Analyzing the Neighborhoods in Chennai for Starting a Restaurant

Applied Data Science Capstone Project

By: Karthikeyan Viswanathan

Date: February 2, 2021

Table of Contents

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 following data is required for the project:

1) Neighbourhood data of Chennai
2) Geographical coordinates of Chennai and all neighbourhoods in Chennai
3) Venue data for neighbourhoods in Chennai

Neighbourhoods Data

The data of the neighbourhoods in Chennai was scraped from 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. The top 10 rows of the dataframe are shown in Figure 1.

	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

Figure 1: Top 10 rows of Chennai neighborhoods data scraped from Wikipedia.

Geographical Coordinates

The geographical coordinates for Chennai 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 code for getting the geographical coordinates of Chennai is shown in Figure 2.

```
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, longitude))
```

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

Figure 2: Obtaining geographical coordinates of Chennai.

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 refined coordinates are then further used for plotting neighborhoods using the Folium library in python. Figure 3 shows the coordinates of neighborhoods in Chennai obtained from Wikipedia as ‘Latitude’ and ‘Longitude’ and those obtained from geocoder as ‘Latitude1’ and ‘Longitude1’. Furthermore, it also shows the absolute difference between the two latitude columns and the two longitude columns as ‘Latdiff’ and ‘Longdiff’, respectively. Once again only the top 10 rows are shown.

	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

Figure 3: Absolute difference between latitude and longitude values obtained from Wikipedia and Geocoder.

Figure 4 shows the top 10 rows of the final Chennai neighborhoods dataframe after replacing the latitude and longitude values as mentioned before and dropping unnecessary columns.

	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

Figure 4: Final Chennai neighborhoods dataframe.

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 as well as build the unsupervised learning model to cluster neighborhoods. The venue recommendations of all neighborhoods were obtained with a limit of 200, that is, maximum of 200 venue recommendations per neighborhood and a radius of 1 km around the neighborhood's geographical coordinates. Figure 5 shows the top 10 rows depicting the results obtained after cleaning the data from Foursquare API.

	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

Figure 5: Data obtained from Foursquare API after cleaning.

Methodology

This section provides details for the methodology used in the project.

Data Visualization

In order to understand the data obtained for Chennai neighborhoods, basic visualization was carried out. Figure 6 shows a bar plot depicting the number of neighborhoods in each location in Chennai.

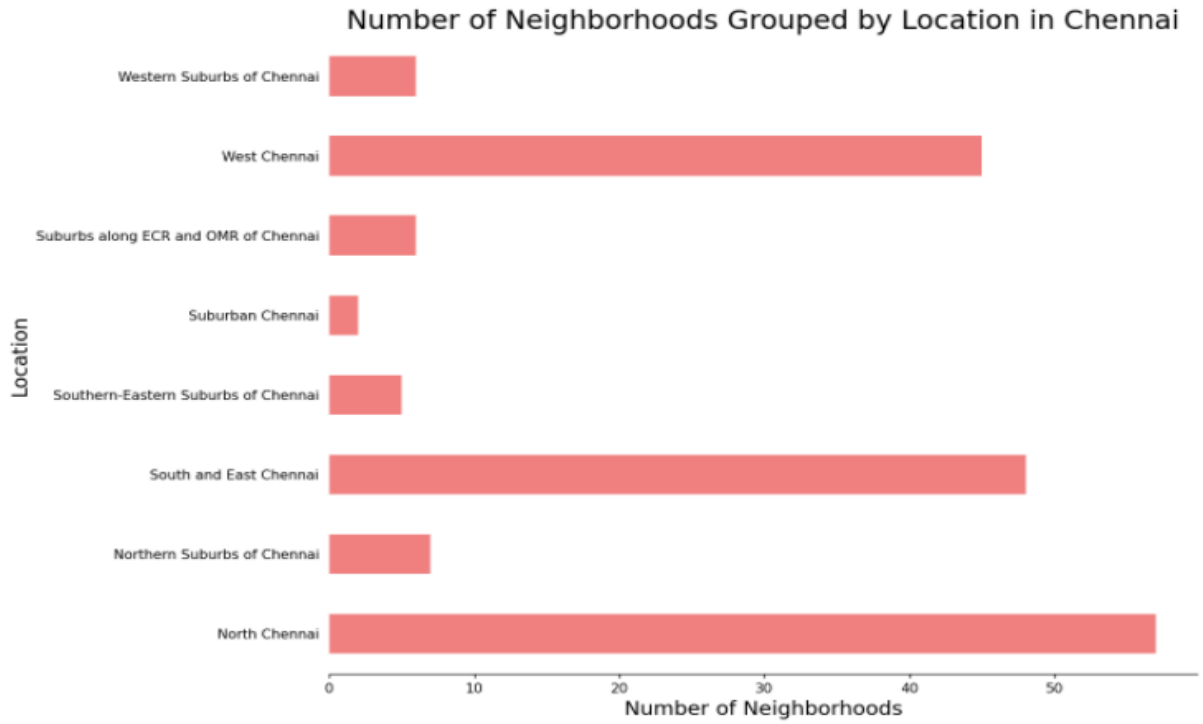

Figure 6: Number of neighborhoods grouped by location.

It is evident from Figure 6 that South Chennai and Western Suburbs 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 the city and thus have been termed as just Chennai. Using folium, a map was plotted to show how the different neighborhoods are spread all across Chennai. This is shown in Figure 7.

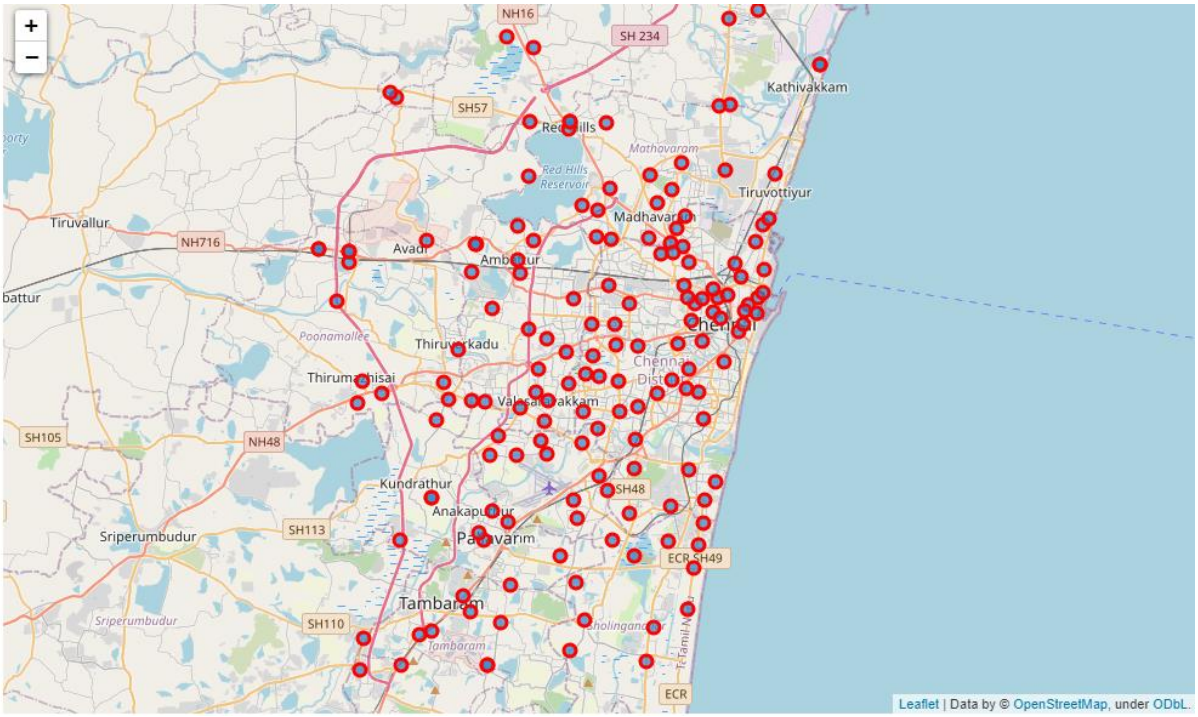

Figure 7: Depicting the neighborhood spread across Chennai.

Feature Extraction

Feature extraction was carried out to obtain features from the Foursquare API data (as shown in Figure 5) which was used for building the unsupervised learning model. In order to achieve this, the "Venue Category" column had to be converted to some form of numeric value to be used for building the model. This was achieved by the One-hot Encoding method which takes all the unique categories and creates a column for each category. Then, if a neighborhood venue belongs to that category, it would get a value of 1 for that row in that specific category column and if a neighborhood venue does not belong to the particular category, the value would be 0. This process was repeated for all venues in all neighborhoods and the result was a sparse matrix containing the neighborhood name and all unique category columns with either 1 or 0 based on whether the

neighborhood venue belonged to that category or not. This dataframe was then grouped by the neighborhood name and the average value was taken for all categories. The result is shown in Figure 8 which shows only the top 10 rows.

	Neighborhood	ATM	Accessories Store	Afghan Restaurant	African Restaurant	Airport Terminal	American Restaurant	Amphitheater	Andhra Restaurant	Arcade	...	Train	Train Station	Travel & Transport	Vegeta / V Restau
0	Adambakkam	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.111111	0.0	0.00
1	Adyar	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.015873	...	0.0	0.000000	0.0	0.01
2	Alandur	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.062500	0.0	0.00
3	Alapakkam	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.000000	0.0	0.00
4	Alwarthirunagar	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.000000	0.0	0.00
5	Ambattur	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.000000	0.0	0.00
6	Aminjikarai	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.000000	0.0	0.00
7	Anna Nagar	0.0	0.0	0.0	0.0	0.0	0.014706	0.0	0.0	0.000000	...	0.0	0.000000	0.0	0.04
8	Annanur	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.333333	0.0	0.00
9	Arumbakkam	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.0	0.000000	...	0.0	0.000000	0.0	0.13

10 rows × 102 columns

Figure 8: One-hot Encoding resulting dataframe.

Notice that most of the values are 0 since there were a large number of unique categories and not all neighborhoods had venues belonging to each category. This data was used for the unsupervised learning model with the neighborhood name dropped. The unsupervised learning model is explained in the next section.

A dataframe was also created which contained the top 10 most common venues of all neighborhoods. Though this is not a part of Feature Extraction, it is important to provide a glimpse into what this dataframe looks like as it will be used later to combine the results from the unsupervised learning model. The top 10 rows of this dataframe are shown in Figure 9.

	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	Adambakkam	Indian Restaurant	Train Station	Metro Station	Supermarket	Hotel	Bakery	Pizza Place	Department Store	Fried Chicken Joint	Food Truck
1	Adyar	Indian Restaurant	Café	Fast Food Restaurant	Dessert Shop	Pizza Place	Asian Restaurant	Electronics Store	North Indian Restaurant	Ice Cream Shop	Chinese Restaurant
2	Alandur	Indian Restaurant	Metro Station	Hotel	Bakery	Supermarket	Breakfast Spot	Church	Café	Pizza Place	Train Station
3	Alapakkam	Department Store	Fast Food Restaurant	Clothing Store	Asian Restaurant	Sandwich Place	Chettinad Restaurant	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
4	Alwarthirunagar	Clothing Store	Fast Food Restaurant	Chinese Restaurant	Movie Theater	Smoke Shop	Gym	Café	Multiplex	Ice Cream Shop	Pizza Place
...	...	...	...	...	...	...	...	...	...	...	...
156	Kanathur	Movie Theater	Café	Whisky Bar	Juice Bar	Food	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
157	Muthukadu	Indian Restaurant	Museum	Coffee Shop	Hotel	Theme Park	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
158	Kelambakkam	Indian Restaurant	Bus Station	Coffee Shop	Fast Food Restaurant	Café	Yoga Studio	Food	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
159	Kovalam	Indian Restaurant	Seafood Restaurant	Café	Hotel	Resort	Restaurant	Surf Spot	Beach	Bar	Yoga Studio
160	Siruseri	ATM	Tea Room	Gas Station	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court

Figure 9: Top 10 most common venues for neighborhoods.

Unsupervised Learning

K-means unsupervised learning technique was used to cluster the neighborhoods based on the category of venues near the neighborhoods. One important aspect of the k-means model is to determine the number of clusters to use in model development. This was determined by the Silhouette score which was calculated for a range of clusters from 2 to 15. The resulting number of clusters and their respective Silhouette scores are shown in Figure 10.

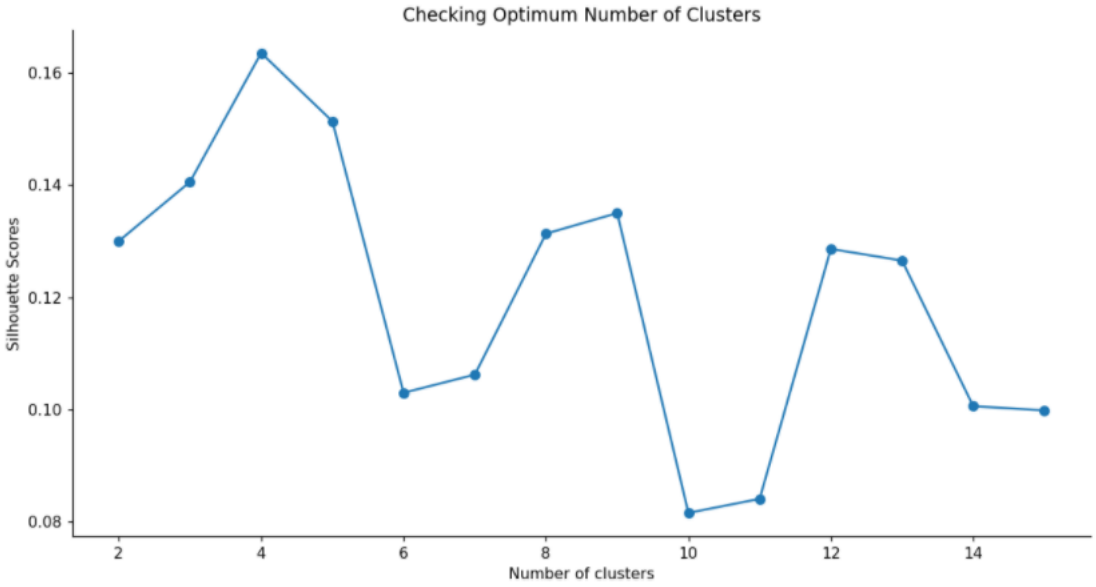

Figure 10: Silhouette scores for different number of clusters.

It is evident that the Silhouette scores are not very high even as the number of clusters increases. This means that the inter-cluster distance is not very high over the range of k-values. Despite this, the data will be clustered to the best possible extent. For this, 4 clusters will be used for the k-means clustering model since it provides the highest silhouette score as seen in Figure 10.

Results

The clustering model then clusters the neighbourhoods in Chennai and provides a label for each neighborhood which is representative of the cluster it belongs to. The cluster labels were then added to the dataframe in Figure 9 along with the Location, Latitude, and Longitude columns to provide a complete summary of the clustering. The top 10 rows are shown in Figure 11.

	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Co
0	Adambakkam	South and East Chennai	12.9919	80.206	2.0	Indian Restaurant	Train Station	Metro Station	Supermarket	Hotel	Bakery	Pizza Place	Department Store	C
1	Adyar	South and East Chennai	13.003	80.2519	2.0	Indian Restaurant	Café	Fast Food Restaurant	Dessert Shop	Pizza Place	Asian Restaurant	Electronics Store	North Indian Restaurant	Ice
2	Alandur	South and East Chennai	13.0001	80.2006	2.0	Indian Restaurant	Metro Station	Hotel	Bakery	Supermarket	Breakfast Spot	Church	Café	
3	Alapakkam	West Chennai	13.0461	80.165	2.0	Department Store	Fast Food Restaurant	Clothing Store	Asian Restaurant	Sandwich Place	Chettinad Restaurant	Flower Shop	Furniture / Home Store	Veg
4	Alwarthirunagar	West Chennai	13.0506	80.184	2.0	Clothing Store	Fast Food Restaurant	Chinese Restaurant	Movie Theater	Smoke Shop	Gym	Café	Multiplex	Ice
5	Ambattur	West Chennai	13.1188	80.1548	2.0	Movie Theater	Flea Market	Ice Cream Shop	Asian Restaurant	River	Bus Station	Multiplex	Department Store	Rest
6	Aminjikarai	West Chennai	13.0714	80.2226	2.0	Fast Food Restaurant	Pizza Place	Furniture / Home Store	Burger Joint	Sporting Goods Shop	Bookstore	Shopping Mall	Café	
7	Anna Nagar	West Chennai	13.0836	80.2101	2.0	Indian Restaurant	Chinese Restaurant	Fast Food Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Clothing Store	Electronics Store	Gym	
8	Annanur	West Chennai	13.1121	80.129	3.0	Platform	Train Station	Medical Supply Store	Stationery Store	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	
9	Arumbakkam	West Chennai	13.0724	80.2102	2.0	Hotel	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Pool	Bakery	Chinese Restaurant	Clothing Store	Event Space	

Figure 11: Clustering neighborhoods in Chennai.

Furthermore, neighborhoods in each individual cluster can be extracted using cluster labels and thus the details of specific clusters can be seen. This is done below for all clusters with only 10 rows for clusters that contain a high number of neighborhoods.

	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 Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
15	Broadway	North Chennai	0.0	Indian Restaurant	Video Store	Restaurant	Market	Harbor / Marina	Yoga Studio	Flea Market	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
35	Kadaperi	South and East Chennai	0.0	Indian Restaurant	Jewelry Store	Light Rail Station	Train Station	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
46	Kosapet	North Chennai	0.0	Indian Restaurant	Department Store	Hotel	Yoga Studio	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
57	Madipakkam	South and East Chennai	0.0	Indian Restaurant	Department Store	Convenience Store	Yoga Studio	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
62	manapakkam	West Chennai	0.0	Indian Restaurant	Trail	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
64	Manjambakkam	North Chennai	0.0	Indian Restaurant	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
67	Medavakkam	South and East Chennai	0.0	Indian Restaurant	Vegetarian / Vegan Restaurant	Chinese Restaurant	Pizza Place	Convenience Store	Bakery	Flea Market	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
93	Parry's Corner	North Chennai	0.0	Indian Restaurant	Video Store	Market	Harbor / Marina	Yoga Studio	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
120	Sowcarpet	North Chennai	0.0	Indian Restaurant	Men's Store	Video Store	Restaurant	Market	Harbor / Marina	Outlet Store	Yoga Studio	Fried Chicken Joint	Food Truck
150	Kancheepuram	Suburban Chennai	0.0	Indian Restaurant	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
151	Chengalpattu	Suburban Chennai	0.0	Indian Restaurant	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
159	Tiruvallur	Western Suburbs of Chennai	0.0	Indian Restaurant	Metro Station	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
170	Karapakkam	Suburbs along ECR and OMR of Chennai	0.0	Indian Restaurant	Restaurant	Afghan Restaurant	Vegetarian / Vegan Restaurant	Shopping Plaza	Fast Food Restaurant	Yoga Studio	Flower Shop	Fruit & Vegetable Store	Fried Chicken Joint
172	Muthukadu	Suburbs along ECR and OMR of Chennai	0.0	Indian Restaurant	Museum	Coffee Shop	Hotel	Theme Park	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck

Figure 12: Cluster 1.

	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 Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
38	Kathirvedu	North Chennai	1.0	ATM	Snack Place	Food & Drink Shop	Cricket Ground	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
41	Kodungaiyur	North Chennai	1.0	ATM	Pharmacy	Coffee Shop	Bank	Food	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
43	Kolathur	North Chennai	1.0	ATM	Indian Restaurant	Bus Stop	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
44	Korattur	West Chennai	1.0	ATM	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court	Food & Drink Shop
48	Kovilambakkam	South and East Chennai	1.0	ATM	Indian Restaurant	Bar	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
50	Kundrathur	West Chennai	1.0	ATM	Soup Place	Bus Station	Garden	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
51	Lakshmipuram	North Chennai	1.0	ATM	Department Store	Intersection	Indian Restaurant	Photography Studio	Hotel	Flea Market	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
63	Mangadu	West Chennai	1.0	ATM	Pharmacy	Fast Food Restaurant	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
70	Moolakadai	North Chennai	1.0	ATM	Coffee Shop	Gym	Bakery	Currency Exchange	Electronics Store	Donut Shop	Gaming Cafe	Dessert Shop	Furniture / Home Store
72	Mudichur	South and East Chennai	1.0	Breakfast Spot	Pharmacy	Yoga Studio	Food	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
75	Nagalkeni	South and East Chennai	1.0	Supermarket	Pharmacy	Yoga Studio	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
91	Pammal	South and East Chennai	1.0	ATM	South Indian Restaurant	Warehouse Store	Bus Station	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
94	Pattabiram	North Chennai	1.0	ATM	Light Rail Station	Supermarket	Fast Food Restaurant	Platform	Concert Hall	Food	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
133	Thiruverkadu	West Chennai	1.0	ATM	Pharmacy	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
141	Vallalar Nagar	North Chennai	1.0	ATM	Concert Hall	Supermarket	Light Rail Station	Fast Food Restaurant	Platform	Diner	Donut Shop	Furniture / Home Store	Fruit & Vegetable Store
160	Pattabiram	Western Suburbs of Chennai	1.0	ATM	Light Rail Station	Supermarket	Fast Food Restaurant	Platform	Concert Hall	Food	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
163	Kundrathur	Western Suburbs of Chennai	1.0	ATM	Soup Place	Bus Station	Garden	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
175	Siruseri	Suburbs along ECR and OMR of Chennai	1.0	ATM	Tea Room	Gas Station	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court

Figure 13: Cluster 2.

	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 Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Adambakkam	South and East Chennai	2.0	Indian Restaurant	Train Station	Metro Station	Supermarket	Hotel	Bakery	Pizza Place	Department Store	Fried Chicken Joint	Food Truck
1	Adyar	South and East Chennai	2.0	Indian Restaurant	Café	Fast Food Restaurant	Dessert Shop	Pizza Place	Asian Restaurant	Electronics Store	North Indian Restaurant	Ice Cream Shop	Chinese Restaurant
2	Alandur	South and East Chennai	2.0	Indian Restaurant	Metro Station	Hotel	Bakery	Supermarket	Breakfast Spot	Church	Café	Pizza Place	Train Station
3	Alapakkam	West Chennai	2.0	Department Store	Fast Food Restaurant	Clothing Store	Asian Restaurant	Sandwich Place	Chettinad Restaurant	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
4	Alwarthirunagar	West Chennai	2.0	Clothing Store	Fast Food Restaurant	Chinese Restaurant	Movie Theater	Smoke Shop	Gym	Café	Multiplex	Ice Cream Shop	Pizza Place
...	...	...	...	...	...	...	...	...	...	...	...	...	...
168	Urapakkam	Southern-Eastern Suburbs of Chennai	2.0	South Indian Restaurant	Juice Bar	Department Store	Indian Restaurant	Coffee Shop	Flower Shop	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
169	Guduvanchery	Southern-Eastern Suburbs of Chennai	2.0	Department Store	Indie Movie Theater	Indian Restaurant	North Indian Restaurant	Bakery	Food	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck
171	Kanathur	Suburbs along ECR and OMR of Chennai	2.0	Movie Theater	Café	Whisky Bar	Juice Bar	Food	Garden	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
173	Kelambakkam	Suburbs along ECR and OMR of Chennai	2.0	Indian Restaurant	Bus Station	Coffee Shop	Fast Food Restaurant	Café	Yoga Studio	Food	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint
174	Kovalam	Suburbs along ECR and OMR of Chennai	2.0	Indian Restaurant	Seafood Restaurant	Café	Hotel	Resort	Restaurant	Surf Spot	Beach	Bar	Yoga Studio

127 rows × 13 columns

Figure 14: Cluster 3.

	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 Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
8	Annanur	West Chennai	3.0	Platform	Train Station	Medical Supply Store	Stationery Store	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
22	Ennore	North Chennai	3.0	Train Station	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
68	Minjur	North Chennai	3.0	Train Station	Scenic Lookout	Park	Yoga Studio	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
131	Thirunindravur	West Chennai	3.0	Train Station	Pharmacy	Yoga Studio	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
154	Athipattu	Northern Suburbs of Chennai	3.0	Train Station	Platform	Yoga Studio	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
156	Minjur	Northern Suburbs of Chennai	3.0	Train Station	Scenic Lookout	Park	Yoga Studio	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service
158	Ennore	Northern Suburbs of Chennai	3.0	Train Station	Yoga Studio	Flower Shop	Gaming Cafe	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court
161	Thirunindravur	Western Suburbs of Chennai	3.0	Train Station	Pharmacy	Yoga Studio	Flea Market	Furniture / Home Store	Fruit & Vegetable Store	Fried Chicken Joint	Food Truck	Food Service	Food Court

Figure 15: Cluster 4.

Based on the clusters shown above, the neighborhoods can once again be plotted on a map of Chennai, however, this time with different color markers to distinguish between different clusters. This is shown in Figure 17.

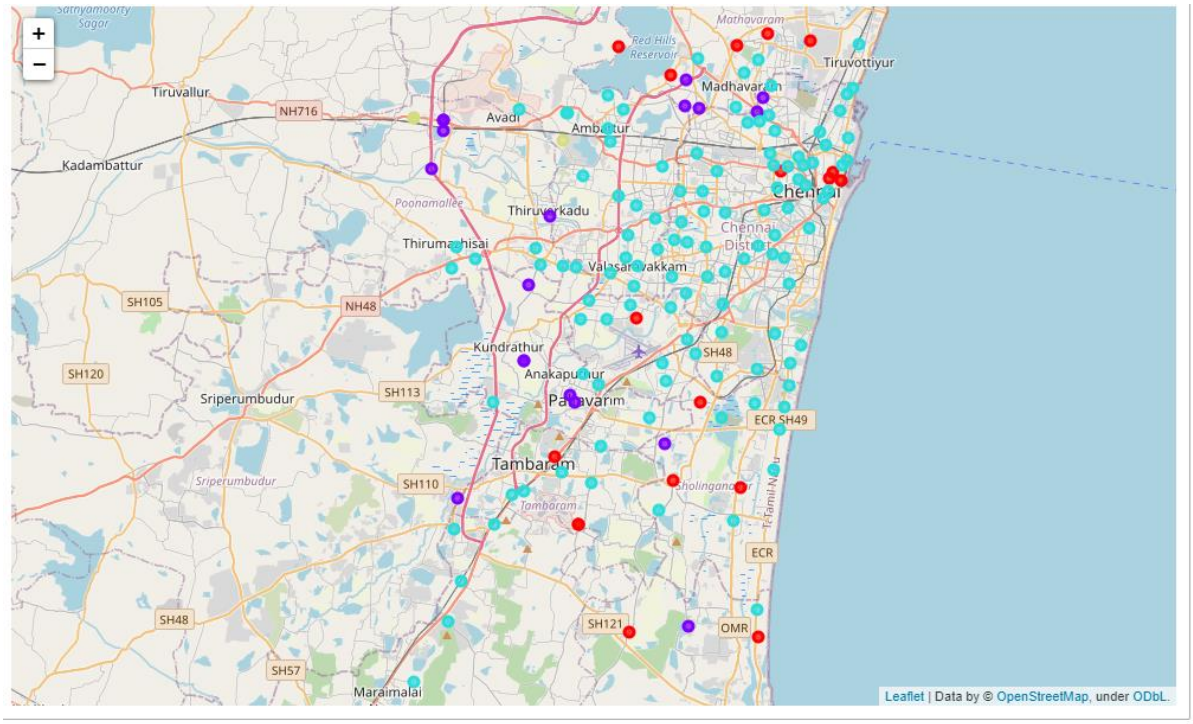

Figure 17: Visualizing the clustering of neighborhoods in Chennai.

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. This neighborhood can be further plotted on a map as shown below in Figure 18.

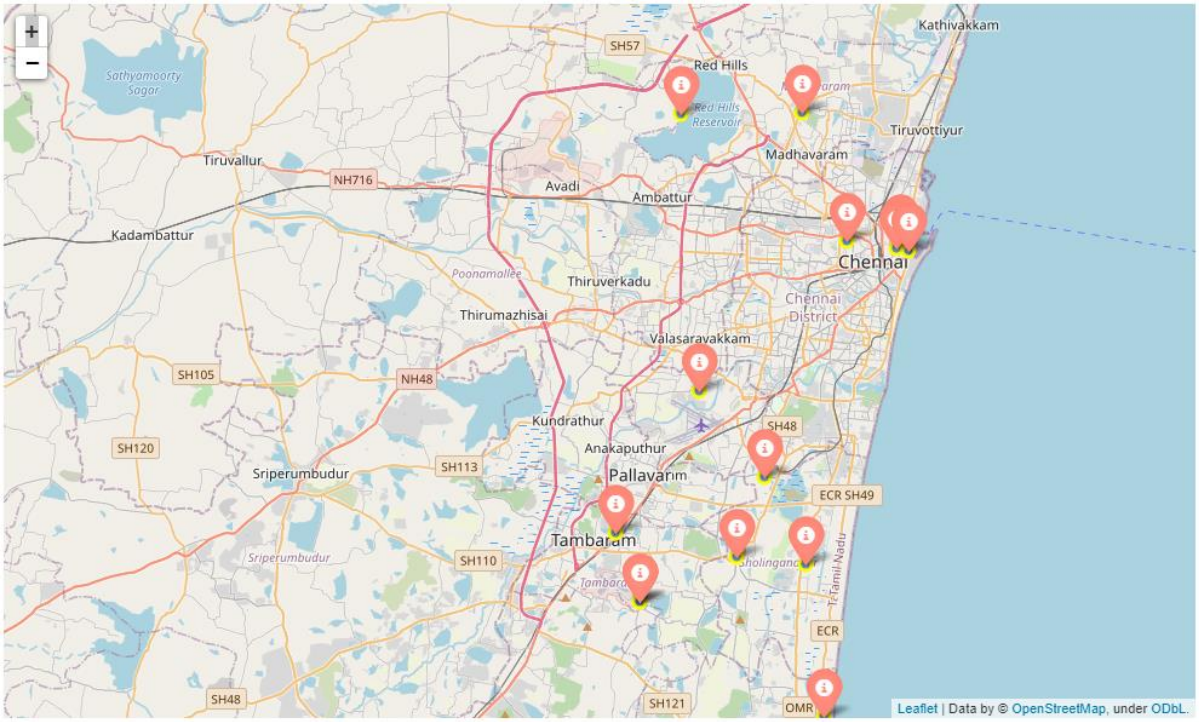

Figure 18: Neighborhoods most suited for starting a new restaurant.

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. This has also been plotted in the map in Figure 18.

Final Comments

1. Broadway
2. Kadaperi
3. Kosapet
4. Madipakkam
5. manapakkam
6. Manjambakkam
7. Medavakkam
8. Parry's Corner
9. Sowcarpet
10. Kancheepuram
11. Chengalpattu
12. Tiruvallur
13. Karapakkam
14. Muthukadu

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

Github link :

https://github.com/yankarto/Coursera_Capstone/blob/main/final_project_week5/Neighborhoods%20in%20Chennai%20to%20Open%20a%20Restaurant.ipynb

IBM Cloud link : its better for MAP viewing

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/fe94db64-64d3-4154-8862-a39fd77dd718/view?access_token=50c7269f87cd7c18f0117087493b8b74d50dfc22fd353e4c70a207604215682b