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.

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. Thai restaurants have become so popular in the United States now it seems that there is one on every corner, not only in major cities but also in smaller cities. Starting a Thai restaurant can be a great business opportunity, but you need to distinguish yourself from others to enjoy long-term success.

If you plan a real restaurant that can demand higher prices for fresh Thai food, focus on neighborhoods and outlets that already attract Thai clients. If you plan a cheap buffet restaurant, points to the masses looking for affordable high-traffic locations with large shopping centers and other local points of interest.

My client wants to open his business in Manhattan area, so I focus on that borough during my analysis. We define potential neighborhood based on the number of Thai restaurant which are operating right in each neighborhood. Manhattan has full potential but also is a very challenging district to open a business because of high competition. New Thai restaurant should be open in an area that inadequate neighborhood in this way the restaurant can attract more customers. Therefore, this analysis necessary to ensure that we have enough customers and that we are not so close to other Thai restaurants.

Data

I am going to work on New York City neighborhood. In order to segment the neighborhoods and explore them, we will essentially 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. This dataset exists for free on the web. Link to the dataset is: https://cocl.us/new_york_dataset

New York City geographical coordinates data will be utilized as input for the Foursquare API that will be leveraged to provision venues information for each neighborhood. We will use the Foursquare API to explore neighborhoods in New York City. 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.

So the dataset having new York neighborhood names will be used for boroughs and the Thai restaurant venues are collected by foursquare API and both of them will be merged to get a complete dataset on which clustering can be done. The retrieved neighborhood data is given below
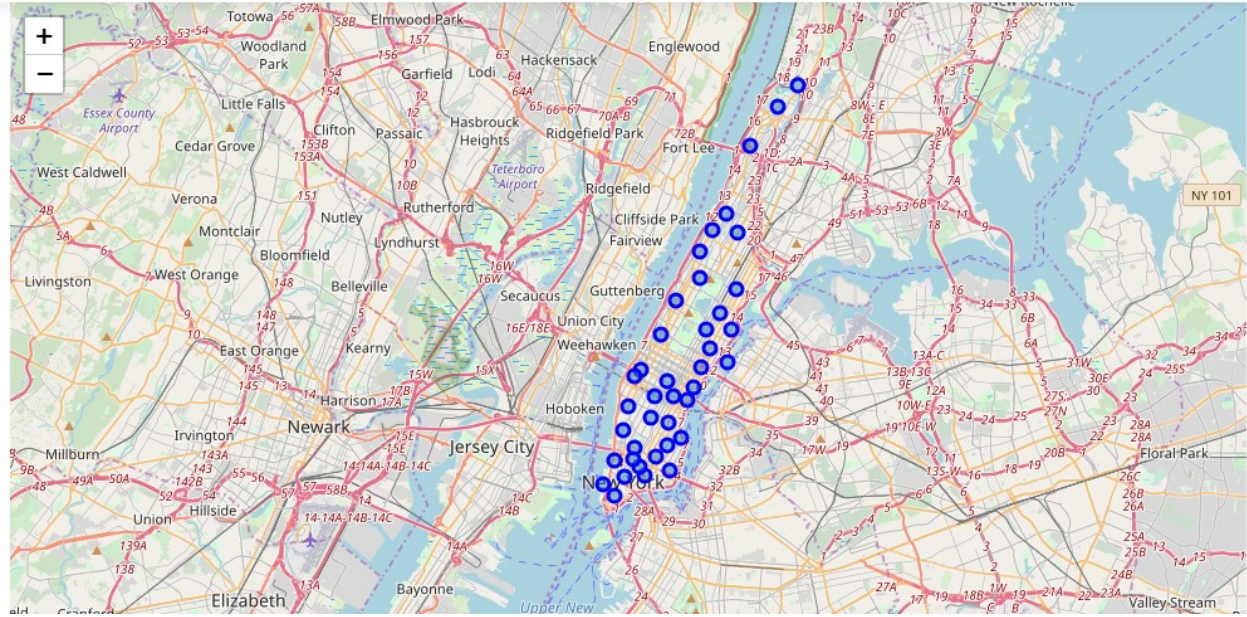
```
neighborhoods.head()
```

	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.

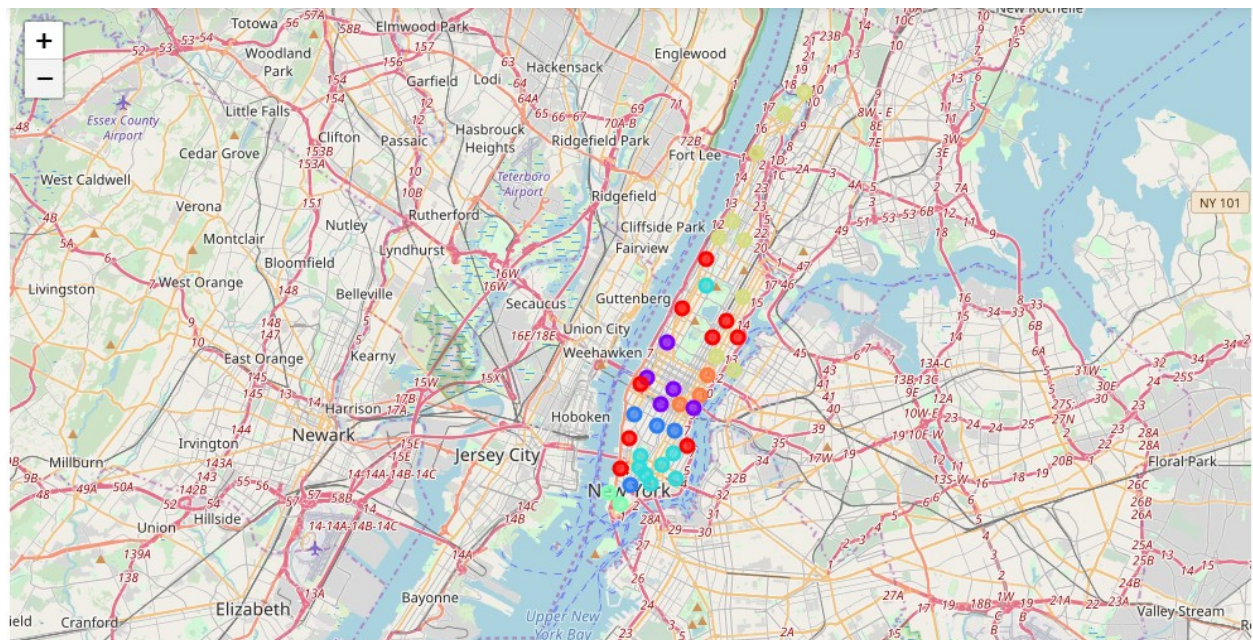|	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Marble Hill	40.876551	-73.910660	Siam Square	40.878796	-73.916701	Thai Restaurant
1	Marble Hill	40.876551	-73.910660	Nam Thai	40.886388	-73.910025	Thai Restaurant
2	Chinatown	40.715618	-73.994279	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

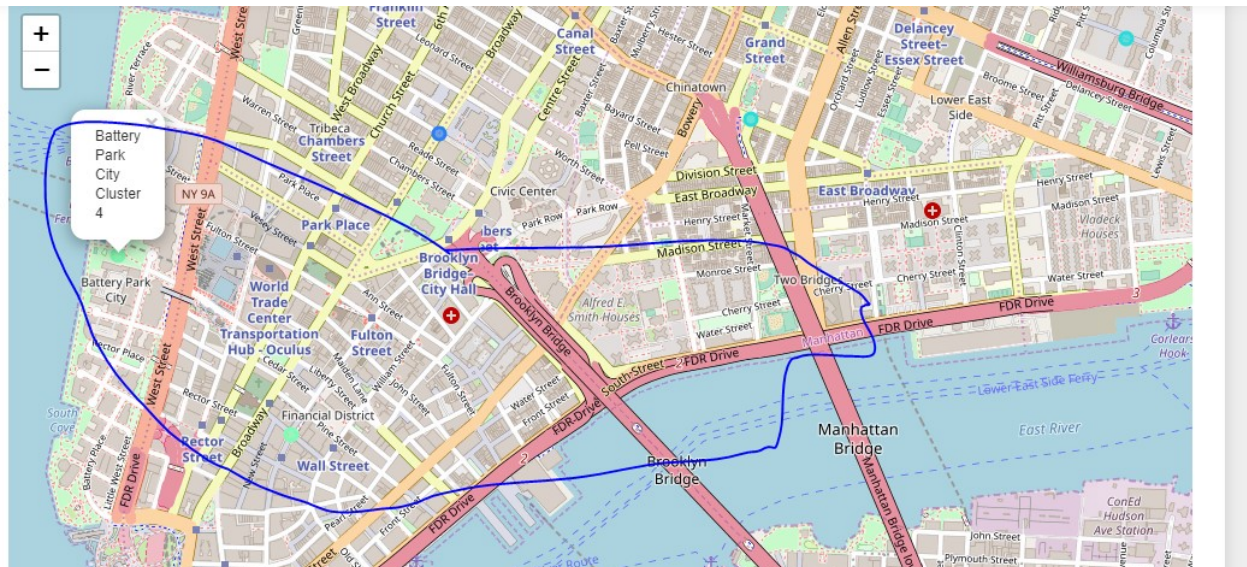|	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
28	Battery Park City	Thai Restaurant	Japanese Restaurant	Food Truck	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.