

Introduction:

In this project we will try to find an optimal location for a restaurant. Specifically, this report will be targeted to stakeholders interested in opening an **restaurant and school** in **New York**, United States.

Since there are lots of restaurants in **New York** we will try to detect **locations that are not already crowded with restaurants**. We choose some candidate location in Queens New York city. We want to get the cluster information about the Center Queens, so that we can analyze the cluster. Secondly, it is important that analyze the distribution of the **restaurant type** in each cluster.

We will use our data science powers to generate a few most promising neighborhoods based on this criteria. Advantages of each area will then be clearly expressed and get the cluster character, so that best possible final location and restaurant type can be chosen by stakeholders. So, we want to explore the center candidate location that belongs to the restaurant type.

Data Acquisition And Cleaning

Based on definition of our problem, factors that will influence our decision are:

- number of existing restaurants in the neighborhood (any type of restaurant)
- number of and distance to Italian restaurants in the neighborhood, if any
- distance of neighborhood from city center
- number of school in the neighborhood (any type of school)

We decided to use regularly spaced grid of locations, centered around city center, to define our neighborhoods. This is our **data flow**:

- Get the Queens geometry information
- Calculate candidate geometry information, under the conditions, like ~6 km from Queens center, and each are has 600 meters each circle apart
- Get the detailed information in each circle by using Foursquare API

Besides we use other packages, likes:

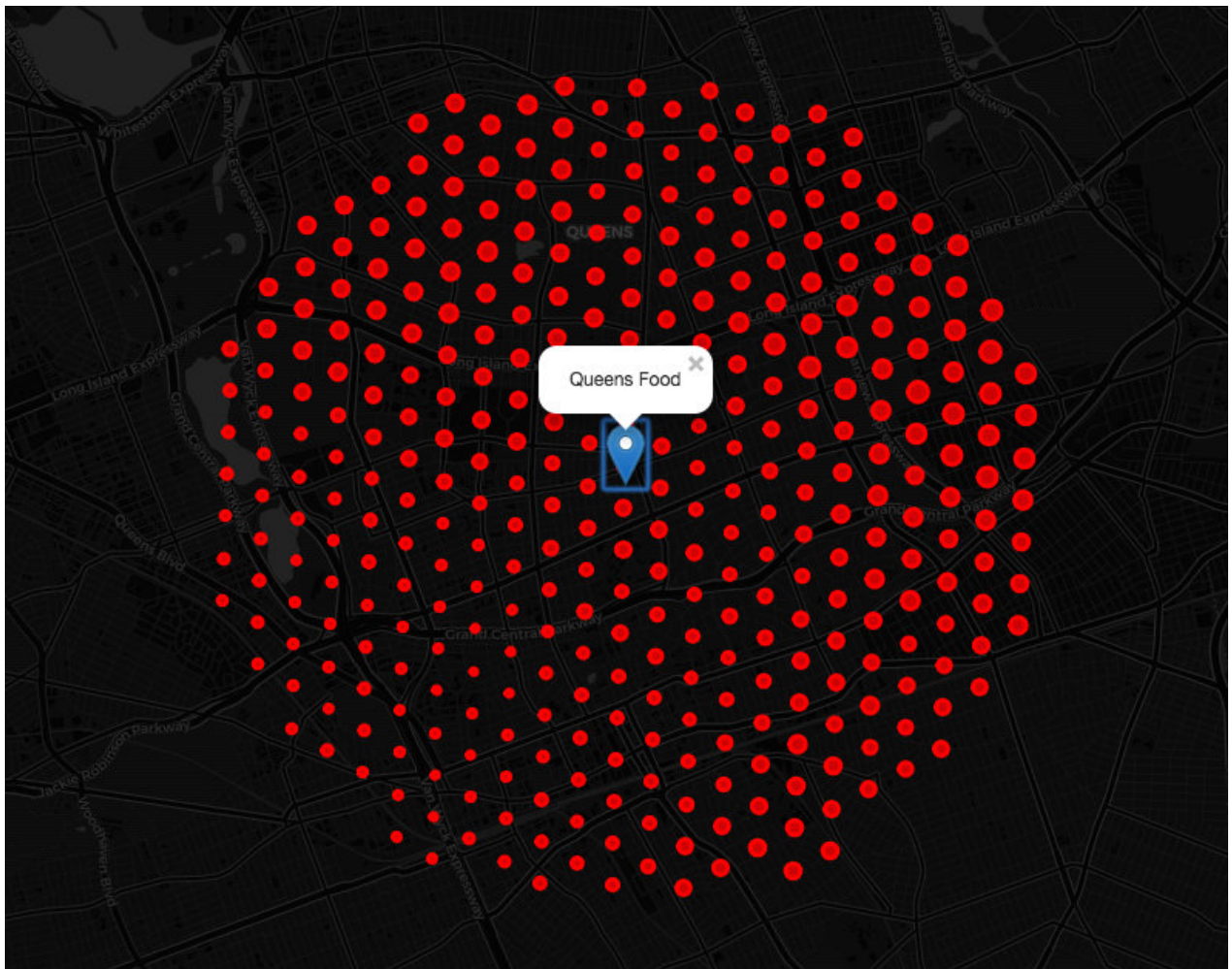
- Pandas
- Numpy
- Json
- Geopy
- Matplotlib
- Shapely
- Pyproj
- Sklearn
- Folium
- Requests

We get the basic information like:

	Address	Latitude	Longitude	X	Y	Distance from center
0	93-46 210th Pl, Queens Village, NY 11428	40.716520	-73.751049	-5.820665e+06	9.836718e+06	5992.495307
1	211-30 90th Ct, Jamaica, NY 11428	40.720054	-73.750895	-5.820065e+06	9.836718e+06	5840.376700
2	89-28 213th St, Queens Village, NY 11427	40.723589	-73.750740	-5.819465e+06	9.836718e+06	5747.173218
3	214-46 Whitehall Terrace, Jamaica, NY 11427	40.727124	-73.750586	-5.818865e+06	9.836718e+06	5715.767665
4	218-17 Grand Central Pkwy, Jamaica, NY 11427	40.730659	-73.750431	-5.818265e+06	9.836718e+06	5747.173218
5	220-24 Hartland Ave, Jamaica, NY 11427	40.734194	-73.750276	-5.817665e+06	9.836718e+06	5840.376700
6	220-72 77th Ave, Flushing, NY 11364	40.737730	-73.750122	-5.817065e+06	9.836718e+06	5992.495307

Methodology

We create the data flow to get the data by using API, then extract the schools and the restaurants information. Right now, we can visualize the distribution of the number of restaurants and schools:



The restaurants is almost uniform in the each candidate location. Wherese, the school is uniform.



After extraction, we dive into exploring the data. We use the PCA method to reduce dimensions and analyze the two main components KDE information. Finally, we use the KMeans method and Silhouette metric to create the cluster. **Caution**, we preprocessing the feature *Distance from center* by *StandardScaler* method.

Distance from center	Thai Restaurant	Mediterranean Restaurant	Cantonese Restaurant	Sushi Restaurant	Latin American Restaurant	Mexican Restaurant	Southern / Soul Food Restaurant	American Restaurant	Filipino Restaurant	...	New American Restaurant	Chinese Restaurant	Tapas Restaurant	Indian Restaurant	Dumpling Restaurant	Halal Restaurant	Elementary School	Szechuan Restaurant	AllRestaurant	AllSc
1.400281	0	0	0	2	1	2	1	0	0	...	0	5	0	0	0	0	0	0	1.098931	
1.292965	0	0	0	2	1	2	1	0	0	...	0	4	0	0	0	1	0	0	0.673840	

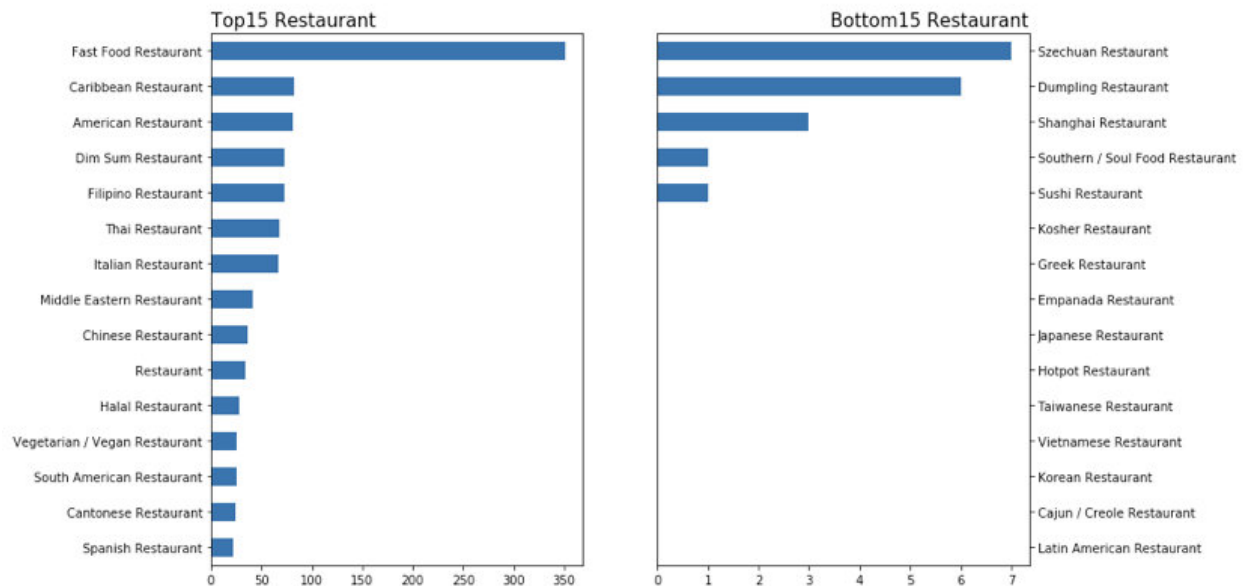
Result And Conclusion

We can explore the cluster information, so that we can get the initial conclusion.

Cluster I Candidate Location

- Fast Restaurant is main type
- Western Restaurants have the largest market
- Eastern Restaurants have the few market

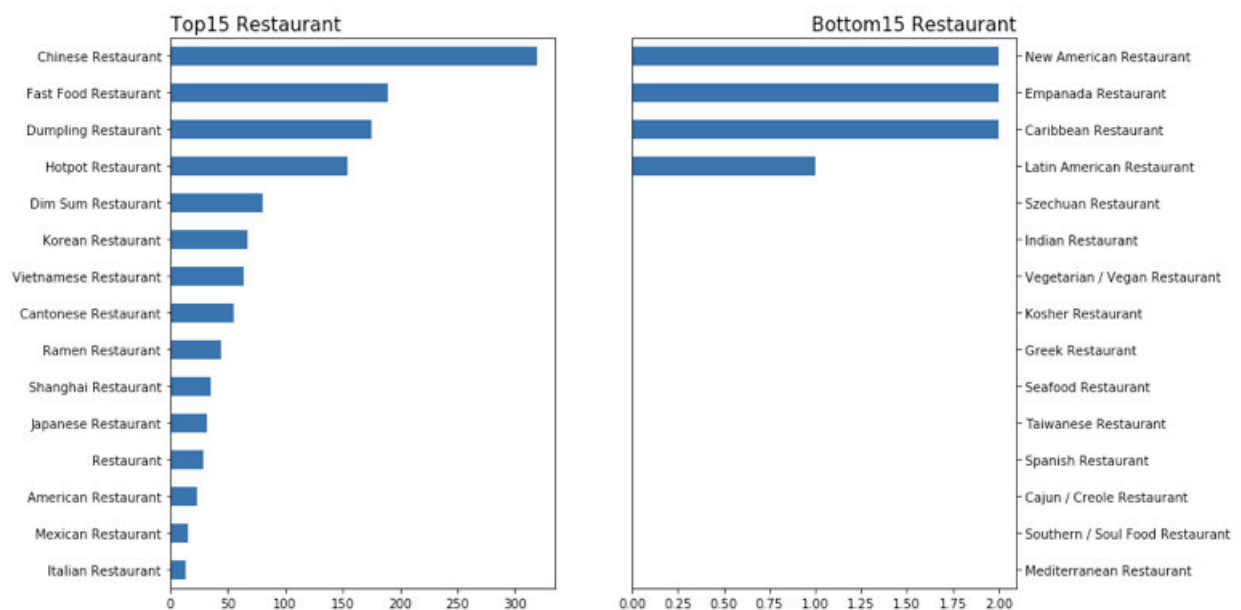
Total Number Of Different Restaurant Type In Cluster I



Cluster II Candidate Location

- Chinese Restaurant is main type
- Asian Restaurants have the largest market, like Chinese Breakfast restaurant
- Western Restaurants have the few market

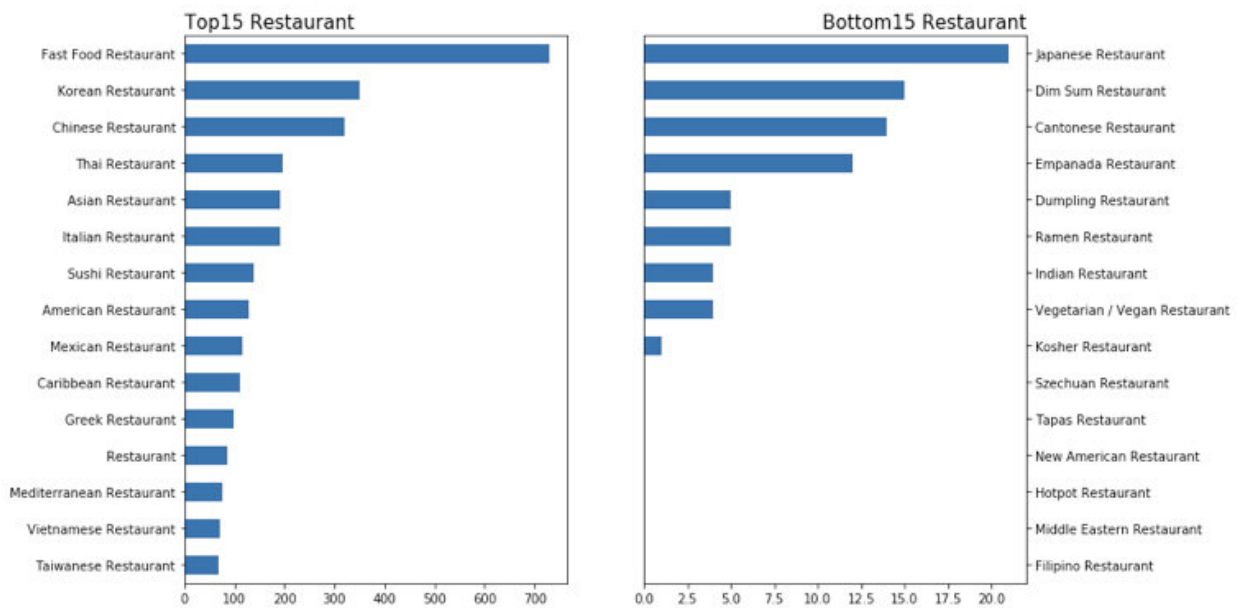
Total Number Of Different Restaurant Type In Cluster II



Cluster III Candidate Location

- Fast Food Restaurant is main type
- The candidate location has mixture restaurant type. Asian Restaurants and western restaurant are same important type the Asian restaurant is lack of variety
- The candidate location is a good choice to open an Asian restaurant. Maybe the Chinese Breakfast restaurant is a good idea

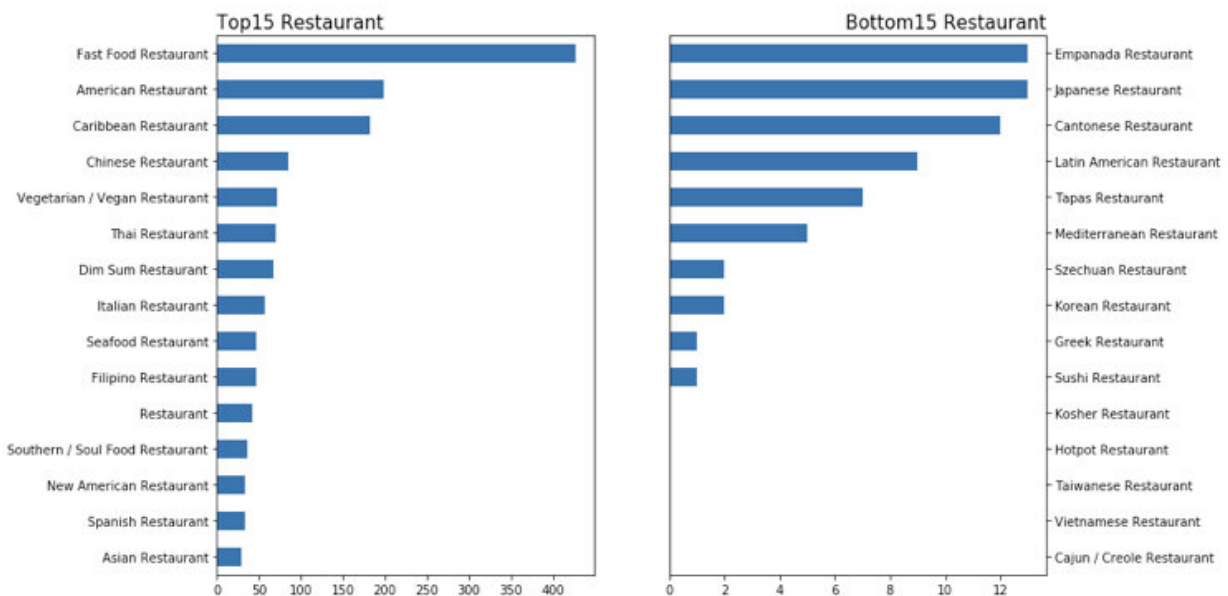
Total Number Of Different Restaurant Type In Cluster III



Cluster IV Candidate Location

- Fast Food Restaurant is main type
- The candidate location has mixture restaurant type
- Asian Restaurants and western restaurant are same important type the Asian restaurant is lack of variety. The candidate location is a good choice to open an Asian restaurant. But the southeastern Asian restaurant is not a good idea

Total Number Of Different Restaurant Type In Cluster IV



Final conclusion

We can make a choice that choose the appropriate restaurant type at appropriate candidate location. Like that the Chinese Breakfast restaurant is good choice at Cluster III candidate location