

Capstone Project - Battle of Neighbourhoods: Restaurants in Mumbai (Week 1 and 2)

1. Introduction

1.1 Business Problem & Discussion of the Background

The restaurant industry in India has been growing at a rapid pace over the last decade or so and the growth story is set to continue for the next foreseeable future. There were nearly 22 lakh hotel and restaurant establishments in India in 2002. The food service or restaurant industry was worth a whopping Rs. 43,000 crores in 2010 and growing at a healthy rate of 15-20 percent annually. Restaurants and other food-service providers are so widespread that half of all adults have worked in food service in one way or another at some point in their lives. The food service industry encompasses any establishment that serves food to people outside their home. This includes restaurants, carryout operations, cafeterias, university dining halls, catering and vending companies, hotels and inns, and rehab and retirement centers. This means the demand for restaurants is only going to grow further and more people would want to get their legs in the game.

- How should a new business person decide where to open a restaurant?
- What factors should he look at before investing?
- Which neighborhood venues affect a user's rating for location of restaurant?

For this project I have chosen the city 'Mumbai'

So, the Business Problem would be

"To recommend the best neighborhoods to someone who is looking forward to open a restaurant in the city Mumbai."

Mumbai, also known as Bombay is a city and capital of Maharashtra state located in southwestern India. It is the country's financial and commercial center and it is a principal port on the Arabian Sea. Located on Maharashtra's coast, Mumbai is India's most-populous city, and it is one of the largest and most densely populated urban areas in the world.

1.2 Target Audience

This project will serve two groups of audience:

1. **Travelers:** Help them make an informed decision while choosing a restaurant by providing an in-depth analysis of restaurant and their neighbourhood.
2. **Business Person:** Provide useful information and models which can help them where to open their first/next restaurant.

2. Data Requirements

Following are the datasets used in the project:

1. Data that contains list of districts along with their latitude and longitude. Data source: https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai
2. Restaurants in each neighborhood of Mumbai. Data source: Foresquare API, Description: By using this API, we will get all the venues in each neighborhood.

3. Methodology

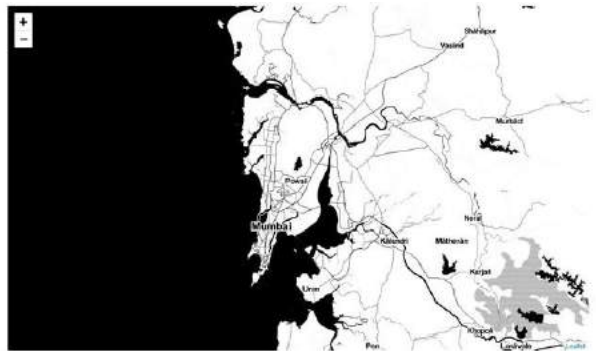
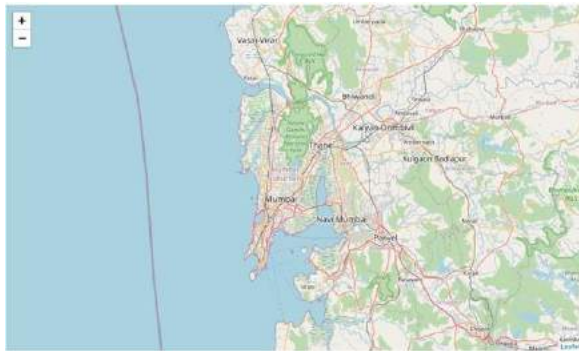
3.1 Data Preparation

For the database, I got data from https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai.

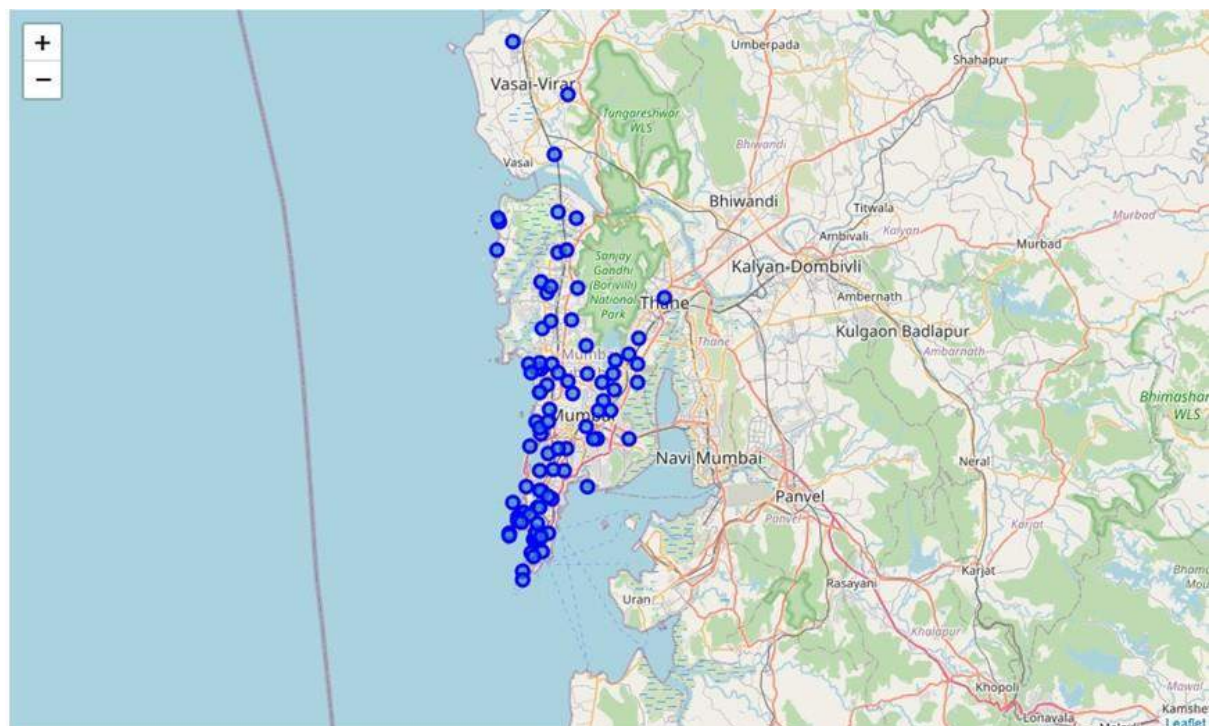
The data frame has the main components: *Neighborhood*, *Borough*, *Latitude* and *Longitude* information of the city.

	Neighborhood	Borough	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

I used python **folium** library to visualize geographic details of Mumbai and its boroughs and I created a map of Mumbai with boroughs superimposed on top. I used latitude and longitude values to get the visual as below:



Neighborhoods in Mumbai:



3.2 Exploratory Data Analysis

Firstly, I used *exploratory data analysis(EDA)* to uncover hidden properties of data and provide useful insights to the reader, both future traveler and investor.

3.2.1 Using Foursquare Location Data

Let's explore the first neighborhood in our data frame which is 'Amboli'

Lets make use of Foursquare API and get the top 100 venues that are in 'Amboli' within a radius of 500 meters.

	name	categories	lat	lng
0	Subway	Sandwich Place	19.127860	72.844461
1	Cafe Arfa	Indian Restaurant	19.128930	72.847140
2	5 Spice , Bandra	Chinese Restaurant	19.130421	72.847206
3	Cafe Coffee Day	Coffee Shop	19.127748	72.844663
4	Apple Service Centre	IT Services	19.128036	72.842718

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

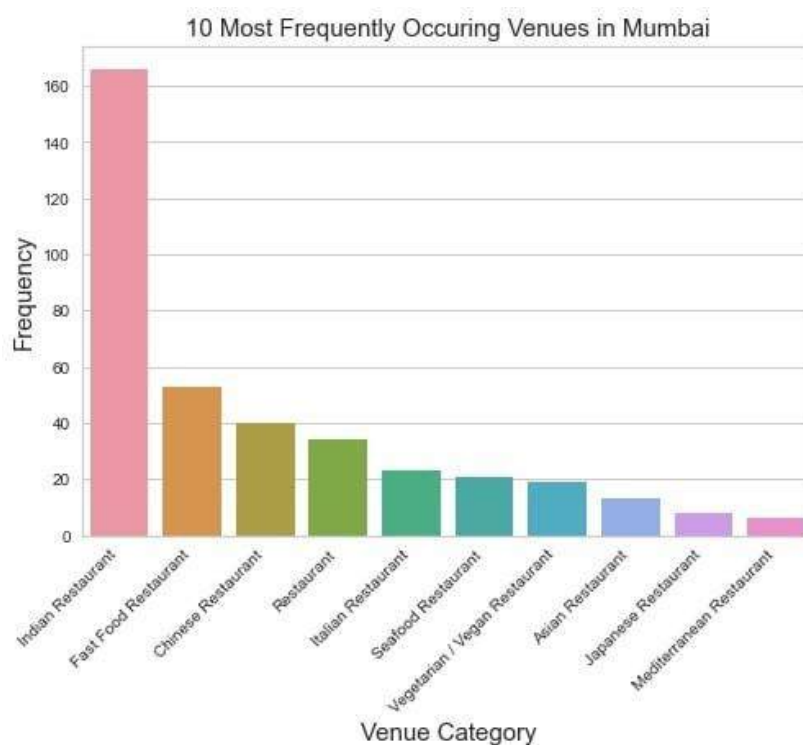
9 venues were returned by Foursquare.

We notice that 9 unique venue categories were returned by Foresquare

Now, let's do this for all the boroughs and concentrate only in restaurant category.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
1	Amboli	19.129300	72.843400	Cafe Arfa	19.128930	72.847140	Indian Restaurant
2	Amboli	19.129300	72.843400	5 Spice , Bandra	19.130421	72.847206	Chinese Restaurant
3	Amboli	19.129300	72.843400	Spices & Chillies	19.127765	72.844131	Asian Restaurant
4	Amboli	19.129300	72.843400	Nukkad Food Bistro	19.126058	72.846618	Fast Food Restaurant
5	Chakala	19.111388	72.860833	Faaso's	19.113938	72.862330	Fast Food Restaurant

There are 32 unique venue categories, and Indian Restaurants tops the chart as we can see in the plot below:



3.2.2 Let's analyze each neighborhood to know about the top 5 venues

So, we proceed as follows:

1. Create a data-frame with [pandas one hot encoding](#) for the venue categories.

	Neighborhood	Afghan Restaurant	American Restaurant	Asian Restaurant	Bengali Restaurant	Cantonese Restaurant	Chinese Restaurant	Dim Sum Restaurant	Dumpling Restaurant	Falafel Restaurant	...	Multicuisine Indian Restaurant	New American Restaurant
1	Amboli	0	0	0	0	0	0	0	0	0	...	0	0
2	Amboli	0	0	0	0	0	1	0	0	0	...	0	0
3	Amboli	0	0	1	0	0	0	0	0	0	...	0	0
4	Amboli	0	0	0	0	0	0	0	0	0	...	0	0
5	Chakala	0	0	0	0	0	0	0	0	0	...	0	0

2. Use pandas groupby on neighborhood column and calculate the mean of the frequency of occurrence of each venue category.

	Neighborhood	Afghan Restaurant	American Restaurant	Asian Restaurant	Bengali Restaurant	Cantonese Restaurant	Chinese Restaurant	Dim Sum Restaurant	Dumpling Restaurant	Falafel Restaurant	...	Multicuisine Indian Restaurant	New American Restaurant
0	Agripada	0.0000	0.0000	0.0000	0.0	0.000000	0.0000	0.0	0.0	0.0000	...	0.0	0.0
1	Altamount Road	0.0000	0.0000	0.0000	0.0	0.000000	0.0000	0.0	0.0	0.0000	...	0.0	0.0
2	Amboli	0.0000	0.0000	0.2500	0.0	0.000000	0.2500	0.0	0.0	0.0000	...	0.0	0.0
3	Amrut Nagar	0.0625	0.0625	0.0625	0.0	0.000000	0.0625	0.0	0.0	0.0625	...	0.0	0.0
4	Bandstand Promenade	0.0000	0.0000	0.0000	0.0	0.000000	0.2500	0.0	0.0	0.0000	...	0.0	0.0

3. Output each neighborhood along with the top 5 most common venues:

```

----Agripada----
      venue  freq
0      Restaurant  0.5
1    Indian Restaurant  0.5
2    Afghan Restaurant  0.0
3  Maharashtrian Restaurant  0.0
4      Udupi Restaurant  0.0

----Altamount Road----
      venue  freq
0    Indian Restaurant  1.0
1    Afghan Restaurant  0.0
2  Maharashtrian Restaurant  0.0
3      Udupi Restaurant  0.0
4    Tex-Mex Restaurant  0.0

----Amboli----
      venue  freq
0  Fast Food Restaurant  0.25
1    Asian Restaurant  0.25
2    Chinese Restaurant  0.25
3    Indian Restaurant  0.25
4    Parsi Restaurant  0.00

----Amrut Nagar----
      venue  freq
0    Indian Restaurant  0.38
1  Fast Food Restaurant  0.12
2    Afghan Restaurant  0.06
3    Falafel Restaurant  0.06
4  Mediterranean Restaurant  0.06

```

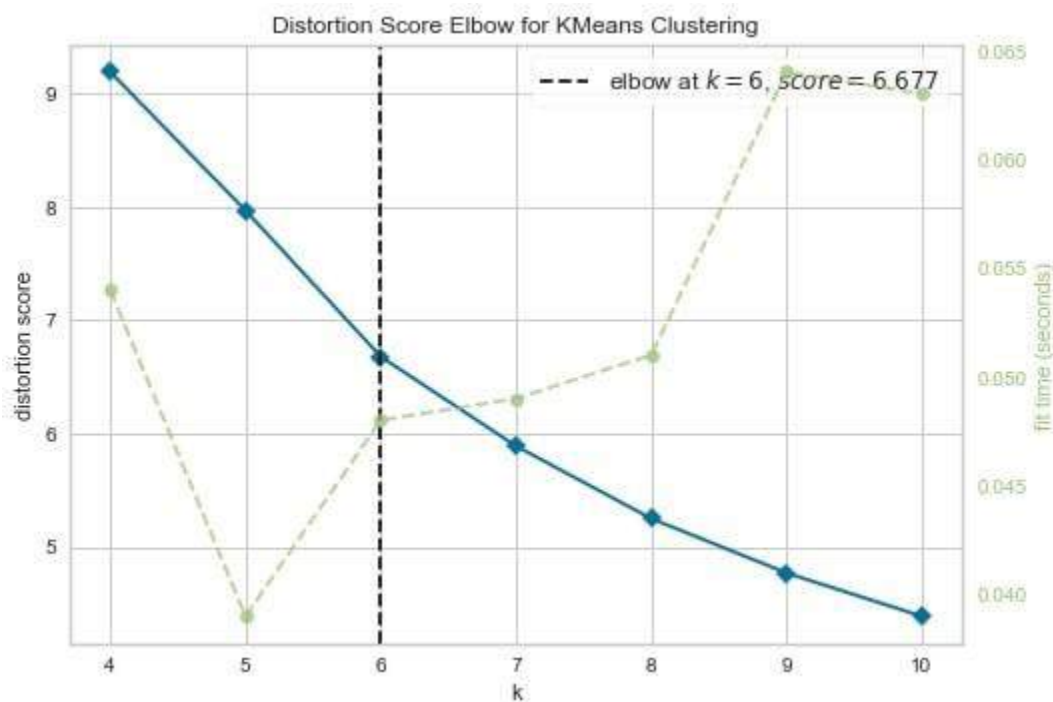

Creating a table which shows list of top 10 venue category for each borough in below table.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Agripada	Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant	North Indian Restaurant
1	Altamount Road	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
2	Amboli	Fast Food Restaurant	Asian Restaurant	Chinese Restaurant	Indian Restaurant	Parsi Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant
3	Amrut Nagar	Indian Restaurant	Fast Food Restaurant	Afghan Restaurant	Falafel Restaurant	Mediterranean Restaurant	American Restaurant	Italian Restaurant	Restaurant	Chinese Restaurant	Asian Restaurant
4	Bandstand Promenade	Fast Food Restaurant	Italian Restaurant	Indian Restaurant	Chinese Restaurant	North Indian Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	Afghan Restaurant

3.3 Clustering

To analyze which neighborhood of Mumbai is good to open a new restaurant, we will use a **K-means clustering**: a type of unsupervised learning, which is used when you have unlabeled data (i.e., data without defined categories or groups). The goal of this algorithm is to find groups in the data, with the number of groups represented by the variable K. The algorithm works iteratively to assign each data point to one of K groups based on the features that are provided. Data points are clustered based on feature similarity.

So the first step is identify the best “K” using a famous analytical approach: **the elbow method**.



From the plot up here, we can say that the best K is 6.

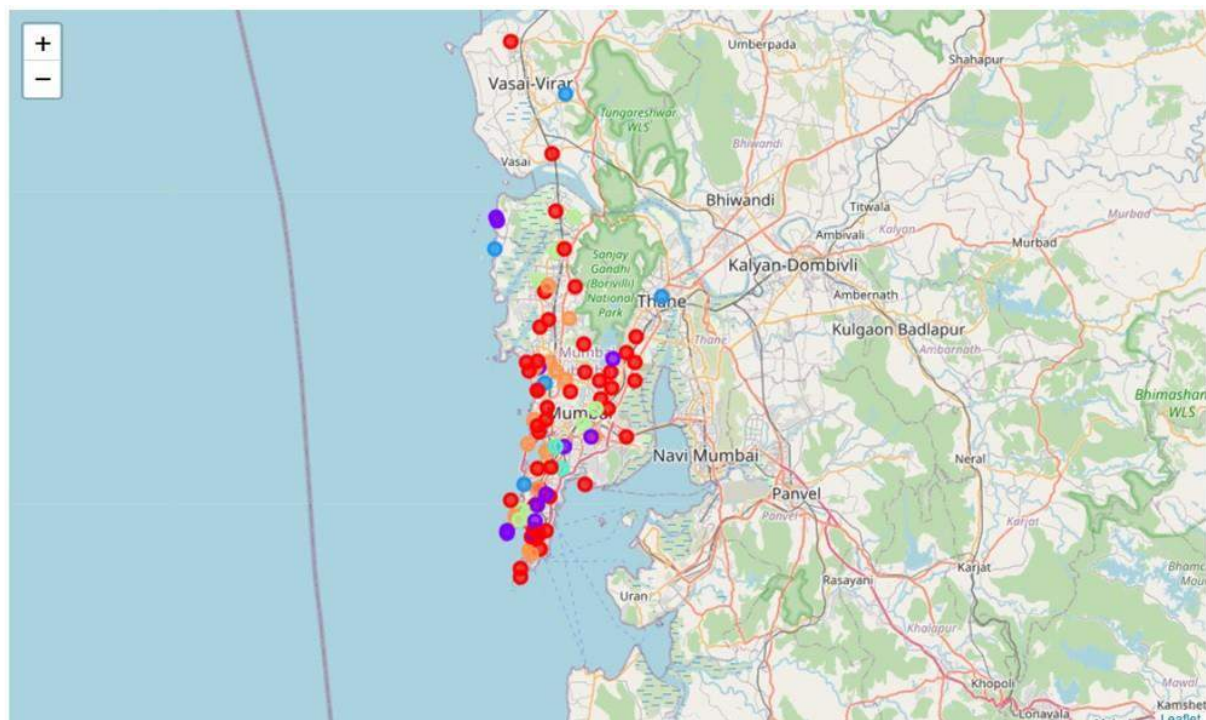
Finally, we can try to cluster the neighborhood based on the venue categories and use K-Means clustering. The 6 clusters are partitioned based on similar type of restaurants that belongs to neighborhoods.

Here is the merged table with cluster labels for each borough.

	Neighborhood	Borough	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
0	Amboli	Andheri, Western Suburbs	19.129300	72.843400	5.0	Fast Food Restaurant	Asian Restaurant	Chinese Restaurant	Indian Restaurant	Parsi Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Restaurant
1	Chakala	Andheri, Western Suburbs	19.111388	72.860833	5.0	Restaurant	Fast Food Restaurant	Asian Restaurant	Indian Restaurant	Seafood Restaurant	Falafel Restaurant	North Indian Restaurant	Middle Eastern Restaurant
2	D.N. Nagar	Andheri, Western Suburbs	19.124085	72.831373	1.0	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant
3	Four Bungalows	Andheri, Western Suburbs	19.124714	72.827210	5.0	Vegetarian / Vegan Restaurant	Restaurant	American Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant
4	Lokhandwala	Andheri, Western Suburbs	19.130815	72.829270	0.0	Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant

4. Results

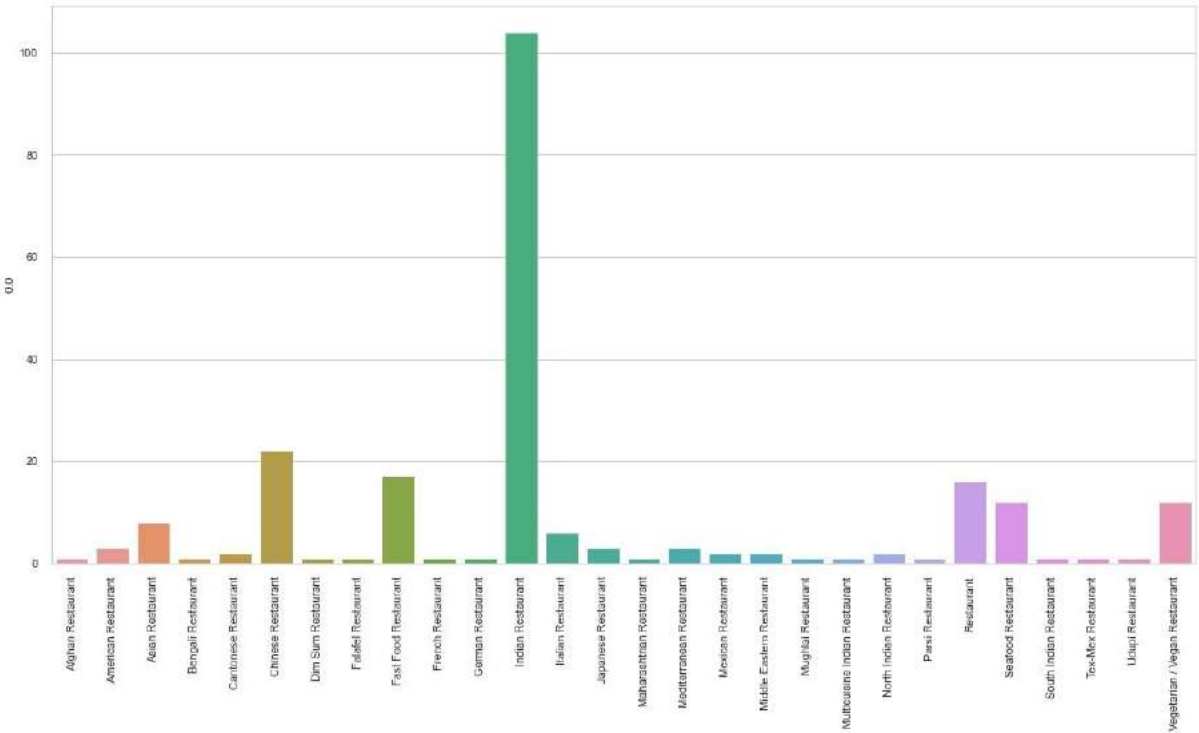
Before starting the analysis of all the clusters, let's take a look on the folium map:



As we can see, each cluster belong to a color with different characteristics.

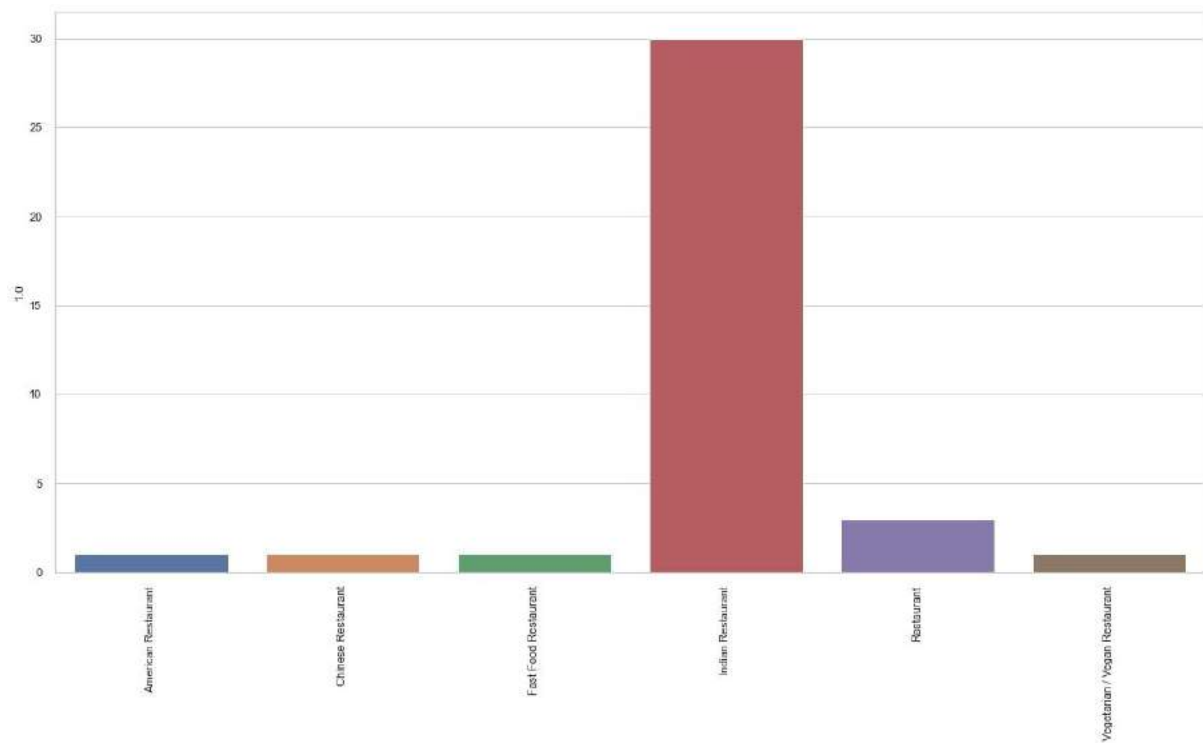
Cluster 1:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
4	Lokhandwala	Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant	North Indian Restaurant
5	Marol	Indian Restaurant	Vegetarian / Vegan Restaurant	Chinese Restaurant	Restaurant	Asian Restaurant	Tex-Mex Restaurant	Udupi Restaurant	South Indian Restaurant	Seafood Restaurant	Mediterranean Restaurant
6	Sahar	0	0	0	0	0	0	0	0	0	0
7	Seven Bungalows	Indian Restaurant	Chinese Restaurant	Seafood Restaurant	South Indian Restaurant	Dim Sum Restaurant	North Indian Restaurant	Afghan Restaurant	New American Restaurant	Middle Eastern Restaurant	Mughlai Restaurant
8	Versova	0	0	0	0	0	0	0	0	0	0
10	Bhayandar	0	0	0	0	0	0	0	0	0	0
13	Kherwadi	Indian Restaurant	Chinese Restaurant	Vegetarian / Vegan Restaurant	German Restaurant	Seafood Restaurant	Fast Food Restaurant	Asian Restaurant	Mediterranean Restaurant	South Indian Restaurant	Tex-Mex Restaurant
17	Dahisar	Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant	North Indian Restaurant
18	Aarey Milk Colony	0	0	0	0	0	0	0	0	0	0
19	Bangur Nagar	0	0	0	0	0	0	0	0	0	0
21	Juhu	Indian Restaurant	Japanese Restaurant	Fast Food Restaurant	Seafood Restaurant	Vegetarian / Vegan Restaurant	Cantonese Restaurant	Chinese Restaurant	Mexican Restaurant	Udupi Restaurant	Tex-Mex Restaurant



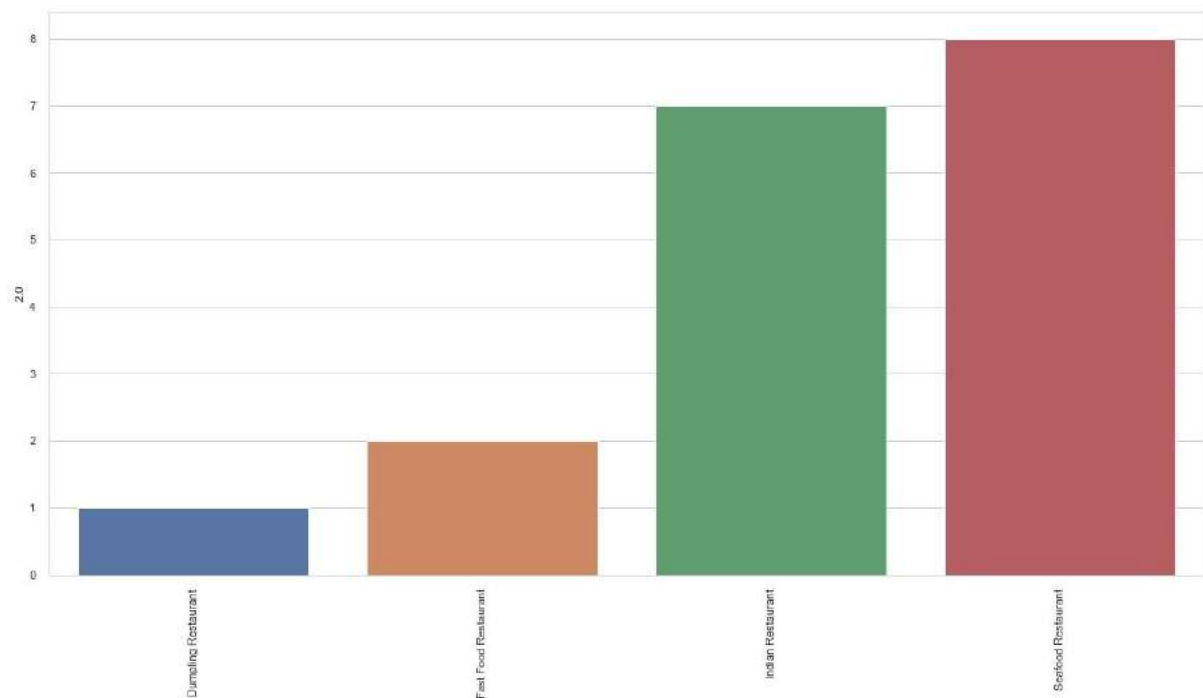
Cluster 2:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
2	D.N. Nagar	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
11	Uttan	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
45	Indian Institute of Technology Bombay campus	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
49	Deonar	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
53	Altamount Road	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
54	Bhuleshwar	Indian Restaurant	American Restaurant	Fast Food Restaurant	Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	Afghan Restaurant
57	Cavel	Indian Restaurant	Chinese Restaurant	Afghan Restaurant	North Indian Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	Parsi Restaurant



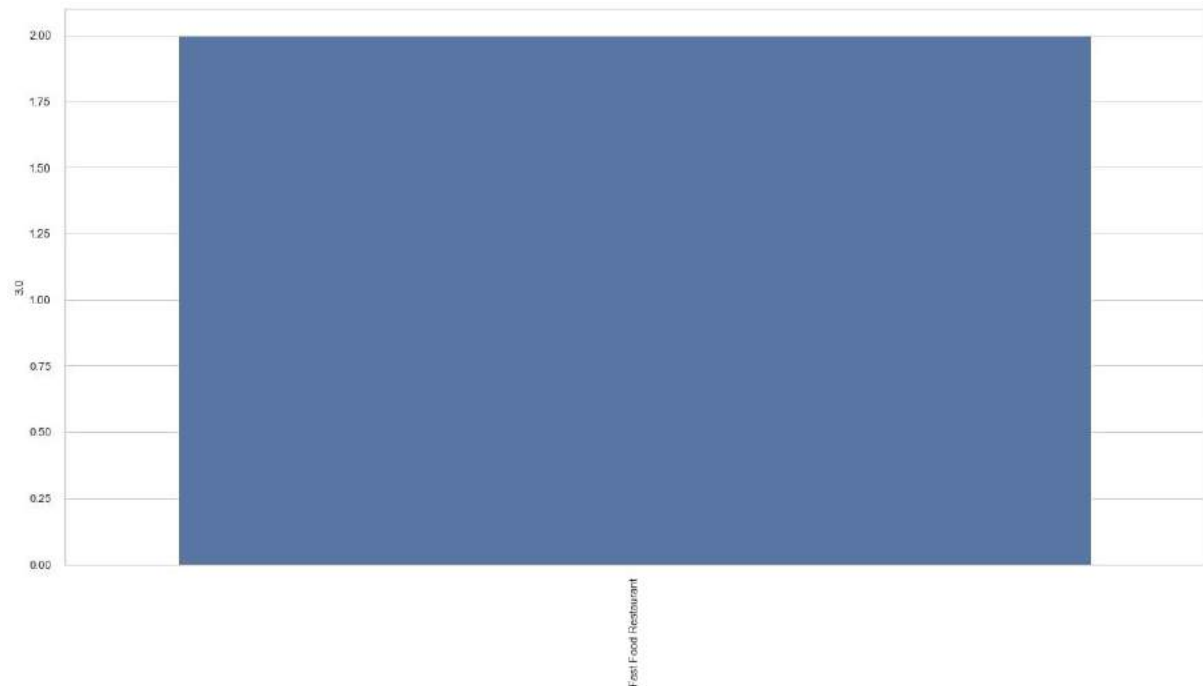
Cluster 3:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
16	Gorai	Seafood Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
32	Nalasopara	Seafood Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
34	Irla	Seafood Restaurant	Indian Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
78	Worli	Seafood Restaurant	Indian Restaurant	Dumpling Restaurant	Fast Food Restaurant	Afghan Restaurant	North Indian Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant
92	Thane	Indian Restaurant	Seafood Restaurant	Fast Food Restaurant	Afghan Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant



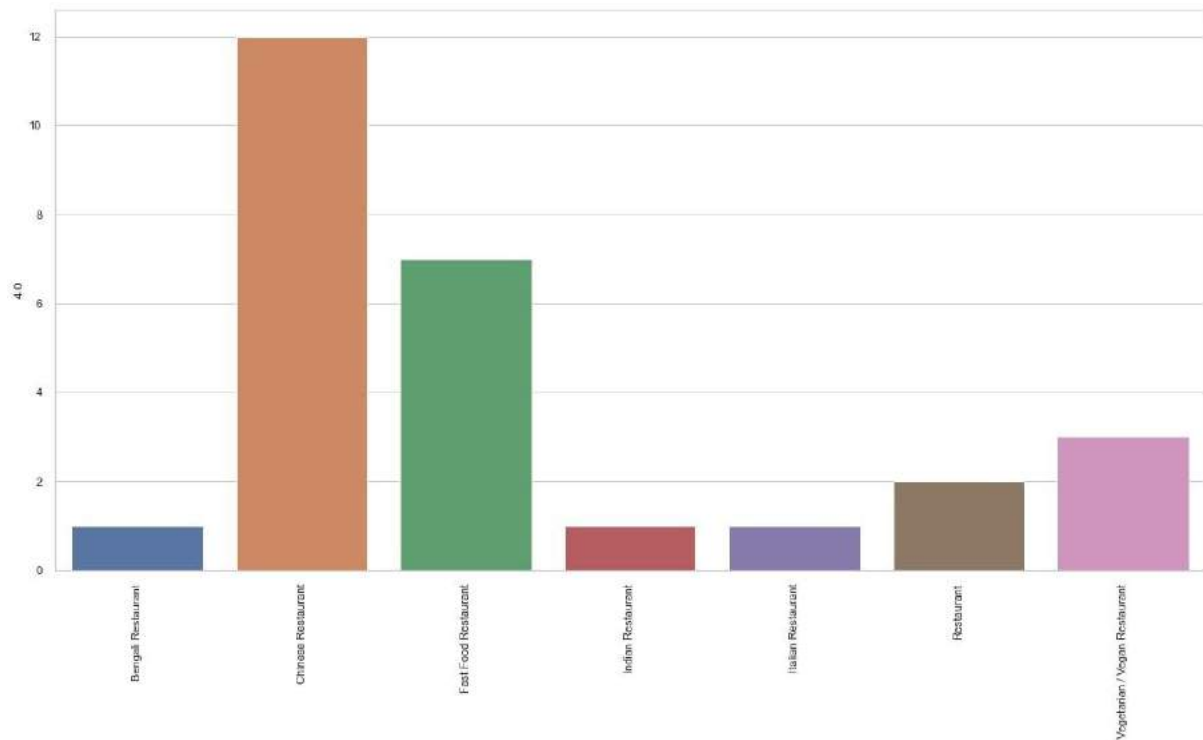
Cluster 4:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
79	C.G.S. colony	Fast Food Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
91	Dharavi	Fast Food Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant



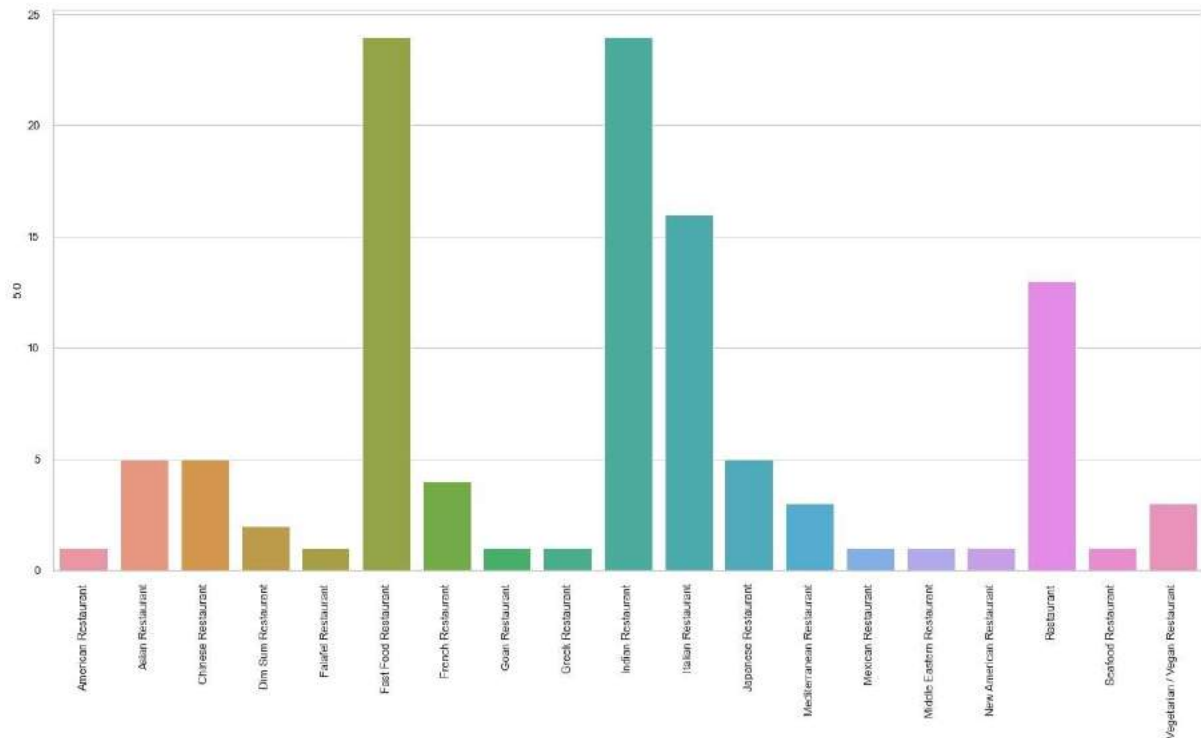
Cluster 5:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
9	Mira Road	Vegetarian / Vegan Restaurant	Fast Food Restaurant	Chinese Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant	Parsi Restaurant
15	I.C. Colony	Chinese Restaurant	Fast Food Restaurant	Indian Restaurant	Afghan Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant	Parsi Restaurant
22	Charkop	Chinese Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
41	Nehru Nagar	Vegetarian / Vegan Restaurant	Chinese Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Restaurant	Parsi Restaurant	North Indian Restaurant
46	Vidyavihar	Fast Food Restaurant	Chinese Restaurant	Afghan Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant	Parsi Restaurant
56	Carmichael Road	Fast Food Restaurant	Chinese Restaurant	Bengali Restaurant	Italian Restaurant	Parsi Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant
73	Mumbai Central	Chinese Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Restaurant	North Indian Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant
89	Gowalia Tank	Chinese Restaurant	Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant	North Indian Restaurant



Cluster 6:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Amboli	Fast Food Restaurant	Asian Restaurant	Chinese Restaurant	Indian Restaurant	Parsi Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant
1	Chakala	Restaurant	Fast Food Restaurant	Asian Restaurant	Indian Restaurant	Seafood Restaurant	Falafel Restaurant	North Indian Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant
3	Four Bungalows	Vegetarian / Vegan Restaurant	Restaurant	American Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant	North Indian Restaurant	New American Restaurant
12	Bandstand Promenade	Fast Food Restaurant	Italian Restaurant	Indian Restaurant	Chinese Restaurant	North Indian Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	Afghan Restaurant
14	Pali Hill	Fast Food Restaurant	Italian Restaurant	Indian Restaurant	Dim Sum Restaurant	Restaurant	Greek Restaurant	New American Restaurant	Middle Eastern Restaurant	Asian Restaurant	Seafood Restaurant
20	Jogeshwari West	Fast Food Restaurant	Indian Restaurant	Afghan Restaurant	Mexican Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant	Maharashtrian Restaurant
24	Mahavir Nagar	Fast Food Restaurant	Indian Restaurant	Italian Restaurant	Afghan Restaurant	Middle Eastern Restaurant	Mughlai Restaurant	Multicuisine Indian Restaurant	New American Restaurant	North Indian Restaurant	Mediterranean Restaurant
28	Dindoshi	Restaurant	Fast Food Restaurant	Afghan Restaurant	Maharashtrian Restaurant	Udupi Restaurant	Tex-Mex Restaurant	South Indian Restaurant	Seafood Restaurant	Parsi Restaurant	North Indian Restaurant



5. Discussion

We got a glimpse of the Restaurants in Mumbai and were able to find out some interesting insights which might be useful to people with business interests as well as travelers. Let's summarize our findings:

- The most common venues in Mumbai are Indian Restaurant and Fast Food Restaurant.
- "Kala Ghoda" and "Hiranandani Gardens" districts has maximum number of restaurants.
- Cluster 1, cluster 2 and cluster 6 has maximum number of Indian Restaurants.
- Most common venue in cluster 3 is Seafood Restaurant.
- Most common venue in cluster 5 is Chinese Restaurant
- Most common venue in cluster 4 and cluster 6 is Fast Food Restaurant.

The clustering is completely based on the most common venues obtained from Foursquare data.

As I mentioned before, Mumbai is a big city with a high population density in a narrow area. The total number of measurements and population densities of the districts in total can vary. As there is such a complexity, very different approaches can be tried in clustering and classification studies.

I used the Kmeans algorithm as part of this clustering study. When I tested the Elbow method, I set the optimum k value to 6. For more detailed and accurate guidance, the data set can be expanded and the details of the neighborhood or street can also be drilled.

I ended the study by visualizing the data and clustering information on the Mumbai map.

6. Conclusion

In a fast-moving world, there are many real-life problems or scenarios where data can be used to find solutions to those problems. Like seen in the example above, data was used to cluster neighborhoods in Mumbai based on the most common food venues (Restaurants) in its major districts. The results can help investors and travelers to decide about the district that fits the most according to their needs.