Capstone Project - The Battle of Neighbourhoods

BY:OMAR EMAD ELDIN

Selecting the best location to open an SUSHI BAR IN Manhattan, New York

Introduction

The City of New York is famous for its excellent cuisine. It's food culture includes an array of international cuisines influenced by the city's immigrant history.

A client has asked for help in trying to determine which neighborhood in Manhattan he should open his sushi restaurant in.

Problem

Which neighborhood should my client open his new Restaurant Supply store in Manhattan? He wants to ensure steady and sustainable business.

Requirements:

Store needs to be strategically located inside the biggest concentration of restaurants in Manhattan area.

2. Confirm any assumption by means of modeling and testing the data. Specifically, visually cluster common restaurants in Manhattan by neighborhood.

3. Additionally determine that a good number people can frequent these restaurants with sustainable frequency inside these neighborhoods.

My client wants to be able to judge which neighborhoods also may be poised to grow in restaurant numbers in coming years.

Locating his new store according to these requirements will ensure the following:

lowest cost for delivery

shortest travel time to his store for his clients

overall lower run costs

increase in overall business

overall greater customer satisfaction

Data Selection

To identify the characteristics of our competitors' venues in Manhattan, we would first need to find out the number of sushi restaurants in Manhattan currently and their location.

We then used Google Map API to find their geographic coordinates based on their postal code addresses.

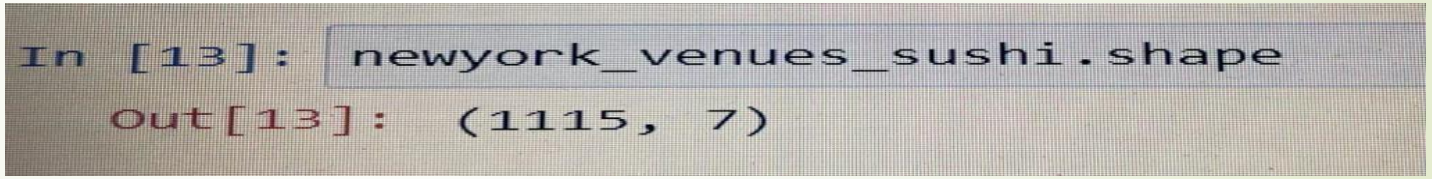
https://geo.nyu.edu/catalog/nyu_2451_34572

Manhattan list of Restaurants or Venues that could potentially use Restaurant Equipment

4SQUARE API
https://api.foursquare.com

and for sushi category

https://developer.foursquare.com/docs/resources/categories



In Manhattan, there is 1115 sushi Restaurants are currently operating.

Data Selection

Next, we also used Google Map API to find their geographic coordinates of the 5 locations shortlisted for our sushi bar:

t[12]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Marble Hill	40.876551	-73.910660	Planet Tokyo	40.886233	-73.909479	Sushi Restaurant
1	Chinatown	40.715618	-73.994279	Nakaji	40.715912	-73.996597	Sushi Restaurant
2	Chinatown	40.715618	-73.994279	Shinsen	40.715608	-73.996611	Japanese Restaurant
3	Chinatown	40.715618	-73.994279	Quan Sushi	40.720323	-73.996257	Sushi Restaurant
4	Chinatown	40.715618	-73.994279	Bondi Bar	40.721247	-73.996264	Sushi Restaurant

Methodology

Aaddresses are transformed into their equivalent latitude and longitude values.

Foursquare API is used to explore neighborhoods in Manhattan, New York.

After that, explore function to get sushi restaurant categories in each neighborhood.

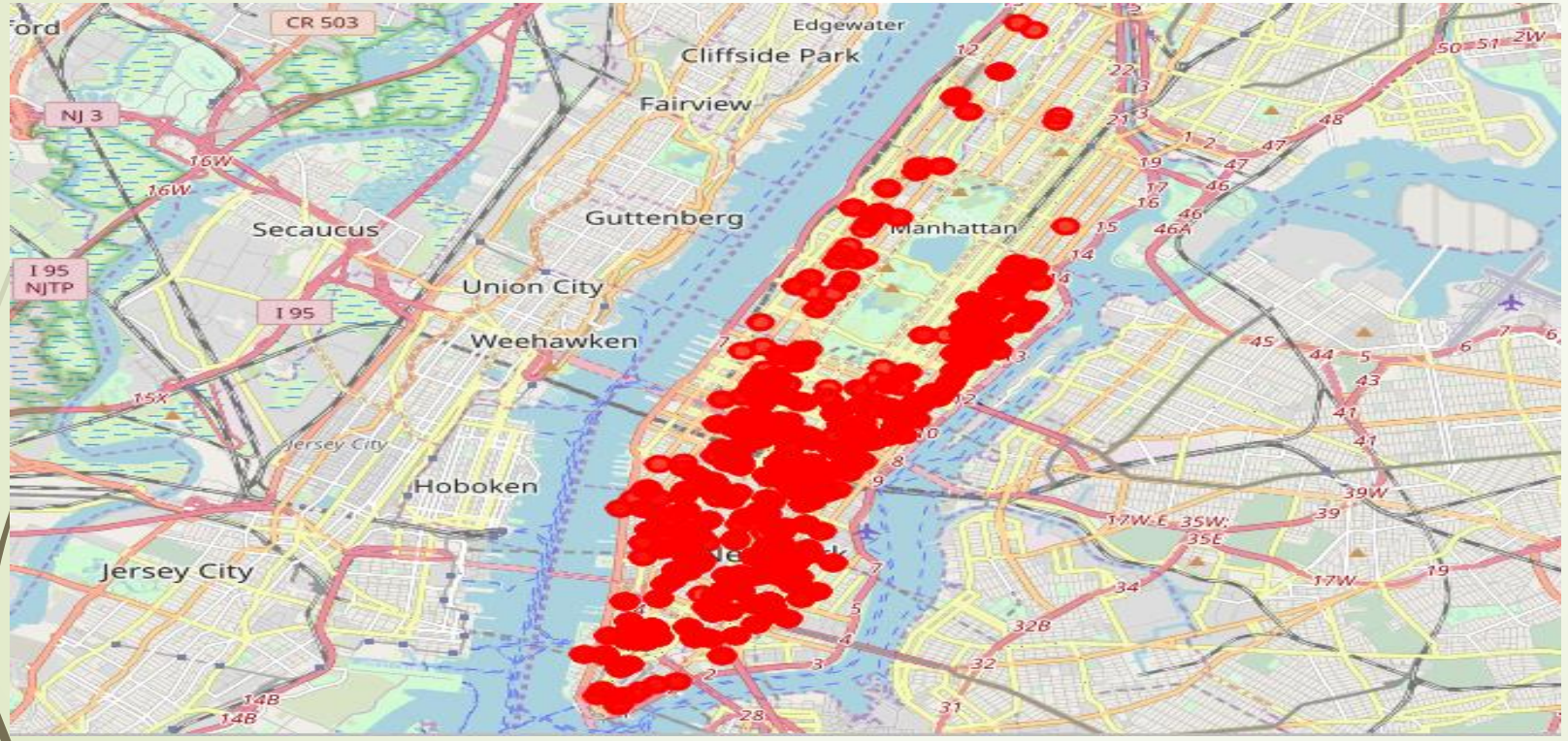
Methodology

[18]:

	Neighborhood	Asian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant	Japanese Restaurant	Noodle House	Ramen Restaurant	Restaurant	Sake Bar	Sandwich Place	Seafood Restaurant	Smoothie Shop	Steakhouse	Rest
0	Marble Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1	Chinatown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	Chinatown	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
3	Chinatown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	Chinatown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

```
]: manhattan_grouped = manhattan_onehot.groupby('Neighborhood').mean().reset_index()
```

Methodology



Sushi restaurants in Manhattan

Methodology

Then using 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.

I chose K-Means Clustering.
A backgrounder on K-Means clustering
"K-means clustering is an iterative clustering algorithm where the number of clusters K is predetermined and the algorithm iteratively assigns each data point to one of the K clusters based on the feature similarity."

*** Key Observation: And for my project feature similarity means restaurant similarity in Neighborhoods ***

Out[21]:

	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	Sushi Restaurant	Japanese Restaurant	Noodle House	Indian Chinese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store
1	Carnegie Hill	Sushi Restaurant	Japanese Restaurant	Indian Chinese Restaurant	Vegetarian / Vegan Restaurant	Asian Restaurant	Seafood Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant
2	Central Harlem	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
3	Chelsea	Sushi Restaurant	Japanese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Fish Market	Hawaiian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega
4	Chinatown	Sushi Restaurant	Japanese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant

Results

Using K-mean to clustering data area with less number of sushi restaurant

Cluster 0

Out[23]:

	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	9th Most Common Venue	10th Most Common Venue
0	Manhattan	Marble Hill	40.876551	-73.910660	1	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
1	Manhattan	Chinatown	40.715618	-73.994279	3	Sushi Restaurant	Japanese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
2	Manhattan	Washington Heights	40.851903	-73.936900	1	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
3	Manhattan	Inwood	40.867684	-73.921210	1	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
4	Manhattan	Hamilton Heights	40.823604	-73.949688	1	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant

Result

Cluster 1

```
In [27]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 1, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

Out[27]:

	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	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
2	Washington Heights	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
3	Inwood	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
4	Hamilton Heights	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
5	Manhattanville	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
6	Central Harlem	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
7	East Harlem	Sushi Restaurant	Vegetarian / Vegan Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
18	Greenwich Village	Sushi Restaurant	Japanese Restaurant	Sake Bar	Indian Chinese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store
21	Tribeca	Sushi Restaurant	Noodle House	Vegetarian / Vegan Restaurant	Indian Chinese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store

Result

Cluster 2

```
In [28]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 2, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

Out[28]:

	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	Sushi Restaurant	Japanese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Fish Market	Hawaiian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega
9	Yorkville	Sushi Restaurant	Japanese Restaurant	Fish Market	Indian Chinese Restaurant	Vegetarian / Vegan Restaurant	Asian Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant
10	Lenox Hill	Sushi Restaurant	Asian Restaurant	Japanese Restaurant	Vegetarian / Vegan Restaurant	Fish Market	Hawaiian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega
15	Midtown	Sushi Restaurant	Asian Restaurant	Seafood Restaurant	Japanese Restaurant	Sandwich Place	Restaurant	Ramen Restaurant	Bakery	Vegetarian / Vegan Restaurant	Smoothie Shop
17	Chelsea	Sushi Restaurant	Japanese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Fish Market	Hawaiian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega
30	Carnegie Hill	Sushi Restaurant	Japanese Restaurant	Indian Chinese Restaurant	Vegetarian / Vegan Restaurant	Asian Restaurant	Seafood Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant
34	Sutton Place	Sushi Restaurant	Japanese Restaurant	Asian Restaurant	Deli / Bodega	Steakhouse	Seafood Restaurant	Smoothie Shop	Grocery Store	Bakery	Chinese Restaurant

Result

Cluster 3

```
In [29]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 3, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

Out[29]:

	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	Sushi Restaurant	Japanese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
13	Lincoln Square	Sushi Restaurant	Japanese Restaurant	Smoothie Shop	Chinese Restaurant	Grocery Store	Indian Chinese Restaurant	Bakery	Cocktail Bar	Deli / Bodega	Fish Market
14	Clinton	Sushi Restaurant	Japanese Restaurant	Chinese Restaurant	Cocktail Bar	Asian Restaurant	Seafood Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant
16	Murray Hill	Sushi Restaurant	Japanese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Bakery	Restaurant	Ramen Restaurant	Grocery Store	Chinese Restaurant	Cocktail Bar
20	Lower East Side	Sushi Restaurant	Japanese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
24	West Village	Sushi Restaurant	Japanese Restaurant	Sake Bar	Fish Market	Vegetarian / Vegan Restaurant	Asian Restaurant	Sandwich Place	Seafood Restaurant	Restaurant	Ramen Restaurant
25	Manhattan Valley	Sushi Restaurant	Japanese Restaurant	Hawaiian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Indian Chinese Restaurant
26	Morningside Heights	Sushi Restaurant	Japanese Restaurant	Hawaiian Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Indian Chinese Restaurant
27	Gramercy	Sushi Restaurant	Japanese Restaurant	Deli / Bodega	Vegetarian / Vegan Restaurant	Seafood Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant	Noodle House
28	Battery Park City	Sushi Restaurant	Japanese Restaurant	Noodle House	Indian Chinese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store
29	Financial District	Sushi Restaurant	Japanese Restaurant	Bakery	Chinese Restaurant	Cocktail Bar	Deli / Bodega	Fish Market	Grocery Store	Hawaiian Restaurant	Indian Chinese Restaurant
33	Midtown South	Sushi Restaurant	Japanese Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	Bakery	Restaurant	Ramen Restaurant	Grocery Store	Chinese Restaurant	Cocktail Bar
38	Flatiron	Sushi Restaurant	Japanese Restaurant	Deli / Bodega	Vegetarian / Vegan Restaurant	Asian Restaurant	Seafood Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant

Result

Cluster 4

```
In [30]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 4, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

Out[30]:

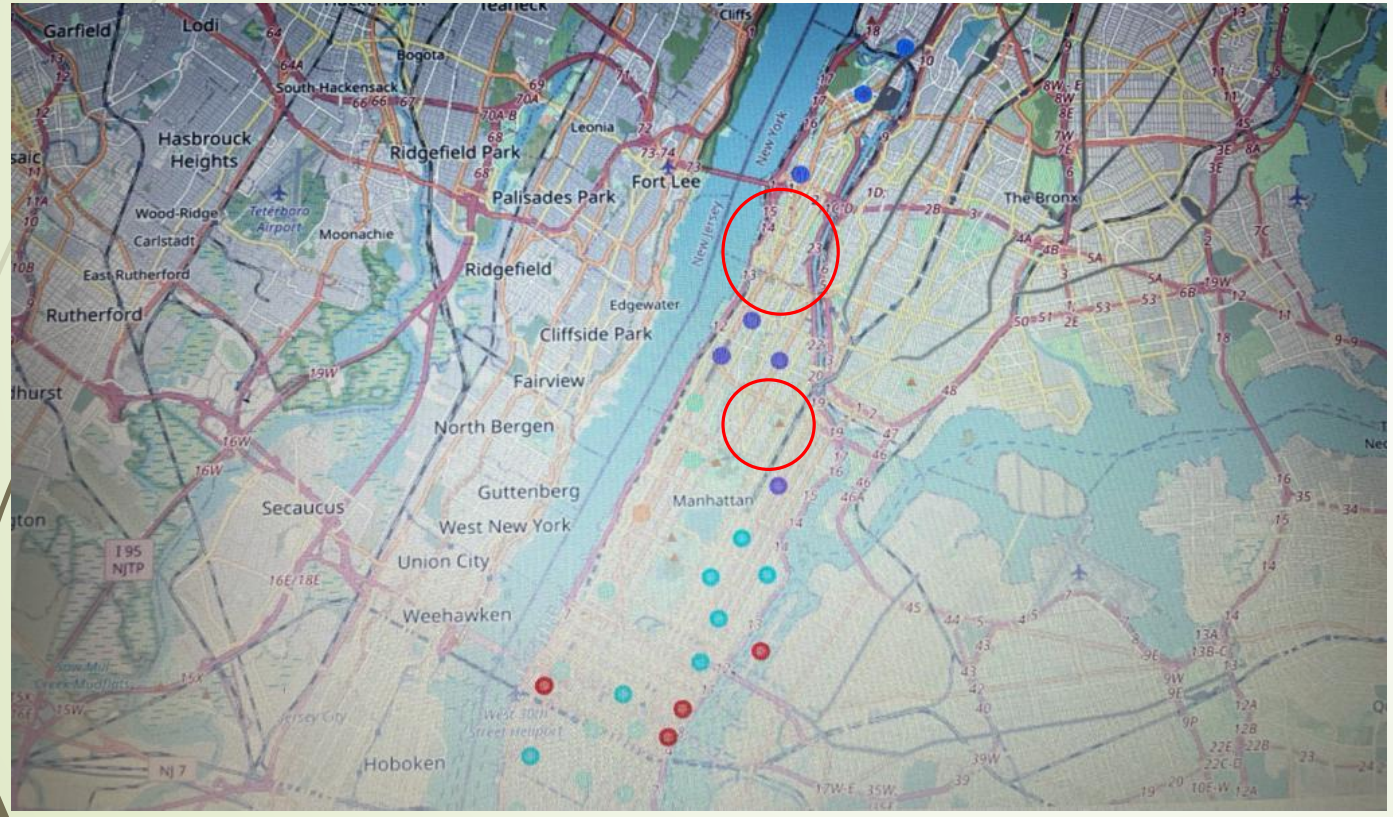
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
12	Upper West Side	Sushi Restaurant	Japanese Restaurant	Grocery Store	Asian Restaurant	Seafood Restaurant	Sandwich Place	Sake Bar	Restaurant	Ramen Restaurant	Noodle House

```
In [ ]:
```

Result


Saddle Brook
Hackensack
Englewood
Garfield
Lodi
Hasbrouck Heights
Ridgefield Park
Fort Lee
Teterboro Airport
Ridgefield
Rutherford
Cliffside Park
Fairview
North Bergen
Secaucus
Guttenberg
Union City
Weehawken
Hoboken
Jersey City

Result



Plot the clusters on a Map of the *Manhattan* to find the best location of a Store

Based on dataframe analysis this areas are the best places to open a new sushi restaurant business.

Discussion

As we built our list of neighborhoods with Restaurant venues exclusively we discovered most neighborhoods were similar and the greatest concentration of restaurants was in Central Manhattan and south Manhattan. This might seem obvious but it would also appear that these are some of the most affluent neighborhoods in Manhattan so there appears to be a correlation. By Locating in the general vicinity of the Exact location my client could be geographically centered in this cluster and poised to service his restaurant customer base with the greatest efficiency.

When we built our K-Means dataset to tell us there was a lot of similarity between neighborhoods and the most common restaurants contained within. Really there were 5 types of clusters or neighborhoods in greater Manhattan

10 for cluster 0 , 9 for cluster 1 , 7 for cluster 2 ,13 for cluster 3 and 1 for cluster 4. So Manhattan restaurants might be many but they are located near the center of Manhattan.

It appears that the greatest concentration of affluence is near south Manhattan.

Conclusion

I feel confident with the recommendation I have given my client as it is backed up with demonstrated data analysis. While nothing can ever be 100% certain he will certainly be better informed than he was prior to asking for my help.

Much more inference can be obtained with more work. A potential side business for my client might be assisting new restaurant owners where they might locate a new restaurant, who their competition is and who their clientele might be.