



Battle of the Neighborhoods: **Singapore**

CAPSTONE PROJECT

Overview

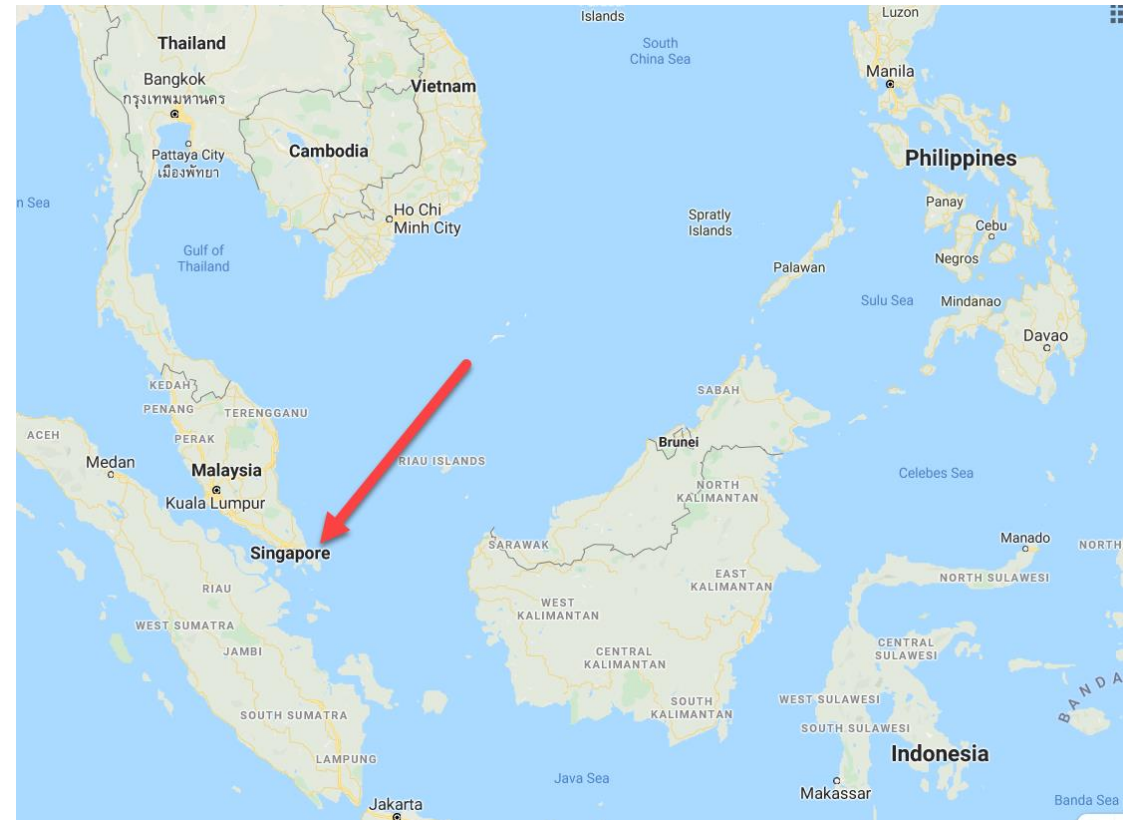
- ❖ Introduction
- ❖ Data
- ❖ Methodology
- ❖ Results
- ❖ Discussion
- ❖ Conclusion

Introduction

- ❖ Background
- ❖ Problem Statement

Background

- ❖ Singapore ranked #1 in Asia and #25 in the world in [Mercer's 2019 Quality of Living Index](#)
- ❖ Many expats interested in moving to Singapore due to the excellent quality of living and ample job opportunities



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
 - (2) rank the typical price of housing within each cluster

Data

- ❖ Data Sources
- ❖ Data Acquisition and Cleaning

Data Sources

1. General Information
2. Location Data
3. Home Rental Pricing
4. Venues Nearby

Data Acquisition and Cleaning (1)

General Information about each neighborhood (“Total area (km2),” “Population,” etc.) is scraped from Wikipedia ([here](#)) using BeautifulSoup

	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	bīshān	பீஷான்	6.90	1.72	19664	34000	65700
3	Bukit Batok	武吉巴督	wǔjībādū	புக்கிட் பாத்தோக்	7.85	2.91	32275	53000	113800
4	Bukit Merah	红山	hóngshān	புக்கிட் மேரா	8.58	3.12	51885	68000	147000

Data Acquisition and Cleaning (2)

Location Data includes each neighborhood (“Town”) along with its corresponding latitude and longitude

	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

Data Acquisition and Cleaning (3)

Home Rental Pricing Data 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

Data Acquisition and Cleaning (4)

Venues Nearby: 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

Additional steps to restructure the dataset:

- ❖ Using One-Hot Encoding
- ❖ Grouping by Neighborhood

Data Acquisition and Cleaning (5)

Venues Nearby: Our final dataset includes each neighborhood along with how many venues it has in each category

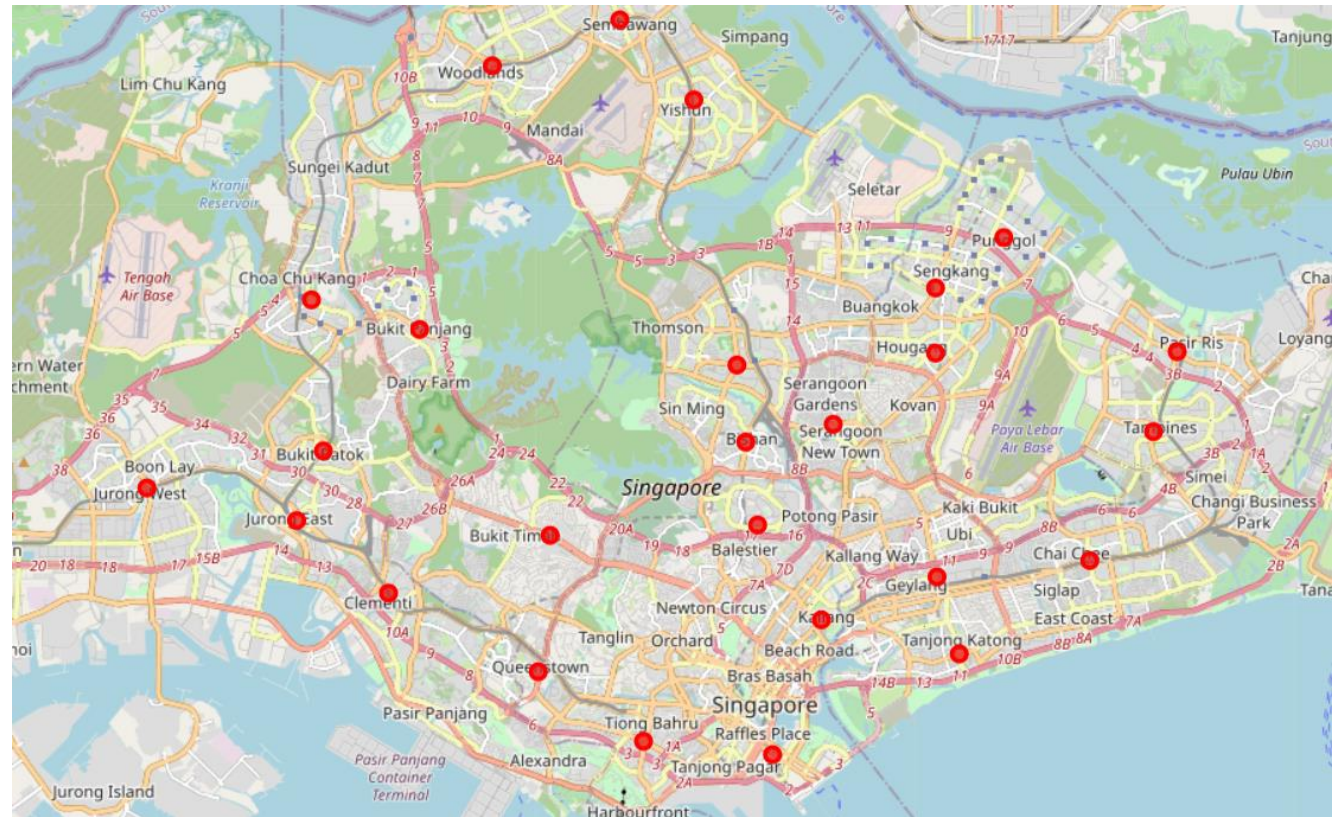
	Neighborhood	Accessories Store	American Restaurant	Arcade	Art Gallery	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	BBQ Joint	Bakery	...	Toy / Game Store	Track Stadium	Trail	Vegetarian / Vegan Restaurant	Video Game Store	Video Store	Vietnamese Restaurant	Waterfront	Wings Joint	Yoga Studio
0	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

Methodology

- ❖ Exploratory Data Analysis
- ❖ K-Means Clustering
- ❖ Home Rental Price Ranking

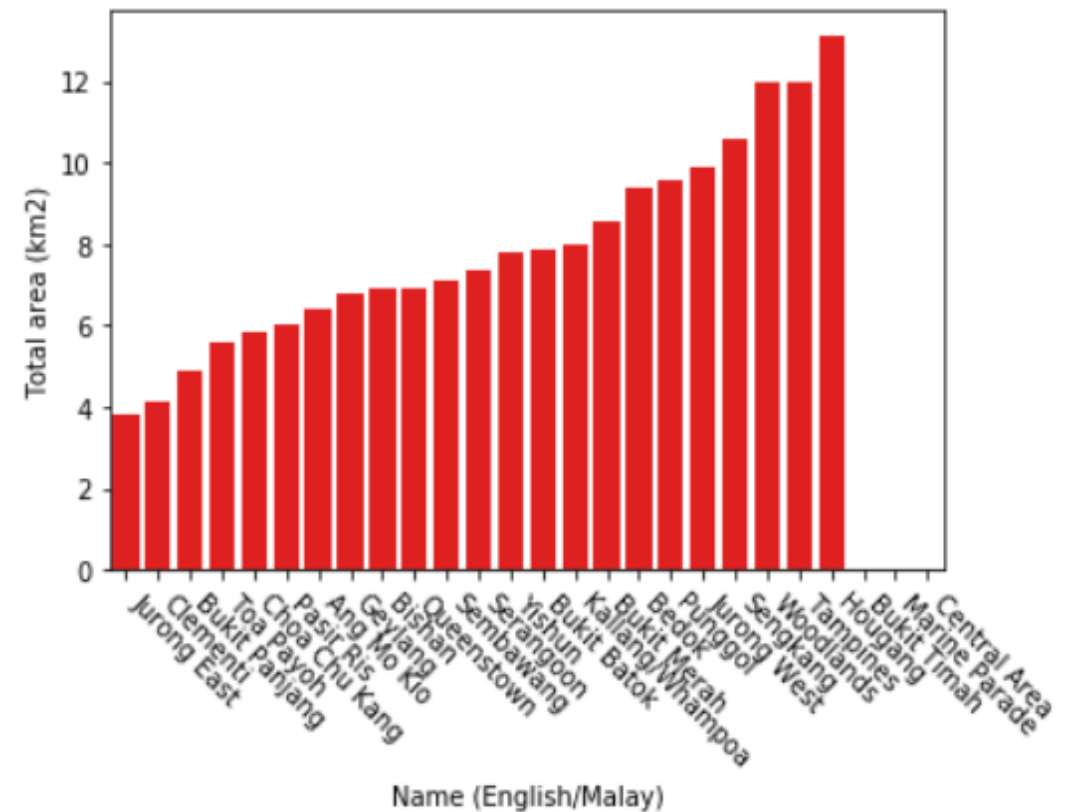
Exploratory Data Analysis (1)

- ❖ Map of Singapore neighborhoods
- ❖ Generated using Folium



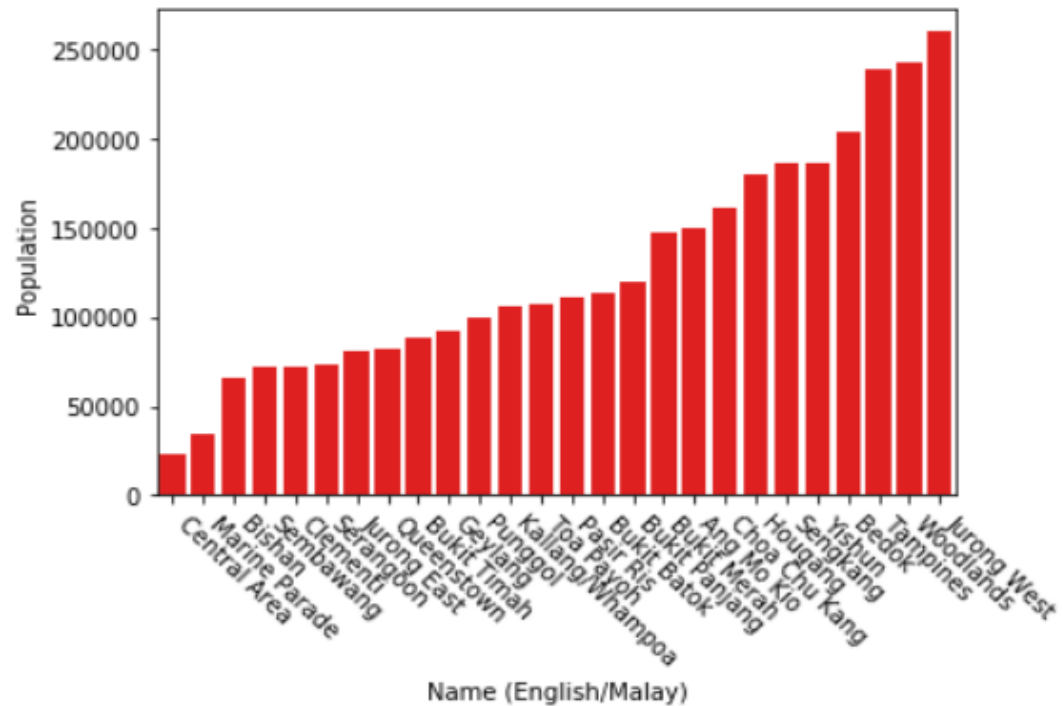
Exploratory Data Analysis (2)

- ❖ Size of each neighborhood, in square kilometers
- ❖ Largest neighborhood is Hougang
- ❖ Smallest neighborhood is Jurong East



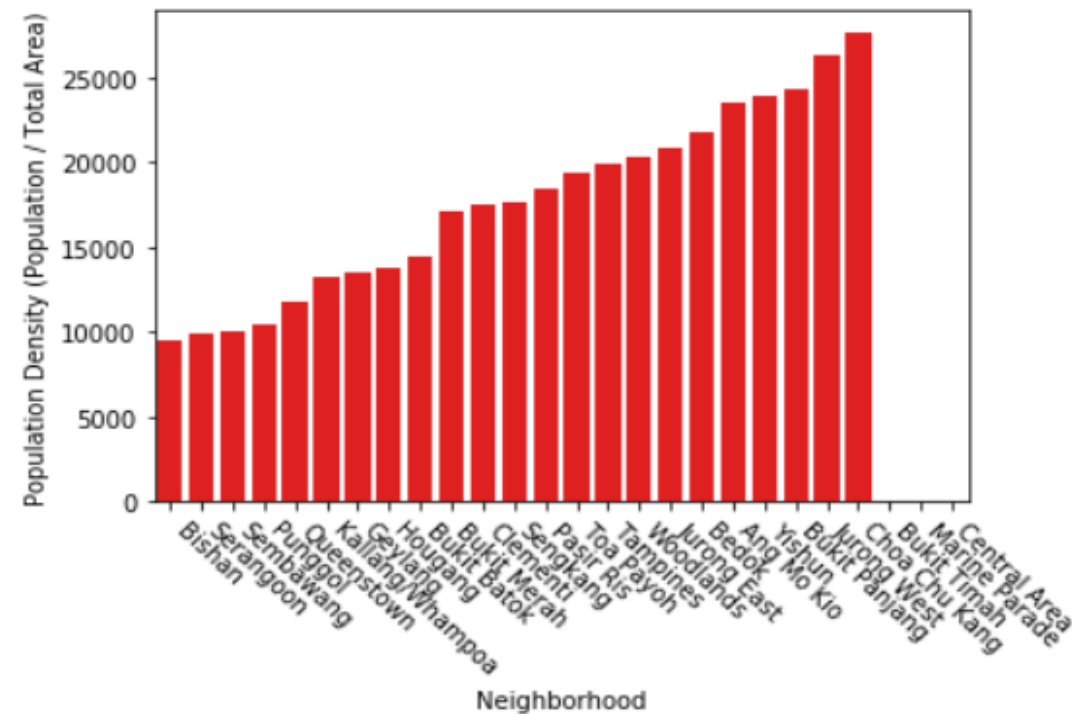
Exploratory Data Analysis (3)

- ❖ Population of each neighborhood
- ❖ Most populous neighborhood is Jurong West
- ❖ Least populous neighborhood is Central



Exploratory Data Analysis (4)

- ❖ Population density of each neighborhood (Population / Area [km²])
- ❖ Most densely populated neighborhood is Choa Chu Kang
- ❖ Least densely populated neighborhood is Bishan

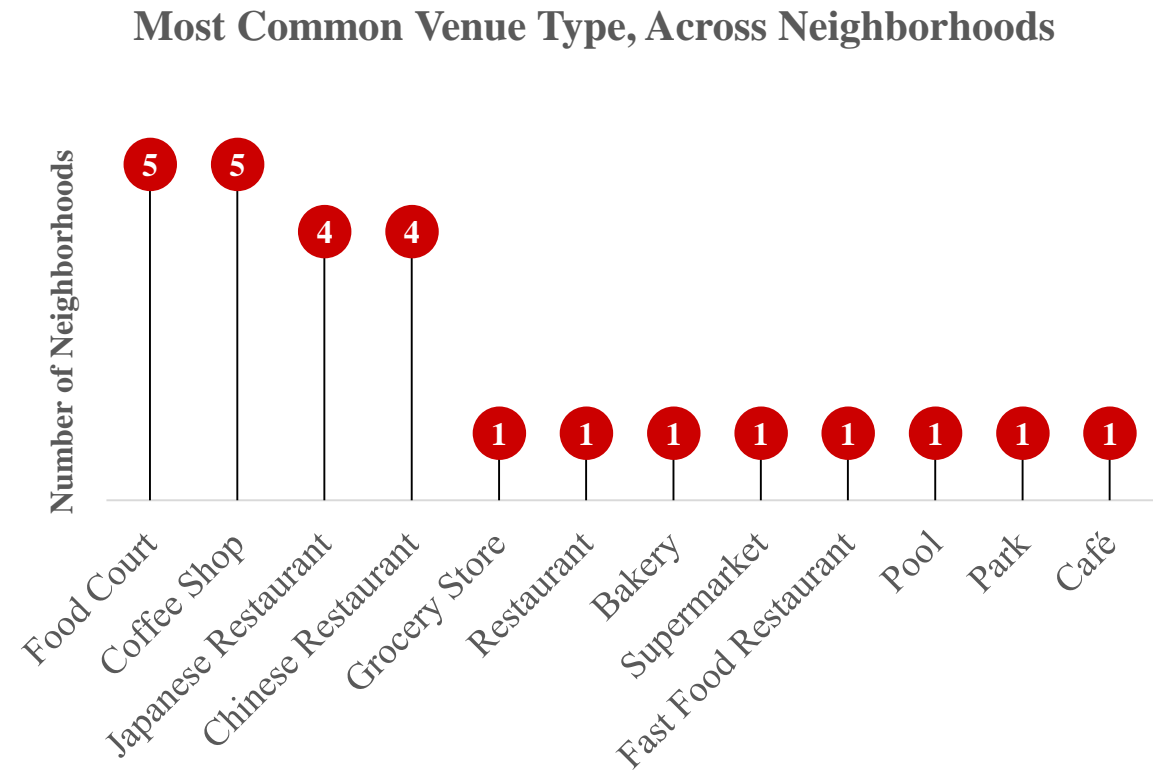


Exploratory Data Analysis (5)

❖ Frequency of “Most Common Venue Type” across neighborhoods

❖ 5 out of 26 neighborhoods have...

- “Coffee Shop” as their most common venue type
- “Food Court” as their most common venue type



K-Means Clustering

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

Home Rental Price Ranking

Rank	Cluster 0	Cluster 1	Cluster 2	Cluster 3
1 (<i>cheapest</i>)	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 (<i>most expensive</i>)		Queenstown	Clementi	

Results

- ❖ Exploring Clusters of Neighborhoods
- ❖ Home Rental Prices within Clusters

Exploring Clusters of Neighborhoods (1)

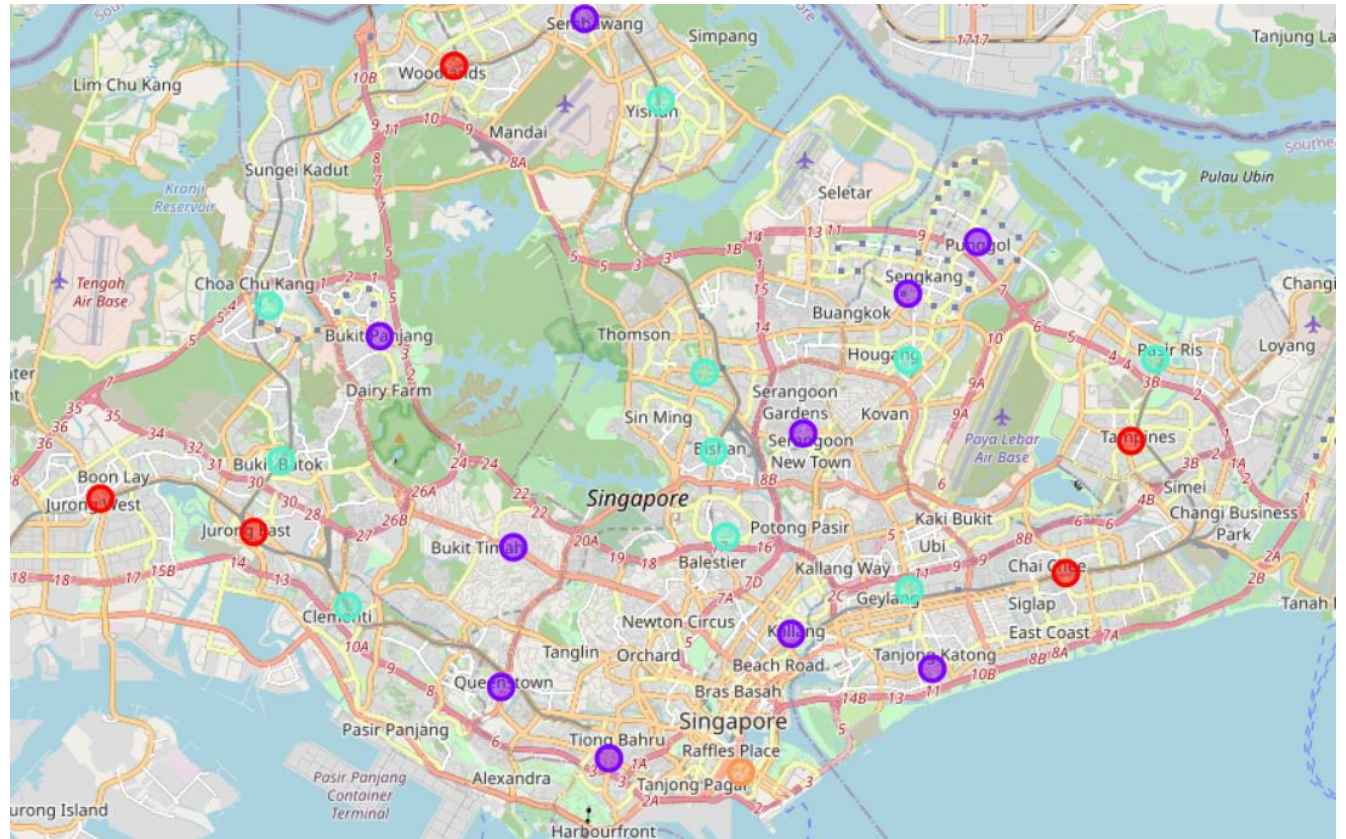
- ❖ Map of Singapore neighborhoods, color-coded by cluster

Cluster 0

Cluster 1

Cluster 2

Cluster 3



Exploring Clusters of Neighborhoods (2)

Cluster 0: 5 Neighborhoods

- ❖ All 5 neighborhoods have “Café” included at some point in their top 10 most common venue types
- ❖ 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”

	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

Exploring Clusters of Neighborhoods (3)

Cluster 1: 10 Neighborhoods

- ❖ 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

Exploring Clusters of Neighborhoods (4)

Cluster 2: 10 Neighborhoods

- ❖ In 9 out of the 10 neighborhoods, the 1st most common venue type is “Food Court” or “Coffee Shop”
- ❖ 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

Exploring Clusters of Neighborhoods (5)

Cluster 3: 1 Neighborhood (Central)

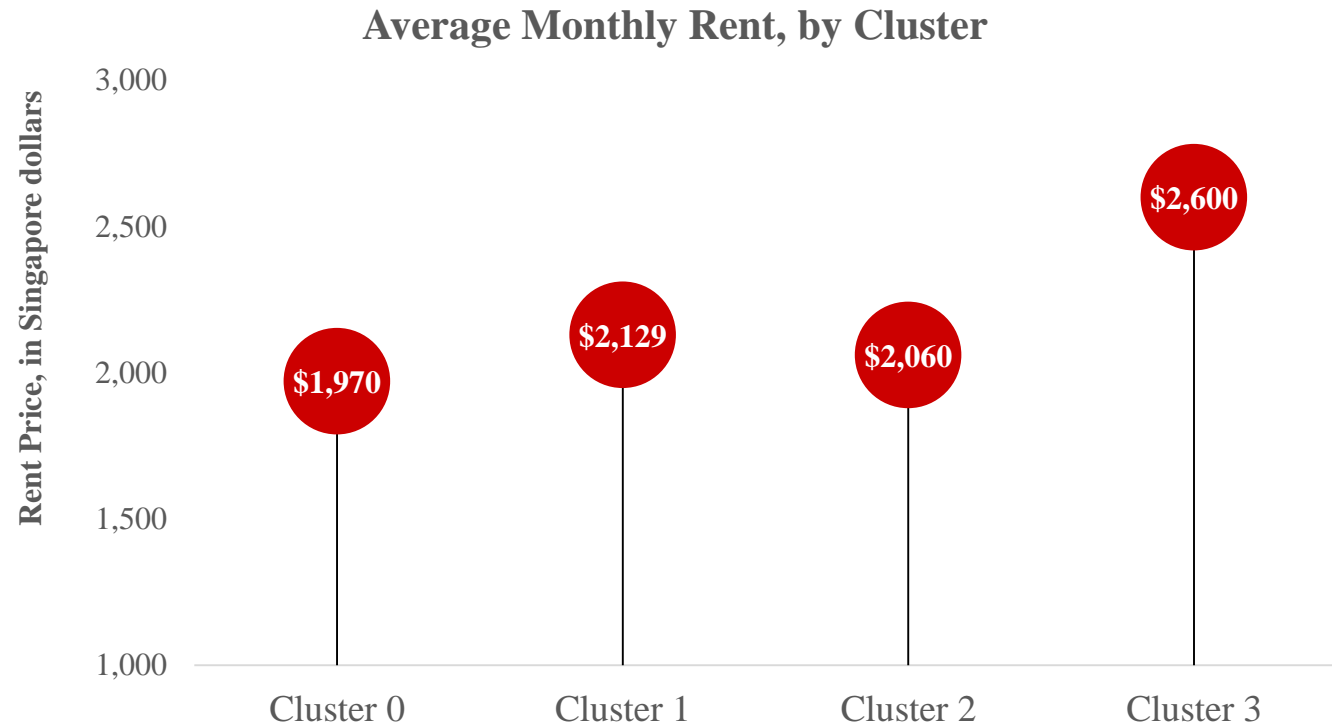
- ❖ The Central neighborhood's top 10 most common venue types list does not include casual dining options such a “Food Court” or “Fast Food Restaurant”
- ❖ Instead, the Central neighborhood has a more upscale feel, with “Hotel” and “Bar” appearing as common venues

	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

Home Rental Prices within Clusters (1)

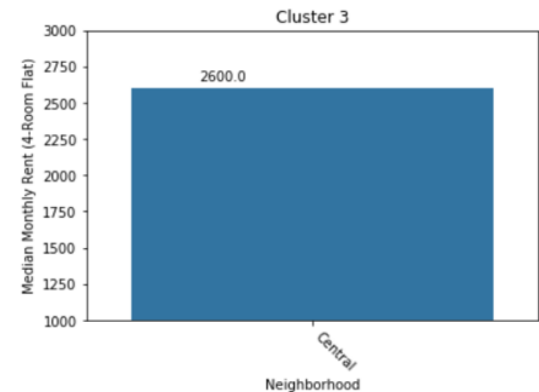
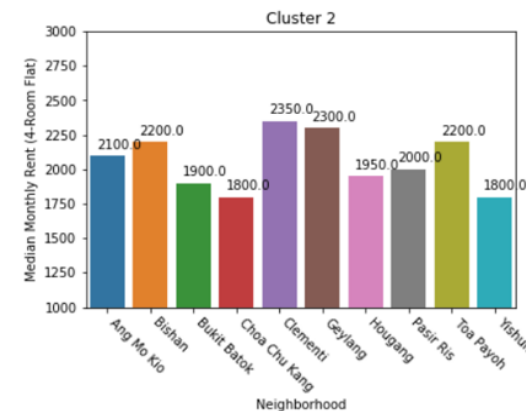
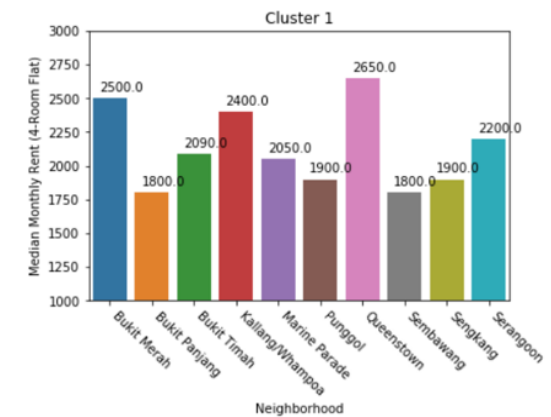
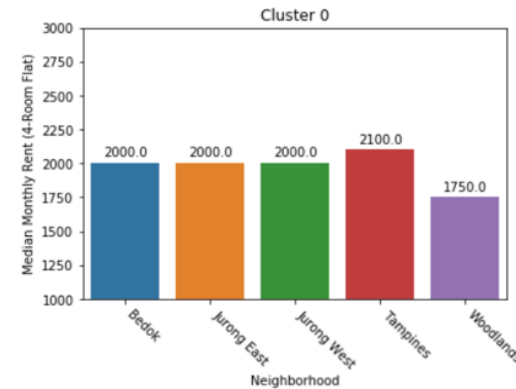
❖ Looking across clusters:

- Cluster 0 is the cheapest, on average
- Cluster 3 (the Central neighborhood) is the most expensive



Home Rental Prices within Clusters (2)

- ❖ 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
- ❖ Cluster 3 has only one neighborhood (Central)



Discussion

Profiling Each Cluster of Neighborhoods (1)

CLUSTER 0: “SAVE ROOM FOR DESSERT”

- ❖ Perfect for individuals who like to eat—especially desserts
- ❖ 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

CLUSTER 1: “LIVELY AND FIT”

- ❖ Ample opportunities to exercise, at both indoor and outdoor venues
- ❖ Also provides vibrant nightlife and entertainment with venues
- ❖ Includes neighborhoods at a variety of price points, from inexpensive Bukit Panjang and Sembawang to the pricier expat favorite of Queenstown

Profiling Each Cluster of Neighborhoods (2)

CLUSTER 2: “SHOP AND EAT LOCAL”

- ❖ Abundant in food courts, where all kinds of local cuisines can be sampled
- ❖ Many shopping options, both department stores and shopping malls, as well as specialty shops
- ❖ Includes neighborhoods at varying price points, from inexpensive Choa Chu Kang and Yishun to more upscale Clementi

CLUSTER 3: “DOWNTOWN”

- ❖ “In the middle of it all”
- ❖ Walking distance from the iconic Gardens by the Bay as well as countless shopping and dining options
- ❖ Cost of living is among the highest in Singapore

Conclusion

Takeaways

4 Clusters of Neighborhood:

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

Home Rental Price Insights:

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

Thank You!
