Analyzing Neighborhoods in Chennai, India for Starting a Restaurant

Github does not support map viewing , to view map click the link below to open project in IBM cloud :

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/fe94
64d3-4154-8862-a39fd77dd718/view?
access_token=50c7269f87cd7c18f0117087493b8b74d50dfc2
(https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/fe94
64d3-4154-8862-a39fd77dd718/view?
access_token=50c7269f87cd7c18f0117087493b8b74d50dfc2

Introduction

Chennai is termed **"India's health capital"**

Located on the Coromandel Coast of the Bay of Bengal, it is one of the largest cultural, economic and educational centres of south India.

According to the 2011 Indian census, it is the sixth-most populous city and fourth-most populous urban agglomeration in India. The city together with the adjoining regions constitutes the Chennai Metropolitan Area, which is the 36th-largest urban area by population in the world.

The traditional and de facto gateway of South India, Chennai is among the most-visited Indian cities by foreign tourists. It was ranked the 43rd-most visited city in the world for the year 2015.The Quality of Living Survey rated Chennai as the safest city in India.Chennai attracts 45 percent of health tourists visiting India, and 30 to 40 percent of domestic health tourists. As such,Chennai has the fifth-largest urban economy of India.

It lies on the west coast of India and attracts heavy tourism from all over the globe every year. Personally, I have been brought up in Chennai and have loved the city from the bottom of my heart.

It is one of the major hubs of the world and is extremely diverse with people from various ethnicities residing here. The multi-cultural nature of the city of chennai has brought along with it numerous cuisines from all over the world. The people of India generally love food and I personally love to try different cuisines and experience different flavors. Thus, the aim of this project is to study the neighborhoods in chennai to determine possible locations for opening a restaurant. This

project can be useful for business owners and entrepreneurs who are looking to invest in a restaurant in chennai. The main objective of this project is to carefully analyze appropriate data and find recommendations for the stakeholders.

Data Collection

The data required for this project has been collected from multiple sources. A summary of the data required for this project is given below.

Neighborhoods Data

The data of the neighborhoods in chennai was scraped from https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Chennai (https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Chennai). The data is read into a pandas data frame using the read_html() method. The main reason for doing so is that the Wikipedia page provides a comprehensive and detailed table of the data which can easily be scraped using the read_html() method of pandas.

Geographical Coordinates

The geographical coordinates for chennai data has been obtained from the GeoPy library in python. This data is relevant for plotting the map of chennai using the Folium library in python. The geocoder library in python has been used to obtain latitude and longitude data for various neighborhoods in chennai. The coordinates of all neighborhoods in chennai are used to check the accuracy of coordinates given on Wikipedia and replace them in our data frame if the absolute difference is more than 0.001. These coordinates are then further used for plotting using the Folium library in python.

Venue Data

The venue data has been extracted using the Foursquare API. This data contains venue recommendations for all neighborhoods in chennai and is used to study the popular venues of different neighborhoods.

Importing required libraries

In [4]:
```
!pip install geopy
!pip install geocoder
!pip install folium

import numpy as np
import pandas as pd
import json
from geopy.geocoders import Nominatim
import geocoder
import requests
import matplotlib.cm as cm
import matplotlib.colors as colors
from sklearn.cluster import KMeans
import folium
import matplotlib.pyplot as plt
import seaborn as sns
from pandas.io.json import json_normalize
from sklearn.metrics import silhouette_score

%matplotlib notebook

print('All libraries imported.')
```

```
Requirement already satisfied: geopy in c:\users\m1056162\anaconda3\lib\site
-packages (2.1.0)
Requirement already satisfied: geographiclib<2,>=1.49 in c:\users\m1056162\a
naconda3\lib\site-packages (from geopy) (1.50)
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ite-packages (1.38.1)
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ite-packages (from geocoder) (2.24.0)
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-packages (from geocoder) (7.1.2)
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te-packages (from geocoder) (0.1.6)
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ib\site-packages (from requests->geocoder) (2.10)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in
c:\users\m1056162\anaconda3\lib\site-packages (from requests->geocoder) (1.2
5.11)
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da3\lib\site-packages (from requests->geocoder) (3.0.4)
Requirement already satisfied: decorator in c:\users\m1056162\anaconda3\lib
\site-packages (from ratelim->geocoder) (4.4.2)
Requirement already satisfied: folium in c:\users\m1056162\anaconda3\lib\sit
e-packages (0.12.1)
Requirement already satisfied: requests in c:\users\m1056162\anaconda3\lib\s
ite-packages (from folium) (2.24.0)
Requirement already satisfied: numpy in c:\users\m1056162\anaconda3\lib\site
-packages (from folium) (1.19.2)
```

```
Requirement already satisfied: jinja2>=2.9 in c:\users\m1056162\anaconda3\li
b\site-packages (from folium) (2.11.2)
Requirement already satisfied: branca>=0.3.0 in c:\users\m1056162\anaconda3
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da3\lib\site-packages (from requests->folium) (3.0.4)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in
c:\users\m1056162\anaconda3\lib\site-packages (from requests->folium) (1.25.
11)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\m1056162\anaco
nda3\lib\site-packages (from requests->folium) (2020.6.20)
Requirement already satisfied: idna<3,>=2.5 in c:\users\m1056162\anaconda3\l
ib\site-packages (from requests->folium) (2.10)
Requirement already satisfied: MarkupSafe>=0.23 in c:\users\m1056162\anacond
a3\lib\site-packages (from jinja2>=2.9->folium) (1.1.1)
All libraries imported.
```

Data Retrieval

Scraping data from https://en.wikipedia.org/wiki/List_of_neighbourhoods_of_Chennai (https://en.wikipedia.org/wiki/List_of_neighbourhoods_of_Chennai) and reading it into a dataframe.

In [5]:
```
df = pd.read_html('https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Chenna
df.rename(columns={'Area': 'Neighborhood'}, inplace=True)
df.head(10)
```

Out[5]:

	Neighborhood	Location	Latitude	Longitude
0	Adambakkam	South and East Chennai	12.9880	80.2047
1	Adyar	South and East Chennai	13.0012	80.2565
2	Alandur	South and East Chennai	12.9975	80.2006
3	Alapakkam	West Chennai	13.0490	80.1673
4	Alwarthirunagar	West Chennai	13.0426	80.1840
5	Ambattur	West Chennai	13.1143	80.1548
6	Aminjikarai	West Chennai	13.0698	80.2245
7	Anna Nagar	West Chennai	13.0850	80.2101
8	Annanur	West Chennai	13.1184	80.1246
9	Arumbakkam	West Chennai	13.0724	80.2102

Data Wrangling

Lets look at the different values for Location present in the Location column.

In [6]:
```
df['Location'].value_counts()
```

Out[6]:
```
North Chennai                          57
South and East Chennai                 48
West Chennai                           45
Northern Suburbs of Chennai             7
Suburbs along ECR and OMR of Chennai    6
Western Suburbs of Chennai              6
Southern-Eastern Suburbs of Chennai     5
Suburban Chennai                        2
Name: Location, dtype: int64
```

We can see that there are many locations that appear less than 10. This is because the main locations like "South and East Chennai " or "South and East Chennai " are being further divided by the area within these locations. Lets clean the Location column to make it easier to understand.

In [7]:
```
df['Location'] = df['Location'].apply(lambda x: x.split(',')[-1])
df.head(10)
```

Out[7]:

	Neighborhood	Location	Latitude	Longitude
0	Adambakkam	South and East Chennai	12.9880	80.2047
1	Adyar	South and East Chennai	13.0012	80.2565
2	Alandur	South and East Chennai	12.9975	80.2006
3	Alapakkam	West Chennai	13.0490	80.1673
4	Alwarthirunagar	West Chennai	13.0426	80.1840
5	Ambattur	West Chennai	13.1143	80.1548
6	Aminjikarai	West Chennai	13.0698	80.2245
7	Anna Nagar	West Chennai	13.0850	80.2101
8	Annanur	West Chennai	13.1184	80.1246
9	Arumbakkam	West Chennai	13.0724	80.2102

Now lets again look at the values in Location column.

In [8]:
```
df['Location'].value_counts()
```

Out[8]:
```
North Chennai                          57
South and East Chennai                 48
West Chennai                           45
Northern Suburbs of Chennai             7
Suburbs along ECR and OMR of Chennai    6
Western Suburbs of Chennai              6
Southern-Eastern Suburbs of Chennai     5
Suburban Chennai                        2
Name: Location, dtype: int64
```

Now that the data is much easier to interpret, lets display the dataframe created.

In [9]:
```
df
```

Out[9]:

	Neighborhood	Location	Latitude	Longitude
0	Adambakkam	South and East Chennai	12.98800	80.20470
1	Adyar	South and East Chennai	13.00120	80.25650
2	Alandur	South and East Chennai	12.99750	80.20060
3	Alapakkam	West Chennai	13.04900	80.16730
4	Alwarthirunagar	West Chennai	13.04260	80.18400
...	...	...	...	...
171	Kanathur	Suburbs along ECR and OMR of Chennai	12.86630	80.24470
172	Muthukadu	Suburbs along ECR and OMR of Chennai	12.82700	80.24030
173	Kelambakkam	Suburbs along ECR and OMR of Chennai	13.06042	80.24958
174	Kovalam	Suburbs along ECR and OMR of Chennai	12.78700	80.25040
175	Siruseri	Suburbs along ECR and OMR of Chennai	12.83500	80.22000

176 rows × 4 columns

Although the data we gathered contained latitude and longitude information, we can reconfirm these coordinates using Geocoder.

In [10]:
```
df['Latitude1'] = None
df['Longitude1'] = None

for i, neigh in enumerate(df['Neighborhood']):
    lat_lng_coords = None

    while(lat_lng_coords is None):
        g = geocoder.arcgis('{}, Chennai, India'.format(neigh))
        lat_lng_coords = g.latlng

    if lat_lng_coords:
        latitude = lat_lng_coords[0]
        longitude = lat_lng_coords[1]

    df.loc[i, 'Latitude1'] = latitude
    df.loc[i, 'Longitude1'] = longitude

df.head(10)
```

Out[10]:

	Neighborhood	Location	Latitude	Longitude	Latitude1	Longitude1
0	Adambakkam	South and East Chennai	12.9880	80.2047	12.9919	80.206
1	Adyar	South and East Chennai	13.0012	80.2565	13.003	80.2519
2	Alandur	South and East Chennai	12.9975	80.2006	13.0001	80.2005
3	Alapakkam	West Chennai	13.0490	80.1673	13.0461	80.165
4	Alwarthirunagar	West Chennai	13.0426	80.1840	13.0506	80.184
5	Ambattur	West Chennai	13.1143	80.1548	13.1188	80.1544
6	Aminjikarai	West Chennai	13.0698	80.2245	13.0714	80.2226
7	Anna Nagar	West Chennai	13.0850	80.2101	13.0836	80.2102
8	Annanur	West Chennai	13.1184	80.1246	13.1121	80.129
9	Arumbakkam	West Chennai	13.0724	80.2102	13.0731	80.2095

We can create new columns to see the difference between coordinate values obtained from wikipedia and those obtained from geocoder. We will take the absolute difference between these values and store them in our dataframe.

In [11]:
```
df['Latdiff'] = abs(df['Latitude'] - df['Latitude1'])
df['Longdiff'] = abs(df['Longitude'] - df['Longitude1'])
df.head(10)
```

Out[11]:

	Neighborhood	Location	Latitude	Longitude	Latitude1	Longitude1	Latdiff	Longdiff
0	Adambakkam	South and East Chennai	12.9880	80.2047	12.9919	80.206	0.00392	0.00133
1	Adyar	South and East Chennai	13.0012	80.2565	13.003	80.2519	0.00184	0.00463
2	Alandur	South and East Chennai	12.9975	80.2006	13.0001	80.2005	0.00263	0.00011
3	Alapakkam	West Chennai	13.0490	80.1673	13.0461	80.165	0.00287	0.00229
4	Alwarthirunagar	West Chennai	13.0426	80.1840	13.0506	80.184	0.00795	3e-05
5	Ambattur	West Chennai	13.1143	80.1548	13.1188	80.1544	0.00452	0.00038
6	Aminjikarai	West Chennai	13.0698	80.2245	13.0714	80.2226	0.00159	0.00194
7	Anna Nagar	West Chennai	13.0850	80.2101	13.0836	80.2102	0.00141	5e-05
8	Annanur	West Chennai	13.1184	80.1246	13.1121	80.129	0.00628	0.00435
9	Arumbakkam	West Chennai	13.0724	80.2102	13.0731	80.2095	0.00068	0.00068

We can see that the latitude and longitudes from wikipedia and geocoder are very similar, yet there are some differences. We will replace the values with the coordinates obtained from geocoder if the absolute difference is more than 0.001.

In [12]:
```
df.loc[df.Latdiff>0.001, 'Latitude'] = df.loc[df.Latdiff>0.001, 'Latitude1']
df.loc[df.Longdiff>0.001, 'Longitude'] = df.loc[df.Longdiff>0.001, 'Longitude1']
df.head(10)
```

Out[12]:

	Neighborhood	Location	Latitude	Longitude	Latitude1	Longitude1	Latdiff	Longdiff
0	Adambakkam	South and East Chennai	12.9919	80.206	12.9919	80.206	0.00392	0.00133
1	Adyar	South and East Chennai	13.003	80.2519	13.003	80.2519	0.00184	0.00463
2	Alandur	South and East Chennai	13.0001	80.2006	13.0001	80.2005	0.00263	0.00011
3	Alapakkam	West Chennai	13.0461	80.165	13.0461	80.165	0.00287	0.00229
4	Alwarthirunagar	West Chennai	13.0506	80.184	13.0506	80.184	0.00795	3e-05
5	Ambattur	West Chennai	13.1188	80.1548	13.1188	80.1544	0.00452	0.00038
6	Aminjikarai	West Chennai	13.0714	80.2226	13.0714	80.2226	0.00159	0.00194
7	Anna Nagar	West Chennai	13.0836	80.2101	13.0836	80.2102	0.00141	5e-05
8	Annanur	West Chennai	13.1121	80.129	13.1121	80.129	0.00628	0.00435
9	Arumbakkam	West Chennai	13.0724	80.2102	13.0731	80.2095	0.00068	0.00068

In order to confirm if values have actually been replaced we can use the where method. Values with NaN means those values have not been replaced.

In [13]:
```
df.where(df['Latitude']==df['Latitude1'])
```

Out[13]:

	Neighborhood	Location	Latitude	Longitude	Latitude1	Longitude1	Latdiff	Longdiff
0	Adambakkam	South and East Chennai	12.9919	80.206	12.9919	80.206	0.00392	0.00133
1	Adyar	South and East Chennai	13.003	80.2519	13.003	80.2519	0.00184	0.00463
2	Alandur	South and East Chennai	13.0001	80.2006	13.0001	80.2005	0.00263	0.00011
3	Alapakkam	West Chennai	13.0461	80.165	13.0461	80.165	0.00287	0.00229
4	Alwarthirunagar	West Chennai	13.0506	80.184	13.0506	80.184	0.00795	3e-05
...	...	...	...	...	...	...	...	...
171	Kanathur	Suburbs along ECR and OMR of Chennai	12.8472	80.2414	12.8472	80.2414	0.01912	0.00333
172	Muthukadu	Suburbs along ECR and OMR of Chennai	12.8317	80.2421	12.8317	80.2421	0.00465	0.00177
173	Kelambakkam	Suburbs along ECR and OMR of Chennai	12.7861	80.2203	12.7861	80.2203	0.27428	0.02928
174	Kovalam	Suburbs along ECR and OMR of Chennai	12.7898	80.2491	12.7898	80.2491	0.00284	0.00126
175	Siruseri	Suburbs along ECR and OMR of Chennai	12.8376	80.2019	12.8376	80.2019	0.00258	0.01815

176 rows × 8 columns

We can do the same for the Longitude column.

In [14]:
```
df.where(df['Longitude']==df['Longitude1'])
```

Out[14]:

	Neighborhood	Location	Latitude	Longitude	Latitude1	Longitude1	Latdiff	Longdiff
0	Adambakkam	South and East Chennai	12.9919	80.206	12.9919	80.206	0.00392	0.00133
1	Adyar	South and East Chennai	13.003	80.2519	13.003	80.2519	0.00184	0.00463
2	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	Alapakkam	West Chennai	13.0461	80.165	13.0461	80.165	0.00287	0.00229
4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
...	...	...	...	...	...	...	...	...
171	Kanathur	Suburbs along ECR and OMR of Chennai	12.8472	80.2414	12.8472	80.2414	0.01912	0.00333
172	Muthukadu	Suburbs along ECR and OMR of Chennai	12.8317	80.2421	12.8317	80.2421	0.00465	0.00177
173	Kelambakkam	Suburbs along ECR and OMR of Chennai	12.7861	80.2203	12.7861	80.2203	0.27428	0.02928
174	Kovalam	Suburbs along ECR and OMR of Chennai	12.7898	80.2491	12.7898	80.2491	0.00284	0.00126
175	Siruseri	Suburbs along ECR and OMR of Chennai	12.8376	80.2019	12.8376	80.2019	0.00258	0.01815

176 rows × 8 columns

Now that we have the data, we can drop the columns that are no longer useful.

In [15]:
```
df.drop(['Latitude1', 'Longitude1', 'Latdiff', 'Longdiff'], axis=1, inplace=True)
df.head(10)
```

Out[15]:

	Neighborhood	Location	Latitude	Longitude
0	Adambakkam	South and East Chennai	12.9919	80.206
1	Adyar	South and East Chennai	13.003	80.2519
2	Alandur	South and East Chennai	13.0001	80.2006
3	Alapakkam	West Chennai	13.0461	80.165
4	Alwarthirunagar	West Chennai	13.0506	80.184
5	Ambattur	West Chennai	13.1188	80.1548
6	Aminjikarai	West Chennai	13.0714	80.2226
7	Anna Nagar	West Chennai	13.0836	80.2101
8	Annanur	West Chennai	13.1121	80.129
9	Arumbakkam	West Chennai	13.0724	80.2102

Data Visualization

To understand our data better, we can see how many neighborhoods are in each location.

In [16]:
```
neighborhoods_chennai = df.groupby('Location')['Neighborhood'].nunique()
neighborhoods_chennai
```

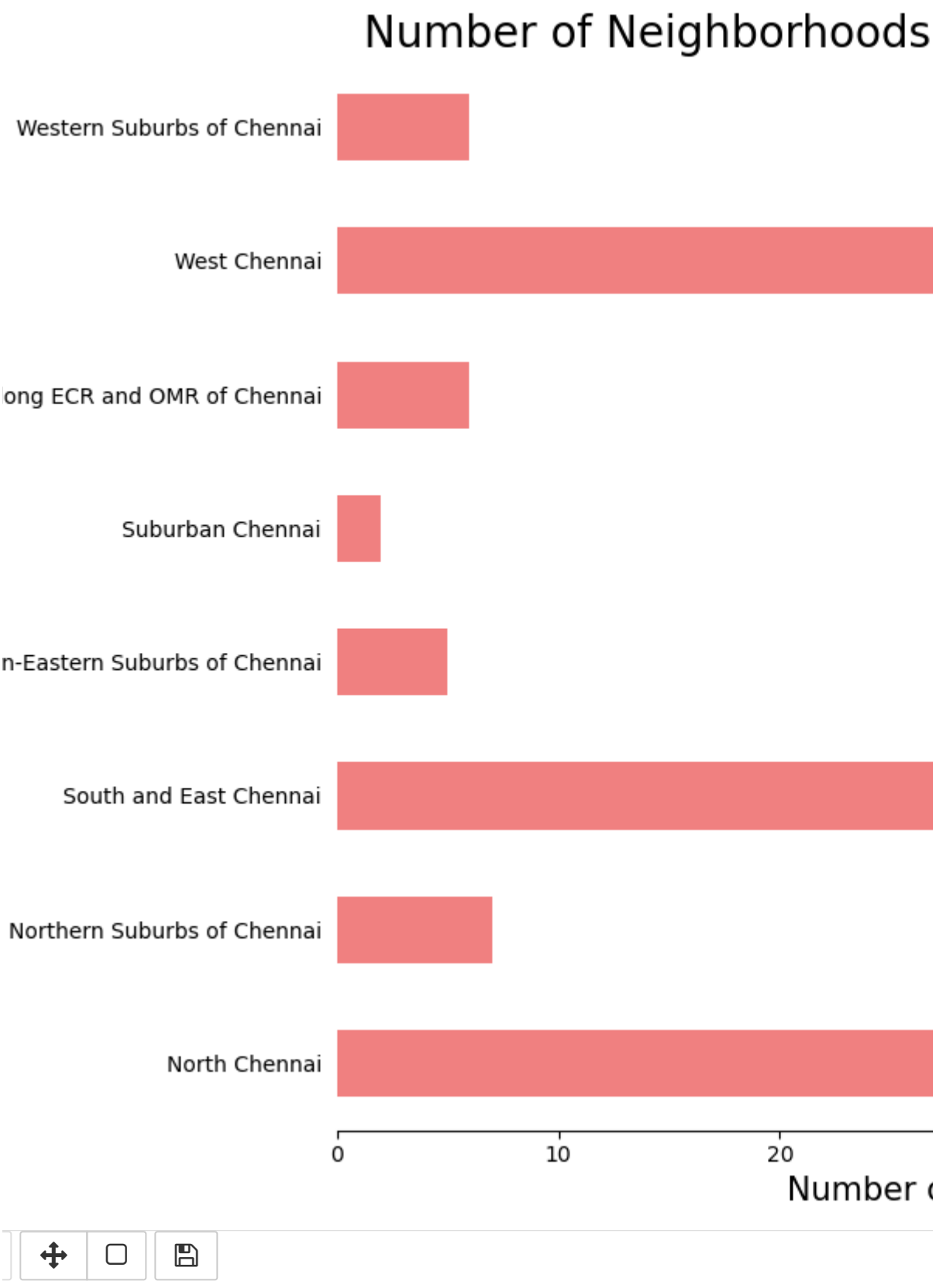
Out[16]:
```
Location
North Chennai                           57
Northern Suburbs of Chennai              7
South and East Chennai                  48
Southern-Eastern Suburbs of Chennai      5
Suburban Chennai                         2
Suburbs along ECR and OMR of Chennai     6
West Chennai                            45
Western Suburbs of Chennai               6
Name: Neighborhood, dtype: int64
```

We can now plot this data.

In [62]:

```
fig = plt.figure(figsize=(12,8))

ax = neighborhoods_chennai.plot(kind='barh', color='lightcoral')
ax.set_title('Number of Neighborhoods Grouped by Location in Chennai', fontsize=2
ax.set_xlabel('Number of Neighborhoods', fontsize=15)
ax.set_ylabel('Location', fontsize=15)
ax.spines['right'].set_visible(False)
ax.spines['top'].set_visible(False)
ax.spines['left'].set_visible(False)
ax.tick_params(which='major', left=False)

fig.tight_layout()
```

Figure 3



Clearly we can see that **North chennai and south and east chennai have the most number of neighborhoods**. Notice how we see one of the locations as chennai itself? This is because the neighborhoods contained in this location are located at the outskirts of chennai and thus have

been grouped as just chennai.

Now lets visualize the neighborhoods on a map using Folium. First we will obtain the geographical coordinates of chennai using GeoPy.

In [18]:
```
from geopy.geocoders import Nominatim
```

In [19]:
```
address = 'Chennai, IN'
geolocator = Nominatim(user_agent="coursera-capstone-project1")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinates of Chennai are {}, {}.'.format(latitude, longi
```

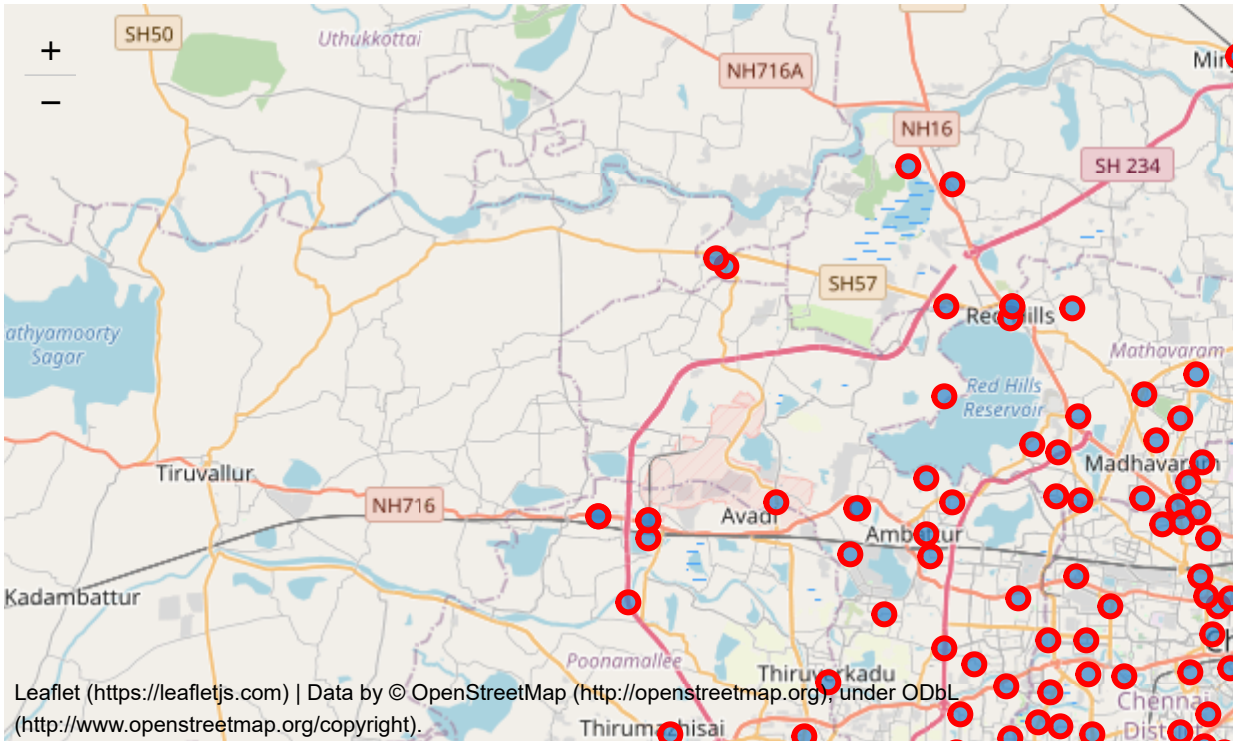
```
The geograpical coordinates of Chennai are 13.0836939, 80.270186.
```

Now we can plot the map.

In [20]:

```
map_chennai = folium.Map(location=[latitude, longitude], zoom_start=10)

for lat, lng, location, neighborhood in zip(df['Latitude'], df['Longitude'], df['
    label = '{}, {}'.format(neighborhood, location)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='red',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_chennai)

map_chennai
```

Out[20]:



Using Foursquare API

Now we can start working with the Foursquare API to obtain venue recommendations.

Lets create the Foursquare credentials first.

In [21]:

```
# The code was removed by Watson Studio for sharing.
```

Lets start by exploring just the first neighborhood in our dataframe using Foursquare API.

In [22]:
```
neighborhood_name = df.loc[0, 'Neighborhood']
neighborhood_lat = df.loc[0, 'Latitude']
neighborhood_long = df.loc[0, 'Longitude']

print("The neighborhood is {} and it's geographical coordinates are {} latitude a
```

```
The neighborhood is Adambakkam and it's geographical coordinates are 12.9919200
0000005 latitude and 80.20603000000006 longitude
```

In [23]:
```
CLIENT_ID="5VBIHGGSLPVIIO3BFUQIL3BDFGBJ4222IFUTE5Y3FTP0YVCN"
CLIENT_SECRET="MGOYTOPWD1WNID1GMG1DZQWWZUNKPDGNJG3WLP00VRX1SSXE"
VERSION=20120609
LIMIT = 200
radius = 1000

url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    neighborhood_lat,
    neighborhood_long,
    radius,
    LIMIT)
```

We can now use the GET method to get our results.

In [24]:
```
results = requests.get(url).json()
results
```

Out[24]:

```
{'meta': {'code': 200, 'requestId': '601978ea8a030b1f61e08a92'},
 'response': {'headerLocation': 'Velachery',
  'headerFullLocation': 'Velachery, Chennai',
  'headerLocationGranularity': 'neighborhood',
  'totalResults': 9,
  'suggestedBounds': {'ne': {'lat': 13.000920009000058,
    'lng': 80.21524920008119},
   'sw': {'lat': 12.982919991000042, 'lng': 80.19681079991892}},
  'groups': [{'type': 'Recommended Places',
    'name': 'recommended',
    'items': [{'reasons': {'count': 1,
       'items': [{'summary': 'Lots of people like this place',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '5155ca10e4b0cc3dad2cf381',
       'name': 'Pizza Republic',
       'contact': {},
       'location': {'address': 'VIHAS Restaurant',
        'crossStreet': '195/5 Medavakkam Main Road, Adambakkam',
        'lat': 12.99098677891081,
        'lng': 80.19861315843515,
        'labeledLatLngs': [{'label': 'display',
          'lat': 12.99098677891081,
          'lng': 80.19861315843515}],
        'distance': 811,
        'postalCode': '600088',
        'cc': 'IN',
        'city': 'Chennai',
        'state': 'Tamil Nadu',
        'country': 'India',
        'formattedAddress': ['VIHAS Restaurant (195/5 Medavakkam Main Road, Ada
mbakkam)',
         'Chennai 600088',
         'Tamil Nadu',
         'India']},
       'categories': [{'id': '4bf58dd8d48988d1ca941735',
         'name': 'Pizza Place',
         'pluralName': 'Pizza Places',
         'shortName': 'Pizza',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/pizza
_',
          'suffix': '.png'},
         'primary': True}],
       'verified': False,
       'stats': {'tipCount': 0,
        'usersCount': 0,
        'checkinsCount': 0,
        'visitsCount': 0},
       'beenHere': {'count': 0,
        'lastCheckinExpiredAt': 0,
        'marked': False,
        'unconfirmedCount': 0},
       'photos': {'count': 0, 'groups': []},
       'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
```

```
      'referralId': 'e-0-5155ca10e4b0cc3dad2cf381-0'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '5207320711d23e81c20152b1',
       'name': 'Sukkkubai Beef Biryani Shop',
       'contact': {},
       'location': {'lat': 12.998769171130256,
        'lng': 80.20138073942545,
        'labeledLatLngs': [{'label': 'display',
          'lat': 12.998769171130256,
          'lng': 80.20138073942545}],
        'distance': 914,
        'cc': 'IN',
        'country': 'India',
        'formattedAddress': ['India']},
       'categories': [{'id': '4bf58dd8d48988d10f941735',
         'name': 'Indian Restaurant',
         'pluralName': 'Indian Restaurants',
         'shortName': 'Indian',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/indian
_',
          'suffix': '.png'},
         'primary': True}],
       'verified': False,
       'stats': {'tipCount': 0,
        'usersCount': 0,
        'checkinsCount': 0,
        'visitsCount': 0},
       'beenHere': {'count': 0,
        'lastCheckinExpiredAt': 0,
        'marked': False,
        'unconfirmedCount': 0},
       'photos': {'count': 0, 'groups': []},
       'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
      'referralId': 'e-0-5207320711d23e81c20152b1-1'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4d3449cc329e5481bfd7c01d',
       'name': 'St Thomas Mount Railway Station',
       'contact': {},
       'location': {'address': '9, Medavakkam Main Rd, TNGO Colony, Adambakka
m',
        'lat': 12.994986869352775,
        'lng': 80.20030204728278,
        'labeledLatLngs': [{'label': 'display',
          'lat': 12.994986869352775,
          'lng': 80.20030204728278}],
        'distance': 708,
        'postalCode': '600088',
        'cc': 'IN',
        'city': 'Chennai',
        'state': 'Tamil Nadu',
        'country': 'India',
```

```
        'formattedAddress': ['9, Medavakkam Main Rd, TNGO Colony, Adambakkam',
         'Chennai 600088',
         'Tamil Nadu',
         'India']},
       'categories': [{'id': '4bf58dd8d48988d129951735',
         'name': 'Train Station',
         'pluralName': 'Train Stations',
         'shortName': 'Train Station',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/trai
nstation_',
          'suffix': '.png'},
         'primary': True}],
       'verified': False,
       'stats': {'tipCount': 0,
        'usersCount': 0,
        'checkinsCount': 0,
        'visitsCount': 0},
       'beenHere': {'count': 0,
        'lastCheckinExpiredAt': 0,
        'marked': False,
        'unconfirmedCount': 0},
       'photos': {'count': 0, 'groups': []},
       'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
      'referralId': 'e-0-4d3449cc329e5481bfd7c01d-2'},
     {'reasons': {'count': 1,
       'items': [{'summary': 'Lots of people like this place',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4f047fd3b6348c9d31ab2010',
       'name': 'Loiee',
       'contact': {},
       'location': {'lat': 12.992196715461018,
        'lng': 80.19899997141512,
        'labeledLatLngs': [{'label': 'display',
          'lat': 12.992196715461018,
          'lng': 80.19899997141512}],
        'distance': 763,
        'cc': 'IN',
        'country': 'India',
        'formattedAddress': ['India']},
       'categories': [{'id': '4bf58dd8d48988d16a941735',
         'name': 'Bakery',
         'pluralName': 'Bakeries',
         'shortName': 'Bakery',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/bakery
_',
          'suffix': '.png'},
         'primary': True}],
       'verified': False,
       'stats': {'tipCount': 0,
        'usersCount': 0,
        'checkinsCount': 0,
        'visitsCount': 0},
       'beenHere': {'count': 0,
        'lastCheckinExpiredAt': 0,
        'marked': False,
        'unconfirmedCount': 0},
```

```
        'photos': {'count': 0, 'groups': []},
        'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
       'referralId': 'e-0-4f047fd3b6348c9d31ab2010-3'},
      {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]},
       'venue': {'id': '4c4187ffd691c9b6d6e28c0a',
        'name': 'Venkateshwara Super Market',
        'contact': {},
        'location': {'address': 'Shaw wallace 3rd St, Adambakkam',
         'lat': 12.98632,
         'lng': 80.20516812801361,
         'labeledLatLngs': [{'label': 'display',
           'lat': 12.98632,
           'lng': 80.20516812801361}],
         'distance': 630,
         'cc': 'IN',
         'city': 'Chennai',
         'state': 'Tamil Nadu',
         'country': 'India',
         'formattedAddress': ['Shaw wallace 3rd St, Adambakkam',
          'Chennai',
          'Tamil Nadu',
          'India']},
        'categories': [{'id': '4bf58dd8d48988d1f6941735',
          'name': 'Department Store',
          'pluralName': 'Department Stores',
          'shortName': 'Department Store',
          'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/depar
tmentstore_',
           'suffix': '.png'},
          'primary': True}],
        'verified': False,
        'stats': {'tipCount': 0,
         'usersCount': 0,
         'checkinsCount': 0,
         'visitsCount': 0},
        'beenHere': {'count': 0,
         'lastCheckinExpiredAt': 0,
         'marked': False,
         'unconfirmedCount': 0},
        'photos': {'count': 0, 'groups': []},
        'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
       'referralId': 'e-0-4c4187ffd691c9b6d6e28c0a-4'},
      {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]},
       'venue': {'id': '518f171b498e4ddbcf6724d3',
        'name': 'Deepam Restaurant',
        'contact': {},
        'location': {'lat': 12.985379742996784,
         'lng': 80.20528135061485,
         'labeledLatLngs': [{'label': 'display',
           'lat': 12.985379742996784,
           'lng': 80.20528135061485}],
```

```
        'distance': 732,
        'cc': 'IN',
        'country': 'India',
        'formattedAddress': ['India']},
       'categories': [{'id': '4bf58dd8d48988d10f941735',
         'name': 'Indian Restaurant',
         'pluralName': 'Indian Restaurants',
         'shortName': 'Indian',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/indian
_',
          'suffix': '.png'},
         'primary': True}],
       'verified': False,
       'stats': {'tipCount': 0,
        'usersCount': 0,
        'checkinsCount': 0,
        'visitsCount': 0},
       'beenHere': {'count': 0,
        'lastCheckinExpiredAt': 0,
        'marked': False,
        'unconfirmedCount': 0},
       'photos': {'count': 0, 'groups': []},
       'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
      'referralId': 'e-0-518f171b498e4ddbcf6724d3-5'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '5620d52f498ed9f1f54bde11',
       'name': 'Design Hotel Chennai by jüSTa',
       'contact': {},
       'location': {'address': 'Phoenix Market City, 142, Velachery Rd',
        'crossStreet': 'Indira Gandhi Nagar, Velachery, Chennai',
        'lat': 12.9920677,
        'lng': 80.2149649,
        'labeledLatLngs': [{'label': 'display',
          'lat': 12.9920677,
          'lng': 80.2149649}],
        'distance': 969,
        'postalCode': '600042',
        'cc': 'IN',
        'state': 'Tamil Nadu',
        'country': 'India',
        'formattedAddress': ['Phoenix Market City, 142, Velachery Rd (Indira Ga
ndhi Nagar, Velachery, Chennai)',
         '600042',
         'Tamil Nadu',
         'India']},
       'categories': [{'id': '4bf58dd8d48988d1fa931735',
         'name': 'Hotel',
         'pluralName': 'Hotels',
         'shortName': 'Hotel',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/hote
l_',
          'suffix': '.png'},
         'primary': True}],
       'verified': True,
```

```
        'stats': {'tipCount': 0,
         'usersCount': 0,
         'checkinsCount': 0,
         'visitsCount': 0},
        'beenHere': {'count': 0,
         'lastCheckinExpiredAt': 0,
         'marked': False,
         'unconfirmedCount': 0},
        'photos': {'count': 0, 'groups': []},
        'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
       'referralId': 'e-0-5620d52f498ed9f1f54bde11-6'},
      {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]},
       'venue': {'id': '584a25865a5869668fb4a00d',
        'name': 'St. Thomas Mount Metro Station',
        'contact': {},
        'location': {'lat': 12.994772,
         'lng': 80.197556,
         'labeledLatLngs': [{'label': 'display',
           'lat': 12.994772,
           'lng': 80.197556}],
         'distance': 972,
         'postalCode': '600088',
         'cc': 'IN',
         'city': 'Chennai',
         'state': 'Tamil Nadu',
         'country': 'India',
         'formattedAddress': ['Chennai 600088', 'Tamil Nadu', 'India']},
        'categories': [{'id': '4bf58dd8d48988d1fd931735',
          'name': 'Metro Station',
          'pluralName': 'Metro Stations',
          'shortName': 'Metro',
          'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/travel/subw
ay_',
           'suffix': '.png'},
          'primary': True}],
        'verified': False,
        'stats': {'tipCount': 0,
         'usersCount': 0,
         'checkinsCount': 0,
         'visitsCount': 0},
        'beenHere': {'count': 0,
         'lastCheckinExpiredAt': 0,
         'marked': False,
         'unconfirmedCount': 0},
        'photos': {'count': 0, 'groups': []},
        'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
       'referralId': 'e-0-584a25865a5869668fb4a00d-7'},
      {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]},
       'venue': {'id': '4fd4b22de4b0a1f00743d487',
        'name': 'Heritage Fresh',
        'contact': {},
```

```
        'location': {'address': 'No 16',
         'crossStreet': 'City Link Road, Adambakkam',
         'lat': 13.000498667706818,
         'lng': 80.2080868474329,
         'labeledLatLngs': [{'label': 'display',
           'lat': 13.000498667706818,
           'lng': 80.2080868474329}],
         'distance': 980,
         'postalCode': '600088',
         'cc': 'IN',
         'city': 'Chennai',
         'state': 'Tamil Nadu',
         'country': 'India',
         'formattedAddress': ['No 16 (City Link Road, Adambakkam)',
          'Chennai 600088',
          'Tamil Nadu',
          'India']},
        'categories': [{'id': '52f2ab2ebcbc57f1066b8b46',
          'name': 'Supermarket',
          'pluralName': 'Supermarkets',
          'shortName': 'Supermarket',
          'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/food_
grocery_',
           'suffix': '.png'},
          'primary': True}],
        'verified': False,
        'stats': {'tipCount': 0,
         'usersCount': 0,
         'checkinsCount': 0,
         'visitsCount': 0},
        'beenHere': {'count': 0,
         'lastCheckinExpiredAt': 0,
         'marked': False,
         'unconfirmedCount': 0},
        'photos': {'count': 0, 'groups': []},
        'hereNow': {'count': 0, 'summary': 'Nobody here', 'groups': []}},
       'referralId': 'e-0-4fd4b22de4b0a1f00743d487-8'}]}]}}
```


We will now create a function get_category_type to extract the categories of venues.

In [25]:
```
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']
```

Now we can clean the JSON obtained using the GET method and store our results in a dataframe.

In [26]:
```
venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues)

filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'venu
nearby_venues = nearby_venues.loc[:, filtered_columns]

nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type, axis=1

nearby_venues.columns = [col.split(".")[-1] for col in nearby_venues.columns]

nearby_venues.head()
```

```
<ipython-input-26-dc733077f29a>:3: FutureWarning: pandas.io.json.json_normalize
is deprecated, use pandas.json_normalize instead
  nearby_venues = json_normalize(venues)
```

Out[26]:

	name	categories	lat	lng
0	Pizza Republic	Pizza Place	12.990987	80.198613
1	Sukkkubai Beef Biryani Shop	Indian Restaurant	12.998769	80.201381
2	St Thomas Mount Railway Station	Train Station	12.994987	80.200302
3	Loiee	Bakery	12.992197	80.199000
4	Venkateshwara Super Market	Department Store	12.986320	80.205168

We can check how many venues were returned by Foursquare.

In [27]:
```
print("{} venues were returned for {} by Foursquare".format(len(nearby_venues), r
```

```
9 venues were returned for Adambakkam by Foursquare
```

Generalizing Foursquare API

Now that we have seen how the API call works and how we can clean our data to get relevant information, we can generalize this procedure to get nearby venues for all neighborhoods by creating the function getNearbyVenues.

In [28]:
```
def getNearbyVenues(names, latitudes, longitudes, radius=500):

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

        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)

        results = requests.get(url).json()["response"]['groups'][0]['items']

        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
    nearby_venues.columns = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

We can apply the function created to get nearby venues for all neighborhoods in Chennai. We will get 200 nearby venues within a 1km radius, same as before.

In [30]:
```
chennai_venues = getNearbyVenues(names=df['Neighborhood'], latitudes=df['Latitude
```

```
Vepery
Villivakkam
Virugambakkam
Vyasarpadi
West Mambalam
Kancheepuram
Chengalpattu
Pazhaverkadu
Ponneri
Athipattu
Sholavaram
Minjur
Red Hills
Ennore
Tiruvallur
Pattabiram
Thirunindravur
Kattupakkam
Kundrathur
Kadambathur
```

Lets see what our dataframe looks like.

In [31]:
```
print(chennai_venues.shape)
chennai_venues.head(10)
```

```
(2010, 7)
```

Out[31]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Adambakkam	12.99192	80.20603	Pizza Republic	12.990987	80.198613	Pizza Place
1	Adambakkam	12.99192	80.20603	Sukkkubai Beef Biryani Shop	12.998769	80.201381	Indian Restaurant
2	Adambakkam	12.99192	80.20603	St Thomas Mount Railway Station	12.994987	80.200302	Train Station
3	Adambakkam	12.99192	80.20603	Loiee	12.992197	80.199000	Bakery
4	Adambakkam	12.99192	80.20603	Venkateshwara Super Market	12.986320	80.205168	Department Store
5	Adambakkam	12.99192	80.20603	Deepam Restaurant	12.985380	80.205281	Indian Restaurant
6	Adambakkam	12.99192	80.20603	Design Hotel Chennai by jüSTa	12.992068	80.214965	Hotel
7	Adambakkam	12.99192	80.20603	St. Thomas Mount Metro Station	12.994772	80.197556	Metro Station
8	Adambakkam	12.99192	80.20603	Heritage Fresh	13.000499	80.208087	Supermarket
9	Adyar	13.00304	80.25187	That Madras Place	13.005848	80.250726	Café

Lets see how many venues were returned for each neighborhood.

In [32]:
```
chennai_venues.groupby('Neighborhood', as_index=False).count()
```

Out[32]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Adambakkam	9	9	9	9	9	9
1	Adyar	63	63	63	63	63	63
2	Alandur	16	16	16	16	16	16
3	Alapakkam	8	8	8	8	8	8
4	Alwarthirunagar	13	13	13	13	13	13
...	...	...	...	...	...	...	...
156	Villivakkam	6	6	6	6	6	6
157	Virugambakkam	6	6	6	6	6	6
158	Vyasarpadi	4	4	4	4	4	4
159	West Mambalam	19	19	19	19	19	19
160	manapakkam	3	3	3	3	3	3

161 rows × 7 columns

We can now check how many unique categories are there in our data.

In [33]:
```
print("There are {} unique categories".format(chennai_venues['Venue Category'].nu
```

```
There are 192 unique categories
```

Analyzing each neighborhood

We can start analyzing each neighborhood by One-hot Encoding to see which categories belong in which neighborhoods.

In [34]:
```
chennai_onehot = pd.get_dummies(chennai_venues[['Venue Category']], prefix="", pr
chennai_onehot.head()
```

Out[34]:

	ATM	Accessories Store	Afghan Restaurant	African Restaurant	Airport Terminal	American Restaurant	Amphitheater	Andhra Restaurant	Arc
0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	

5 rows × 192 columns

Adding Neighborhood column to the one-hot encoded dataframe.

In [35]:
```
chennai_onehot['Neighborhood'] = chennai_venues['Neighborhood']
chennai_onehot.head()
```

Out[35]:

	ATM	Accessories Store	Afghan Restaurant	African Restaurant	Airport Terminal	American Restaurant	Amphitheater	Andhra Restaurant	Arc
0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	

5 rows × 192 columns

Moving the Neighborhood column to the first column.

In [36]:
```
temp = list(chennai_onehot.columns)

if 'Neighborhood' in temp:
    temp.remove('Neighborhood')

fixed_columns = ['Neighborhood'] + temp
chennai_onehot = chennai_onehot[fixed_columns]

chennai_onehot.head()
```

Out[36]:

	Neighborhood	ATM	Accessories Store	Afghan Restaurant	African Restaurant	Airport Terminal	American Restaurant	Amphitheater	I
0	Adambakkam	0	0	0	0	0	0	0	
1	Adambakkam	0	0	0	0	0	0	0	
2	Adambakkam	0	0	0	0	0	0	0	
3	Adambakkam	0	0	0	0	0	0	0	
4	Adambakkam	0	0	0	0	0	0	0	

5 rows × 192 columns

Now we can groupby neighborhood and take the mean for all categories.

In [37]:
```
chennai_grouped = chennai_onehot.groupby('Neighborhood', sort=False).mean().reset
print(chennai_grouped .shape)
chennai_grouped .head(10)
```

```
(161, 192)
```

Out[37]:

	Neighborhood	ATM	Accessories Store	Afghan Restaurant	African Restaurant	Airport Terminal	American Restaurant	Amphitheater
0	Adambakkam	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
1	Adyar	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
2	Alandur	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
3	Alapakkam	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
4	Alwarthirunagar	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
5	Ambattur	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
6	Aminjikarai	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
7	Anna Nagar	0.0	0.0	0.0	0.0	0.0	0.014706	0.0
8	Annanur	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
9	Arumbakkam	0.0	0.0	0.0	0.0	0.0	0.000000	0.0

10 rows × 192 columns

In order to further understand the data, we can display the top 5 venues of all neighborhoods.

In [38]:
```
num_top_venues = 5

for hood in chennai_grouped ['Neighborhood']:
    print("----"+hood+"----")
    temp = chennai_grouped [chennai_grouped ['Neighborhood'] == hood].T.reset_inc
    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(r
    print('\n')
```

```
----Adambakkam----
                venue  freq
0  Indian Restaurant  0.22
1   Department Store  0.11
2      Train Station  0.11
3        Supermarket  0.11
4              Hotel  0.11


----Adyar----
                  venue  freq
0     Indian Restaurant  0.25
1                 Café  0.06
2      Asian Restaurant  0.05
3          Dessert Shop  0.05
4  Fast Food Restaurant  0.05


----Alandur----
                venue  freq
0  Indian Restaurant  0.19
1             Bakery  0.12
2              Hotel  0.12
3      Metro Station  0.12
4      Train Station  0.06


----Alapakkam----
                  venue  freq
0      Department Store  0.25
1  Fast Food Restaurant  0.25
2        Sandwich Place  0.12
3      Asian Restaurant  0.12
4        Clothing Store  0.12


----Alwarthirunagar----
                  venue  freq
0        Clothing Store  0.15
1  Fast Food Restaurant  0.15
2             Multiplex  0.08
3                 Café  0.08
4        Ice Cream Shop  0.08
```

```
----Ambattur----
              venue  freq
0     Movie Theater  0.17
1       Flea Market  0.17
2    Ice Cream Shop  0.17
3  Department Store  0.08
4       Bus Station  0.08


----Aminjikarai----
                    venue  freq
0    Fast Food Restaurant  0.17
1             Pizza Place  0.11
2  Furniture / Home Store  0.11
3             Event Space  0.06
4     Sporting Goods Shop  0.06


----Anna Nagar----
                  venue  freq
0     Indian Restaurant  0.18
1    Chinese Restaurant  0.07
2  Fast Food Restaurant  0.07
3        Clothing Store  0.04
4           Coffee Shop  0.04


----Annanur----
                  venue  freq
0              Platform  0.33
1         Train Station  0.33
2      Stationery Store  0.17
3  Medical Supply Store  0.17
4                   ATM  0.00


----Arumbakkam----
                          venue  freq
0                         Hotel  0.20
1  Vegetarian / Vegan Restaurant  0.13
2           Fast Food Restaurant  0.13
3                        Bakery  0.07
4                Clothing Store  0.07


----Ashok Nagar----
                          venue  freq
0                   Pizza Place  0.18
1              Indian Restaurant  0.14
2  Vegetarian / Vegan Restaurant  0.14
3           Fast Food Restaurant  0.09
4                          Café  0.05


----Avadi----
              venue  freq
0   Department Store   0.2
```

```
1  Indian Restaurant   0.2
2        IT Services   0.2
3               Park   0.2
4     Breakfast Spot   0.2


----Ayappakkam----
              venue  freq
0        Print Shop  0.33
1          Pharmacy  0.33
2  Department Store  0.33
3        Kids Store  0.00
4       Music Venue  0.00


----Basin Bridge----
                    venue  freq
0                Platform  0.50
1      Light Rail Station  0.12
2             Pizza Place  0.12
3           Train Station  0.12
4  Thrift / Vintage Store  0.12


----Besant Nagar----
                      venue  freq
0        Indian Restaurant  0.20
1                     Café  0.08
2           Ice Cream Shop  0.08
3              Coffee Shop  0.06
4  South Indian Restaurant  0.04


----Broadway----
               venue  freq
0  Indian Restaurant  0.43
1        Video Store  0.14
2             Market  0.14
3         Restaurant  0.14
4    Harbor / Marina  0.14


----Central----
                venue  freq
0  Miscellaneous Shop   0.2
1  Light Rail Station   0.2
2              Market   0.2
3          Food Truck   0.2
4       Metro Station   0.2


----Chetpet----
                venue  freq
0   Indian Restaurant  0.31
1               Hotel  0.13
2                Café  0.05
3  Chinese Restaurant  0.05
```

```
4         Coffee Shop  0.05


----Choolai----
               venue  freq
0          Juice Bar   0.4
1           Platform   0.2
2     Soccer Stadium   0.2
3  Indian Restaurant   0.2
4               Park   0.0


----MMDA Colony----
                      venue  freq
0  Bike Rental / Bike Share   1.0
1                       ATM   0.0
2                   Museum   0.0
3              Music Venue   0.0
4   New American Restaurant   0.0


----Defence Colony----
                       venue  freq
0          Indian Restaurant  0.33
1  Middle Eastern Restaurant  0.17
2              Movie Theater  0.17
3                     Market  0.17
4           Asian Restaurant  0.17


----Egmore----
               venue  freq
0  Indian Restaurant  0.12
1              Hotel  0.08
2               Café  0.06
3   Department Store  0.04
4             Bakery  0.04


----Ennore----
                     venue  freq
0            Train Station   1.0
1                      ATM   0.0
2         Parsi Restaurant   0.0
3             Music Venue   0.0
4  New American Restaurant   0.0


----Erukanchery----
         venue  freq
0  Pizza Place   0.2
1  Coffee Shop   0.2
2     Pharmacy   0.2
3          Gym   0.2
4       Bakery   0.2
```

```
----George Town----
                  venue  freq
0       Harbor / Marina  0.25
1     Convenience Store  0.25
2  Fast Food Restaurant  0.25
3         Train Station  0.25
4                   ATM  0.00


----Gerugambakkam----
                     venue  freq
0         Department Store  0.25
1                  Bakery  0.25
2                   Diner  0.25
3             Pizza Place  0.25
4  New American Restaurant  0.00


----Gopalapuram----
               venue  freq
0  Indian Restaurant  0.25
1              Hotel  0.06
2     Ice Cream Shop  0.05
3               Café  0.05
4         Restaurant  0.05


----Guindy----
               venue  freq
0              Hotel  0.15
1  Indian Restaurant  0.12
2         Restaurant  0.08
3          Pool Hall  0.04
4               Café  0.04


----Hastinapuram----
              venue  freq
0  Department Store   0.2
1    Ice Cream Shop   0.2
2    Clothing Store   0.2
3          Pharmacy   0.2
4            Bakery   0.2


----ICF Colony----
                  venue  freq
0     Indian Restaurant  0.16
1      Department Store  0.16
2  Fast Food Restaurant  0.09
3    Chinese Restaurant  0.06
4               Bakery  0.06


----Injambakkam----
               venue  freq
0  Indian Restaurant   0.2
```

```
1              Beach   0.1
2         Restaurant   0.1
3               Café   0.1
4             Bistro   0.1


----Irumbuliyur----
             venue  freq
0        Juice Bar  0.17
1       Restaurant  0.17
2      Bus Station  0.17
3  Motorcycle Shop  0.17
4      Coffee Shop  0.17


----Iyyapanthangal----
                           venue  freq
0                         Bakery  0.22
1                    Bus Station  0.11
2           Fast Food Restaurant  0.11
3                    Pizza Place  0.11
4  Vegetarian / Vegan Restaurant  0.11


----Jamalia----
               venue  freq
0  Indian Restaurant   0.2
1      Train Station   0.1
2         Theme Park   0.1
3        Coffee Shop   0.1
4          BBQ Joint   0.1


----K.K. Nagar----
                     venue  freq
0              Music Venue   1.0
1                      ATM   0.0
2         Parsi Restaurant   0.0
3  New American Restaurant   0.0
4               Nightclub   0.0


----Kadaperi----
                venue  freq
0   Indian Restaurant  0.62
1       Jewelry Store  0.12
2  Light Rail Station  0.12
3       Train Station  0.12
4    Parsi Restaurant  0.00


----Karambakkam----
                venue  freq
0   Indian Restaurant  0.33
1    Department Store  0.11
2          Restaurant  0.11
3  Travel & Transport  0.11
```

```
4    Asian Restaurant  0.11


----Kathirvedu----
                         venue  freq
0                          ATM  0.33
1                  Snack Place  0.33
2             Food & Drink Shop  0.33
3                   Playground  0.00
4  Paper / Office Supplies Store  0.00


----Keelkattalai----
                  venue  freq
0     Electronics Store  0.25
1           Pizza Place  0.25
2  Fast Food Restaurant  0.25
3            Food Truck  0.25
4                   ATM  0.00


----Kodungaiyur----
              venue  freq
0               ATM  0.25
1       Coffee Shop  0.25
2          Pharmacy  0.25
3              Bank  0.25
4  Parsi Restaurant  0.00


----Kolappakkam----
                  venue  freq
0                Bakery  0.50
1           Pizza Place  0.25
2  Fast Food Restaurant  0.25
3                   ATM  0.00
4      Parsi Restaurant  0.00


----Kolathur----
                     venue  freq
0                      ATM  0.50
1                Bus Stop  0.25
2        Indian Restaurant  0.25
3         Parsi Restaurant  0.00
4  New American Restaurant  0.00


----Korattur----
                     venue  freq
0                      ATM   1.0
1         Parsi Restaurant   0.0
2              Music Venue   0.0
3  New American Restaurant   0.0
4               Nightclub   0.0
```

```
----Korukkupet----
                          venue  freq
0  Vegetarian / Vegan Restaurant  0.22
1                            ATM  0.11
2                    Bus Station  0.11
3                Warehouse Store  0.11
4                       Boutique  0.11


----Kosapet----


              venue  freq
0  Indian Restaurant  0.50
1   Department Store  0.25
2             Hotel  0.25
3   Parsi Restaurant  0.00
4        Music Venue  0.00


----Kottivakkam----
              venue  freq
0             Beach  0.21
1    Clothing Store  0.11
2    Scenic Lookout  0.05
3  Indian Restaurant  0.05
4       Burger Joint  0.05


----Kovilambakkam----
              venue  freq
0               ATM  0.33
1  Indian Restaurant  0.33
2               Bar  0.33
3   Parsi Restaurant  0.00
4        Music Venue  0.00


----Koyambedu----
                          venue  freq
0                    Bus Station  0.19
1  Vegetarian / Vegan Restaurant  0.14
2               Department Store  0.10
3                  Metro Station  0.10
4                        Bakery  0.10


----Kundrathur----
                    venue  freq
0                     ATM   0.4
1              Soup Place   0.4
2             Bus Station   0.2
3             Music Store   0.0
4  New American Restaurant   0.0


----Lakshmipuram----
               venue  freq
```

```
0                ATM  0.29
1    Department Store  0.14
2        Intersection  0.14
3  Photography Studio  0.14
4   Indian Restaurant  0.14


----M.G.R. Garden----
                venue  freq
0   Indian Restaurant  0.14
1               Hotel  0.10
2                Café  0.10
3         Coffee Shop  0.05
4  Chinese Restaurant  0.05


----M.G.R. Nagar----
             venue  freq
0    Grocery Store  0.25
1      Bus Station  0.25
2  Bed & Breakfast  0.25
3  Thai Restaurant  0.25
4      Music Store  0.00


----M.K.B. Nagar----
                      venue  freq
0                Juice Bar   1.0
1               Print Shop   0.0
2              Music Venue   0.0
3  New American Restaurant   0.0
4                Nightclub   0.0


----Madhavaram----
            venue  freq
0       Bookstore  0.17
1            Farm  0.17
2     Bus Station  0.17
3  Ice Cream Shop  0.17
4      Smoke Shop  0.17


----Madhavaram Milk Colony----
              venue  freq
0  Botanical Garden   0.2
1              Farm   0.2
2    Ice Cream Shop   0.2
3       IT Services   0.2
4            Bakery   0.2


----Madipakkam----
                      venue  freq
0        Indian Restaurant  0.50
1         Department Store  0.25
2        Convenience Store  0.25
```

```
3    Performing Arts Venue  0.00
4  New American Restaurant  0.00


----Maduravoyal----
                 venue  freq
0          Pizza Place  0.50
1        Movie Theater  0.25
2  Fast Food Restaurant  0.25
3                  ATM  0.00
4     Parsi Restaurant  0.00


----Manali New Town----
                      venue  freq
0  Bike Rental / Bike Share   1.0
1                       ATM   0.0
2                    Museum   0.0
3              Music Venue   0.0
4   New American Restaurant   0.0


----manapakkam----
               venue  freq
0  Indian Restaurant  0.67
1              Trail  0.33
2                ATM  0.00
3               Park  0.00
4       Music Store  0.00


----Mangadu----
                 venue  freq
0                  ATM  0.33
1             Pharmacy  0.33
2  Fast Food Restaurant  0.33
3     Parsi Restaurant  0.00
4          Music Venue  0.00


----Manjambakkam----
                      venue  freq
0       Indian Restaurant   1.0
1                       ATM   0.0
2        Parsi Restaurant   0.0
3             Music Venue   0.0
4  New American Restaurant   0.0


----Mannadi----
                 venue  freq
0    Convenience Store  0.17
1  Fast Food Restaurant  0.17
2         Train Station  0.17
3    Indian Restaurant  0.17
4       Ice Cream Shop  0.17
```

```
----Medavakkam----
                          venue  freq
0              Indian Restaurant  0.45
1  Vegetarian / Vegan Restaurant  0.18
2             Chinese Restaurant  0.09
3              Convenience Store  0.09
4                    Pizza Place  0.09


----Minjur----
              venue  freq
0     Train Station   0.4
1    Scenic Lookout   0.4
2              Park   0.2
3               ATM   0.0
4  Parsi Restaurant   0.0


----Mogappair----
                      venue  freq
0       Chinese Restaurant   0.2
1                   Bakery   0.2
2  South Indian Restaurant   0.1
3        Accessories Store   0.1
4              Bus Station   0.1


----Moolakadai----
               venue  freq
0                ATM   0.2
1             Bakery   0.2
2                Gym   0.2
3        Coffee Shop   0.2
4  Currency Exchange   0.2


----Mowlivakkam----
                  venue  freq
0                Bakery   0.4
1                  Farm   0.2
2           Pizza Place   0.2
3  Fast Food Restaurant   0.2
4                   ATM   0.0


----Mudichur----
            venue  freq
0  Breakfast Spot   0.5
1        Pharmacy   0.5
2             ATM   0.0
3            Park   0.0
4     Music Venue   0.0


----Mugalivakkam----
                venue  freq
```

```
0   Indian Restaurant  0.18
1    Department Store  0.09
2  Italian Restaurant  0.09
3              Office  0.09
4                Café  0.09


----Mylapore----
                          venue  freq
0                    Restaurant  0.08
1              Indian Restaurant  0.08
2  Vegetarian / Vegan Restaurant  0.07
3                   Snack Place  0.05
4                         Hotel  0.05


----Nagalkeni----
         venue  freq
0  Supermarket   0.5
1     Pharmacy   0.5
2          ATM   0.0
3         Park   0.0
4  Music Venue   0.0


----Nandambakkam----
                      venue  freq
0     Fast Food Restaurant  0.22
1             Burger Joint  0.11
2                    Hotel  0.11
3  South Indian Restaurant  0.11
4              Bus Station  0.11


----Nanganallur----
                 venue  freq
0   Chinese Restaurant   0.2
1          Pizza Place   0.2
2            Multiplex   0.2
3  Indie Movie Theater   0.2
4        Grocery Store   0.2


----Naravarikuppam----
               venue  freq
0                Gym   0.2
1   Department Store   0.2
2          Multiplex   0.2
3  Indian Restaurant   0.2
4      Shopping Mall   0.2


----Neelankarai----
                      venue  freq
0        Indian Restaurant  0.12
1             Burger Joint  0.12
2                   Buffet  0.06
```

```
3  South Indian Restaurant  0.06
4                    Café  0.06


----Nerkundrum----
                         venue  freq
0               Department Store  0.25
1           Gym / Fitness Center  0.25
2                     Playground  0.25
3  Vegetarian / Vegan Restaurant  0.25
4                           Park  0.00


----Nesapakkam----
                  venue  freq
0        Ice Cream Shop  0.22
1      Department Store  0.11
2  Fast Food Restaurant  0.11
3           Pizza Place  0.11
4           Coffee Shop  0.11


----New Washermenpet----
                 venue  freq
0                Beach  0.29
1          Bus Station  0.14
2      Harbor / Marina  0.14
3  Martial Arts School  0.14
4    Indian Restaurant  0.14


----Nolambur----
                  venue  freq
0                Bakery  0.29
1    Indian Restaurant  0.29
2  Gym / Fitness Center  0.14
3    Electronics Store  0.14
4   Chinese Restaurant  0.14


----Old Washermenpet----
                 venue  freq
0          Bus Station  0.29
1        Women's Store  0.14
2      Warehouse Store  0.14
3        Train Station  0.14
4  Indie Movie Theater  0.14


----Oragadam----
                    venue  freq
0  South Indian Restaurant  0.25
1              Pizza Place  0.25
2         Video Game Store  0.25
3                Pet Store  0.25
4                      ATM  0.00
```

```
----Otteri----
              venue  freq
0         BBQ Joint  0.14
1  Department Store  0.14
2       Bus Station  0.14
3        Restaurant  0.14
4          Tea Room  0.14


----Padi----
         venue  freq
0         Café   0.4
1         Park   0.2
2          Gym   0.2
3  Snack Place   0.2
4          ATM   0.0


----Palavakkam----
                        venue  freq
0             Ice Cream Shop  0.13
1           Indian Restaurant  0.13
2     South Indian Restaurant  0.07
3                       Café  0.07
4  Modern European Restaurant  0.07


----Pallavaram----
                  venue  freq
0       Department Store   0.2
1       Airport Terminal   0.2
2                   Bank   0.2
3            Pizza Place   0.2
4  Hyderabadi Restaurant   0.2


----Pallikaranai----
                     venue  freq
0                      Bar   1.0
1                      ATM   0.0
2                   Museum   0.0
3             Music Venue   0.0
4  New American Restaurant   0.0


----Pammal----
                     venue  freq
0                      ATM  0.25
1  South Indian Restaurant  0.25
2          Warehouse Store  0.25
3              Bus Station  0.25
4                     Park  0.00


----Park Town----
                   venue  freq
```

```
0       Indian Restaurant  0.17
1           Train Station  0.13
2             Bus Station  0.09
3               Bookstore  0.09
4  Furniture / Home Store  0.04


----Parry's Corner----
               venue  freq
0  Indian Restaurant  0.50
1        Video Store  0.17
2             Market  0.17
3    Harbor / Marina  0.17
4                ATM  0.00


----Pattabiram----


                  venue  freq
0                   ATM  0.18
1    Light Rail Station  0.18
2           Supermarket  0.18
3              Platform  0.18
4  Fast Food Restaurant  0.18


----Pattalam----
                      venue  freq
0                 BBQ Joint   0.2
1                     River   0.2
2  Bike Rental / Bike Share   0.2
3      Fast Food Restaurant   0.2
4    Furniture / Home Store   0.2


----Pattravakkam----
            venue  freq
0       Multiplex  0.17
1   Movie Theater  0.17
2           River  0.17
3   Train Station  0.17
4  Ice Cream Shop  0.17


----Pazhavanthangal----
               venue  freq
0              Hotel  0.15
1  Indian Restaurant  0.15
2     Breakfast Spot  0.08
3      Train Station  0.08
4          Multiplex  0.08


----Peerkankaranai----
               venue  freq
0  Convenience Store  0.33
1        Bus Station  0.33
```

```
2      Train Station  0.33
3                ATM  0.00
4   Parsi Restaurant  0.00


----Perambur----
              venue  freq
0  Department Store  0.25
1         Multiplex  0.25
2       Pizza Place  0.25
3       Snack Place  0.25
4              Park  0.00


----Periamet----
                           venue  freq
0                          Hotel  0.12
1                      Juice Bar  0.08
2                      Bookstore  0.08
3  Vegetarian / Vegan Restaurant  0.08
4              Indian Restaurant  0.08


----Perungalathur----
                     venue  freq
0                Juice Bar   0.5
1                   Bakery   0.5
2         Parsi Restaurant   0.0
3              Music Venue   0.0
4  New American Restaurant   0.0


----Perungudi----
                  venue  freq
0     Indian Restaurant   0.2
1            Food Court   0.2
2    Chinese Restaurant   0.2
3  Fast Food Restaurant   0.1
4                  Park   0.1


----Ponniammanmedu----
                   venue  freq
0          Auto Workshop  0.25
1   Fast Food Restaurant  0.25
2            Coffee Shop  0.25
3               Pharmacy  0.25
4  Performing Arts Venue  0.00


----Poonamallee----
                  venue  freq
0           Gas Station   0.2
1           Bus Station   0.2
2          Optical Shop   0.2
3  Fast Food Restaurant   0.2
4     Indian Restaurant   0.2
```

```
----Porur----
               venue  freq
0   Asian Restaurant  0.14
1             Bakery  0.10
2              Café  0.10
3  Indian Restaurant  0.10
4         Restaurant  0.05


----Pozhichalur----
               venue  freq
0   Department Store  0.22
1     Ice Cream Shop  0.11
2  Convenience Store  0.11
3        Pizza Place  0.11
4           Pharmacy  0.11


----Pudur----
                     venue  freq
0              Pizza Place  0.50
1                    Hotel  0.25
2  South Indian Restaurant  0.25
3                      ATM  0.00
4              Music Venue  0.00


----Pulianthope----
                venue  freq
0            Platform  0.50
1  Light Rail Station  0.25
2         Pizza Place  0.25
3                 ATM  0.00
4                Park  0.00


----Purasawalkam----
                venue  freq
0   Indian Restaurant  0.34
1               Hotel  0.10
2         Pizza Place  0.07
3  Italian Restaurant  0.07
4    Department Store  0.07


----Puzhal----
             venue  freq
0              Gym  0.25
1     Snack Place  0.25
2      Food Truck  0.25
3  Sandwich Place  0.25
4              ATM  0.00


----Red Hills----
```

```
               venue  freq
0               Gym   0.2
1   Department Store   0.2
2          Multiplex   0.2
3  Indian Restaurant   0.2
4      Shopping Mall   0.2


----Royapuram----
                  venue  freq
0          Dessert Shop  0.17
1     Convenience Store  0.17
2                Bakery  0.17
3        Ice Cream Shop  0.17
4  Fast Food Restaurant  0.17


----Saidapet----
                venue  freq
0         Bus Station  0.13
1       Metro Station  0.13
2  Chinese Restaurant  0.13
3   Indian Restaurant  0.13
4           BBQ Joint  0.07


----Saligramam----
               venue  freq
0  Indian Restaurant  0.20
1     Clothing Store  0.10
2        Pizza Place  0.10
3  Convenience Store  0.05
4              Hotel  0.05


----Selaiyur----
               venue  freq
0        Pizza Place  0.22
1              Hotel  0.11
2               Café  0.11
3        Coffee Shop  0.11
4  Indian Restaurant  0.11


----Selavoyal----
              venue  freq
0  Department Store  0.33
1       Pizza Place  0.17
2        Food Truck  0.17
3       IT Services  0.17
4               ATM  0.17


----Sembiam----
                   venue  freq
0      Chinese Restaurant   0.2
1  Furniture / Home Store   0.2
```

```
2             Snack Place   0.2
3             Coffee Shop   0.2
4        Asian Restaurant   0.2


----Sholinganallur----
              venue  freq
0              Food  0.15
1  Department Store  0.08
2            Resort  0.08
3       Sports Club  0.08
4    Sandwich Place  0.08


----Sowcarpet----
               venue  freq
0  Indian Restaurant  0.33
1        Video Store  0.11
2             Market  0.11
3         Restaurant  0.11
4    Harbor / Marina  0.11


----T. Nagar----
               venue  freq
0  Indian Restaurant  0.18
1     Clothing Store  0.11
2      Jewelry Store  0.06
3        Coffee Shop  0.05
4      Train Station  0.05


----T.V.K. Nagar----
                 venue  freq
0          Bus Station  0.25
1  Indie Movie Theater  0.25
2    Indian Restaurant  0.25
3        Historic Site  0.25
4                  ATM  0.00


----Tambaram----
               venue  freq
0               Food   0.2
1        Food Court   0.2
2        Bus Station   0.2
3  Convenience Store   0.2
4  Indian Restaurant   0.2


----Taramani----
                          venue  freq
0                    Food Court  0.17
1                 Sandwich Place  0.08
2  Vegetarian / Vegan Restaurant  0.08
3                   Food Service  0.08
4              Indian Restaurant  0.08
```

```
----Teynampet----
                venue  freq
0   Indian Restaurant  0.18
1               Hotel  0.08
2              Lounge  0.07
3               Café  0.06
4  Chinese Restaurant  0.05


----Thirumangalam----
                  venue  freq
0     Indian Restaurant  0.19
1             Multiplex  0.12
2           Pizza Place  0.12
3  Fast Food Restaurant  0.08
4         Jewelry Store  0.04


----Thirumazhisai----
                     venue  freq
0                BBQ Joint  0.17
1  South Indian Restaurant  0.17
2     Fast Food Restaurant  0.17
3              Snack Place  0.17
4                    Café  0.17


----Thirumullaivayal----
              venue  freq
0  Halal Restaurant  0.25
1            Market  0.25
2       Bus Station  0.25
3          Pharmacy  0.25
4               ATM  0.00


----Thirumullaivoyal north----
              venue  freq
0  Halal Restaurant  0.25
1            Market  0.25
2       Bus Station  0.25
3          Pharmacy  0.25
4               ATM  0.00


----Thirunindravur----
              venue  freq
0     Train Station  0.67
1          Pharmacy  0.33
2               ATM  0.00
3  Parsi Restaurant  0.00
4       Music Venue  0.00


----Thiruvanmiyur----
```

```
               venue  freq
0              Beach  0.10
1               Park  0.06
2     Ice Cream Shop  0.06
3        Pizza Place  0.06
4  Indian Restaurant  0.06


----Thiruverkadu----
                     venue  freq
0                      ATM   0.5
1                 Pharmacy   0.5
2         Parsi Restaurant   0.0
3              Music Venue   0.0
4  New American Restaurant   0.0


----Thoraipakkam----
              venue  freq
0               Gym  0.33
1          Tea Room  0.33
2         Juice Bar  0.33
3        Kids Store  0.00
4  Parsi Restaurant  0.00


----Thousand Lights----
                venue  freq
0   Indian Restaurant  0.16
1               Café  0.10
2          Multiplex  0.05
3              Hotel  0.04
4  Chinese Restaurant  0.04


----Tiruvottiyur----
                 venue  freq
0          Bus Station  0.25
1  Martial Arts School  0.25
2          Coffee Shop  0.25
3                Beach  0.25
4                  ATM  0.00


----Tondiarpet----
              venue  freq
0               ATM  0.17
1  Department Store  0.17
2     Movie Theater  0.17
3   Harbor / Marina  0.17
4          Platform  0.17


----Triplicane----
               venue  freq
0  Indian Restaurant  0.20
1     Clothing Store  0.11
```

```
2          Multiplex  0.08
3              Café  0.05
4      Movie Theater  0.05


----Vadapalani----
               venue  freq
0  Indian Restaurant  0.13
1              Hotel  0.08
2          Multiplex  0.08
3   Asian Restaurant  0.05
4     Clothing Store  0.05


----Valasaravakkam----
                           venue  freq
0               Asian Restaurant  0.23
1  Vegetarian / Vegan Restaurant  0.15
2              Indian Restaurant  0.15
3                 Sandwich Place  0.15
4               Department Store  0.08


----Vallalar Nagar----
                venue  freq
0                 ATM  0.17
1  Light Rail Station  0.17
2         Supermarket  0.17
3            Platform  0.17
4        Concert Hall  0.17


----Vandalur----
                    venue  freq
0                Cafeteria   0.4
1  South Indian Restaurant   0.2
2                Platform   0.2
3                  Bakery   0.2
4                     ATM   0.0


----Varadharajapuram----
                  venue  freq
0     Indian Restaurant  0.33
1             BBQ Joint  0.17
2          Snack Place  0.17
3  Fast Food Restaurant  0.17
4                 Café  0.17


----Velachery----
                  venue  freq
0     Indian Restaurant  0.29
1  Fast Food Restaurant  0.09
2        Ice Cream Shop  0.07
3           Pizza Place  0.07
4            Restaurant  0.07
```

```
----Vepery----
                venue  freq
0            Platform  0.50
1  Light Rail Station  0.25
2      Shopping Plaza  0.25
3                 ATM  0.00
4    Parsi Restaurant  0.00


----Villivakkam----
                venue  freq
0       Train Station  0.33
1           Multiplex  0.17
2              Bakery  0.17
3  Light Rail Station  0.17
4         Bus Station  0.17


----Virugambakkam----
              venue  freq
0             Café  0.33
1  Department Store  0.17
2            Bakery  0.17
3       Pizza Place  0.17
4    Sandwich Place  0.17


----Vyasarpadi----
                      venue  freq
0         Department Store  0.25
1       Chinese Restaurant  0.25
2   Furniture / Home Store  0.25
3                   Bakery  0.25
4  North Indian Restaurant  0.00


----West Mambalam----
               venue  freq
0  Indian Restaurant  0.11
1       Pizza Place  0.11
2     Clothing Store  0.11
3      Jewelry Store  0.05
4             Bakery  0.05


----Kancheepuram----
                      venue  freq
0        Indian Restaurant   1.0
1                      ATM   0.0
2         Parsi Restaurant   0.0
3              Music Venue   0.0
4  New American Restaurant   0.0


----Chengalpattu----
```

```
                    venue  freq
0        Indian Restaurant   1.0
1                      ATM   0.0
2         Parsi Restaurant   0.0
3              Music Venue   0.0
4  New American Restaurant   0.0


----Pazhaverkadu----
                venue  freq
0  Indian Restaurant  0.20
1      Train Station  0.15
2     Sandwich Place  0.05
3           Platform  0.05
4             Museum  0.05


----Athipattu----
              venue  freq
0     Train Station  0.67
1          Platform  0.33
2               ATM  0.00
3  Parsi Restaurant  0.00
4       Music Venue  0.00


----Sholavaram----
                venue  freq
0           Tea Room   0.5
1  Indian Sweet Shop   0.5
2               ATM   0.0
3              Park   0.0
4        Music Store   0.0


----Tiruvallur----
                    venue  freq
0            Metro Station   0.5
1        Indian Restaurant   0.5
2                      ATM   0.0
3              Music Venue   0.0
4  New American Restaurant   0.0


----Kattupakkam----
                venue  freq
0        Bus Station   0.2
1        Pizza Place   0.2
2  Indian Restaurant   0.2
3     Sandwich Place   0.2
4             Bakery   0.2


----Chembarambakkam----
                    venue  freq
0  South Indian Restaurant  0.17
1              Snack Place  0.17
```

```
2     Fast Food Restaurant  0.17
3                    Café  0.17
4        Indian Restaurant  0.17


----Singaperumalkoil----
                     venue  freq
0                    Hotel  0.17
1                 Platform  0.17
2  Fruit & Vegetable Store  0.17
3              Coffee Shop  0.17
4            Train Station  0.17


----Maraimalai nagar----
         venue  freq
0   Sports Bar  0.33
1  Gaming Cafe  0.33
2       Bakery  0.33
3         Park  0.00
4  Music Venue  0.00


----Urapakkam----
                     venue  freq
0                Juice Bar  0.17
1        Indian Restaurant  0.17
2              Coffee Shop  0.17
3  South Indian Restaurant  0.17
4         Department Store  0.17


----Guduvanchery----
                     venue  freq
0                   Bakery   0.2
1         Department Store   0.2
2  North Indian Restaurant   0.2
3      Indie Movie Theater   0.2
4        Indian Restaurant   0.2


----Karapakkam----
                          venue  freq
0              Indian Restaurant   0.4
1                     Restaurant   0.2
2              Afghan Restaurant   0.1
3  Vegetarian / Vegan Restaurant   0.1
4           Fast Food Restaurant   0.1


----Kanathur----
              venue  freq
0     Movie Theater  0.33
1              Café  0.33
2         Juice Bar  0.17
3        Whisky Bar  0.17
4  Parsi Restaurant  0.00
```

```
----Muthukadu----
               venue  freq
0  Indian Restaurant  0.43
1         Theme Park  0.14
2        Coffee Shop  0.14
3             Museum  0.14
4              Hotel  0.14


----Kelambakkam----
                  venue  freq
0           Bus Station   0.2
1  Fast Food Restaurant   0.2
2                 Café   0.2
3           Coffee Shop   0.2
4     Indian Restaurant   0.2


----Kovalam----
                venue  freq
0  Seafood Restaurant  0.11
1                 Bar  0.11
2               Café  0.11
3              Resort  0.11
4          Restaurant  0.11


----Siruseri----
                     venue  freq
0                      ATM   0.5
1                Tea Room   0.5
2                  Museum   0.0
3             Music Venue   0.0
4  New American Restaurant   0.0
```

Lets now create a dataframe with the top 10 common venues for each neighborhood.

In [39]:
```
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]
```

In [40]:
```
num_top_venues = 10

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

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))

neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = chennai_grouped['Neighborhood']

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

neighborhoods_venues_sorted
```

Out[40]:

	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 I Com Ve
0	Adambakkam	Indian Restaurant	Train Station	Metro Station	Supermarket	Hotel	Bakery	F F
1	Adyar	Indian Restaurant	Café	Fast Food Restaurant	Dessert Shop	Pizza Place	Asian Restaurant	Electro S
2	Alandur	Indian Restaurant	Metro Station	Hotel	Bakery	Supermarket	Breakfast Spot	Ch
3	Alapakkam	Department Store	Fast Food Restaurant	Clothing Store	Asian Restaurant	Sandwich Place	Chettinad Restaurant	Fl S
4	Alwarthirunagar	Clothing Store	Fast Food Restaurant	Chinese Restaurant	Movie Theater	Smoke Shop	Gym	
...	...	...	...	...	...	...	...	
156	Kanathur	Movie Theater	Café	Whisky Bar	Juice Bar	Food	Garden	Ga
157	Muthukadu	Indian Restaurant	Museum	Coffee Shop	Hotel	Theme Park	Flea Market	Furnit H S
158	Kelambakkam	Indian Restaurant	Bus Station	Coffee Shop	Fast Food Restaurant	Café	Yoga Studio	I
159	Kovalam	Indian Restaurant	Seafood Restaurant	Café	Hotel	Resort	Restaurant	Surf
160	Siruseri	ATM	Tea Room	Gas Station	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	I Chi

161 rows × 11 columns

Clustering neighborhoods

Now we can use KMeans clustering method to cluster the neighborhoods.

First we need to determine how many clusters to use. This will be done using the Silhouette Score.

We will define a function to plot the Silhouette Score that will be calculated using different number of clusters.

In [41]:
```
def plot(x, y):
    fig = plt.figure(figsize=(12,6))
    plt.plot(x, y, 'o-')
    plt.xlabel('Number of clusters')
    plt.ylabel('Silhouette Scores')
    plt.title('Checking Optimum Number of Clusters')
    ax = plt.gca()
    ax.spines['right'].set_visible(False)
    ax.spines['top'].set_visible(False)
```

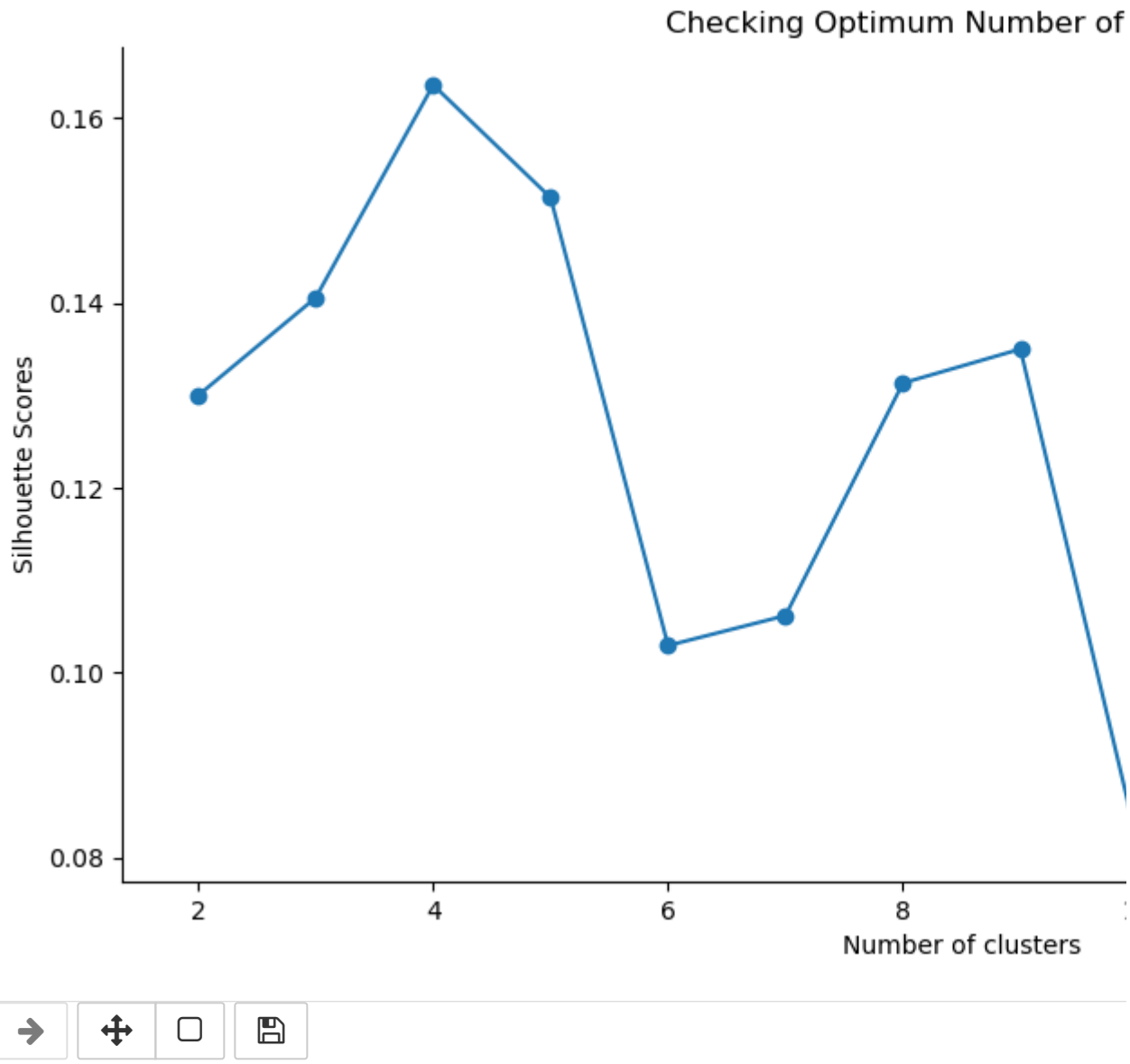
In [42]:
```
maxk = 15
scores = []
kval = []

for k in range(2, maxk+1):
    cl_df = chennai_grouped.drop('Neighborhood', axis=1)
    kmeans = KMeans(n_clusters=k, init="k-means++", random_state=40).fit_predict(

    score = silhouette_score(cl_df, kmeans, metric='euclidean', random_state=0)
    kval.append(k)
    scores.append(score)
```

We can now display the scores for different number of clusters and plot the data as well.

In [43]:
```
print(scores)
print(kval)
plot(kval, scores)
```

```
[0.13001415490019286, 0.14058080150465582, 0.16359747557782178, 0.1514060516447
099, 0.10293949987835495, 0.1061768009851362, 0.13134315743102876, 0.1350175509
0303574, 0.08149884936456084, 0.08400559469203524, 0.12861737560910522, 0.12653
8775100004, 0.10055036873688378, 0.0997970568627141]
[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15]
```

Figure 2



We can see that the silhouette scores are not very high even as we increase the number of clusters. This means that the inter-cluster distance between different clusters is not very high over the range of k-values. However, we will try to cluster our data as best as we can. For this, we will use 5 clusters for our clustering model since it provides the highest silhouette score as seen above.

In [44]:
```
k = 4

chennai_clustering = chennai_grouped.drop('Neighborhood', axis=1)
kmeans = KMeans(n_clusters=k, init="k-means++", random_state=40).fit(chennai_clus

type(kmeans.labels_)
```

Out[44]:
```
numpy.ndarray
```

Now we can create a new dataframe that includes cluster labels and the top 10 venues.

In [45]:
```
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
chennai_merged = df
chennai_merged = chennai_merged.join(neighborhoods_venues_sorted.set_index('Neigh
```

Lets view the newly created dataframe.

In [48]:
```
print(chennai_merged.shape)

chennai_merged.head(10)
```

```
(176, 15)
```

Out[48]:

	Neighborhood	Location	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Cor
0	Adambakkam	South and East Chennai	12.9919	80.206	2.0	Indian Restaurant	Train Station	Metro Station	Superr
1	Adyar	South and East Chennai	13.003	80.2519	2.0	Indian Restaurant	Café	Fast Food Restaurant	D
2	Alandur	South and East Chennai	13.0001	80.2006	2.0	Indian Restaurant	Metro Station	Hotel	E
3	Alapakkam	West Chennai	13.0461	80.165	2.0	Department Store	Fast Food Restaurant	Clothing Store	Rest
4	Alwarthirunagar	West Chennai	13.0506	80.184	2.0	Clothing Store	Fast Food Restaurant	Chinese Restaurant	T
5	Ambattur	West Chennai	13.1188	80.1548	2.0	Movie Theater	Flea Market	Ice Cream Shop	Rest
6	Aminjikarai	West Chennai	13.0714	80.2226	2.0	Fast Food Restaurant	Pizza Place	Furniture / Home Store	Burge
7	Anna Nagar	West Chennai	13.0836	80.2101	2.0	Indian Restaurant	Chinese Restaurant	Fast Food Restaurant	Coffee
8	Annanur	West Chennai	13.1121	80.129	3.0	Platform	Train Station	Medical Supply Store	Stat
9	Arumbakkam	West Chennai	13.0724	80.2102	2.0	Hotel	Fast Food Restaurant	Vegetarian / Vegan Restaurant	

In [49]:
```
type(chennai_merged)
```

Out[49]:
```
pandas.core.frame.DataFrame
```

In [50]:
```
chennai_merged.describe()
```

Out[50]:

	Cluster Labels
count	167.000000
mean	1.772455
std	0.664746
min	0.000000
25%	2.000000
50%	2.000000
75%	2.000000
max	3.000000

We can visualize the clustering by creating a map.

marking with 4 which does not have any recomendation

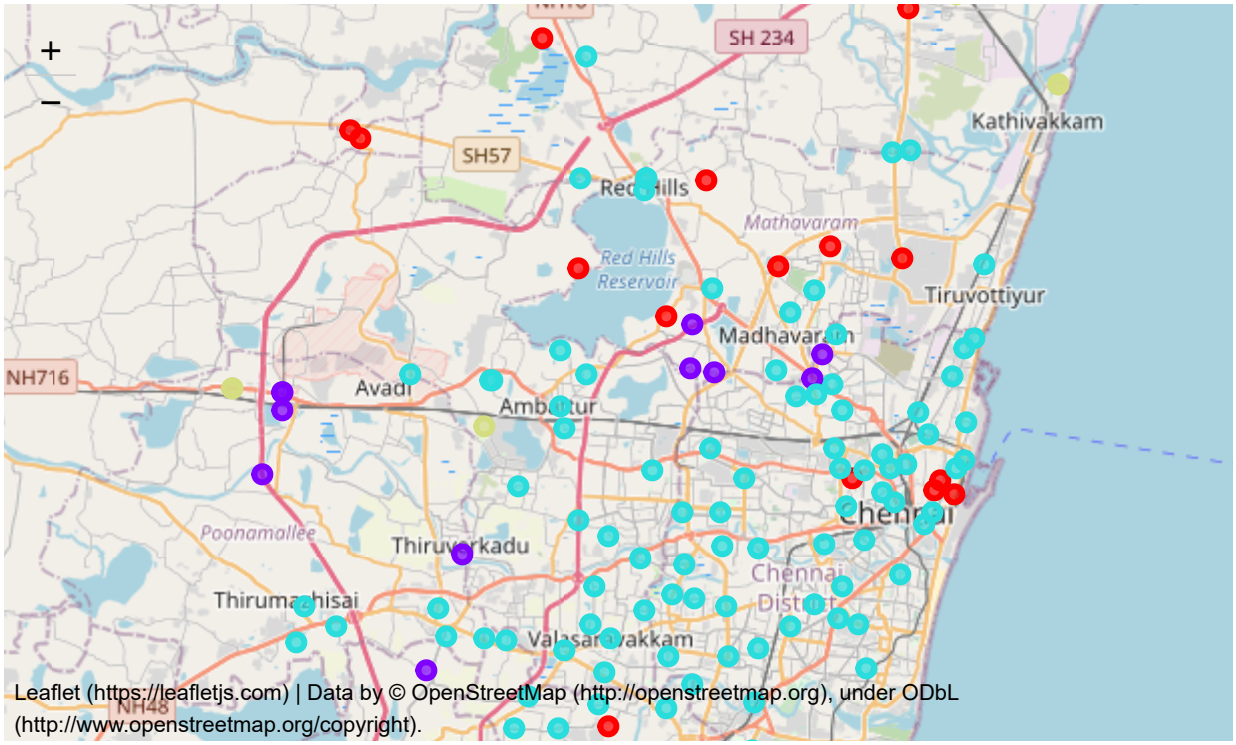
In [51]:
```
chennai_merged['Cluster Labels'] = chennai_merged['Cluster Labels'].replace(np.na
```

In [52]:
```
chennai_merged['Cluster Labels'].unique()
```

Out[52]:
```
array([2., 3., 0., 4., 1.])
```

In [53]:
```
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=10)

x = np.arange(k)
ys = [i + x + (i*x)**2 for i in range(k)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

markers_colors = []
for lat, lon, poi, cluster in zip(chennai_merged['Latitude'], chennai_merged['Lor
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=4,
        popup=label,
        color=rainbow[int(cluster-1.00)],
        fill=True,
        fill_color=rainbow[int(cluster-1.00)],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters
```

Out[53]:



We can now view the neighborhoods in each cluster and their top 10 most common venues.

Cluster 1

In [54]:
```
nai_merged.loc[chennai_merged['Cluster Labels'] == 0, chennai_merged.columns[[0]
```

Out[54]:

	Neighborhood	Location	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Mos Commo Venu
15	Broadway	North Chennai	0.0	Indian Restaurant	Video Store	Restaurant	Market	Harbor Marin
35	Kadaperi	South and East Chennai	0.0	Indian Restaurant	Jewelry Store	Light Rail Station	Train Station	Flea Marke
46	Kosapet	North Chennai	0.0	Indian Restaurant	Department Store	Hotel	Yoga Studio	Flower Sho
57	Madipakkam	South and East Chennai	0.0	Indian Restaurant	Department Store	Convenience Store	Yoga Studio	Flower Sho
62	manapakkam	West Chennai	0.0	Indian Restaurant	Trail	Yoga Studio	Flower Shop	Gaming Caf
64	Manjambakkam	North Chennai	0.0	Indian Restaurant	Yoga Studio	Flower Shop	Gaming Cafe	Furniture Home Stor
67	Medavakkam	South and East Chennai	0.0	Indian Restaurant	Vegetarian / Vegan Restaurant	Chinese Restaurant	Pizza Place	Convenienc Stor
93	Parry's Corner	North Chennai	0.0	Indian Restaurant	Video Store	Market	Harbor / Marina	Yoga Studi
120	Sowcarpet	North Chennai	0.0	Indian Restaurant	Men's Store	Video Store	Restaurant	Marke
150	Kancheepuram	Suburban Chennai	0.0	Indian Restaurant	Yoga Studio	Flower Shop	Gaming Cafe	Furniture Home Stor
151	Chengalpattu	Suburban Chennai	0.0	Indian Restaurant	Yoga Studio	Flower Shop	Gaming Cafe	Furniture Home Stor
159	Tiruvallur	Western Suburbs of Chennai	0.0	Indian Restaurant	Metro Station	Yoga Studio	Flower Shop	Gaming Caf
170	Karapakkam	Suburbs along ECR and OMR of Chennai	0.0	Indian Restaurant	Restaurant	Afghan Restaurant	Vegetarian / Vegan Restaurant	Shoppin Plaz
172	Muthukadu	Suburbs along ECR and OMR of Chennai	0.0	Indian Restaurant	Museum	Coffee Shop	Hotel	Theme Par

Cluster 2

In [55]:
```
chennai_merged.loc[chennai_merged['Cluster Labels'] == 1, chennai_merged.columns[
```

Out[55]:

	Neighborhood	Location	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Co
38	Kathirvedu	North Chennai	1.0	ATM	Snack Place	Food & Drink Shop	Cricket Ground	G
41	Kodungaiyur	North Chennai	1.0	ATM	Pharmacy	Coffee Shop	Bank	
43	Kolathur	North Chennai	1.0	ATM	Indian Restaurant	Bus Stop	Flower Shop	Furn Home
44	Korattur	West Chennai	1.0	ATM	Flower Shop	Gaming Cafe	Furniture / Home Store	Veg
48	Kovilambakkam	South and East Chennai	1.0	ATM	Indian Restaurant	Bar	Flower Shop	G
50	Kundrathur	West Chennai	1.0	ATM	Soup Place	Bus Station	Garden	Furn Home
51	Lakshmipuram	North Chennai	1.0	ATM	Department Store	Intersection	Indian Restaurant	Photog
63	Mangadu	West Chennai	1.0	ATM	Pharmacy	Fast Food Restaurant	Flower Shop	G
70	Moolakadai	North Chennai	1.0	ATM	Coffee Shop	Gym	Bakery	Cu Exc
72	Mudichur	South and East Chennai	1.0	Breakfast Spot	Pharmacy	Yoga Studio	Food	G
75	Nagalkeni	South and East Chennai	1.0	Supermarket	Pharmacy	Yoga Studio	Flower Shop	Furn Home
91	Pammal	South and East Chennai	1.0	ATM	South Indian Restaurant	Warehouse Store	Bus Station	Flowe
94	Pattabiram	North Chennai	1.0	ATM	Light Rail Station	Supermarket	Fast Food Restaurant	Pl
133	Thiruverkadu	West Chennai	1.0	ATM	Pharmacy	Flower Shop	Gaming Cafe	Furn Home
141	Vallalar Nagar	North Chennai	1.0	ATM	Concert Hall	Supermarket	Light Rail Station	Fas Rest

	Neighborhood	Location	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Co
160	Pattabiram	Western Suburbs of Chennai	1.0	ATM	Light Rail Station	Supermarket	Fast Food Restaurant	Pl
163	Kundrathur	Western Suburbs of Chennai	1.0	ATM	Soup Place	Bus Station	Garden	Furn Home
175	Siruseri	Suburbs along ECR and OMR of Chennai	1.0	ATM	Tea Room	Gas Station	Gaming Cafe	Furn Home

Cluster 3

In [56]:
```
chennai_merged.loc[chennai_merged['Cluster Labels'] == 2, chennai_merged.columns[
```

Out[56]:

	Neighborhood	Location	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Mos Commo Venu
0	Adambakkam	South and East Chennai	2.0	Indian Restaurant	Train Station	Metro Station	Supermarket	Hote
1	Adyar	South and East Chennai	2.0	Indian Restaurant	Café	Fast Food Restaurant	Dessert Shop	Pizza Plac
2	Alandur	South and East Chennai	2.0	Indian Restaurant	Metro Station	Hotel	Bakery	Supermarke
3	Alapakkam	West Chennai	2.0	Department Store	Fast Food Restaurant	Clothing Store	Asian Restaurant	Sandwic Plac
4	Alwarthirunagar	West Chennai	2.0	Clothing Store	Fast Food Restaurant	Chinese Restaurant	Movie Theater	Smoke Sho
...	...	...	...	...	...	...	...	.
168	Urapakkam	Southern-Eastern Suburbs of Chennai	2.0	South Indian Restaurant	Juice Bar	Department Store	Indian Restaurant	Coffee Sho
169	Guduvanchery	Southern-Eastern Suburbs of Chennai	2.0	Department Store	Indie Movie Theater	Indian Restaurant	North Indian Restaurant	Baker
171	Kanathur	Suburbs along ECR and OMR of Chennai	2.0	Movie Theater	Café	Whisky Bar	Juice Bar	Foo
173	Kelambakkam	Suburbs along ECR and OMR of Chennai	2.0	Indian Restaurant	Bus Station	Coffee Shop	Fast Food Restaurant	Caf
174	Kovalam	Suburbs along ECR and OMR of Chennai	2.0	Indian Restaurant	Seafood Restaurant	Café	Hotel	Reso

127 rows × 13 columns

Cluster 4

In [57]:
```
chennai_merged.loc[chennai_merged['Cluster Labels'] == 3, chennai_merged.columns[
```

Out[57]:

	Neighborhood	Location	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Mos Commo Venu
8	Annanur	West Chennai	3.0	Platform	Train Station	Medical Supply Store	Stationery Store	Flea Market	Furnitu / Hom Sto
22	Ennore	North Chennai	3.0	Train Station	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit Vegetab Sto
68	Minjur	North Chennai	3.0	Train Station	Scenic Lookout	Park	Yoga Studio	Flea Market	Furnitu / Hom Sto
131	Thirunindravur	West Chennai	3.0	Train Station	Pharmacy	Yoga Studio	Flea Market	Furniture / Home Store	Fruit Vegetab Sto
154	Athipattu	Northern Suburbs of Chennai	3.0	Train Station	Platform	Yoga Studio	Flea Market	Furniture / Home Store	Fruit Vegetab Sto
156	Minjur	Northern Suburbs of Chennai	3.0	Train Station	Scenic Lookout	Park	Yoga Studio	Flea Market	Furnitu / Hom Sto
158	Ennore	Northern Suburbs of Chennai	3.0	Train Station	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit Vegetab Sto
161	Thirunindravur	Western Suburbs of Chennai	3.0	Train Station	Pharmacy	Yoga Studio	Flea Market	Furniture / Home Store	Fruit Vegetab Sto

Results and Discussion

By analyzing the five clusters obtained we can see that some of the clusters are more suited for restaurants and hotels, whereas, other clusters are less suited. Neighborhoods in clusters 3, 4 contain a small percentage of restaurants, hotels, cafe and pubs in their top 10 common venues. These clusters contain a higher degree of other venues like train station, bus station, fish market, gym, performing arts venue and smoke shop, to name a few. Thus, they are not well suited for opening a new restaurant. On the other hand, neighborhoods in clusters 1 and 2 contain a much higher degree of restaurants, hotels, multiplex, cafes, bars and other food joints. Thus, the neighborhoods in these clusters would be well suited for opening a new restaurant.

Comparing clusters 1 and 2, neighborhoods in cluster 1 seem to be more suited for starting a restaurant since they contains a larger percentage of food joints in the top 10 most common venues than cluster 2. The neighborhoods in cluster 1 contain a variety of food joints like restaurants, tea rooms, bakery, cafe, steakhouse and pubs and also contain very diverse cuisines like Japanese, Indian, Chinese, Italian and seafood restaurants. Most neighborhoods in cluster 2 seem to have Indian Restaurant as their top most common venue; however, on careful analysis we can see that neighborhoods in cluster 2 also contain other venues like soccer field, flea market, smoke shop, gym, train station, dance studio, music store, cosmetics shop and so on. Thus, it is recommended that the new restaurant can be opened in the neighborhoods belonging to cluster 1. This neighborhood can be further plotted on a map as shown below.

In [58]:
```
new_restaurant_neighborhoods = chennai_merged.loc[chennai_merged['Cluster Labels'
new_restaurant_neighborhoods
```

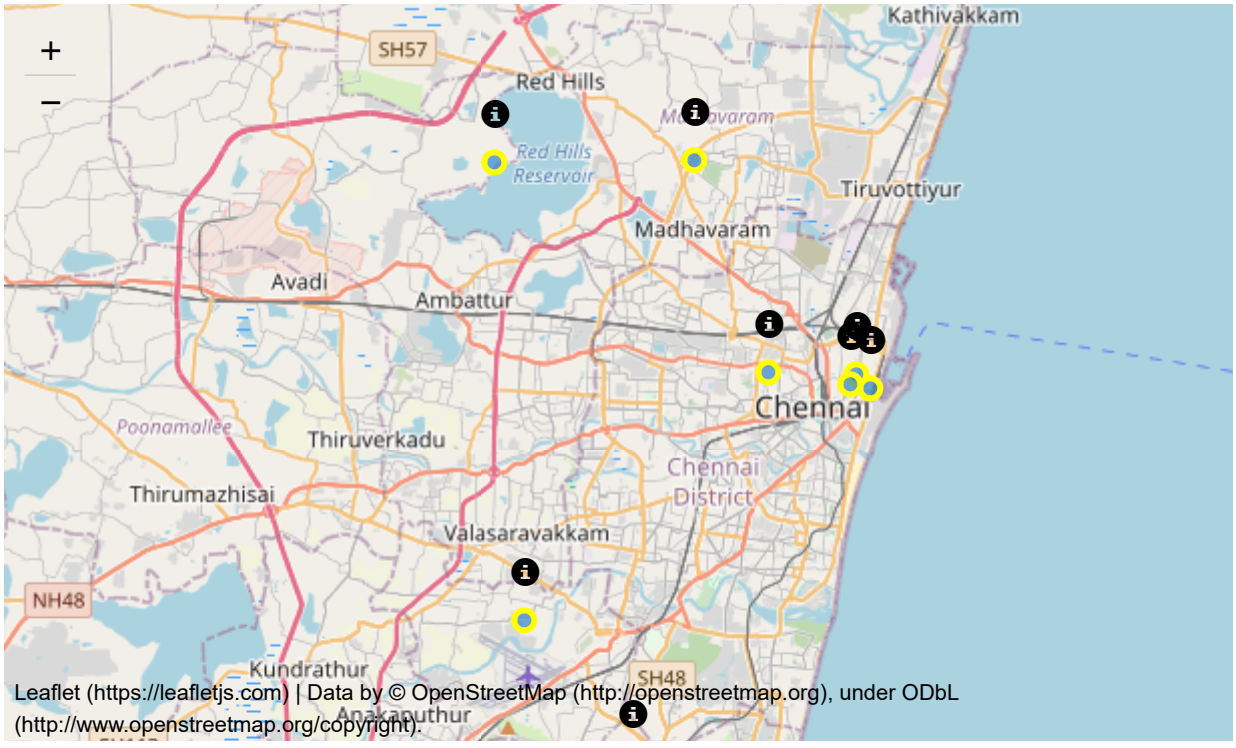
Out[58]:

	Neighborhood	Location	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Mos Commo Venu
15	Broadway	North Chennai	13.0942	80.2854	0.0	Indian Restaurant	Video Store	Restaurar
35	Kadaperi	South and East Chennai	12.9336	80.1243	0.0	Indian Restaurant	Jewelry Store	Light Ra Statio
46	Kosapet	North Chennai	13.0945	80.2551	0.0	Indian Restaurant	Department Store	Hote
57	Madipakkam	South and East Chennai	12.9647	80.2087	0.0	Indian Restaurant	Department Store	Convenienc Stor
62	manapakkam	West Chennai	13.0119	80.1716	0.0	Indian Restaurant	Trail	Yoga Studi
64	Manjambakkam	North Chennai	13.1656	80.2294	0.0	Indian Restaurant	Yoga Studio	Flower Sho
67	Medavakkam	South and East Chennai	12.9201	80.1923	0.0	Indian Restaurant	Vegetarian / Vegan Restaurant	Chines Restaurar
93	Parry's Corner	North Chennai	13.0896	80.2904	0.0	Indian Restaurant	Video Store	Marke
120	Sowcarpet	North Chennai	13.091	80.2834	0.0	Indian Restaurant	Men's Store	Video Stor
150	Kancheepuram	Suburban Chennai	12.8952	80.1376	0.0	Indian Restaurant	Yoga Studio	Flower Sho
151	Chengalpattu	Suburban Chennai	12.8952	80.1376	0.0	Indian Restaurant	Yoga Studio	Flower Sho
159	Tiruvallur	Western Suburbs of Chennai	13.1651	80.1612	0.0	Indian Restaurant	Metro Station	Yoga Studi
170	Karapakkam	Suburbs along ECR and OMR of Chennai	12.916	80.2319	0.0	Indian Restaurant	Restaurant	Afgha Restaurar

	Neighborhood	Location	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Mos Commo Venu
172	Muthukadu	Suburbs along ECR and OMR of Chennai	12.8317	80.2421	0.0	Indian Restaurant	Museum	Coffee Sho

In [59]:
```
map_res_locations = folium.Map(location=[latitude, longitude], zoom_start=10)

for lat, lng, location, neighborhood in zip(new_restaurant_neighborhoods['Latitud
                                            new_restaurant_neighborhoods['Locatic
    label = '{}, {}'.format(neighborhood, location)
    folium.Marker([lat, lng], popup='{} has geographical coordinates ({:.4f}, {:.
                  icon=folium.Icon(color='lightred'), tooltip=label).add_to(map_r

    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='yellow',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_res_locations)

map_res_locations
```

Out[59]:



Conclusion

We have successfully analyzed the neighborhoods in Chennai , India for determining which would be the best neighborhoods for opening a new restaurant. Based on our analysis, neighborhoods in cluster 1 are recommended as locations for the new restaurant. This has also been plotted in the map above. The stakeholders and investors can further tune this by considering various other factors like transport, legal requirements, and costs associated. These were out of the scope for this project and thus were not considered.

Final Understanding:

In [60]:
```
new_restaurant_neighborhoods[['Neighborhood', 'Location','1st Most Common Venue',
       '3rd Most Common Venue']]
```

Out[60]:

	Neighborhood	Location	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
15	Broadway	North Chennai	Indian Restaurant	Video Store	Restaurant
35	Kadaperi	South and East Chennai	Indian Restaurant	Jewelry Store	Light Rail Station
46	Kosapet	North Chennai	Indian Restaurant	Department Store	Hotel
57	Madipakkam	South and East Chennai	Indian Restaurant	Department Store	Convenience Store
62	manapakkam	West Chennai	Indian Restaurant	Trail	Yoga Studio
64	Manjambakkam	North Chennai	Indian Restaurant	Yoga Studio	Flower Shop
67	Medavakkam	South and East Chennai	Indian Restaurant	Vegetarian / Vegan Restaurant	Chinese Restaurant
93	Parry's Corner	North Chennai	Indian Restaurant	Video Store	Market
120	Sowcarpet	North Chennai	Indian Restaurant	Men's Store	Video Store
150	Kancheepuram	Suburban Chennai	Indian Restaurant	Yoga Studio	Flower Shop
151	Chengalpattu	Suburban Chennai	Indian Restaurant	Yoga Studio	Flower Shop
159	Tiruvallur	Western Suburbs of Chennai	Indian Restaurant	Metro Station	Yoga Studio
170	Karapakkam	Suburbs along ECR and OMR of Chennai	Indian Restaurant	Restaurant	Afghan Restaurant
172	Muthukadu	Suburbs along ECR and OMR of Chennai	Indian Restaurant	Museum	Coffee Shop

Broadway ,Kadaperi ,Kosapet ,Madipakkam

,manapakkam, Manjambakkam, Medavakkam ,Parry's Corner ,Sowcarpet ,Kancheepuram ,Chengalpattu ,Tiruvallur ,Karapakkam ,Muthukadu

Above all these places first choice of shop is Indian Restaurant .

Git hub does not support maps viewing , to view map click the link below to open project in IBM cloud :

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/fe94 64d3-4154-8862-a39fd77dd718/view?access_token=50c7269f87cd7c18f0117087493b8b74d50dfc2 (https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/fe94 64d3-4154-8862-a39fd77dd718/view?access_token=50c7269f87cd7c18f0117087493b8b74d50dfc2

Thank You!