

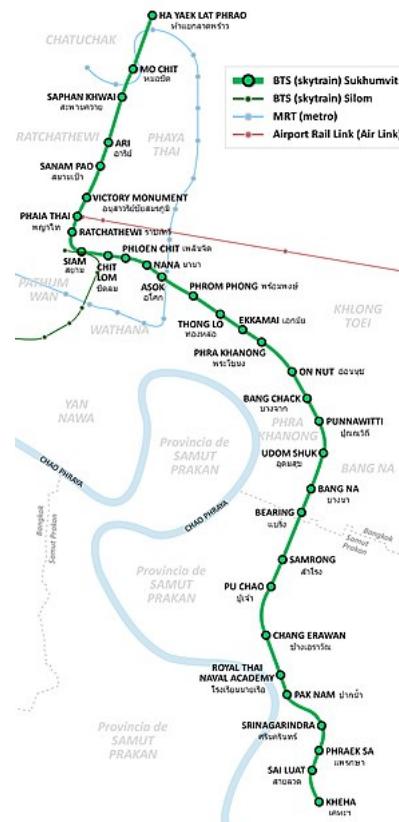
Bangkok Neighborhood Analysis along BTS Sukhumvit Line

Background

Bangkok is one of the mega cities where 10 million people reside. The city occupies 1,568.7 square kilometres and consists of 50 districts with different lifestyles and neighborhoods. The main transportation in Bangkok is by roads which can accommodate only 1.5 million vehicles whereas the city has 9.7 million automobiles and motorbikes combined. This overcapacity has led to multiple issues such as traffic jam, high fuel consumption and air pollution. The average person would spend 207 extra hours per year driving in the rush hours in Bangkok.

The Bangkok Mass Transit System, commonly known as the BTS is an elevated rapid transit system in Bangkok has opened the first line called “Green Line” which consists of 1.Silom Line and 2.Sukhumvit Line in late 1999 to ease the mentioned traffic jam issues on the roads. Currently, this Green Line support around 700 thousand people daily and became the major mass transit system in Bangkok.

In this study, the scope of study will be the neighborhood along “BTS Sukhumvit Line” which consists of 32 stations as depicted below:



Source: https://en.wikipedia.org/wiki/Sukhumvit_line

The main reason to pick this Sukhumvit line is due to its importance in term of people served per day compared to Silom Line. Also, this line also passed “Asok Intersection” which marked as one of the central business districts in Bangkok.

Business Problem

This study will try to identify the suitable neighborhoods along BTS Sukhumvit Line which lower living expenses and shorten commute time to work. The results of this study would benefit many stakeholders such as expatriates and multinational companies who need to identify the suitable location for their employees to reside. Also, it will be good for real estate developers to explore new potential areas to develop the new projects based on the model of this analysis.

For this study, I will assume that the target work location is at “Asok Station” in the central business district and residential neighborhood would be around stations along BTS Sukhumvit Line. The preferred commute time from/to work location would be within 30 mins which can be indirectly transform to the distance of 12 stations away.

Data used to solve problem

1. Location of BTS Sukhumvit Line: Due to unavailability of preformatted data source and the limit number of stations on Sukhumvit Line, I have extracted the location of each station from [Wikipedia](#) and put into CSV format as the below:

Sequence	Station Name	Latitude	Longitude
1	Ha Yaek Lat Phrao	13.647363	100.596153
2	Mo Chit	13.802583	100.553833
3	Saphan Khwai	13.793800	100.549731
4	Ari	13.779703	100.544642
5	Sanam Pao	13.772622	100.542092

Sequence: Sequence identification of each station along Sukhumvit Line

Station Name: Name of each station

Latitude and Longitude: Coordinates of each station

2. Foursquare Venues: Using [Foursquare's Place API](#) to retrieve details of venues, categories and price.

Methodology

Explore the location of stations along BTS Sukhumvit Line

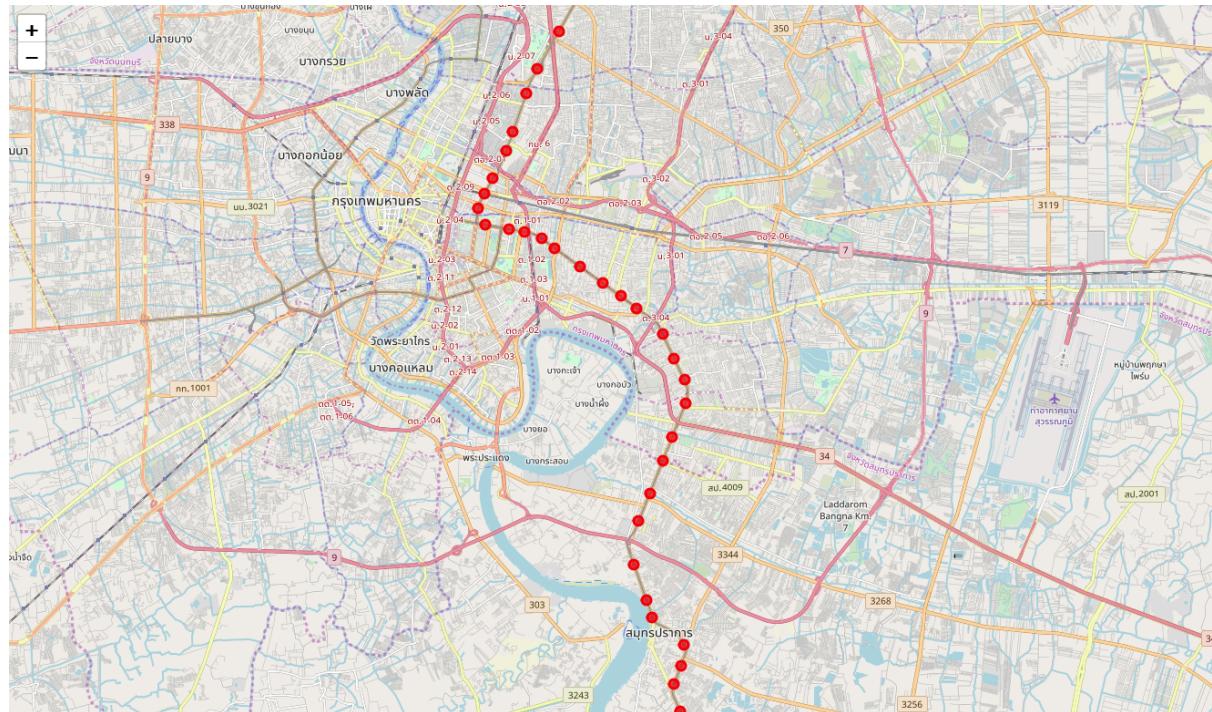


Figure 1 BTS Sukhumvit Line - All Stations

Filter out stations beyond 12 stations away from “Asok Station”. 25 stations met this criteria are listed below:

Table 1 BTS Sukhumvit Line - Stations within 30 mins commute time from Asok Station

Sequence	Station Name	Latitude	Longitude	Distance
0	1 Ha Yaek Lat Phrao	13.816552	100.562012	12
1	2 Mo Chit	13.802583	100.553833	11
2	3 Saphan Khwai	13.793800	100.549731	10
3	4 Ari	13.779703	100.544642	9
4	5 Sanam Pao	13.772622	100.542092	8
5	6 Victory Monument	13.762744	100.537086	7
6	7 Phaya Thai	13.756942	100.533844	6
7	8 Ratchathewi	13.751875	100.531575	5
8	9 Siam	13.745619	100.534228	4
9	10 Chit Lom	13.744108	100.543097	3
10	11 Phloen Chit	13.743081	100.549019	2
11	12 Nana	13.740603	100.555397	1
12	13 Asok	13.737033	100.560419	0
13	14 Phrom Phong	13.730439	100.569731	1
14	15 Thong Lo	13.724244	100.578558	2
15	16 Ekkamai	13.719558	100.585175	3
16	17 Phra Khanong	13.715194	100.591283	4
17	18 On Nut	13.705611	100.601083	5
18	19 Bang Chak	13.696751	100.605349	6
19	20 Punnawithi	13.688919	100.609211	7
20	21 Udom Suk	13.680317	100.609658	8
21	22 Bang Na	13.668146	100.604703	9
22	23 Bearing	13.659336	100.601050	10
23	24 Samrong	13.647363	100.596153	11
24	25 Pu Chao	13.637280	100.592000	12

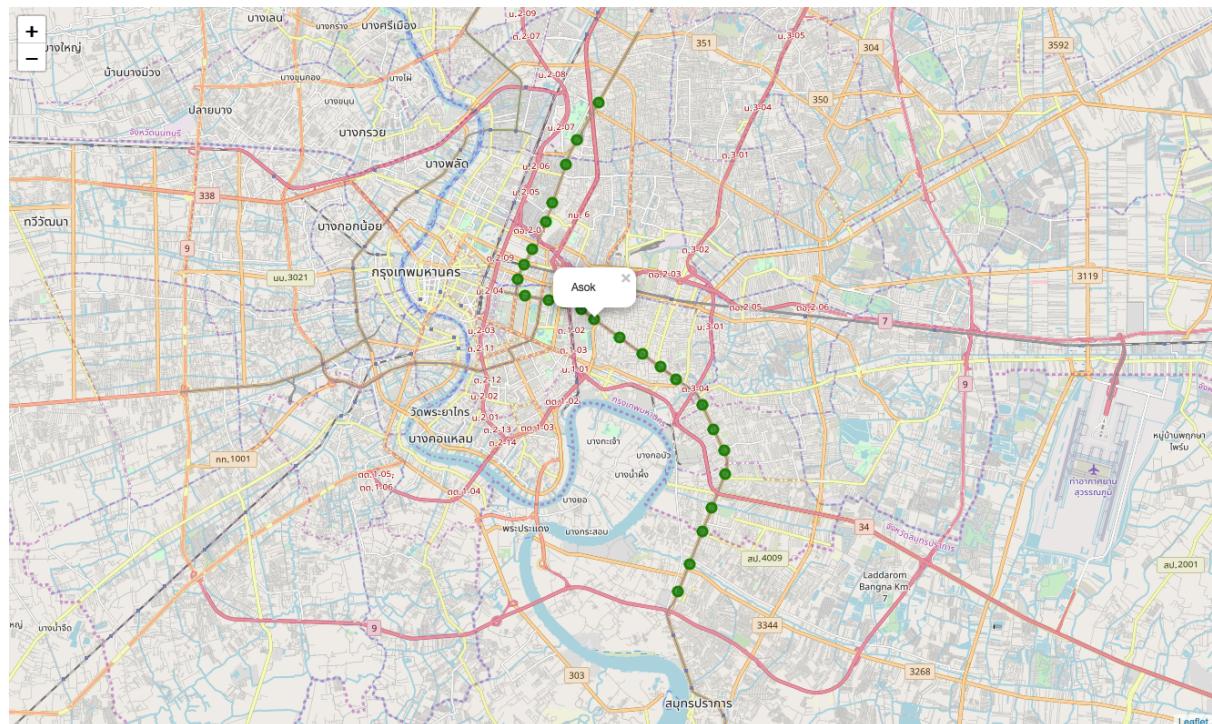


Figure 2 Map show 25 stations within 30 mins commute time to Asok Station

Since the distance between each station varies from 600 meters to 2,500 meters, I select the distance 1,000 meters to explore the venues around the stations via FourSquare API. This distance would ensure the good amount of venues return by FourSquare API and reduce the duplicate of venues between each station. The table below show number of venues return by FourSquare API for each station.

Table 2 Number of Venues return by FourSquare API for each station

Station Name	Station Latitude	Station Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Ari	100	100	100	100	100	100
Asok	100	100	100	100	100	100
Bang Chak	44	44	44	44	44	44
Bang Na	52	52	52	52	52	52
Bearing	38	38	38	38	38	38
Chit Lom	100	100	100	100	100	100
Ekkamai	100	100	100	100	100	100
Ha Yaek Lat Phrao	100	100	100	100	100	100
Mo Chit	100	100	100	100	100	100
Nana	100	100	100	100	100	100
On Nut	89	89	89	89	89	89
Phaya Thai	100	100	100	100	100	100
Phloen Chit	100	100	100	100	100	100
Phra Khanong	100	100	100	100	100	100
Phrom Phong	100	100	100	100	100	100
Pu Chao	34	34	34	34	34	34
Punnawithi	83	83	83	83	83	83
Ratchathewi	100	100	100	100	100	100
Samrong	44	44	44	44	44	44
Sanam Pao	100	100	100	100	100	100
Saphan Khwai	88	88	88	88	88	88
Siam	100	100	100	100	100	100
Thong Lo	100	100	100	100	100	100
Udom Suk	83	83	83	83	83	83
Victory Monument	100	100	100	100	100	100

Analyze categories of venues for each station to define the characteristics of those neighborhoods around the station. The results are normalized by number of venues return as show in the table below:

Table 3 Show venue category characteristics of each station

	Station Name	Accessories Store	American Restaurant	Aquarium	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Australian Restaurant	...	Train Station	vegetarian / Vegan Restaurant	Vietnamese Restaurant	Whisky Bar	Wine Bar	Women's Store	Yakitori Restaurant	Yoga Studio	Yoshoku Restaurant	Zoo Exhibit	
0	Ari	0.00	0.00	0.00	0.000000	0.00	0.00	0.010000	0.000000	0.000000	...	0.010000	0.010000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
1	Asok	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.000000	0.010000	0.000000	0.01	0.000000	0.000000	0.01	0.00	0.00	0.00	
2	Bang Chak	0.00	0.00	0.00	0.022727	0.00	0.00	0.000000	0.019231	0.019231	...	0.038462	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
3	Bang Na	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.019231	0.019231	...	0.026316	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
4	Bearing	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
5	Chit Lom	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.010000	0.010000	0.000000	0.00	0.000000	0.010000	0.00	0.01	0.00	0.00	
6	Ekkamai	0.00	0.00	0.00	0.010000	0.00	0.00	0.010000	0.010000	0.010000	...	0.010000	0.010000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.01	0.00	
7	Ha Yaek Lat Phrao	0.00	0.00	0.00	0.000000	0.00	0.00	0.010000	0.000000	0.000000	...	0.000000	0.000000	0.010000	0.00	0.000000	0.000000	0.00	0.00	0.01	0.00	
8	Mo Chit	0.00	0.00	0.00	0.010000	0.00	0.01	0.010000	0.000000	0.000000	...	0.010000	0.020000	0.010000	0.01	0.000000	0.010000	0.00	0.00	0.00	0.01	
9	Nana	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00	0.010000	0.000000	0.00	0.00	0.00	0.00	
10	On Nut	0.00	0.00	0.00	0.000000	0.00	0.00	0.011236	0.000000	0.000000	...	0.011236	0.011236	0.011236	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
11	Phaya Thai	0.00	0.00	0.00	0.010000	0.00	0.00	0.010000	0.000000	0.000000	...	0.010000	0.000000	0.020000	0.00	0.000000	0.010000	0.00	0.00	0.00	0.00	
12	Phloen Chit	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.000000	0.020000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
13	Phra Khanong	0.00	0.00	0.00	0.020000	0.00	0.00	0.020000	0.010000	0.010000	...	0.020000	0.010000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
14	Phrom Phong	0.00	0.00	0.00	0.000000	0.00	0.00	0.010000	0.000000	0.000000	...	0.000000	0.010000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
15	Pu Chao	0.00	0.00	0.00	0.000000	0.00	0.00	0.029412	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
16	Punnawithi	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.024096	0.000000	0.012048	0.00	0.012048	0.000000	0.00	0.00	0.00	0.00	
17	Ratchathewi	0.00	0.00	0.01	0.010000	0.01	0.00	0.000000	0.000000	0.000000	...	0.000000	0.010000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
18	Samrong	0.00	0.00	0.00	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.022727	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
19	Sanam Pao	0.01	0.00	0.00	0.010000	0.00	0.00	0.010000	0.000000	0.000000	...	0.010000	0.010000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
20	Saphan Khwai	0.00	0.00	0.00	0.011364	0.00	0.00	0.011364	0.000000	0.000000	...	0.011364	0.022727	0.000000	0.00	0.000000	0.011364	0.00	0.00	0.00	0.00	
21	Siam	0.00	0.01	0.01	0.000000	0.00	0.00	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	
22	Thong Lo	0.00	0.00	0.00	0.010000	0.00	0.00	0.000000	0.000000	0.000000	...	0.000000	0.010000	0.000000	0.01	0.000000	0.000000	0.00	0.00	0.00	0.00	
23	Udom Suk	0.00	0.00	0.00	0.000000	0.00	0.00	0.012048	0.000000	0.000000	...	0.012048	0.000000	0.012048	0.000000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00
24	Victory Monument	0.01	0.00	0.00	0.010000	0.00	0.00	0.010000	0.000000	0.000000	...	0.020000	0.000000	0.020000	0.00	0.000000	0.000000	0.00	0.00	0.00	0.00	

Top 10 categories for each station are listed below:

Sequence	Station Name	Latitude	Longitude	Distance	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 Ha Yaek Lat Phrao	13.816552	100.562012	12	1	Coffee Shop	Bar	Thai Restaurant	Dessert Shop	Ice Cream Shop	Japanese Restaurant	Korean Restaurant	Clothing Store	Bakery	Bookstore
1	2 Mo Chit	13.802583	100.553833	11	1	Coffee Shop	Thai Restaurant	Convenience Store	Café	Noodle House	Shopping Mall	Som Tum Restaurant	Seafood Restaurant	Park	Fast Food Restaurant
2	3 Saphan Khwai	13.793800	100.549731	10	1	Thai Restaurant	Coffee Shop	Noodle House	Som Tum Restaurant	Café	Convenience Store	Hotel	Seafood Restaurant	Bar	BBQ Joint
3	4 Ari	13.779703	100.544642	9	4	Thai Restaurant	Coffee Shop	Café	Noodle House	Bar	Sushi Restaurant	Som Tum Restaurant	Restaurant	Japanese Restaurant	BBQ Joint
4	5 Sanam Pao	13.772622	100.542092	8	1	Noodle House	Coffee Shop	Thai Restaurant	Sushi Restaurant	Bar	Restaurant	Bakery	Hotel	BBQ Joint	Café
5	6 Victory Monument	13.762744	100.537086	7	0	Hotel	Noodle House	Coffee Shop	Café	Steakhouse	Thai Restaurant	Hostel	Convenience Store	Bakery	Food Court
6	7 Phaya Thai	13.756942	100.533844	6	0	Hotel	Noodle House	Coffee Shop	Hostel	Steakhouse	Café	Restaurant	Som Tum Restaurant	Convenience Store	Bar
7	8 Ratchathewi	13.751875	100.531575	5	0	Hotel	Coffee Shop	Hostel	Dessert Shop	Bakery	Café	Restaurant	Shopping Mall	Korean Restaurant	Bar
8	9 Siam	13.745619	100.534228	4	1	Coffee Shop	Dessert Shop	Bakery	Café	Thai Restaurant	Shopping Mall	Korean Restaurant	Movie Theater	Cosmetics Shop	Boutique
9	10 Chit Lom	13.741408	100.543097	3	0	Hotel	Coffee Shop	Thai Restaurant	Spa	Chinese Restaurant	Ice Cream Shop	Italian Restaurant	Department Store	Restaurant	Cosmetics Shop
10	11 Phloen Chit	13.743081	100.549019	2	0	Hotel	Coffee Shop	Café	Thai Restaurant	Restaurant	Hotel Bar	French Restaurant	Japanese Restaurant	Italian Restaurant	Buffet
11	12 Nana	13.740603	100.555397	1	0	Hotel	Korean Restaurant	Hotel Bar	Indian Restaurant	Japanese Restaurant	Coffee Shop	Pizza Place	Spa	Café	Bar
12	13 Asok	13.737033	100.560419	0	0	Hotel	Korean Restaurant	Coffee Shop	Thai Restaurant	Spa	Restaurant	Hotel Bar	Burger Joint	Café	BBQ Joint
13	14 Phrom Phong	13.730439	100.569731	1	4	Japanese Restaurant	Café	Hotel	Coffee Shop	Thai Restaurant	Supermarket	Shopping Mall	Spa	Massage Studio	Restaurant
14	15 Thong Lo	13.724244	100.578558	2	4	Thai Restaurant	Coffee Shop	Japanese Restaurant	Café	Hotel	BBQ Joint	Bar	Noodle House	Spa	Cocktail Bar
15	16 Ekkamai	13.719558	100.585175	3	4	Japanese Restaurant	Coffee Shop	Thai Restaurant	Café	Dessert Shop	Noodle House	Gym / Fitness Center	Hotel	Ramen Restaurant	Theme Park
16	17 Phra Khanong	13.715194	100.591283	4	4	Coffee Shop	Japanese Restaurant	Convenience Store	Gym / Fitness Center	Noodle House	Bakery	Café	Ramen Restaurant	Art Gallery	Thai Restaurant
17	18 On Nut	13.705611	100.601063	5	2	Convenience Store	Hotel	Coffee Shop	Italian Restaurant	Fast Food Restaurant	Residential Building (Apartment / Condo)	Noodle House	Ice Cream Shop	Chinese Restaurant	Café
18	19 Bang Chak	13.696751	100.605349	6	2	Convenience Store	Noodle House	Coffee Shop	Chinese Restaurant	Hotel	Thai Restaurant	Italian Restaurant	Train Station	Spa	Market
19	20 Punnawithi	13.688919	100.609211	7	2	Convenience Store	Thai Restaurant	Fast Food Restaurant	Coffee Shop	Noodle House	Ice Cream Shop	Bakery	Café	Hotel	Gas Station
20	21 Udom Suk	13.680317	100.609658	8	2	Thai Restaurant	Convenience Store	Noodle House	Fast Food Restaurant	Café	Coffee Shop	Bar	Bakery	Dim Sum Restaurant	BBQ Joint
21	22 Bang Na	13.668146	100.604703	9	1	Coffee Shop	Convenience Store	Fast Food Restaurant	Noodle House	Train Station	Thai Restaurant	Hotpot Restaurant	Music Venue	Stadium	Golf Driving Range
22	23 Bearing	13.659336	100.601050	10	2	Convenience Store	Noodle House	Coffee Shop	Thai Restaurant	Café	Steakhouse	Market	Bus Stop	Asian Restaurant	Bakery
23	24 Samrong	13.647363	100.596153	11	2	Noodle House	Convenience Store	Fast Food Restaurant	Market	Hotpot Restaurant	Ramen Restaurant	Bakery	Shabu-Shabu Restaurant	Buffet	Medical Center
24	25 Pu Chao	13.637280	100.592000	12	3	Convenience Store	Noodle House	Food Truck	Intersection	BBQ Joint	Bus Station	Bus Stop	Soccer Field	Café	Museum

By using k-means Clustering with 5 clusters, we can cluster these neighborhoods as the below:

Cluster Label = 0

Station Name	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
Victory Monument	0	Hotel	Noodle House	Coffee Shop	Café	Steakhouse	Thai Restaurant	Hostel	Convenience Store	Bakery	Food Court
Phaya Thai	0	Hotel	Noodle House	Coffee Shop	Hostel	Steakhouse	Café	Restaurant	Som Tum Restaurant	Convenience Store	Bar
Ratchathewi	0	Hotel	Coffee Shop	Hostel	Dessert Shop	Bakery	Café	Restaurant	Shopping Mall	Korean Restaurant	Bar
Chit Lom	0	Hotel	Coffee Shop	Thai Restaurant	Spa	Chinese Restaurant	Ice Cream Shop	Italian Restaurant	Department Store	Restaurant	Cosmetics Shop
Phloen Chit	0	Hotel	Coffee Shop	Café	Thai Restaurant	Restaurant	Hotel Bar	French Restaurant	Japanese Restaurant	Italian Restaurant	Buffet
Nana	0	Hotel	Korean Restaurant	Hotel Bar	Indian Restaurant	Japanese Restaurant	Coffee Shop	Pizza Place	Spa	Café	Bar
Asok	0	Hotel	Korean Restaurant	Coffee Shop	Thai Restaurant	Spa	Restaurant	Hotel Bar	Burger Joint	Café	BBQ Joint

Cluster Label = 1

Station Name	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
Ha Yaek Lat Phrao	1	Coffee Shop	Bar	Thai Restaurant	Dessert Shop	Ice Cream Shop	Japanese Restaurant	Korean Restaurant	Clothing Store	Bakery	Bookstore
Mo Chit	1	Coffee Shop	Thai Restaurant	Convenience Store	Café	Noodle House	Shopping Mall	Som Tum Restaurant	Seafood Restaurant	Park	Fast Food Restaurant
Saphan Khwai	1	Thai Restaurant	Coffee Shop	Noodle House	Som Tum Restaurant	Café	Convenience Store	Hotel	Seafood Restaurant	Bar	BBQ Joint
Sanam Pao	1	Noodle House	Coffee Shop	Thai Restaurant	Sushi Restaurant	Bar	Restaurant	Bakery	Hotel	BBQ Joint	Café
Siam	1	Coffee Shop	Dessert Shop	Bakery	Café	Thai Restaurant	Shopping Mall	Korean Restaurant	Movie Theater	Cosmetics Shop	Boutique
Bang Na	1	Coffee Shop	Convenience Store	Fast Food Restaurant	Noodle House	Train Station	Thai Restaurant	Hotpot Restaurant	Music Venue	Stadium	Golf Driving Range

Cluster Label = 2

Station Name	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
On Nut	2	Convenience Store	Hotel	Coffee Shop	Italian Restaurant	Fast Food Restaurant	Residential Building (Apartment / Condo)	Noodle House	Ice Cream Shop	Chinese Restaurant	Café
Bang Chak	2	Convenience Store	Noodle House	Coffee Shop	Chinese Restaurant	Hotel	Thai Restaurant	Italian Restaurant	Train Station	Spa	Market
Punnawithi	2	Convenience Store	Thai Restaurant	Fast Food Restaurant	Coffee Shop	Noodle House	Ice Cream Shop	Bakery	Café	Hotel	Gas Station
Udom Suk	2	Thai Restaurant	Convenience Store	Noodle House	Fast Food Restaurant	Café	Coffee Shop	Bar	Bakery	Dim Sum Restaurant	BBQ Joint
Bearing	2	Convenience Store	Noodle House	Coffee Shop	Thai Restaurant	Café	Steakhouse	Market	Bus Stop	Asian Restaurant	Bakery
Samrong	2	Noodle House	Convenience Store	Fast Food Restaurant	Market	Hotpot Restaurant	Ramen Restaurant	Bakery	Shabu-Shabu Restaurant	Buffet	Medical Center

Cluster Label = 3

Station Name	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
Pu Chao	3	Convenience Store	Noodle House	Food Truck	Intersection	BBQ Joint	Bus Station	Bus Stop	Soccer Field	Café	Museum

Cluster Label = 4

Station Name	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
Ari	4	Thai Restaurant	Coffee Shop	Café	Noodle House	Bar	Sushi Restaurant	Som Tum Restaurant	Restaurant	Japanese Restaurant	BBQ Joint
Phrom Phong	4	Japanese Restaurant	Café	Hotel	Coffee Shop	Thai Restaurant	Supermarket	Shopping Mall	Spa	Massage Studio	Restaurant
Thong Lo	4	Thai Restaurant	Coffee Shop	Japanese Restaurant	Café	Hotel	BBQ Joint	Bar	Noodle House	Spa	Cocktail Bar
Ekkamai	4	Japanese Restaurant	Coffee Shop	Thai Restaurant	Café	Dessert Shop	Noodle House	Gym / Fitness Center	Hotel	Ramen Restaurant	Theme Park
Phra Khanong	4	Coffee Shop	Japanese Restaurant	Convenience Store	Gym / Fitness Center	Noodle House	Bakery	Café	Ramen Restaurant	Art Gallery	Thai Restaurant

These cluster can be depicted on the map as the below:

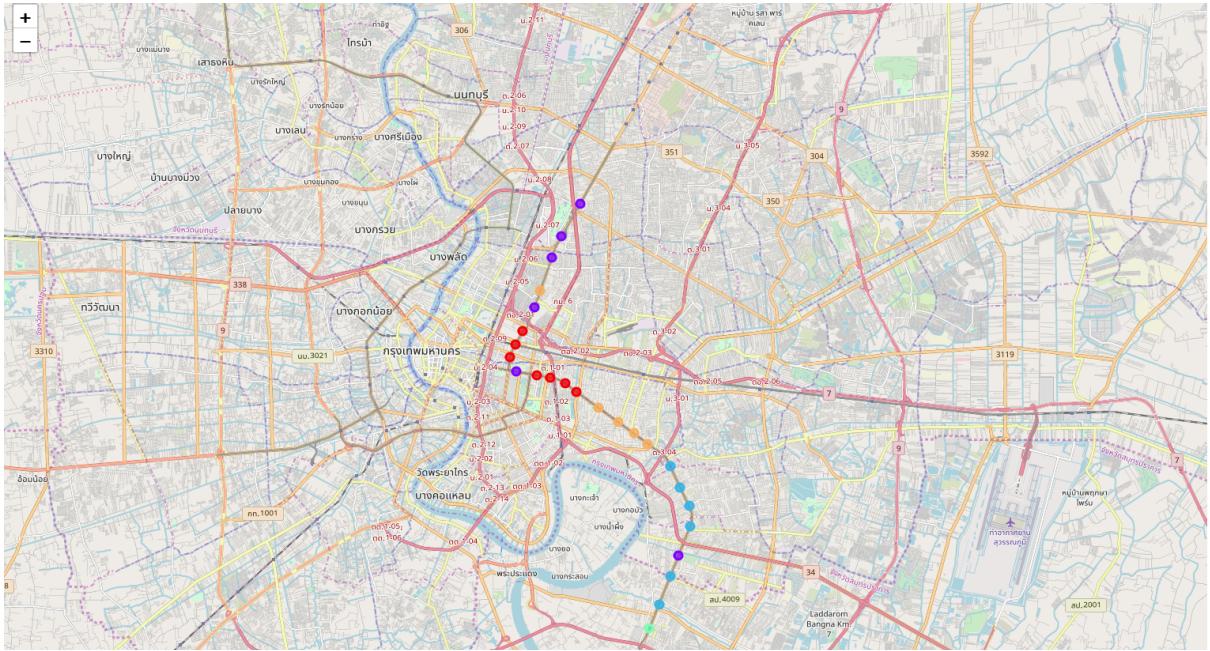


Figure 3 Map show each cluster of neighborhood. Same clusters are marked with the same colors

Based on Table 2, I picked the sample size of 30 venues for each cluster to ensure that the Premium Foursquare API call are not exceeding daily quota. By using these sample venues, I retrieved ‘price tier’ (from 1 least pricey to 4 most pricey) of each venue and then do the average to represent the living expenses of these clusters. The result of each cluster is presented in the below table:

Table 4 Price Tier of each Cluster Label

Cluster Labels	Price Tier
0	2.733333
1	2.105263
2	2.000000
3	1.800000
4	2.050000

From this table, we can see that Cluster Label 3 has the cheapest living expense and Cluster Label 0 has the most expensive living expense which is align with the truth that Cluster Label 0 neighborhoods are falling in the central business district of Bangkok.

Results

To answer our business problem, the neighborhoods that met our criteria; within 12 stations away from “Asok Station” and falling in the low living expenses cluster are:

Table 5 Show neighborhood around stations that met our criteria

Sequence	Station Name	Latitude	Longitude	Distance	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
25	Pu Chao	13.637280	100.592000	12	3	Convenience Store	Noodle House	Food Truck	Intersection	BBQ Joint	Bus Station	Bus Stop	Soccer Field	Café	Museum
18	On Nut	13.705611	100.601083	5	2	Convenience Store	Hotel	Coffee Shop	Italian Restaurant	Fast Food Restaurant	Residential Building (Apartment / Condo)	Noodle House	Ice Cream Shop	Chinese Restaurant	Café
19	Bang Chak	13.696751	100.605349	6	2	Convenience Store	Noodle House	Coffee Shop	Chinese Restaurant	Hotel	Thai Restaurant	Italian Restaurant	Train Station	Spa	Market
20	Punnawithi	13.688919	100.609211	7	2	Convenience Store	Thai Restaurant	Fast Food Restaurant	Coffee Shop	Noodle House	Ice Cream Shop	Bakery	Café	Hotel	Gas Station
21	Udom Suk	13.680317	100.609658	8	2	Thai Restaurant	Convenience Store	Noodle House	Fast Food Restaurant	Café	Coffee Shop	Bar	Bakery	Dim Sum Restaurant	BBQ Joint
23	Bearing	13.659336	100.601050	10	2	Convenience Store	Noodle House	Coffee Shop	Thai Restaurant	Café	Steakhouse	Market	Bus Stop	Asian Restaurant	Bakery
24	Samrong	13.647363	100.596153	11	2	Noodle House	Convenience Store	Fast Food Restaurant	Market	Hotpot Restaurant	Ramen Restaurant	Bakery	Shabu-Shabu Restaurant	Buffet	Medical Center

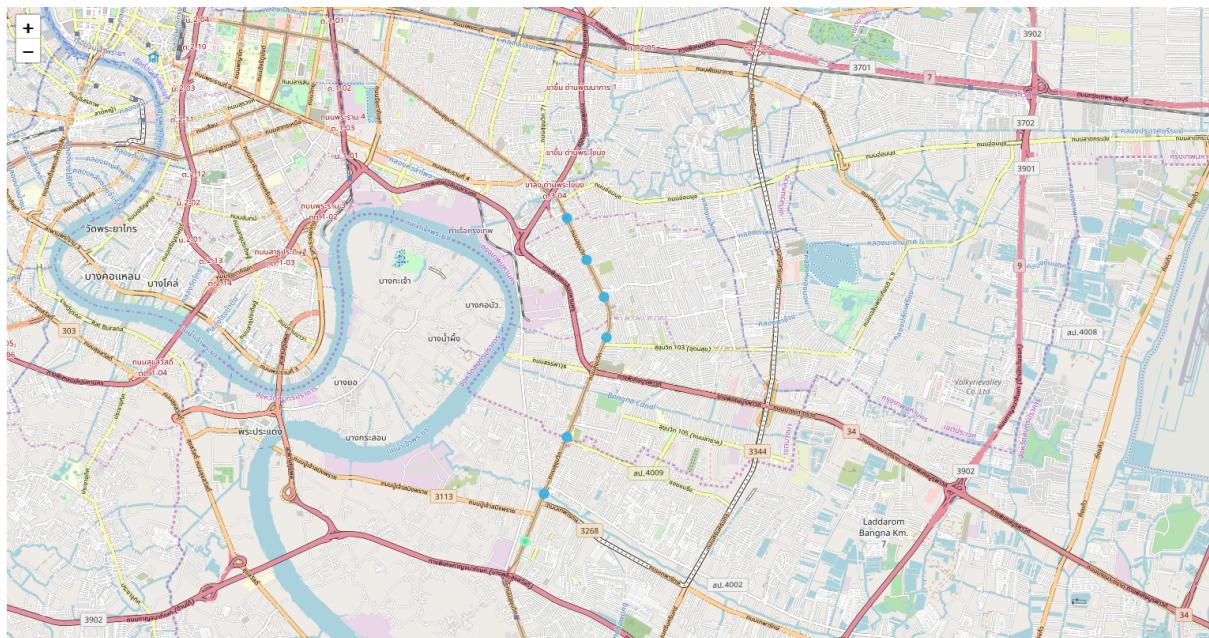


Figure 4 Map of selected stations

Discussion

The results of this study to provide the broad idea of how to implement FourSquare API to do location selection based on specific criteria by exploration of venues, its category and its rich details provided by FourSquare. In this study, we explore venues around BTS Sukhumvit Line Stations within 12 stations away. Using venues' categories, we are able to cluster the neighborhoods that contain the same characteristics together. And, by using price tier from sample venues in each cluster, we are able to identify the living expenses in this cluster to fulfil the problem in this study.

My observations are that:

1. FourSquare database seems to focus on some particular categories e.g. Restaurant, Café and doesn't contain all categories that would provide more inside into neighborhood characteristics. Also, I noticed that their database is not up-to-date, so the venues might not be available and its details might not reflect the reality.

2. Venues details are not accurate as it's based on community, so the price tier on the same restaurants may differ between branches.
3. Not all venue contains price tier which would reduce the sample used to calculate the average of price tier of each cluster
4. There is a limit on FourSquare Premium API, so I need to utilize it within the quota; however, the results are aligned with the reality.

My recommendations to this study are:

1. To go further another step to explore the actual condominiums/apartments. We can use FourSquare API to get their venues' details such as price tier, rating and tips.
2. To use different data sources e.g. Property Listing, Real Estate Forums, etc. to get more accurate posting rental for condominiums/apartments which would be more accurate compared to price tier input by community for FourSquare's venues.
3. Adding more variables such as crime rates to add more aspects into the location selection model.
4. Adding more neighborhoods along another mass transit line e.g. BTS Silom Line or MRT Blue Line, etc.

Conclusion

By using FourSquare API, we are able to cluster the neighborhood based on their venues' categories characteristics by using k-Means Clustering methods into 5 clusters. Based on this clustering, we then assume that the living expenses in the same cluster are not that different. By this assumption, we sample the venues in the same cluster and retrieve the price tier information from FourSquare which we used to represent the living expenses standard in the cluster. By consolidating the result, we are about to filter/select the suitable neighborhood according to our criteria which are neighborhoods around "Pu Chao", "On Nut", "Bang Chak", "Punnawithi", "Udom Suk", "Bearing" and "Samrong"

References

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