The Battle of Neighborhoods – Report

1. Introduction & Business Problem :

Problem background:

New York City is the most diverse and populous city in the United States. It is, in the eyes of many, the most attractive urban Centre in America. This City is very well known for its diverse, religiously varied, commercially driven and famously congested streets. As example, Wall Street means finance, Broadway is synonymous with theatre, Fifth Avenue is automatically paired with shopping, Madison Avenue means the advertising industry, Greenwich Village connotes bohemian lifestyles, Seventh Avenue signifies fashion, Tammany Hall defines machine politics, and Harlem evokes images of the Jazz Age, African American aspirations, and slums, etc…

For the past two centuries, New York has been the largest and wealthiest American city. More than half the people and goods that ever entered the United States came through its port, and that stream of commerce has made change a constant presence in city life. As a matter of fact, the City of New York offers many business opportunities on its markets and somehow they are highly competitive. With this being said, any new business idea must be strictly analyzed before venturing on this business environment.

Problem description:

In this paper we are trying to determine the best locations to start a new restaurant in the City of New York. For instance, we have a company named *"La belle bouche Ltd."* That is trying to open a new restaurant in New York and we will provide the best location to do it.

The City of New York is famous for its excellent cuisine. Its food culture includes an array of international cuisines influenced by the city's immigrant history.

1. Central and Eastern European immigrants, especially Jewish immigrants - bagels, cheesecake, hot dogs, knishes, and delicatessens
2. Italian immigrants - New York-style pizza and Italian cuisine
3. Jewish immigrants and Irish immigrants - pastrami and corned beef
4. Chinese and other Asian restaurants, sandwich joints, trattorias, diners, and coffeehouses are ubiquitous throughout the city
5. Mobile food vendors - Some 4,000 licensed by the city
6. Middle Eastern foods such as falafel and kebabs examples of modern New York street food
7. Pizzerias and Cafe's

In order to decide on the best Location of the restaurant, many factors need to be taken into account such as:

1. New York City Demographics
2. Are there any Farmers Markets, Wholesale markets nearby so that the ingredients can be purchased fresh to maintain quality and cost?
3. Are there any venues like Gyms, Entertainment zones or Parks nearby where floating population is high?
4. Who are the competitors in that location?
5. Cuisine served / Menu of the competitors
6. Segmentation of the Borough
7. Untapped markets
8. Saturated markets

All these factors are very important for anyone considering to start a new restaurant in New York. As a matter of fact, each of these factors will impact the business directly or indirectly. One should take the time to carefully analyze every parameters or factors to take the best decision. This paper will be very useful to anyone who intends to start a new restaurant in the City of New York.

2. Data :

Data Requirements:

For this project, we will be utilizing the Foursquare API to pull the following location data on restaurants in New York City:

- Venue Name
- Venue ID
- Venue Location
- Venue Category
- Count of Likes

We will be using the below datasets for analyzing New York City

Data 1: Neighborhood has a total of 5 boroughs and 306 neighborhoods. In order to segment the neighborhoods and explore them, we will essentially need a dataset that contains the 5 boroughs and the neighborhoods that exist in each borough as well as the latitude and longitude coordinates of each neighborhood.

This dataset exists for free on the web. Link to the dataset is :
https://geo.nyu.edu/catalog/nyu_2451_34572

	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

Data 2: Second data which will be used is the DOHMH Farmers Markets and Food Boxes dataset. In this we will be using the data of Farmers Markets.

https://data.cityofnewyork.us/dataset/DOHMH-Farmers-Markets-and-Food-Boxes/8vwk-6iz2

https://www.grownyc.org/greenmarketco/foodbox

GrowNYC's Fresh Food Box Program is a food access initiative that enables under-served communities to purchase fresh, healthy, and primarily regionally grown produce well below traditional retail prices.

A farmers' market is often defined as a public site used by two or more local or regional producers for the direct sale of farm products to consumers. In addition to fresh fruits and vegetables, markets may sell dairy products, fish, meat, baked goods, and other minimally processed foods.

	FacilityName	Service Category	Service_Type	Address	Address 2	Borough	ZipCode	Latitude	Longitude	AdditionalInfo	StartDate	EndDate	Monday	Tuesday	Wednesday	Thursday
0	Inwood Park Greenmarket	Farmers Markets and Food Boxes	Farmers Markets	Isham St bet Seaman & Cooper	NaN	Manhattan	10034	40.869009	-73.920320	Open year-round	NaN	NaN	NaN	NaN	NaN	NaN
1	82nd Street Greenmarket	Farmers Markets and Food Boxes	Farmers Markets	82nd St bet 1st & York Aves	NaN	Manhattan	10028	40.773448	-73.948954	Open year-round	NaN	NaN	NaN	NaN	NaN	NaN
3	125th Street Farmers Market	Farmers Markets and Food Boxes	Farmers Markets	125th St & Adam Clayton Powell Jr Blvd	NaN	Manhattan	10027	40.808981	-73.948327	Market open dates: 6/13/2017 to 11/21/2017	06/13/2017	11/21/2017	NaN	10am-7pm	NaN	NaN
4	170 Farm Stand	Farmers Markets and Food Boxes	Farmers Markets	170th St & Townsend Ave	NaN	Bronx	10452	40.840095	-73.916827	Market open dates: 7/5/2017 to 11/22/2017	07/05/2017	11/22/2017	NaN	NaN	2:30pm-6:30pm	NaN
5	175th Street Greenmarket	Farmers Markets and Food Boxes	Farmers Markets	175th St bet Wadsworth Ave & Broadway	NaN	Manhattan	10033	40.845956	-73.937813	Market open dates: 6/29/2017 to 11/30/2017	06/29/2017	11/30/2017	NaN	NaN	NaN	8am-5pm

Data 3: For the below analysis we will get data from Wikipedia as given below:

a. New York Population
b. New York City Demographics 3.
   Cuisine of New York city

https://en.wikipedia.org/wiki/New_York_City
https://en.wikipedia.org/wiki/Economy_of_New_York_City
https://en.wikipedia.org/wiki/Portal:New_York_City
https://en.wikipedia.org/wiki/Cuisine_of_New_York_City

Data 4: New York City geographical coordinates data will be utilized as input for the Foursquare API, which will be leveraged to provision venues information for each neighborhood. We will use the Foursquare API to explore neighborhoods in New York City. The below is image of the Foursquare API data.

	Neighborhood	NeighborhoodLatitude	NeighborhoodLongitude	Venue	VenueLatitude	VenueLongitude	VenueCategory
0	Marble Hill	40.876551	-73.91066	Arturo's	40.874412	-73.910271	Pizza Place
1	Marble Hill	40.876551	-73.91066	Bikram Yoga	40.876844	-73.906204	Yoga Studio
2	Marble Hill	40.876551	-73.91066	Tibbett Diner	40.880404	-73.908937	Diner
3	Marble Hill	40.876551	-73.91066	Sam's Pizza	40.879435	-73.905859	Pizza Place
4	Marble Hill	40.876551	-73.91066	Loeser's Delicatessen	40.879242	-73.905471	Sandwich Place

3. Methodology :

Business Understanding:

Our main goal is to get optimum location for new restaurant business in New York City for XYZ Company.

Analytic Approach:

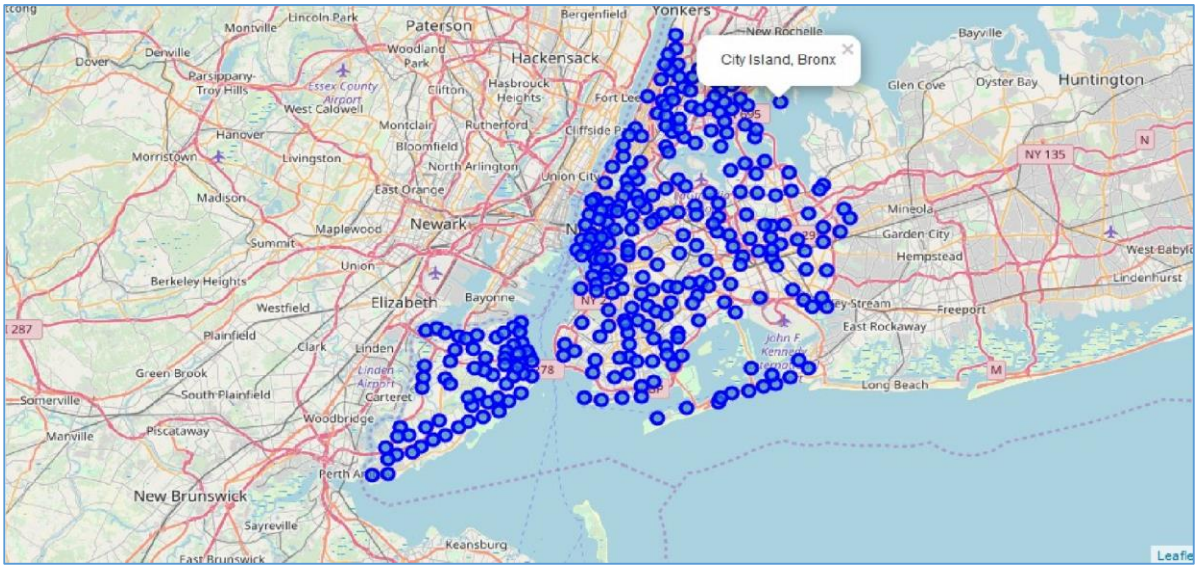
New York City neighborhood has a total of 5 boroughs and 306 neighborhoods. In this project first part is clustering of Manhattan and Brooklyn. And second part is clustering of Bronx, Queens and Staten Island. This is done because of the following exploratory data analysis.

Exploratory Data Analysis:

Data 1- New York City Geographical Coordinates Data.

1. In this we load the data and explore data from newyork_data.json file.
2. Transform the data of nested python dictionaries into a pandas dataframe.
3. This dataframe contains the geographical coordinates of New York City neighborhoods.
4. This data will used to get Venues data from Foursquare.
5. We used geopy and folium libraries to create a map of New York City with neighborhoods superimposed on top.

New York neighborhood visualization

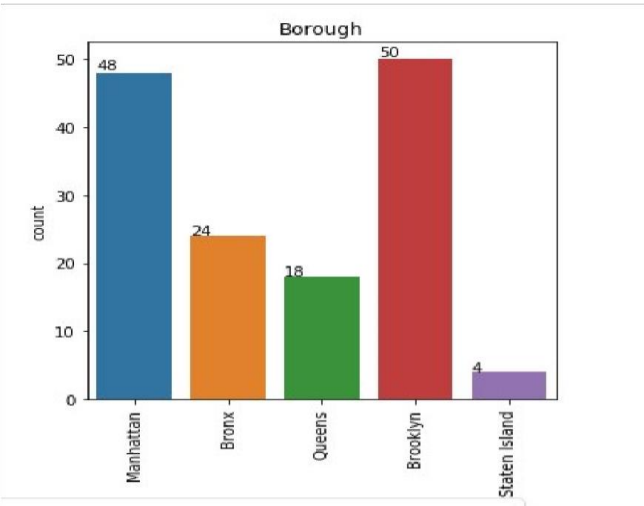


Data 2- Second data which is used is the DOHMH Farmers Markets and Food Boxes dataset. In this we will be using the data of Farmers Markets data.

There are totally 144 Farmers Markets in New York City. Highest number are in Manhattan and Brooklyn.

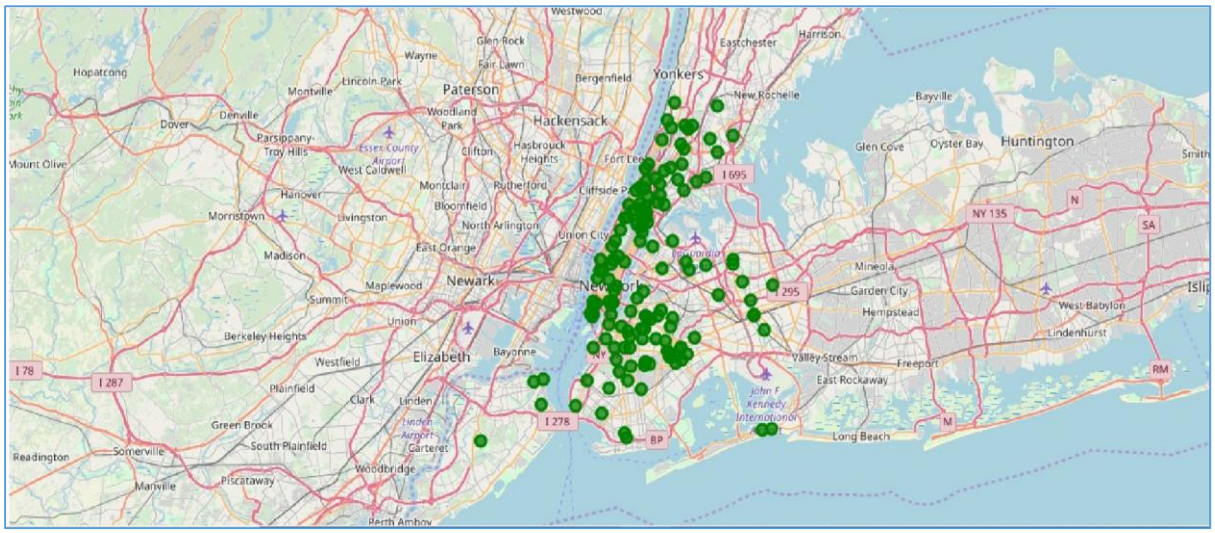
And lowest in Queens, Bronx and Staten Island.

The proof of this is as given below.



We used geopy and folium libraries to create a map to visualize farmers markets of New York city.

Farmers Market visualization - New York City



Data 3 : To analyze New York city Population, Demographics and Cuisine , scrapped the data from Wikipedia pages given above in the data section. We used Beautiful Soup python library. Beautiful Soup is a Python package for parsing HTML and XML documents (including having malformed markup, i.e. non-closed tags, so named after tag soup). It creates a parse tree for parsed pages that can be used to extract data from HTML, which is useful for web scraping

1) New York Population : Insights from the data :

- Manhattan (New York County) is the geographically smallest and most densely populated borough.
- Manhattan's (New York County's) population density of 72,033 people per square mile (27,812/km²) in 2015 makes it the highest of any county in the United States and higher than the density of any individual American city.
- Brooklyn (Kings County), on the western tip of Long Island, is the city's most populous borough.
- Queens (Queens County), on Long Island north and east of Brooklyn, is geographically the largest borough.

	Borough	County	Estimate_2017	square_miles	square_km	persons_sq_mi	persons_sq_km
0	Manhattan	New York	1,664,727	22.83	59.13	72,033	27,826
1	The Bronx	Bronx	1,471,160	42.10	109.04	34,653	13,231
2	Brooklyn	Kings	2,648,771	70.82	183.42	37,137	14,649
3	Queens	Queens	2,358,582	108.53	281.09	21,460	8,354
4	Staten Island	Richmond	479,458	58.37	151.18	8,112	3,132
5		City of New York	8,622,698	302.64	783.83	28,188	10,947
6		State of New York	19,849,399	47,214	122,284	416.4	159

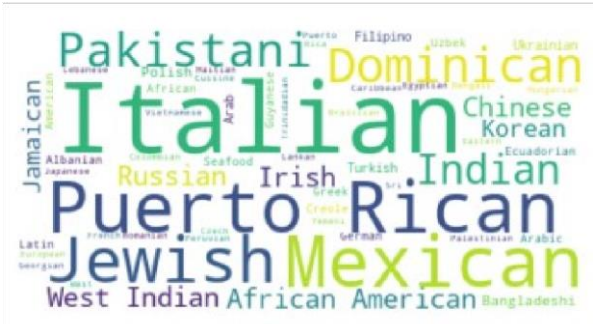
New York City Demographics: New York City is the most populous city in the United States with an estimated record high of 8,622,698 residents as of 2017 incorporating more immigration into the city than outmigration since the 2010 United States Census.

The racial composition is as given below. This is the reason New York City has restaurants serving cuisine from many countries such as Indian, African, Japan etc. This also increases the scope for restaurants business in New York City.

	Racialcomposition	2010	1990	1970	1940
0	White	44.0%	52.3%	76.6%	93.6%
1	—Non-Hispanic	33.3%	43.2%	62.9%	92.0%
2	Black or African American	25.5%	28.7%	21.1%	6.1%
3	Hispanic or Latino (of any race)	28.6%	24.4%	16.2%	1.6%
4	Asian	12.7%	7.0%	1.2%	–

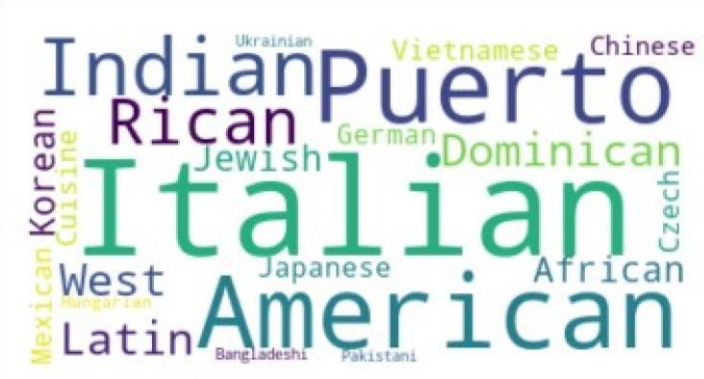
Cuisine of New York city: This data has been manually prepared. Data is taken from Wikipedia page - https://en.wikipedia.org/wiki/Cuisine_of_New_York_City . Using this data we did word cloud.

NEW YORK CITY CUISINE: Most Preferred Food in New York City –Italian, Puerto Rican, Mexican, Jewish, Indian, Pakistani & Dominican.

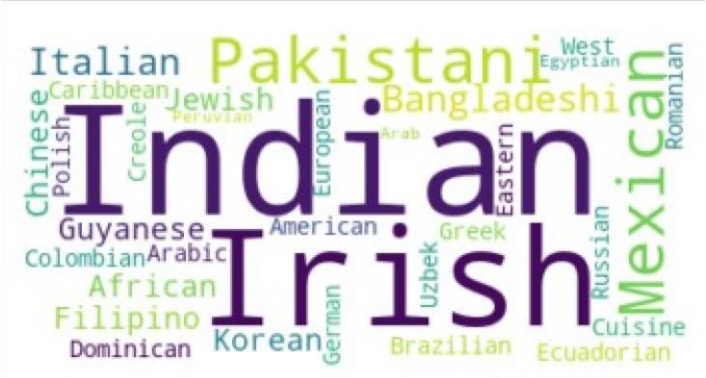


BROOKLYN CUISINE - Most Preferred Food in Brooklyn is Italian, Puerto Rican & Mexican

MANHATTAN CUISINE - Most Preferred Food in Manhattan is –Italian, American, Puerto Rican and Indian.



QUEENS CUISINE - Most Preferred Food in Queens is Indian, Irish, Pakistani and Mexican.



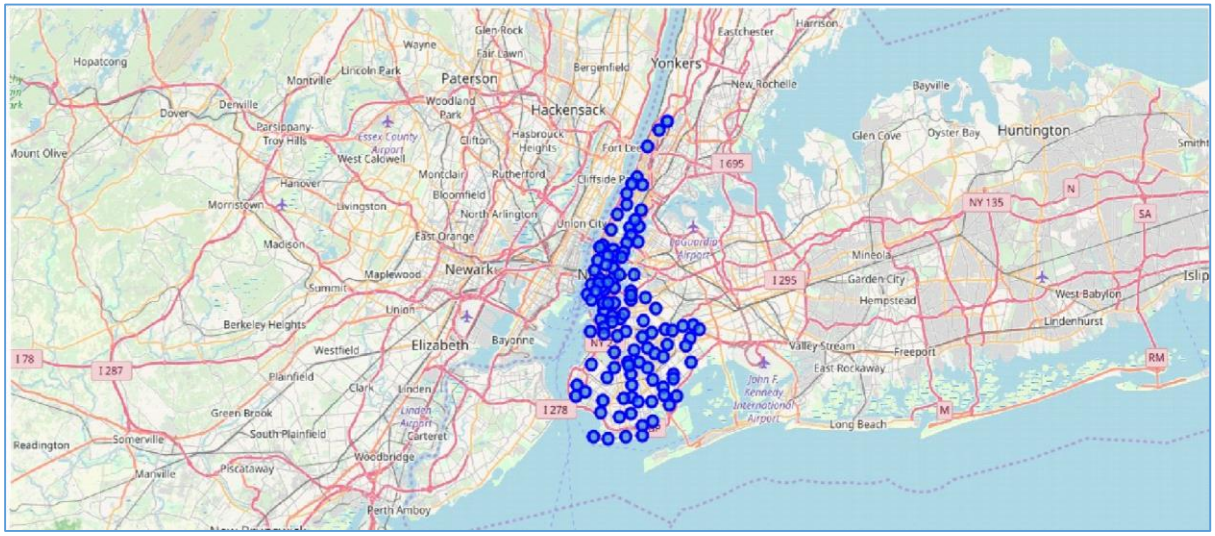
THE BRONX CUISINE - Most Preferred Food in The Bronx is Italian, Puerto Rican, Albanian and Dominican.

There is very less data of cuisine relating to Staten Island. So could not develop word cloud with it.

Data 4: New York City geographical coordinates data has to be utilized as input for the Foursquare API, which has been leveraged to provision venues information for each neighborhood. We used the Foursquare API data to explore neighborhoods in New York City.

Brooklyn and Manhattan

Brooklyn and Manhattan Visualization:



Using the geographical coordinates of each neighborhood foursquare API calls are made to get top 200 venues in a radius of 1000 meters. The venues data is as given below:

Brooklyn and Manhattan Venues:

	Neighborhood	NeighborhoodLatitude	NeighborhoodLongitude	Venue	VenueLatitude	VenueLongitude	VenueCategory
0	Marble Hill	40.876551	-73.91066	Arturo's	40.874412	-73.910271	Pizza Place
1	Marble Hill	40.876551	-73.91066	Bikram Yoga	40.876844	-73.906204	Yoga Studio
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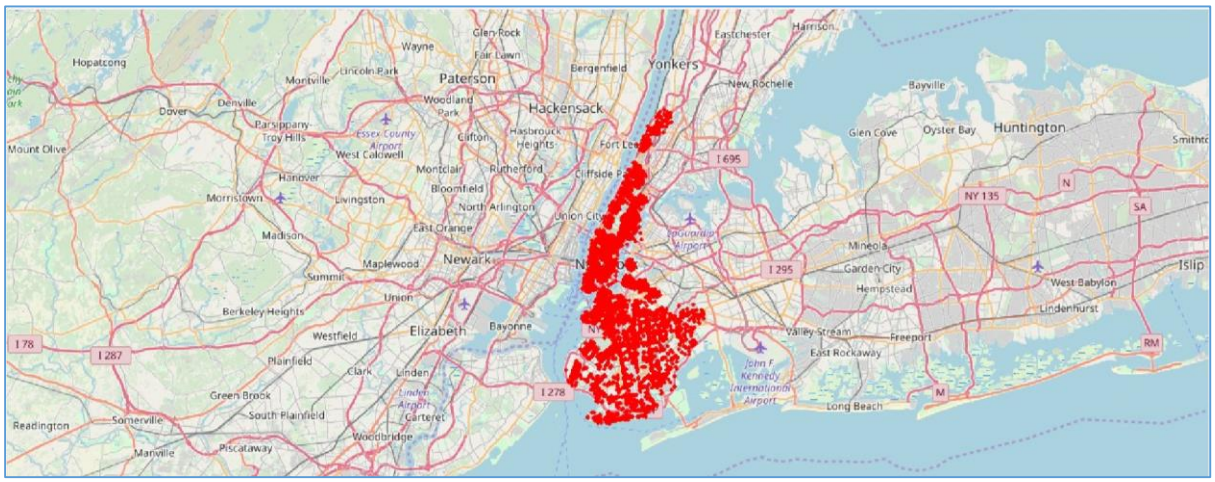
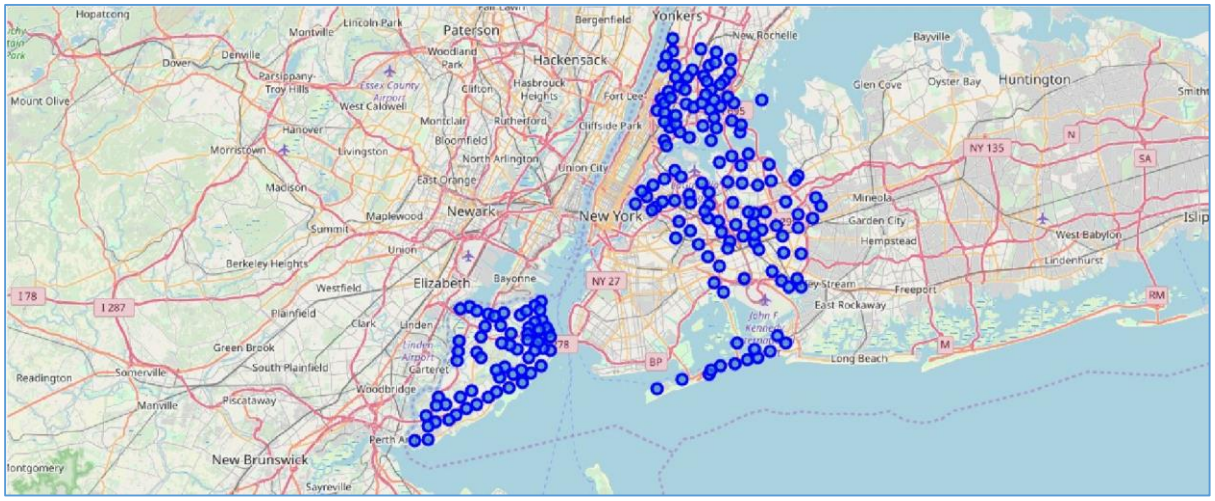
4	Marble Hill	40.876551	-73.91066	Loeser's Delicatessen	40.879242	-73.905471	Sandwich Place

Brooklyn and Manhattan Venues Visualization: Generated the below Brooklyn and Manhattan Venues Visualization. The "BM_venues" data frame has 9708 venues and 397 unique venue types.



Bronx, Queens and Staten Island

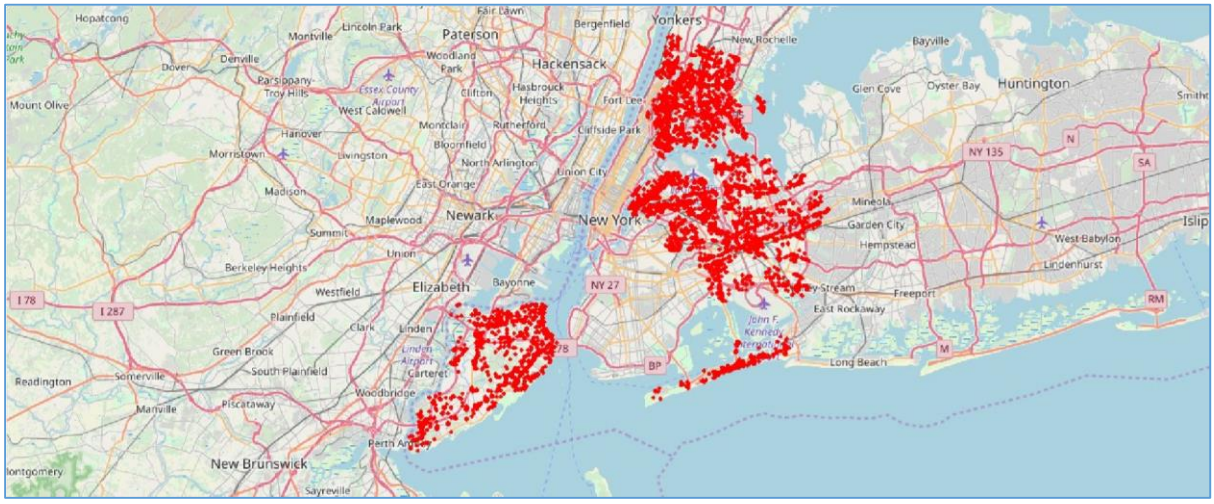
Bronx, Queens and Staten Island Neighborhoods Visualization:



Bronx, Queens and Staten Island Venues Visualization: The "BQS_venues" dataframe has 10805 venues and 387 unique venue types.

	Neighborhood	NeighborhoodLatitude	NeighborhoodLongitude	Venue	VenueLatitude	VenueLongitude	VenueCategory
0	Wakefield	40.894705	-73.847201	Lollipops Gelato	40.894123	-73.845892	Dessert Shop
1	Wakefield	40.894705	-73.847201	Ripe Kitchen & Bar	40.898152	-73.838875	Caribbean Restaurant
2	Wakefield	40.894705	-73.847201	Jackie's West Indian Bakery	40.889283	-73.843310	Caribbean Restaurant
3	Wakefield	40.894705	-73.847201	Ali's Roti Shop	40.894036	-73.856935	Caribbean Restaurant
4	Wakefield	40.894705	-73.847201	Rite Aid	40.896521	-73.844680	Pharmacy

Bronx, Queens and Staten Island Venues Map Visualization:



4. RESULTS :

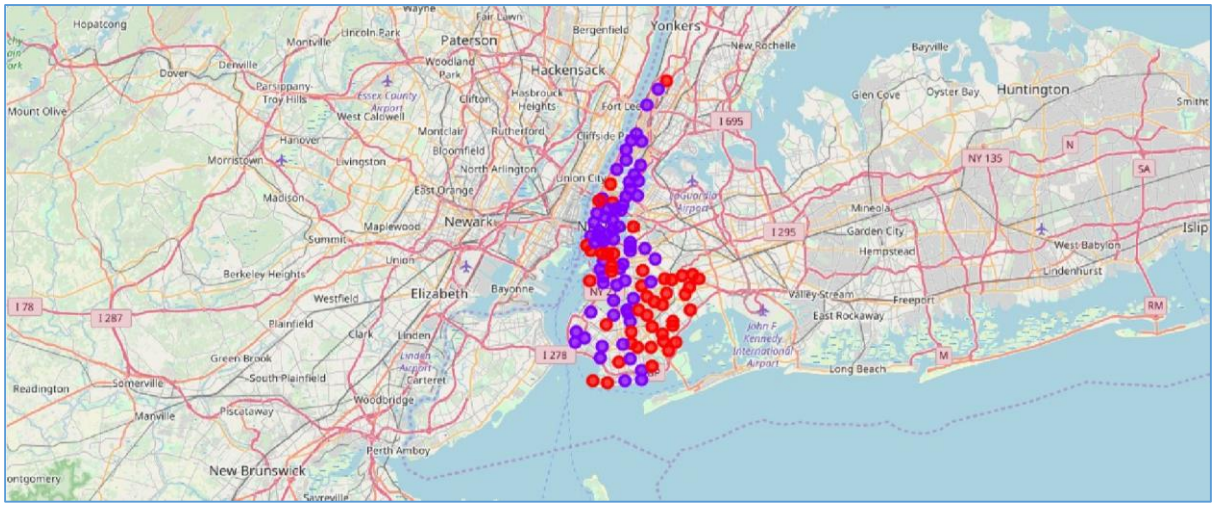
From this venues data we filtered and used only the restaurant data for Brooklyn & Manhattan clustering and Bronx, Queens and Staten Island clustering. As we focused only on restaurants business.

Neighborhood K-Means clustering based on mean occurrence of venue category:

To cluster the neighborhoods into two clusters we used the K-Means clustering Algorithm. K-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean. It uses iterative refinement approach.

Brooklyn & Manhattan:

In the below Map Visualization, we can see the different types of clusters created by using K-Means for Brooklyn & Manhattan.



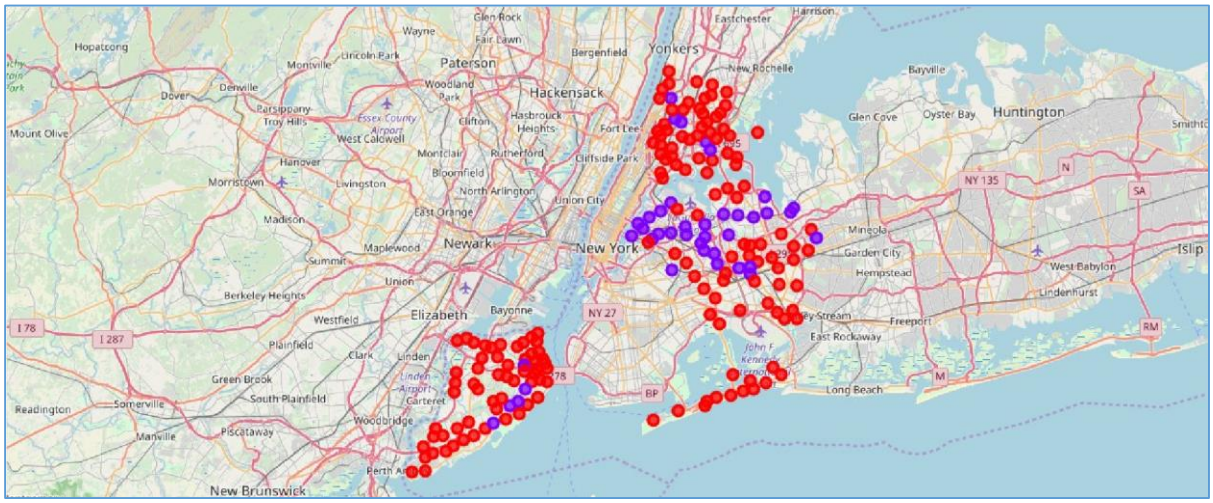
Cluster 0: The Total and Total Sum of cluster0 has smallest value. It shows that the market is not saturated.

Cluster 1: The Total and Total Sum of cluster1 has highest value. It shows that the markets are saturated. Number of restaurants are very high.

There are no untapped neighborhoods in Brooklyn and Manhattan.

Bronx, Queens and Staten Island:

In the below Map Visualization, we can see the different types of clusters created by using K-Means for Bronx, Queens and Staten Island.



Cluster 0: The Total and Total Sum of cluster0 has smallest value. It shows that the market is not saturated. There are untapped neighborhoods. List is as given below.

	Borough	Neighborhood	Latitude	Longitude	Total	Cluster_Labels
0	Staten Island	Todt Hill	40.597069	-74.111329	0	0
1	Staten Island	Port Ivory	40.639683	-74.174645	0	0
2	Staten Island	Bloomfield	40.605779	-74.187256	0	0

Cluster 1: The Total and Total Sum of cluster1 has highest value. It shows that the markets are saturated. Number of restaurants are very high.

5. Discussion:

From the analysis made we can state those facts as a matter of discussion:

1) There is scope to increase Farmers markets in Bronx, Queens and Staten Island.
2) There is scope to explore cuisines of various countries in Bronx, Queens and Staten Island.
3) In Manhattan and Brooklyn restaurants of cuisines of many countries are available. So if risk can be taken with great menu on board. It also shows people love eating cuisines of various countries.

6. Conclusion:

As we are facing a limited amount of data, if we get much more of data, there is scope to come up with better results.

If there are lot of restaurants probably there is lot of demand. Brooklyn and Manhattan has high concentration of restaurant business. It is a very competitive market. Bronx, Queens and Staten Island also has good number of restaurants but not as many as required. So this can be explored as a potential place for opening our new restaurant *"La belle bouche Ltd"*.

As per the neighborhood or restaurant type mentioned like Indian Restaurant analysis can be checked. A venue with lowest risk and competition can be identified.

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