The Battle of Neighbourhoods – Singapore Edition

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1. Introduction

1.1 Background

In Singapore, food courts popular dining option for the locals. They consist of a number of food stalls operating in the same premise, and offer affordable everyday meals.

There are several key food courts operators in the market such as Koufu, Food Republic and Kopitiam. They operate as a chain for efficiency and cost effectiveness, but many of the food courts are similar and not well differentiated.

Fig. 1: Food courts in Singapore (left: Koufu, right: Kopitiam)

1.2 Business Problem

The Timbre Group is a relatively new entrant in the food court scene. It started off with bistros and restaurants business, and later on ventured into the food court market with its first food court Timbre+, which has a more modern and hip vibe as compared to other food courts. Timbre+ is located in Ayer Rajah neighbourhood, which is in postal district 05 in Singapore.

Fig. 2: Timbre+, a modern food court concept in Singapore

Suppose Timbre Group would like to replicate its modern food court concept, and they would like to find suitable neighbourhood for their second food court.

The ideal locations for the new food court should be neighbourhoods with other food and beverage venues (which is indicative of good foot fall) but have fewer food court businesses.

2. Data

First, I defined the neighbourhoods in Singapore based on the postal districts. There are a total of 28 postal districts in Singapore, as seen in figure 3 below. Using the Beautiful Soup package, I scraped the list of postal districts and neighbourhood names from Wikipedia:

	PostalDist	PostalSector	Neighborhood
0	1	01, 02, 03, 04, 05, 06	Raffles Place, Cecil, Marina, People's Park
1	2	07, 08	Anson, Tanjong Pagar
2	3	14, 15, 16	Bukit Merah, Queenstown, Tiong Bahru
3	4	09, 10	Telok Blangah, Harbourfront
4	5	11, 12, 13	Pasir Panjang, Hong Leong Garden, Clementi New...

Fig. 3: List of postal districts and corresponding postal sector and neighbourhood names from Wikipedia

Second, the geographical coordinates data for each neighbourhood is obtained in the form of an Excel file, and was utilized as input for retrieve venues information in each neighbourhood from the Foursquare API.

	Postcode	Latitude	Longitude
0	1	1.279114	103.851259
1	2	1.276904	103.843854
2	3	1.306456	103.794766
3	4	1.279457	103.817898
4	5	1.285272	103.779117

Fig. 4: Geographical coordinates of postal districts

Using the geographical coordinates, I plotted the various neighbourhoods in Singapore on a map.
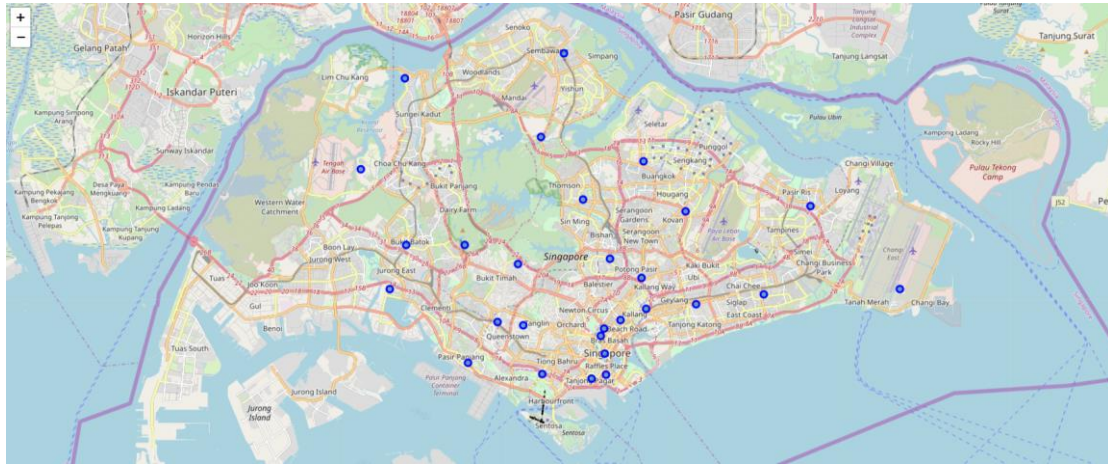

Fig. 5: Plot of Singapore postal districts on Singapore map

Finally, the venue information of the top 100 venues in each neighbourhood within 1000m radius is retrieved from the Foursquare API.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Raffles Place, Cecil, Marina, People's Park	1.279114	103.851259	Pure Fitness	1.278631	103.851487	Gym
1	Raffles Place, Cecil, Marina, People's Park	1.279114	103.851259	The Westin Singapore	1.278275	103.850772	Hotel
2	Raffles Place, Cecil, Marina, People's Park	1.279114	103.851259	Lau Pa Sat Satay Street	1.280261	103.850235	Street Food Gathering
3	Raffles Place, Cecil, Marina, People's Park	1.279114	103.851259	Sofitel So Singapore	1.280124	103.849867	Hotel
4	Raffles Place, Cecil, Marina, People's Park	1.279114	103.851259	Lobby Lounge Westin	1.277811	103.850966	Bar

Fig. 6: Venue information from Foursquare API

3. Methodology

3.1 Data Pre-processing

First, I explored the venue information obtained from Foursquare API through grouping by neighbourhoods.

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Anson, Tanjong Pagar	100	100	100	100	100	100
Ardmore, Bukit Timah, Holland Road, Tanglin	71	71	71	71	71	71
Balestier, Toa Payoh, Serangoon	90	90	90	90	90	90
Bedok, Upper East Coast, Eastwood, Kew Drive	100	100	100	100	100	100
Bishan, Ang Mo Kio	72	72	72	72	72	72
Bukit Merah, Queenstown, Tiong Bahru	100	100	100	100	100	100

Fig. 7: Explore the number of venue categories within each neighbourhood

Next, one-hot key was applied to Venue Category to segregate the different types of venues into columns for further analysis.

	Neighborhood	Yoga Studio	American Restaurant	Arcade	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Australian Restaurant	BBQ Joint
0	Anson, Tanjong Pagar	0.01	0.000000	0.000000	0.01	0.000000	0.000000	0.020000	0.000000	0.020000	0.010000
1	Ardmore, Bukit Timah, Holland Road, Tanglin	0.00	0.000000	0.000000	0.00	0.014085	0.000000	0.014085	0.000000	0.000000	0.000000
2	Balestier, Toa Payoh, Serangoon	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.044444	0.000000	0.000000	0.011111
3	Bedok, Upper East Coast, Eastwood, Kew Drive	0.01	0.010000	0.000000	0.00	0.000000	0.000000	0.030000	0.010000	0.000000	0.000000
4	Bishan, Ang Mo Kio	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.013889	0.000000	0.013889	0.000000

Fig. 8: Apply one-hot key on Venue Category to segregate into various columns

3.2 K-mean Clustering

First, I explored each neighbourhood by examining the top 10 most common venues in each one.

	Neighborhood	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	Anson, Tanjong Pagar	Japanese Restaurant	Coffee Shop	Bakery	Café	Hotel	Cocktail Bar	Ramen Restaurant	Tapas Restaurant	Italian Restaurant	Korean Restaurant
1	Ardmore, Bukit Timah, Holland Road, Tanglin	Café	Chinese Restaurant	Seafood Restaurant	Bar	Lounge	Gastropub	Lake	Thai Restaurant	French Restaurant	Indian Restaurant
2	Balestier, Toa Payoh, Serangoon	Chinese Restaurant	Coffee Shop	Noodle House	Seafood Restaurant	Food Court	Bakery	Fast Food Restaurant	Asian Restaurant	Snack Place	Café
3	Bedok, Upper East Coast, Eastwood, Kew Drive	Food Court	Coffee Shop	Chinese Restaurant	Bus Stop	Noodle House	Sandwich Place	Indian Restaurant	Asian Restaurant	Café	Bakery
4	Bishan, Ang Mo Kio	Chinese Restaurant	Food Court	Fast Food Restaurant	Dessert Shop	Japanese Restaurant	Bus Station	Bubble Tea Shop	Park	Coffee Shop	Gym

Fig. 9: Top 10 most common venues in each neighbourhood

Next, I would like to perform k-means clustering to group similar neighbourhoods together based on common venues. In order to find the optimal k value for k-means clustering, I used to elbow method. The optimal k value where the "elbow" was found to be 5, after which the inertias start decreasing in a linear fashion.
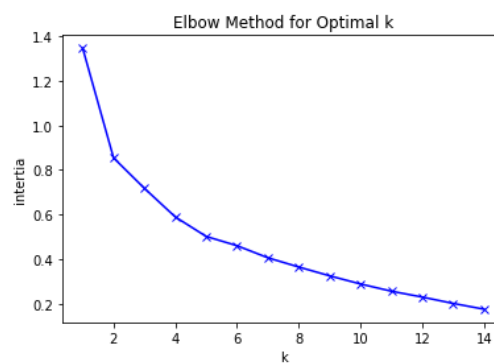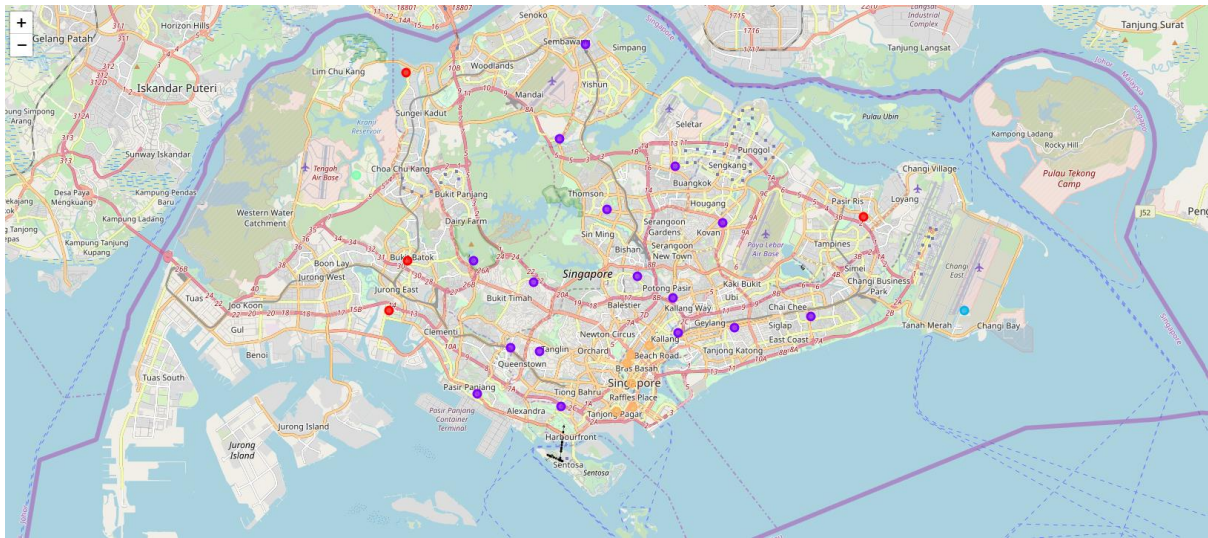

Fig. 10: Plot of inertias for various k values

Finally, k=5 was used to build a k-means clustering model, and the following map was plotted to visualise the various clusters.

Fig. 11: Plot of 5 clusters on the Singapore map

4. Results

Cluster 1 (Cluster Label = 0, Red)

	PostalDist	Neighborhood	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
17	18	Simei, Tampines, Pasir Ris	0	Coffee Shop	Supermarket	Food Court	Seafood Restaurant	Bus Line	Convenience Store	Asian Restaurant	Gym / Fitness Center	Café	General Entertainment
21	22	Jurong, Tuas	0	Coffee Shop	Malay Restaurant	Food Court	Bus Stop	Supermarket	Cafeteria	Café	Grocery Store	Tech Startup	Park
22	23	Hillview, Dairy Farm, Bukit Panjang, Choa Chu ...	0	Coffee Shop	Food Court	Chinese Restaurant	Bus Station	Bus Line	Fast Food Restaurant	Convenience Store	Bowling Alley	Frozen Yogurt Shop	Multiplex
24	25	Kranji, Woodgrove, Woodlands	0	Food Court	Coffee Shop	Arcade	Park	Soup Place	Asian Restaurant	Bus Station	Women's Store	French Restaurant	Food

Cluster 2 (Cluster Label = 1, Purple)

	PostalDist	Neighborhood	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
2	3	Bukit Merah, Queenstown, Tiong Bahru	1	Chinese Restaurant	Bakery	Indian Restaurant	Food Court	Japanese Restaurant	Coffee Shop	Café	Salad Place	Italian Restaurant	Ice Cream Shop
3	4	Telok Blangah, Harbourfront	1	Chinese Restaurant	Food Court	Coffee Shop	Café	Scenic Lookout	Trail	Park	Fast Food Restaurant	Noodle House	Pool
4	5	Pasir Panjang, Hong Leong Garden, Clementi New...	1	Café	Asian Restaurant	Bar	Port	Kebab Restaurant	Bus Station	Miscellaneous Shop	Food Court	Pier	Metro Station
9	10	Ardmore, Bukit Timah, Holland Road, Tanglin	1	Café	Chinese Restaurant	Seafood Restaurant	Bar	Lounge	Gastropub	Lake	Thai Restaurant	French Restaurant	Indian Restaurant
10	11	Watten Estate, Novena, Thomson	1	Italian Restaurant	Pool	Chinese Restaurant	Bakery	Restaurant	Japanese Restaurant	Gym	Nightclub	Tennis Court	Seafood Restaurant
11	12	Balestier, Toa Payoh, Serangoon	1	Chinese Restaurant	Coffee Shop	Noodle House	Seafood Restaurant	Food Court	Bakery	Fast Food Restaurant	Asian Restaurant	Snack Place	Café
12	13	Macpherson, Braddell	1	Coffee Shop	Chinese Restaurant	Food Court	Bus Station	Convenience Store	Gym	Restaurant	Indian Restaurant	Fast Food Restaurant	Café
13	14	Geylang, Eunos	1	Coffee Shop	Chinese Restaurant	Hotel	Indian Restaurant	Food Court	Noodle House	Supermarket	BBQ Joint	Café	Dim Sum Restaurant
14	15	Katong, Joo Chiat, Amber Road	1	Asian Restaurant	Noodle House	Chinese Restaurant	Coffee Shop	Food Court	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Vietnamese Restaurant	Supermarket	Snack Place
15	16	Bedok, Upper East Coast, Eastwood, Kew Drive	1	Food Court	Coffee Shop	Chinese Restaurant	Bus Stop	Noodle House	Sandwich Place	Indian Restaurant	Asian Restaurant	Café	Bakery
18	19	Serangoon Garden, Hougang, Punggol	1	Chinese Restaurant	Coffee Shop	Food Court	Noodle House	Asian Restaurant	Café	Fast Food Restaurant	Snack Place	Bakery	Dessert Shop
19	20	Bishan, Ang Mo Kio	1	Chinese Restaurant	Food Court	Fast Food Restaurant	Dessert Shop	Japanese Restaurant	Bus Station	Bubble Tea Shop	Park	Coffee Shop	Gym
20	21	Upper Bukit Timah, Clementi Park, Ulu Pandan	1	Trail	Korean Restaurant	Chinese Restaurant	Café	Food Court	Rest Area	Asian Restaurant	Thai Restaurant	Seafood Restaurant	Scenic Lookout
25	26	Upper Thomson, Springleaf	1	Café	Chinese Restaurant	Bus Station	Asian Restaurant	Indian Restaurant	Golf Course	Beer Garden	Italian Restaurant	Grocery Store	Convenience Store
26	27	Yishun, Sembawang	1	Chinese Restaurant	Asian Restaurant	Coffee Shop	Thai Restaurant	Indian Restaurant	Fast Food Restaurant	Shop & Service	Bus Station	Bus Stop	Spa
27	28	Seletar	1	Coffee Shop	Café	Chinese Restaurant	Asian Restaurant	Food Court	Diner	Shopping Mall	Supermarket	Playground	Thai Restaurant

Cluster 3 (Cluster Label = 2, Blue)

	PostalDist	Neighborhood	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
16	17	Loyang, Changi	2	Military Base	Gym	Women's Store	Garden Center	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant

Cluster 4 (Cluster Label = 3, Green)

	PostalDist	Neighborhood	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
23	24	Lim Chu Kang, Tengah	3	Farm	Flower Shop	Pet Store	Garden	Café	Farmers Market	Garden Center	Coffee Shop	Spa	Fried Chicken Joint

Cluster 5 (Cluster Label = 4, Orange)

	PostalDist	Neighborhood	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	1	Raffles Place, Cecil, Marina, People's Park	4	Coffee Shop	Hotel	Café	Japanese Restaurant	Korean Restaurant	Gym / Fitness Center	Cocktail Bar	Restaurant	Waterfront	Food Court
1	2	Anson, Tanjong Pagar	4	Japanese Restaurant	Coffee Shop	Bakery	Café	Hotel	Cocktail Bar	Ramen Restaurant	Tapas Restaurant	Italian Restaurant	Korean Restaurant
5	6	High Street, Beach Road (part)	4	Hotel	Japanese Restaurant	Cocktail Bar	Café	Italian Restaurant	Coffee Shop	Concert Hall	Waterfront	Supermarket	Gym / Fitness Center
6	7	Middle Road, Golden Mile	4	Café	Indian Restaurant	Hotel	Bakery	Vegetarian / Vegan Restaurant	Arts & Crafts Store	Japanese Restaurant	Shopping Mall	Whisky Bar	Coffee Shop
7	8	Little India, Farrer Park, Jalan Besar, Lavender	4	Indian Restaurant	Chinese Restaurant	Café	Hotel	Bakery	Coffee Shop	Restaurant	Vietnamese Restaurant	Hostel	Indonesian Restaurant
8	9	Orchard, Cairnhill, River Valley	4	Hotel	Café	Japanese Restaurant	Coffee Shop	Art Gallery	Arts & Crafts Store	Sushi Restaurant	French Restaurant	Movie Theater	Clothing Store

5. Discussion

In this section, I would be discussion the key observations based on the k-mean clusters and provide my recommendation based on the results.

Cluster 1, Cluster 2 and Cluster 5 contain neighbourhoods which have food and beverages outlets as their top common venues.

Cluster 3 and Cluster 4 have neighbourhoods with very specific types of venues as listed below and are not ideal locations for Timbre+ to launch its new food court:
- Cluster 3: Military base, Gym
- Cluster 4: Farm, flower shop

Examining Cluster 1, it is noted that "Food Court" appeared as one of the top 3 most common venues in all neighbourhoods. The high density of food courts means these are neighbourhood with high competition, and it would be risky for Timbre+ to open its new food court in these neighbourhood.

Cluster 2 has a mix of various types of restaurants as well as food courts among top 5 most common venues, so there is some level of competition for Timbre+.

Cluster 5 tend to have other types of food and beverage outlets such as café and restaurant, which may be potential areas that Timbre+ can consider.

This analysis is performed on limited data available for Singapore. The analysis may yield better results if there is greater adoption and usage of Foursquare in the Singapore market.

6. Conclusion

Using Foursquare API, I can obtain data of common places in Singapore to:
- Identify the similarity or dissimilarity of different neighbourhoods
- Cluster the neighbourhoods based on commonality

I can then use such analysis as one of my input to assess areas which may have good potential for new business in addition to other market and financial data.