IBM APPLIED DATA SCIENCE CAPSTONE

Generating Area-based recommendations regarding the category of Restaurants to open in Mumbai

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Introduction:-

Nowadays since the market is very competitive it is very important to analyze a particular area very carefully and find out the taste of the local people, their preferences and their inclination towards a particular cuisine before starting a new business venture, to open a particular restaurant, in this case. This project is aimed towards generating Area-based recommendations regarding the category of Restaurants to open in Mumbai.

Business Problem:-

Opening the right-type of restaurant serving the particular category of cuisine is very important for anyone who wants to start a new business venture in terms of restaurants. The decision to open a restaurant which specializes in a particular cuisine depends on many important factors, few of which are listed below:-

1. The taste of the local people staying in that particular Area, their preferences and inclinations towards a particular food item/category/cuisine.

2. The number of similar type of restaurants serving the same kind of food in the nearby locations of that Area.

The target audience for this project includes any **new food chain** who is interested in starting a **new business venture** in the **city of Mumbai** and wishes to have recommendations regarding **which particular cuisine or which particular food item** they should serve **in their outlets** based on the **particular Area in Mumbai** where they are planning **to set up their new outlets**.

Here the project scope is limited to **South of Mumbai** , this scope can be extended to other Locations/Sectors of Mumbai by similar kind of Analytics.

Data Anatomization

To tackle the above mentioned problem, we need to have the dataset that contains:-

1. All the Areas and Locations in the City Of Mumbai.
2. Latitude and longitudes of all the Areas.
3. The most common venues and their categories in a particular Location of Mumbai (eg :- South Mumbai, Andheri; Western Suburbs; Bandra, Western Suburbs etc.)

- The Wikipedia page https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai is the major source of data that is being used to obtain all the Areas and Locations of Mumbai. We then use **beautifulsoup4 package, a Python module that helps to scrape** information from the web Pages to extract all the tables from this Wikipedia page and convert it into a pandas Data frame.
- Then we use **Python's geopy package** to obtain the latitude and longitude of all the Areas present in the Data frame.
- Finally we use **Four Square API** to generate **nearby venues and their categories** for a particular Area of Mumbai.

Description of the data -
The output shows the different datasets used to complete the project. Description of each processed dataset is given at the top of the Dataframe.

- Data scraped from https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai showing the Area, locations and Latitude/Longitude values.

<title>List of neighbourhoods in Mumbai - Wikipedia</title>

Area	Location	Latitude	Longitude
Amboli	Andheri,Western Suburbs	19.1293	72.8434
Chakala, Andheri	Western Suburbs	19.111388	72.860833
D.N. Nagar	Andheri,Western Suburbs	19.124085	72.831373
Four Bungalows	Andheri,Western Suburbs	19.124714	72.82721
Lokhandwala	Andheri,Western Suburbs	19.130815	72.82927
Marol	Andheri,Western Suburbs	19.119219	72.882743
Sahar	Andheri,Western Suburbs	19.098889	72.867222
Seven Bungalows	Andheri,Western Suburbs	19.129052	72.817018
Versova	Andheri,Western Suburbs	19.12	72.82
Mira Road	Mira-Bhayandar,Western Suburbs	19.284167	72.871111
Bhayandar	Mira-Bhayandar,Western Suburbs	19.29	72.85
Uttan	Mira-Bhayandar,Western Suburbs	19.28	72.785
Bandstand Promenade	Bandra,Western Suburbs	19.042718	72.819132
Kherwadi	Bandra,Western Suburbs	19.0553	72.8314
Pali Hill	Bandra,Western Suburbs	19.068	72.826
I.C. Colony	Borivali (West),Western Suburbs	19.247039	72.84983
Gorai	Borivali (West),Western Suburbs	19.250057	72.782021
Dahisa	Western Suburbs	19.250069	72.859347
Aarey Milk Colony	Goregaon,Western Suburbs	19.148493	72.881756
Bangur Nagar	Goregaon,Western Suburbs	19.167362	72.832252
Jogeshwari West	Western Suburbs	19.12	72.85
Juhu	Western Suburbs	19.1	72.83
Charkop	Kandivali West,Western Suburbs	19.216182	72.830575
Poisar	Kandivali West,Western Suburbs	19.204511	72.837639
Mahavir Nagar	Kandivali West,Western Suburbs	19.211319	72.842737
Thakur village	Kandivali East,Western Suburbs	19.210206	72.87298
Pali Naka	Khar,Western Suburbs	19.062742	72.829396

- Location Map of Mumbai obtained from geopy library.
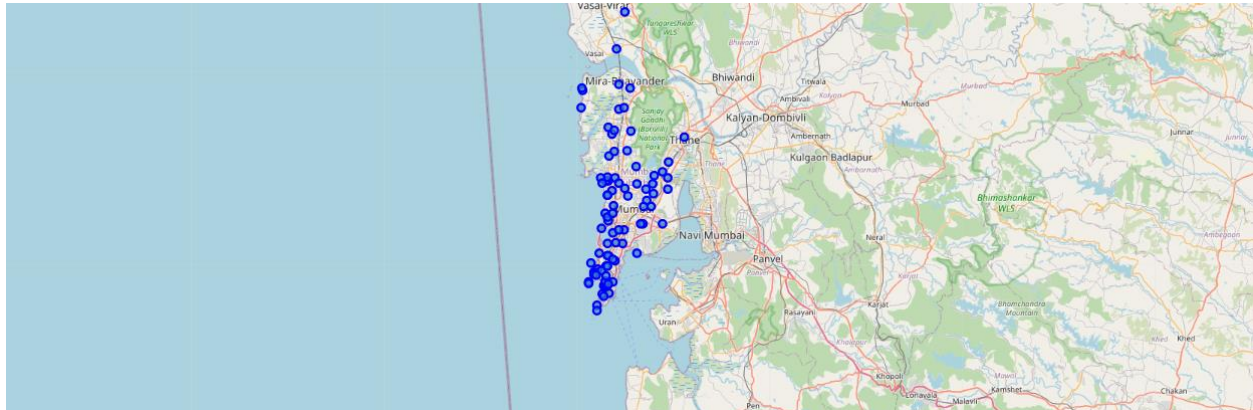
- Processed data obtained from Four Square API showing the different Areas and the 10 most common venues for each Area corresponding to **South Mumbai.**

	Area	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
0	Agripada	Bakery	Indian Restaurant	Coffee Shop	Gym	Restaurant	Food Court	Diner	Donut Shop	Dumpling R
1	Altamount Road	Café	Indian Restaurant	Coffee Shop	Bakery	Theater	Sandwich Place	Food	Diner	Do
2	Bhuleshwar	Indian Restaurant	Restaurant	Cheese Shop	Fast Food Restaurant	Food	Ice Cream Shop	Market	American Restaurant	T
3	Breach Candy	Café	Coffee Shop	Bakery	Sandwich Place	Fast Food Restaurant	Department Store	Dessert Shop	Men's Store	Japanese R
4	Carmichael Road	Ice Cream Shop	Chinese Restaurant	Fast Food Restaurant	Food Truck	Snack Place	Outlet Mall	Café	Sandwich Place	Shop

Methodology

First we scrape the data containing the Areas, Location, Latitude and Longitude of Mumbai from the below Wikipedia URL:-

https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai

The dataset is obtained as below:-


```
<title>List of neighbourhoods in Mumbai - Wikipedia</title>
              Area                      Location                      Latitude  Longitude
Amboli                     Andheri,Western Suburbs         19.1293    72.8434
Chakala, Andheri           Western Suburbs                 19.111388  72.860833
D.N. Nagar                 Andheri,Western Suburbs         19.124085  72.831373
Four Bungalows             Andheri,Western Suburbs         19.124714  72.82721
Lokhandwala                Andheri,Western Suburbs         19.130815  72.82927
Marol                      Andheri,Western Suburbs         19.119219  72.882743
Sahar                      Andheri,Western Suburbs         19.098889  72.867222
Seven Bungalows            Andheri,Western Suburbs         19.129052  72.817018
Versova                    Andheri,Western Suburbs         19.12      72.82
Mira Road                  Mira-Bhayandar,Western Suburbs  19.284167  72.871111
Bhayandar                  Mira-Bhayandar,Western Suburbs  19.29      72.85
Uttan                      Mira-Bhayandar,Western Suburbs  19.28      72.785
Bandstand Promenade        Bandra,Western Suburbs          19.042718  72.819132
Kherwadi                   Bandra,Western Suburbs          19.0553    72.8314
Pali Hill                  Bandra,Western Suburbs          19.068     72.826
I.C. Colony                Borivali (West),Western Suburbs 19.247039  72.84983
Gorai                      Borivali (West),Western Suburbs 19.250057  72.782021
Dahisa                     Western Suburbs                 19.250069  72.859347
Aarey Milk Colony          Goregaon,Western Suburbs        19.148493  72.881756
Bangur Nagar               Goregaon,Western Suburbs        19.167362  72.832252
Jogeshwari West            Western Suburbs                 19.12      72.85
Juhu                       Western Suburbs                 19.1       72.83
Charkop                    Kandivali West,Western Suburbs  19.216182  72.830575
Poisar                     Kandivali West,Western Suburbs  19.204511  72.837639
Mahavir Nagar              Kandivali West,Western Suburbs  19.211319  72.842737
Thakur village             Kandivali East,Western Suburbs  19.210206  72.87298
Pali Naka                  Khar,Western Suburbs            19.062742  72.829396
Khar Danda                 Khar,Western Suburbs            19.068596  72.840042
Dindoshi                   Malad,Western Suburbs           19.176382  72.864891
Sunder Nagar               Malad,Western Suburbs           19.175     72.842
```

Then, we transform the data into a pandas data frame. The data frame obtained is given below:-

	Area	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

Use geopy library to get the latitude and longitude values of Mumbai. Then we use folium to plot the neighborhood locations of Mumbai.
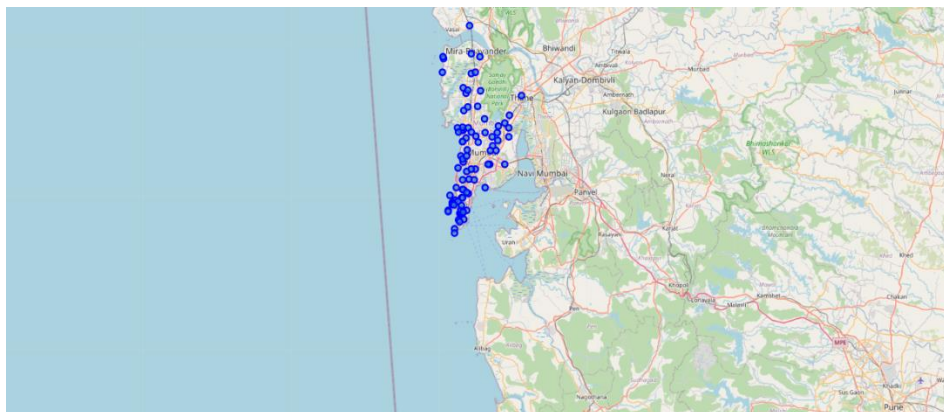
After this it is time to use the Four Square API to explore the different areas of South Mumbai and segment them. Now since we are interested in only the areas in South Mumbai, so let's slice the original data frame and create a new data frame of the South Mumbai data.

```python
southmumbai_data = neighbourhoods[neighbourhoods['Location'] == 'South Mumbai'].reset_index(drop=True)
southmumbai_data.head()
```

	Area	Location	Latitude	Longitude
0	Agripada	South Mumbai	18.9777	72.8273
1	Altamount Road	South Mumbai	18.9681	72.8095
2	Bhuleshwar	South Mumbai	18.9500	72.8300
3	Breach Candy	South Mumbai	18.9670	72.8050
4	Carmichael Road	South Mumbai	18.9722	72.8113

Once this is done we pick-up a specific area "Agripada" in South Mumbai, get its latitude and longitude using geopy/from the data frame we already scraped from Wikipedia and find the top 100 venues that are within the radius of 500 mts. from Agripada. We also get the category name for each venue and the latitude and longitude values. This is done using the Four Square API and the final dataset looks like below:-

	name	categories	lat	lng
0	Celejor	Bakery	18.975844	72.823679
1	cafe coffee day	Coffee Shop	18.976988	72.824051
2	Gold Gym IndiaBulls, Lower Parel	Gym	18.981424	72.824900
3	Warden bakery	Bakery	18.980180	72.826118
4	Vedanta Veg Restaurant	Indian Restaurant	18.980548	72.828777

Finally we extend this process to all nearby areas in South Mumbai:-

	Area	Area Latitude	Area Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Agripada	18.977700	72.827300	Celejor	18.975844	72.823679	Bakery
1	Agripada	18.977700	72.827300	cafe coffee day	18.976988	72.824051	Coffee Shop
2	Agripada	18.977700	72.827300	Gold Gym IndiaBulls, Lower Parel	18.981424	72.824900	Gym
3	Agripada	18.977700	72.827300	Warden bakery	18.980180	72.826118	Bakery
4	Agripada	18.977700	72.827300	Vedanta Veg Restaurant	18.980548	72.828777	Indian Restaurant
5	Agripada	18.977700	72.827300	Blue Waters	18.981119	72.827098	Restaurant
6	Altamount Road	18.968100	72.809500	Theobroma	18.970735	72.809816	Bakery
7	Altamount Road	18.968100	72.809500	Swati Snacks	18.966442	72.813531	Indian Restaurant
8	Altamount Road	18.968100	72.809500	Sophia Bhabha Hall	18.969819	72.807082	Theater
9	Altamount Road	18.968100	72.809500	Under The Banyan Tree	18.969328	72.808344	Café
10	Altamount Road	18.968100	72.809500	Cafe Coffee Day	18.966999	72.813983	Coffee Shop

Data Pre-processing

Now we perform one-hot encoding with respect to the venue-categories of each area, then *group rows by Area and by taking the mean of the frequency of occurrence of each category and finally print each Area along with the top 5 most common venues.*

```
----Agripada----
              venue  freq
0            Bakery  0.33
1  Indian Restaurant  0.17
2        Coffee Shop  0.17
3         Restaurant  0.17
4               Gym  0.17


----Altamount Road----
              venue  freq
0              Café  0.29
1  Indian Restaurant  0.14
2            Bakery  0.14
3        Coffee Shop  0.14
4            Theater  0.14


----Bhuleshwar----
              venue  freq
0  Indian Restaurant  0.50
1        Cheese Shop  0.07
2         Restaurant  0.07
3             Market  0.07
4     Ice Cream Shop  0.07
```

Finally we put this into a pandas data frame and find the top 10 most popular venues for each Area.

	Area	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Agripada	Bakery	Indian Restaurant	Coffee Shop	Gym	Restaurant	Food Court	Diner	Donut Shop	Dumpling Restaurant	Electronics Store
1	Altamount Road	Café	Indian Restaurant	Coffee Shop	Bakery	Theater	Sandwich Place	Food	Diner	Donut Shop	Dumpling Restaurant
2	Bhuleshwar	Indian Restaurant	Restaurant	Cheese Shop	Fast Food Restaurant	Food	Ice Cream Shop	Market	American Restaurant	Tea Room	Concert Hall
3	Breach Candy	Café	Coffee Shop	Bakery	Sandwich Place	Fast Food Restaurant	Department Store	Dessert Shop	Men's Store	Japanese Restaurant	Italian Restaurant
4	Carmichael Road	Ice Cream Shop	Chinese Restaurant	Fast Food Restaurant	Food Truck	Snack Place	Outlet Mall	Café	Sandwich Place	Shopping Mall	Deli / Bodega

Clustering

Cluster Areas
1. First we use the elbow method to find the optimal number of clusters.
2. Run k-means with the optimal number of clusters to cluster the Areas.

Clustering is done with respect to the most common venues occurring for each Area.

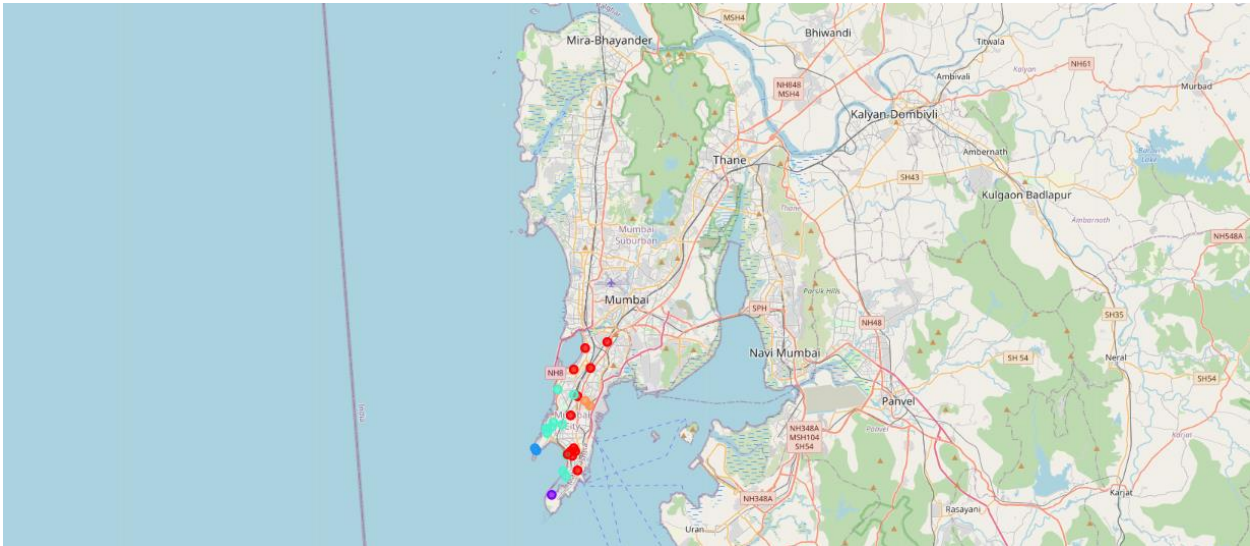We choose number of clusters as 6 as determined by the elbow method.

```
southmumbai_grouped_clustering = southmumbai_grouped.drop('Area', 1)

#Usingthe elbow method to find the optimal number of clusters using WCSS
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', random_state = 0)
    kmeans.fit(southmumbai_grouped_clustering)
    wcss.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss)
plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```


Clustering Results:-

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Agripada	South Mumbai	18.977700	72.827300	0.0	Bakery	Indian Restaurant	Coffee Shop	Gym	Restaurant	Food Court	Diner	Donut Shop	Dumpling Restaurant	Electronics Store
1	Altamount Road	South Mumbai	18.968100	72.809500	3.0	Café	Indian Restaurant	Coffee Shop	Bakery	Theater	Sandwich Place	Food	Diner	Donut Shop	Dumpling Restaurant
2	Bhuleshwar	South Mumbai	18.950000	72.830000	0.0	Indian Restaurant	Restaurant	Cheese Shop	Fast Food Restaurant	Food	Ice Cream Shop	Market	American Restaurant	Tea Room	Concert Hall
3	Breach Candy	South Mumbai	18.967000	72.805000	3.0	Café	Coffee Shop	Bakery	Sandwich Place	Fast Food Restaurant	Department Store	Dessert Shop	Men's Store	Japanese Restaurant	Italian Restaurant
4	Carmichael Road	South Mumbai	18.972200	72.811300	3.0	Ice Cream Shop	Chinese Restaurant	Fast Food Restaurant	Food Truck	Snack Place	Outlet Mall	Café	Sandwich Place	Shopping Mall	Deli / Bodega
5	Cavel	South Mumbai	18.947400	72.827200	0.0	Indian Restaurant	Café	Bakery	Cheese Shop	Chinese Restaurant	Coffee Shop	Bar	Train Station	Movie Theater	Multiplex
6	Churchgate	South Mumbai	18.930000	72.820000	3.0	Hotel	Italian Restaurant	Restaurant	Wine Bar	Coffee Shop	Indian Restaurant	Sandwich Place	Diner	Mexican Restaurant	Mediterranean Restaurant
7	Cotton Green	South Mumbai	18.986209	72.844076	5.0	Whisky Bar	Train Station	Plaza	Bakery	Yoga Studio	Food Court	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant
8	Cuffe Parade	South Mumbai	18.910000	72.810000	1.0	Indian Restaurant	Garden	Food Court	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant	Electronics Store	Farmers Market	Fast Food Restaurant
9	Cumbala Hill	South Mumbai	18.965833	72.805833	3.0	Café	Coffee Shop	Fast Food Restaurant	Concert Hall	Men's Store	Japanese Restaurant	Italian Restaurant	French Restaurant	Dessert Shop	Department Store
10	Currey Road	South Mumbai	18.994000	72.833000	0.0	Indian Restaurant	Coffee Shop	Plaza	Maharashtrian Restaurant	Food	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant	Electronics Store

Results:-

The following clusters were obtained.

Map:-

Cluster 1

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Agripada	South Mumbai	18.977700	72.827300	0.0	Bakery	Indian Restaurant	Coffee Shop	Gym	Restaurant	Food Court	Diner	Donut Shop	Dumpling Restaurant	Electronics Store
2	Bhuleshwar	South Mumbai	18.950000	72.830000	0.0	Indian Restaurant	Restaurant	Cheese Shop	Fast Food Restaurant	Food	Ice Cream Shop	Market	American Restaurant	Tea Room	Concert Hall
5	Cavel	South Mumbai	18.947400	72.827200	0.0	Indian Restaurant	Café	Bakery	Cheese Shop	Chinese Restaurant	Coffee Shop	Bar	Train Station	Movie Theater	Multiplex
10	Currey Road	South Mumbai	18.994000	72.833000	0.0	Indian Restaurant	Coffee Shop	Plaza	Maharashtrian Restaurant	Food	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant	Electronics Store
11	Dhobitalao	South Mumbai	18.943300	72.826600	0.0	Indian Restaurant	Bakery	Bar	Café	Boutique	Multiplex	Movie Theater	Pizza Place	Mexican Restaurant	Coffee Shop
13	Kala Ghoda	South Mumbai	18.930700	72.833100	0.0	Indian Restaurant	Café	Coffee Shop	Seafood Restaurant	Fast Food Restaurant	Dessert Shop	History Museum	Hotel	Chinese Restaurant	Boutique
17	Mahim	South Mumbai	19.035000	72.840000	0.0	Indian Restaurant	Chinese Restaurant	Café	Fast Food Restaurant	Seafood Restaurant	Bakery	Bar	Beach	Breakfast Spot	Coffee Shop
20	Marine Lines	South Mumbai	18.944700	72.824400	0.0	Indian Restaurant	Bakery	Café	Jewelry Store	Multiplex	Coffee Shop	Clothing Store	Chinese Restaurant	Mexican Restaurant	Bridal Shop
23	Prabhadevi	South Mumbai	19.016600	72.829500	0.0	Indian Restaurant	Café	Electronics Store	Smoke Shop	Bakery	Chinese Restaurant	Coffee Shop	Convenience Store	Dessert Shop	Fast Food Restaurant
24	Sion	South Mumbai	19.040000	72.860000	0.0	Indian Restaurant	Snack Place	Gym	Movie Theater	Pizza Place	Plaza	Sandwich Place	Gym / Fitness Center	Vegetarian / Vegan Restaurant	Bar
27	Matunga	South Mumbai	19.017980	72.844763	0.0	Indian Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Fast Food Restaurant	Café	Breakfast Spot	Women's Store	Juice Bar	Lounge	Flower Shop
29	Dava Bazaar	South Mumbai	18.946882	72.831362	0.0	Indian Restaurant	Restaurant	Bakery	Bar	Café	Cheese Shop	Electronics Store	Fast Food Restaurant	Ice Cream Shop	Market

Cluster 2

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
8	Cuffe Parade	South Mumbai	18.91	72.81	1.0	Indian Restaurant	Garden	Food Court	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant	Electronics Store	Farmers Market	Fast Food Restaurant

Cluster 3:-

```
southmumbai_merged.loc[southmumbai_merged['Cluster Labels'] == 2.0, southmumbai_merged.columns[[0] + list(range(1, southmumbai_merged.shape[1]))]]
```

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
18	Malabar Hill	South Mumbai	18.950000	72.795000	2.0	Indian Restaurant	Lighthouse	Convenience Store	Coffee Shop	Fast Food Restaurant	Ice Cream Shop	Gourmet Shop	Goan Restaurant	Hotel	Diner
25	Walkeshwar	South Mumbai	18.947596	72.795957	2.0	Indian Restaurant	Lighthouse	Ice Cream Shop	Convenience Store	Coffee Shop	Department Store	Gourmet Shop	Field	Hotel	History Museum

Cluster 4:-

```
southmumbai_merged.loc[southmumbai_merged['Cluster Labels'] == 3.0, southmumbai_merged.columns[[0] + list(range(1, southmumbai_merged.shape[1]))]]
```

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Altamount Road	South Mumbai	18.968100	72.809500	3.0	Café	Indian Restaurant	Coffee Shop	Bakery	Theater	Sandwich Place	Food	Diner	Donut Shop	Dumpling Restaurant
3	Breach Candy	South Mumbai	18.967000	72.805000	3.0	Café	Coffee Shop	Bakery	Sandwich Place	Fast Food Restaurant	Department Store	Dessert Shop	Men's Store	Japanese Restaurant	Italian Restaurant
4	Carmichael Road	South Mumbai	18.972200	72.811300	3.0	Ice Cream Shop	Chinese Restaurant	Fast Food Restaurant	Food Truck	Snack Place	Outlet Mall	Café	Sandwich Place	Shopping Mall	Deli / Bodega
6	Churchgate	South Mumbai	18.930000	72.820000	3.0	Hotel	Italian Restaurant	Restaurant	Wine Bar	Coffee Shop	Indian Restaurant	Sandwich Place	Diner	Mexican Restaurant	Mediterranean Restaurant
9	Cumbala Hill	South Mumbai	18.965833	72.805833	3.0	Café	Coffee Shop	Fast Food Restaurant	Concert Hall	Men's Store	Japanese Restaurant	Italian Restaurant	French Restaurant	Dessert Shop	Department Store
14	Kemps Corner	South Mumbai	18.962900	72.805400	3.0	Café	Dessert Shop	Bookstore	Fast Food Restaurant	Bakery	Salon / Barbershop	Coffee Shop	Concert Hall	Bus Station	Pizza Place
15	Lower Parel	South Mumbai	18.995278	72.830000	3.0	Indian Restaurant	Italian Restaurant	Shopping Mall	Office	Coffee Shop	Clothing Store	Pub	Recreation Center	Fast Food Restaurant	Café
19	Marine Drive	South Mumbai	18.944000	72.823000	3.0	Indian Restaurant	Italian Restaurant	Café	Scenic Lookout	Lounge	Chinese Restaurant	Clothing Store	Jewelry Store	Bridal Shop	Bakery
21	Mumbai Central	South Mumbai	18.969700	72.819400	3.0	Department Store	Fast Food Restaurant	Ice Cream Shop	Vegetarian / Vegan Restaurant	Pizza Place	Chinese Restaurant	Movie Theater	Juice Bar	Snack Place	Restaurant
22	Nariman Point	South Mumbai	18.926000	72.823000	3.0	Indian Restaurant	Italian Restaurant	Theater	Hotel	Restaurant	Chaat Place	Mediterranean Restaurant	Diner	Sandwich Place	Performing Arts Venue
26	Worli	South Mumbai	19.000000	72.815000	3.0	Indian Restaurant	Ice Cream Shop	Diner	Gourmet Shop	Sandwich Place	Dessert Shop	Seafood Restaurant	Fast Food Restaurant	Spa	Dumpling Restaurant

Cluster 5:-

```
southmumbai_merged.loc[southmumbai_merged['Cluster Labels'] == 4.0, southmumbai_merged.columns[[0] + list(range(1, southmumbai_merged.shape[1]))]]
```

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
12	Dongri	South Mumbai	19.283333	72.783333	4.0	Beach	Indian Restaurant	Playground	Resort	Bus Station	Food	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant

Cluster 6:-

```
southmumbai_merged.loc[southmumbai_merged['Cluster Labels'] == 5.0, southmumbai_merged.columns[[0] + list(range(1, southmumbai_merged.shape[1]))]]
```

	Area	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
7	Cotton Green	South Mumbai	18.986209	72.844076	5.0	Whisky Bar	Train Station	Plaza	Bakery	Yoga Studio	Food Court	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant
28	Parel	South Mumbai	18.990000	72.840000	5.0	Indian Restaurant	Asian Restaurant	Whisky Bar	Plaza	Food Court	Dessert Shop	Diner	Donut Shop	Dumpling Restaurant	Electronics Store

Discussion:-

- A very important observation that surfaces from the above analysis is that if we take a closer look at the different clusters we find that in **Cluster 1** the first most common venue is "**Indian Restaurants**" and the second and third most common venues are mainly **Coffee Shops, Bakeries, Café's, Pizza Corners and other fast food restaurants**. **So, it is very clear that people residing in Cluster 1 areas have a special liking or prefer Indian cuisine over other cuisines.** But, at the same time since this cluster has a high density of Indian Restaurants as their most popular venue, so keeping in mind **the tough competition from other popular food joints** any new business venture should be a bit cautious in serving Indian cuisine in these areas. **But if they can improvise their menu to serve quality Indian food items or add some newer items and can lower the rates**, then they can attract these customers to dine at their joints.

- If we examine **Cluster 4,** we find mostly **Cafe's, Ice Cream Shops, Coffee Shops and Bakery as the most popular venues**. So, it is very clear that people residing in Cluster 4 areas have a special liking or prefer light refreshments over heavy course meals. So, going by the above analysis, it will be quite advantageous for any new food chain to open these kinds of light food joints in the areas that fall within this cluster. **But if they want to avoid competition from other vendors** they can as well open up Indian Restaurants as there are **very few restaurants** serving Indian Cuisine in these areas.

Conclusion:-

All these analyses will be of great help for any new food chain which wants to start operation in Mumbai, they can decide well on their business strategy to maximize their ROI by avoiding stiff competition as well as catering to the preferences of people residing in a particular Area.

This analysis can be further extended to other locations of Mumbai like Andheri, Western Suburbs, Mira-Bhayandar, Western Suburbs, Bandra, Western Suburbs, Kandivali East, Western Suburbs etc.