The Battle of Neighborhoods Report

1. Introduction

1.1 Background

ABC Company located in Manhattan, New York is planning to host a company lunch for its employees to celebrate its success in landing a huge business contract. For this purpose, it wants to choose a restaurant offering Italian cuisine in Manhattan, New York that is known for excellent service and serving great food.

1.2 Problem

Find an Italian restaurant in Manhattan, New York with highest number of likes by customers so that its employees will really have an excellent dining experience and awesome food.

1.3 Interest

Anyone interested in finding any popular category of venue in any geographic location may be interested in this project by modifying search criteria.

2. Data

2.1 Data sources

Dataset containing geographical coordinates of New York neighborhoods is retrieved from scrapping web https://geo.nyu.edu/catalog/nyu_2451_34572. Transformed this data into Pandas dataframe and sliced it to contain only Manhattan borough of New York.

Used Foursquare API to get the venues using the search criteria 'Italian" for the Manhattan latitude and longitude and transformed it into Pandas dataframe. As the data returned by API also contained venues other than Italian restaurant, cleaned the dataset removing those venues.

Afterwards, used again Foursquare API to retrieve venue details relating to 'likes' 'count' for each venue and added this data point as 'likes count' column to venues dataset. The ‘likes count’ used for determining the top 3 restaurant choices and offering preferred choice to solve the problem

Foursquare API was used again to retrieve venue details relating to 'rating', though rating would not be available for all venues to verify the venues ranked high based on likes count would also be rated high

Recommendation of top three venues choices would be based on twin criteria: high likes count and high rating to solve the business problem

3. Methodology

Used pandas library to hold data, clean, explore and analyze dataset

Used numpy library to handle data in a vectorized manner

Used geopy, folium libraries to create maps of New York and Manhattan with neighborhoods and restaurant venues superimposed on top

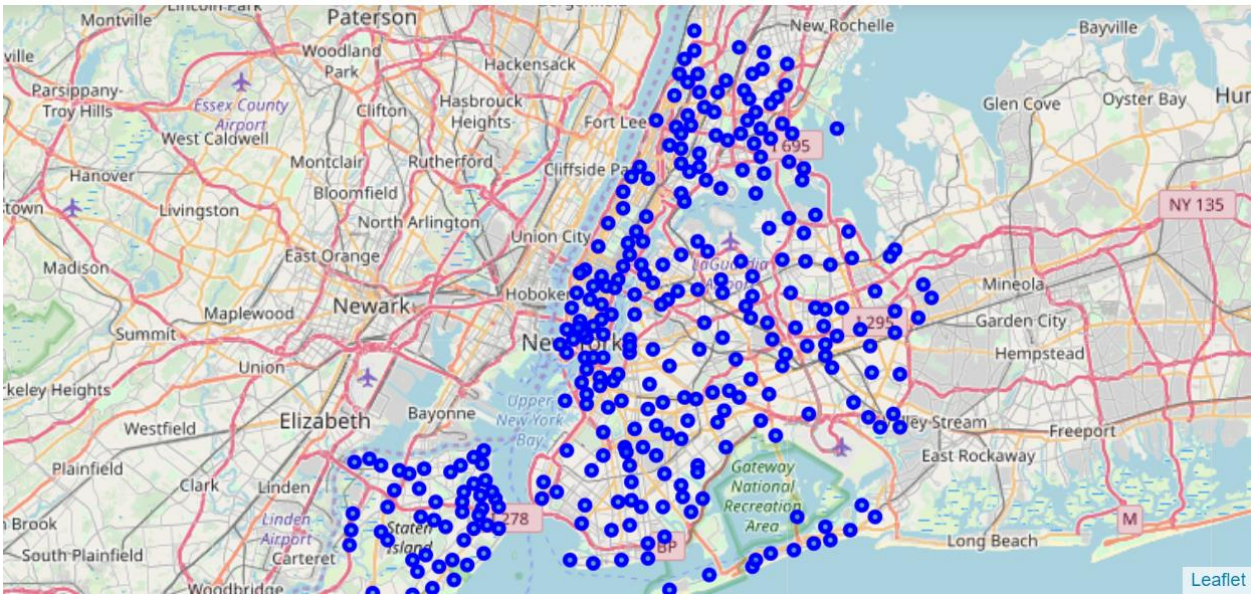
Used Foursquare API to search for venues categorized as Italian Restaurant and explore venue details relating to ‘likes’ count

Run unsupervised learning K-means algorithm to cluster the venues

Used Foursquare API to get venue rating, though rating is not available for all the venues

Recommendation of top three venues choices would be based on twin criteria: high likes count and high rating.

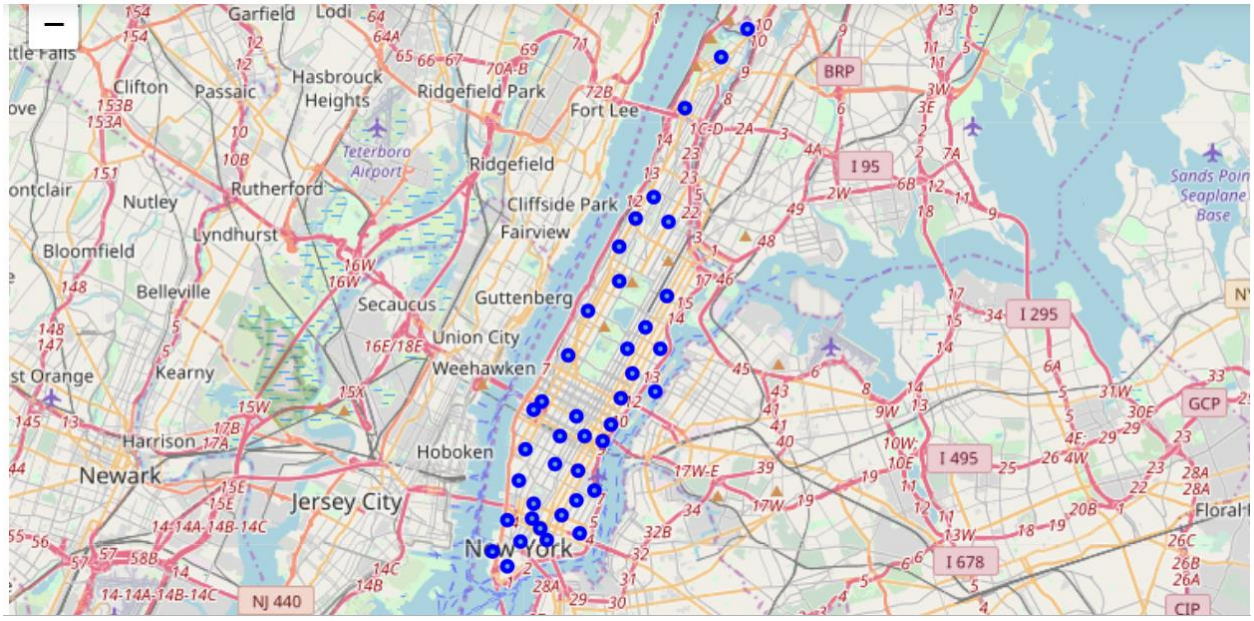
New York map with neighborhoods superimposed on top. New York has 5 boroughs and 306 neighborhoods.



Created Manhattan dataframe slicing New York dataset. First 10 rows of Manhattan neighborhoods dataset

	Borough	Neighborhood	Latitude	Longitude
0	Manhattan	Marble Hill	40.876551	-73.910660
1	Manhattan	Chinatown	40.715618	-73.994279
2	Manhattan	Washington Heights	40.851903	-73.936900
3	Manhattan	Inwood	40.867684	-73.921210
4	Manhattan	Hamilton Heights	40.823604	-73.949688
5	Manhattan	Manhattanville	40.816934	-73.957385
6	Manhattan	Central Harlem	40.815976	-73.943211
7	Manhattan	East Harlem	40.792249	-73.944182
8	Manhattan	Upper East Side	40.775639	-73.960508
9	Manhattan	Yorkville	40.775930	-73.947118

Manhattan has 40 neighborhoods. Created map of Manhattan with neighborhoods superimposed on top



Venues data set retrieved using search criteria ‘Italian’ for Manhattan geographic coordinates. 50 venues are returned by Foursquare API

Here’re the first 10 rows of Venues dataset

	id	name	categories	lat	lng
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991
1	4a90dbbef964a520a11920e3	Italian Village Pizzeria	Pizza Place	40.772669	-73.952319
2	4ba00318f964a520285237e3	The Italian Academy (Casa Italiana)	General College & University	40.807645	-73.960396
3	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032
4	3fd66200f964a5209ee81ee3	Carmine’s Italian Restaurant	Italian Restaurant	40.757497	-73.986779
5	4b786cecf964a52052cd2ee3	Bellini Italian Restaurant & Brick Oven Pizza	Italian Restaurant	40.784656	-73.973522
6	4f32883519836c91c7e0fe4f	Italian Eatery	Italian Restaurant	40.801706	-73.961285
7	4e7a3a40775b9ed4d3844232	Italian Cousin	Pizza Place	40.803357	-73.963440
8	556f1642498e3a292961c735	Italian lessons with Bretta Bracali Lundell	Language School	40.785728	-73.978029
9	4d7024805b5ca1cdaadd7644	Italian Academy Theater, Columbia University 1161 Amsterdam Ave.	College Theater	40.807664	-73.959910

As we notice the venues dataset created from the results returned by Foursquare API contained venues other than restaurants, dataset is cleaned. Now, the venues dataset has 20 rows

First 10 rows of cleaned venues dataset

	id	name	categories	lat	lng
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032
2	3fd66200f964a5209ee81ee3	Carmine’s Italian Restaurant	Italian Restaurant	40.757497	-73.986779
3	4b786cecf964a52052cd2ee3	Bellini Italian Restaurant & Brick Oven Pizza	Italian Restaurant	40.784656	-73.973522
4	4f32883519836c91c7e0fe4f	Italian Eatery	Italian Restaurant	40.801706	-73.961285
5	4e4c4d06bd413c4cc66856b9	Italian Caterers	Italian Restaurant	40.805768	-73.966000
6	4f44a2bd19836ed0019571be	Mama Mia 44sw Italian Cuisine	Italian Restaurant	40.759716	-73.991829
7	4c8174d42f1c236a66213043	Italian Tomato	Italian Restaurant	40.819351	-73.960352
8	4c5742f5d12a20a1545766bd	Italian Tomato	Italian Restaurant	40.816234	-73.979814
9	5a457b8d3b83076b58991a87	The Italian Brothers	Italian Restaurant	40.759424	-73.969038

Afterwards, used Foursquare API again to retrieve venue details relating to 'likes' 'count' for each venue and added this data point as 'likes count' column to venues dataset

First 5 rows of the venues dataset after adding the ‘likes count’

	id	name	categories	lat	lng	likes count
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991	385
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032	678
2	3fd66200f964a5209ee81ee3	Carmine's Italian Restaurant	Italian Restaurant	40.757497	-73.986779	1569
3	4b786cecf964a52052cd2ee3	Bellini Italian Restaurant & Brick Oven Pizza	Italian Restaurant	40.784656	-73.973522	32
4	4f32883519836c91c7e0fe4f	Italian Eatery	Italian Restaurant	40.801706	-73.961285	0

Categorized venues based on 'likes count' by adding computed 'grade' column to venues dataset.

Likes Count	**Grade**
<=50	poor
51 - 100	average
101 – 200	good
201 – 300	great
>300	awesome

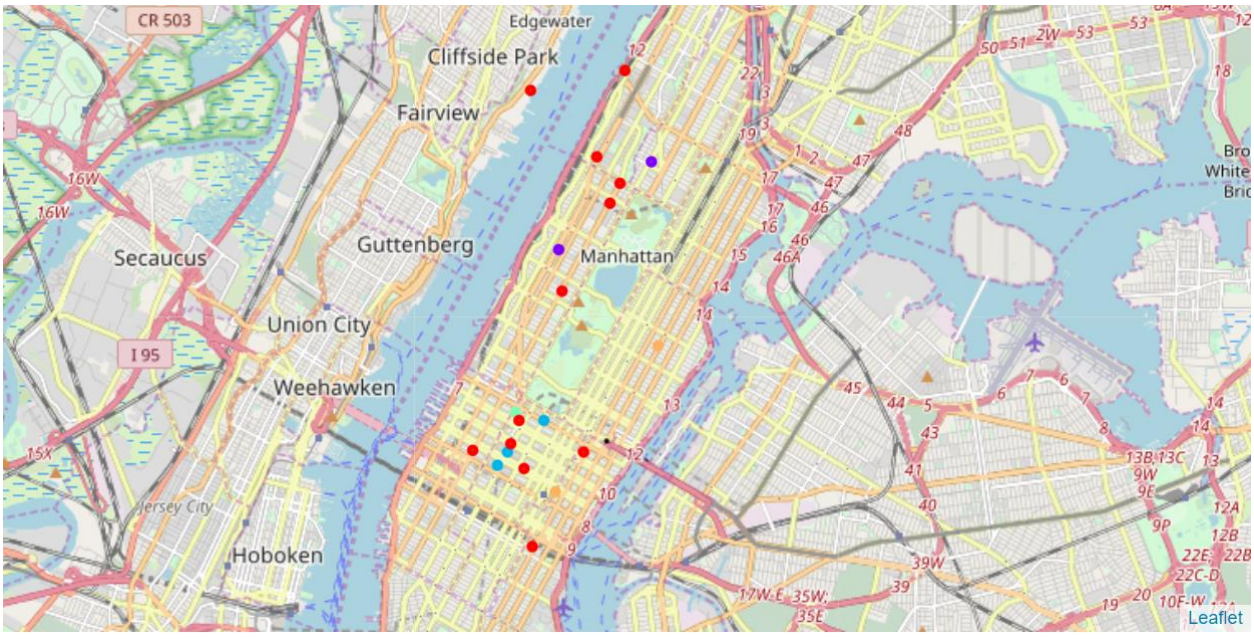
First 8 rows of venues dataframe after adding the grade column.

	id	name	categories	lat	lng	likes count	cluster	grade
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991	385	3	great
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032	678	2	awesome
2	3fd66200f964a5209ee81ee3	Carmine's Italian Restaurant	Italian Restaurant	40.757497	-73.986779	1569	2	awesome
3	4b786cecf964a52052cd2ee3	Bellini Italian Restaurant & Brick Oven Pizza	Italian Restaurant	40.784656	-73.973522	32	1	poor
4	4f32883519836c91c7e0fe4f	Italian Eatery	Italian Restaurant	40.801706	-73.961285	0	1	poor
5	4e4c4d06bd413c4cc66856b9	Italian Caterers	Italian Restaurant	40.805768	-73.966000	0	1	poor
6	4f44a2bd19836ed0019571be	Mama Mia 44sw Italian Cuisine	Italian Restaurant	40.759716	-73.991829	17	1	poor
7	4c8174d42f1c236a66213043	Italian Tomato	Italian Restaurant	40.819351	-73.960352	0	1	poor

Run unsupervised learning K-means algorithm to cluster the venues. Here're the first 8 rows of venues dataset with cluster label

	id	name	categories	lat	lng	likes count	cluster	grade
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991	385	3	great
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032	678	2	awesome
2	3fd66200f964a5209ee81ee3	Carmine's Italian Restaurant	Italian Restaurant	40.757497	-73.986779	1569	2	awesome
3	4b786cecf964a52052cd2ee3	Bellini Italian Restaurant & Brick Oven Pizza	Italian Restaurant	40.784656	-73.973522	32	1	poor
4	4f32883519836c91c7e0fe4f	Italian Eatery	Italian Restaurant	40.801706	-73.961285	0	1	poor
5	4e4c4d06bd413c4cc66856b9	Italian Caterers	Italian Restaurant	40.805768	-73.966000	0	1	poor
6	4f44a2bd19836ed0019571be	Mama Mia 44sw Italian Cuisine	Italian Restaurant	40.759716	-73.991829	17	1	poor
7	4c8174d42f1c236a66213043	Italian Tomato	Italian Restaurant	40.819351	-73.960352	0	1	poor

Visualize Clustering of venues



Examination of each cluster and find the discriminating likes count and grade that distinguish each cluster.

Cluster 0

	id	name	categories	lat	lng	likes count	cluster	grade
12	3fd66200f964a520a2e91ee3	Erminia Ristorante	Italian Restaurant	40.775993	-73.953590	57	0	average
13	525d7bde498e3a406f590b1d	Davio's North Italian Steakhouse	Italian Restaurant	40.753233	-73.974774	57	0	average

Cluster 1 – First 8 rows

	id	name	categories	lat	lng	likes count	cluster	grade
3	4b786cecf964a52052cd2ee3	Bellini Italian Restaurant & Brick Oven Pizza	Italian Restaurant	40.784656	-73.973522	32	1	poor
4	4f32883519836c91c7e0fe4f	Italian Eatery	Italian Restaurant	40.801706	-73.961285	0	1	poor
5	4e4c4d06bd413c4cc66856b9	Italian Caterers	Italian Restaurant	40.805768	-73.966000	0	1	poor
6	4f44a2bd19836ed0019571be	Mama Mia 44sw Italian Cuisine	Italian Restaurant	40.759716	-73.991829	17	1	poor
7	4c8174d42f1c236a66213043	Italian Tomato	Italian Restaurant	40.819351	-73.960352	0	1	poor
8	4c5742f5d12a20a1545766bd	Italian Tomato	Italian Restaurant	40.816234	-73.979814	1	1	poor
9	5a457b8d3b83076b58991a87	The Italian Brothers	Italian Restaurant	40.759424	-73.969038	0	1	poor
10	53d0596d498e713d024c6506	Italian Bistro - Time Square	Italian Restaurant	40.760656	-73.984000	0	1	poor

Cluster 2 – Venues

	id	name	categories	lat	lng	likes count	cluster	grade
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032	678	2	awesome
2	3fd66200f964a5209ee81ee3	Carmine's Italian Restaurant	Italian Restaurant	40.757497	-73.986779	1569	2	awesome
17	42f15a80f964a520bb261fe3	Olive Garden	Italian Restaurant	40.759414	-73.984702	867	2	awesome

Cluster 3 – Venues

	id	name	categories	lat	lng	likes count	cluster	grade
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991	385	3	great
11	4d573d8aa747b60cc83b332b	Lido Harlem	Italian Restaurant	40.804987	-73.954885	337	3	great

Cluster 4 – Venues

	id	name	categories	lat	lng	likes count	cluster	grade
18	4af0e7f3f964a52009e021e3	Patsy's Italian Restaurant	Italian Restaurant	40.765763	-73.982816	129	4	good

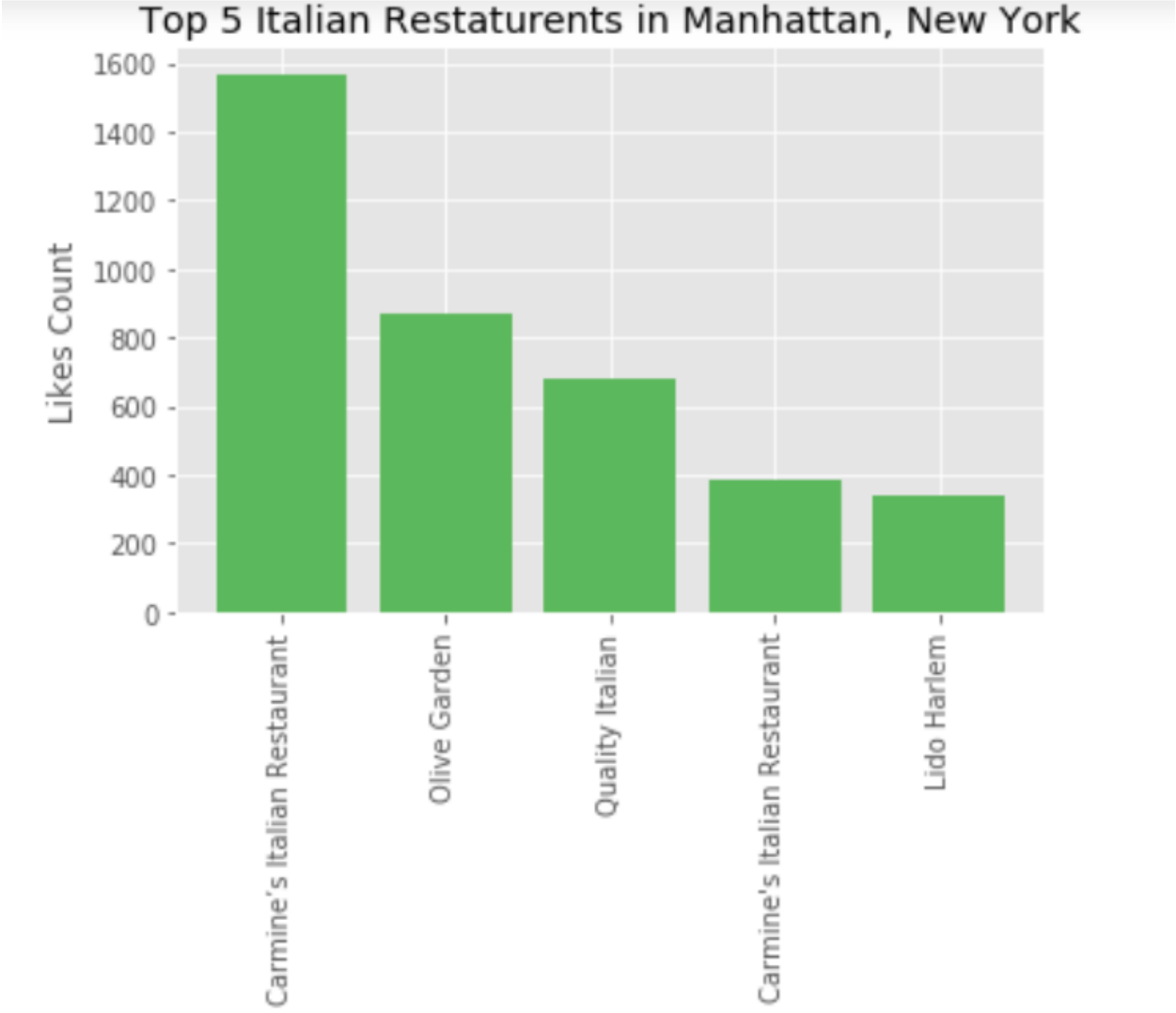
Sorted venues based on 'likes count' and created new dataframe with top 5 venues. Here's the this dataframe.

	id	name	categories	lat	lng	likes count	cluster	grade
2	3fd66200f964a5209ee81ee3	Carmine's Italian Restaurant	Italian Restaurant	40.757497	-73.986779	1569	2	awesome
17	42f15a80f964a520bb261fe3	Olive Garden	Italian Restaurant	40.759414	-73.984702	867	2	awesome
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032	678	2	awesome
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991	385	3	great
11	4d573d8aa747b60cc83b332b	Lido Harlem	Italian Restaurant	40.804987	-73.954885	337	3	great

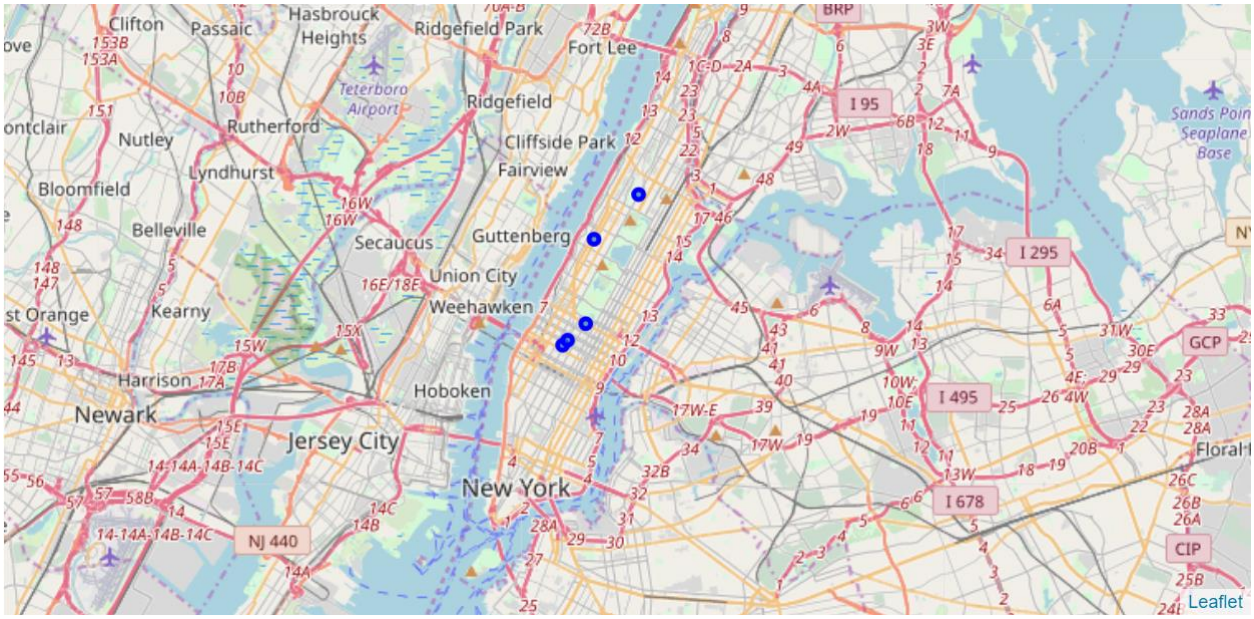
After adding 'rating' retrieved from Foursquare API to the venues dataset, top 5 venues of the dataframe

	id	name	categories	lat	lng	likes count	cluster	grade	rating
2	3fd66200f964a5209ee81ee3	Carmine's Italian Restaurant	Italian Restaurant	40.757497	-73.986779	1569	2	awesome	8.8
17	42f15a80f964a520bb261fe3	Olive Garden	Italian Restaurant	40.759414	-73.984702	867	2	awesome	8.2
1	51e7310c498e639ed27062b1	Quality Italian	Italian Restaurant	40.764476	-73.977032	678	2	awesome	8.8
0	4a7778a1f964a5209be41fe3	Carmine's Italian Restaurant	Italian Restaurant	40.791096	-73.973991	385	3	great	8.3
11	4d573d8aa747b60cc83b332b	Lido Harlem	Italian Restaurant	40.804987	-73.954885	337	3	great	8.6

Created bar chart representing top 5 venues with their like count



Created Manhattan, NY map with top 5 venues superimposed on top



4. Results

Cleaned dataset representing Italian restaurant venues have 20 rows. Categorizing venues based on 'like count' has resulted in the following break-down: 3 venues with 'awesome', 2 venues with 'great', 1 venue with 'good' and 2 venues with 'average' and the remaining 12 with 'poor' grades.

k-means clustering of venues has resulted in the following 5 clusters and grouping of venues by clustering matches with grade computed based on likes count:

Cluster label	**venues**
Cluster 0	2 venues with 'average' grade
Cluster 1	12 venues with 'poor' grade
Cluster 2	3 venues with 'awesome' grade
Cluster 3	2 venues with 'great' grade
Cluster 4	1 venue with 'good' grade

It is noticed that all the top 5 venues ranked by likes count got more than 8 rating and the top ranked venue got the highest rating of 8.8

5. Discussion

Chosen the criteria of 'likes count' and 'rating' returned by Foursquare API for venues to group and decide which venues to be recommended to ABC Company for selecting the Italian restaurant. It is obvious that there may be other criteria based on other sources of data. This project scope is limited to using the data available through FoureSquare API.

This project demonstrated how we can leverage the data freely available on web and Foursquare API(though free version has limits on data points we can retrieve) to search and explore restaurant venues. We can adapt it to choose any other venue by changing the search query. This project is therefore, useful for anyone interested in selecting any other category of venue.

6. Conclusion

Based on two factors, namely ‘likes count’ and ‘rating’, Carmine's Italian Restaurant, Olive Garden and Quality Italian are ranked as the top 3 venues and presented as possible choices for consideration of the ABC Company, with the top 1 venue Carmine's Italian Restaurant as the preferred choice. Anyone interested in finding any popular category of venue in any geographic location may also be interested in this project as we can adapt it choose any other venue by changing the search query.