Battle of the Neighborhoods: Venues of Mumbai

Introduction

This projects explores different venues in the city of Mumbai, for which Foursquare data is used to compare and explore the different neighborhoods within the city

Problem description

Mumbai is a costal city of India, located at the western side of Maharashtra. Mumbai is the 7th most populated city in the World, and the 2nd most populas city in India. Mumbai has a vast history, from Vasco Da Gama, to being the capital of the state, to iconic hotels.

With so much population, finding the right business in Mumbai can lead to a lot of sucess, lots of customers = lots of profit. The question that arises is what kind of business should one look into, what king of things do the people of Mumbai like?

Targe Audience

This project could be use by somebody who wants to start a business in Mumbai, that provides some service to the people residing there. One can check what kind of taste do the residants of Mumbai posses and where would one set up his/her business to serve the needs of the people.

Data Description

There are 2 sources of data used in this project. The first one is a wikipedia page https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai that contains the list of areas of Mumbai and their respective coordinates. The second source of data, is the venue data of different neighborhoods, which is gathered by using Folium API.

Methodoly

Here, the first step carried is scrapping the data from the webpage using BeautifulSoup and processing it to get the details of different areas of Mumbai.

Importing the required libraries

In [ ]:

```
import pandas as pd
import numpy as np

!pip install folium
import folium

import requests
from bs4 import BeautifulSoup

from sklearn.cluster import KMeans

import matplotlib.pyplot as plt
import matplotlib.cm as cm
import matplotlib.colors as colors
!pip install seaborn
import seaborn as sns
```

In [142]:

```
# capture the data from the webpage
url = 'https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai'
page = requests.get(url).text
soup = BeautifulSoup(page, 'html5lib')
```

In [143]:

```
areas = []
locations = []
longitudes = []
latitudes = []

for row in soup.table.find_all('tr')[1:]:
    area = row.find_all('td')[0].text.strip()
    location =row.find_all('td')[1].text.strip()
    latitude = row.find_all('td')[2].text.strip()
    longitude = row.find_all('td')[3].text.strip()

    areas.append(area)
    locations.append(location)
    latitudes.append(latitude)
    longitudes.append(longitude)
```

In [187]:

```
df = pd.DataFrame(data = {
    'Neighborhood' : areas,
    'Location' : locations,
    'Latitude': map(float, latitudes),
    'Longitude': map(float, longitudes)

})
```

In [188]:

```
df
```

Out[188]:

	Neighborhood	Location	Latitude	Longitude
0	Amboli	Andheri,Western Suburbs	19.129300	72.843400
1	Chakala, Andheri	Western Suburbs	19.111388	72.860833
2	D.N. Nagar	Andheri,Western Suburbs	19.124085	72.831373
3	Four Bungalows	Andheri,Western Suburbs	19.124714	72.827210
4	Lokhandwala	Andheri,Western Suburbs	19.130815	72.829270
...	...	...	...	...
88	Parel	South Mumbai	18.990000	72.840000
89	Gowalia Tank	Tardeo,South Mumbai	18.962450	72.809703
90	Dava Bazaar	South Mumbai	18.946882	72.831362
91	Dharavi	Mumbai	19.040208	72.850850
92	Thane	Mumbai	19.200000	72.970000

93 rows × 4 columns

Using the geocode library to get the cooridnates of the city

In [189]:

```
address = 'Mumbai, India'
```

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

```
The geographical coordinate of Mumbai are 19.0759899, 72.8773928.
```

Plotting the neighborhoods of the city using folium library

In [190]:

```
mumbai_map = folium.Map(location=[latitude, longitude], zoom_start=11)

# add neighborhood markers to map
for lat, lng, location, area in zip(df['Latitude'], df['Longitude'], df['Neighborhood'],
df['Location']):
    label = '{}, {}'.format(area, location)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
```

Mumbai Suburban
Mumbai
NH48
SPH
Parsik Hills
Navi Mumbai
Pan

Details required for using the Foursquare API

In [191]:

```
CLIENT_ID = '' # Foursquare ID
CLIENT_SECRET = '' # Foursquare Secret
ACCESS_TOKEN = '' # FourSquare Access Token
```

```
VERSION = '20180604'
LIMIT = 30
print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET:' + CLIENT_SECRET)
```

```
Your credentails:
CLIENT_ID: X3SSIHFCKZ3CO3UGTNWZ0DKJZBILG1CF1TE1SNFGCJ0AIDEW
CLIENT_SECRET:VAELWTD4LC35GKKBXIIIMTGFRADLSKGC0B13SIB3Y2AOQ5A4
```

Next we get the nearby venues for a given location that lie with 500 meters

After getting the venues, exploratory analysis is performed to know the data better

In [193]:

```
def getNearbyVenues(names, latitudes, longitudes, radius=500, limit=100):

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

        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret=
{}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            limit)

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

        # return only relevant information for each nearby venue
        venues_list.append([(
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

    nearby_venues = pd.DataFrame([item for venue_list in venues_list for item in venue_l
ist])
    nearby_venues.columns = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

In [194]:

```
mumbai_venues = getNearbyVenues(names = df['Neighborhood'],
                                latitudes = df['Latitude'],
                                longitudes = df['Longitude']
                                )

print(mumbai_venues.shape)
mumbai_venues.head()
```

```
(1278, 7)
```

Out[194]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Amboli	19.129300	72.843400	Cafe Arfa	19.128930	72.847140	Indian Restaurant
1	Amboli	19.129300	72.843400	5 Spice , Bandra	19.130421	72.847206	Chinese Restaurant
2	Amboli	19.129300	72.843400	Subway	19.127860	72.844461	Sandwich Place
3	Amboli	19.129300	72.843400	Cafe Coffee Day	19.127748	72.844663	Coffee Shop
4	Chakala, Andheri	19.111388	72.860833	Courtyard Mumbai International Airport	19.114167	72.864131	Hotel

In [195]:

```
mumbai_venues['Venue Category'].value_counts()[:20]
```

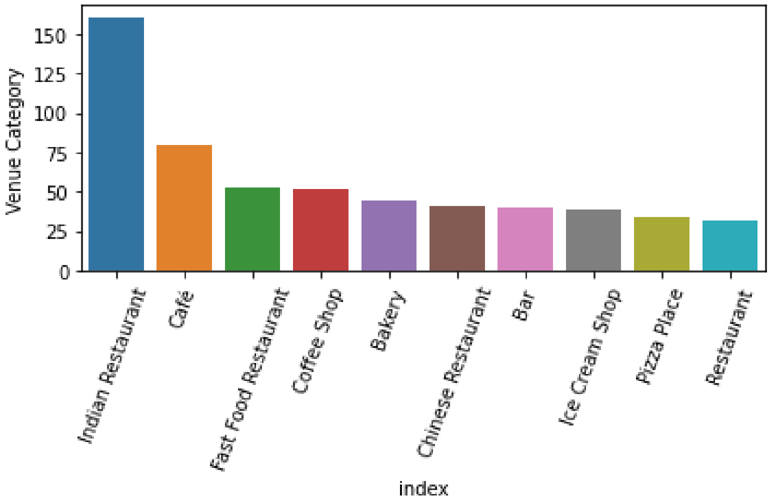
Out[195]:

```
Indian Restaurant                 160
Café                               79
Fast Food Restaurant               53
Coffee Shop                        51
Bakery                             44
Chinese Restaurant                 41
Bar                                40
Ice Cream Shop                     38
Pizza Place                        34
Restaurant                         31
Dessert Shop                       27
Italian Restaurant                 24
Snack Place                        23
Hotel                              21
Seafood Restaurant                 21
Sandwich Place                     18
Lounge                             15
Electronics Store                  15
Vegetarian / Vegan Restaurant      15
Department Store                   14
Name: Venue Category, dtype: int64
```

Here are the top 10 most common venue categories

In [196]:

```
sns.barplot(x='index', y='Venue Category',
            data=mumbai_venues['Venue Category'].value_counts().to_frame().reset_index()
[:10])
plt.xticks(rotation=70)
plt.tight_layout()
```



Analyzing each neighborhood for top 10 venues

One hot encoding

In [197]:

```
mumbai_onehot = pd.get_dummies(mumbai_venues['Venue Category'], prefix="", prefix_sep=""
)

# add neighborhood column back to dataframe
mumbai_onehot['Neighborhood'] = mumbai_venues['Neighborhood']

# move neighborhood column to the first column
fixed_columns = mumbai_onehot.columns.tolist()
fixed_columns.insert(0, fixed_columns.pop(fixed_columns.index('Neighborhood')))
mumbai_onehot = mumbai_onehot.reindex(columns = fixed_columns)

print(mumbai_onehot.shape)
mumbai_onehot.head()
```

```
(1278, 167)
```

Out[197]:

	Neighborhood	Accessories Store	Afghan Restaurant	American Restaurant	Amphitheater	Antique Shop	Arcade	Art Gallery	Asian Restaurant	BBQ Joint	...	Theater
0	Amboli	0	0	0	0	0	0	0	0	0	...	0
1	Amboli	0	0	0	0	0	0	0	0	0	...	0
2	Amboli	0	0	0	0	0	0	0	0	0	...	0
3	Amboli	0	0	0	0	0	0	0	0	0	...	0
4	Chakala, Andheri	0	0	0	0	0	0	0	0	0	...	0

5 rows × 167 columns

In [223]:

```
mumbai_grouped = mumbai_onehot.groupby('Neighborhood').mean().reset_index()
print(mumbai_grouped.shape)
mumbai_grouped.head()
```

```
(86, 167)
```

Out[223]:

	Neighborhood	Accessories Store	Afghan Restaurant	American Restaurant	Amphitheater	Antique Shop	Arcade	Art Gallery	Asian Restaurant	BBQ Joint	...	Theate
0	Agripada	0.0	0.000000	0.000000	0.0	0.0	0.0	0.0	0.000000	0.0	...	0.00000
1	Altamount Road	0.0	0.000000	0.000000	0.0	0.0	0.0	0.0	0.000000	0.0	...	0.14285
2	Amboli	0.0	0.000000	0.000000	0.0	0.0	0.0	0.0	0.000000	0.0	...	0.00000
3	Amrut Nagar	0.0	0.027027	0.027027	0.0	0.0	0.0	0.0	0.027027	0.0	...	0.00000
4	Asalfa	0.0	0.000000	0.000000	0.0	0.0	0.0	0.0	0.000000	0.0	...	0.00000

5 rows × 167 columns

In [224]:

In [224]:

```
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 [236]:

```
num_top_venues = 10

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

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

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

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

neighborhoods_venues_sorted.head()
```

Out[236]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th M Comm Ver
0	Agripada	Bakery	Indian Restaurant	Gym	Coffee Shop	Convenience Store	Dhaba	Falafel Restaurant	Event Space	Electron St
1	Altamount Road	Café	Coffee Shop	Theater	Bakery	Indian Restaurant	Sandwich Place	Cupcake Shop	Event Space	Electron St
2	Amboli	Coffee Shop	Sandwich Place	Chinese Restaurant	Indian Restaurant	Yoga Studio	Dhaba	Event Space	Electronics Store	Do Sh
3	Amrut Nagar	Indian Restaurant	Café	Clothing Store	Restaurant	Electronics Store	Fast Food Restaurant	Chinese Restaurant	Paper / Office Supplies Store	P
4	Asalfa	Park	Bus Station	Dessert Shop	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	Dim S Restaur

Lastly, KNN was used to cluster the data into 5 clusters, and plot the clusters on the map

In [237]:

```
# set number of clusters
kclusters = 5

mumbai_grouped_clustering = mumbai_grouped.drop('Neighborhood', 1)

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

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

Out[237]:

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

In [238]:

```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

mumbai_merged = df

# merge toronto_grouped with toronto_data to add latitude/longitude for each neighborhood
mumbai_merged = mumbai_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'),
on='Neighborhood')

mumbai_merged.dropna(inplace=True)
mumbai_merged.head()
```

Out[238]:

	Neighborhood	Location	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Amboli	Andheri,Western Suburbs	19.129300	72.843400	0.0	Coffee Shop	Sandwich Place	Chinese Restaurant	Indian Restaurant	Yoga Studio
1	Chakala, Andheri	Western Suburbs	19.111388	72.860833	0.0	Hotel	Multiplex	Pizza Place	Café	Restaurant
2	D.N. Nagar	Andheri,Western Suburbs	19.124085	72.831373	0.0	Indian Restaurant	Gym / Fitness Center	Snack Place	Pizza Place	Bus Line
3	Four Bungalows	Andheri,Western Suburbs	19.124714	72.827210	0.0	Gym	Women's Store	Juice Bar	Vegetarian / Vegan Restaurant	Residential Building (Apartment / Condo)
4	Lokhandwala	Andheri,Western Suburbs	19.130815	72.829270	0.0	Department Store	Lounge	Ice Cream Shop	Pizza Place	Market

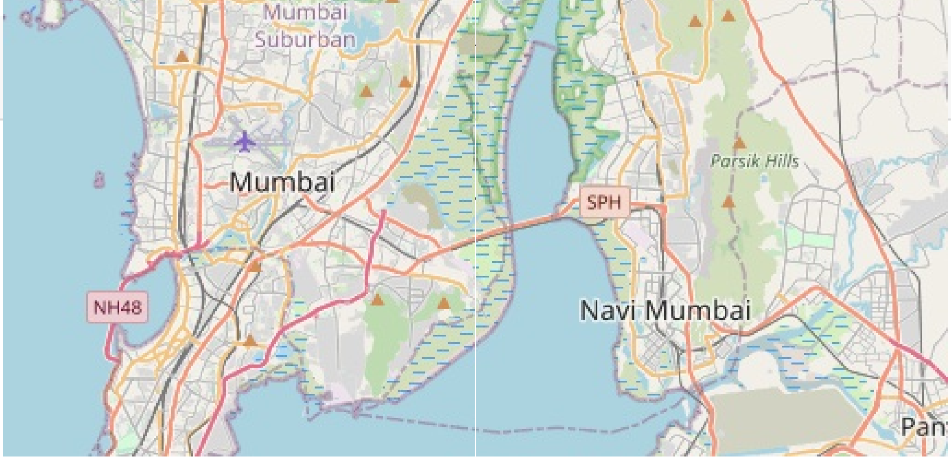
Results

In [243]:

```
mumbai_clusters_map = folium.Map(location=[latitude, longitude], zoom_start=11)

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

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(mumbai_merged['Latitude'], mumbai_merged['Longitude'],
mumbai_merged['Neighborhood'], mumbai_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[int(cluster-1)],
        fill=True,
        fill_color=rainbow[int(cluster-1)],
```



Discussion

Examining the Clusters

Cluster 1

CLuster that contains a variety of venues that people use in the daily life. Ranging from entertainment, food, health, to essentials and shops.

In [260]:

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

Out[260]:

	Location	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	(
0	Andheri,Western Suburbs	Coffee Shop	Sandwich Place	Chinese Restaurant	Indian Restaurant	Yoga Studio	Dhaba	Event Space	Electronics Store	
1	Western Suburbs	Hotel	Multiplex	Pizza Place	Café	Restaurant	Fast Food Restaurant	Cocktail Bar	Salon / Barbershop	Re
2	Andheri,Western Suburbs	Indian Restaurant	Gym / Fitness Center	Snack Place	Pizza Place	Bus Line	Dessert Shop	Electronics Store	Donut Shop	
3	Andheri,Western Suburbs	Gym	Women's Store	Juice Bar	Vegetarian / Vegan Restaurant	Residential Building (Apartment / Condo)	Smoke Shop	Market	Pizza Place	
							Residential			

	Location	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	(
4	Andheri,Western Suburbs	Department Store	Lounge	Ice Cream Shop	Pizza Place	Market	Residential Building (Apartment / Condo)	Pub	Indian Restaurant	
...	...	...	...	...	...	...	...	...	...	
88	South Mumbai	Indian Restaurant	Electronics Store	Asian Restaurant	Plaza	Department Store	Event Space	Donut Shop	Dog Run	
89	Tardeo,South Mumbai	Café	Coffee Shop	Bar	Deli / Bodega	Clothing Store	Bus Station	Restaurant	Brewery	Ba
90	South Mumbai	Indian Restaurant	Fast Food Restaurant	Bar	Multiplex	Middle Eastern Restaurant	Cheese Shop	Café	Market	Re
91	Mumbai	Fast Food Restaurant	Juice Bar	Café	Coffee Shop	Convenience Store	Creperie	Event Space	Electronics Store	
92	Mumbai	Indian Restaurant	BBQ Joint	Lake	Bus Station	Café	Ice Cream Shop	Seafood Restaurant	Department Store	

77 rows × 11 columns

Cluster 2

This cluster seems to contain places that one can visit like Multiplex, Event Space, Yoga Studio. This cluster doesn't seem to have a bias towards restaurants, like cluster 1.

In [257]:

```
mumbai_merged.loc[mumbai_merged['Cluster Labels'] == 1, mumbai_merged.columns[[2] + list(
range(5, mumbai_merged.shape[1]))]]
```

Out[257]:

	Latitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
40	19.13	Multiplex	Yoga Studio	Dessert Shop	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	Dim Sum Restaurant	Dhaba

Cluster 3

This cluter contains the region nearby shipping store

In [258]:

```
mumbai_merged.loc[mumbai_merged['Cluster Labels'] == 2, mumbai_merged.columns[[2] + list(
range(5, mumbai_merged.shape[1]))]]
```

Out[258]:

	Latitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
10	19.29	Shipping Store	Dessert Shop	Falafel Restaurant	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	Dim Sum Restaurant	Dhaba

Cluster 4

This cluster is heavly infleuced by Indian Restaurants and food places.

In [259]:

```
mumbai_merged.loc[mumbai_merged['Cluster Labels'] == 3, mumbai_merged.columns[[2] + list(
range(5, mumbai_merged.shape[1]))]]
```

Out[259]:

	Latitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	1
32	19.415400	Bus Station	Indian Restaurant	Yoga Studio	Dessert Shop	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	R
42	19.157000	Indian Restaurant	Restaurant	Ice Cream Shop	Yoga Studio	Dessert Shop	Event Space	Electronics Store	Donut Shop	Dog Run	
54	18.950000	Indian Restaurant	Cheese Shop	Market	Restaurant	Food	Ice Cream Shop	Fast Food Restaurant	American Restaurant	Dance Studio	
80	18.977129	Indian Restaurant	Bakery	Dessert Shop	Falafel Restaurant	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	R
84	18.948140	Indian Restaurant	Café	Train Station	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	Dim Sum Restaurant	
85	18.951811	Indian Restaurant	Fast Food Restaurant	Food	Bus Station	Dhaba	Event Space	Electronics Store	Donut Shop	Dog Run	

Cluster 5

This cluster lies in the southern part of the city and contains Gardens, yoga studio, dog run, etc. suggestion a high standard emerging area.

In [261]:

```
mumbai_merged.loc[mumbai_merged['Cluster Labels'] == 4, mumbai_merged.columns[[2] + list(
range(5, mumbai_merged.shape[1]))]]
```

Out[261]:

	Latitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
60	18.91	Garden	Yoga Studio	Dessert Shop	Falafel Restaurant	Event Space	Electronics Store	Donut Shop	Dog Run	Diner	Dim Sum Restaurant

Conclusion

Due to the huge customer base in Mumbai, you can run wide vareity of businees in the city. Cluster 1 is spread thorought the city, hence any place there can work. The other option could be to targer the people of cluster 4 by setting up a restaurant or a food place, as the people of this cluster are foodies. Finally, one could set up a niche and unique business to target the people of the southern part of the city.

Refernces

- **List of neighbourhoods in Mumbai : https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai**
- **Foursquare api**

In [ ]:

```

```