

## **Introduction & Business Problem:**

Being the most populous city of USA, New York City is having diverse culture influenced by the immigrants. This diversity is in every aspect whether it is living, business, dressing or food. It provides a lot of business opportunities and a business friendly environment. It has attracted many different players into the market. The city is a major center for banking and finance, retailing, world trade, transportation, tourism, real estate, new media, traditional media, advertising, legal services, accountancy, insurance, theater, fashion, and the arts in the United States. This also means that the market is highly competitive. As it is highly developed city so cost of doing business is also one of the highest. Thus, any new business venture or expansion needs to be analyzed carefully. The insights derived from analysis will give good understanding of the business environment which helps in strategically targeting the market. This will help in reduction of risk. And the Return on Investment will be reasonable.

I am considering my client is a multinational food chain which has different cuisines in different places in the world. They are not only one in this business so there is competition from other companies in the same business. The client is having so many restaurants in the city of New York but they are targeting a new Thai restaurant in the most populous city of US so that they can grow their business by targeting a large number of customers available in New York interested in Thai food. Also, the population living in New York has more spending power to pay a large amount for the services and products without any problem.

The problem is that there are so many Thai restaurants already in the New York City so we should not start a Thai restaurant in the locality where there are already a lot of popular Thai restaurants present. Also, another problem is to figure out the location having people more interested in Thai food because opening a Thai restaurant in the location where people are more interested in Korean or Japanese food will not attract the customers and our business will fail. So, the task is to find out a location which is having lesser number of Thai food restaurants and the people are interested in Thai food in that location so that we can start the restaurant with less competition.

## **Data**

As our problem statement is about opening a Thai restaurant in New York City by knowing the location having lesser number of Thai food restaurants already present and having the population which is interested in Thai food. For this we should know the boroughs and neighborhood in New York and the people's preference for the cuisines. The preference of cuisines can be obtained by fetching the data from Foursquare API in which the top 10

preference of venues are mentioned for each neighborhood and we need to select the neighborhoods having Thai food restaurants as their 1<sup>st</sup> preference.

As I am going to work on New York City neighborhood we need a dataset that contains the boroughs and the neighborhoods that exist in each borough as well as the latitude and longitude coordinates of each neighborhood. It will help us to see the locations and visualize the distribution of the Thai food restaurants over the particular location and help us in selecting the location for our new Thai Restaurant. The dataset for New York City having names and location coordinates of Neighborhood exists for free on the web.

Link to the dataset is: [https://cocl.us/new\\_york\\_dataset](https://cocl.us/new_york_dataset)

New York City geographical coordinates can be obtained by geocoder. It will be used by Folium library to make a map. The data of locations of neighborhood from the New York City dataset will be utilized as input for the Foursquare API that will be leveraged to provision venues information for each neighborhood. I am going to find out the best location for starting a Thai restaurant so I will retrieve the venues for Thai category. Thai category Id 4bf58dd8d48988d149941735 is used for retrieving data from Foursquare API.

Of the neighborhoods with Chinese, Ramen, Vietnamese, Korean, Japanese, Sushi or Thai Restaurants in the top 10 venues, I remove those neighborhoods that already have Thai restaurant in the top 10 venues. I then use Foursquare to find Thai restaurant in the 0.5 km vicinity of these areas that are not listed in the top 10 venues. This enables me to choose only those locations with no Thai restaurant in the specified vicinity. I exclude locations with Thai restaurant.

Now the neighborhoods of these venues are explored by the data obtained from foursquare API. The neighborhoods are grouped by neighborhood keeping a count of venue by its category so that we can know about which venue is most popular in that particular neighborhood. So, after getting this preference of venue data we can cluster the locations based on the venue preferences of the people to find out the location with least number of pre established Thai restaurant and having 1<sup>st</sup> preference of people of that location. In this way we can find out the desired location for our new Thai restaurant.

The retrieved neighborhood data is given below

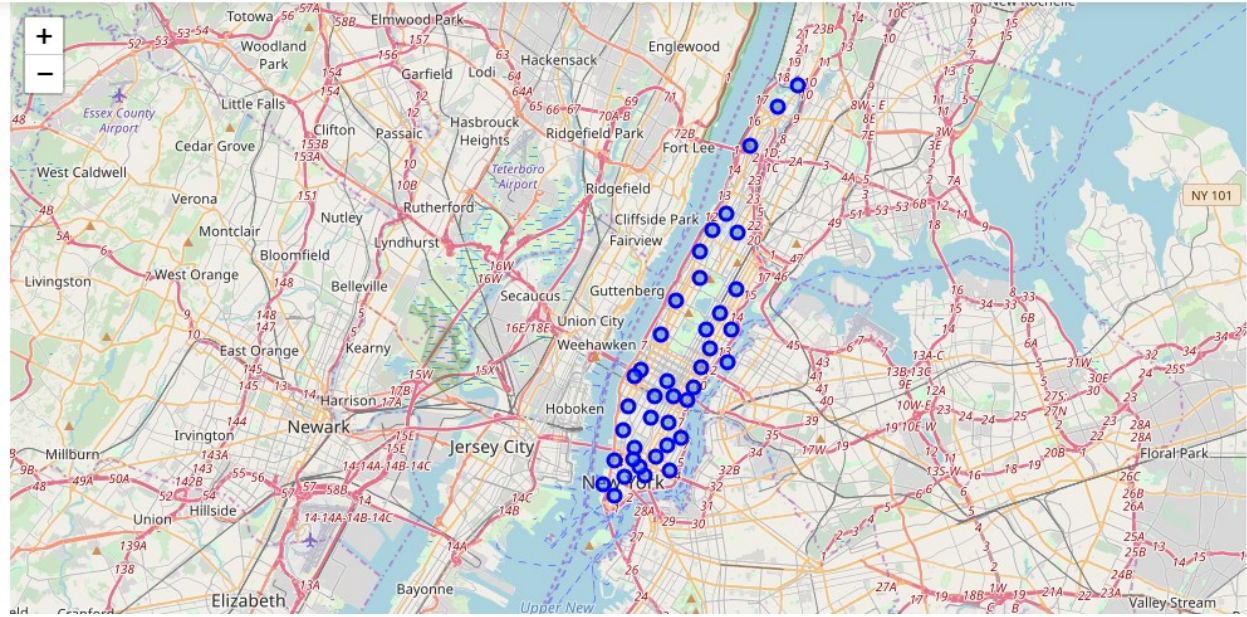
```
neighborhoods.head()
```

	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

## Methodology

In this project, I have retrieved addresses into their equivalent latitude and longitude values using geocoder. Then I used the Foursquare API to explore neighborhoods in Manhattan, New York. After that, explore function to get Thai restaurant categories in each neighborhood.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Marble Hill	40.876551	-73.910660	Siam Square	40.878796	-73.916701	Thai Restaurant
1	Marble Hill	40.876551	-73.910660	Nam Thai	40.886388	-73.910025	Thai Restaurant
2	Chinatown	40.715618	-73.994279	Noree Thai Bazaar	40.717900	-73.992966	Thai Restaurant
3	Chinatown	40.715618	-73.994279	Little Wayla	40.718337	-73.992693	Thai Restaurant
4	Chinatown	40.715618	-73.994279	Thai Diner	40.720739	-73.995631	Thai Restaurant



Neighborhood	Asian Restaurant	Chinese Restaurant	Filipino Restaurant	Food Truck	Indian Restaurant	Japanese Restaurant	Malay Restaurant	Ramen Restaurant	Sushi Restaurant	Thai Restaurant	Vietnamese Restaurant	Wine Bar
0 Marble Hill	0	0	0	0	0	0	0	0	0	1	0	0
1 Marble Hill	0	0	0	0	0	0	0	0	0	1	0	0
2 Chinatown	0	0	0	0	0	0	0	0	0	1	0	0
3 Chinatown	0	0	0	0	0	0	0	0	0	1	0	0
4 Chinatown	0	0	0	0	0	0	0	0	0	1	0	0

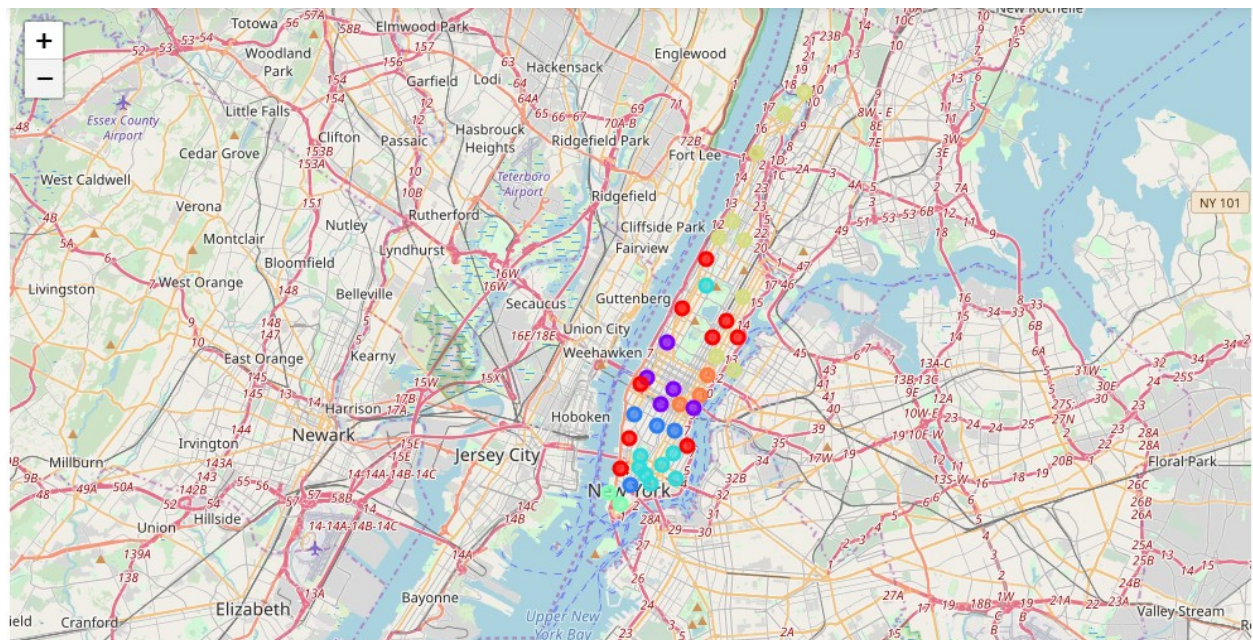
Figure 1: Thai Restaurants in Manhattan

Then use this feature to group the neighborhoods into clusters K-means clustering algorithm will be use to complete this task. And also, the Folium library to visualize the neighborhoods in Manhattan and its emerging clusters.

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0 Battery Park City	Thai Restaurant	Japanese Restaurant	Food Truck	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Indian Restaurant	Filipino Restaurant
1 Carnegie Hill	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
2 Central Harlem	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
3 Chelsea	Thai Restaurant	Malay Restaurant	Japanese Restaurant	Food Truck	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Indian Restaurant
4 Chinatown	Thai Restaurant	Asian Restaurant	Vietnamese Restaurant	Sushi Restaurant	Malay Restaurant	Filipino Restaurant	Wine Bar	Ramen Restaurant	Japanese Restaurant	Indian Restaurant



	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue
0	Manhattan	Marble Hill	40.876551	-73.910660	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
1	Manhattan	Chinatown	40.715618	-73.994279	3	Thai Restaurant	Asian Restaurant	Vietnamese Restaurant	Sushi Restaurant	Malay Restaurant	Filipino Restaurant	Wine Bar	Ramen Restaurant
2	Manhattan	Washington Heights	40.851903	-73.936900	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
3	Manhattan	Inwood	40.867684	-73.921210	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
4	Manhattan	Hamilton Heights	40.823604	-73.949688	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
5	Manhattan	Manhattanville	40.816934	-73.957385	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
6	Manhattan	Central Harlem	40.815976	-73.943211	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
7	Manhattan	East Harlem	40.792249	-73.944182	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
8	Manhattan	Upper East Side	40.775639	-73.960508	0	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant
9	Manhattan	Yorkville	40.775930	-73.947118	0	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant
10	Manhattan	Lenox Hill	40.768113	-73.958860	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
11	Manhattan	Roosevelt Island	40.762160	-73.949168	5	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant



## Results

K-mean Cluster Using K-mean to clustering data area with less number of Thai Restaurant

## Cluster 0

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
8	Upper East Side	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
9	Yorkville	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
12	Upper West Side	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
21	Tribeca	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
24	West Village	Thai Restaurant	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
26	Morningside Heights	Thai Restaurant	Indian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Food Truck	Filipino Restaurant
30	Carnegie Hill	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
37	Stuyvesant Town	Thai Restaurant	Sushi Restaurant	Wine Bar	Vietnamese Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
39	Hudson Yards	Thai Restaurant	Food Truck	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant

## Cluster 1

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
13	Lincoln Square	Thai Restaurant	Ramen Restaurant	Food Truck	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
14	Clinton	Thai Restaurant	Ramen Restaurant	Food Truck	Chinese Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Malay Restaurant	Japanese Restaurant
15	Midtown	Thai Restaurant	Food Truck	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
33	Midtown South	Thai Restaurant	Food Truck	Japanese Restaurant	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Indian Restaurant
36	Tudor City	Thai Restaurant	Food Truck	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant

## Cluster 2

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
17	Chelsea	Thai Restaurant	Malay Restaurant	Japanese Restaurant	Food Truck	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Indian Restaurant
27	Gramercy	Thai Restaurant	Food Truck	Chinese Restaurant	Malay Restaurant	Japanese Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant
32	Civic Center	Thai Restaurant	Malay Restaurant	Japanese Restaurant	Food Truck	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Indian Restaurant
38	Flatiron	Thai Restaurant	Food Truck	Chinese Restaurant	Malay Restaurant	Japanese Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant



## Cluster 3

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Chinatown	Thai Restaurant	Asian Restaurant	Vietnamese Restaurant	Sushi Restaurant	Malay Restaurant	Filipino Restaurant	Wine Bar	Ramen Restaurant	Japanese Restaurant	Indian Restaurant
18	Greenwich Village	Thai Restaurant	Asian Restaurant	Sushi Restaurant	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
19	East Village	Thai Restaurant	Sushi Restaurant	Chinese Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Food Truck	Filipino Restaurant	Ramen Restaurant	Malay Restaurant
20	Lower East Side	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Filipino Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
22	Little Italy	Thai Restaurant	Asian Restaurant	Vietnamese Restaurant	Sushi Restaurant	Malay Restaurant	Filipino Restaurant	Wine Bar	Ramen Restaurant	Japanese Restaurant	Indian Restaurant
23	Soho	Thai Restaurant	Asian Restaurant	Sushi Restaurant	Malay Restaurant	Wine Bar	Vietnamese Restaurant	Ramen Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck
25	Manhattan Valley	Thai Restaurant	Indian Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Food Truck
31	Noho	Thai Restaurant	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Filipino Restaurant	Chinese Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant

## Cluster 4

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
28	Battery Park City	Thai Restaurant	Japanese Restaurant	Food Truck	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Indian Restaurant	Filipino Restaurant
29	Financial District	Thai Restaurant	Japanese Restaurant	Food Truck	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Indian Restaurant	Filipino Restaurant

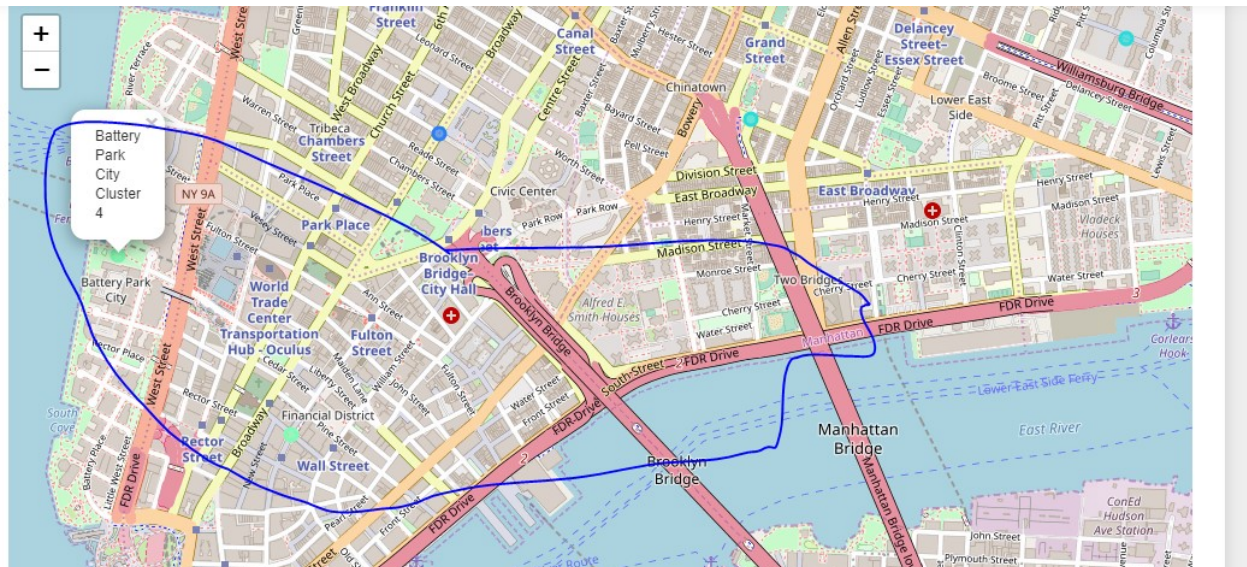
## Cluster 5

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Marble Hill	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
2	Washington Heights	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
3	Inwood	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
4	Hamilton Heights	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
5	Manhattanville	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
6	Central Harlem	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
7	East Harlem	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
10	Lenox Hill	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant
11	Roosevelt Island	Thai Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant	Food Truck	Filipino Restaurant

## Cluster 6

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
16	Murray Hill	Thai Restaurant	Food Truck	Asian Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
34	Sutton Place	Thai Restaurant	Food Truck	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant	Indian Restaurant
35	Turtle Bay	Thai Restaurant	Food Truck	Asian Restaurant	Chinese Restaurant	Wine Bar	Vietnamese Restaurant	Sushi Restaurant	Ramen Restaurant	Malay Restaurant	Japanese Restaurant

Based on data frame analysis above Cluster 4 (Battery Park City and Financial District) is the best places to open a new Thai Restaurant.



## Discussion

In this section, I would be discussing the observations I have noted and the recommendation that I can make based on the results.

This analysis is performed on limited data. This may be right or may be wrong. But if good amount of data is available there is scope to come up with better results.

There is high competition in Midtown and Noho so it is very risky to open business in these areas.

It can be done more detailed analysis by adding other factors such as transportation, demographics of inhabitants.



## **Conclusion**

Although all of the goals of this project were met but there is definitely room for further improvement and development as noted below. However, the goals of the project were met and, with some more work, could easily be developed into a complete application that could support the opening a business idea in an unknown location.

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