Capstone Project Report

1. Introduction/Business Problem

1.1 Background

Nowadays, the pace of college students' life has become increasingly faster. With hectic classwork, homework, and extra curriculum, students do not have much time to cook for themselves. They either choose to eat at college canteens or go to restaurants. As a graduate student at Columbia University, a well-known university which located in Manhattan, New York, I feel my fellow students' time is extremely limited. As most students live around campus, they tend to eat at college canteens and local restaurant for lunch and dinner. As a university with high reputation, Columbia attracts a large amount of students each year, and so there is a high demand for good restaurants around campus to fill students' appetite. Also, there is a large proportion of international students at Columbia University, so there might be recipes other than American cuisines that are more popular amongst students.

1.2 Business Problem

Many individuals and small businesses want to capture this opportunity to open a new restaurant around Columbia University's campus. However, they might not have the knowledge of what type of restaurant to open as they do not possess the knowledge of restaurant popularity among students. Certainly, they do not want to waste money on opening an unpopular restaurant, and they are eager to fill this gap of information.

1.3 Interest

As mentioned above, individuals and businesses who are interested in opening a new restaurant near Columbia University's campus will be happy if they can have a summary of common restaurant types near the university, so they can make decisions based on that.

2. Data

2.1 Data Source

We want to examine the restaurants around Columbia University, so we need the university's location data and local restaurants' location data. We will source those data from Foursquare.

2.2 Data Description

The data of interest in the total number of restaurants in each restaurant category, for example, Chinese, Japanese, Korean, French, American, Italian and etc. Firstly, we will use the geographical coordinate of Columbia University to pinpoint our data range. Secondly, we will send requests through API to fetch the venue information about those venues within a certain radius distance from the Columbia University coordinate. Thirdly, we will sum up the venue information to find most common restaurant types near Columbia University.

3. Methodology

3.1 Import Data

We will first need the geographical location of Columbia University which is (40.8079488, -73.96179735 775709).
We can get a general idea about Columbia University's layout by looking at the following map:

Then we can use the Foursquare API to explore the neighborhood. We make the request and then store relevant information like venue name, venue latitude, venue longitude, and venue category into a data frame like the one below:
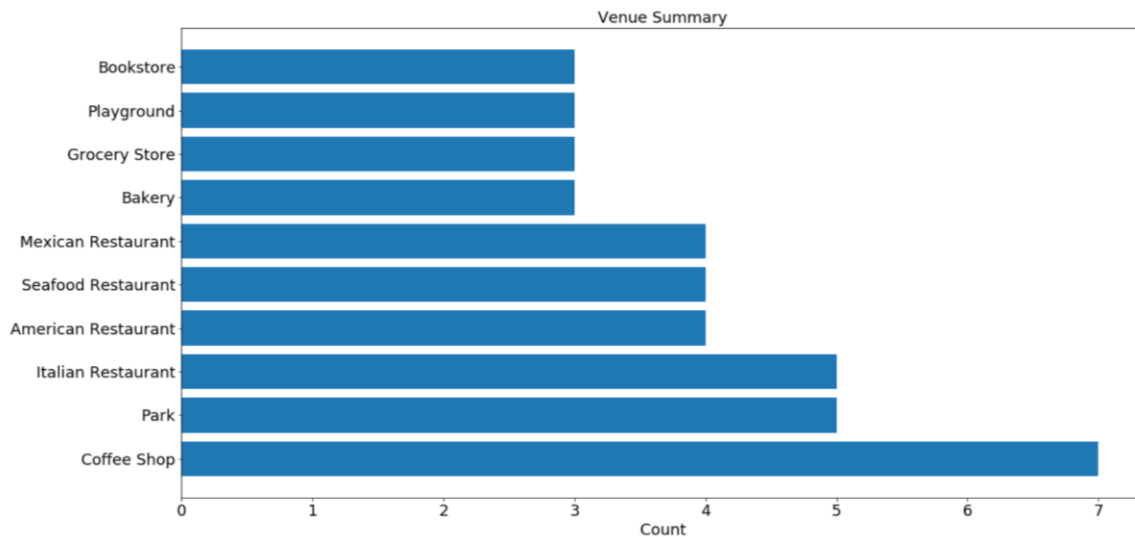
	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Alma Mater Statue	40.807726	-73.962252	Outdoor Sculpture
1	Arts and Crafts Beer Parlor	40.806689	-73.961094	Pub
2	Nous Espresso Bar - Graduate Student Center	40.807533	-73.960879	Café
3	Columbia Greenmarket	40.807195	-73.964335	Farmers Market
4	Morningside Park	40.806144	-73.958797	Park

3.2 Analyze Data

For the data frame we created, we need to count how many venues are in each venue category and we get this:

	Category	Count
0	Coffee Shop	7
1	Park	5
2	Italian Restaurant	5
3	American Restaurant	4
4	Seafood Restaurant	4
5	Mexican Restaurant	4
6	Bakery	3
7	Grocery Store	3
8	Playground	3
9	Bookstore	3
10	Chinese Restaurant	3
11	Bagel Shop	2
12	Sandwich Place	2
13	Burger Joint	2
14	Wine Shop	2
15	Pizza Place	2
16	Caribbean Restaurant	2
17	Farmers Market	2
18	Salon / Barbershop	1
19	Ethiopian Restaurant	1
20	Food Truck	1
21	Dessert Shop	1
22	Whisky Bar	1
23	Spa	1
24	Vietnamese Restaurant	1
25	Middle Eastern Restaurant	1
26	Greek Restaurant	1
27	Ramen Restaurant	1
28	Thai Restaurant	1
29	Food Court	1
30	Latin American Restaurant	1
31	Hawaiian Restaurant	1
32	Bank	1
33	Fountain	1
34	Juice Bar	1
35	Gastropub	1
36	Salad Place	1
37	Gay Bar	1
38	Cocktail Bar	1
39	Arts & Crafts Store	1
40	Wine Bar	1
41	Garden	1
42	Speakeasy	1
43	Dog Run	1
44	Indian Restaurant	1
45	Dumpling Restaurant	1
46	Southern / Soul Food Restaurant	1
47	Outdoor Sculpture	1
48	Pub	1
49	French Restaurant	1
50	Café	1
51	Boutique	1
52	Historic Site	1
53	African Restaurant	1
54	Ice Cream Shop	1
55	Theater	1
56	Tennis Court	1
57	Deli / Bodega	1
58	Pharmacy	1
59	Music Venue	1

There are 60 unique categories, but we are only interested in the most common ones, so let's only focus on the top 10 most common venues and visualize them:

We can see clearly that coffee shops, parks, Italian restaurants are most common. But in this list, there are many venues that are not in the restaurant category, such as bookstore, playground, grocery store, bakery, park, and coffee shop.

Therefore, let us only search for restaurants when we make request to Foursquare, and again we store the information into a data frame:

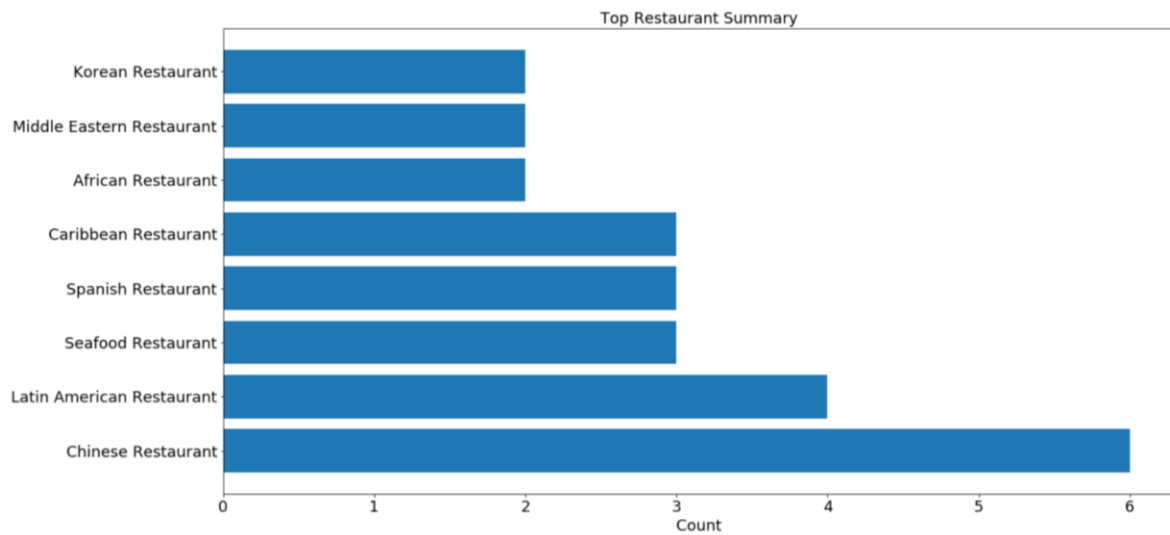|	name	categories	address	crossStreet	lat	lng	labeledLatLngs	distance	postalCode	cc	city	state	country	formattedAddress	neighborhood	
0	Tom's Restaurant	Diner	2880 Broadway	at W 112th St	40.805436	-73.965334	[{'label': 'display', 'lat': 40.805436, 'lng':...	408	10025	US	New York	NY	United States	[2880 Broadway (at W 112th St), New York, NY 1...	NaN	415c9
1	Chocolat Restaurant & Bar	American Restaurant	2223 Frederick Douglass Blvd	at W 120th St	40.806982	-73.953751	[{'label': 'display', 'lat': 40.8069823, 'lng'...	686	10026	US	New York	NY	United States	[2223 Frederick Douglass Blvd (at W 120th St),...	NaN	505e73
2	Acosta Deli - Restaurant	Latin American Restaurant	934 Amsterdam Ave	106th	40.800293	-73.965621	[{'label': 'display', 'lat': 40.80029263884989...	911	10025	US	New York	NY	United States	[934 Amsterdam Ave (106th), New York, NY 10025...	NaN	4cb1f
3	Accra Restaurant	African Restaurant	2065 Adam Clayton Powell Jr Blvd	At West 122nd street	40.807868	-73.949107	[{'label': 'display', 'lat': 40.80786779413678...	1069	10027	US	New York	NY	United States	[2065 Adam Clayton Powell Jr Blvd (At West 122...	Central Harlem	513e60
4	Amsterdam Pizza Restaurant	Diner	1343 Amsterdam Ave	at 125th St	40.813465	-73.955948	[{'label': 'display', 'lat': 40.8134651184082,...	787	10027	US	New York	NY	United States	[1343 Amsterdam Ave (at 125th St), New York, N...	NaN	4c03f

We again need to count the number of restaurants in each category and we get:

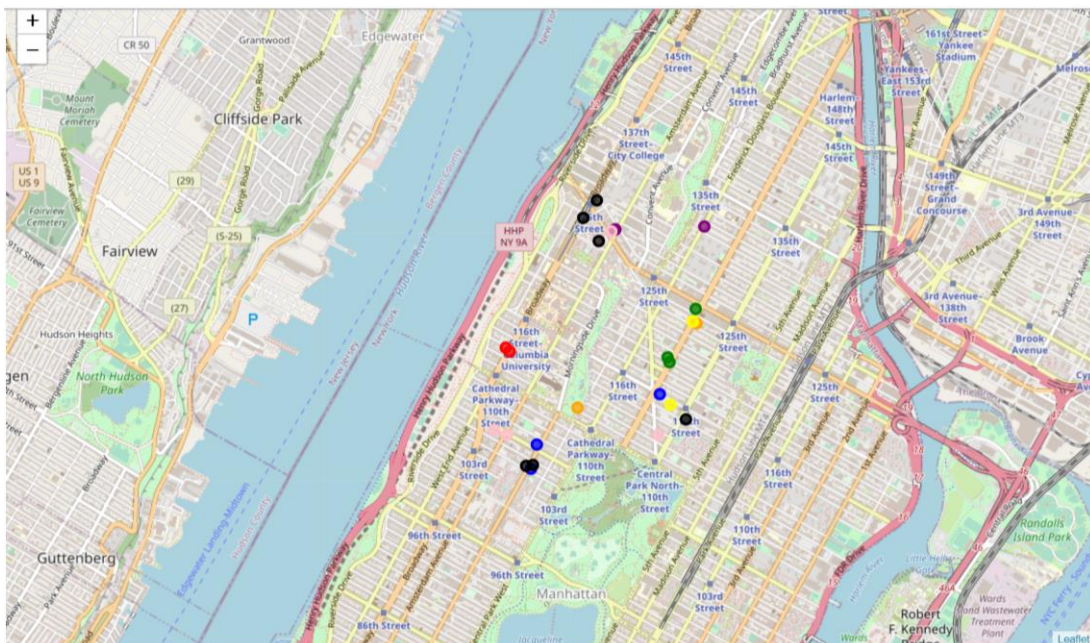|	Category	Count
0	Chinese Restaurant	6
1	Food	5
2	Restaurant	4
3	Latin American Restaurant	4
4	Seafood Restaurant	3
5	Spanish Restaurant	3
6	Caribbean Restaurant	3
7	Diner	2
8	African Restaurant	2
9	Middle Eastern Restaurant	2
10	Korean Restaurant	2
11	Mexican Restaurant	1
12	American Restaurant	1
13	Breakfast Spot	1
14	Eastern European Restaurant	1
15	Cocktail Bar	1
16	Metro Station	1
17	Pizza Place	1
18	Housing Development	1
19	Thai Restaurant	1
20	Music Venue	1
21	Indian Restaurant	1

But we still have some ambiguous categories like food, restaurant, dinner. We need to remove these rows and only focus on the top ones, so we get this:

	Category	Count
0	Chinese Restaurant	6
1	Latin American Restaurant	4
2	Seafood Restaurant	3
3	Spanish Restaurant	3
4	Caribbean Restaurant	3
5	African Restaurant	2
6	Middle Eastern Restaurant	2
7	Korean Restaurant	2

We visualize as follows:

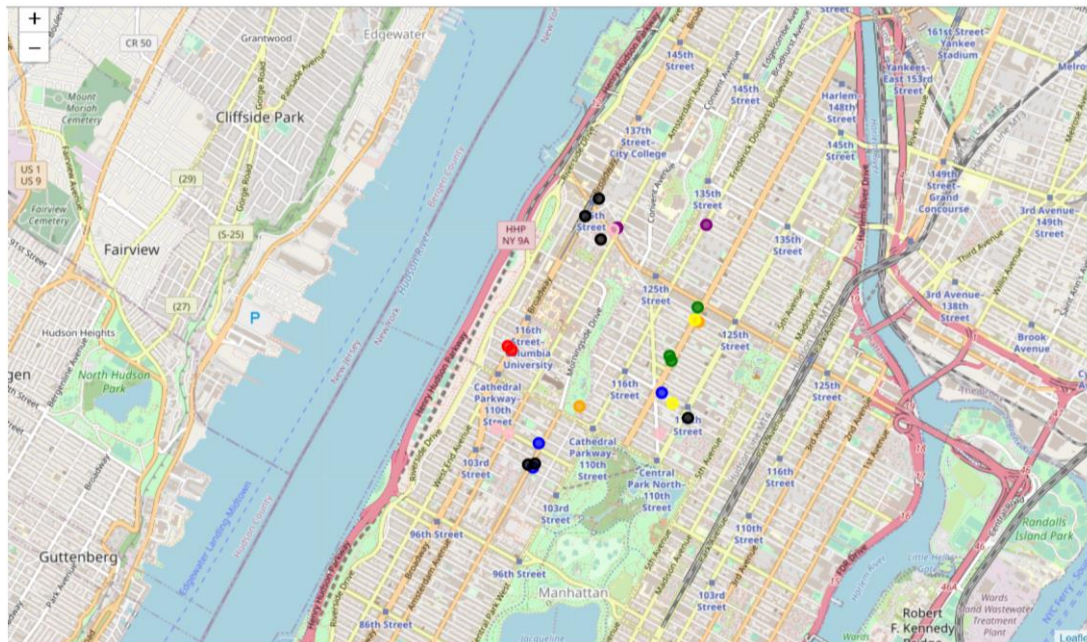Finally, we want to visualize the locations of these restaurants on the map:

4. Results

After analysis, we find that the 8 most common restaurant categories are Chinese, Latin American, Seafood, Spanish, Caribbean, African, Middle Eastern, and Korean.

5. Discussion

From the observation we made in the Results session, we can recommend to open a Chinese restaurant for the highest priority. As a Chinese student, I can verify that the demand for good Chinese food is definitely high among Chinese students and there are a lot of Chinese students at Columbia University. Also, Chinese recipes are popular among Americans as well.

Apart from the above observation, we can also look at clusters. Below is the locations of restaurants around Columbia University, we can see that Korean restaurants (red dots) are located at the west side, where Caribbean restaurants (green dots) are located on the east side. African restaurants (yellow dots) are also located on the east side, where seafood restaurants (purple dots) are located on the north side.

Therefore, choosing a good location is also something to consider when opening a new restaurant, you might want to decide on a strategy whether you want to open the restaurant near other restaurant of the same type to exploit synergy and maybe eat their pie, or you want to open the restaurant at a distant location with the same type of restaurants to explore new demand.

6. Conclusion

When opening a new restaurant, there are many things you need to consider like what the local population likes and which location to open the restaurant. As in our example, we need to find out what students like around campus, what the most common types of restaurants are currently, and what locations of them are respectively. After knowing the local market information, new restaurant owners can make their decision by considering their ability and willingness.