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:

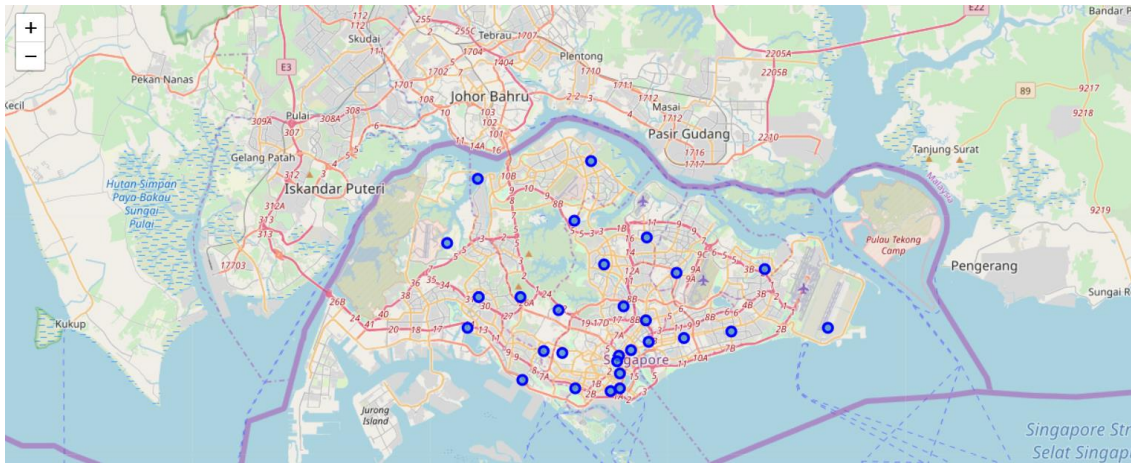|	PostalDist	PostalSector	Neighborhood
0	01	01, 02, 03, 04, 05, 06	Raffles Place, Cecil, Marina, People's Park
1	02	07, 08	Anson, Tanjong Pagar
2	03	14, 15, 16	Bukit Merah, Queenstown, Tiong Bahru
3	04	09, 10	Telok Blangah, Harbourfront
4	05	11, 12, 13	Pasir Panjang, Hong Leong Garden, Clementi New...

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 500m 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	46	46	46	46	46	46
Balestier, Toa Payoh, Serangoon	26	26	26	26	26	26
Bedok, Upper East Coast, Eastwood, Kew Drive	14	14	14	14	14	14
Bishan, Ang Mo Kio	24	24	24	24	24	24
Bukit Merah, Queenstown, Tiong Bahru	35	35	35	35	35	35
Geylang, Eunos	17	17	17	17	17	17
High Street, Beach Road (part)	85	85	85	85	85	85
Hillview, Dairy Farm, Bukit Panjang, Choa Chu Kang	28	28	28	28	28	28
Jurong, Tuas	6	6	6	6	6	6

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	Accessories Store	American Restaurant	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Australian Restaurant	BBQ Joint	Bagel Shop	Bakery	Bar	Basketball Court
0	Raffles Place, Cecil, Marina, People's Park	0	0	0	0	0	0	0	0	0	0	0	0	0
1	Raffles Place, Cecil, Marina, People's Park	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Raffles Place, Cecil, Marina, People's Park	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Raffles Place, Cecil, Marina, People's Park	0	0	0	0	0	0	0	0	0	0	0	0	0

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	Italian Restaurant	Ramen Restaurant	Hotel	Cocktail Bar	Café	Tapas Restaurant	Korean Restaurant
1	Ardmore, Bukit Timah, Holland Road, Tanglin	Café	Bar	Modern European Restaurant	Ice Cream Shop	Lounge	Italian Restaurant	Seafood Restaurant	Indian Restaurant	Spanish Restaurant	Wine Bar
2	Balestier, Toa Payoh, Serangoon	Noodle House	Chinese Restaurant	Food Court	Seafood Restaurant	Steakhouse	Asian Restaurant	Thai Restaurant	Market	Supermarket	Café
3	Bedok, Upper East Coast, Eastwood, Kew Drive	Chinese Restaurant	Coffee Shop	Fast Food Restaurant	Café	Noodle House	Bakery	Food Court	French Restaurant	Sports Bar	Bus Stop
4	Bishan, Ang Mo Kio	Chinese Restaurant	Food Court	Coffee Shop	Fast Food Restaurant	Seafood Restaurant	Vegetarian / Vegan Restaurant	Pharmacy	Supermarket	General Entertainment	Noodle House

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" is was found to be 6, after which the inertias start decreasing in a linear fashion.
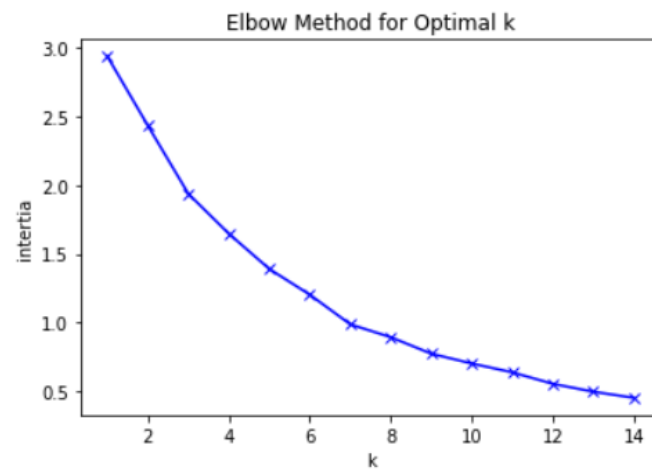

Fig. 10: Plot of inertias for various k values

Finally, k=6 was used to build a k-means clustering model, and the following map was plotted to visualise the various clusters.
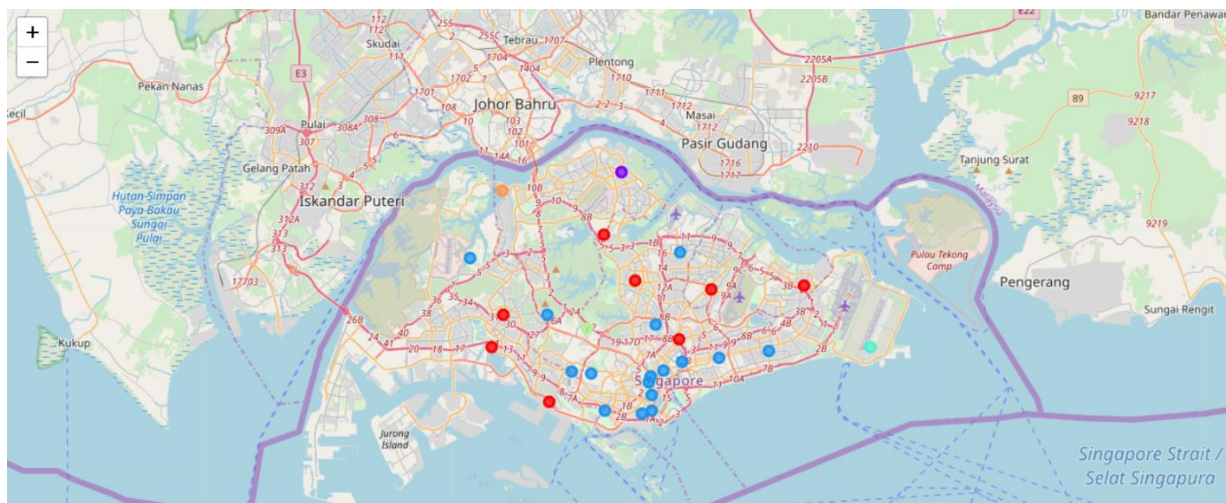

Fig. 11: Plot of 6 clusters on the Singapore map

4. Results

Cluster 1 (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
4	5	Pasir Panjang, Hong Leong Garden, Clementi New...	0	Bus Station	Miscellaneous Shop	Coffee Shop	Sculpture Garden	Korean Restaurant	Theme Park	Metro Station	Food Court	Asian Restaurant	Indian Restaurant
12	13	Macpherson, Braddell	0	Chinese Restaurant	Food Court	Convenience Store	Coffee Shop	Fast Food Restaurant	Restaurant	Music Venue	Café	Sporting Goods Shop	Cafeteria
17	18	Simei, Tampines, Pasir Ris	0	Coffee Shop	Department Store	Noodle House	Food Court	Supermarket	General Entertainment	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food & Drink Shop
18	19	Serangoon Garden, Hougang, Punggol	0	Bus Station	Coffee Shop	Chinese Restaurant	Grocery Store	Bus Line	Asian Restaurant	Convenience Store	Café	Frozen Yogurt Shop	Fried Chicken Joint
19	20	Bishan, Ang Mo Kio	0	Chinese Restaurant	Food Court	Coffee Shop	Fast Food Restaurant	Seafood Restaurant	Vegetarian / Vegan Restaurant	Pharmacy	Supermarket	General Entertainment	Noodle House
21	22	Jurong, Tuas	0	Coffee Shop	Pet Store	Food Court	Bus Station	Supermarket	Yoga Studio	Farmers Market	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant
22	23	Hillview, Dairy Farm, Bukit Panjang, Choa Chu ...	0	Coffee Shop	Food Court	Chinese Restaurant	Fast Food Restaurant	Frozen Yogurt Shop	Shopping Mall	Sandwich Place	Supermarket	Department Store	Café
25	26	Upper Thomson, Springleaf	0	Bus Station	Chinese Restaurant	Convenience Store	Café	Food Court	BBQ Joint	Thai Restaurant	Asian Restaurant	Park	Indian Restaurant

Cluster 2 (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
26	27	Yishun, Sembawang	1	Asian Restaurant	Coffee Shop	Bus Stop	Park	Yoga Studio	Farmers Market	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Court

Cluster 3 (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
0	1	Raffles Place, Cecil, Marina, People's Park	2	Café	Coffee Shop	Chinese Restaurant	Salad Place	Restaurant	Hotel	Cocktail Bar	Italian Restaurant	Japanese Restaurant	Korean Restaurant
1	2	Anson, Tanjong Pagar	2	Japanese Restaurant	Coffee Shop	Bakery	Italian Restaurant	Ramen Restaurant	Hotel	Cocktail Bar	Café	Tapas Restaurant	Korean Restaurant
2	3	Bukit Merah, Queenstown, Tiong Bahru	2	Bakery	Coffee Shop	Asian Restaurant	Sandwich Place	Café	Salad Place	Indian Restaurant	Pizza Place	Chinese Restaurant	Supermarket
3	4	Telok Blangah, Harbourfront	2	Coffee Shop	Bus Line	Chinese Restaurant	Food Court	Pool	Soccer Field	Scenic Lookout	Café	Fast Food Restaurant	Clothing Store
5	6	High Street, Beach Road (part)	2	Café	Event Space	Concert Hall	History Museum	Shopping Mall	Art Gallery	Bar	Japanese Restaurant	Restaurant	Lounge
6	7	Middle Road, Golden Mile	2	Café	Indian Restaurant	Vegetarian / Vegan Restaurant	Art Gallery	Chinese Restaurant	Hotel	Japanese Restaurant	Dim Sum Restaurant	Playground	Other Repair Shop
7	8	Little India, Farrer Park, Jalan Besar, Lavender	2	Chinese Restaurant	Café	Indian Restaurant	Asian Restaurant	Hotel	Coffee Shop	Noodle House	Dessert Shop	Dim Sum Restaurant	Bed & Breakfast
8	9	Orchard, Cairnhill, River Valley	2	Café	Hotel	Art Gallery	Art Museum	Restaurant	Ice Cream Shop	Sandwich Place	Museum	Coffee Shop	Cosmetics Shop
9	10	Ardmore, Bukit Timah, Holland Road, Tanglin	2	Café	Bar	Modern European Restaurant	Ice Cream Shop	Lounge	Italian Restaurant	Seafood Restaurant	Indian Restaurant	Spanish Restaurant	Wine Bar
11	12	Balestier, Toa Payoh, Serangoon	2	Noodle House	Chinese Restaurant	Food Court	Seafood Restaurant	Steakhouse	Asian Restaurant	Thai Restaurant	Market	Supermarket	Café
13	14	Geylang, Eunos	2	Hostel	BBQ Joint	Food Court	Snack Place	Seafood Restaurant	Rock Club	Thai Restaurant	Noodle House	Chinese Restaurant	Soup Place
14	15	Katong, Joo Chiat, Amber Road	2	Malay Restaurant	Hotpot Restaurant	Snack Place	Food Court	Asian Restaurant	Restaurant	Chinese Restaurant	BBQ Joint	Coffee Shop	Thai Restaurant
15	16	Bedok, Upper East Coast, Eastwood, Kew Drive	2	Chinese Restaurant	Coffee Shop	Fast Food Restaurant	Café	Noodle House	Bakery	Food Court	French Restaurant	Sports Bar	Bus Stop
20	21	Upper Bukit Timah, Clementi Park, Ulu Pandan	2	Trail	Chinese Restaurant	Korean Restaurant	Rest Area	Nature Preserve	Hainan Restaurant	Scenic Lookout	Bowling Alley	Diner	Snack Place
23	24	Lim Chu Kang, Tengah	2	Farm	Café	Seafood Restaurant	Garden Center	Flower Shop	Farmers Market	Spa	Pet Store	Coffee Shop	Fast Food Restaurant
27	28	Seletar	2	Café	Convenience Store	Thai Restaurant	Diner	Coffee Shop	Farm	Shopping Mall	Supermarket	Dessert Shop	American Restaurant

Cluster 4 (Label 3, Cyan)

	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	3	Gym	Military Base	Farm	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Court	Food & Drink Shop	Flower Shop	Field

Cluster 5 (Label 4, 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
10	11	Watten Estate, Novena, Thomson	4	Playground	Moving Target	Bus Line	Nightclub	Yoga Studio	Farmers Market	Fried Chicken Joint	French Restaurant	Food Court	Food & Drink Shop

Cluster 6 (Label 5, 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
24	25	Kranji, Woodgrove, Woodlands	5	Campground	Bus Stop	Yoga Studio	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Court	Food & Drink Shop	Flower Shop

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 3 contain neighbourhoods which have food and beverages outlets as their top common venues.

Cluster 4, Cluster 5 and Cluster 6 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 4: Gym, military base
- Cluster 5: Playground
- Cluster 6: Campground

Examining Cluster 1, it is noted that "Food Court" appeared as one of the top 5 most common venues in all neighbourhoods with the exception of Pasir Panjang and Serangoon Garden. 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 and Cluster 3 tend to have other types of food and beverage outlets, 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.