

The Battle of Neighborhoods

Exploring business opportunity around train stations' neighborhood in Singapore

1. Introduction

1.1 Background Information

Singapore railway system is made up of five Mass Rapid Transit (MRT) lines and two Light Rapid Transit (LRT) lines. The MRT & LRT 230km system has over three million daily ridership. There are a total of 187 Mass Rapid Transit (MRT)/Light Rapid Transit (LRT) train stations as of Jan 2019.

In general, the neighborhoods around MRT/LRT stations are highly populated and many shopping centers, shops, business offices are found near the MRT/LRT stations. The typical business or shops near the railway station include shopping malls, supermarkets, coffee shops, restaurants, dessert shops and etc. The kinds of business or shops clustered around the railway stations could vary significantly from station to station. As such, it will be interesting and beneficial for those who are keen in seeking business opportunity in the neighborhood area of railway stations to have a better idea of what are the most common business and/or shops that exist currently around these railway stations so as to make a better business decision.

1.2 Business Problem

To find out the existing common business or shops in the neighborhood around MRT/LRT stations and to explore business opportunity based on the analysis of the MRT/LRT trains' neighborhood data.

1.3 Target Audience

People who are interested in opening a shop for certain business of their interest at location near any of the MRT/LRT stations in Singapore

2. Data Acquisition and Cleaning

2.1 Location Data of MRT/LRT train stations

The location data (latitude & longitude coordinates) of MRT & LRT stations in Singapore is obtained from the following data source:

<https://data.world/hxchua/train-stations-in-singapore>

The following two methods can be used to retrieve the latitude & longitude data of train stations from the above website:

(1) Direct downloading of .csv file

```
!wget -q -O 'mrtlrt_sg.csv' https://data.world/hxchua/train-stations-in-singapore/workspace/file?filename=mrtsg.csv
```

(2) Calling pandas.read_csv() to read the location data from a provided URL into a dataframe:

```
import pandas as pd
url = 'https://query.data.world/s/heji2ztgpnwx5j5362iqgspyjioh2u'
df_sgp = pd.read_csv(url)
```

The csv data read in consists of 8 columns of data, namely 'OBJECTID', 'STN NAME', 'STN NO', 'X', 'Y', 'Latitude', 'Longitude' and 'COLOR', as shown in the following diagram:

```
url = 'https://query.data.world/s/heji2ztgpnwx5j5362iqgspyjioh2u'
df_sgp = pd.read_csv(url)
df_sgp
```

	OBJECTID	STN NAME	STN NO	X	Y	Latitude	Longitude	COLOR
0	12	ADMIRALTY MRT STATION	NS10	24402.1063	46918.1131	1.440585	103.800998	RED
1	16	ALJUNIED MRT STATION	EW9	33518.6049	33190.0020	1.316433	103.882893	GREEN
2	33	ANG MO KIO MRT STATION	NS16	29807.2655	39105.7720	1.369933	103.849553	RED
3	81	BAKAU LRT STATION	SE3	36026.0821	41113.8766	1.388093	103.905418	OTHERS
4	80	BANGKIT LRT STATION	BP9	21248.2460	40220.9693	1.380018	103.772667	OTHERS
...
182	175	WOODLANDS SOUTH MRT STATION	TE3	23607.8309	45444.7113	1.427260	103.793863	OTHERS
183	146	WOODLEIGH MRT STATION	NE11	32173.3186	35706.3794	1.339190	103.870808	PURPLE
184	6	YEW TEE MRT STATION	NS5	18438.9791	42158.0124	1.397535	103.747431	RED
185	41	YIO CHU KANG MRT STATION	NS15	29294.1283	40413.0820	1.381756	103.844944	RED
186	13	YISHUN MRT STATION	NS13	28187.6787	45686.0701	1.429443	103.835005	RED

187 rows x 8 columns

There are a total of 187 rows of data (with each row represents a train stations) retrieved. In our analysis, only 4 columns of data, i.e. 'STN NAME', 'STN NO', 'Latitude', 'Longitude', are needed. The unwanted columns of data will be discarded.

For some train stations, the same station name could be associated with more than one station number, for instance, the 'Bayfront MRT station' has two station numbers, i.e. 'DT16' and 'CE1', as these train stations comprise of platforms for more than one MRT lines and these platforms even though are linked but they could be at a distance from each other and hence each station no ('STN NO') is having its own latitude & longitude data. In our analysis, each station number is treated as a unique station and for the sake of station identification

completeness, the 'STN NAME' and 'STN NO' are combined to form the 'Station ID' (Station Identifier) and subsequent data analysis will be performed based on the 'Station ID' data.

The following diagram shows a new dataframe which contains only the required 'Station ID', 'Latitude' and 'Longitude' data.

```
df_stnloc = df_sgp[['Latitude', 'Longitude']].copy(deep=True)
df_stnloc['Station ID'] = df_sgp['STN_NAME'] + ' (' + df_sgp['STN_NO'] + ')'

# move Station_ID column to the first column
new_columns = [df_stnloc.columns[-1]] + list(df_stnloc.columns[:-1])
df_stnloc = df_stnloc[new_columns]
df_stnloc.head()
```

	Station ID	Latitude	Longitude
0	ADMIRALTY MRT STATION (NS10)	1.440585	103.800998
1	ALJUNIED MRT STATION (EW9)	1.316433	103.882893
2	ANG MO KIO MRT STATION (NS16)	1.369933	103.849553
3	BAKAU LRT STATION (SE3)	1.388093	103.905418
4	BANGKIT LRT STATION (BP9)	1.380018	103.772667

2.2 Latitude & Longitude Data of Singapore

The Python's geopy library is used to obtain the latitude and longitude values of Singapore.

```
address = 'Singapore'

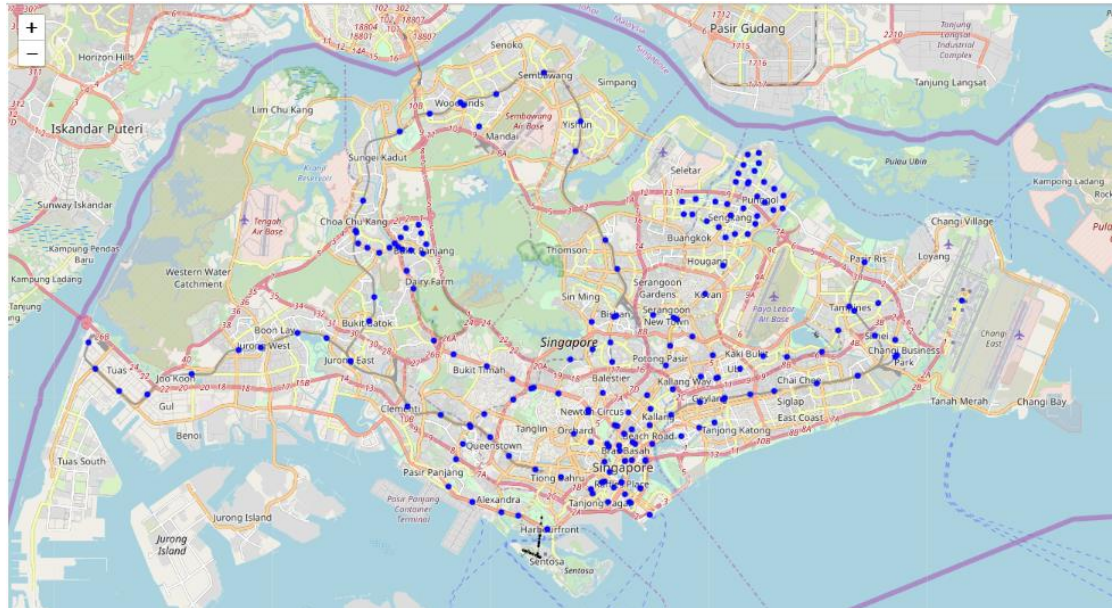
geolocator = Nominatim(user_agent="sg_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude

print ('The latitude and longitude of Singapore is ({},{})'.format(latitude, longitude))

The latitude and longitude of Singapore is (1.340863,103.830391822121)
```

The latitude and longitude data of Singapore is needed for drawing a map of Singapore using Python's folium library.

Together with the latitude & longitude data of train stations, a map of Singapore with markers of train station is generated which is shown in the diagram below:



2.3 Foursquare's Neighborhood Venues Data

Foursquare Places Data API is called to find out the venues (up to 50) located within 500m from each of the train station.

The Python code that calls the Foursquare Places Data API calls for retrieving the nearby venues of each train station is shown below:

```
LIMIT = 50 # limit of number of venues returned by Foursquare API
RADIUS = 500 # define radius
```

```
def getNearbyVenues(station_ids, latitudes, longitudes, radius=RADIUS):
```

```
    count = 1
    venues_list=[]
    for stn_id, lat, lng in zip(station_ids, latitudes, longitudes):
        print(count, stn_id)
        count = count + 1
```

```
    # create the API request URL
    url =
```

```
'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll={}&radius={}&limit={}'.format(
        CLIENT_ID,
        CLIENT_SECRET,
        VERSION,
        lat,
        lng,
        radius,
        LIMIT)
```

```
    # make the GET request
    results = requests.get(url).json()[["response"]][0][["items"]]
```

```
    venues_list.append(((
        stn_id,
```

```

lat,
lng,
v['venue']['name'],
v['venue']['location']['lat'],
v['venue']['location']['lng'],
v['venue']['categories'][0]['name']) for v in results])

nearby_venues = pd.DataFrame([item for venue_list in venues_list for item in venue_list])
nearby_venues.columns = [
    'Station ID',
    'Stn Latitude',
    'Stn Longitude',
    'Venue',
    'Venue Latitude',
    'Venue Longitude',
    'Venue Category']

return(nearby_venues)

sgp_venues = getNearbyVenues(station_ids=df_stnloc['Station ID'],
                             latitudes=df_stnloc['Latitude'],
                             longitudes=df_stnloc['Longitude']
                             )

```

The venue, its latitude & longitude data as well as the venue category the venue belongs to are tabulated in a dataframe as shown in the diagram below. These data will then be further processed and analyzed so as to identify the most common venue categories for each of the train stations.

	Station ID	Stn Latitude	Stn Longitude		Venue	Venue Latitude	Venue Longitude	Venue Category
0	ADMIRALTY MRT STATION (NS10)	1.440585	103.800998	Kampung Admiralty Hawker Centre		1.439939	103.800774	Food Court
1	ADMIRALTY MRT STATION (NS10)	1.440585	103.800998	Starbucks		1.439761	103.800659	Coffee Shop
2	ADMIRALTY MRT STATION (NS10)	1.440585	103.800998	NTUC Fairprice		1.439955	103.800761	Supermarket
3	ADMIRALTY MRT STATION (NS10)	1.440585	103.800998	Saamudeen		1.439852	103.800750	Halal Restaurant
4	ADMIRALTY MRT STATION (NS10)	1.440585	103.800998	NTUC FairPrice		1.437707	103.797636	Supermarket
5	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Phoon Huat & Co		1.316521	103.881152	Kitchen Supply Store
6	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	The Sinner Bar		1.313674	103.883670	BBQ Joint
7	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Hong Qin Fish & Duck Porridge		1.315787	103.885663	Chinese Restaurant
8	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	No Signboard Seafood Restaurant		1.313155	103.882700	Seafood Restaurant
9	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Ben Ser Seng Herbs (Turtle) Restaurant 牛成山瑞補品 ...		1.314068	103.879981	Chinese Restaurant
10	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	J.B. Ah Meng Restaurant		1.313735	103.886182	Chinese Restaurant
11	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	悦恩坊 Yes Natural F & B Vegetarian Restaurant		1.315828	103.883807	Vegetarian / Vegan Restaurant
12	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Builders At Sims		1.317739	103.879848	Cafe
13	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Tei Dong Teochew Braised Duck Rice		1.317166	103.879990	Food Truck
14	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	The Lorong 24A shophouse series		1.312777	103.884045	Boarding House
15	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Koung's Wan Ian Mee 黃氏雲吞面 (Koung's Wan Ian Mee)		1.314880	103.880855	Noodle House
16	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Shuang Shun Chicken Rice		1.312680	103.882536	Asian Restaurant
17	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	7-Eleven		1.312758	103.880738	Convenience Store
18	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Penang Seafood Restaurant		1.314833	103.882075	Seafood Restaurant
19	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Sims Vista Market & Food Centre		1.316978	103.879382	Food Court
20	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Aikido Shing-u-kai (Singapore) HQ 心聯合空道道場		1.315173	103.883155	Martial Arts Dojo
21	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Ci Hang Western & Chinese Vegetarian Fast Food		1.315744	103.883248	Vegetarian / Vegan Restaurant
22	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Hollywood Duck Rice • Duck Porridge		1.318095	103.879745	Chinese Restaurant
23	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Dunans @ Lorong 21 Geylang		1.314700	103.879937	Farmers Market
24	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	The Ranch		1.316328	103.883760	Steakhouse
25	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Shi Wei Xian HongKong Tim Sum		1.319740	103.885760	Dim Sum Restaurant
26	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Islove Restaurant		1.313421	103.883765	Indian Restaurant
27	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	聯合堂 Kwam Inn Vegetarian Food		1.315932	103.886388	Vegetarian / Vegan Restaurant
28	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Sweet Guan Hokkien Mee		1.313999	103.885706	Noodle House
29	ALJUNIED MRT STATION (EW9)	1.316433	103.882893	Sen Hin Restaurant		1.319785	103.885765	Asian Restaurant

3. Methodology

3.1 Exploratory Analysis

After obtaining the data of venues (along with their venue categories) for each of the train station, exploratory analysis is performed to find out the total number of venues retrieved and the number of venues for each station.

Find out how many venues were returned for each neighborhood

```
sgp_venues.groupby('Station ID').count()
```

	Stn Latitude	Stn Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Station ID						
ADMIRALTY MRT STATION (NS10)	5	5	5	5	5	5
ALJUNIED MRT STATION (EW9)	45	45	45	45	45	45
ANG MO KIO MRT STATION (NS16)	40	40	40	40	40	40
BAKAU LRT STATION (SE3)	12	12	12	12	12	12
BANGKIT LRT STATION (BP9)	11	11	11	11	11	11
...
WOODLANDS SOUTH MRT STATION (TE3)	6	6	6	6	6	6
WOODLEIGH MRT STATION (NE11)	11	11	11	11	11	11
YEW TEE MRT STATION (NS5)	9	9	9	9	9	9
YIO CHU KANG MRT STATION (NS15)	14	14	14	14	14	14
YISHUN MRT STATION (NS13)	48	48	48	48	48	48

187 rows × 6 columns

```
sgp_venues.shape
```

```
(5337, 7)
```

Based on the data collected, it is noticed that a total of 5337 neighborhood venues are retrieved for the 187 train stations.

Find out how many unique categories can be curated from all the returned venues

```
print('There are {} uniques categories.'.format(len(sgp_venues['Venue Category'].unique())))
```

```
There are 308 uniques categories.
```

It is further analyzed to find out the 5337 venues fall under 308 unique venue categories.

3.2 Cluster Analysis

The objective of cluster analysis is to group the train stations into different clusters according to the individual station's five most common or popular venue categories.

To find out the 5 most common venue categories for each of the train stations, one hot encoding method is applied.

Analyze each MRT/LRT station

```
# one hot encoding
sgp_onehot = pd.get_dummies(sgp_venues[['Venue Category']], prefix="", prefix_sep="")
print(sgp_onehot.shape)

# add station name column back to dataframe
sgp_onehot['Station ID'] = sgp_venues['Station ID']

# move neighborhood column to the first column
reorder_columns = [sgp_onehot.columns[-1]] + list(sgp_onehot.columns[:-1])
sgp_onehot = sgp_onehot[reorder_columns]

sgp_onehot.head(20)
```

(5337, 308)

	Station ID	ATM	Accessories Store	Airport	Airport Food Court	Airport Lounge	American Restaurant	Arcade	Art Gallery	Art Museum	...	Warehouse Store	Water Park	Waterfall	Waterfront	Whisky Bar	Wine Bar	Wine Shop	Wings Joint	Women's Store	Yoga Studio
0	ADMIRALTY MRT STATION (NS10)	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
1	ADMIRALTY MRT STATION (NS10)	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
2	ADMIRALTY MRT STATION (NS10)	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	ADMIRALTY MRT STATION (NS10)	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	ADMIRALTY MRT STATION (NS10)	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
5	ALJUNIED MRT STATION (EW9)	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

The mean of frequency of occurrence of venue category for each of the train stations is computed.

Group rows by station id and taking the mean of the frequency of occurrence for each venue category

```
sgp_onehot_grouped = sgp_onehot.groupby('Station ID').mean().reset_index()
sgp_onehot_grouped
```

	Station ID	ATM	Accessories Store	Airport	Airport Food Court	Airport Lounge	American Restaurant	Arcade	Art Gallery	Art Museum	...	Warehouse Store	Water Park	Waterfall	Waterfront	Whisky Bar	Wine Bar	Wine Shop	Wings Joint	Women's Store	Yoga Studio
0	ADMIRALTY MRT STATION (NS10)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	ALJUNIED MRT STATION (EW9)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	ANG MO KIO MRT STATION (NS16)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	BAKAU LRT STATION (SE3)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	BANGKIT LRT STATION (BP9)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
...
182	WOODLANDS SOUTH MRT STATION (TE3)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
183	WOODLEIGH MRT STATION (NE11)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
184	YEW TEE MRT STATION (NS5)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
185	YIO CHU KANG MRT STATION (NS15)	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
186	YISHUN MRT STATION (NS13)	0.0	0.0	0.0	0.0	0.0	0.0	0.020833	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

187 rows × 309 columns

The top 5 most common venue categories and the associated frequency of occurrence for each station is printed out as shown below. Please refer to the Appendix of this report for the full list of data.

```

num_top_venues = 5

for stn_id in sgp_onehot_grouped['Station ID']:
    print("----"+stn_id+"----")
    temp = sgp_onehot_grouped[sgp_onehot_grouped['Station ID'] == stn_id].T.reset_index()
    temp.columns = ['venue', 'freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_top_venues))
    print('\n')

----ADMIRALTY MRT STATION (NS10)----
      venue  freq
0   Supermarket  0.4
1   Coffee Shop  0.2
2   Food Court  0.2
3   Halal Restaurant  0.2
4  Paper / Office Supplies Store  0.0

----ALJUNIED MRT STATION (EW9)----
      venue  freq
0  Chinese Restaurant  0.13
1         Café  0.07
2   Asian Restaurant  0.07
3   Noodle House  0.07
4  Vegetarian / Vegan Restaurant  0.07

----ANG MO KIO MRT STATION (NS16)----
      venue  freq
0   Coffee Shop  0.10
1   Food Court  0.10
2   Dessert Shop  0.08
3  Japanese Restaurant  0.05
4   Snack Place  0.05

```

The top 5 most common venue categories for each train station is sorted and tabulated in a new dataframe for further cluster analysis.

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	ADMIRALTY MRT STATION (NS10)	Supermarket	Halal Restaurant	Food Court	Coffee Shop	Yoga Studio
1	ALJUNIED MRT STATION (EW9)	Chinese Restaurant	Vegetarian / Vegan Restaurant	Cafe	Noodle House	Asian Restaurant
2	ANG MO KIO MRT STATION (NS16)	Food Court	Coffee Shop	Dessert Shop	Snack Place	Supermarket
3	BAKAU LRT STATION (SE3)	Trail	Food Stand	Food & Drink Shop	Fast Food Restaurant	Sandwich Place
4	BANGKIT LRT STATION (BP9)	Food Court	Fruit & Vegetable Store	Bike Trail	Spa	Park
5	BARTLEY MRT STATION (CC12)	Pet Store	Bus Station	Noodle House	Metro Station	Café
6	BAYFRONT MRT STATION (CE1)	Hotel	Boutique	Bridge	Tea Room	Casino
7	BAYFRONT MRT STATION (DT16)	Hotel	Boutique	Bridge	Tea Room	Casino
8	BEAUTY WORLD MRT STATION (DT5)	Korean Restaurant	Café	Chinese Restaurant	Food Court	Asian Restaurant
9	BEDOK MRT STATION (EW5)	Chinese Restaurant	Coffee Shop	Japanese Restaurant	Food Court	Sandwich Place
10	BEDOK NORTH MRT STATION (DT29)	Food Court	Indian Restaurant	Basketball Court	Laundromat	Food & Drink Shop
11	BEDOK RESERVOIR MRT STATION (DT30)	Noodle House	Park	Supermarket	Food Court	Asian Restaurant
12	BENCOOLEN MRT STATION (DT21)	Café	Hotel	Japanese Restaurant	Coffee Shop	Restaurant
13	BENDEMEER MRT STATION (DT23)	Hostel	BBQ Joint	Vegetarian / Vegan Restaurant	Coffee Shop	Restaurant
14	BISHAN MRT STATION (CC15)	Coffee Shop	Food Court	Bubble Tea Shop	Chinese Restaurant	Japanese Restaurant
15	BISHAN MRT STATION (NS17)	Coffee Shop	Food Court	Bubble Tea Shop	Chinese Restaurant	Japanese Restaurant
16	BOON KENG MRT STATION (NE9)	Chinese Restaurant	Noodle House	Seafood Restaurant	Fast Food Restaurant	Bakery
17	BOON LAY MRT STATION (EW27)	Asian Restaurant	Japanese Restaurant	Fast Food Restaurant	Chinese Restaurant	Dessert Shop
18	BOTANIC GARDENS MRT STATION (CC19)	Asian Restaurant	Bakery	Cafe	Noodle House	French Restaurant
19	BOTANIC GARDENS MRT STATION (DT9)	Asian Restaurant	Cafe	Bakery	Noodle House	Burger Joint

With the MRT/LRT station's 5 top most common venue categories data obtained in previous steps, the following two clustering algorithms are applied to the data:

- 1) k-Means Clustering
- 2) Hierarchical Clustering

For the clusters generated using the above mentioned clustering algorithms, each of the clusters will be examined to determine the discriminating venue categories that distinguish each cluster.

3.2.1 Clustering of Train Stations using k-Means Clustering Algorithm

Setting k=5 and use scikit-learn library's KMeans class to run k-means clustering algorithm to cluster the train stations into 5 clusters based on the train stations' venue categories.

Run k-means to cluster the neighborhood into 5 clusters.

```
# import k-means from clustering stage
from sklearn.cluster import KMeans

# set number of clusters
kclusters = 5

sgp_onehot_grouped_clustering = sgp_onehot_grouped.drop('Station ID', 1)

# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(sgp_onehot_grouped_clustering)

# check cluster Label generated for each row in the dataframe
kmeans.labels_[0:186]
```

```
array([4, 0, 4, 3, 4, 2, 3, 3, 3, 3, 3, 4, 3, 3, 4, 4, 0, 3, 3, 3, 0, 3,
       2, 3, 3, 4, 2, 4, 3, 3, 3, 3, 3, 2, 3, 4, 3, 3, 0, 4, 4, 3, 3, 3,
       3, 0, 2, 3, 0, 0, 1, 3, 3, 3, 4, 3, 3, 0, 3, 3, 4, 3, 3, 0, 4, 3,
       4, 4, 3, 3, 2, 3, 3, 3, 3, 4, 3, 3, 3, 4, 3, 3, 4, 0, 4, 4, 2,
       0, 3, 3, 3, 4, 3, 4, 3, 3, 3, 2, 2, 3, 3, 3, 4, 0, 4, 0, 0, 0,
       3, 3, 3, 3, 3, 3, 3, 0, 3, 3, 3, 4, 3, 3, 3, 0, 3, 3, 3, 3, 3,
       0, 3, 3, 4, 0, 2, 3, 3, 3, 3, 3, 4, 3, 3, 3, 3, 3, 3, 3, 3, 4,
       4, 3, 3, 3, 0, 3, 3, 3, 3, 3, 3, 3, 2, 3, 3, 3, 4, 0, 4, 2, 3,
       3, 1, 4, 2, 3, 3, 4, 3, 3, 0], dtype=int32)
```

3.2.2 Clustering of Train Stations using Hierarchical Clustering Algorithm

Use scipy library to perform agglomerative approach-based Hierarchical Clustering to group the train stations into 5 clusters.

In the function call of `scipy.cluster.hierarchy.linkage()`, the linkage parameter value of "average" is used while in the function call of `scipy.cluster.hierarchy.fcluster()`, the k and criterion parameters are set to 5 and 'maxclust' are used in order to perform hierarchical clustering of up to 5 clusters.

```
import scipy
leng = hc_feature_mtx.shape[0]
D = scipy.zeros([leng,leng])
for i in range(leng):
    for j in range(leng):
        D[i,j] = scipy.spatial.distance.euclidean(hc_feature_mtx[i], hc_feature_mtx[j])
```

Use average method as the linkage

```
from scipy.cluster import hierarchy
import pylab
import scipy.cluster.hierarchy
Z = hierarchy.linkage(D, 'average')
```

Forms flat clusters from the hierarchical clustering defined by the linkage matrix Z

```
from scipy.cluster.hierarchy import fcluster

# Form no more than 5 flat clusters
hc_k = 5
hc_clusters = fcluster(Z, hc_k, criterion='maxclust')
hc_clusters

array([1, 1, 1, 1, 1, 1, 3, 3, 1, 1, 1, 1, 5, 1, 1, 1, 1, 1, 1, 1, 5,
       1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 5, 5, 2,
       1, 1, 1, 1, 1, 1, 1, 5, 5, 5, 1, 5, 5, 1, 1, 1, 1, 1, 1, 1, 2,
       1, 1, 4, 4, 1, 1, 1, 1, 1, 1, 5, 5, 1, 1, 1, 1, 1, 1, 5, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 5, 1, 1, 1, 1, 2, 5, 1, 1, 1, 1, 1, 1, 1,
       5, 1, 1, 1, 1, 5, 5, 2, 1, 1, 1, 1, 1, 1, 5, 1, 1, 3, 3, 1, 1, 1,
       1, 5, 5, 1, 1, 1, 5, 5, 1, 1, 5, 1, 1, 1, 1, 1, 1, 5, 1, 5, 1,
       5, 5, 1, 1, 1, 5, 1, 1, 1, 1, 5, 5, 1, 5, 1, 1, 5, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], dtype=int32)
```

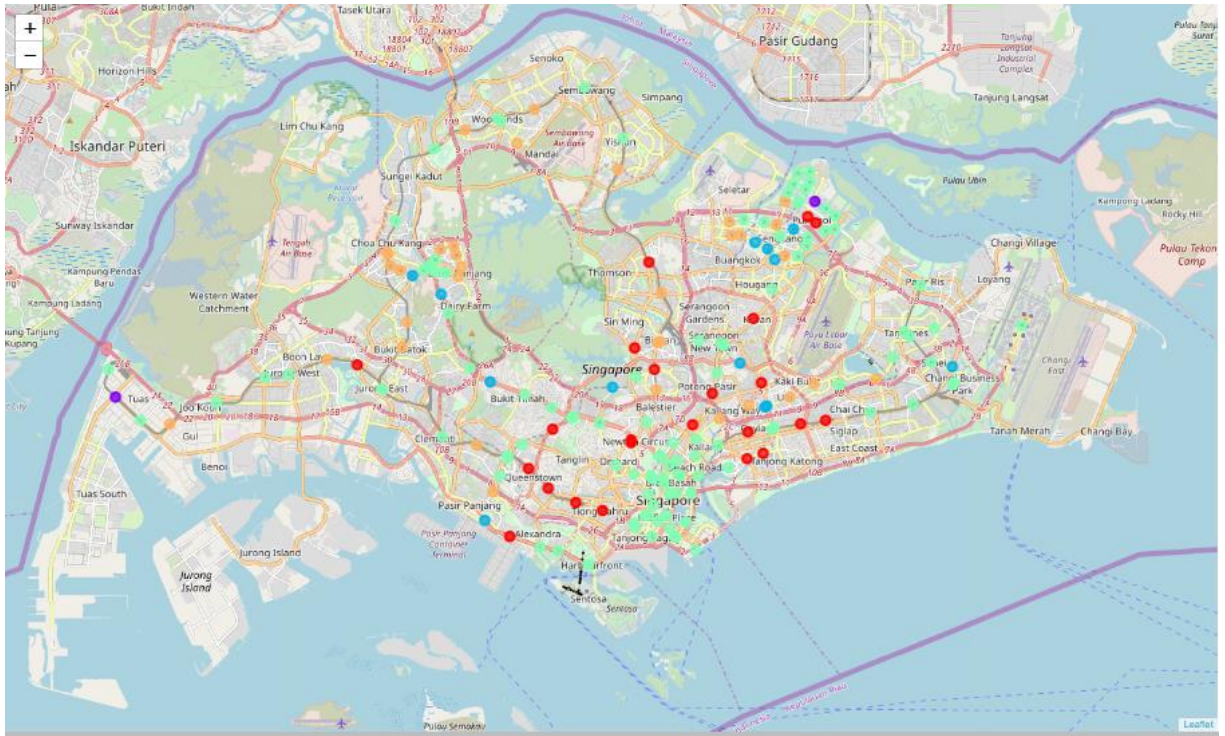
4. Results

4.1 Train Station clusters obtained via k-Means Clustering algorithm, with k=5

Cluster Label	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	4	ADMIRALTY MRT STATION (NS10)	Supermarket	Halal Restaurant	Food Court	Coffee Shop
1	0	ALJUNIED MRT STATION (EW9)	Chinese Restaurant	Vegetarian / Vegan Restaurant	Cafe	Noodle House
2	4	ANG MO KIO MRT STATION (NS16)	Food Court	Coffee Shop	Dessert Shop	Snack Place
3	3	BAKAU LRT STATION (SE3)	Trail	Food Stand	Food & Drink Shop	Fast Food Restaurant
4	4	BANGKIT LRT STATION (BP9)	Food Court	Fruit & Vegetable Store	Bike Trail	Spa
...
182	4	WOODLANDS SOUTH MRT STATION (TE3)	Food Court	Park	Trail	Gym / Fitness Center
183	3	WOODLEIGH MRT STATION (NE11)	Cafe	Convenience Store	Chinese Restaurant	Soccer Field
184	3	YEW TEE MRT STATION (NS5)	Fast Food Restaurant	Diner	Shopping Mall	Pool
185	0	YIO CHU KANG MRT STATION (NS15)	Food Court	Chinese Restaurant	Noodle House	Coffee Shop
186	3	YISHUN MRT STATION (NS13)	Chinese Restaurant	Food Court	Italian Restaurant	Fried Chicken Joint

187 rows × 7 columns

4.1.1 Data Visualization



4.1.2 Examining cluster's characteristics

Cluster 1 – marked with red circle in the above map and consists of 23 train stations and characterized by having plenty of restaurants, particularly Chinese & Indian restaurants

Cluster 1

```
df_stnloc_venues_merged_km.loc[df_stnloc_venues_merged_km['Cluster Label'] == 0, df_stnloc_venues_merged_km.columns[[0] + list(range(4, df_stnloc_venues_merged_km.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	ALJUNIED MRT STATION (EW9)	Chinese Restaurant	Vegetarian / Vegan Restaurant	Cafe	Noodle House	Asian Restaurant
16	BOON KENG MRT STATION (NE9)	Chinese Restaurant	Noodle House	Seafood Restaurant	Fast Food Restaurant	Bakery
20	BRADDELL MRT STATION (NS18)	Noodle House	Chinese Restaurant	Food Court	Cafe	Thai Restaurant
38	CHINESE GARDEN MRT STATION (EW25)	Chinese Restaurant	Coffee Shop	Indian Restaurant	Food Court	Cafe
45	COMMONWEALTH MRT STATION (EW20)	Chinese Restaurant	Coffee Shop	Asian Restaurant	Noodle House	Indian Restaurant
48	COVE LRT STATION (PE1)	Indian Restaurant	Coffee Shop	Supermarket	Gym	Chinese Restaurant
49	DAKOTA MRT STATION (CC8)	Noodle House	Chinese Restaurant	Asian Restaurant	Seafood Restaurant	Dessert Shop
57	EUNOS MRT STATION (EW7)	Chinese Restaurant	Noodle House	Coffee Shop	Breakfast Spot	Asian Restaurant
63	FARRER ROAD MRT STATION (CC20)	Chinese Restaurant	Gym / Fitness Center	Food Court	Noodle House	Metro Station
84	KEMBANGAN MRT STATION (EW6)	Indian Restaurant	Chinese Restaurant	Asian Restaurant	Bistro	Shopping Mall
88	KOVAN MRT STATION (NE13)	Chinese Restaurant	Noodle House	Food Court	Asian Restaurant	Cafe
104	MARYMOUNT MRT STATION (CC16)	Chinese Restaurant	Bakery	Outdoors & Recreation	Food Court	Thai Restaurant
106	MERIDIAN LRT STATION (PE2)	Garden	Chinese Restaurant	Coffee Shop	Casino	Yoga Studio
107	MOUNTBATTEN MRT STATION (CC7)	Noodle House	Food Court	Chinese Restaurant	Fast Food Restaurant	Dessert Shop
108	NEWTON MRT STATION (DT11)	Chinese Restaurant	Seafood Restaurant	Italian Restaurant	Hotel Bar	Indian Restaurant
109	NEWTON MRT STATION (NS21)	Chinese Restaurant	Italian Restaurant	Hotel Bar	Seafood Restaurant	Indian Restaurant
118	PASIR PANJANG MRT STATION (CC26)	Chinese Restaurant	Food Court	Thai Restaurant	Indian Restaurant	Asian Restaurant
126	POTONG PASIR MRT STATION (NE10)	Chinese Restaurant	Convenience Store	Coffee Shop	Food Court	Fast Food Restaurant
132	QUEENSTOWN MRT STATION (EW19)	Chinese Restaurant	Food Court	Train Station	Spa	Pool
136	REDHILL MRT STATION (EW18)	Chinese Restaurant	Coffee Shop	Park	Train Station	Malay Restaurant
158	TAI SENG MRT STATION (CC11)	Chinese Restaurant	Cafe	Food Court	Coffee Shop	Seafood Restaurant
172	TIONG BAHRU MRT STATION (EW17)	Chinese Restaurant	Coffee Shop	Food Court	Bakery	Japanese Restaurant
185	YIO CHU KANG MRT STATION (NS15)	Food Court	Chinese Restaurant	Noodle House	Coffee Shop	Seafood Restaurant

Cluster 2 – marked with purple circle in the above map and consists of only 2 train stations and does not exhibit any obvious characteristic other than both are having yoga studio.

Cluster 2

```
df_stnloc_venues_merged_kn.loc[df_stnloc_venues_merged_kn['Cluster Label'] == 1, df_stnloc_venues_merged_kn.columns[[0] + list(range(4, df_stnloc_venues_merged_kn.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
	50	DAMAI LRT STATION (PE7)	High School	Tea Room	Yoga Studio	Event Space
	177	TUAS WEST ROAD MRT STATION (EW32)	Malay Restaurant	Yoga Studio	Flower Shop	Fast Food Restaurant
						Field

Cluster 3 – marked with light blue circle in the above map and consists of 13 train stations and mainly characterized by having bus station/stop or gym

Cluster 3

```
df_stnloc_venues_merged_kn.loc[df_stnloc_venues_merged_kn['Cluster Label'] == 2, df_stnloc_venues_merged_kn.columns[[0] + list(range(4, df_stnloc_venues_merged_kn.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
	5	BARTLEY MRT STATION (CC12)	Pet Store	Bus Station	Noodle House	Metro Station
	22	BUANGKOK MRT STATION (NE15)	Pharmacy	Bus Station	Cricket Ground	Metro Station
	26	BUKIT BROWN MRT STATION (CC18)	Gym	Non-Profit	Flower Shop	Farmers Market
	33	CASHEW MRT STATION (DT2)	Bus Station	Convenience Store	Seafood Restaurant	Pool
	46	COMPASSVALE LRT STATION (SE1)	Sculpture Garden	Garden	Chinese Restaurant	Playground
	70	HAW PAR VILLA MRT STATION (CC25)	Bus Station	Convenience Store	Pet Store	Food Court
	87	KING ALBERT PARK MRT STATION (DT6)	Bus Station	Gym	Gym / Fitness Center	Indian Restaurant
	98	MACPHERSON MRT STATION (CC10)	Gym	Food Court	Bus Station	Diner
	99	MACPHERSON MRT STATION (DT26)	Bus Station	Vegetarian / Vegan Restaurant	Asian Restaurant	Coffee Shop
	137	RENJONG LRT STATION (SW8)	Grocery Store	Bus Line	Bus Station	Metro Station
	167	TECK WHYE LRT STATION (BP4)	Bus Station	Gym	Asian Restaurant	Theater
	174	TONGKANG LRT STATION (SW7)	Bus Station	Basketball Court	Athletics & Sports	Bookstore
	179	UPPER CHANGI MRT STATION (DT34)	Bus Stop	Pool	Bus Station	Cafeteria
						Playground

Cluster 4 – marked with light green in the above map. It is the biggest cluster consisting 115 train stations and somewhat characterized by having café, hotel, Japanese/Korean restaurant in their top 5 most common venue categories.

Cluster 4

```
df_stnloc_venues_merged_kn.loc[df_stnloc_venues_merged_kn['Cluster Label'] == 3, df_stnloc_venues_merged_kn.columns[[0] + list(range(4, df_stnloc_venues_merged_kn.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
	3	BAKAU LRT STATION (SE3)	Trail	Food Stand	Food & Drink Shop	Fast Food Restaurant
	6	BAYFRONT MRT STATION (DT16)	Hotel	Boutique	Bridge	Tea Room
	7	BAYFRONT MRT STATION (CE1)	Hotel	Boutique	Bridge	Tea Room
	8	BEAUTY WORLD MRT STATION (DT5)	Korean Restaurant	Cafe	Chinese Restaurant	Food Court
	9	BEDOK MRT STATION (EW5)	Chinese Restaurant	Coffee Shop	Japanese Restaurant	Food Court

	180	WOODLANDS MRT STATION (NS9)	Japanese Restaurant	Cafe	Coffee Shop	Indian Restaurant
	181	WOODLANDS MRT STATION (TE2)	Japanese Restaurant	Cafe	Electronics Store	Food Court
	183	WOODLEIGH MRT STATION (NE11)	Cafe	Convenience Store	Chinese Restaurant	Soccer Field
	184	YEW TEE MRT STATION (NS5)	Fast Food Restaurant	Diner	Shopping Mall	Pool
	186	YISHUN MRT STATION (NS13)	Chinese Restaurant	Food Court	Italian Restaurant	Fried Chicken Joint
						Grocery Store

115 rows x 6 columns

Cluster 5 – marked with light orange circle in the above map and consists of 34 train stations, mainly characterized by having food courts and coffee shops

Cluster 5 f

```
df_stnloc_venues_merged_kn.loc[df_stnloc_venues_merged_kn['Cluster Label'] == 4, df_stnloc_venues_merged_kn.columns[[0] + list(range(4, df_stnloc_venues_merged_kn.shape[1]))]]
```

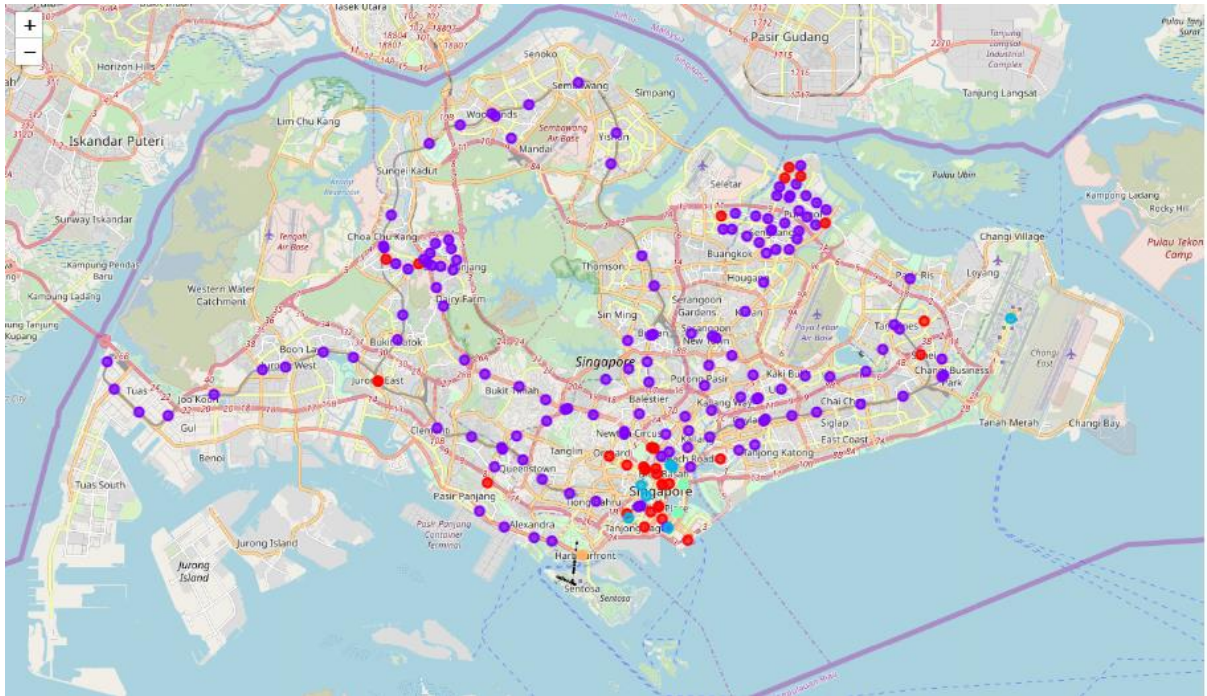
	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	ADMIRALTY MRT STATION (NS10)	Supermarket	Halal Restaurant	Food Court	Coffee Shop	Yoga Studio
2	ANG MO KIO MRT STATION (NS16)	Food Court	Coffee Shop	Dessert Shop	Snack Place	Supermarket
4	BANGKIT LRT STATION (BP9)	Food Court	Fruit & Vegetable Store	Bike Trail	Spa	Park
11	BEDOK RESERVOIR MRT STATION (DT30)	Noodle House	Park	Supermarket	Food Court	Asian Restaurant
14	BISHAN MRT STATION (CC15)	Coffee Shop	Food Court	Bubble Tea Shop	Chinese Restaurant	Japanese Restaurant
15	BISHAN MRT STATION (NS17)	Coffee Shop	Food Court	Bubble Tea Shop	Chinese Restaurant	Japanese Restaurant
25	BUKIT BATOK MRT STATION (NS2)	Coffee Shop	Chinese Restaurant	Food Court	Bakery	Spa
27	BUKIT GOMBAK MRT STATION (NS3)	Food Court	Stadium	Convenience Store	Train Station	Sandwich Place
35	CHENG LIM LRT STATION (SW1)	Fast Food Restaurant	Coffee Shop	Asian Restaurant	Pastery Shop	Food Court
39	CHOA CHU KANG LRT STATION (BP1)	Coffee Shop	Fast Food Restaurant	Furniture / Home Store	Asian Restaurant	Playground
40	CHOA CHU KANG MRT STATION (NS4)	Coffee Shop	Fast Food Restaurant	Furniture / Home Store	Asian Restaurant	Playground
54	DOVER MRT STATION (EW22)	College Cafeteria	Fast Food Restaurant	Food Court	Sandwich Place	Coffee Shop
60	FAJAR LRT STATION (BP10)	Fast Food Restaurant	College Cafeteria	Food Court	Coffee Shop	Yoga Studio
64	FEINVALE LRT STATION (SW5)	Coffee Shop	Food Court	Asian Restaurant	Indian Restaurant	Cafe
66	GEYLANG BAHRU MRT STATION (DT24)	Food Court	Coffee Shop	Department Store	Cafe	Bus Station
67	GUL CIRCLE MRT STATION (EW30)	Electronics Store	Train Station	Food Court	Coffee Shop	Flea Market
75	JELAPANG LRT STATION (BP12)	Convenience Store	Food Court	Park	Fast Food Restaurant	Bus Station
80	KAO BUKIT MRT STATION (DT28)	Coffee Shop	Food Court	Convenience Store	Bike Shop	Skate Park
83	KEAT HOONG LRT STATION (BP3)	Fast Food Restaurant	Bus Stop	Grocery Store	Delis / Bodega	Cafe
85	KENT RIDGE MRT STATION (CC24)	Coffee Shop	Vietnamese Restaurant	Sandwich Place	Korean Restaurant	Medical Center
86	KHARIB MRT STATION (NS14)	Asian Restaurant	Coffee Shop	Supermarket	Convenience Store	Bakery
92	LAKESIDE MRT STATION (EW26)	Convenience Store	Snack Place	Coffee Shop	Vegetarian / Vegan Restaurant	Farmers Market
94	LAYAR LRT STATION (SW6)	Coffee Shop	Food Court	Asian Restaurant	Bakery	Indian Restaurant
103	MARSHLING MRT STATION (NS8)	Grocery Store	Pizza Place	Fast Food Restaurant	Hainan Restaurant	Bus Stop
105	MATTAR MRT STATION (DT25)	Food Court	Coffee Shop	Bus Station	Vegetarian / Vegan Restaurant	Park
122	PENDING LRT STATION (BP8)	Food Court	Fruit & Vegetable Store	Miscellaneous Shop	Park	Market
135	RANGGANG LRT STATION (SE5)	Food Court	Fast Food Restaurant	Gym	Metro Station	Wings Joint
143	SEGAR LRT STATION (BP11)	Fast Food Restaurant	Food Court	Coffee Shop	Yoga Studio	Flower Shop
153	SIO TECK LRT STATION (PW7)	Market	Food Court	Yoga Studio	Flower Shop	Fast Food Restaurant
154	SOUTH VIEW LRT STATION (BP2)	Fast Food Restaurant	Furniture / Home Store	Bakery	Coffee Shop	Paper / Office Supplies Store
171	THANGGAM LRT STATION (SW4)	Coffee Shop	Bus Stop	Cupcake Shop	Southern / Soul Food Restaurant	Dessert Shop
173	TODD MOUNTAIN MRT STATION (NS19)	Coffee Shop	Snack Place	Food Court	Dessert Shop	Pool
178	UBI MRT STATION (DT27)	Food Court	Asian Restaurant	Bus Station	Restaurant	Chinese Restaurant
182	WOODLANDS SOUTH MRT STATION (TE3)	Food Court	Park	Trail	Gym / Fitness Center	Video Store

4.2 Train Station Clusters obtained via Hierarchical Clustering with agglomerative approach, up to 5 flat clusters formed

Cluster Label	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	1	ADMIRALTY MRT STATION (NS10)	Supermarket	Halal Restaurant	Food Court	Coffee Shop
1	1	ALJUNIED MRT STATION (EW9)	Chinese Restaurant	Vegetarian / Vegan Restaurant	Cafe	Noodle House
2	1	ANG MO KIO MRT STATION (NS16)	Food Court	Coffee Shop	Dessert Shop	Snack Place
3	1	BAKAU LRT STATION (SE3)	Trail	Food Stand	Food & Drink Shop	Fast Food Restaurant
4	1	BANGKIT LRT STATION (BP9)	Food Court	Fruit & Vegetable Store	Bike Trail	Spa
...
182	1	WOODLANDS SOUTH MRT STATION (TE3)	Food Court	Park	Trail	Gym / Fitness Center
183	1	WOODLEIGH MRT STATION (NE11)	Cafe	Convenience Store	Chinese Restaurant	Soccer Field
184	1	YEW TEE MRT STATION (NS5)	Fast Food Restaurant	Diner	Shopping Mall	Pool
185	1	YIO CHU KANG MRT STATION (NS15)	Food Court	Chinese Restaurant	Noodle House	Coffee Shop
186	1	YISHUN MRT STATION (NS13)	Chinese Restaurant	Food Court	Italian Restaurant	Fried Chicken Joint

187 rows × 7 columns

4.2.1 Data Visualization



4.2.2 Examining cluster's characteristics

Cluster 1 – marked with purple circles in the above map and it is the biggest cluster comprising of 142 stations, primarily characterized by having eating places e.g. food courts, Chinese restaurants, fast food restaurants, coffee shops.

Cluster 1

```
df_stnloc_venues_merged_hc.loc[df_stnloc_venues_merged_hc['Cluster Label'] == 1, df_stnloc_venues_merged_hc.columns[[0] + list(range(4, df_stnloc_venues_merged_hc.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	ADMIRALTY MRT STATION (NS10)	Supermarket	Halal Restaurant	Food Court	Coffee Shop	Yoga Studio
1	ALJUNIED MRT STATION (EW9)	Chinese Restaurant	Vegetarian / Vegan Restaurant	Café	Noodle House	Asian Restaurant
2	ANG MO KIO MRT STATION (NS16)	Food Court	Coffee Shop	Dessert Shop	Snack Place	Supermarket
3	BAKAU LRT STATION (SE3)	Trail	Food Stand	Food & Drink Shop	Fast Food Restaurant	Sandwich Place
4	BANGKIT LRT STATION (BP9)	Food Court	Fruit & Vegetable Store	Bike Trail	Spa	Park
...
182	WOODLANDS SOUTH MRT STATION (TE3)	Food Court	Park	Trail	Gym / Fitness Center	Video Store
183	WOODLEIGH MRT STATION (NE11)	Café	Convenience Store	Chinese Restaurant	Soccer Field	Nightclub
184	YEW TEE MRT STATION (NS5)	Fast Food Restaurant	Diner	Shopping Mall	Pool	Food Court
185	YIO CHU KANG MRT STATION (NS15)	Food Court	Chinese Restaurant	Noodle House	Coffee Shop	Seafood Restaurant
186	YISHUN MRT STATION (NS13)	Chinese Restaurant	Food Court	Italian Restaurant	Fried Chicken Joint	Grocery Store

142 rows × 6 columns

Cluster 2 – marked with light blue circles and consists of 7 stations, primarily characterized by having Japanese restaurant, hotel or bakery.

Cluster 2

```
df_stnloc_venues_merged_hc.loc[df_stnloc_venues_merged_hc['Cluster Label'] == 2, df_stnloc_venues_merged_hc.columns[[0] + list(range(4, df_stnloc_venues_merged_hc.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
23	BUGIS MRT STATION (DT14)	Bakery	Café	Hotel	Dessert Shop	Coffee Shop
24	BUGIS MRT STATION (EW12)	Bakery	Dessert Shop	Hotel	Japanese Restaurant	Sushi Restaurant
34	CHANGI AIRPORT MRT STATION (CG2)	Airport Lounge	Airport	Garden	Coffee Shop	Duty-free Shop
43	CLARKE QUAY MRT STATION (NE5)	Hotel	Japanese Restaurant	Yoga Studio	Nightclub	Lounge
65	FORT CANNING MRT STATION (DT20)	Japanese Restaurant	Hotel	Nightclub	Vegetarian / Vegan Restaurant	Bakery
101	MARINA BAY MRT STATION (CE2)	Coffee Shop	Japanese Restaurant	Sandwich Place	Bar	Chinese Restaurant
117	OUTRAM PARK MRT STATION (EW16)	Italian Restaurant	Japanese Restaurant	Café	Bakery	Burger Joint

Cluster 3 – marked with light green circles and consists of 4 train stations, characterized by having hotel as the 1st or 2nd most common venue category.

Cluster 3

```
df_stnloc_venues_merged_hc.loc[df_stnloc_venues_merged_hc['Cluster Label'] == 3, df_stnloc_venues_merged_hc.columns[[0] + list(range(4, df_stnloc_venues_merged_hc.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
6	BAYFRONT MRT STATION (DT16)	Hotel	Boutique	Bridge	Tea Room	Casino
7	BAYFRONT MRT STATION (CE1)	Hotel	Boutique	Bridge	Tea Room	Casino
127	PROMENADE MRT STATION (DT15)	Hotel	Hotel Bar	Japanese Restaurant	Buffet	Event Space
128	PROMENADE MRT STATION (CC4)	Japanese Restaurant	Hotel	Hotel Bar	Buffet	Event Space

Cluster 4 – marked with light orange circles and consists of 2 train stations located very near to each other, characterized by having “clothing store” as the 1st most common venue category.

Cluster 4

```
df_stnloc_venues_merged_hc.loc[df_stnloc_venues_merged_hc['Cluster Label'] == 4, df_stnloc_venues_merged_hc.columns[[0] + list(range(4, df_stnloc_venues_merged_hc.shape[1]))]]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
68	HARBOURFRONT MRT STATION (NE1)	Clothing Store	Chinese Restaurant	German Restaurant	Cosmetics Shop	Multiplex
69	HARBOURFRONT MRT STATION (CC29)	Clothing Store	Chinese Restaurant	German Restaurant	Cosmetics Shop	Multiplex

Cluster 5 – marked with red circles in the above map and consists of 32 train stations, characterized by most of them having café, coffee shop or hotel as their top 5 most common venue categories.

Cluster 5

```
df_stnloc_venues_merged.loc[df_stnloc_venues_merged['Cluster Label'] == 5, df_stnloc_venues_merged.columns[0]] + list(range(4, df_stnloc_venues_merged.shape[1]))]
```

	Station ID	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
12	BENCOLEN MRT STATION (DT21)	Cafe	Hotel	Japanese Restaurant	Coffee Shop	Restaurant
21	BRAS BASAH MRT STATION (CC2)	Hotel	Cafe	Chinese Restaurant	Restaurant	Ice Cream Shop
41	CITY HALL MRT STATION (EW13)	Hotel	Cafe	Shopping Mall	French Restaurant	Cocktail Bar
42	CITY HALL MRT STATION (NS25)	Hotel	Cafe	Shopping Mall	French Restaurant	Cocktail Bar
51	DHOBY GHAT MRT STATION (NS24)	Cafe	Hotel	Japanese Restaurant	Cosmetics Shop	Park
52	DHOBY GHAT MRT STATION (NS6)	Japanese Restaurant	Hotel	Cafe	Dessert Shop	Cosmetics Shop
53	DHOBY GHAT MRT STATION (CC1)	Cafe	Hotel	Japanese Restaurant	Dessert Shop	Cosmetics Shop
55	DOWNTOWN MRT STATION (DT17)	Cafe	Hotel	Mexican Restaurant	Pub	Gym
56	ESPLANADE MRT STATION (CC3)	Hotel	Concert Hall	Bar	Dumpling Restaurant	Shopping Mall
77	JURONG EAST MRT STATION (EW24)	Coffee Shop	Chinese Restaurant	Japanese Restaurant	Bubble Tea Shop	Shopping Mall
78	JURONG EAST MRT STATION (NS1)	Coffee Shop	Chinese Restaurant	Japanese Restaurant	Bubble Tea Shop	Shopping Mall
85	KENT RIDGE MRT STATION (CC24)	Coffee Shop	Vietnamese Restaurant	Sandwich Place	Korean Restaurant	Medical Center
96	LITTLE INDIA MRT STATION (NE7)	Indian Restaurant	Vegetarian / Vegan Restaurant	Hotel	Bakery	Breakfast Spot
102	MARINA SOUTH PIER MRT STATION (NS28)	Boat or Ferry	Mexican Restaurant	Gastropub	Road	Metro Station
110	NIBONG LRT STATION (PW5)	Soccer Field	Bar	Farm	Steakhouse	Chinese Restaurant
115	ORCHARD MRT STATION (NS22)	Boutique	Bakery	Chinese Restaurant	Coffee Shop	Sushi Restaurant
116	OUTRAM PARK MRT STATION (NE3)	Chinese Restaurant	Japanese Restaurant	Burger Joint	Wine Bar	Modern European Restaurant
124	PHOENIX LRT STATION (BP5)	Trail	Vegetarian / Vegan Restaurant	Chinese Breakfast Place	Thai Restaurant	Light Rail Station
133	RAFFLES PLACE MRT STATION (EW14)	Japanese Restaurant	Cafe	Coffee Shop	Chinese Restaurant	Cocktail Bar
134	RAFFLES PLACE MRT STATION (NS26)	Japanese Restaurant	Cafe	Coffee Shop	Chinese Restaurant	Cocktail Bar
138	RIVIERA LRT STATION (PW4)	Gastropub	Fast Food Restaurant	Seafood Restaurant	Fishing Spot	Pool Hall
139	ROCHOR MRT STATION (DT13)	Indian Restaurant	Vegetarian / Vegan Restaurant	Hotel	Museum	Coffee Shop
142	SAMUDERA LRT STATION (PW4)	Soccer Field	Bar	Sporting Goods Shop	Harbor / Marina	Steakhouse
150	SIMEI MRT STATION (EW3)	Chinese Restaurant	Shopping Mall	Japanese Restaurant	Coffee Shop	Juice Bar
152	SOMERSET MRT STATION (NS23)	Japanese Restaurant	Wine Bar	Hotel	Clothing Store	Coffee Shop
154	SOUTH VIEW LRT STATION (BP2)	Fast Food Restaurant	Furniture / Home Store	Bakery	Coffee Shop	Paper / Office Supplies Store
155	STADIUM MRT STATION (CC6)	Stadium	Coffee Shop	Soup Place	Japanese Restaurant	Clothing Store
159	TAMPINES EAST MRT STATION (DT33)	Coffee Shop	Indian Restaurant	Rock Club	South Indian Restaurant	Food & Drink Shop
165	TANJONG PAGAR MRT STATION (EW15)	Japanese Restaurant	Coffee Shop	Bakery	Hotel	Barren Restaurant
166	TECK LEE LRT STATION (PW2)	Fast Food Restaurant	Light Rail Station	Yoga Studio	Trail	Pool
168	TELOK AYER MRT STATION (DT18)	Japanese Restaurant	Korean Restaurant	Restaurant	Wine Bar	Coffee Shop
171	THANGGAM LRT STATION (SW4)	Coffee Shop	Bus Stop	Cupcake Shop	Southern / Soul Food Restaurant	Dessert Shop

5. Discussion

By comparing the outcome of clustering using k-means clustering algorithm and the hierarchical clustering algorithm, we have the following observations:

- 1) Even though both the clustering algorithms are set up to produce 5 clusters, the clustering outcomes are quite different.
- 2) There is a dominant cluster which covers a big majority of the train station, for instance the Cluster 4 of k-means clustering (includes 114 out of 187 stations) and Cluster 1 of hierarchical clustering (includes 143 out of 187 stations). However, the main characteristics of these two dominant clusters are quite different. The dominant cluster of hierarchical clustering is primarily characterized by having 'eating places' that include food courts, Chinese restaurants, fast food restaurants, coffee shops and etc. On the other hand, the dominant cluster of k-means clustering does not exhibit any obvious characteristic, it is more like a grouping of stations mostly having café, hotel, Japanese or Korean restaurant as their 1st or 2nd most common venue categories.
- 3) Besides both clustering algorithms produced a dominant cluster, both also produced a insignificant cluster which contains only two train stations, i.e Cluster 3 of k-means clustering and Cluster 4 of hierarchical clustering. Again, these two insignificant clusters are pretty different.

It is unclear to the author of this report at this stage what are the main factors contributing to the significantly different clustering outcome of these two algorithms. The lack of venues data of certain train stations, the values used for the clustering parameters (e.g. the number of clusters, linkage method) in each clustering algorithm, the inherent differences between the algorithm and etc, could potentially be the reasons that explain the differences in the clustering outcomes.

6. Conclusion

The analysis of the venue category data of the neighborhood venues of each MRT/LRT train stations in Singapore as presented in this report allows us to find out the top 5 most common venue categories in the neighborhood of each train station.

The clustering of the train stations either by k-means clustering algorithm or hierarchical clustering algorithm provides another guiding means for user to identify a group of train stations with similar characteristic (in terms of their most common venue categories) so as to narrow down the selection of train station of their interest. For instance, if a user interested in opening a Chinese restaurant in a train station's neighborhood with considerable less competition, he/she could base on the clustering outcome of k-means clustering to explore the train stations in Cluster 2 or 3, of which "eating venues" are not of the clusters' most common venue categories. Alternatively, he/she can make use of the clustering outcome of hierarchical clustering and tries to explore business opportunity in Cluster 3, 4 or 5.

Appendix

This list of the top 5 common venue categories and their associated frequency of occurrence of each MRT/LRT station in Singapore is given below:

----ADMIRALTY MRT STATION (NS10)----

	venue	freq
0	Supermarket	0.4
1	Coffee Shop	0.2
2	Food Court	0.2
3	Halal Restaurant	0.2
4	Paper / Office Supplies Store	0.0

----ALJUNIED MRT STATION (EW9)----

	venue	freq
0	Chinese Restaurant	0.13
1	Café	0.07
2	Asian Restaurant	0.07
3	Noodle House	0.07
4	Vegetarian / Vegan Restaurant	0.07

----ANG MO KIO MRT STATION (NS16)----

	venue	freq
0	Coffee Shop	0.10
1	Food Court	0.10
2	Dessert Shop	0.08
3	Japanese Restaurant	0.05
4	Snack Place	0.05

----BAKAU LRT STATION (SE3)----

	venue	freq
0	Fast Food Restaurant	0.08
1	Food Stand	0.08
2	Shopping Mall	0.08
3	Trail	0.08
4	Sandwich Place	0.08

----BANGKIT LRT STATION (BP9)----

	venue	freq
0	Food Court	0.18
1	Market	0.09
2	Bike Trail	0.09
3	Vegetarian / Vegan Restaurant	0.09
4	Miscellaneous Shop	0.09

----BARTLEY MRT STATION (CC12)----

	venue	freq
0	Pet Store	0.3
1	Bus Station	0.3
2	Noodle House	0.2
3	Metro Station	0.1
4	Café	0.1

----BAYFRONT MRT STATION (CE1)----

	venue	freq
0	Hotel	0.08
1	Boutique	0.08
2	Bridge	0.04
3	Casino	0.04
4	Theater	0.04

----BAYFRONT MRT STATION (DT16)----

	venue	freq
0	Hotel	0.08
1	Boutique	0.08
2	Bridge	0.04
3	Casino	0.04
4	Theater	0.04

----BEAUTY WORLD MRT STATION (DT5)----

	venue	freq
0	Korean Restaurant	0.12
1	Chinese Restaurant	0.12
2	Café	0.12
3	Food Court	0.06
4	Indian Restaurant	0.04

----BEDOK MRT STATION (EW5)----

	venue	freq
0	Chinese Restaurant	0.08
1	Japanese Restaurant	0.06
2	Coffee Shop	0.06
3	Food Court	0.04
4	Sandwich Place	0.04

----BEDOK NORTH MRT STATION (DT29)----

	venue	freq
0	Food Court	0.11
1	Café	0.06
2	Fast Food Restaurant	0.06
3	Pet Store	0.06
4	Sandwich Place	0.06

----BEDOK RESERVOIR MRT STATION (DT30)----

	venue	freq
0	Asian Restaurant	0.2
1	Food Court	0.2
2	Supermarket	0.2
3	Noodle House	0.2
4	Park	0.2

----BENCOOLEN MRT STATION (DT21)----

	venue	freq
0	Café	0.14
1	Hotel	0.08
2	Japanese Restaurant	0.06
3	Ice Cream Shop	0.04
4	Vegetarian / Vegan Restaurant	0.04

----BENDEMEER MRT STATION (DT23)----

	venue	freq
0	Hostel	0.17
1	BBQ Joint	0.13
2	Coffee Shop	0.09
3	Vegetarian / Vegan Restaurant	0.09
4	Restaurant	0.09

----BISHAN MRT STATION (CC15)----

	venue	freq
0	Coffee Shop	0.12
1	Food Court	0.09
2	Chinese Restaurant	0.07
3	Bubble Tea Shop	0.07
4	Supermarket	0.05

----BISHAN MRT STATION (NS17)----

	venue	freq
0	Coffee Shop	0.12
1	Food Court	0.09
2	Bubble Tea Shop	0.07
3	Chinese Restaurant	0.07
4	Electronics Store	0.05

----BOON KENG MRT STATION (NE9)----

	venue	freq
0	Noodle House	0.16
1	Chinese Restaurant	0.16
2	Bakery	0.08
3	Seafood Restaurant	0.08
4	Coffee Shop	0.08

----BOON LAY MRT STATION (EW27)----

	venue	freq
0	Asian Restaurant	0.14
1	Japanese Restaurant	0.12
2	Fast Food Restaurant	0.10
3	Chinese Restaurant	0.08
4	Coffee Shop	0.06

----BOTANIC GARDENS MRT STATION (CC19)----

	venue	freq
0	Café	0.09
1	Bakery	0.09
2	Asian Restaurant	0.09
3	Noodle House	0.06
4	Supermarket	0.03

----BOTANIC GARDENS MRT STATION (DT9)----

	venue	freq
0	Café	0.09
1	Asian Restaurant	0.09
2	Bakery	0.06
3	Noodle House	0.06
4	Supermarket	0.03

----BRADDELL MRT STATION (NS18)----

	venue	freq
0	Noodle House	0.13
1	Chinese Restaurant	0.10
2	Food Court	0.10
3	Café	0.08
4	Bakery	0.05

----BRAS BASAH MRT STATION (CC2)----

	venue	freq
0	Hotel	0.12
1	Café	0.10
2	Chinese Restaurant	0.08
3	Restaurant	0.04
4	Coffee Shop	0.04

----BUANGKOK MRT STATION (NE15)----

	venue	freq
0	Bus Station	0.15
1	Pharmacy	0.15
2	Cricket Ground	0.08
3	BBQ Joint	0.08
4	Fast Food Restaurant	0.08

----BUGIS MRT STATION (DT14)----

	venue	freq
0	Bakery	0.08
1	Dessert Shop	0.06
2	Café	0.06
3	Hotel	0.06
4	Coffee Shop	0.04

----BUGIS MRT STATION (EW12)----

	venue	freq
0	Bakery	0.08
1	Dessert Shop	0.06
2	Sushi Restaurant	0.04
3	Japanese Restaurant	0.04
4	Café	0.04

----BUKIT BATOK MRT STATION (NS2)----

	venue	freq
0	Coffee Shop	0.16
1	Chinese Restaurant	0.08
2	Food Court	0.08
3	Spa	0.04
4	Mobile Phone Shop	0.04

----BUKIT BROWN MRT STATION (CC18)----

	venue	freq
0	Gym	0.5
1	Non-Profit	0.5
2	ATM	0.0
3	Other Great Outdoors	0.0

4 Paper / Office Supplies Store 0.0

----BUKIT GOMBAK MRT STATION (NS3)----

	venue	freq
0	Food Court	0.19
1	Stadium	0.10
2	Sandwich Place	0.05
3	Seafood Restaurant	0.05
4	Chinese Restaurant	0.05

----BUKIT PANJANG LRT STATION (BP6)----

	venue	freq
0	Fast Food Restaurant	0.06
1	Café	0.06
2	Coffee Shop	0.06
3	Sushi Restaurant	0.06
4	Asian Restaurant	0.06

----BUKIT PANJANG MRT STATION (DT1)----

	venue	freq
0	Café	0.07
1	Fast Food Restaurant	0.07
2	Sushi Restaurant	0.07
3	Coffee Shop	0.07
4	Asian Restaurant	0.07

----BUONA VISTA MRT STATION (CC22)----

	venue	freq
0	Japanese Restaurant	0.10
1	Coffee Shop	0.08
2	Asian Restaurant	0.05
3	Indian Restaurant	0.05
4	Salad Place	0.05

----BUONA VISTA MRT STATION (EW21)----

	venue	freq
0	Japanese Restaurant	0.08
1	Indian Restaurant	0.08
2	Coffee Shop	0.06
3	Chinese Restaurant	0.06
4	Food Court	0.06

----CALDECOTT MRT STATION (CC17)----

	venue	freq
0	Flower Shop	0.55
1	Metro Station	0.18
2	Garden Center	0.09
3	Office	0.09
4	Sandwich Place	0.09

----CASHEW MRT STATION (DT2)----

	venue	freq
0	Bus Station	0.38
1	Pool	0.12
2	Seafood Restaurant	0.12

- 3 Convenience Store 0.12
- 4 Food Court 0.12

----CHANGI AIRPORT MRT STATION (CG2)----

- venue freq
- 0 Airport Lounge 0.09
- 1 Airport 0.06
- 2 Garden 0.06
- 3 Snack Place 0.04
- 4 Duty-free Shop 0.04

----CHENG LIM LRT STATION (SW1)----

- venue freq
- 0 Fast Food Restaurant 0.19
- 1 Coffee Shop 0.12
- 2 Video Store 0.06
- 3 Asian Restaurant 0.06
- 4 Shopping Mall 0.06

----CHINATOWN MRT STATION (DT19)----

- venue freq
- 0 Hostel 0.10
- 1 Chinese Restaurant 0.08
- 2 Food Court 0.08
- 3 Seafood Restaurant 0.06
- 4 Spa 0.06

----CHINATOWN MRT STATION (NE4)----

- venue freq
- 0 Hostel 0.10
- 1 Food Court 0.10
- 2 Chinese Restaurant 0.08
- 3 Seafood Restaurant 0.06
- 4 Spa 0.06

----CHINESE GARDEN MRT STATION (EW25)----

- venue freq
- 0 Chinese Restaurant 0.22
- 1 Coffee Shop 0.22
- 2 Food Court 0.11
- 3 Indian Restaurant 0.11
- 4 Train Station 0.11

----CHOA CHU KANG LRT STATION (BP1)----

- venue freq
- 0 Coffee Shop 0.20
- 1 Fast Food Restaurant 0.13
- 2 Supermarket 0.07
- 3 Thai Restaurant 0.07
- 4 Food Court 0.07

----CHOA CHU KANG MRT STATION (NS4)----

- venue freq
- 0 Coffee Shop 0.20
- 1 Fast Food Restaurant 0.13

2	Supermarket	0.07
3	Thai Restaurant	0.07
4	Food Court	0.07

----CITY HALL MRT STATION (EW13)----

	venue	freq
0	Hotel	0.08
1	Cocktail Bar	0.06
2	Café	0.06
3	Coffee Shop	0.06
4	Shopping Mall	0.06

----CITY HALL MRT STATION (NS25)----

	venue	freq
0	Hotel	0.08
1	Cocktail Bar	0.06
2	Café	0.06
3	Coffee Shop	0.06
4	Shopping Mall	0.06

----CLARKE QUAY MRT STATION (NE5)----

	venue	freq
0	Hotel	0.08
1	Japanese Restaurant	0.06
2	Yoga Studio	0.04
3	Vegetarian / Vegan Restaurant	0.04
4	Nightclub	0.04

----CLEMENTI MRT STATION (EW23)----

	venue	freq
0	Coffee Shop	0.10
1	Food Court	0.06
2	Chinese Restaurant	0.06
3	Asian Restaurant	0.06
4	Dim Sum Restaurant	0.04

----COMMONWEALTH MRT STATION (EW20)----

	venue	freq
0	Chinese Restaurant	0.14
1	Coffee Shop	0.10
2	Noodle House	0.07
3	Asian Restaurant	0.07
4	Diner	0.03

----COMPASSVALE LRT STATION (SE1)----

	venue	freq
0	Garden	0.2
1	Playground	0.2
2	Bus Station	0.2
3	Sculpture Garden	0.2
4	Chinese Restaurant	0.2

----CORAL EDGE LRT STATION (PE3)----

	venue	freq
0	Soccer Field	0.2

1	Bus Station	0.1
2	Pool Hall	0.1
3	Fast Food Restaurant	0.1
4	Café	0.1

----COVE LRT STATION (PE1)----

	venue	freq
0	Chinese Restaurant	0.14
1	Coffee Shop	0.14
2	Gym	0.14
3	Indian Restaurant	0.14
4	Seafood Restaurant	0.14

----DAKOTA MRT STATION (CC8)----

	venue	freq
0	Noodle House	0.22
1	Chinese Restaurant	0.16
2	Asian Restaurant	0.09
3	Dessert Shop	0.06
4	Seafood Restaurant	0.06

----DAMAI LRT STATION (PE7)----

	venue	freq
0	Tea Room	0.5
1	High School	0.5
2	Pastry Shop	0.0
3	Paper / Office Supplies Store	0.0
4	Pakistani Restaurant	0.0

----DHOBY GHAUT MRT STATION (CC1)----

	venue	freq
0	Café	0.12
1	Japanese Restaurant	0.06
2	Hotel	0.06
3	Cosmetics Shop	0.04
4	Dessert Shop	0.04

----DHOBY GHAUT MRT STATION (NE6)----

	venue	freq
0	Japanese Restaurant	0.08
1	Café	0.06
2	Hotel	0.06
3	Dessert Shop	0.04
4	Cosmetics Shop	0.04

----DHOBY GHAUT MRT STATION (NS24)----

	venue	freq
0	Café	0.10
1	Japanese Restaurant	0.06
2	Hotel	0.06
3	Park	0.04
4	Dessert Shop	0.04

----DOVER MRT STATION (EW22)----

	venue	freq
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0	College Cafeteria	0.29
1	Fast Food Restaurant	0.14
2	Coffee Shop	0.14
3	Sandwich Place	0.14
4	Food Court	0.14

----DOWNTOWN MRT STATION (DT17)----

	venue	freq
0	Café	0.12
1	Hotel	0.06
2	Mexican Restaurant	0.06
3	Gym	0.04
4	Japanese Restaurant	0.04

----ESPLANADE MRT STATION (CC3)----

	venue	freq
0	Hotel	0.14
1	Lounge	0.04
2	Concert Hall	0.04
3	Dumpling Restaurant	0.04
4	Shopping Mall	0.04

----EUNOS MRT STATION (EW7)----

	venue	freq
0	Chinese Restaurant	0.21
1	Noodle House	0.11
2	Coffee Shop	0.11
3	Café	0.05
4	Arts & Crafts Store	0.05

----EXPO MRT STATION (CG1)----

	venue	freq
0	Café	0.12
1	Coffee Shop	0.10
2	Japanese Restaurant	0.08
3	Chinese Restaurant	0.08
4	Fast Food Restaurant	0.06

----EXPO MRT STATION (DT35)----

	venue	freq
0	Café	0.10
1	Japanese Restaurant	0.08
2	Coffee Shop	0.08
3	Chinese Restaurant	0.08
4	Fast Food Restaurant	0.06

----FAJAR LRT STATION (BP10)----

	venue	freq
0	Food Court	0.25
1	Coffee Shop	0.25
2	College Cafeteria	0.25
3	Fast Food Restaurant	0.25
4	Pastry Shop	0.00

----FARMWAY LRT STATION (SW2)----

	venue	freq
0	Bridge	0.09
1	Sake Bar	0.09
2	Bistro	0.09
3	Gym	0.09
4	Gym / Fitness Center	0.09

----FARRER PARK MRT STATION (NE8)----

	venue	freq
0	Indian Restaurant	0.20
1	Café	0.14
2	Chinese Restaurant	0.10
3	Hotel	0.06
4	Vegetarian / Vegan Restaurant	0.06

----FARRER ROAD MRT STATION (CC20)----

	venue	freq
0	Chinese Restaurant	0.25
1	Pool	0.06
2	Convenience Store	0.06
3	Metro Station	0.06
4	Gym / Fitness Center	0.06

----FERNVALE LRT STATION (SW5)----

	venue	freq
0	Coffee Shop	0.18
1	Food Court	0.11
2	Asian Restaurant	0.07
3	Japanese Restaurant	0.04
4	Bakery	0.04

----FORT CANNING MRT STATION (DT20)----

	venue	freq
0	Japanese Restaurant	0.12
1	Hotel	0.08
2	Spa	0.04
3	Bar	0.04
4	Wine Bar	0.04

----GEYLANG BAHRU MRT STATION (DT24)----

	venue	freq
0	Coffee Shop	0.2
1	Food Court	0.2
2	Bus Station	0.1
3	Department Store	0.1
4	Indian Restaurant	0.1

----GUL CIRCLE MRT STATION (EW30)----

	venue	freq
0	Coffee Shop	0.25
1	Train Station	0.25
2	Electronics Store	0.25
3	Food Court	0.25
4	Other Repair Shop	0.00

----HARBOURFRONT MRT STATION (CC29)----

	venue	freq
0	Chinese Restaurant	0.06
1	Clothing Store	0.06
2	Multiplex	0.04
3	Coffee Shop	0.04
4	German Restaurant	0.04

----HARBOURFRONT MRT STATION (NE1)----

	venue	freq
0	Chinese Restaurant	0.06
1	Clothing Store	0.06
2	Multiplex	0.04
3	Coffee Shop	0.04
4	German Restaurant	0.04

----HAW PAR VILLA MRT STATION (CC25)----

	venue	freq
0	Bus Station	0.31
1	Theme Park	0.08
2	Metro Station	0.08
3	Convenience Store	0.08
4	Office	0.08

----HILLVIEW MRT STATION (DT3)----

	venue	freq
0	Café	0.11
1	Shopping Mall	0.07
2	Coffee Shop	0.07
3	Italian Restaurant	0.07
4	Ice Cream Shop	0.07

----HOLLAND VILLAGE MRT STATION (CC21)----

	venue	freq
0	Bar	0.08
1	Bakery	0.08
2	Ice Cream Shop	0.08
3	Italian Restaurant	0.05
4	Spa	0.05

----HOUGANG MRT STATION (NE14)----

	venue	freq
0	Food Court	0.08
1	Chinese Restaurant	0.08
2	Coffee Shop	0.08
3	Fast Food Restaurant	0.08
4	Dessert Shop	0.05

----JALAN BESAR MRT STATION (DT22)----

	venue	freq
0	Indian Restaurant	0.16
1	Café	0.08
2	Chinese Restaurant	0.08
3	Vegetarian / Vegan Restaurant	0.08
4	Hostel	0.06

----JELAPANG LRT STATION (BP12)----

	venue	freq
0	Bus Station	0.14
1	Multiplex	0.14
2	Fast Food Restaurant	0.14
3	Food Court	0.14
4	Supermarket	0.14

----JOO KOON MRT STATION (EW29)----

	venue	freq
0	Fast Food Restaurant	0.17
1	Bus Station	0.13
2	Snack Place	0.04
3	Chinese Restaurant	0.04
4	Gym / Fitness Center	0.04

----JURONG EAST MRT STATION (EW24)----

	venue	freq
0	Coffee Shop	0.08
1	Chinese Restaurant	0.08
2	Japanese Restaurant	0.08
3	Bubble Tea Shop	0.06
4	Shopping Mall	0.04

----JURONG EAST MRT STATION (NS1)----

	venue	freq
0	Coffee Shop	0.08
1	Chinese Restaurant	0.08
2	Japanese Restaurant	0.08
3	Bubble Tea Shop	0.06
4	Shopping Mall	0.04

----KADALLOOR LRT STATION (PE5)----

	venue	freq
0	Café	0.11
1	Gym	0.11
2	Bus Stop	0.11
3	Fishing Spot	0.06
4	Food Court	0.06

----KAKI BUKIT MRT STATION (DT28)----

	venue	freq
0	Coffee Shop	0.27
1	Food Court	0.18
2	Skate Park	0.09
3	Bike Shop	0.09
4	Convenience Store	0.09

----KALLANG MRT STATION (EW10)----

	venue	freq
0	Food Court	0.11
1	BBQ Joint	0.11
2	Snack Place	0.11
3	Hostel	0.11
4	Thai Restaurant	0.06

----KANGKAR LRT STATION (SE4)----

	venue	freq
0	Shopping Mall	0.08
1	Food Court	0.08
2	Basketball Court	0.08
3	Mexican Restaurant	0.08
4	Playground	0.08

----KEAT HONG LRT STATION (BP3)----

	venue	freq
0	Fast Food Restaurant	0.25
1	Coffee Shop	0.12
2	Deli / Bodega	0.12
3	Grocery Store	0.12
4	Bus Stop	0.12

----KEMBANGAN MRT STATION (EW6)----

	venue	freq
0	Chinese Restaurant	0.15
1	Indian Restaurant	0.15
2	Noodle House	0.05
3	Supermarket	0.05
4	Bistro	0.05

----KENT RIDGE MRT STATION (CC24)----

	venue	freq
0	Coffee Shop	0.19
1	Snack Place	0.06
2	Korean Restaurant	0.06
3	Sandwich Place	0.06
4	Food	0.06

----KHATIB MRT STATION (NS14)----

	venue	freq
0	Coffee Shop	0.13
1	Asian Restaurant	0.13
2	Supermarket	0.09
3	Bus Stop	0.09
4	Bakery	0.09

----KING ALBERT PARK MRT STATION (DT6)----

	venue	freq
0	Bus Station	0.14
1	Gym / Fitness Center	0.10
2	Gym	0.10
3	Gas Station	0.05
4	Supermarket	0.05

----KOVAN MRT STATION (NE13)----

	venue	freq
0	Chinese Restaurant	0.14
1	Noodle House	0.11
2	Food Court	0.09
3	Café	0.07

4 Asian Restaurant 0.07

----KRANJI MRT STATION (NS7)----

	venue	freq
0	Racetrack	0.38
1	Dessert Shop	0.12
2	Noodle House	0.12
3	Bus Line	0.12
4	Bakery	0.12

----KUPANG LRT STATION (SW3)----

	venue	freq
0	Bridge	0.2
1	Supermarket	0.2
2	Bakery	0.2
3	Light Rail Station	0.2
4	Park	0.2

----LABRADOR PARK MRT STATION (CC27)----

	venue	freq
0	Café	0.06
1	Coffee Shop	0.06
2	Chinese Restaurant	0.06
3	Fast Food Restaurant	0.06
4	Sushi Restaurant	0.06

----LAKESIDE MRT STATION (EW26)----

	venue	freq
0	Coffee Shop	0.25
1	Convenience Store	0.25
2	Vegetarian / Vegan Restaurant	0.25
3	Snack Place	0.25
4	ATM	0.00

----LAVENDER MRT STATION (EW11)----

	venue	freq
0	Coffee Shop	0.10
1	Restaurant	0.06
2	Fast Food Restaurant	0.06
3	Café	0.04
4	Bed & Breakfast	0.04

----LAYAR LRT STATION (SW6)----

	venue	freq
0	Coffee Shop	0.14
1	Food Court	0.10
2	Bakery	0.07
3	Asian Restaurant	0.07
4	Japanese Restaurant	0.03

----LITTLE INDIA MRT STATION (DT12)----

	venue	freq
0	Indian Restaurant	0.27
1	Vegetarian / Vegan Restaurant	0.12
2	Café	0.10

3	Hostel	0.07
4	Hotel	0.07

----LITTLE INDIA MRT STATION (NE7)----

	venue	freq
0	Indian Restaurant	0.40
1	Vegetarian / Vegan Restaurant	0.08
2	Hotel	0.06
3	Bakery	0.04
4	Breakfast Spot	0.04

----LORONG CHUAN MRT STATION (CC14)----

	venue	freq
0	Gym	0.25
1	Gay Bar	0.25
2	Ski Lodge	0.25
3	Café	0.25
4	ATM	0.00

----MACPHERSON MRT STATION (CC10)----

	venue	freq
0	Gym	0.13
1	Bus Station	0.13
2	Food Court	0.13
3	Metro Station	0.07
4	Furniture / Home Store	0.07

----MACPHERSON MRT STATION (DT26)----

	venue	freq
0	Bus Station	0.14
1	Gym	0.09
2	Coffee Shop	0.09
3	Vegetarian / Vegan Restaurant	0.09
4	Food Court	0.09

----MARINA BAY MRT STATION (CE2)----

	venue	freq
0	Coffee Shop	0.16
1	Japanese Restaurant	0.10
2	Sandwich Place	0.08
3	Chinese Restaurant	0.06
4	Bar	0.06

----MARINA BAY MRT STATION (NS27)----

	venue	freq
0	Pub	0.08
1	Mexican Restaurant	0.04
2	Gym	0.04
3	Government Building	0.04
4	Sushi Restaurant	0.04

----MARINA SOUTH PIER MRT STATION (NS28)----

	venue	freq
0	Boat or Ferry	0.25
1	BBQ Joint	0.12

2 Metro Station 0.12
 3 Mexican Restaurant 0.12
 4 History Museum 0.12

----MARSILING MRT STATION (NS8)----

venue freq
 0 Grocery Store 0.17
 1 Japanese Restaurant 0.08
 2 Coffee Shop 0.08
 3 Hainan Restaurant 0.08
 4 Steakhouse 0.08

----MARYMOUNT MRT STATION (CC16)----

venue freq
 0 Chinese Restaurant 0.33
 1 Bakery 0.17
 2 Thai Restaurant 0.17
 3 Outdoors & Recreation 0.17
 4 Food Court 0.17

----MATTAR MRT STATION (DT25)----

venue freq
 0 Food Court 0.18
 1 Bus Station 0.12
 2 Coffee Shop 0.12
 3 Vegetarian / Vegan Restaurant 0.12
 4 Japanese Restaurant 0.06

----MERIDIAN LRT STATION (PE2)----

venue freq
 0 Chinese Restaurant 0.25
 1 Coffee Shop 0.25
 2 Casino 0.25
 3 Garden 0.25
 4 Noodle House 0.00

----MOUNTBATTEN MRT STATION (CC7)----

venue freq
 0 Noodle House 0.16
 1 Chinese Restaurant 0.08
 2 Food Court 0.08
 3 Fast Food Restaurant 0.06
 4 Dessert Shop 0.06

----NEWTON MRT STATION (DT11)----

venue freq
 0 Chinese Restaurant 0.21
 1 Seafood Restaurant 0.11
 2 Hotel Bar 0.07
 3 Italian Restaurant 0.07
 4 Japanese Restaurant 0.04

----NEWTON MRT STATION (NS21)----

venue freq
 0 Chinese Restaurant 0.21

1	Hotel Bar	0.08
2	Italian Restaurant	0.08
3	Seafood Restaurant	0.08
4	Japanese Restaurant	0.04

----NIBONG LRT STATION (PW5)----

	venue	freq
0	Soccer Field	0.12
1	Bar	0.12
2	Steakhouse	0.06
3	BBQ Joint	0.06
4	Boat or Ferry	0.06

----NICOLL HIGHWAY MRT STATION (CC5)----

	venue	freq
0	Thai Restaurant	0.11
1	Hotel	0.09
2	Italian Restaurant	0.07
3	Vietnamese Restaurant	0.04
4	Food Court	0.04

----NOVENA MRT STATION (NS20)----

	venue	freq
0	Café	0.10
1	Coffee Shop	0.08
2	Japanese Restaurant	0.08
3	Asian Restaurant	0.06
4	Chinese Restaurant	0.06

----OASIS LRT STATION (PE6)----

	venue	freq
0	Supermarket	0.15
1	Gym	0.10
2	Fast Food Restaurant	0.10
3	Soup Place	0.05
4	Athletics & Sports	0.05

----ONE-NORTH MRT STATION (CC23)----

	venue	freq
0	Café	0.16
1	Coffee Shop	0.09
2	Food Court	0.07
3	Salad Place	0.05
4	Sandwich Place	0.05

----ORCHARD MRT STATION (NS22)----

	venue	freq
0	Boutique	0.14
1	Sushi Restaurant	0.06
2	Chinese Restaurant	0.06
3	Bakery	0.06
4	Coffee Shop	0.06

----OUTRAM PARK MRT STATION (EW16)----

	venue	freq
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0	Italian Restaurant	0.10
1	Café	0.06
2	Japanese Restaurant	0.06
3	French Restaurant	0.04
4	Cocktail Bar	0.04

----OUTRAM PARK MRT STATION (NE3)----

	venue	freq
0	Chinese Restaurant	0.08
1	Japanese Restaurant	0.08
2	Italian Restaurant	0.05
3	Australian Restaurant	0.05
4	Burger Joint	0.05

----PASIR PANJANG MRT STATION (CC26)----

	venue	freq
0	Chinese Restaurant	0.18
1	Thai Restaurant	0.12
2	Food Court	0.12
3	Vietnamese Restaurant	0.06
4	Gas Station	0.06

----PASIR RIS MRT STATION (EW1)----

	venue	freq
0	Food Court	0.09
1	Bus Line	0.06
2	Sandwich Place	0.06
3	Pharmacy	0.06
4	Coffee Shop	0.06

----PAYA LEBAR MRT STATION (CC9)----

	venue	freq
0	Fast Food Restaurant	0.08
1	Asian Restaurant	0.06
2	Supermarket	0.06
3	Snack Place	0.04
4	Ramen Restaurant	0.04

----PAYA LEBAR MRT STATION (EW8)----

	venue	freq
0	Fast Food Restaurant	0.08
1	Supermarket	0.06
2	Asian Restaurant	0.06
3	Hotpot Restaurant	0.04
4	Steakhouse	0.04

----PENDING LRT STATION (BP8)----

	venue	freq
0	Food Court	0.22
1	Market	0.11
2	Bus Station	0.11
3	Miscellaneous Shop	0.11
4	Playground	0.11

----PETIR LRT STATION (BP7)----

	venue	freq
0	Coffee Shop	0.09
1	Sushi Restaurant	0.09
2	Fast Food Restaurant	0.09
3	Shopping Mall	0.06
4	Noodle House	0.06

----PHOENIX LRT STATION (BP5)----

	venue	freq
0	Bubble Tea Shop	0.08
1	Asian Restaurant	0.08
2	Chinese Breakfast Place	0.08
3	Coffee Shop	0.08
4	Trail	0.08

----PIONEER MRT STATION (EW28)----

	venue	freq
0	Stadium	0.1
1	Pool	0.1
2	Gym / Fitness Center	0.1
3	Fast Food Restaurant	0.1
4	Golf Course	0.1

----POTONG PASIR MRT STATION (NE10)----

	venue	freq
0	Chinese Restaurant	0.26
1	Convenience Store	0.13
2	Fast Food Restaurant	0.09
3	Coffee Shop	0.09
4	Food Court	0.09

----PROMENADE MRT STATION (CC4)----

	venue	freq
0	Hotel	0.08
1	Hotel Bar	0.08
2	Japanese Restaurant	0.08
3	Event Space	0.06
4	Buffet	0.06

----PROMENADE MRT STATION (DT15)----

	venue	freq
0	Hotel	0.10
1	Japanese Restaurant	0.08
2	Hotel Bar	0.08
3	Event Space	0.06
4	Buffet	0.06

----PUNGGOL LRT STATION (PTC)----

	venue	freq
0	Snack Place	0.04
1	Ice Cream Shop	0.04
2	Café	0.04
3	Japanese Restaurant	0.04
4	Chinese Restaurant	0.04

----PUNGGOL MRT STATION (NE17)----

	venue	freq
0	Snack Place	0.04
1	Ice Cream Shop	0.04
2	Café	0.04
3	Japanese Restaurant	0.04
4	Chinese Restaurant	0.04

----PUNGGOL POINT LRT STATION (PW3)----

	venue	freq
0	Light Rail Station	0.5
1	Campground	0.5
2	ATM	0.0
3	Pedestrian Plaza	0.0
4	Park	0.0

----QUEENSTOWN MRT STATION (EW19)----

	venue	freq
0	Chinese Restaurant	0.23
1	Food Court	0.15
2	Pool	0.08
3	Seafood Restaurant	0.08
4	Train Station	0.08

----RAFFLES PLACE MRT STATION (EW14)----

	venue	freq
0	Japanese Restaurant	0.08
1	Hotel	0.06
2	Coffee Shop	0.06
3	Cocktail Bar	0.06
4	Gym / Fitness Center	0.06

----RAFFLES PLACE MRT STATION (NS26)----

	venue	freq
0	Japanese Restaurant	0.08
1	Hotel	0.06
2	Coffee Shop	0.06
3	Cocktail Bar	0.06
4	Gym / Fitness Center	0.06

----RANGGUNG LRT STATION (SE5)----

	venue	freq
0	Food Court	0.25
1	Fast Food Restaurant	0.17
2	BBQ Joint	0.08
3	Metro Station	0.08
4	Wings Joint	0.08

----REDHILL MRT STATION (EW18)----

	venue	freq
0	Chinese Restaurant	0.27
1	Coffee Shop	0.20
2	Pharmacy	0.07
3	Food Court	0.07
4	Park	0.07

----RENJONG LRT STATION (SW8)----

	venue	freq
0	Grocery Store	0.25
1	Metro Station	0.25
2	Bus Line	0.25
3	Bus Station	0.25
4	ATM	0.00

----RIVIERA LRT STATION (PE4)----

	venue	freq
0	Fishing Spot	0.10
1	Fast Food Restaurant	0.10
2	Seafood Restaurant	0.10
3	Gastropub	0.10
4	Beer Garden	0.05

----ROCHOR MRT STATION (DT13)----

	venue	freq
0	Indian Restaurant	0.58
1	Vegetarian / Vegan Restaurant	0.08
2	General College & University	0.03
3	Hotel	0.03
4	Coffee Shop	0.03

----RUMBIA LRT STATION (SE2)----

	venue	freq
0	Fast Food Restaurant	0.2
1	Light Rail Station	0.1
2	Chinese Restaurant	0.1
3	Japanese Restaurant	0.1
4	Bus Station	0.1

----SAM KEE LRT STATION (PW1)----

	venue	freq
0	Fast Food Restaurant	0.09
1	Chinese Restaurant	0.04
2	Japanese Restaurant	0.04
3	Bridge	0.04
4	Steakhouse	0.04

----SAMUDERA LRT STATION (PW4)----

	venue	freq
0	Soccer Field	0.13
1	Bar	0.13
2	Steakhouse	0.07
3	Light Rail Station	0.07
4	Boat or Ferry	0.07

----SEGAR LRT STATION (BP11)----

	venue	freq
0	Coffee Shop	0.33
1	Food Court	0.33
2	Fast Food Restaurant	0.33
3	Non-Profit	0.00
4	Outdoor Supply Store	0.00

----SEMBAWANG MRT STATION (NS11)----

	venue	freq
0	Fast Food Restaurant	0.13
1	Coffee Shop	0.13
2	Chinese Restaurant	0.13
3	Asian Restaurant	0.13
4	Japanese Restaurant	0.07

----SENGKANG LRT STATION (STC)----

	venue	freq
0	Chinese Restaurant	0.11
1	Food Court	0.08
2	Fast Food Restaurant	0.08
3	Asian Restaurant	0.06
4	Bus Station	0.06

----SENGKANG MRT STATION (NE16)----

	venue	freq
0	Chinese Restaurant	0.11
1	Food Court	0.08
2	Fast Food Restaurant	0.08
3	Asian Restaurant	0.06
4	Bus Station	0.06

----SENJA LRT STATION (BP13)----

	venue	freq
0	Asian Restaurant	0.08
1	Fast Food Restaurant	0.08
2	Bus Station	0.06
3	Café	0.06
4	Sushi Restaurant	0.06

----SERANGOON MRT STATION (CC13)----

	venue	freq
0	Chinese Restaurant	0.07
1	Asian Restaurant	0.07
2	Ice Cream Shop	0.05
3	Japanese Restaurant	0.05
4	Noodle House	0.05

----SERANGOON MRT STATION (NE12)----

	venue	freq
0	Chinese Restaurant	0.10
1	Clothing Store	0.05
2	Japanese Restaurant	0.05
3	Noodle House	0.05
4	Fast Food Restaurant	0.05

----SIMEI MRT STATION (EW3)----

	venue	freq
0	Japanese Restaurant	0.10
1	Shopping Mall	0.10
2	Chinese Restaurant	0.10
3	Coffee Shop	0.10

4 Dim Sum Restaurant 0.05

----SIXTH AVENUE MRT STATION (DT7)----

	venue	freq
0	Indian Restaurant	0.10
1	Building	0.07
2	Bakery	0.07
3	Food Court	0.07
4	Coffee Shop	0.07

----SOMERSET MRT STATION (NS23)----

	venue	freq
0	Japanese Restaurant	0.08
1	Hotel	0.06
2	Clothing Store	0.06
3	Wine Bar	0.06
4	Shopping Mall	0.04

----SOO TECK LRT STATION (PW7)----

	venue	freq
0	Market	0.5
1	Food Court	0.5
2	Other Great Outdoors	0.0
3	Park	0.0
4	Paper / Office Supplies Store	0.0

----SOUTH VIEW LRT STATION (BP2)----

	venue	freq
0	Fast Food Restaurant	0.14
1	Food Court	0.07
2	Lottery Retailer	0.07
3	Furniture / Home Store	0.07
4	Shoe Store	0.07

----STADIUM MRT STATION (CC6)----

	venue	freq
0	Stadium	0.06
1	Coffee Shop	0.04
2	Japanese Restaurant	0.04
3	Frozen Yogurt Shop	0.04
4	Supermarket	0.04

----STEVENS MRT STATION (DT10)----

	venue	freq
0	Diner	0.25
1	Italian Restaurant	0.12
2	Bus Station	0.12
3	Café	0.12
4	Sandwich Place	0.12

----SUMANG LRT STATION (PW6)----

	venue	freq
0	Japanese Restaurant	0.09
1	Café	0.06
2	Chinese Restaurant	0.06

3 Food Court 0.06
4 Market 0.06

----TAI SENG MRT STATION (CC11)----

venue freq
0 Chinese Restaurant 0.14
1 Café 0.12
2 Food Court 0.09
3 Seafood Restaurant 0.07
4 Coffee Shop 0.07

----TAMPINES EAST MRT STATION (DT33)----

venue freq
0 Coffee Shop 0.15
1 Optical Shop 0.05
2 Rock Club 0.05
3 Betting Shop 0.05
4 Food & Drink Shop 0.05

----TAMPINES MRT STATION (DT32)----

venue freq
0 Café 0.08
1 Bakery 0.08
2 Pharmacy 0.04
3 Bubble Tea Shop 0.04
4 Gym 0.04

----TAMPINES MRT STATION (EW2)----

venue freq
0 Bakery 0.08
1 Café 0.08
2 Bubble Tea Shop 0.06
3 Chinese Restaurant 0.04
4 Thai Restaurant 0.04

----TAMPINES WEST MRT STATION (DT31)----

venue freq
0 Halal Restaurant 0.11
1 Coffee Shop 0.11
2 Fast Food Restaurant 0.11
3 Pool 0.06
4 Gym 0.06

----TAN KAH KEE MRT STATION (DT8)----

venue freq
0 Café 0.14
1 Shopping Mall 0.07
2 Coffee Shop 0.07
3 Spanish Restaurant 0.07
4 Thai Restaurant 0.07

----TANAH MERAH MRT STATION (EW4)----

venue freq
0 Noodle House 0.17
1 Indian Restaurant 0.17

- 2 Coffee Shop 0.08
- 3 Dessert Shop 0.08
- 4 Flower Shop 0.08

----TANJONG PAGAR MRT STATION (EW15)----

- venue freq
- 0 Japanese Restaurant 0.12
- 1 Coffee Shop 0.10
- 2 Bakery 0.08
- 3 Ramen Restaurant 0.06
- 4 Hotel 0.06

----TECK LEE LRT STATION (PW2)----

- venue freq
- 0 Light Rail Station 0.12
- 1 Fast Food Restaurant 0.12
- 2 Yoga Studio 0.06
- 3 Pool 0.06
- 4 Park 0.06

----TECK WHYE LRT STATION (BP4)----

- venue freq
- 0 Bus Station 0.24
- 1 Light Rail Station 0.06
- 2 Hotel 0.06
- 3 Gym 0.06
- 4 Grocery Store 0.06

----TELOK AYER MRT STATION (DT18)----

- venue freq
- 0 Restaurant 0.08
- 1 Japanese Restaurant 0.08
- 2 Korean Restaurant 0.08
- 3 Café 0.06
- 4 Wine Bar 0.06

----TELOK BLANGAH MRT STATION (CC28)----

- venue freq
- 0 Food Court 0.09
- 1 Chinese Restaurant 0.09
- 2 Yoga Studio 0.04
- 3 Board Shop 0.04
- 4 Market 0.04

----TEN MILE JUNCTION LRT STATION (BP14)----

- venue freq
- 0 Café 0.08
- 1 Sushi Restaurant 0.08
- 2 Fast Food Restaurant 0.08
- 3 Shopping Mall 0.05
- 4 Asian Restaurant 0.05

----THANGGAM LRT STATION (SW4)----

- venue freq
- 0 Dessert Shop 0.08

- 1 Coffee Shop 0.08
- 2 Cupcake Shop 0.08
- 3 Noodle House 0.08
- 4 Steakhouse 0.08

----TIONG BAHRU MRT STATION (EW17)----

- | | venue | freq |
|---|---------------------|------|
| 0 | Chinese Restaurant | 0.25 |
| 1 | Coffee Shop | 0.14 |
| 2 | Bakery | 0.07 |
| 3 | Japanese Restaurant | 0.07 |
| 4 | Food Court | 0.07 |

----TOA PAYOH MRT STATION (NS19)----

- | | venue | freq |
|---|--------------|------|
| 0 | Coffee Shop | 0.14 |
| 1 | Snack Place | 0.11 |
| 2 | Food Court | 0.07 |
| 3 | Dessert Shop | 0.07 |
| 4 | Steakhouse | 0.04 |

----TONGKANG LRT STATION (SW7)----

- | | venue | freq |
|---|--------------------|------|
| 0 | Bus Station | 0.4 |
| 1 | Basketball Court | 0.2 |
| 2 | Bookstore | 0.2 |
| 3 | Athletics & Sports | 0.2 |
| 4 | ATM | 0.0 |

----TUAS CRESCENT MRT STATION (EW31)----

- | | venue | freq |
|---|------------------|------|
| 0 | Business Service | 0.25 |
| 1 | Food Truck | 0.25 |
| 2 | Cafeteria | 0.25 |
| 3 | Harbor / Marina | 0.25 |
| 4 | Noodle House | 0.00 |

----TUAS LINK MRT STATION (EW33)----

- | | venue | freq |
|---|--------------------|------|
| 0 | Sports Club | 0.14 |
| 1 | Train Station | 0.14 |
| 2 | Gastropub | 0.14 |
| 3 | Bus Station | 0.14 |
| 4 | Chinese Restaurant | 0.14 |

----TUAS WEST ROAD MRT STATION (EW32)----

- | | venue | freq |
|---|-------------------------------|------|
| 0 | Malay Restaurant | 1.0 |
| 1 | Other Great Outdoors | 0.0 |
| 2 | Park | 0.0 |
| 3 | Paper / Office Supplies Store | 0.0 |
| 4 | Pakistani Restaurant | 0.0 |

----UBI MRT STATION (DT27)----

	venue	freq
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0	Food Court	0.23
1	Bus Station	0.15
2	Asian Restaurant	0.15
3	Restaurant	0.08
4	Lighting Store	0.08

----UPPER CHANGI MRT STATION (DT34)----

	venue	freq
0	Pool	0.15
1	Bus Stop	0.15
2	Bus Station	0.15
3	Metro Station	0.08
4	Coffee Shop	0.08

----WOODLANDS MRT STATION (NS9)----

	venue	freq
0	Japanese Restaurant	0.08
1	Coffee Shop	0.06
2	Café	0.06
3	Electronics Store	0.04
4	Mobile Phone Shop	0.04

----WOODLANDS MRT STATION (TE2)----

	venue	freq
0	Japanese Restaurant	0.08
1	Café	0.06
2	Electronics Store	0.04
3	Shopping Mall	0.04
4	Coffee Shop	0.04

----WOODLANDS SOUTH MRT STATION (TE3)----

	venue	freq
0	Food Court	0.33
1	Video Store	0.17
2	Trail	0.17
3	Gym / Fitness Center	0.17
4	Park	0.17

----WOODLEIGH MRT STATION (NE11)----

	venue	freq
0	Nightclub	0.09
1	Asian Restaurant	0.09
2	Track	0.09
3	Theater	0.09
4	Metro Station	0.09

----YEW TEE MRT STATION (NS5)----

	venue	freq
0	Fast Food Restaurant	0.22
1	Sandwich Place	0.11
2	Japanese Restaurant	0.11
3	Diner	0.11
4	Café	0.11

----YIO CHU KANG MRT STATION (NS15)----

	venue	freq
0	Food Court	0.14
1	Chinese Restaurant	0.14
2	Seafood Restaurant	0.07
3	College Auditorium	0.07
4	Gym	0.07

----YISHUN MRT STATION (NS13)----

	venue	freq
0	Chinese Restaurant	0.08
1	Food Court	0.06
2	Italian Restaurant	0.04
3	Grocery Store	0.04
4	Coffee Shop	0.04