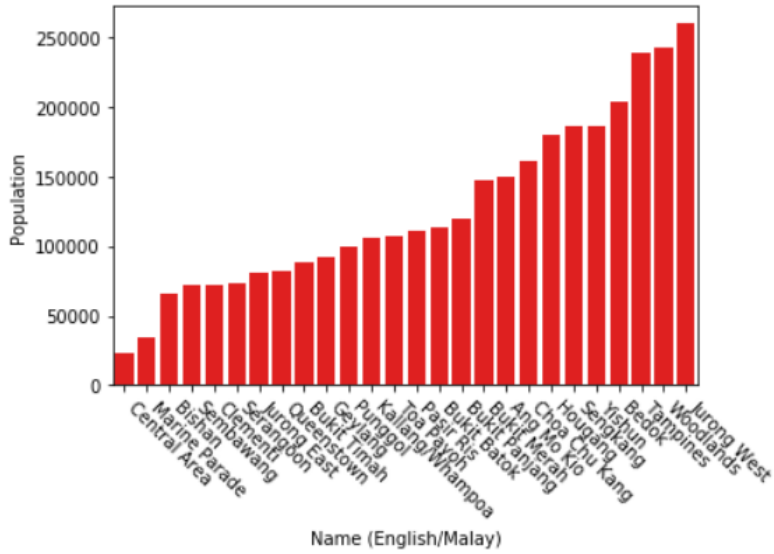

Figure 10. Neighborhood populations

We can also examine neighborhood size in conjunction with neighborhood population to see that larger neighborhoods tend to be more populated (see Figure 11). In addition, it appears that Choa Chu Kang is the most densely population neighborhood, whereas Bishan is the most sparsely populated neighborhood (see Figure 12).

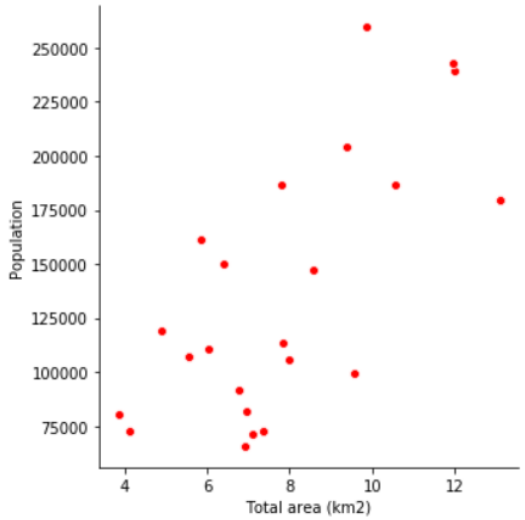

Figure 11. Neighborhood sizes and populations

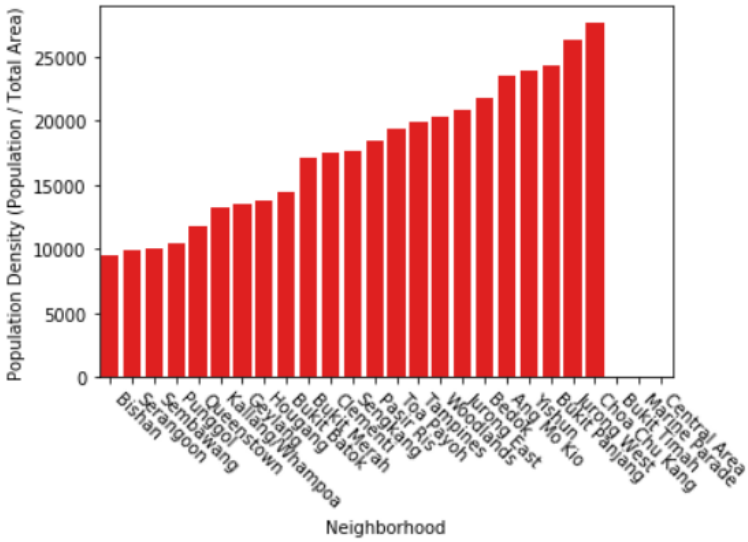

Figure 12. Neighborhood population density

3.1.3 Most Common Venue Types across Neighborhoods

For each neighborhood, we can calculate the most common venue type; subsequently, we can examine which venue types are most abundant across neighborhoods. It appears that coffee shops and food courts are the most abundant venue types, with 5 out of 26 neighborhoods having “Coffee Shop” as their most common venue type, and 5 out of 26 neighborhoods having “Food Court” as their most common venue type.

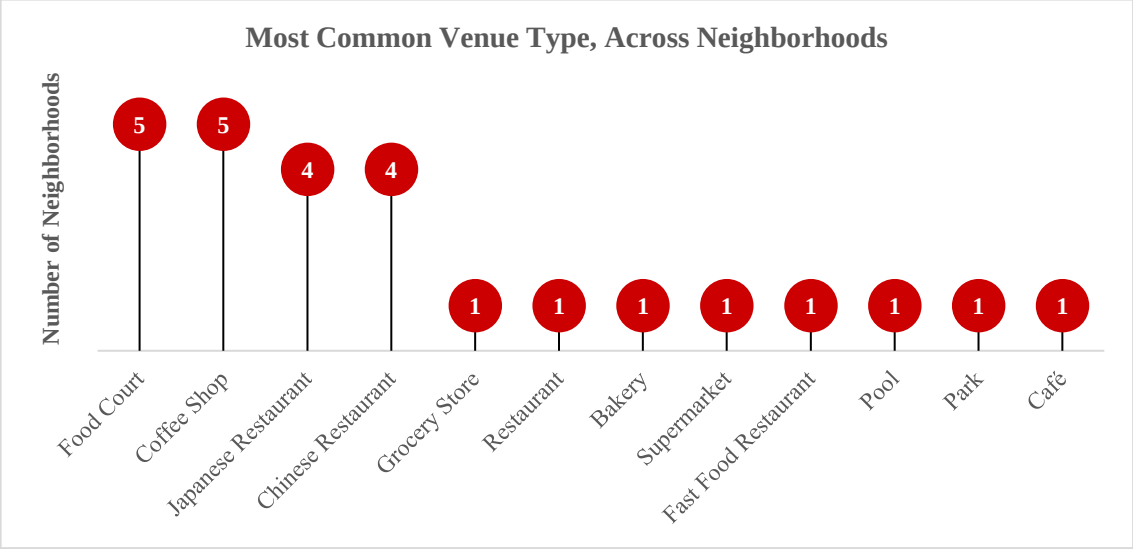

Figure 13. Most common venue types across neighborhoods

3.2 K-Means Clustering

We now leverage K-Means Clustering, which uses our numeric features (i.e., how many venues in each category) to group similar neighborhoods together. K-Means Clustering requires the user to specify how many clusters the model should find, so we first generate an "elbow graph" to show the optimal number clusters to use. There's not a very clear "elbow" in our plot, so we select 4 clusters.

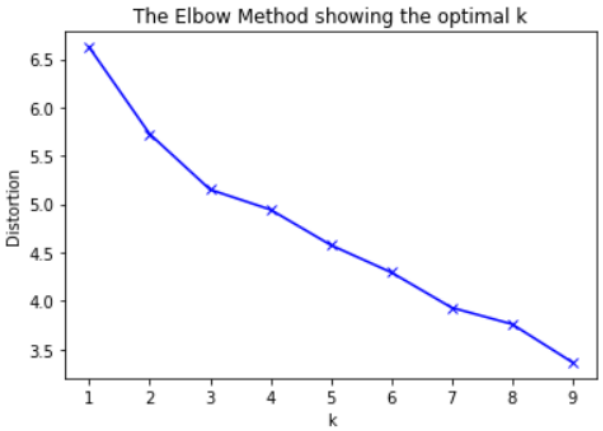

Figure 14. Elbow plot to choose the optimal k (number of clusters)

Next, the algorithm sorts our 26 neighborhoods into 4 clusters.

Cluster	Neighborhoods
0	Bedok, Jurong East, Jurong West, Tampines, Woodlands
1	Bukit Merah, Bukit Panjang, Bukit Timah, Kallang/Whampoa, Marine Parade, Punggol, Queenstown, Sembawang, Sengkang, Serangoon
2	Ang Mo Kio, Bishan, Bukit Batok, Choa Chu Kang, Clementi, Geylang, Hougang, Pasir Ris, Toa Payoh, Yishun
3	Central

Table 1. Summary of cluster analysis results

3.3 Home Rental Price Ranking

Sorting neighborhoods into clusters, we can rank the least to most expensive neighborhoods within each cluster, based on the median monthly rent of a 4-room flat.

Rank	Cluster 0	Cluster 1	Cluster 2	Cluster 3
1 *(cheapest)*	Woodlands	Bukit Panjang , Sembawang	Choa Chu Kang , Yishun	Central
2	Bedok , Jurong East , Jurong West	Punggol , Sengkang	Bukit Batok	
3	Tampines	Marine Parade	Hougang	
4		Bukit Timah	Pasir Ris	
5		Serangoon	Ang Mo Kio	
6		Kallang/Whampoa	Toa Payoh , Bishan	
7		Bukit Merah	Geylang	
8 *(most expensive)*		Queenstown	Clementi	

Table 2. Ranking of home rental prices by neighborhood, within cluster

4. RESULTS

4.1 Exploring Clusters of Neighborhoods

4.1.1 Mapping Clusters

Folium is used to generate another map, this time showing each neighborhood color-coded according to its cluster. Cluster 1 (in purple) and Cluster 2 (in teal) each contain 10 neighborhoods, Cluster 0 (in red) contains 5 neighborhoods, and Cluster 3 (in orange) contains only one neighborhood (Central).

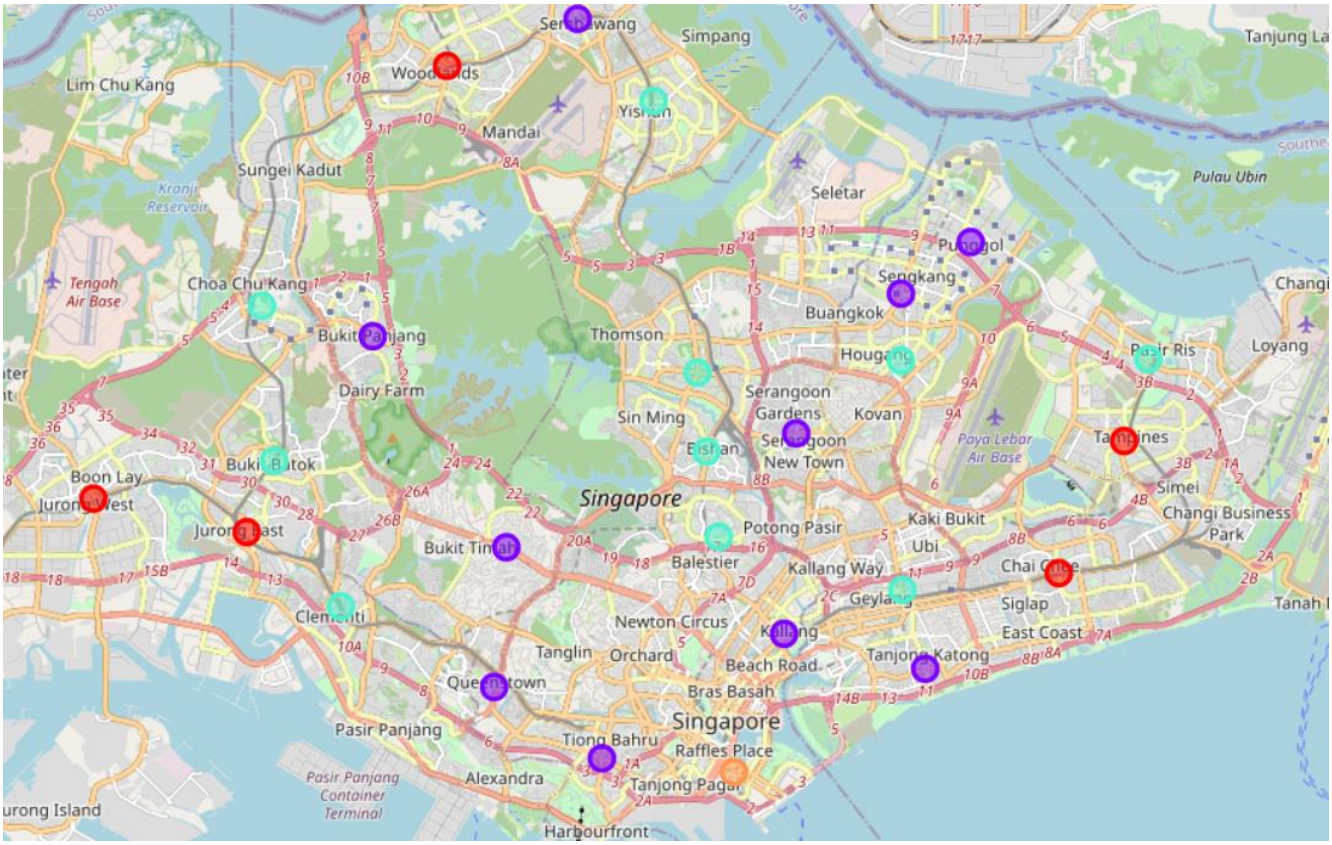

Figure 15. Map of neighborhoods, color-coded by cluster

4.1.2 Examining Each Cluster

4.1.2.1 Cluster 0

Cluster 0 contains 5 neighborhoods. In 3 out of the 5 neighborhoods, the 1st most common venue type is "Japanese Restaurant." All 5 neighborhoods have some variety of restaurant as the 2nd most common venue type ("Chinese Restaurant," "Asian Restaurant," or "Indian Restaurant"), and all 5 neighborhoods have "Café" included at some point in their top 10 most common venue types. In addition, each of the 5 neighborhoods includes some form of sweets shop in its top 10 most common venue types: "Bakery," "Bubble Tea Shop," "Dessert Shop," "Frozen Yogurt Shop." Overall, food-related venues—especially cafés and shops selling sweets—are featured prominently in neighborhoods of this cluster.

	Town	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
1	Bedok	1.323604	103.927338	0	Café	Chinese Restaurant	Sushi Restaurant	Food Court	Coffee Shop	Supermarket	Bakery	Garden Center	Japanese Restaurant	Malay Restaurant
12	Jurong East	1.332900	103.743600	0	Japanese Restaurant	Chinese Restaurant	Café	Shopping Mall	Coffee Shop	Food Court	Bubble Tea Shop	Clothing Store	Korean Restaurant	Sushi Restaurant
13	Jurong West	1.340400	103.709000	0	Japanese Restaurant	Asian Restaurant	Fast Food Restaurant	Chinese Restaurant	Dessert Shop	Coffee Shop	Indian Restaurant	Café	Seafood Restaurant	Sporting Goods Shop
22	Tampines	1.353718	103.942009	0	Bakery	Indian Restaurant	Coffee Shop	Café	Sushi Restaurant	Chinese Restaurant	Gym	Fast Food Restaurant	Dessert Shop	Thai Restaurant
24	Woodlands	1.438200	103.789000	0	Japanese Restaurant	Chinese Restaurant	Café	Food Court	Shopping Mall	Coffee Shop	Electronics Store	Frozen Yogurt Shop	Bus Station	Snack Place

Figure 16. Neighborhoods in Cluster 0

4.1.2.2 Cluster 1

Cluster 1 contains 10 neighborhoods. In 4 out of the 10 neighborhoods, the 1st most common venue type is "Chinese Restaurant." Another 2 neighborhoods have a 1st most common venue type of "Food Court" or "Restaurant," and an additional 2 neighborhoods have a 1st most common venue type of "Grocery Story" or "Supermarket." The final two neighborhoods have a 1st most common venue type of "Park" or "Pool." Fitness emerges as a key theme among the most common venues of Cluster 1, with entries such as "Gym," "Yoga Studio," "Basketball Court," "Track Stadium," "Trail," and "Sporting Goods Shop." Cluster 1 also suggests a trendy vibe, with venues such as "Nightclub," "Bar," and "Music Venue."

	Town	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
4	Bukit Merah	1.281900	103.823900	1	Chinese Restaurant	Furniture / Home Store	Convenience Store	Asian Restaurant	Coffee Shop	Japanese Restaurant	Residential Building (Apartment / Condo)	Seafood Restaurant	Gym	Fish & Chips Shop
5	Bukit Panjang	1.377400	103.771900	1	Food Court	Park	Miscellaneous Shop	Market	Noodle House	Yoga Studio	Flower Shop	French Restaurant	Food Truck	Food & Drink Shop
6	Bukit Timah	1.329400	103.802100	1	Pool	Gym	Yoga Studio	Flower Shop	Fried Chicken Joint	French Restaurant	Food Truck	Food Court	Food & Drink Shop	Food
14	Kallang/Whampoa	1.310000	103.865100	1	Restaurant	Coffee Shop	BBQ Joint	Fast Food Restaurant	Supermarket	Hostel	Metro Station	Asian Restaurant	Food Court	Nightclub
15	Marine Parade	1.302046	103.896999	1	Chinese Restaurant	Bar	Ice Cream Shop	Bakery	Flower Shop	Food	Café	Food Court	Steakhouse	Supermarket
17	Punggol	1.398400	103.907200	1	Chinese Restaurant	Indian Restaurant	Music Venue	Bus Station	Bus Stop	Café	High School	Bagel Shop	Basketball Court	Yoga Studio
18	Queenstown	1.298129	103.799471	1	Chinese Restaurant	Noodle House	Vegetarian / Vegan Restaurant	Asian Restaurant	Bakery	Ice Cream Shop	Stadium	Pool	Convenience Store	Food & Drink Shop
19	Sembawang	1.449100	103.818500	1	Supermarket	Coffee Shop	Fast Food Restaurant	Shopping Mall	Convenience Store	Food Court	Japanese Restaurant	Sporting Goods Shop	Chinese Restaurant	Government Building
20	Sengkang	1.386800	103.891400	1	Grocery Store	Gym	Coffee Shop	Metro Station	Basketball Court	Yoga Studio	Fried Chicken Joint	French Restaurant	Food Truck	Food Court
21	Serangoon	1.355400	103.867900	1	Park	Asian Restaurant	Smoke Shop	Indonesian Restaurant	Trail	Track Stadium	Bus Station	Auto Garage	Fast Food Restaurant	Bakery

Figure 17. Neighborhoods in Cluster 1

4.1.2.3 Cluster 2

Cluster 2 contains 10 neighborhoods. In 9 out of the 10 neighborhoods, the 1st most common venue type is "Food Court" or "Coffee Shop." (The final neighborhood has "Fast Food Restaurant" as its most common venue type.) In fact, "Coffee Shop" and "Food Court" each appear in the top 10 most common venue types lists in 9 out of the 10 neighborhoods. Looking to the rest of the common venue types across neighborhoods of Cluster 2, shopping and leisure seem prominent, with "Cosmetics Shop," "Department Store," "Shopping Mall," "Bookstore," Shoe Store," "Electronics Store," "Accessories Store," and "Multiplex" all appearing.

	Town	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	1.369115	103.845436	2	Food Court	Coffee Shop	Fast Food Restaurant	Dessert Shop	Supermarket	Bubble Tea Shop	Japanese Restaurant	Snack Place	Sandwich Place	Asian Restaurant
2	Bishan	1.351197	103.847578	2	Food Court	Bubble Tea Shop	Café	Chinese Restaurant	Coffee Shop	Ice Cream Shop	Japanese Restaurant	Asian Restaurant	Cosmetics Shop	Supermarket
3	Bukit Batok	1.348971	103.749896	2	Coffee Shop	Fast Food Restaurant	Chinese Restaurant	Food Court	Department Store	Basketball Court	Sandwich Place	Café	Multiplex	Shopping Mall
8	Choa Chu Kang	1.384000	103.747000	2	Coffee Shop	Noodle House	Fast Food Restaurant	Accessories Store	Shoe Store	Sandwich Place	Café	Snack Place	Bubble Tea Shop	Bookstore
9	Clementi	1.316116	103.764816	2	Coffee Shop	Food Court	Dessert Shop	Asian Restaurant	Chinese Restaurant	Japanese Restaurant	Noodle House	Dim Sum Restaurant	Electronics Store	Fast Food Restaurant
10	Geylang	1.320100	103.891800	2	Fast Food Restaurant	Shopping Mall	Bakery	Asian Restaurant	Supermarket	Food Court	Bubble Tea Shop	Steakhouse	Ramen Restaurant	Gym
11	Hougang	1.371802	103.891619	2	Coffee Shop	Fast Food Restaurant	Supermarket	Food Court	Café	Shopping Mall	Chinese Restaurant	Bus Station	Gym	Bookstore
16	Pasir Ris	1.372100	103.947400	2	Food Court	Japanese Restaurant	Coffee Shop	Sandwich Place	Bakery	Bus Station	Supermarket	Restaurant	Diner	Bus Stop
23	Toa Payoh	1.331835	103.850177	2	Coffee Shop	Snack Place	Pool	Chinese Restaurant	Food Court	Supermarket	Park	Dessert Shop	Fast Food Restaurant	Residential Building (Apartment / Condo)
25	Yishun	1.430400	103.835400	2	Food Court	Italian Restaurant	Chinese Restaurant	Fried Chicken Joint	Hainan Restaurant	Pharmacy	Coffee Shop	Fast Food Restaurant	Supermarket	Restaurant

Figure 18. Neighborhoods in Cluster 2

4.1.2.4 Cluster 3

Cluster 3 contains only one neighborhood: Central. Its most common venue type is "Japanese Restaurant," followed by "Coffee Shop." The Central neighborhood's top 10 most common venue types list does not include casual dining options such a "Food Court" or "Fast Food Restaurant." Instead, the Central neighborhood has a more upscale feel, with "Hotel" and "Bar" appearing as common venues.

	Town	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	Central	1.2789	103.8536	3	Japanese Restaurant	Coffee Shop	Café	Sandwich Place	Chinese Restaurant	Gym / Fitness Center	Bar	Hotel	Mexican Restaurant	Bakery

Figure 19. Neighborhood in Cluster 3

4.2 Home Rental Prices within Clusters

We now examine home rental prices for a 4-room flat (3-bedroom apartment, ~970 square feet) across and within clusters. Looking across clusters, Cluster 0 is the cheapest, on average, and Cluster 3 (the Central neighborhood) is the most expensive.

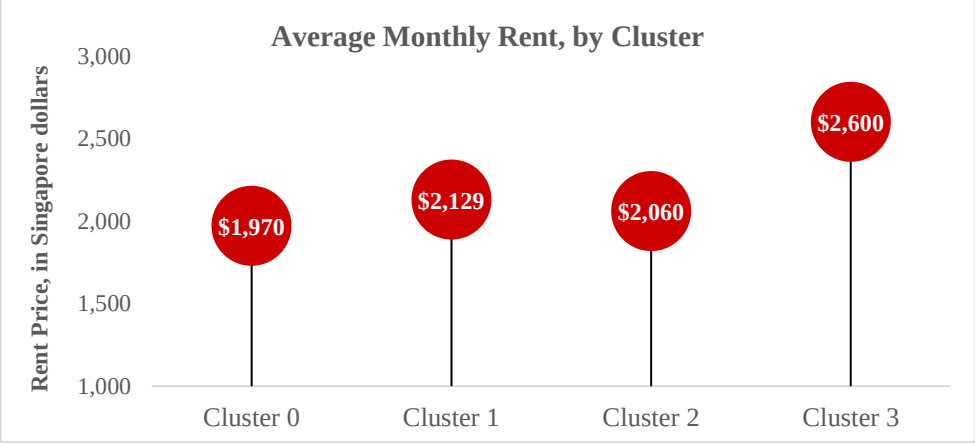

Figure 20. Monthly rent for a 4-room flat, averaged across neighborhoods within each cluster

Looking within clusters, we can see that in Cluster 0, the cheapest neighborhood is Woodlands, and the most expensive neighborhood is Tampines. In Cluster 1, the cheapest neighborhoods are Bukit Panjang and Sembawang, and the most expensive neighborhood is Queenstown. In Cluster 2, the cheapest neighborhoods are Choa Chu Kang and Yishun, and the most expensive neighborhood is Clementi. Finally, Cluster 3 consists of only one neighborhood: Central.

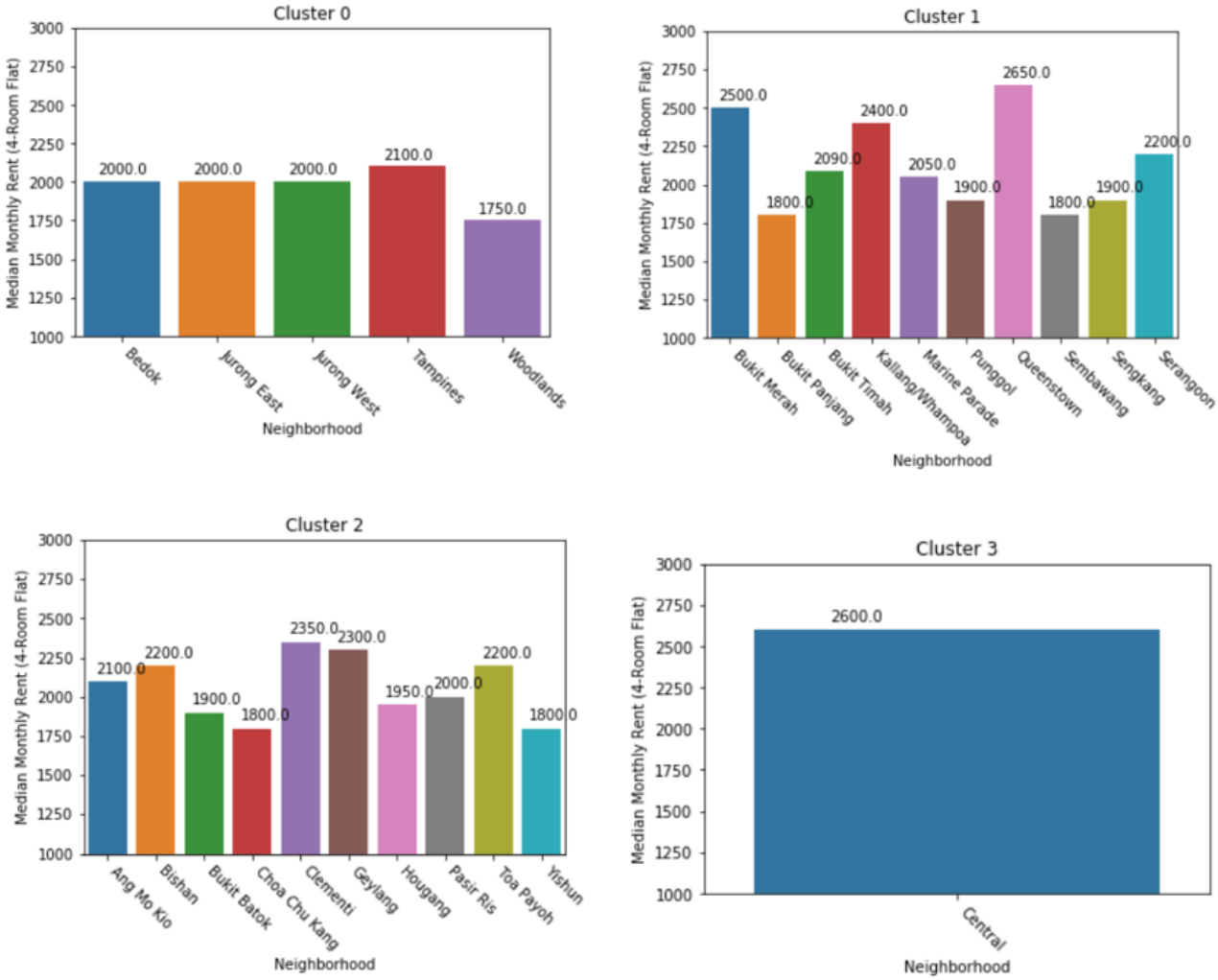

Figure 21. Median rent price by neighborhood, sorted by clusters

5. DISCUSSION

5.1 Cluster 0: Save Room for Dessert

Individuals who like to eat should consider a neighborhood in Cluster 0, which is defined by an abundance of restaurants and cafes, along with an especially high concentration of sweets shops, such as “Bakery,” “Bubble Tea Shop,” “Dessert Shop,” and “Frozen Yogurt Shop.” Woodlands provides the most inexpensive neighborhood in Cluster 0, but all in general, neighborhoods of Cluster 0 are on the less expensive side compared to the other clusters.

5.2 Cluster 1: Lively and Fit

Those who enjoy an active lifestyle should consider a neighborhood in Cluster 1, which provides ample opportunities to exercise, both at indoor venues such as a “Gym,” “Yoga Studio,” “Basketball Court,” or “Track Stadium,” and at outdoor venues such as a “Park” or “Trail.” Cluster 1 also provides vibrant nightlife and entertainment with venues such as “Nightclub,” “Bar,” and “Music Venue.” In terms of price, Cluster 1 includes neighborhoods at a variety of price points, from inexpensive Bukit Panjang and Sembawang to the pricier expat favorite of Queenstown.

5.3 Cluster 2: Shop and Eat Local

For those who like authentic Singaporean food and enjoy shopping, a neighborhood in Cluster 2 is a perfect fit. Cluster 2 neighborhoods are abundant in “Food Court” venues, where all kinds of local cuisines can be sampled, and shopping options abound, including “Cosmetics Shop,” “Department Store,” “Shopping Mall,” “Bookstore,” Shoe Store,” “Electronics Store,” and “Accessories Store.” Like Cluster 1, Cluster 2 includes neighborhoods at varying price points, from inexpensive Choa Chu Kang and Yishun to more upscale Clementi.

5.4 Cluster 3: Downtown

If you want to be in the middle of it all, Downtown is the place for you. Walking distance from the iconic Gardens by the Bay as well as countless shopping and dining options, Cluster 3, or the Central neighborhood, provides convenience and excitement. The cost of living is among the highest in Singapore, though, making Cluster 3 a desirable but expensive choice.

6. CONCLUSION

In conclusion, this report provides individuals considering moving to Singapore with information about the city-state's neighborhoods, including which venues are most common in each neighborhood as well as how much to budget for rent in each neighborhood.

Our analysis produced four clusters of neighborhoods:

- Cluster 0: "Save Room for Dessert"
- Cluster 1: "Lively and Fit"
- Cluster 2: "Shop and Eat Local"
- Cluster 3: "Downtown"

Overall, neighborhoods in Cluster 0 tend to be the cheapest, Clusters 1 and 2 contain neighborhoods at a variety of price points, and Cluster 3 (the Central neighborhood) tends to be the most expensive.

Ultimately, we hope this report will serve as a helpful resource to inform expats who are considering relocating to Singapore.