

The Battle of Neighborhoods

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1. Introduction

Discuss the business problem and audience who would interested in this project.

Business Problem: Recommend the *best place* to open a *Cafe* in Singapore.

The Cafe will serve ***pastries and good coffee***. Seatings will also be provided for visitors to enjoy their coffee and meet up with friends. People will visit Cafe for numerous reasons and on different occasions. On ***weekdays***, students might visit after school to ***do assignments*** together with their school mates. For cafes near to offices, working adults may use it as a place for ***informal meetings and discussions*** or just to ***grab a cup of coffee*** in the morning before heading to the office. On ***weekends***, adults will usually visit a Cafe to ***meet and catch up with friends***. For cafes near to ***public transportations*** and ***attractions or hostels and hotels***, tourists will tend to visit due to ***convenience***. Therefore, we can infer firsthand that the visitors to the cafe is ***heavily dependent on its location on weekdays*** but less likely on weekends.

In order to maximise revenues, cafes need to be located near offices to capture the weekday crowd but also not too far away from places of attractions and hotels where tourists will pay a visit. As working adults has larger spending powers than students, the analysis will focus more on the working adults.

2. Data Extraction

Describe the data that you will be using to solve the problem or execute your idea.

Requires Singapore City data that contains Towns, Neighborhoods along with their latitude and longitude.

The **5** Regions of Singapore are:

1. Central Region
2. East Region
3. North-East Region
4. North Region
5. West Region

There are a total of **55** planning areas organised into these **5** regions. The information of these 55 planning areas can be extracted from wikipedia.

Import Libraries

```
In [3]: import numpy as np # Library to handle data in a vectorized manner

import pandas as pd # Library for data analysis
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # Library to handle JSON files

!conda install -c conda-forge geopy --yes # uncomment this line if you haven't completed the Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into latitude and longitude values

import requests # Library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas dataframe

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors

import seaborn as sns

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

!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if you haven't completed the Foursquare API lab
import folium # map rendering library

print('Libraries imported.')
```

Solving environment: done

Package Plan

environment location: /opt/conda/envs/DSX-Python35

added / updated specs:

- geopy

The following NEW packages will be INSTALLED:

geographiclib:	1.49-py_0	conda-forge
geopy:	1.20.0-py_0	conda-forge

The following packages will be UPDATED:

ca-certificates:	2019.1.23-0	--> 2019.3.9-hecc5488_0	conda-forge
certifi:	2018.8.24-py35_1	--> 2018.8.24-py35_1001	conda-forge
openssl:	1.0.2r-h7b6447c_0	--> 1.0.2r-h14c3975_0	conda-forge

Preparing transaction: done

Verifying transaction: done

Executing transaction: done

Solving environment: done

Package Plan

environment location: /opt/conda/envs/DSX-Python35

added / updated specs:

- folium=0.5.0

The following NEW packages will be INSTALLED:

altair:	2.2.2-py35_1	conda-forge
branca:	0.3.1-py_0	conda-forge
folium:	0.5.0-py_0	conda-forge
vincent:	0.4.4-py_1	conda-forge

Preparing transaction: done

Verifying transaction: done

Executing transaction: done

Libraries imported.

2a. Webscrap Singapore's Neighborhood from Wikipedia

(Data Source: Wikipedia: https://en.wikipedia.org/wiki/Planning_Areas_of_Singapore (https://en.wikipedia.org/wiki/Planning_Areas_of_Singapore))

Then transform the data into a pandas dataframe that consists of five columns: Name, Region, Area, Population and Density

```
In [378]: from bs4 import BeautifulSoup

source = requests.get('https://en.wikipedia.org/wiki/Planning_Areas_of_Singapore').text

soup = BeautifulSoup(source, 'html5lib')
```

```
In [379]: table_post = soup.find_all('table')[2] #Grab the third table
fields = table_post.find_all('td')

EName = []
MName = []
CName = []
Pinyin = []
TName = []
Region = []
Area = []
Population = []
Density = []

for i in range(0, len(fields), 9):
    EName.append(fields[i].text.strip())
    MName.append(fields[i+1].text.strip())
    CName.append(fields[i+2].text.strip())
    Pinyin.append(fields[i+3].text.strip())
    TName.append(fields[i+4].text.strip())
    Region.append(fields[i+5].text.strip())
    Area.append(fields[i+6].text.strip())
    Population.append(fields[i+7].text.strip())
    Density.append(fields[i+8].text.strip())

df_sg = pd.DataFrame(data=[EName, MName, CName, Pinyin, TName, Region, Area, Population, Density]).transpose()
df_sg.columns = ['EName', 'MName', 'CName', 'Pinyin', 'TName', 'Region', 'Area', 'Population', 'Density']
df_sg.head()
```

```
Out[379]:
```

	EName	MName	CName	Pinyin	TName	Region	Area	Population	Density
0	Ang Mo Kio		宏茂桥	Hóng mào qiáo	ஆங் மோ கியோ	North-East	13.94	165,710	12,000
1	Bedok	*	勿洛	Wù luò	பிடோக	East	21.69	281,300	13,000
2	Bishan		碧山	Bì shān	பீஷான்	Central	7.62	88,490	12,000
3	Boon Lay		文礼	Wén lǐ	பூன் லே	West	8.23	30	3.6
4	Bukit Batok	*	武吉巴督	Wǔjí bā dū	புகிட் பாத்தோக	West	11.13	144,410	13,000

```
In [380]: # Check 55 Neighborhoods
df_sg.shape
```

```
Out[380]: (55, 9)
```

```
In [381]: # Extract only column 'EName'
df_sg2 = pd.DataFrame(data=[EName]).transpose()
df_sg2.columns = ['EName2']
df_sg2.head()
```

Out[381]:

	EName2
0	Ang Mo Kio
1	Bedok
2	Bishan
3	Boon Lay
4	Bukit Batok

2b. Use Googlemaps to get Geographical Coordinates for all 55 Singapore Neighborhoods

(Data Source: Google Maps API)

```
In [382]: # install the google map api client library
!pip install -U googlemaps
```

```
Requirement already up-to-date: googlemaps in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (3.0.2)
Requirement not upgraded as not directly required: requests<3.0,>=2.11.1 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from googlemaps) (2.18.4)
Requirement not upgraded as not directly required: chardet<3.1.0,>=3.0.2 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps) (3.0.4)
Requirement not upgraded as not directly required: idna<2.7,>=2.5 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps) (2.6)
Requirement not upgraded as not directly required: urllib3<1.23,>=1.21.1 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps) (1.22)
Requirement not upgraded as not directly required: certifi>=2017.4.17 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps) (2019.3.9)
tensorflow 1.3.0 requires tensorflow-tensorboard<0.2.0,>=0.1.0, which is not installed.
```

```
In [383]: # @hidden_cell
import googlemaps
gmaps = googlemaps.Client(key='AIzaSyA9yEjViJb93QUEgGkZjIfwDzldcfqPoxQ')
```

```
In [384]: lat = []
long = []

for i in range(0,len(df_sg2),1):
    geocode_result = gmaps.geocode('{}, Singapore'.format(df_sg2["EName2"][i]))
    lat.append(geocode_result[0]['geometry']['location']['lat'])
    long.append(geocode_result[0]['geometry']['location']['lng'])
print (lat, long)

[1.3691149, 1.3236038, 1.3525845, 1.3142556, 1.3590288, 1.2819046, 1.3774142, 1.3294113, 1.3551526, 1.3450101, 1.3219708, 1.3839803, 1.3161811, 1.2866961, 1.3200544, 1.3612182, 1.3328572, 1.3403898, 1.3100334, 1.4304941, 1.4260074, 1.2912788, 1.279294, 1.3019687, 1.2966147, 1.3075517, 1.4063775, 1.3208572, 1.301674, 1.2848825, 1.3720937, 1.3516087, 1.2857497, 1.3984457, 1.2941664, 1.2959376, 1.3051345, 1.405163, 1.4491107, 1.3868121, 1.3553567, 1.4443218, 1.2895263, 1.2536568, 1.2785501, 1.4073821, 1.3495907, 1.306932, 1.3555189, 1.3343035, 1.2949472, 1.2478844, 1.3471977, 1.4381922, 1.430368] [103.8454342, 103.9273405, 103.8352116, 103.7093099, 103.7636796, 103.8239182, 103.7719498, 103.8020777, 103.7972022, 103.9832089, 104.0290022, 103.7469611, 103.7649377, 103.8535097, 103.8917746, 103.8862529, 103.7435522, 103.7089875, 103.8651056, 103.7173325, 103.8241046, 103.8709039, 103.8701686, 103.8970821, 103.8485095, 103.8403765, 104.0323021, 103.8424319, 103.8380766, 103.8438992, 103.9473728, 103.899516, 103.8079907, 103.9072046, 103.7861271, 103.8360614, 103.8509134, 103.8663418, 103.8184954, 103.8914433, 103.8678708, 103.8427696, 103.8397852, 103.8257048, 103.8527531, 103.7561919, 103.9567879, 103.8188845, 103.7308145, 103.8563265, 103.6304833, 103.6767958, 103.682541, 103.7889597, 103.8353628]
```

3. Data Transformation

Transform the data into a new **pandas** dataframe

```
In [385]: # define the dataframe columns
neighborhood = ['Region','Neighborhood','Latitude','Longitude']

# instantiate the dataframe
df_sgNeigh = pd.DataFrame(columns=neighborhood)
df_sgNeigh
```

Out[385]:

	Region	Neighborhood	Latitude	Longitude
--	--------	--------------	----------	-----------

```
In [386]: for i in range(0, df_sg.shape[0],1):

          df_sgNeigh = df_sgNeigh.append({'Region': df_sg['Region'][i],
                                           'Neighborhood': df_sg['ENAME'][i],
                                           'Latitude': lat[i],
                                           'Longitude': long[i],
                                           'Population Density': df_sg['Density'][i] }, ignore_index=True)

df_sgNeigh.head(55)
```


Out[386]:

	Region	Neighborhood	Latitude	Longitude	Population Density
0	North-East	Ang Mo Kio	1.369115	103.845434	12,000
1	East	Bedok	1.323604	103.927340	13,000
2	Central	Bishan	1.352585	103.835212	12,000
3	West	Boon Lay	1.314256	103.709310	3.6
4	West	Bukit Batok	1.359029	103.763680	13,000
5	Central	Bukit Merah	1.281905	103.823918	11,000
6	West	Bukit Panjang	1.377414	103.771950	16,000
7	Central	Bukit Timah	1.329411	103.802078	4,400
8	North	Central Water Catchment	1.355153	103.797202	*
9	East	Changi	1.345010	103.983209	62.3
10	East	Changi Bay	1.321971	104.029002	*
11	West	Choa Chu Kang	1.383980	103.746961	31,000
12	West	Clementi	1.316181	103.764938	9,800
13	Central	Downtown Core	1.286696	103.853510	580
14	Central	Geylang	1.320054	103.891775	12,129
15	North-East	Hougang	1.361218	103.886253	16,000
16	West	Jurong East	1.332857	103.743552	4,600
17	West	Jurong West	1.340390	103.708988	27,000
18	Central	Kallang	1.310033	103.865106	11,000
19	North	Lim Chu Kang	1.430494	103.717332	5.2
20	North	Mandai	1.426007	103.824105	180.2
21	Central	Marina East	1.291279	103.870904	*
22	Central	Marina South	1.279294	103.870169	*
23	Central	Marine Parade	1.301969	103.897082	7,700
24	Central	Museum	1.296615	103.848510	480
25	Central	Newton	1.307552	103.840377	3,700
26	North-East	North-Eastern Islands	1.406378	104.032302	1.2
27	Central	Novena	1.320857	103.842432	5,344.1
28	Central	Orchard	1.301674	103.838077	960.3
29	Central	Outram	1.284882	103.843899	16,081.6
30	East	Pasir Ris	1.372094	103.947373	9,313
31	East	Paya Lebar	1.351609	103.899516	3.4
32	West	Pioneer	1.285750	103.807991	8.3

	Region	Neighborhood	Latitude	Longitude	Population Density
33	North-East	Punggol	1.398446	103.907205	17,000
34	Central	Queenstown	1.294166	103.786127	4,800.5
35	Central	River Valley	1.295938	103.836061	6,230.5
36	Central	Rochor	1.305135	103.850913	9,034.1
37	North-East	Seletar	1.405163	103.866342	26.3
38	North	Sembawang	1.449111	103.818495	6,203.3
39	North-East	Sengkang	1.386812	103.891443	19,511
40	North-East	Serangoon	1.355357	103.867871	11,945.2
41	North	Simpong	1.444322	103.842770	*
42	Central	Singapore River	1.289526	103.839785	2,842.2
43	Central	Southern Islands	1.253657	103.825705	244
44	Central	Straits View	1.278550	103.852753	*
45	North	Sungei Kadut	1.407382	103.756192	53.2
46	East	Tampines	1.349591	103.956788	12,506.2
47	Central	Tanglin	1.306932	103.818884	2,491.8
48	West	Tengah	1.355519	103.730814	1.4
49	Central	Toa Payoh	1.334304	103.856326	15,298.2
50	West	Tuas	1.294947	103.630483	2.3
51	West	Western Islands	1.247884	103.676796	
52	West	Western Water Catchment	1.347198	103.682541	13
53	North	Woodlands	1.438192	103.788960	18,424
54	North	Yishun	1.430368	103.835363	9,507.2

```
In [387]: print('The dataframe has {} Region and {} neighborhoods.'.format(
            len(df_sgNeigh['Region'].unique()),
            df_sgNeigh.shape[0]
        )
    )
```

The dataframe has 5 Region and 55 neighborhoods.

```
In [388]: address = 'Singapore'

geolocator = Nominatim(user_agent="foursquare_agent")
location = geolocator.geocode(address)
Sglatitude = location.latitude
Sglongitude = location.longitude
print('The geographical coordinate of Singapore are {}, {}'.format(Sglatitude, Sglongitude))
```

The geographical coordinate of Singapore are 1.3408528, 103.878446863736.

4. Data Visualization

Using Folium Library

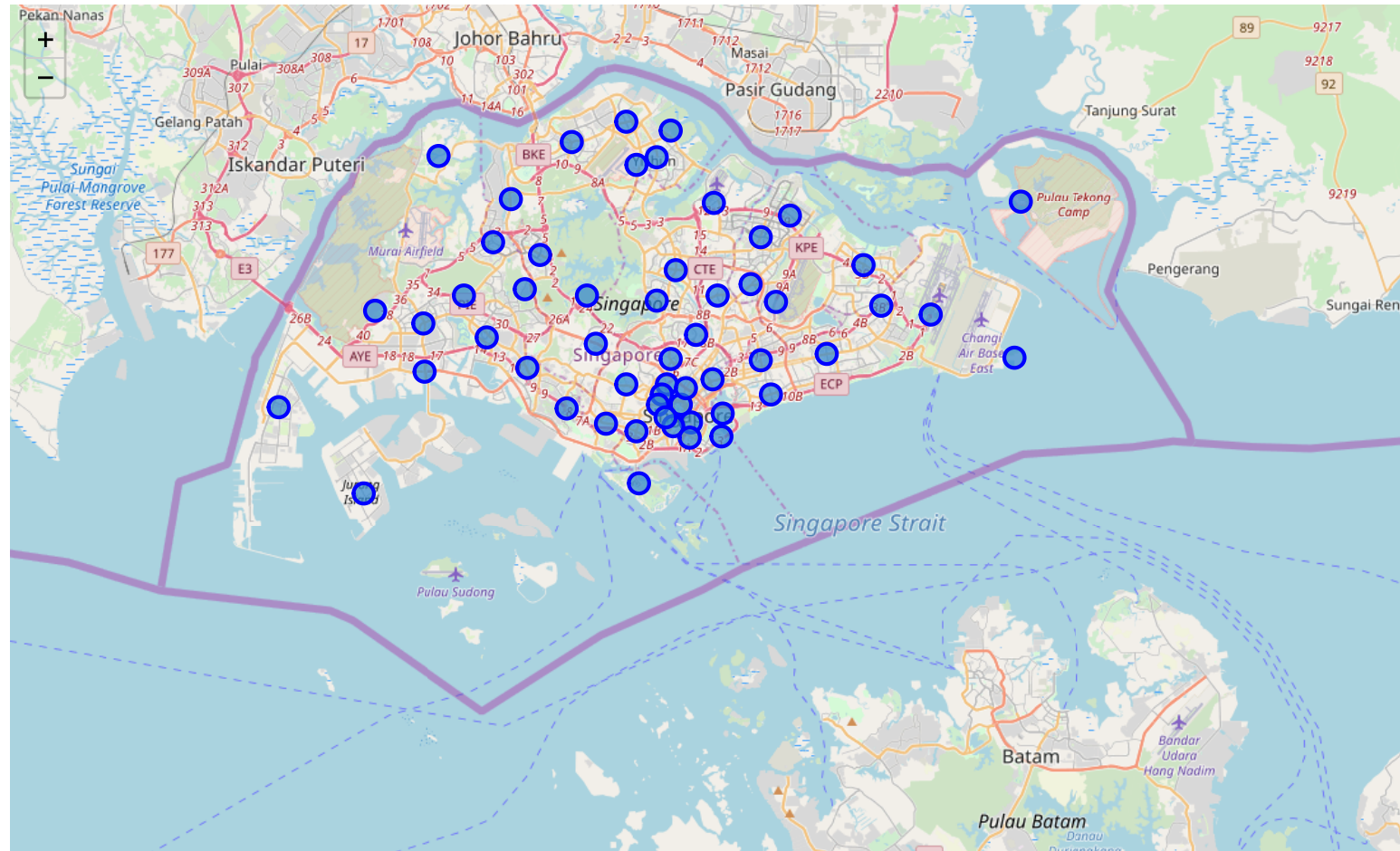
Create a map of Singapore with neighborhoods superimposed on top.

```
In [431]: # create map of Singapore using latitude and longitude values
map_sg = folium.Map(location=[SGlatitude, SGlongitude], zoom_start=10)

# add markers to map
for lat, lng, region, neighborhood in zip(df_sgNeigh['Latitude'], df_sgNeigh['Longitude'], df_sgNeigh['Region'], df_sgNeigh['Neighborhood']):
    label = '{}, {}'.format(neighborhood, region)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=8,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_sg)

map_sg
```

Out[431]:



Leaflet (<http://leafletjs.com>)

5. Data Exploration

Using Foursquare API

Define Foursquare Credentials and Version

(Data Source: Foursquare API)

```
In [391]: # @hidden_cell
CLIENT_ID = 'UCVO2GVTL120H00WGRITBRVBU02XABHYHFTVA2YIYXWZY2XE' # your Foursquare ID
CLIENT_SECRET = 'C5HRVGKZXEGWYOV0D03E4HRRCM5JW2AJ44A3ORJXDLSFLFUO' # your Foursquare Secret
VERSION = '20180604'
```

Explore the top 10 venues of each neighborhood in Singapore

We start by first exploring the first neighborhood - Ang Mo Kio

```
In [392]: # type your answer here
LIMIT = 100
radius = 500

url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    df_sgNeigh['Latitude'][0],
    df_sgNeigh['Longitude'][0],
    radius,
    LIMIT)
```

```
In [393]: results = requests.get(url).json()  
          results
```

```
Out[393]: {'meta': {'code': 200, 'requestId': '5cf92bb0db04f52f63047f9a'},
  'response': {'groups': [{'items': [{'reasons': {'count': 0,
  'items': [{'reasonName': 'globalInteractionReason',
    'summary': 'This spot is popular',
    'type': 'general'}]}],
  'referralId': 'e-0-4b9f647df964a520032037e3-0',
  'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d142941735',
    'name': 'Asian Restaurant',
    'pluralName': 'Asian Restaurants',
    'primary': True,
    'shortName': 'Asian'}]},
  'id': '4b9f647df964a520032037e3',
  'location': {'address': 'Blk 202 Ang Mo Kio Ave 3',
    'cc': 'SG',
    'country': 'Singapore',
    'distance': 180,
    'formattedAddress': ['Blk 202 Ang Mo Kio Ave 3', 'Singapore'],
    'labeledLatLngs': [{'label': 'display',
      'lat': 1.3681666144843387,
      'lng': 103.84411848687625}],
      'lat': 1.3681666144843387,
      'lng': 103.84411848687625},
    'name': 'Kam Jia Zhuang Restaurant',
    'photos': {'count': 0, 'groups': []}}}],
  'reasons': {'count': 0,
  'items': [{'reasonName': 'globalInteractionReason',
    'summary': 'This spot is popular',
    'type': 'general'}]},
  'referralId': 'e-0-4bc30123abf495215220c393-1',
  'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/snacks_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d1c7941735',
    'name': 'Snack Place',
    'pluralName': 'Snack Places',
    'primary': True,
    'shortName': 'Snacks'}]},
  'id': '4bc30123abf495215220c393',
  'location': {'address': 'AMK Hub',
    'cc': 'SG',
    'city': 'Ang Mo Kio',
    'country': 'Singapore',
    'crossStreet': '53 Ang Mo Kio Avenue 3',
    'distance': 328,
    'formattedAddress': ['AMK Hub (53 Ang Mo Kio Avenue 3)',
      '569933',
      'Singapore'],
    'labeledLatLngs': [{'label': 'display',
      'lat': 1.369093882325005,
      'lng': 103.84838865753792}],
      'lat': 1.369093882325005,
      'lng': 103.84838865753792,
      'postalCode': '569933'},
    'name': 'Old Chang Kee',
    'photos': {'count': 0, 'groups': []}}}],
  'reasons': {'count': 0,
  'items': [{'reasonName': 'globalInteractionReason',
    'summary': 'This spot is popular',
```



```
    'type': 'general']]],
    'referralId': 'e-0-4bceddaeb6c49c7410bb9791-2',
    'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/deli_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d1c5941735',
    'name': 'Sandwich Place',
    'pluralName': 'Sandwich Places',
    'primary': True,
    'shortName': 'Sandwiches'}]},
    'id': '4bceddaeb6c49c7410bb9791',
    'location': {'address': '#01-35 AMK Hub',
    'cc': 'SG',
    'city': 'Singapore',
    'country': 'Singapore',
    'crossStreet': '53 Ang Mo Kio Ave 3',
    'distance': 242,
    'formattedAddress': ['#01-35 AMK Hub (53 Ang Mo Kio Ave 3)',
    '569933',
    'Singapore'],
    'labeledLatLngs': [{'label': 'display',
    'lat': 1.3691362071202464,
    'lng': 103.8476121994989}],
    'lat': 1.3691362071202464,
    'lng': 103.8476121994989,
    'postalCode': '569933'},
    'name': 'Subway',
    'photos': {'count': 0, 'groups': []}},
    {'reasons': {'count': 0,
    'items': [{'reasonName': 'globalInteractionReason',
    'summary': 'This spot is popular',
    'type': 'general'}]},
    'referralId': 'e-0-4b1ea04ff964a520e21c24e3-3',
    'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/burger_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d16c941735',
    'name': 'Burger Joint',
    'pluralName': 'Burger Joints',
    'primary': True,
    'shortName': 'Burgers'}]},
    'id': '4b1ea04ff964a520e21c24e3',
    'location': {'address': '#01-33, AMK Hub',
    'cc': 'SG',
    'city': 'Singapore',
    'country': 'Singapore',
    'crossStreet': '53 Ang Mo Kio Ave 3',
    'distance': 266,
    'formattedAddress': ['#01-33, AMK Hub (53 Ang Mo Kio Ave 3)',
    '569933',
    'Singapore'],
    'labeledLatLngs': [{'label': 'display',
    'lat': 1.369170234303566,
    'lng': 103.84783132985862}],
    'lat': 1.369170234303566,
    'lng': 103.84783132985862,
    'postalCode': '569933'},
    'name': 'MOS Burger',
    'photos': {'count': 0, 'groups': []}},
    {'reasons': {'count': 0,
    'items': [{'reasonName': 'globalInteractionReason',
    'summary': 'This spot is popular',
```

```
    'type': 'general']]],
  'referralId': 'e-0-53300a03498ec51f067f0f70-4',
  'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/bakery_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d16a941735',
    'name': 'Bakery',
    'pluralName': 'Bakeries',
    'primary': True,
    'shortName': 'Bakery'}]},
  'id': '53300a03498ec51f067f0f70',
  'location': {'address': 'Ang Mo Kio Hub',
    'cc': 'SG',
    'country': 'Singapore',
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'id': '57d171f9498e736bc91a1eee',
'location': {'address': '5 Ang Mo Kio Central 2',
'cc': 'SG',
'city': 'Ang Mo Kio',
'country': 'Singapore',
'crossStreet': '5 Ang Mo Kio Central 2',
'distance': 492,
'formattedAddress': ['5 Ang Mo Kio Central 2 (5 Ang Mo Kio Central 2)',
'569663',
'Singapore']},
'labeledLatLngs': [{'label': 'display',
'lat': 1.372963932814485,
'lng': 103.84761831609302}],
'lat': 1.372963932814485,
'lng': 103.84761831609302,
'neighborhood': 'Ang Mo Kio',
'postalCode': '569663'},
'name': 'Buddy Hoagies Café & Grill',
'photos': {'count': 0, 'groups': []}},
{'reasons': {'count': 0,
'items': [{'reasonName': 'globalInteractionReason',
'summary': 'This spot is popular',
'type': 'general'}]},
'referralId': 'e-0-4cd66840b2a43704c2ae8444-61',
'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/busstation_',
'suffix': '.png'},
'id': '4bf58dd8d48988d12b951735',
'name': 'Bus Line',
'pluralName': 'Bus Lines',
'primary': True,
'shortName': 'Bus'}]},
'id': '4cd66840b2a43704c2ae8444',
'location': {'cc': 'SG',
'city': 'Singapore',
'country': 'Singapore',
'distance': 407,
'formattedAddress': ['Singapore'],
'labeledLatLngs': [{'label': 'display',
'lat': 1.3696102358916296,
'lng': 103.84180437975954}],
'lat': 1.3696102358916296,
'lng': 103.84180437975954},
'name': 'SBS Transit: Bus 268',
'photos': {'count': 0, 'groups': []}},
{'reasons': {'count': 0,
'items': [{'reasonName': 'globalInteractionReason',
'summary': 'This spot is popular',
'type': 'general'}]},
'referralId': 'e-0-4b9b8d9bf964a520fd0e36e3-62',
'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/food_grocery_',
'suffix': '.png'},
'id': '52f2ab2ebcbc57f1066b8b46',
'name': 'Supermarket',
'pluralName': 'Supermarkets',
'primary': True,
'shortName': 'Supermarket'}]},
'id': '4b9b8d9bf964a520fd0e36e3',
'location': {'address': '122 Ang Mo Kio Ave 3 #01-1753/1755',
```

```

'cc': 'SG',
'city': 'Singapore',
'country': 'Singapore',
'crossStreet': 'Ang Mo Kio St 12',
'distance': 442,
'formattedAddress': ['122 Ang Mo Kio Ave 3 #01-1753/1755 (Ang Mo Kio St 12)',
'560122',
'Singapore'],
'labeledLatLngs': [{'label': 'display',
'lat': 1.3717542411478814,
'lng': 103.84245642664055}],
'lat': 1.3717542411478814,
'lng': 103.84245642664055,
'postalCode': '560122'},
'name': 'Sheng Siong Supermarket',
'photos': {'count': 0, 'groups': []}}],
'name': 'recommended',
'type': 'Recommended Places']],
'headerFullLocation': 'Ang Mo Kio, Singapore',
'headerLocation': 'Ang Mo Kio',
'headerLocationGranularity': 'neighborhood',
'suggestedBounds': {'ne': {'lat': 1.3736149045000046,
'lng': 103.84992708512969},
'sw': {'lat': 1.3646148954999955, 'lng': 103.8409413148703}},
'suggestedFilters': {'filters': [{'key': 'openNow', 'name': 'Open now'}]},
'header': 'Tap to show:}',
'totalResults': 63}}

```

Create a Function using the `get_category_type` function from the Foursquare Lab

```

In [394]: # function that extracts the category of the venue
def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

    if len(categories_list) == 0:
        return None
    else:
        return categories_list[0]['name']

```

```
In [395]: def getNearbyVenues(names, latitudes, longitudes, radius=500):

    venues_list=[]
    for name, lat, lng in zip(neighborhood, latitudes, longitudes):
        print(name)

        # 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"]["groups"][0]["items"]

        # return only relevant information for each nearby venue
        venues_list.append([(
            name,
            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 = ['Neighborhood',
                            'Neighborhood Latitude',
                            'Neighborhood Longitude',
                            'Venue',
                            'Venue Latitude',
                            'Venue Longitude',
                            'Venue Category']

    return(nearby_venues)
```

```
In [396]: venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues) # flatten JSON

# filter columns
filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'venue.location.lng']
nearby_venues = nearby_venues.loc[:, filtered_columns]

# filter the category for each row
nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type, axis=1)

# clean columns
nearby_venues.columns = [col.split(".")[0] for col in nearby_venues.columns]

nearby_venues.head()
```

Out[396]:

	name	categories	lat	lng
0	Kam Jia Zhuang Restaurant	Asian Restaurant	1.368167	103.844118
1	Old Chang Kee	Snack Place	1.369094	103.848389
2	Subway	Sandwich Place	1.369136	103.847612
3	MOS Burger	Burger Joint	1.369170	103.847831
4	Bun Master	Bakery	1.369242	103.849031

```
In [397]: print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))

63 venues were returned by Foursquare.
```

Now Let's explore the top venues of all 55 Neighborhoods in Singapore


```

In [398]: def getNearbyVenues(names, latitudes, longitudes, radius=500):

    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

        # 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"]["groups"][0]["items"]

        # return only relevant information for each nearby venue
        venues_list.append([(
            name,
            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 = ['Neighborhood',
                            'Neighborhood Latitude',
                            'Neighborhood Longitude',
                            'Venue',
                            'Venue Latitude',
                            'Venue Longitude',
                            'Venue Category']

    return(nearby_venues)

```

Create a new dataframe called **sg_venues**

```
In [399]: sg_venues = getNearbyVenues(names=df_sgNeigh['Neighborhood'],
                                     latitudes=df_sgNeigh['Latitude'],
                                     longitudes=df_sgNeigh['Longitude']
                                     )
```

Ang Mo Kio
Bedok
Bishan
Boon Lay
Bukit Batok
Bukit Merah
Bukit Panjang
Bukit Timah
Central Water Catchment
Changi
Changi Bay
Choa Chu Kang
Clementi
Downtown Core
Geylang
Hougang
Jurong East
Jurong West
Kallang
Lim Chu Kang
Mandai
Marina East
Marina South
Marine Parade
Museum
Newton
North-Eastern Islands
Novena
Orchard
Outram
Pasir Ris
Paya Lebar
Pioneer
Punggol
Queenstown
River Valley
Rochor
Seletar
Sembawang
Sengkang
Serangoon
Simpang
Singapore River
Southern Islands
Straits View
Sungei Kadut
Tampines
Tanglin
Tengah
Toa Payoh
Tuas
Western Islands
Western Water Catchment
Woodlands
Yishun

```
In [401]: print(sg_venues.shape)
sg_venues.head()
```

(1545, 7)

Out[401]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Ang Mo Kio	1.369115	103.845434	Kam Jia Zhuang Restaurant	1.368167	103.844118	Asian Restaurant
1	Ang Mo Kio	1.369115	103.845434	Old Chang Kee	1.369094	103.848389	Snack Place
2	Ang Mo Kio	1.369115	103.845434	Subway	1.369136	103.847612	Sandwich Place
3	Ang Mo Kio	1.369115	103.845434	MOS Burger	1.369170	103.847831	Burger Joint
4	Ang Mo Kio	1.369115	103.845434	Bun Master	1.369242	103.849031	Bakery

Number of Venues returned for each neighborhood

```
In [402]: sg_venues.groupby('Neighborhood').count()
```

Out[402]:

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Ang Mo Kio	63	63	63	63	63	63
Bedok	61	61	61	61	61	61
Bishan	49	49	49	49	49	49
Boon Lay	1	1	1	1	1	1
Bukit Batok	34	34	34	34	34	34
Bukit Merah	12	12	12	12	12	12
Bukit Panjang	11	11	11	11	11	11
Bukit Timah	3	3	3	3	3	3
Central Water Catchment	2	2	2	2	2	2
Changi	12	12	12	12	12	12
Changi Bay	5	5	5	5	5	5
Choa Chu Kang	21	21	21	21	21	21
Clementi	59	59	59	59	59	59
Downtown Core	74	74	74	74	74	74
Geylang	49	49	49	49	49	49
Hougang	43	43	43	43	43	43
Jurong East	68	68	68	68	68	68
Jurong West	50	50	50	50	50	50
Kallang	18	18	18	18	18	18
Lim Chu Kang	4	4	4	4	4	4
Mandai	7	7	7	7	7	7
Marina East	4	4	4	4	4	4
Marina South	15	15	15	15	15	15
Marine Parade	17	17	17	17	17	17
Museum	58	58	58	58	58	58
Newton	7	7	7	7	7	7
North-Eastern Islands	7	7	7	7	7	7
Novena	56	56	56	56	56	56
Orchard	100	100	100	100	100	100
Outram	100	100	100	100	100	100
Pasir Ris	25	25	25	25	25	25
Paya Lebar	1	1	1	1	1	1

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Pioneer	44	44	44	44	44	44
Punggol	4	4	4	4	4	4
Queenstown	30	30	30	30	30	30
River Valley	19	19	19	19	19	19
Rochor	41	41	41	41	41	41
Seletar	7	7	7	7	7	7
Sembawang	17	17	17	17	17	17
Sengkang	9	9	9	9	9	9
Serangoon	8	8	8	8	8	8
Singapore River	65	65	65	65	65	65
Southern Islands	51	51	51	51	51	51
Straits View	51	51	51	51	51	51
Sungei Kadut	6	6	6	6	6	6
Tampines	7	7	7	7	7	7
Tanglin	22	22	22	22	22	22
Toa Payoh	25	25	25	25	25	25
Tuas	2	2	2	2	2	2
Western Water Catchment	9	9	9	9	9	9
Woodlands	47	47	47	47	47	47
Yishun	45	45	45	45	45	45

Check number of unique categories from all the returned venues from the 55 neighborhoods

```
In [405]: print('There are {} uniques categories.'.format(len(sg_venues['Venue Category'].unique())))
```

There are 227 uniques categories.

6. Data Analysis

Using one hot encoding to convert the returned venues into numerical values for K-Clustering

```
In [406]: # one hot encoding
sg_onehot = pd.get_dummies(sg_venues[['Venue Category']], prefix="", prefix_sep="")

# add neighborhood column back to dataframe
sg_onehot['Neighborhood'] = sg_venues['Neighborhood']

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

sg_onehot.head()
```

Out[406]:

	Neighborhood	Accessories Store	Airport	Airport Service	Airport Terminal	American Restaurant	Arcade	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	BBQ Joint	Bagel Shop	Bakery	Bank	Bar	Basketball Court	Bay	Bed & Breakfast	Beer Bar	Be
0	Ang Mo Kio	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
1	Ang Mo Kio	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Ang Mo Kio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Ang Mo Kio	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

```
In [407]: sg_onehot.shape
```

Out[407]: (1545, 228)

Group rows by neighborhood and by taking the mean of the frequency of occurrence of each category


```
In [408]: sg_grouped = sg_onehot.groupby('Neighborhood').mean().reset_index()  
sg_grouped
```

Out[408]:

	Neighborhood	Accessories Store	Airport	Airport Service	Airport Terminal	American Restaurant	Arcade	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	BBQ Joint	Bagel Shop	Bakery	Bank	Bar	Basketball Court	Bay	Bre
0	Ang Mo Kio	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015873	0.000000	0.000000	0.000000	0.015873	0.015873	0.000000	0.000000	0.000000	0.00
1	Bedok	0.000000	0.000000	0.000000	0.000000	0.016393	0.000000	0.000000	0.000000	0.000000	0.016393	0.000000	0.000000	0.000000	0.032787	0.000000	0.000000	0.000000	0.000000	0.00
2	Bishan	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.020408	0.000000	0.000000	0.000000	0.040816	0.000000	0.000000	0.000000	0.000000	0.00
3	Boon Lay	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
4	Bukit Batok	0.000000	0.000000	0.000000	0.000000	0.029412	0.000000	0.000000	0.000000	0.029412	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.029412	0.000000	0.000000	0.00
5	Bukit Merah	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.083333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
6	Bukit Panjang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
7	Bukit Timah	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
8	Central Water Catchment	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
9	Changi	0.000000	0.083333	0.083333	0.166667	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
10	Changi Bay	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
11	Choa Chu Kang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.047619	0.000000	0.000000	0.000000	0.047619	0.000000	0.000000	0.000000	0.000000	0.00
12	Clementi	0.000000	0.000000	0.000000	0.000000	0.016949	0.000000	0.000000	0.000000	0.016949	0.050847	0.000000	0.016949	0.000000	0.033898	0.000000	0.000000	0.000000	0.000000	0.00
13	Downtown Core	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.013514	0.000000	0.000000	0.027027	0.000000	0.013514	0.000000	0.000000	0.000000	0.040541	0.000000	0.013514	0.00
14	Geylang	0.000000	0.000000	0.000000	0.000000	0.020408	0.000000	0.000000	0.000000	0.000000	0.061224	0.000000	0.000000	0.000000	0.061224	0.000000	0.000000	0.020408	0.000000	0.00
15	Hougang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.069767	0.000000	0.000000	0.000000	0.046512	0.000000	0.000000	0.000000	0.000000	0.00
16	Jurong East	0.014706	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014706	0.000000	0.029412	0.000000	0.000000	0.000000	0.000000	0.00
17	Jurong West	0.000000	0.000000	0.000000	0.000000	0.020000	0.000000	0.000000	0.000000	0.000000	0.120000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
18	Kallang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.111111	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
19	Lim Chu Kang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
20	Mandai	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.142857	0.000000	0.000000	0.000000	0.000000	0.000000	0.142857	0.000000	0.000000	0.00
21	Marina East	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
22	Marina South	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.066667	0.000000	0.000000	0.000000	0.066667	0.000000	0.000000	0.00
23	Marine Parade	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.058824	0.000000	0.117647	0.000000	0.000000	0.00
24	Museum	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.017241	0.000000	0.000000	0.000000	0.000000	0.000000	0.017241	0.000000	0.017241	0.000000	0.000000	0.00
25	Newton	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
26	North-Eastern Islands	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.142857	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
27	Novena	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.035714	0.000000	0.000000	0.017857	0.035714	0.000000	0.017857	0.000000	0.000000	0.00
28	Orchard	0.000000	0.000000	0.000000	0.000000	0.010000	0.000000	0.000000	0.000000	0.000000	0.010000	0.000000	0.010000	0.000000	0.020000	0.000000	0.010000	0.000000	0.000000	0.00
29	Outram	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010000	0.010000	0.000000	0.010000	0.000000	0.010000	0.000000	0.010000	0.000000	0.000000	0.01

	Neighborhood	Accessories Store	Airport	Airport Service	Airport Terminal	American Restaurant	Arcade	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	BBQ Joint	Bagel Shop	Bakery	Bank	Bar	Basketball Court	Bay	Bre
30	Pasir Ris	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.040000	0.000000	0.000000	0.000000	0.000000	0.00
31	Paya Lebar	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
32	Pioneer	0.000000	0.000000	0.000000	0.000000	0.022727	0.000000	0.000000	0.000000	0.000000	0.045455	0.000000	0.045455	0.000000	0.022727	0.000000	0.000000	0.000000	0.000000	0.00
33	Punggol	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
34	Queenstown	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.033333	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
35	River Valley	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.052632	0.052632	0.000000	0.052632	0.000000	0.000000	0.000000	0.000000	0.00
36	Rochor	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.024390	0.000000	0.024390	0.024390	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
37	Seletar	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
38	Sembawang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.058824	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
39	Sengkang	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.111111	0.000000	0.00
40	Serangoon	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.125000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
41	Singapore River	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015385	0.000000	0.000000	0.030769	0.015385	0.015385	0.000000	0.000000	0.000000	0.030769	0.000000	0.000000	0.00
42	Southern Islands	0.000000	0.000000	0.000000	0.000000	0.039216	0.000000	0.000000	0.000000	0.000000	0.019608	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
43	Straits View	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.019608	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.019608	0.000000	0.000000	0.00
44	Sungei Kadut	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
45	Tampines	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
46	Tanglin	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.045455	0.000000	0.000000	0.000000	0.000000	0.00
47	Toa Payoh	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.040000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
48	Tuas	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.500000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
49	Western Water Catchment	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
50	Woodlands	0.000000	0.000000	0.000000	0.000000	0.000000	0.021277	0.000000	0.000000	0.000000	0.063830	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
51	Yishun	0.000000	0.000000	0.000000	0.000000	0.000000	0.022222	0.000000	0.000000	0.000000	0.022222	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00

In [106]: `sg_grouped.shape`

Out[106]: (52, 228)

Print each neighborhood along with top 5 most common venues

```
In [409]: num_top_venues = 5

for hood in sg_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = sg_grouped[sg_grouped['Neighborhood'] == hood].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')
```

----Ang Mo Kio----

	venue	freq
0	Coffee Shop	0.10
1	Food Court	0.08
2	Fast Food Restaurant	0.06
3	Supermarket	0.05
4	Dessert Shop	0.05

----Bedok----

	venue	freq
0	Coffee Shop	0.07
1	Sushi Restaurant	0.05
2	Food Court	0.05
3	Chinese Restaurant	0.05
4	Supermarket	0.05

----Bishan----

	venue	freq
0	Café	0.12
1	Chinese Restaurant	0.10
2	Thai Restaurant	0.08
3	Indian Restaurant	0.06
4	Ice Cream Shop	0.06

----Boon Lay----

	venue	freq
0	Botanical Garden	1.0
1	Accessories Store	0.0
2	Other Repair Shop	0.0
3	Motel	0.0
4	Movie Theater	0.0

----Bukit Batok----

	venue	freq
0	Italian Restaurant	0.09
1	Shopping Mall	0.06
2	Café	0.06
3	Supermarket	0.06
4	Gym	0.06

----Bukit Merah----

	venue	freq
0	Chinese Restaurant	0.25
1	Convenience Store	0.17
2	Coffee Shop	0.08
3	Seafood Restaurant	0.08
4	Japanese Restaurant	0.08

----Bukit Panjang----

	venue	freq
0	Food Court	0.27
1	Park	0.18
2	Fruit & Vegetable Store	0.09

3	Market	0.09
4	Dance Studio	0.09

----Bukit Timah----

	venue	freq
0	Pool	0.33
1	Food	0.33
2	Gym / Fitness Center	0.33
3	Other Repair Shop	0.00
4	Movie Theater	0.00

----Central Water Catchment----

	venue	freq
0	Trail	1.0
1	Accessories Store	0.0
2	Outdoor Sculpture	0.0
3	Motel	0.0
4	Movie Theater	0.0

----Changi----

	venue	freq
0	Airport Terminal	0.17
1	Bus Station	0.17
2	Movie Theater	0.08
3	Airport Service	0.08
4	Coffee Shop	0.08

----Changi Bay----

	venue	freq
0	Boat or Ferry	0.8
1	Military Base	0.2
2	Accessories Store	0.0
3	Other Repair Shop	0.0
4	Movie Theater	0.0

----Choa Chu Kang----

	venue	freq
0	Food Court	0.14
1	Coffee Shop	0.14
2	Bus Station	0.10
3	Fast Food Restaurant	0.10
4	Bubble Tea Shop	0.05

----Clementi----

	venue	freq
0	Coffee Shop	0.10
1	Noodle House	0.07
2	Chinese Restaurant	0.05
3	Japanese Restaurant	0.05
4	Snack Place	0.05

----Downtown Core----

	venue	freq
--	-------	------

0	Cocktail Bar	0.05
1	Italian Restaurant	0.05
2	Yoga Studio	0.04
3	Salad Place	0.04
4	Coffee Shop	0.04

----Geylang----

	venue	freq
0	Fast Food Restaurant	0.08
1	Asian Restaurant	0.06
2	Bakery	0.06
3	Supermarket	0.04
4	Noodle House	0.04

----Hougang----

	venue	freq
0	Chinese Restaurant	0.12
1	Coffee Shop	0.09
2	Asian Restaurant	0.07
3	Café	0.07
4	Noodle House	0.07

----Jurong East----

	venue	freq
0	Japanese Restaurant	0.07
1	Chinese Restaurant	0.07
2	Shopping Mall	0.06
3	Café	0.04
4	Department Store	0.04

----Jurong West----

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

----Kallang----

	venue	freq
0	Restaurant	0.17
1	Coffee Shop	0.11
2	Supermarket	0.11
3	Fast Food Restaurant	0.11
4	BBQ Joint	0.11

----Lim Chu Kang----

	venue	freq
0	Farm	0.50
1	Theme Park Ride / Attraction	0.25
2	Farmers Market	0.25
3	Accessories Store	0.00
4	Movie Theater	0.00

----Mandai----

	venue	freq
0	Coffee Shop	0.14
1	Ice Cream Shop	0.14
2	Bar	0.14
3	Thai Restaurant	0.14
4	Asian Restaurant	0.14

----Marina East----

	venue	freq
0	Golf Course	0.75
1	Park	0.25
2	Accessories Store	0.00
3	Other Repair Shop	0.00
4	Motel	0.00

----Marina South----

	venue	freq
0	Seafood Restaurant	0.20
1	Satay Restaurant	0.13
2	BBQ Joint	0.07
3	Gift Shop	0.07
4	Bus Stop	0.07

----Marine Parade----

	venue	freq
0	Chinese Restaurant	0.24
1	Bar	0.12
2	Café	0.06
3	Food	0.06
4	Flower Shop	0.06

----Museum----

	venue	freq
0	Hotel	0.10
1	Café	0.07
2	Japanese Restaurant	0.07
3	French Restaurant	0.03
4	Ice Cream Shop	0.03

----Newton----

	venue	freq
0	Chinese Restaurant	0.14
1	Wine Bar	0.14
2	Noodle House	0.14
3	Seafood Restaurant	0.14
4	Café	0.14

----North-Eastern Islands----

	venue	freq
0	School	0.14
1	Food Court	0.14
2	Plaza	0.14

3 Island 0.14
4 Coffee Shop 0.14

----Novena----

	venue	freq
0	Coffee Shop	0.09
1	Japanese Restaurant	0.07
2	Café	0.07
3	Hainan Restaurant	0.05
4	Italian Restaurant	0.05

----Orchard----

	venue	freq
0	Japanese Restaurant	0.08
1	Shopping Mall	0.06
2	Hotel	0.05
3	Boutique	0.05
4	Clothing Store	0.04

----Outram----

	venue	freq
0	Chinese Restaurant	0.07
1	Hotel	0.05
2	Hostel	0.05
3	Café	0.04
4	Food Court	0.04

----Pasir Ris----

	venue	freq
0	Bus Station	0.08
1	Optical Shop	0.08
2	Coffee Shop	0.08
3	Sandwich Place	0.08
4	Bus Line	0.08

----Paya Lebar----

	venue	freq
0	Military Base	1.0
1	Accessories Store	0.0
2	Monument / Landmark	0.0
3	Movie Theater	0.0
4	Multiplex	0.0

----Pioneer----

	venue	freq
0	Chinese Restaurant	0.11
1	Coffee Shop	0.07
2	Food Court	0.07
3	Café	0.05
4	Japanese Restaurant	0.05

----Punggol----

	venue	freq
--	-------	------

0	Bus Station	0.50
1	High School	0.25
2	Chinese Restaurant	0.25
3	Paper / Office Supplies Store	0.00
4	Multiplex	0.00

----Queenstown----

	venue	freq
0	Coffee Shop	0.10
1	Food Court	0.10
2	Pharmacy	0.07
3	Office	0.07
4	Noodle House	0.07

----River Valley----

	venue	freq
0	Coffee Shop	0.11
1	Café	0.11
2	Spa	0.05
3	Athletics & Sports	0.05
4	Fried Chicken Joint	0.05

----Rochor----

	venue	freq
0	Indian Restaurant	0.49
1	Café	0.07
2	Hostel	0.05
3	Vegetarian / Vegan Restaurant	0.05
4	Chinese Restaurant	0.05

----Seletar----

	venue	freq
0	Park	0.14
1	Modern European Restaurant	0.14
2	English Restaurant	0.14
3	Food & Drink Shop	0.14
4	Café	0.14

----Sembawang----

	venue	freq
0	Coffee Shop	0.18
1	Bistro	0.12
2	Fast Food Restaurant	0.12
3	Japanese Restaurant	0.06
4	Dessert Shop	0.06

----Sengkang----

	venue	freq
0	Bus Station	0.22
1	Grocery Store	0.22
2	General College & University	0.11
3	Basketball Court	0.11
4	Bus Line	0.11

----Serangoon----

	venue	freq
0	Asian Restaurant	0.12
1	Convenience Store	0.12
2	Coffee Shop	0.12
3	Track Stadium	0.12
4	Trail	0.12

----Singapore River----

	venue	freq
0	Hotel	0.12
1	Japanese Restaurant	0.09
2	Café	0.09
3	Bar	0.03
4	Gym	0.03

----Southern Islands----

	venue	freq
0	Theme Park Ride / Attraction	0.31
1	Theme Park	0.14
2	Fast Food Restaurant	0.04
3	Resort	0.04
4	Pizza Place	0.04

----Straits View----

	venue	freq
0	Café	0.08
1	Coffee Shop	0.08
2	Hotel	0.06
3	Chinese Restaurant	0.04
4	Japanese Restaurant	0.04

----Sungei Kadut----

	venue	freq
0	Café	0.33
1	Bus Station	0.33
2	Chinese Restaurant	0.17
3	Furniture / Home Store	0.17
4	Playground	0.00

----Tampines----

	venue	freq
0	Sandwich Place	0.14
1	Plaza	0.14
2	Indian Restaurant	0.14
3	South Indian Restaurant	0.14
4	Housing Development	0.14

----Tanglin----

	venue	freq
0	Café	0.18
1	Park	0.09
2	Trail	0.09

```
3 Plaza 0.05
4 Bakery 0.05
```

----Toa Payoh----

```
      venue freq
0      Coffee Shop 0.16
1 Chinese Restaurant 0.12
2      Food Court 0.12
3      Noodle House 0.12
4      Park 0.08
```

----Tuas----

```
      venue freq
0      Food Court 0.5
1 Asian Restaurant 0.5
2 Accessories Store 0.0
3 Outdoor Sculpture 0.0
4      Movie Theater 0.0
```

----Western Water Catchment----

```
      venue freq
0 Fast Food Restaurant 0.22
1      Coffee Shop 0.22
2      Sandwich Place 0.11
3      Bookstore 0.11
4 College Cafeteria 0.11
```

----Woodlands----

```
      venue freq
0 Japanese Restaurant 0.09
1      Food Court 0.09
2      Café 0.06
3 Asian Restaurant 0.06
4      Shopping Mall 0.04
```

----Yishun----

```
      venue freq
0 Chinese Restaurant 0.09
1      Food Court 0.07
2      Café 0.04
3      Supermarket 0.04
4 Furniture / Home Store 0.04
```

Create a function to sort the venues in descending order

```
In [410]: def return_most_common_venues(row, num_top_venues):  
          row_categories = row.iloc[1:]  
          row_categories_sorted = row_categories.sort_values(ascending=False)  
  
          return row_categories_sorted.index.values[0:num_top_venues]
```

Create a new dataframe that display the top 10 venues for each neighborhood

```
In [411]: num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = sg_grouped['Neighborhood']

for ind in np.arange(sg_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(sg_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head(55)
```

Out[411]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Ang Mo Kio	Coffee Shop	Food Court	Fast Food Restaurant	Supermarket	Dessert Shop	Bubble Tea Shop	Sushi Restaurant	Sandwich Place	Halal Restaurant	Seafood Restaurant
1	Bedok	Coffee Shop	Supermarket	Sushi Restaurant	Food Court	Chinese Restaurant	Café	Fried Chicken Joint	Dessert Shop	Fast Food Restaurant	Indian Restaurant
2	Bishan	Café	Chinese Restaurant	Thai Restaurant	Ice Cream Shop	Indian Restaurant	Food Court	French Restaurant	Coffee Shop	Park	Spa
3	Boon Lay	Botanical Garden	Yoga Studio	Fast Food Restaurant	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food
4	Bukit Batok	Italian Restaurant	Gym	Café	Ice Cream Shop	Indian Restaurant	Supermarket	Shopping Mall	Coffee Shop	Grocery Store	Bus Stop
5	Bukit Merah	Chinese Restaurant	Convenience Store	Residential Building (Apartment / Condo)	Food Court	Seafood Restaurant	Bus Line	Japanese Restaurant	Asian Restaurant	Coffee Shop	Yoga Studio
6	Bukit Panjang	Food Court	Park	Miscellaneous Shop	Grocery Store	Dance Studio	Fruit & Vegetable Store	Market	Noodle House	Food Stand	Food & Drink Shop
7	Bukit Timah	Pool	Food	Gym / Fitness Center	Farmers Market	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Flower Shop
8	Central Water Catchment	Trail	Yoga Studio	Farmers Market	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food
9	Changi	Airport Terminal	Bus Station	Movie Theater	Tunnel	Café	Coffee Shop	Sporting Goods Shop	Road	Airport Service	Airport
10	Changi Bay	Boat or Ferry	Military Base	Field	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop
11	Choa Chu Kang	Food Court	Coffee Shop	Bus Station	Fast Food Restaurant	Bubble Tea Shop	Furniture / Home Store	Sandwich Place	Lottery Retailer	Thai Restaurant	Bakery
12	Clementi	Coffee Shop	Noodle House	Chinese Restaurant	Asian Restaurant	Snack Place	Japanese Restaurant	Shopping Mall	Bakery	Dessert Shop	Electronics Store
13	Downtown Core	Cocktail Bar	Italian Restaurant	Performing Arts Venue	Salad Place	Japanese Restaurant	Bar	Coffee Shop	Concert Hall	Yoga Studio	Hotel
14	Geylang	Fast Food Restaurant	Asian Restaurant	Bakery	Supermarket	Shopping Mall	Breakfast Spot	Ramen Restaurant	Steakhouse	Vegetarian / Vegan Restaurant	Noodle House
15	Hougang	Chinese Restaurant	Coffee Shop	Noodle House	Café	Asian Restaurant	Dessert Shop	Snack Place	Supermarket	Bakery	Food Court
16	Jurong East	Japanese Restaurant	Chinese Restaurant	Shopping Mall	Coffee Shop	Café	Department Store	Supermarket	Bubble Tea Shop	Sushi Restaurant	Korean Restaurant
17	Jurong West	Japanese Restaurant	Fast Food Restaurant	Asian Restaurant	Chinese Restaurant	Café	Dessert Shop	Food Court	Coffee Shop	Bookstore	Breakfast Spot
18	Kallang	Restaurant	Coffee Shop	Supermarket	BBQ Joint	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Snack Place	Nightclub	Metro Station	Food Court
19	Lim Chu Kang	Farm	Farmers Market	Theme Park Ride / Attraction	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food
20	Mandai	Ice Cream Shop	Asian Restaurant	Bar	Indian Restaurant	Chinese Restaurant	Coffee Shop	Thai Restaurant	Field	Filipino Restaurant	Flea Market
21	Marina East	Golf Course	Park	Yoga Studio	Farmers Market	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food
22	Marina South	Seafood Restaurant	Satay Restaurant	Bar	Harbor / Marina	Food Court	Gift Shop	BBQ Joint	Bus Stop	Scenic Lookout	Science Museum
23	Marine Parade	Chinese Restaurant	Bar	Ice Cream Shop	Japanese Restaurant	Supermarket	Bakery	Steakhouse	Café	Karaoke Bar	Flower Shop
24	Museum	Hotel	Japanese Restaurant	Café	Movie Theater	Ice Cream Shop	French Restaurant	Chinese Restaurant	Yoga Studio	Karaoke Bar	Malay Restaurant
25	Newton	Café	Wine Bar	Food Court	Seafood Restaurant	Chinese Restaurant	Noodle House	Thai Restaurant	Yoga Studio	Food Stand	Food & Drink Shop

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
26	North-Eastern Islands	College Theater	Plaza	Island	Food Court	School	Coffee Shop	Asian Restaurant	Flower Shop	Field	Filipino Restaurant
27	Novena	Coffee Shop	Japanese Restaurant	Café	Chinese Restaurant	Italian Restaurant	Hainan Restaurant	Bakery	Hotel	Sandwich Place	Sporting Goods Shop
28	Orchard	Japanese Restaurant	Shopping Mall	Boutique	Hotel	Clothing Store	Chinese Restaurant	Wine Bar	Ramen Restaurant	Coffee Shop	Spa
29	Outram	Chinese Restaurant	Hostel	Hotel	Café	Seafood Restaurant	Food Court	Cocktail Bar	Spa	Noodle House	Vegetarian / Vegan Restaurant
30	Pasir Ris	Bus Line	Bus Station	Sandwich Place	Coffee Shop	Optical Shop	Comfort Food Restaurant	Gym	Food Court	Flower Shop	Salon / Barbershop
31	Paya Lebar	Military Base	Yoga Studio	Fast Food Restaurant	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food
32	Pioneer	Chinese Restaurant	Coffee Shop	Food Court	BBQ Joint	Japanese Restaurant	Café	Indian Restaurant	Asian Restaurant	Hot Dog Joint	Korean Restaurant
33	Punggol	Bus Station	High School	Chinese Restaurant	Yoga Studio	Fast Food Restaurant	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop
34	Queenstown	Coffee Shop	Food Court	Pharmacy	Office	Noodle House	Pizza Place	Fried Chicken Joint	Beer Bar	Bistro	Snack Place
35	River Valley	Café	Coffee Shop	Chinese Restaurant	BBQ Joint	Gourmet Shop	Grocery Store	Steakhouse	Salad Place	Hainan Restaurant	Fast Food Restaurant
36	Rochor	Indian Restaurant	Café	Chinese Restaurant	Hostel	Vegetarian / Vegan Restaurant	Cantonese Restaurant	Coffee Shop	Music Venue	Museum	Gaming Cafe
37	Seletar	Café	Modern European Restaurant	Food & Drink Shop	Park	English Restaurant	Chinese Restaurant	Other Repair Shop	Yoga Studio	French Restaurant	Food Stand
38	Sembawang	Coffee Shop	Fast Food Restaurant	Bistro	Buffet	Dessert Shop	Food Court	Bus Station	Supermarket	Sushi Restaurant	Chinese Restaurant
39	Sengkang	Bus Station	Grocery Store	Food Stand	General College & University	Metro Station	Bus Line	Basketball Court	Yoga Studio	Flea Market	Fried Chicken Joint
40	Serangoon	Park	Track Stadium	Indonesian Restaurant	Convenience Store	Bus Station	Coffee Shop	Asian Restaurant	Trail	Filipino Restaurant	Flea Market
41	Singapore River	Hotel	Café	Japanese Restaurant	Coffee Shop	Steakhouse	Thai Restaurant	Wine Bar	Gym	Asian Restaurant	Italian Restaurant
42	Southern Islands	Theme Park Ride / Attraction	Theme Park	Pizza Place	Café	Fast Food Restaurant	Resort	American Restaurant	Campground	Candy Store	Juice Bar
43	Straits View	Café	Coffee Shop	Hotel	Gym	Waterfront	Mexican Restaurant	Japanese Restaurant	Chinese Restaurant	Pub	Sandwich Place
44	Sungei Kadut	Bus Station	Café	Furniture / Home Store	Chinese Restaurant	Fast Food Restaurant	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop
45	Tampines	Indian Restaurant	Grocery Store	Housing Development	Sandwich Place	Fast Food Restaurant	South Indian Restaurant	Plaza	Hong Kong Restaurant	Hobby Shop	Food & Drink Shop
46	Tanglin	Café	Park	Trail	Thai Restaurant	Restaurant	Golf Course	Lounge	Malay Restaurant	Bakery	Japanese Restaurant
47	Toa Payoh	Coffee Shop	Chinese Restaurant	Food Court	Noodle House	Fast Food Restaurant	Park	Bus Line	Market	Bus Stop	Thai Restaurant
48	Tuas	Food Court	Asian Restaurant	Yoga Studio	Farmers Market	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food & Drink Shop	Food
49	Western Water Catchment	Fast Food Restaurant	Coffee Shop	College Cafeteria	Bookstore	Korean Restaurant	Grocery Store	Sandwich Place	Food	Food & Drink Shop	Food Court

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
50	Woodlands	Food Court	Japanese Restaurant	Café	Asian Restaurant	Fast Food Restaurant	Frozen Yogurt Shop	Shopping Mall	Bus Station	Supermarket	Indian Restaurant
51	Yishun	Chinese Restaurant	Food Court	Café	Supermarket	Furniture / Home Store	Noodle House	Coffee Shop	Hainan Restaurant	Mexican Restaurant	Fried Chicken Joint

7. K-Mean Clustering

Run k-means to cluster the neighborhood into 10 clusters

```
In [413]: # set number of clusters
kclusters = 10

sg_grouped_clustering = sg_grouped.drop('Neighborhood', 1)

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

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:54]
```

```
Out[413]: array([1, 1, 1, 4, 1, 1, 1, 1, 3, 1, 6, 1, 1, 1, 1, 1, 1, 1, 1, 8, 1, 7, 1,
1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 5, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 5, 1,
1, 1, 9, 1, 1, 1], dtype=int32)
```

New Dataframe that includes the cluster labels as well as the top 10 venues for each neighborhood

```

In [414]: # add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

sg_merged = df_sgNeigh

# merge toronto_grouped with toronto_data to add Latitude/Longitude for each neighborhood
sg_merged = sg_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'), on='Neighborhood')

# Replace NaN with '0'
sg_merged['Cluster Labels'].fillna(value=0, method=None, axis=None, inplace=True)
sg_merged.head() # check the last columns!

```

Out[414]:

	Region	Neighborhood	Latitude	Longitude	Population Density	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	North-East	Ang Mo Kio	1.369115	103.845434	12,000	1.0	Coffee Shop	Food Court	Fast Food Restaurant	Supermarket	Dessert Shop	Bubble Tea Shop	Sushi Restaurant	Sandwich Place	Halal Restaurant	Seafood Restaurant
1	East	Bedok	1.323604	103.927340	13,000	1.0	Coffee Shop	Supermarket	Sushi Restaurant	Food Court	Chinese Restaurant	Café	Fried Chicken Joint	Dessert Shop	Fast Food Restaurant	Indian Restaurant
2	Central	Bishan	1.352585	103.835212	12,000	1.0	Café	Chinese Restaurant	Thai Restaurant	Ice Cream Shop	Indian Restaurant	Food Court	French Restaurant	Coffee Shop	Park	Spa
3	West	Boon Lay	1.314256	103.709310	3.6	4.0	Botanical Garden	Yoga Studio	Fast Food Restaurant	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food
4	West	Bukit Batok	1.359029	103.763680	13,000	1.0	Italian Restaurant	Gym	Café	Ice Cream Shop	Indian Restaurant	Supermarket	Shopping Mall	Coffee Shop	Grocery Store	Bus Stop

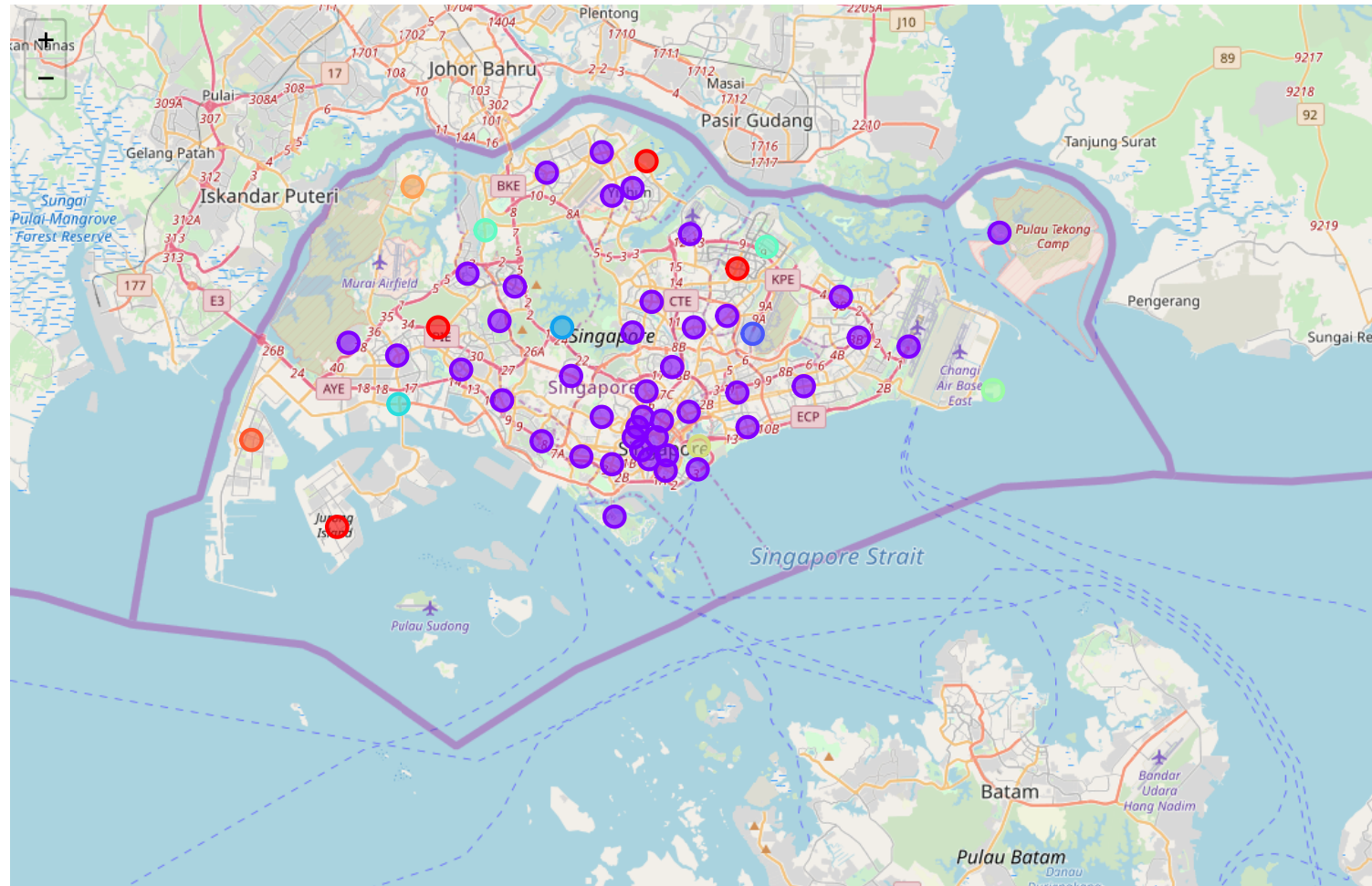
```
In [415]: # create map
map_clusters = folium.Map(location=[SGlatitude, SGlongitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(sg_merged['Latitude'], sg_merged['Longitude'], sg_merged['Neighborhood'], sg_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=8,
        popup=label,
        color=rainbow[int(cluster)-1],
        fill=True,
        fill_color=rainbow[int(cluster)-1],
        fill_opacity=0.6).add_to(map_clusters)

map_clusters
```

Out[415]:



Leaflet (<http://leafletjs.com>)

Visualise the resulting 10 clusters

```
In [416]: sg_merged.loc[sg_merged['Cluster Labels'] == 0, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]
```

Out[416]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
39	Sengkang	0.0	Bus Station	Grocery Store	Food Stand	General College & University	Metro Station	Bus Line	Basketball Court	Yoga Studio	Flea Market	Fried Chicken Joint
41	Simpang	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
48	Tengah	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
51	Western Islands	0.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

The resultant 'NaN' is due to several reasons:

1. Simpang is not yet developed and currently still a forested area.
2. Tengah is a new town that is still under construction.
3. Western island (Jurong island to be specific) is an full fledged industrial area.

```
In [417]: sg_merged.loc[sg_merged['Cluster Labels'] == 1, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]
```

Out[417]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Ang Mo Kio	1.0	Coffee Shop	Food Court	Fast Food Restaurant	Supermarket	Dessert Shop	Bubble Tea Shop	Sushi Restaurant	Sandwich Place	Halal Restaurant	Seafood Restaurant
1	Bedok	1.0	Coffee Shop	Supermarket	Sushi Restaurant	Food Court	Chinese Restaurant	Café	Fried Chicken Joint	Dessert Shop	Fast Food Restaurant	Indian Restaurant
2	Bishan	1.0	Café	Chinese Restaurant	Thai Restaurant	Ice Cream Shop	Indian Restaurant	Food Court	French Restaurant	Coffee Shop	Park	Spa
4	Bukit Batok	1.0	Italian Restaurant	Gym	Café	Ice Cream Shop	Indian Restaurant	Supermarket	Shopping Mall	Coffee Shop	Grocery Store	Bus Stop
5	Bukit Merah	1.0	Chinese Restaurant	Convenience Store	Residential Building (Apartment / Condo)	Food Court	Seafood Restaurant	Bus Line	Japanese Restaurant	Asian Restaurant	Coffee Shop	Yoga Studio
6	Bukit Panjang	1.0	Food Court	Park	Miscellaneous Shop	Grocery Store	Dance Studio	Fruit & Vegetable Store	Market	Noodle House	Food Stand	Food & Drink Shop
7	Bukit Timah	1.0	Pool	Food	Gym / Fitness Center	Farmers Market	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Flower Shop
9	Changi	1.0	Airport Terminal	Bus Station	Movie Theater	Tunnel	Café	Coffee Shop	Sporting Goods Shop	Road	Airport Service	Airport
11	Choa Chu Kang	1.0	Food Court	Coffee Shop	Bus Station	Fast Food Restaurant	Bubble Tea Shop	Furniture / Home Store	Sandwich Place	Lottery Retailer	Thai Restaurant	Bakery
12	Clementi	1.0	Coffee Shop	Noodle House	Chinese Restaurant	Asian Restaurant	Snack Place	Japanese Restaurant	Shopping Mall	Bakery	Dessert Shop	Electronics Store
13	Downtown Core	1.0	Cocktail Bar	Italian Restaurant	Performing Arts Venue	Salad Place	Japanese Restaurant	Bar	Coffee Shop	Concert Hall	Yoga Studio	Hotel
14	Geylang	1.0	Fast Food Restaurant	Asian Restaurant	Bakery	Supermarket	Shopping Mall	Breakfast Spot	Ramen Restaurant	Steakhouse	Vegetarian / Vegan Restaurant	Noodle House
15	Hougang	1.0	Chinese Restaurant	Coffee Shop	Noodle House	Café	Asian Restaurant	Dessert Shop	Snack Place	Supermarket	Bakery	Food Court
16	Jurong East	1.0	Japanese Restaurant	Chinese Restaurant	Shopping Mall	Coffee Shop	Café	Department Store	Supermarket	Bubble Tea Shop	Sushi Restaurant	Korean Restaurant
17	Jurong West	1.0	Japanese Restaurant	Fast Food Restaurant	Asian Restaurant	Chinese Restaurant	Café	Dessert Shop	Food Court	Coffee Shop	Bookstore	Breakfast Spot
18	Kallang	1.0	Restaurant	Coffee Shop	Supermarket	BBQ Joint	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Snack Place	Nightclub	Metro Station	Food Court
20	Mandai	1.0	Ice Cream Shop	Asian Restaurant	Bar	Indian Restaurant	Chinese Restaurant	Coffee Shop	Thai Restaurant	Field	Filipino Restaurant	Flea Market
22	Marina South	1.0	Seafood Restaurant	Satay Restaurant	Bar	Harbor / Marina	Food Court	Gift Shop	BBQ Joint	Bus Stop	Scenic Lookout	Science Museum
23	Marine Parade	1.0	Chinese Restaurant	Bar	Ice Cream Shop	Japanese Restaurant	Supermarket	Bakery	Steakhouse	Café	Karaoke Bar	Flower Shop
24	Museum	1.0	Hotel	Japanese Restaurant	Café	Movie Theater	Ice Cream Shop	French Restaurant	Chinese Restaurant	Yoga Studio	Karaoke Bar	Malay Restaurant
25	Newton	1.0	Café	Wine Bar	Food Court	Seafood Restaurant	Chinese Restaurant	Noodle House	Thai Restaurant	Yoga Studio	Food Stand	Food & Drink Shop
26	North-Eastern Islands	1.0	College Theater	Plaza	Island	Food Court	School	Coffee Shop	Asian Restaurant	Flower Shop	Field	Filipino Restaurant

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
27	Novena	1.0	Coffee Shop	Japanese Restaurant	Café	Chinese Restaurant	Italian Restaurant	Hainan Restaurant	Bakery	Hotel	Sandwich Place	Sporting Goods Shop
28	Orchard	1.0	Japanese Restaurant	Shopping Mall	Boutique	Hotel	Clothing Store	Chinese Restaurant	Wine Bar	Ramen Restaurant	Coffee Shop	Spa
29	Outram	1.0	Chinese Restaurant	Hostel	Hotel	Café	Seafood Restaurant	Food Court	Cocktail Bar	Spa	Noodle House	Vegetarian / Vegan Restaurant
30	Pasir Ris	1.0	Bus Line	Bus Station	Sandwich Place	Coffee Shop	Optical Shop	Comfort Food Restaurant	Gym	Food Court	Flower Shop	Salon / Barbershop
32	Pioneer	1.0	Chinese Restaurant	Coffee Shop	Food Court	BBQ Joint	Japanese Restaurant	Café	Indian Restaurant	Asian Restaurant	Hot Dog Joint	Korean Restaurant
34	Queenstown	1.0	Coffee Shop	Food Court	Pharmacy	Office	Noodle House	Pizza Place	Fried Chicken Joint	Beer Bar	Bistro	Snack Place
35	River Valley	1.0	Café	Coffee Shop	Chinese Restaurant	BBQ Joint	Gourmet Shop	Grocery Store	Steakhouse	Salad Place	Hainan Restaurant	Fast Food Restaurant
36	Rochor	1.0	Indian Restaurant	Café	Chinese Restaurant	Hostel	Vegetarian / Vegan Restaurant	Cantonese Restaurant	Coffee Shop	Music Venue	Museum	Gaming Cafe
37	Seletar	1.0	Café	Modern European Restaurant	Food & Drink Shop	Park	English Restaurant	Chinese Restaurant	Other Repair Shop	Yoga Studio	French Restaurant	Food Stand
38	Sembawang	1.0	Coffee Shop	Fast Food Restaurant	Bistro	Buffet	Dessert Shop	Food Court	Bus Station	Supermarket	Sushi Restaurant	Chinese Restaurant
40	Serangoon	1.0	Park	Track Stadium	Indonesian Restaurant	Convenience Store	Bus Station	Coffee Shop	Asian Restaurant	Trail	Filipino Restaurant	Flea Market
42	Singapore River	1.0	Hotel	Café	Japanese Restaurant	Coffee Shop	Steakhouse	Thai Restaurant	Wine Bar	Gym	Asian Restaurant	Italian Restaurant
43	Southern Islands	1.0	Theme Park Ride / Attraction	Theme Park	Pizza Place	Café	Fast Food Restaurant	Resort	American Restaurant	Campground	Candy Store	Juice Bar
44	Straits View	1.0	Café	Coffee Shop	Hotel	Gym	Waterfront	Mexican Restaurant	Japanese Restaurant	Chinese Restaurant	Pub	Sandwich Place
46	Tampines	1.0	Indian Restaurant	Grocery Store	Housing Development	Sandwich Place	Fast Food Restaurant	South Indian Restaurant	Plaza	Hong Kong Restaurant	Hobby Shop	Food & Drink Shop
47	Tanglin	1.0	Café	Park	Trail	Thai Restaurant	Restaurant	Golf Course	Lounge	Malay Restaurant	Bakery	Japanese Restaurant
49	Toa Payoh	1.0	Coffee Shop	Chinese Restaurant	Food Court	Noodle House	Fast Food Restaurant	Park	Bus Line	Market	Bus Stop	Thai Restaurant
52	Western Water Catchment	1.0	Fast Food Restaurant	Coffee Shop	College Cafeteria	Bookstore	Korean Restaurant	Grocery Store	Sandwich Place	Food	Food & Drink Shop	Food Court
53	Woodlands	1.0	Food Court	Japanese Restaurant	Café	Asian Restaurant	Fast Food Restaurant	Frozen Yogurt Shop	Shopping Mall	Bus Station	Supermarket	Indian Restaurant
54	Yishun	1.0	Chinese Restaurant	Food Court	Café	Supermarket	Furniture / Home Store	Noodle House	Coffee Shop	Hainan Restaurant	Mexican Restaurant	Fried Chicken Joint

In [418]: sg_merged.loc[sg_merged['Cluster Labels'] == 2, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]

Out[418]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
31	Paya Lebar	2.0	Military Base	Yoga Studio	Fast Food Restaurant	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food

In [420]: sg_merged.loc[sg_merged['Cluster Labels'] == 3, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]

Out[420]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
8	Central Water Catchment	3.0	Trail	Yoga Studio	Farmers Market	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food

In [421]: sg_merged.loc[sg_merged['Cluster Labels'] == 4, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]

Out[421]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
3	Boon Lay	4.0	Botanical Garden	Yoga Studio	Fast Food Restaurant	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food

In [422]: sg_merged.loc[sg_merged['Cluster Labels'] == 5, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]

Out[422]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
33	Punggol	5.0	Bus Station	High School	Chinese Restaurant	Yoga Studio	Fast Food Restaurant	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop
45	Sungei Kadut	5.0	Bus Station	Café	Furniture / Home Store	Chinese Restaurant	Fast Food Restaurant	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop

In [423]: sg_merged.loc[sg_merged['Cluster Labels'] == 6, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]

Out[423]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
10	Changi Bay	6.0	Boat or Ferry	Military Base	Field	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop

```
In [424]: sg_merged.loc[sg_merged['Cluster Labels'] == 7, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]
```

Out[424]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
21	Marina East	7.0	Golf Course	Park	Yoga Studio	Farmers Market	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food

```
In [425]: sg_merged.loc[sg_merged['Cluster Labels'] == 8, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]
```

Out[425]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
19	Lim Chu Kang	8.0	Farm	Farmers Market	Theme Park Ride / Attraction	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food Court	Food & Drink Shop	Food

```
In [426]: sg_merged.loc[sg_merged['Cluster Labels'] == 9, sg_merged.columns[[1] + list(range(5, sg_merged.shape[1]))]]
```

Out[426]:

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
50	Tuas	9.0	Food Court	Asian Restaurant	Yoga Studio	Farmers Market	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Stand	Food & Drink Shop	Food

8. Evaluating the 10 Clusters

10 Clusters are chosen to better distinct the neighborhoods as it is initially found that Singapore's Neighborhoods are all too similar. Most Neighborhoods fall into Cluster '0' which is a cluster that is categorised by **eateries**. The 1st most common venues are '**Coffee shop**', '**Restaurant**', '**Food court**', '**Bar**' etc. Areas with coffee shops are **residential neighborhoods** as it is common to have coffee shops within HDB estates. Since **80%** of Singapore residential typologies are HDBs, Cluster '0' consists of most neighborhoods out of the 55 neighborhoods.

Cluster '0' will be the chosen cluster to locate the cafe as the other clusters are less populated areas that are do not have enough human traffic to generate consistent revenues.

The **Museum** neighborhood is the only neighborhood in Cluster '0' that has **hotels** as the **first most common venue**. Therefore the second part of the analysis will use the Museum's **geographically coordinates - (Lat 1.296615, Long 103.848510)** as the epicentre to **query** for potential location for our cafe.

```
In [446]: search_query = 'Hotel'
radius = 500
LIMIT = 100
print(search_query + ' .... OK!')
```

Hotel OK!

Define the corresponding URL

```
In [447]: url = 'https://api.foursquare.com/v2/venues/search?client_id={}&client_secret={}&ll={},{}&v={}&query={}&radius={}&limit={}'.format(CLIENT_ID, CLIENT_SECRET, 1.296615, 103.848510, VERSION, search_query, radius, LIMIT)
url

Out[447]: 'https://api.foursquare.com/v2/venues/search?client_id=UCVO2GVTL120H00WGRITBRVBU02XABHYHFTVA2YIYXWZY2XE&client_secret=C5HRVGKZXEGWYOV0D03E4HRRCM5JW2AJ44A30RJXDLSFLFU0&ll=1.296615,103.84851&v=20180604&query=Hotel&radius=500&limit=100'
```

Send the GET request and examine the results

```
In [448]: results = requests.get(url).json()  
         results
```

```
Out[448]: {'meta': {'code': 200, 'requestId': '5cf93ecddb04f52f5edd7a52'},
  'response': {'venues': [{'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/hotel_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d1fa931735',
    'name': 'Hotel',
    'pluralName': 'Hotels',
    'primary': True,
    'shortName': 'Hotel'}]},
    'hasPerk': False,
    'id': '4b05880af964a520ae22e3',
    'location': {'address': '9 Bras Basah Road',
    'cc': 'SG',
    'city': 'Singapore',
    'country': 'Singapore',
    'distance': 227,
    'formattedAddress': ['9 Bras Basah Road', '189559', 'Singapore'],
    'labeledLatLngs': [{'label': 'display',
    'lat': 1.2985851758211133,
    'lng': 103.84906056770934}],
    'lat': 1.2985851758211133,
    'lng': 103.84906056770934,
    'postalCode': '189559'},
    'name': 'Rendezvous Hotel Singapore',
    'referralId': 'v-1559838413'},
    {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/hotel_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d1fa931735',
    'name': 'Hotel',
    'pluralName': 'Hotels',
    'primary': True,
    'shortName': 'Hotel'}]},
    'hasPerk': False,
    'id': '4b05880af964a5208aad22e3',
    'location': {'address': '76 Bras Basah Rd',
    'cc': 'SG',
    'city': 'Singapore',
    'country': 'Singapore',
    'distance': 471,
    'formattedAddress': ['76 Bras Basah Rd', '189558', 'Singapore'],
    'labeledLatLngs': [{'label': 'display',
    'lat': 1.2957137659427311,
    'lng': 103.85265190696873}],
    'lat': 1.2957137659427311,
    'lng': 103.85265190696873,
    'postalCode': '189558'},
    'name': 'Carlton Hotel',
    'referralId': 'v-1559838413'},
    {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/hotel_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d1fa931735',
    'name': 'Hotel',
    'pluralName': 'Hotels',
    'primary': True,
    'shortName': 'Hotel'}]},
    'hasPerk': False,
    'id': '4b05880af964a52095ad22e3',
    'location': {'address': '47 Bencoolen St.',
    'cc': 'SG',
    'city': 'Singapore',
```

```
'country': 'Singapore',
'distance': 333,
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'labeledLatLngs': [{'label': 'display',
  'lat': 1.2991005826286413,
  'lng': 103.850186415232}],
'lat': 1.2991005826286413,
'lng': 103.850186415232,
'postalCode': '189626'},
'name': 'Hotel Bencoolen',
'referralId': 'v-1559838413'},
{'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/hotel_',
  'suffix': '.png'},
  'id': '4bf58dd8d48988d1fa931735',
  'name': 'Hotel',
  'pluralName': 'Hotels',
  'primary': True,
  'shortName': 'Hotel'}],
'hasPerk': False,
'id': '4b6e3d6df964a520a5b32ce3',
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  'city': 'Singapore',
  'country': 'Singapore',
  'distance': 259,
  'formattedAddress': ['25 Bencoolen St', '189619', 'Singapore'],
  'labeledLatLngs': [{'label': 'display',
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    'lng': 103.84995898321019}],
  'lat': 1.2984418974734215,
  'lng': 103.84995898321019,
  'postalCode': '189619'},
  'name': 'Strand Hotel',
  'referralId': 'v-1559838413'},
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  'suffix': '.png'},
  'id': '4bf58dd8d48988d1fa931735',
  'name': 'Hotel',
  'pluralName': 'Hotels',
  'primary': True,
  'shortName': 'Hotel'}],
'hasPerk': False,
'id': '515d4b70e8897cf50c48cc03',
'location': {'address': '200 Middle Road',
  'cc': 'SG',
  'city': 'Singapore',
  'country': 'Singapore',
  'distance': 558,
  'formattedAddress': ['200 Middle Road', '188980', 'Singapore'],
  'labeledLatLngs': [{'label': 'display',
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    'lng': 103.85147545152623}],
  'lat': 1.3006607302147999,
  'lng': 103.85147545152623,
  'postalCode': '188980'},
  'name': 'Hotel G Singapore',
  'referralId': 'v-1559838413',
  'venuePage': {'id': '55446078'}},
{'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/hotel_',
  'suffix': '.png'},
```

```
'id': '4bf58dd8d48988d1fa931735',
'name': 'Hotel',
'pluralName': 'Hotels',
'primary': True,
'shortName': 'Hotel']],
'hasPerk': False,
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  'name': 'Ballroom',
  'pluralName': 'Ballrooms',
  'primary': True,
  'shortName': 'Ballroom'}]},
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'name': 'Hotel Fort Canning Grand Marquee',
'referralId': 'v-1559838413'},
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  'id': '4bf58dd8d48988d116941735',
  'name': 'Bar',
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  'primary': True,
  'shortName': 'Bar'}]},
'hasPerk': False,
'id': '554393d5498e851f26820c93',
'location': { 'address': '9 Bras Basah Road',
  'cc': 'SG',
  'country': 'Singapore',
  'distance': 230,
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  'labeledLatLngs': [{ 'label': 'display',
    'lat': 1.298557,
    'lng': 103.849219}],
  'lat': 1.298557,
  'lng': 103.849219},
'name': 'The Library, Rendezvous Hotel Singapore',
'referralId': 'v-1559838413'},
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'referralId': 'v-1559838413'},
{'categories': [{ 'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/nightlife/cocktails_',
  'suffix': '.png'},
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  'name': 'Cocktail Bar',
  'pluralName': 'Cocktail Bars',
  'primary': True,
  'shortName': 'Cocktail'}]},
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```
    'lng': 103.84542767455447},
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    'referralId': 'v-1559838413'},
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    'name': 'Hotel',
    'pluralName': 'Hotels',
    'primary': True,
    'shortName': 'Hotel'}]},
  'hasPerk': False,
  'id': '50a7ba2be4b02a7dbfd79230',
  'location': {'address': 'Singapore',
    'cc': 'SG',
    'city': 'Singapore',
    'country': 'Singapore',
    'crossStreet': 'Orchad Road, #10-6',
    'distance': 313,
    'formattedAddress': ['Singapore (Orchad Road, #10-6)', 'Singapore'],
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  'referralId': 'v-1559838413'},
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    'name': 'Conference Room',
    'pluralName': 'Conference Rooms',
    'primary': True,
    'shortName': 'Conference room'}]},
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    'lat': 1.2975339938878863,
    'lng': 103.85271984828105},
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  'referralId': 'v-1559838413'},
  {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/spa_',
    'suffix': '.png'},
    'id': '4bf58dd8d48988d1ed941735',
    'name': 'Spa',
    'pluralName': 'Spas',
    'primary': True,
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'primary': True,
'shortName': 'Convenience Store'}],
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'referralId': 'v-1559838413'},
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'primary': True,
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```
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    'suffix': '.png'},
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    'name': 'Ballroom',
    'pluralName': 'Ballrooms',
    'primary': True,
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  'referralId': 'v-1559838413'},
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  'referralId': 'v-1559838413'},
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    'primary': True,
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    'lat': 1.2962004895738544,
    'lng': 103.85251602444592},
  'name': 'Premier Club Lounge @ Carlton Hotel',
  'referralId': 'v-1559838413'},
```

```
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  'primary': True,
  'shortName': 'Café'}]},
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  'country': 'Singapore',
  'distance': 385,
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  'lng': 103.85163845309033},
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'referralId': 'v-1559838413'},
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  'id': '4bf58dd8d48988d171941735',
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  'primary': True,
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'referralId': 'v-1559838413'},
{'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/building/gym_',
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  'id': '4bf58dd8d48988d176941735',
  'name': 'Gym',
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  'primary': True,
  'shortName': 'Gym'}]},
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'location': {'address': 'Rendezvous Hotel Singapore',
  'cc': 'SG',
  'country': 'Singapore',
  'distance': 251,
  'formattedAddress': ['Rendezvous Hotel Singapore', 'Singapore'],
  'labeledLatLngs': [{'label': 'display',
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    'lng': 103.849538}],
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```

    'lng': 103.849538},
    'name': 'Gymnasium at Rendezvous Hotel Singapore',
    'referralId': 'v-1559838413'},
    {'categories': [],
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     'id': '4ca45321d5a2a143f8bb5090',
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                  'country': 'Singapore',
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                                       'lng': 103.850105}],
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                  'lng': 103.850105},
     'name': 'Room 507 Hotel 81',
     'referralId': 'v-1559838413'},
    {'categories': [],
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                  'city': 'Singapore',
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                  'distance': 276,
                  'formattedAddress': ['30 Bencoolen Road', 'Singapore'],
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                  'lng': 103.8502003806655},
     'name': 'Bayview Hotel @ Emarld Room 2',
     'referralId': 'v-1559838413'},
    {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/parks_outdoors/pool_',
                              'suffix': '.png'},
                      'id': '4bf58dd8d48988d15e941735',
                      'name': 'Pool',
                      'pluralName': 'Pools',
                      'primary': True,
                      'shortName': 'Pool'}}],
     'hasPerk': False,
     'id': '53a828f2498e8e8492423cfa',
     'location': {'address': 'Bayview Hotel',
                  'cc': 'SG',
                  'country': 'Singapore',
                  'distance': 278,
                  'formattedAddress': ['Bayview Hotel', 'Singapore'],
                  'labeledLatLngs': [{'label': 'display',
                                       'lat': 1.298439,
                                       'lng': 103.850225}],
                  'lat': 1.298439,
                  'lng': 103.850225},
     'name': 'Swimming Pool @ Bayview Hotel',
     'referralId': 'v-1559838413'}}]]}

```

Get relevant part of JSON and transform it into a *pandas* dataframe

```
In [449]: # assign relevant part of JSON to venues
venues = results['response']['venues']

# tranform venues into a dataframe
dataframe = json_normalize(venues)
dataframe.shape
```

```
Out[449]: (50, 19)
```

Filter for venue categories

```
In [367]: # keep only columns that include venue name, and anything that is associated with location
filtered_columns = ['name', 'categories'] + [col for col in dataframe.columns if col.startswith('location.')] + ['id']
dataframe_filtered = dataframe.loc[:, filtered_columns]

# function that extracts the category of the venue
def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

    if len(categories_list) == 0:
        return None
    else:
        return categories_list[0]['name']

# filter the category for each row
dataframe_filtered['categories'] = dataframe_filtered.apply(get_category_type, axis=1)

# clean column names by keeping only last term
dataframe_filtered.columns = [column.split('.')[0] for column in dataframe_filtered.columns]

dataframe_filtered
```


Out[367]:

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	neighborhood	postalCode	state	
0	Rendezvous Hotel Singapore	Hotel	9 Bras Basah Road	SG	Singapore	Singapore	NaN	227	[9 Bras Basah Road, 189559, Singapore]	[{"lng": 103.84906056770934, "lat": 1.29858517...}	1.298585	103.849061	NaN	189559	NaN	4b05880af964a520aead2:
1	Carlton Hotel	Hotel	76 Bras Basah Rd	SG	Singapore	Singapore	NaN	471	[76 Bras Basah Rd, 189558, Singapore]	[{"lng": 103.85265190696873, "lat": 1.29571376...}	1.295714	103.852652	NaN	189558	NaN	4b05880af964a5208aad2
2	JW Marriott Hotel Singapore South Beach	Hotel	30 Beach Road, Access Via Nicoll Highway	SG	Singapore	Singapore	NaN	844	[30 Beach Road, Access Via Nicoll Highway, 189...	[{"lng": 103.85579288005829, "lat": 1.29446877...}	1.294469	103.855793	NaN	189763	SG-01	56a80c97498e568a2863f
3	Hotel Bencoolen	Hotel	47 Bencoolen St.	SG	Singapore	Singapore	NaN	333	[47 Bencoolen St., 189626, Singapore]	[{"lng": 103.850186415232, "lat": 1.2991005826...}	1.299101	103.850186	NaN	189626	NaN	4b05880af964a52095ad2
4	Strand Hotel	Hotel	25 Bencoolen St	SG	Singapore	Singapore	NaN	259	[25 Bencoolen St, 189619, Singapore]	[{"lng": 103.84995898321019, "lat": 1.29844189...}	1.298442	103.849959	NaN	189619	NaN	4b6e3d6df964a520a5b32
5	Marina Bay Sands Hotel	Hotel	10 Bayfront Ave.	SG	Singapore	Singapore	NaN	1996	[10 Bayfront Ave., 018956, Singapore]	NaN	1.283096	103.860296	NaN	018956	NaN	4bf7c040a467c92806192
6	Hotel G Singapore	Hotel	200 Middle Road	SG	Singapore	Singapore	NaN	558	[200 Middle Road, 188980, Singapore]	[{"lng": 103.85147545152623, "lat": 1.30066073...}	1.300661	103.851475	NaN	188980	NaN	515d4b70e8897cf50c48c
7	Mercure Hotel	Hotel	122 Middle Road	SG	Singapore	Singapore	NaN	610	[122 Middle Road, 188973, Singapore]	[{"lng": 103.85317286291435, "lat": 1.29950306...}	1.299503	103.853173	NaN	188973	NaN	4b164b8ef964a52011b82
8	V Hotel Bencoolen	Hotel	48 Bencoolen Street #01-01	SG	Bugis	Singapore	NaN	362	[48 Bencoolen Street #01-01, 189627, Singapore]	[{"lng": 103.85058095759739, "lat": 1.29912982...}	1.299130	103.850581	NaN	189627	NaN	5109c750e4b0987e6402f
9	Grand Park City Hall Hotel	Hotel	10 Coleman St.	SG	Singapore	Singapore	NaN	517	[10 Coleman St., 179809, Singapore]	[{"lng": 103.85031946942136, "lat": 1.29232969...}	1.292330	103.850319	NaN	179809	NaN	4b4ea3a5f964a52029f32f
10	Peninsula Excelsior Hotel	Hotel	5 Coleman St.	SG	Singapore	Singapore	Opp Grand Park Hotel	551	[5 Coleman St. (Opp Grand Park Hotel), 179805,...]	[{"lng": 103.85016015585542, "lat": 1.29194450...}	1.291945	103.850160	NaN	179805	NaN	4b05880af964a520a9ad2
11	Studio M Hotel	Hotel	3 Nanson Road	SG	Singapore	Singapore	NaN	1232	[3 Nanson Road, 238910, Singapore]	[{"lng": 103.839276, "lat": 1.290508, "label": "...}	1.290508	103.839276	NaN	238910	NaN	4bb4132a0cbcef3bedb55f
12	Hotel Fort Canning	Hotel	11 Canning Walk	SG	Singapore	Singapore	NaN	350	[11 Canning Walk, 178881, Singapore]	[{"lng": 103.84545315120411, "lat": 1.29585419...}	1.295854	103.845453	NaN	178881	NaN	4cf60fff71538cfaa9feb22f

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	neighborhood	postalCode	state	
13	The Fullerton Hotel	Hotel	1 Fullerton Square	SG	Singapore	Singapore	Financial District	1266	[1 Fullerton Square (Financial District), 0491...	[{"lng": 103.85297157115049, "lat": 1.28615152...}	1.286152	103.852972	NaN	049178	NaN	4b05880bf964a520e8ad2
14	Hotel Jen Orchardgateway Singapore	Hotel	277 Orchard Rd.	SG	Singapore	Singapore	NaN	1154	[277 Orchard Rd., 238858, Singapore]	[{"lng": 103.83887750753954, "lat": 1.30045641...}	1.300456	103.838878	NaN	238858	NaN	54164a0f498e9aee39047
15	Concorde Hotel	Hotel	100 Orchard Rd.	SG	Singapore	Singapore	NaN	842	[100 Orchard Rd., 238840, Singapore]	[{"lng": 103.84205779426074, "lat": 1.30058206...}	1.300582	103.842058	NaN	238840	NaN	4b05880bf964a520cead2
16	Victoria Hotel	Hotel	87 Victoria St.	SG	Singapore	Singapore	NaN	443	[87 Victoria St., 188016, Singapore]	[{"lng": 103.85246867959826, "lat": 1.29708206...}	1.297082	103.852469	NaN	188016	NaN	4b05880bf964a520e4ad2
17	Raffles Hotel	Hotel	1 Beach Rd.	SG	Singapore	Singapore	NaN	581	[1 Beach Rd., 189673, Singapore]	NaN	1.294972	103.853473	NaN	189673	NaN	4b05880bf964a520bfad2
18	Hotel Grand Central	Hotel	22 Cavengah Road	SG	Singapore	Singapore	Orchard Road	908	[22 Cavengah Road (Orchard Road), 229617, Sing...	[{"lng": 103.84182913052203, "lat": 1.30129708...}	1.301297	103.841829	NaN	229617	NaN	4b05880af964a52092ad2
19	Tower 3 Marina Bay Sands Hotel	Hotel	4 Bayfront Ave.	SG	Singapore	Singapore	Marina Bay	1932	[4 Bayfront Ave. (Marina Bay), 018973, Singapore]	[{"lng": 103.86090225184591, "lat": 1.28445222...}	1.284452	103.860902	NaN	018973	NaN	4c5e1dded25320a1ef28cd
20	Village Hotel Bugis	Hotel	390 Victoria St.	SG	Singapore	Singapore	NaN	1214	[390 Victoria St., 188061, Singapore]	[{"lng": 103.85784191057455, "lat": 1.30227332...}	1.302273	103.857842	NaN	188061	NaN	4bcb143768f976b0eb516
21	Fragrance Hotel Selegie Singapore	Hotel	183 Selegie Road	SG	Singapore	Singapore	NaN	808	[183 Selegie Road, Singapore]	[{"lng": 103.85009530279963, "lat": 1.30370411...}	1.303704	103.850095	NaN	NaN	NaN	4bd1022520cd99600ea12
22	Hotel Grand Pacific	Hotel	101 Victoria St.	SG	Singapore	Singapore	NaN	495	[101 Victoria St., 188018, Singapore]	[{"lng": 103.85291418297295, "lat": 1.29726056...}	1.297261	103.852914	NaN	188018	NaN	4be4eec8d4f7c9b6a5ed2
23	Hotel Kai	Hotel	14 Purvis St	SG	NaN	Singapore	NaN	768	[14 Purvis St, Singapore]	[{"lng": 103.85541391734628, "lat": 1.29641888...}	1.296419	103.855414	NaN	NaN	NaN	54dc61c4498eabd1ad1f5
24	Hotel 81 Dickson	Hotel	3 Dickson Rd.	SG	Singapore	Singapore	NaN	1132	[3 Dickson Rd., 209530, Singapore]	[{"lng": 103.85437544299029, "lat": 1.30492776...}	1.304928	103.854375	Little India	209530	NaN	4d5d6eac9ac9a09352577
25	Fragrance Hotel (Bugis)	Hotel	33 Middle Rd	SG	Singapore	Singapore	NaN	793	[33 Middle Rd, 188942, Singapore]	[{"lng": 103.85562822709818, "lat": 1.29706636...}	1.297066	103.855628	NaN	188942	NaN	4bdc584ffed22d7f9cbb57
26	Hotel Chancellor@Orchard	Hotel	28 Cavenagh Rd	SG	Singapore	Singapore	at Orchard Rd	902	[28 Cavenagh Rd (at Orchard Rd), 228751, Singa...	[{"lng": 103.84207873309295, "lat": 1.30155674...}	1.301557	103.842079	Orchard Road	228751	NaN	55b11579498eb11cd5e2c

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	neighborhood	postalCode	state	
27	Hotel Royal @ Queens	Hotel	12 Queen Street	SG	Singapore	Singapore	NaN	425	[12 Queen Street, 188553, Singapore]	[{"lng": 103.85214139826415, "lat": 1.29781527...}	1.297815	103.852141	NaN	188553	NaN	4b05880bf964a520edad2
28	Fragrance Hotel	Hotel	20 Hongkong St.	SG	Singapore	Singapore	New Bridge Rd	984	[20 Hongkong St. (New Bridge Rd), Singapore]	[{"lng": 103.84701640127959, "lat": 1.28789604...}	1.287896	103.847016	NaN	NaN	NaN	4ee17e07f79052212a0b8
29	Summerview Hotel	Hotel	Bencoolen St.	SG	Singapore	Singapore	NaN	699	[Bencoolen St., Singapore]	[{"lng": 103.85254695165821, "lat": 1.30143429...}	1.301434	103.852547	NaN	NaN	NaN	4c37561fae2da593eaa9fe
30	Amaris Hotel Bugis	Hotel	21 Middle Road, Singapore	SG	Singapore	Singapore	NaN	840	[21 Middle Road, Singapore, Singapore]	[{"lng": 103.85605875344861, "lat": 1.29679231...}	1.296792	103.856059	NaN	NaN	NaN	5110eff2e4b0f2f7466bbd0
31	Hotel Innotel	Hotel	11 Penang Lane	SG	Singapore	Singapore	NaN	474	[11 Penang Lane, 238485, Singapore]	[{"lng": 103.84439642666676, "lat": 1.29774024...}	1.297740	103.844396	NaN	238485	NaN	4cc19bc8f4448cfa00f057f
32	Park Regis Hotel	Hotel	23 Merchant Rd.	SG	Singapore	Singapore	NaN	1017	[23 Merchant Rd., 058268, Singapore]	[{"lng": 103.84470425532683, "lat": 1.28830127...}	1.288301	103.844704	NaN	058268	NaN	4c1702eccd4bc9b6e85c4
33	Bus Stop 01012 (Hotel Grand Pacific)	Bus Station	Victoria St	SG	Singapore	Singapore	NaN	479	[Victoria St, Singapore]	[{"lng": 103.8528181810494, "lat": 1.296686602...}	1.296687	103.852818	NaN	NaN	NaN	4c848e5674d7b60c684c9
34	Hotel Intercontinental Gym	Gym	Singapore	SG	Singapore	Singapore	NaN	600	[Singapore, Singapore]	[{"lng": 103.85380691389526, "lat": 1.29765133...}	1.297651	103.853807	NaN	NaN	NaN	4eec0b320e61a418638e4
35	Grand Copthorne Waterfront Hotel	Hotel	392 Havelock Road	SG	Singapore	Singapore	Outram Rd.	1642	[392 Havelock Road (Outram Rd.), 169663, Singa...]	[{"lng": 103.835175, "lat": 1.2903, "label": '...}	1.290300	103.835175	NaN	169663	NaN	4b05880bf964a520d2ad2
36	Tower 1 Marina Bay Sands Hotel	Hotel	Marina Bay Sands Hotel	SG	Singapore	Singapore	1 Bayfront Ave	2042	[Marina Bay Sands Hotel (1 Bayfront Ave), Sing...]	[{"lng": 103.85988067721148, "lat": 1.28221289...}	1.282213	103.859881	NaN	NaN	NaN	4c8dd4d31664b1f7392e9
37	Hotel 81 - Selegie	Motel	10-100 Selegie Rd	SG	Singapore	Singapore	NaN	759	[10-100 Selegie Rd, Singapore]	[{"lng": 103.84970772401218, "lat": 1.30333092...}	1.303331	103.849708	NaN	NaN	NaN	4c2e16073a4d0f4717ebe
38	Raffles Hotel Arcade	Shopping Mall	328 North Bridge Rd.	SG	Singapore	Singapore	NaN	620	[328 North Bridge Rd., 188719, Singapore]	[{"lng": 103.8540390488243, "lat": 1.295907514...}	1.295908	103.854039	NaN	188719	NaN	4c5540e54623be9aace32
39	The Fullerton Bay Hotel	Hotel	80 Collyer Quay	SG	Singapore	Singapore	NaN	1515	[80 Collyer Quay, 049326, Singapore]	[{"lng": 103.85331433621205, "lat": 1.28387752...}	1.283878	103.853314	NaN	049326	NaN	4e3ce52ce4cdab9b933c5
40	Singapore Marriott Tang Plaza Hotel	Hotel	320 Orchard Road	SG	Singapore	Singapore	Scotts Road	1976	[320 Orchard Road (Scotts Road), 238865, Singa...]	[{"lng": 103.8329674785042, "lat": 1.305215106...}	1.305215	103.832967	NaN	238865	NaN	4b05880bf964a520c2ad2

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	neighborhood	postalCode	state	
41	Health Club @ Carlton Hotel Singapore	Gym	76 Bras Basah Rd.	SG	Singapore	Singapore	NaN	456	[76 Bras Basah Rd., 039596, Singapore]	[{"lng": 103.85255813598633, 'lat': 1.29593288...	1.295933	103.852558	NaN	039596	NaN	4ed83454f790c045430f5f
42	Hotel Fort Canning Parking Garage	Parking	NaN	SG	NaN	Singapore	NaN	335	[178881, Singapore]	[{"lng": 103.84552, 'lat': 1.2962054, 'label':...	1.296205	103.845520	NaN	178881	NaN	58841a4289151d6db3dd5f
43	Hotel Supreme (原 首酒店)	Hotel	15 Kramat Rd	SG	Singapore	Singapore	NaN	866	[15 Kramat Rd, 228750, Singapore]	[{"lng": 103.84244685009514, 'lat': 1.30149443...	1.301494	103.842447	NaN	228750	NaN	4b05880bf964a520ccad2f
44	Porcelain Hotel	Hotel	48 Mosque St	SG	Singapore	Singapore	Chinatown	1458	[48 Mosque St (Chinatown), 059526, Singapore]	[{"lng": 103.8441697358697, 'lat': 1.284254181...	1.284254	103.844170	NaN	059526	NaN	4d1d2a92bdd7a093f9cddf
45	Bus Stop 08138 (Concorde Hotel S'pore)	Bus Station	Orchard Rd	SG	Singapore	Singapore	NaN	851	[Orchard Rd, Singapore]	[{"lng": 103.84181924650778, 'lat': 1.30033107...	1.300331	103.841819	NaN	NaN	NaN	4cc6156bb2beb1f7b17a2ff
46	Hotel Nuve	Hotel	NaN	SG	Singapore	Singapore	NaN	1294	[Singapore]	[{"lng": 103.85835710888314, 'lat': 1.30280530...	1.302805	103.858357	NaN	NaN	NaN	544cba98498e22c6b8bd2f
47	Vault @ Intercontinental Hotel	Event Space	NaN	SG	NaN	Singapore	NaN	730	[Singapore]	[{"lng": 103.85478075088737, 'lat': 1.29855466...	1.298555	103.854781	NaN	NaN	NaN	4ceb192e678aa093cd0bfb
48	Hotel Clover 33 Jalan Sultan	Hotel	33 Jalan Sultan	SG	Singapore	Singapore	NaN	1610	[33 Jalan Sultan, Singapore]	[{"lng": 103.86188456569408, 'lat': 1.30213091...	1.302131	103.861885	NaN	NaN	NaN	53c1053e498eecb3e8850f
49	Hotel 81 Bugis	Hotel	31 Middle Road	SG	Singapore	Singapore	NaN	782	[31 Middle Road, Singapore]	[{"lng": 103.85554317440696, 'lat': 1.29673650...	1.296737	103.855543	NaN	NaN	NaN	4c35f40bed37a5931c4a7f

Visualise the hotels nearby *Museum Neighborhood*

```
In [368]: dataframe_filtered.name
```

```
Out[368]: 0      Rendezvous Hotel Singapore
1              Carlton Hotel
2      JW Marriott Hotel Singapore South Beach
3              Hotel Bencoolen
4              Strand Hotel
5              Marina Bay Sands Hotel
6              Hotel G Singapore
7              Mercure Hotel
8              V Hotel Bencoolen
9      Grand Park City Hall Hotel
10     Peninsula Excelsior Hotel
11              Studio M Hotel
12              Hotel Fort Canning
13              The Fullerton Hotel
14      Hotel Jen Orchardgateway Singapore
15              Concorde Hotel
16              Victoria Hotel
17              Raffles Hotel
18              Hotel Grand Central
19      Tower 3 Marina Bay Sands Hotel
20              Village Hotel Bugis
21      Fragrance Hotel Selegie Singapore
22              Hotel Grand Pacific
23              Hotel Kai
24              Hotel 81 Dickson
25      Fragrance Hotel (Bugis)
26      Hotel Chancellor@Orchard
27      Hotel Royal @ Queens
28      Fragrance Hotel
29      Summerview Hotel
30      Amaris Hotel Bugis
31              Hotel Innotel
32      Park Regis Hotel
33      Bus Stop 01012 (Hotel Grand Pacific)
34      Hotel Intercontinental Gym
35      Grand Copthorne Waterfront Hotel
36      Tower 1 Marina Bay Sands Hotel
37      Hotel 81 - Selegie
38      Raffles Hotel Arcade
39      The Fullerton Bay Hotel
40      Singapore Marriott Tang Plaza Hotel
41      Health Club @ Carlton Hotel Singapore
42      Hotel Fort Canning Parking Garage
43      Hotel Supreme (原首酒店)
44      Porcelain Hotel
45      Bus Stop 08138 (Concorde Hotel S'pore)
46              Hotel Nuve
47      Vault @ Intercontinental Hotel
48      Hotel Clover | 33 Jalan Sultan
49      Hotel 81 Bugis
Name: name, dtype: object
```

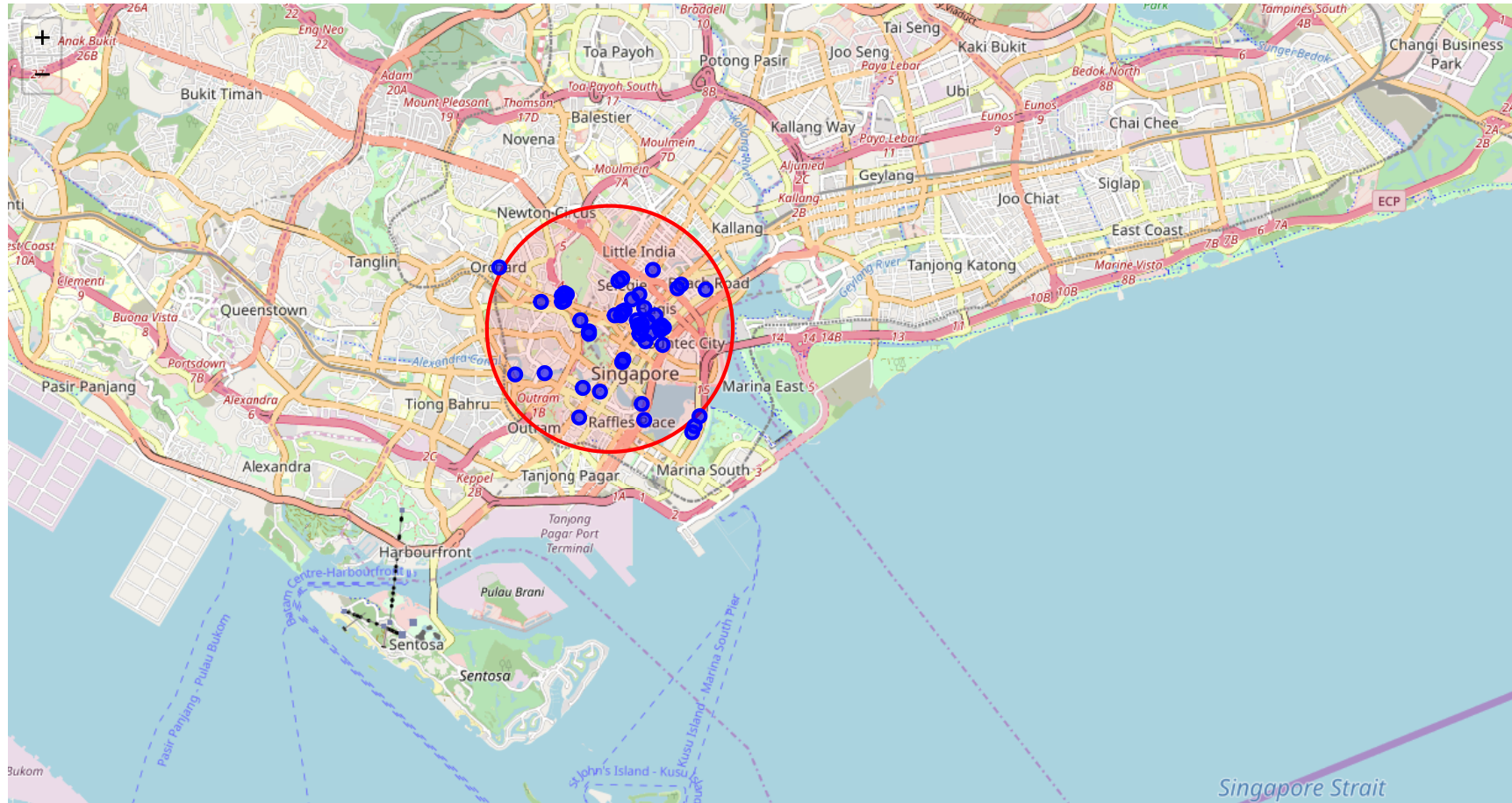
```
In [432]: venues_map = folium.Map(location=[SGlatitude, SGlongitude], zoom_start=13) # generate map centred around the Conrad Hotel
```

```
# add a red circle radius with museum neighborhood as epicentre
folium.features.CircleMarker(
    [1.296615, 103.848510],
    radius=100,
    color='red',
    popup='Museum Neighborhood Radius',
    fill = True,
    fill_color = 'red',
    fill_opacity = 0.1
).add_to(venues_map)

# add the Italian restaurants as blue circle markers
for lat, lng, label in zip(dataframe_filtered.lat, dataframe_filtered.lng, dataframe_filtered.categories):
    folium.features.CircleMarker(
        [lat, lng],
        radius=5,
        color='blue',
        popup=label,
        fill = True,
        fill_color='blue',
        fill_opacity=0.6
    ).add_to(venues_map)

# display map
venues_map
```

Out[432]:



Leaflet (<http://leafletjs.com>)

9. Conclusion

The decision is to locate the cafe within the **500 metres radius** of the **Museum Neighborhood** due to the large number of hotels, restaurants, bars and other eating places. It is also located within walking distance to Singapore's attractions such as Chinatown, Marina Bay Sands, Singapore Flyer, National Gallery and many more.