Restaurant Trends in New York City

I. Introduction

New York is known for its diverse culture which is also evident in the different cuisines influenced by the culturally rich history. It is generally said, '***You could eat outside every single day in New York and still wouldn't have covered all the restaurants.***' This statement in itself is self explanatory how tough the competition in the market is and how it can be difficult to choose a location with good return on investments.

This report aims to give some insights on the cuisines available in different neighborhoods in New York; which cuisines are preferred and popular among customers. This will help to extract information and strategically target the market with the optimal location.

A.Target audience

This report with the information about different cuisines spread out over neighborhoods, would interest anyone who wants to open a restaurant in New York. This report could also be interesting for tourists and locals to refer to when selecting restaurants for eating out.

II. Data

This report will be focusing on New York City neighborhoods data which is available at: https://geo.nyu.edu/catalog/nyu_2451_34572

The data will be cleaned so that in the end we have a data frame consisting of Borough, Neighborhoods, Latitude, and Longitude.

	Borough	Neighborhood	Latitude	Longitude
0	Bronx	Wakefield	40.894705	-73.847201
1	Bronx	Co-op City	40.874294	-73.829939
2	Bronx	Eastchester	40.887556	-73.827806
3	Bronx	Fieldston	40.895437	-73.905643
4	Bronx	Riverdale	40.890834	-73.912585

To get an insight on different cuisines spread out over neighborhoods in New York, data will be extracted from the following Wikipedia page:
https://en.wikipedia.org/wiki/Cuisine_of_New_York_City

A .csv file will be manually created consisting of neighborhoods and cuisines. The data is cleaned into a data frame as below:

	Borough	Neighborhood	Cuisine
0	Bronx	Bedford Park	Mexican, Peurto Rican, Dominican, Korean
1	Bronx	Belmont	Italian, Albanian
2	Bronx	City Island	Italian, Seafood
3	Bronx	Morris Park	Italian, Albanian
4	Bronx	Norwood	Filipino

Based on the information the following cuisines are common in following Boroughs:

i. **Bronx**

ii. **Manhattan**

iii. **Queens**

iv. The Staten Island

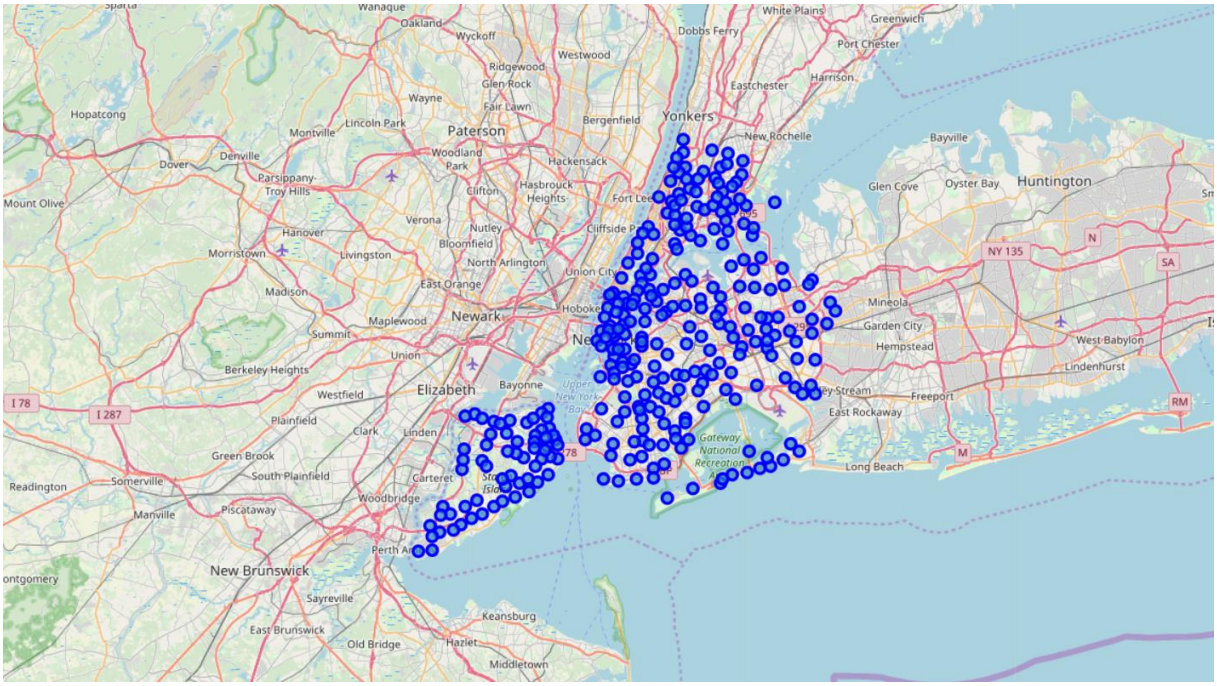
v. Brooklyn

Then foursquare API commands will be executed to gain further insights on venues in the neighborhoods and their ratings and cluster them together.

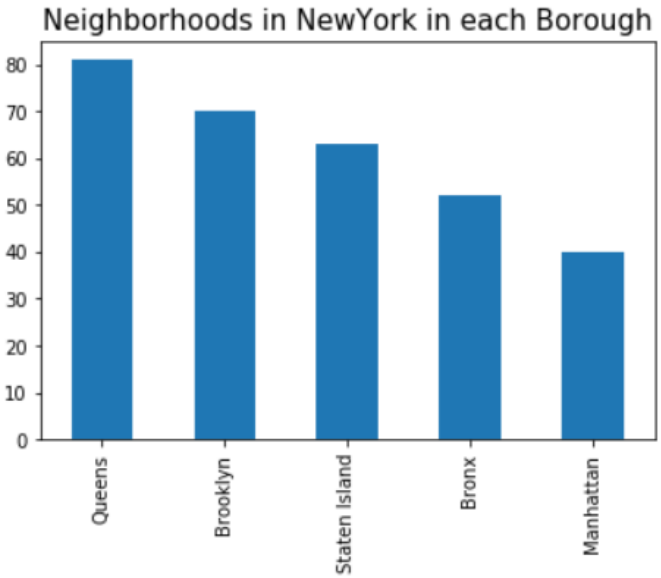
III. Methodology

Firstly all the Neighborhoods in New York City are identified.

The Neighborhoods in New York City are further visualized with a Folium map :



The bar graph below shows how the neighborhoods are spread across Boroughs:



Once the latitudes, longitudes are known for all the neighborhoods, FourSquare API commands are utilized to gather further information on venues nearby. The following functions are utilized:

1. Foursquare API '**explore'** command

`GET https://api.foursquare.com/v2/venues/explore` is used to gain insights into nearby venue based on latitude and longitude, a RADIUS of 500 meters is defined for the search with a LIMIT of 100 venues. The explore command returns information about the venue such as venue name, venue ID, venue latitude, venue longitude and venue category.

2. Further using '**Venue_ID**' returned by the Foursquare API command '**explore**', another Foursquare API command '**venues'**

`GET https://api.foursquare.com/v2/venues/VENUE_ID` is used to gain insights into details about a venue such as category, rating and likes.

IV. Results

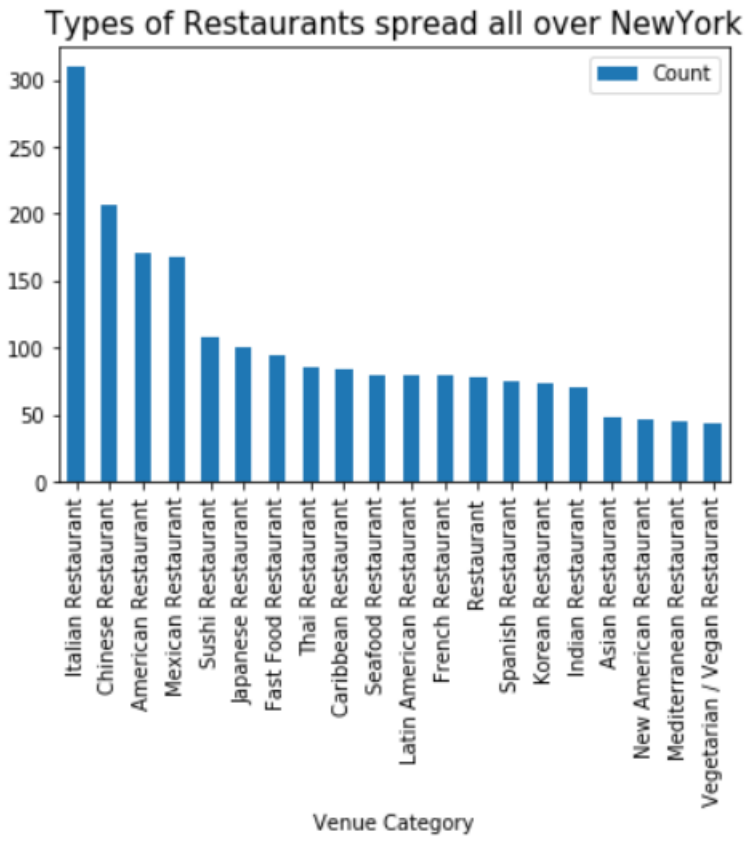
Utilizing the Methodology described above 100 venues are gathered for all neighborhoods within a 500 meter radius using the FourSquare API command.

Below is a chunk of response data frame merged with Borough and Neighborhood details.

Borough	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue ID	Venue Category
Manhattan	Inwood	40.867684	-73.92121	Skyline Bar Lounge	40.863597	-73.919409	4f32446e19836c91c7c6c4bf	Lounge
Manhattan	Inwood	40.867684	-73.92121	Maracas Steak House	40.864325	-73.923627	4e4cd289bd413c4cc66c70ae	Steakhouse
Manhattan	Inwood	40.867684	-73.92121	El Mundo	40.864122	-73.923074	4f36e71be4b00af1796fac7a	Department Store
Manhattan	Inwood	40.867684	-73.92121	MTA MaBSTOA Bus Bx12 / +SBS at 207th Street / ...	40.864195	-73.918171	4d407236eeef88bf30be0b47	Bus Station
Manhattan	Inwood	40.867684	-73.92121	Super Associated Marketplace	40.863875	-73.918067	58103e8738fa8a34203b7c52	Grocery Store

Using the data frame obtained above containing all venues, restaurants spread over New York City are categorized as:

Venue Category	Count
Italian Restaurant	310
Chinese Restaurant	207
American Restaurant	170
Mexican Restaurant	168
Sushi Restaurant	108
Japanese Restaurant	101
Thai Restaurant	85
Caribbean Restaurant	84
Seafood Restaurant	79
Latin American Restaurant	79
French Restaurant	79
Spanish Restaurant	75
Korean Restaurant	73
Indian Restaurant	70
Asian Restaurant	48
New American Restaurant	46
Mediterranean Restaurant	45



As can be seen in the bar graph, Italian Restaurants are most common all over New York, followed by Chinese restaurants and so on.

As an example I work with gathering further insights into Italian and Indian Restaurants. **Similar techniques can be utilized to study the trends for other restaurants.**

The "**Venue Category**" in the data frame above is further used to determine the common restaurants per Borough. Gathering further detailed information on Italian Restaurants within New York City returns:

```
italian_restaurants=ny_venues[ny_venues['Venue Category'].str.contains('Italian Restaurant')]

print("The number of Italian restaurants all over New York are :",italian_restaurants.shape)
```

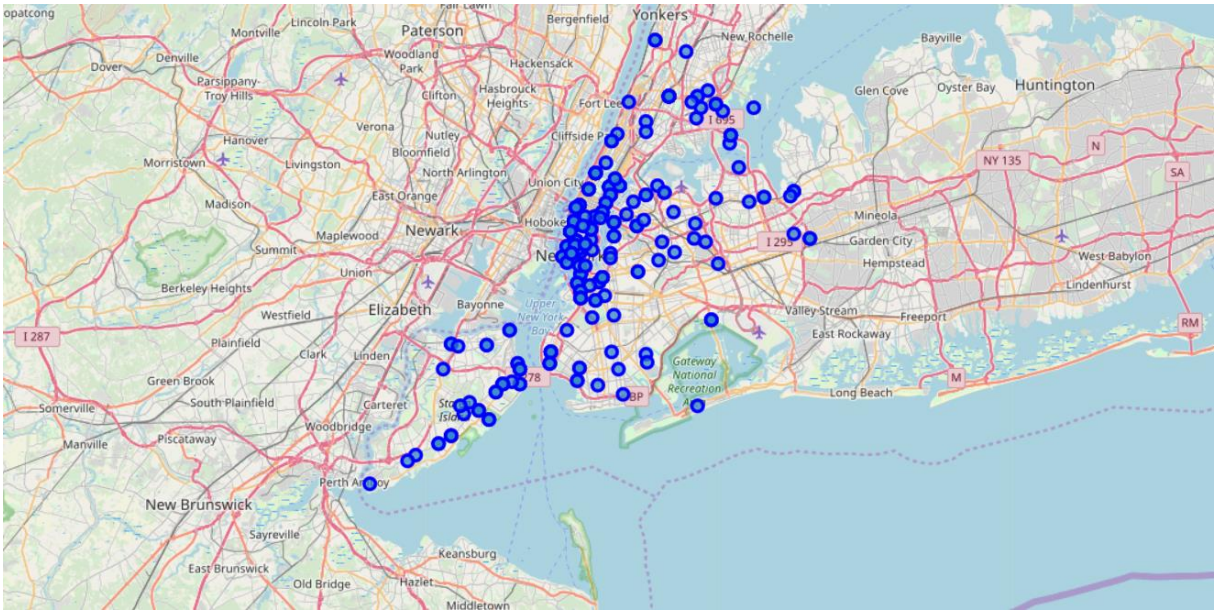
```
The number of Italian restaurants all over New York are : (309, 8)
```

```
italian_restaurants.head()
```

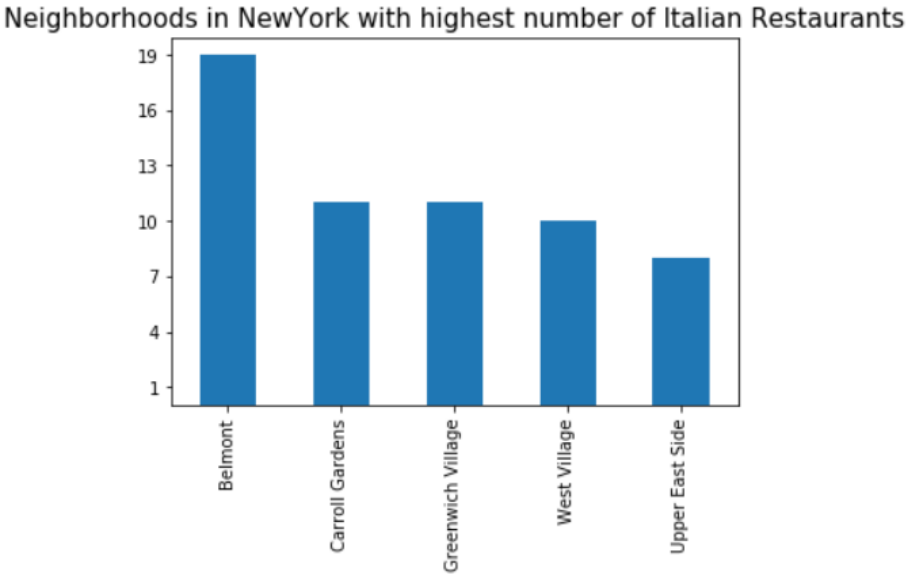
Borough	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Bronx	Woodlawn	40.898273	-73.867315	Patrizia's Of Woodlawn	40.900638	-73.867724	Italian Restaurant
Bronx	Pelham Parkway	40.857413	-73.854756	Enzo's	40.854232	-73.854362	Italian Restaurant
Bronx	Pelham Parkway	40.857413	-73.854756	Pasta Pasta	40.854788	-73.854929	Italian Restaurant
Bronx	City Island	40.847247	-73.786488	Artie's Steak and Seafood	40.849542	-73.787317	Italian Restaurant
Bronx	Throgs Neck	40.815109	-73.816350	Tosca Marquee	40.819222	-73.817601	Italian Restaurant

Dividing Italian Restaurants per Borough shows (image below) that Manhattan has the maximum Italian restaurants (120), with Brooklyn coming in second with 60 Italian Restaurants, and the remaining three Boroughs (Staten Island, Bronx, Queens) comprising of 40 Italian restaurants each:

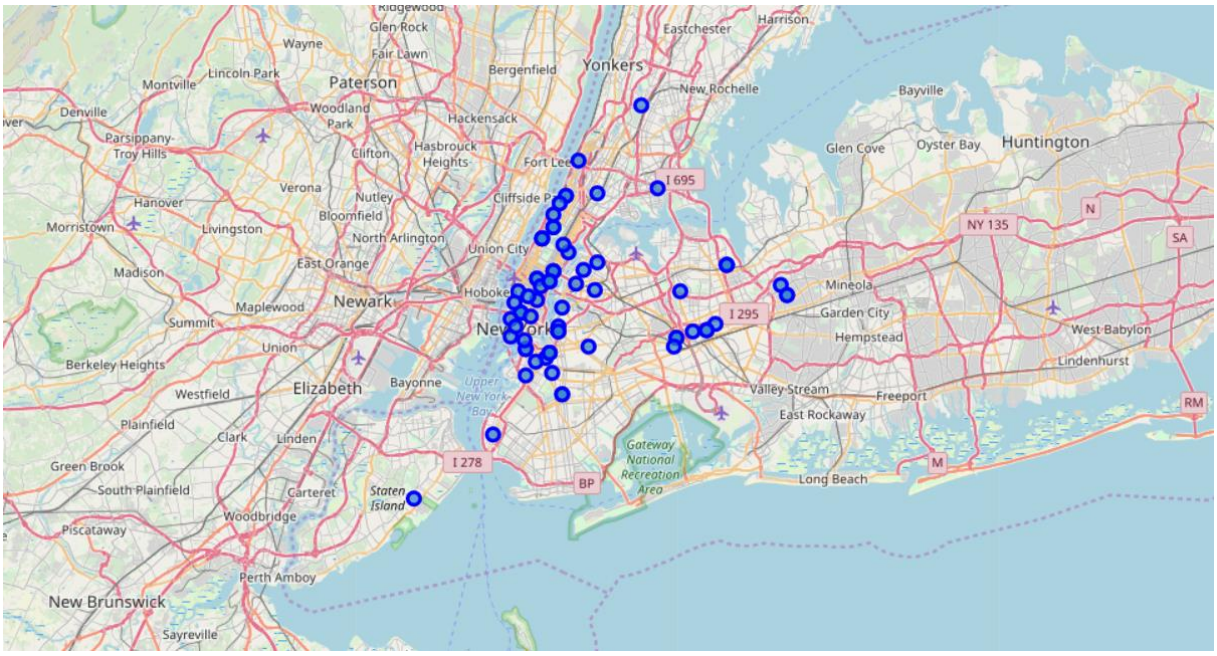
The Map below shows Italian Restaurants spread over New York

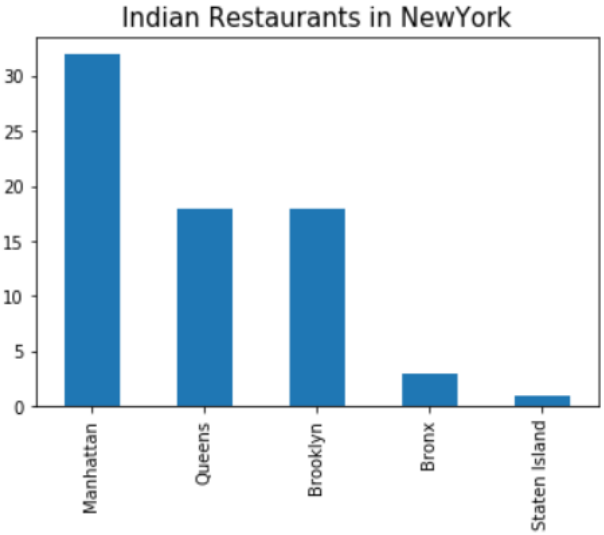


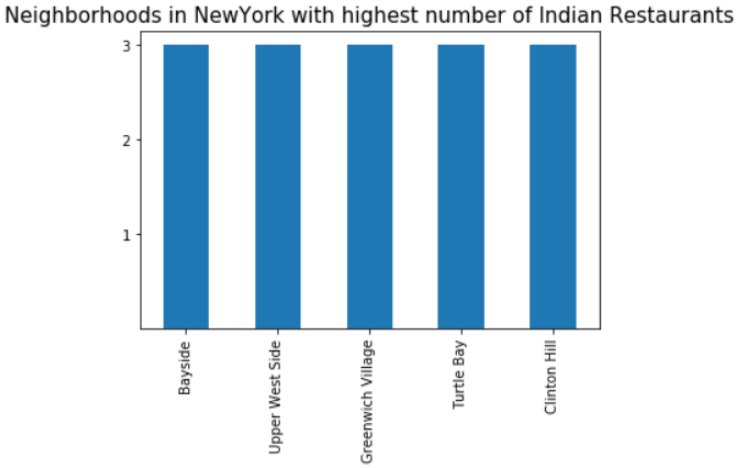
One interesting observation was made whilst categorizing Italian Restaurants per Neighborhood; **Belmont neighborhood in Bronx** has the highest number of Italian Restaurants (a staggering 19!) even though Italian restaurants are maximum spread out over the Borough Manhattan.



Following the same approach as described above; insights were gathered into Indian Restaurants spread over New York City. The Map below shows how the restaurants are spread out:



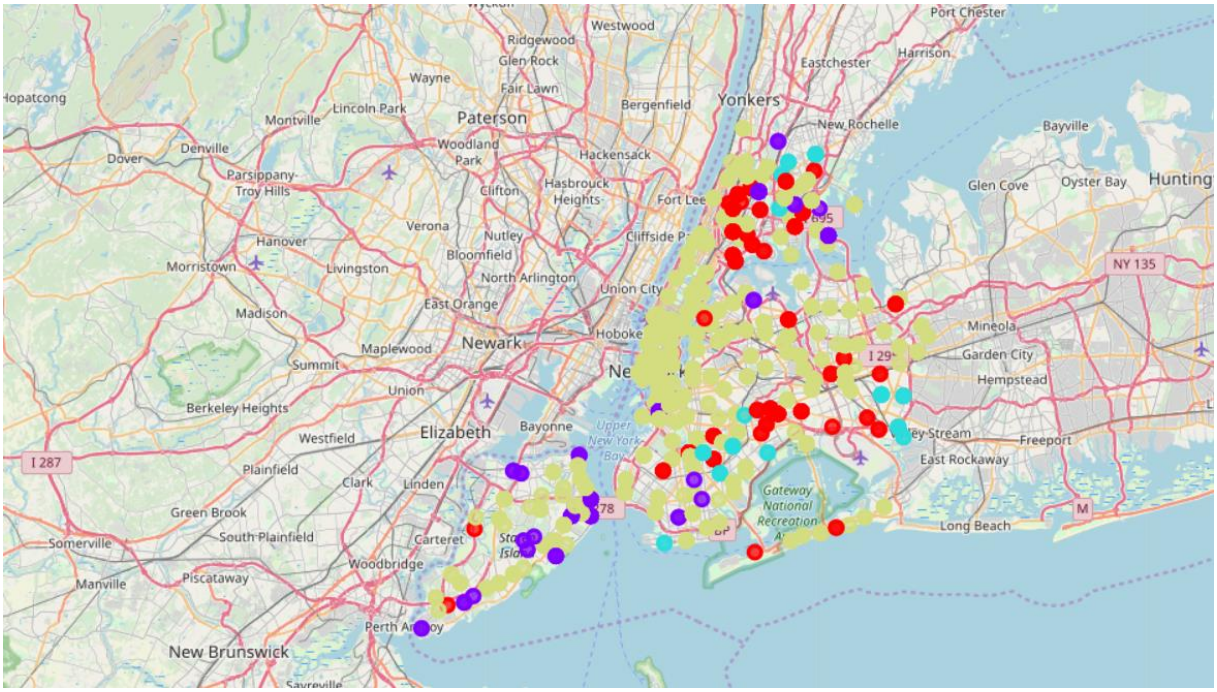




Neighborhoods are further explored to determine the top 10 restaurants in each neighborhood. The dataframe below gives insights into favored restaurants:

	Neighborhood	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
0	Allerton	Fast Food Restaurant	Chinese Restaurant	Spanish Restaurant	Vietnamese Restaurant	Egyptian Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Filipino Restaurant	French Restaurant
1	Annadale	American Restaurant	Sushi Restaurant	Restaurant	Italian Restaurant	Gluten-free Restaurant	Empanada Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant
2	Arrochar	Italian Restaurant	Polish Restaurant	Mediterranean Restaurant	Middle Eastern Restaurant	Vietnamese Restaurant	Greek Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant
3	Arverne	Thai Restaurant	Vietnamese Restaurant	Halal Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant	German Restaurant
4	Astoria	Greek Restaurant	Middle Eastern Restaurant	Seafood Restaurant	Mediterranean Restaurant	Latin American Restaurant	Italian Restaurant	Chinese Restaurant	Japanese Restaurant	Cajun / Creole Restaurant	Comfort Food Restaurant
5	Astoria Heights	Italian Restaurant	Vietnamese Restaurant	Greek Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant	German Restaurant
6	Auburndale	Korean Restaurant	American Restaurant	Italian Restaurant	Fast Food Restaurant	Vietnamese Restaurant	Halal Restaurant	Ethiopian Restaurant	Falafel Restaurant	Filipino Restaurant	French Restaurant
7	Bath Beach	Chinese Restaurant	Italian Restaurant	Fast Food Restaurant	Kebab Restaurant	Sushi Restaurant	Restaurant	Dim Sum Restaurant	German Restaurant	Cantonese Restaurant	Peruvian Restaurant
8	Battery Park City	Italian Restaurant	Sushi Restaurant	American Restaurant	Mediterranean Restaurant	Mexican Restaurant	Chinese Restaurant	Greek Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant
9	Bay Ridge	Italian Restaurant	American Restaurant	Greek Restaurant	Thai Restaurant	Chinese Restaurant	Sushi Restaurant	Mediterranean Restaurant	Vietnamese Restaurant	Middle Eastern Restaurant	Fast Food Restaurant
10	Bay Terrace	American Restaurant	Sushi Restaurant	Gluten-free Restaurant	Halal Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant

Furthermore neighborhoods are clustered according to restaurants:



These Clusters are examined in greater detail in the Code provided. An insight into one of the Clusters:

Cluster 2

```
In [44]: ny_merged.loc[ny_merged['Cluster Labels'] == 1, ny_merged.columns[[1] + list(range(5, ny_merged.shape[1]))]]
```

8906	Astoria Heights	40.768154	-73.894684	4f048814f9ab88b0c268dda3	Italian Restaurant	1	Italian Restaurant	Vietnamese Restaurant	Greek Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant
8913	Astoria Heights	40.768131	-73.894699	5784545038fa06b8a2b110a4	Italian Restaurant	1	Italian Restaurant	Vietnamese Restaurant	Greek Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant
9836	Egbertville	40.575515	-74.127905	4c27cc8f3492a593cb72b628	Italian Restaurant	1	Italian Restaurant	Vietnamese Restaurant	Greek Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant
9908	Prince's Bay	40.525783	-74.201752	4f5149a01081d6d007f00851	Sushi Restaurant	1	Sushi Restaurant	Italian Restaurant	Vietnamese Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant
9911	Prince's Bay	40.525838	-74.201117	4c091311a1b32d7f5efb96f0	Italian Restaurant	1	Sushi Restaurant	Italian Restaurant	Vietnamese Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant
9915	Lighthouse Hill	40.573267	-74.136584	5079ccdce4b065f1dd8155ad	Italian Restaurant	1	Italian Restaurant	Vietnamese Restaurant	Greek Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant
9948	Madison	40.607520	-73.943044	42508380f964a520c1201fe3	Italian Restaurant	1	Italian Restaurant	Vietnamese Restaurant	Greek Restaurant	English Restaurant	Ethiopian Restaurant	Falafel Restaurant	Fast Food Restaurant	Filipino Restaurant	French Restaurant

102 rows × 16 columns

V. Conclusion

In my analysis above I have focused primarily on Italian and Indian Restaurants. However, similar techniques could be used to gather insights into any restaurant types. Knowing the competition in the neighborhood is a good starter to determine returns on investments.

For example, in the analysis above it was observed that Manhattan has the maximum Italian Restaurants, therefore competition would be tough there. Queens and Bronx have good ratings for Italian restaurants, so much so that a neighborhood in Bronx has the highest number of Italian Restaurants all over New York. Since Queens and Bronx have relatively much less Italian restaurants compared to Manhattan, these neighborhoods would be good in terms of competition in the market and appeal of Italian restaurants.

Indian Restaurants are not as widely spread out in New York when one compares to Italian restaurants. Manhattan has a very good Indian restaurants market however, Queens also has good ratings when it comes to Indian restaurants and the Indian restaurants are not as widely spread out as compared to Manhattan. Based on this information I would expect Queens to be a good candidate for a new Indian Restaurant.

VI. Future Work

It would be interesting here to incorporate demographics of New York City to determine if that is related to a restaurants' popularity in the neighborhood. Another interesting aspect would be take into consideration the number of customers a restaurant serves on a business day; this would give and even deeper understanding into the restaurant trends compared to ratings. Also, since many customers home deliver their food that would also have an interesting impact when determining popularity of a restaurant in a neighborhood.