

# Capstone Project - The Battle of Neighborhoods Neighborhoods in Manhattan for a Hotel Chain

## Introduction

A hotel chain is looking to open a hotel in Manhattan and want to know which area they should open it and what kind of business concept should be implemented in the area.

There are 23 Neighborhoods of Manhattan that have more than one hotel located, of which **10 Neighborhoods** have more than three hotels. In order to understand the popular areas for a hotel location, we can create a map where the **top 10 Neighborhoods as a hotel location** are plotted as well as **hotels colored differently per clusters** according to **venue categories nearby**.

## Executive Summary

As the result of K-mean clustering, **7 major areas of popular hotel locations** were identified with categorized into 3 groups: near 1)Theater, 2)Food places and 3) Parks.

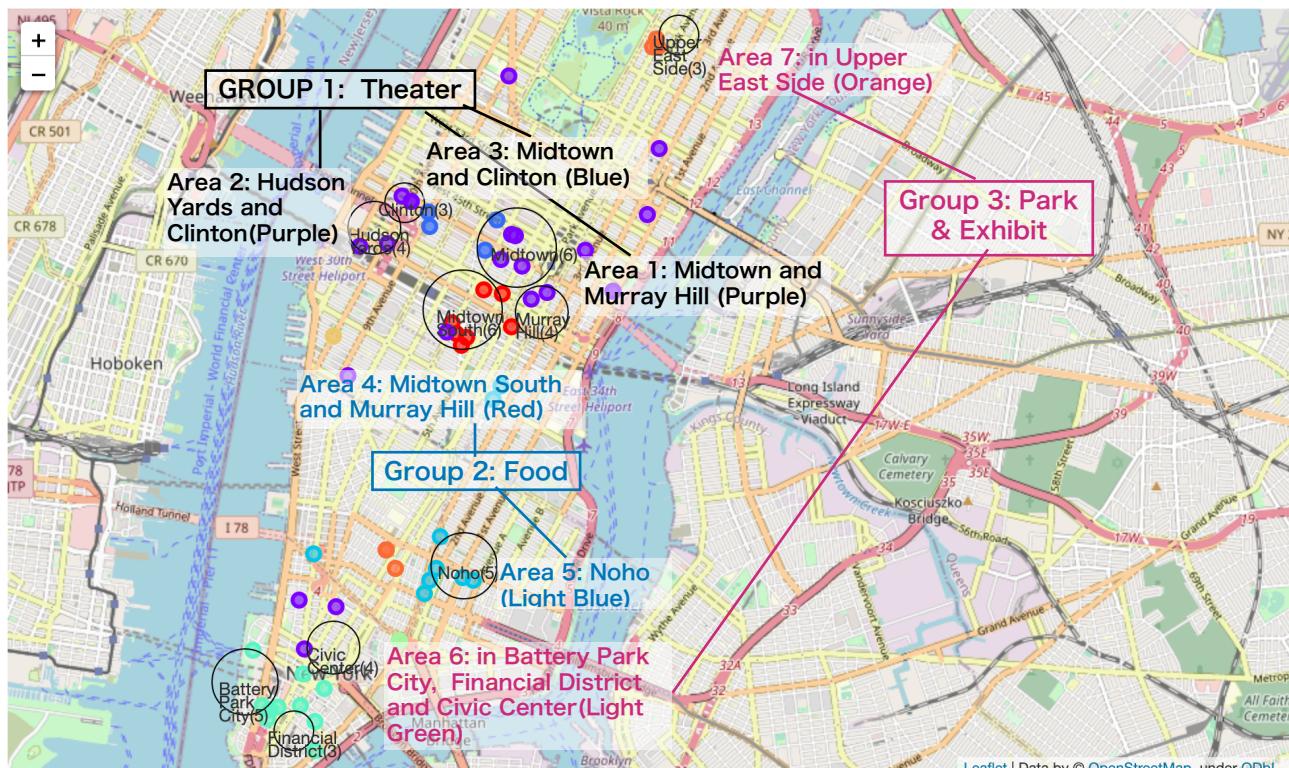
**Group 1 (Theater)** consists of 3 areas, **Area 1** as a busy commercial area where a variety food and retail shops can be found, **Area 2** as more quiet where Gym/Fitness center and Spa and coffee shops can be found, and **Area 3** as more casual places such as bakery and coffee shops can be found.

**Group 2 (Food)** consists of 2 areas, **Area 4** with Korean and ethnic food restaurants and **Area 5** with Mexican and Italian restaurants, both of them have a variety of restaurants.

**Group 3 (Park)** has 2 areas, **Area 6** with casual meals and coffee shops and **Area 7** with exhibit, art space and coffee shops.

As we could identify the areas popular as a hotel location in Manhattan, a hotel chain will be able to select the best place that fit their hotel brand portfolio.

Plot of Clusters of Hotels in Manhattan and Identified 7 Areas



Group	Area	Cluster	Most common venues	Expected Customer
1. Theater	1: Midtown and Murray Hill	1 (Purple)	Theater, clothing store and coffee shop	Enjoys theater and shopping
	2: Hudson Yards and Clinton	1 (Purple)	Theater, Gym / Fitness Center and coffee shop	Enjoys theater and prefers quieter place (places for locals)
	3: in Midtown and Clinton	2 (Blue)	Theater and Bakery	Enjoys theater and love casual place for light meals
2. Food	4: Midtown South and Murray Hill	0 (Red)	Korean restaurant and other ethnic restaurant	Korean and ethnic food lovers
	5: Noho	3 (Light Blue)	Mexican and Italian restaurant	Mexican and Italian food lovers
3. Park and exhibit	6: Battery Park City, Financial District and Civic Center	4 (Light Green)	Park and coffee shop	Loves park and casual place for light meals.
	7: Upper East Side	7 (Orange)	Exhibit, Italian and coffee shop	Loves arts and coffee.

## Data Description

To consider the problem we can list the datas as below:

- I used NY City neighborhoods data that contains boroughs and the neighborhoods that exist in each borough as well as the the latitude and longitude coordinates of each neighborhood. I extracted data of Manhattan from the original data: [https://geo.nyu.edu/catalog/nyu\\_2451\\_34572](https://geo.nyu.edu/catalog/nyu_2451_34572).
- I used Foursquare API explore function to get the most common venue categories in each neighborhood in Manhattan.

## Methodology

My master data has the main components Borough, Neighborhood, Latitude and Longitude informations of the Borough of Manhattan.

Borough	Neighborhood	Latitude	Longitude
6	Manhattan	Marble Hill	40.876551 -73.910660
100	Manhattan	Chinatown	40.715618 -73.994279
101	Manhattan	Washington Heights	40.851903 -73.936900
102	Manhattan	Inwood	40.867684 -73.921210
103	Manhattan	Hamilton Heights	40.823604 -73.949688

I utilized the Foursquare API to explore the Neighborhood to get the location of hotels. I designed the limit 100 and radius 500 meter for each Neighborhood from given latitude and longitude informations. Then extracted Venue Category of Hotel in order to make a list of hotel.

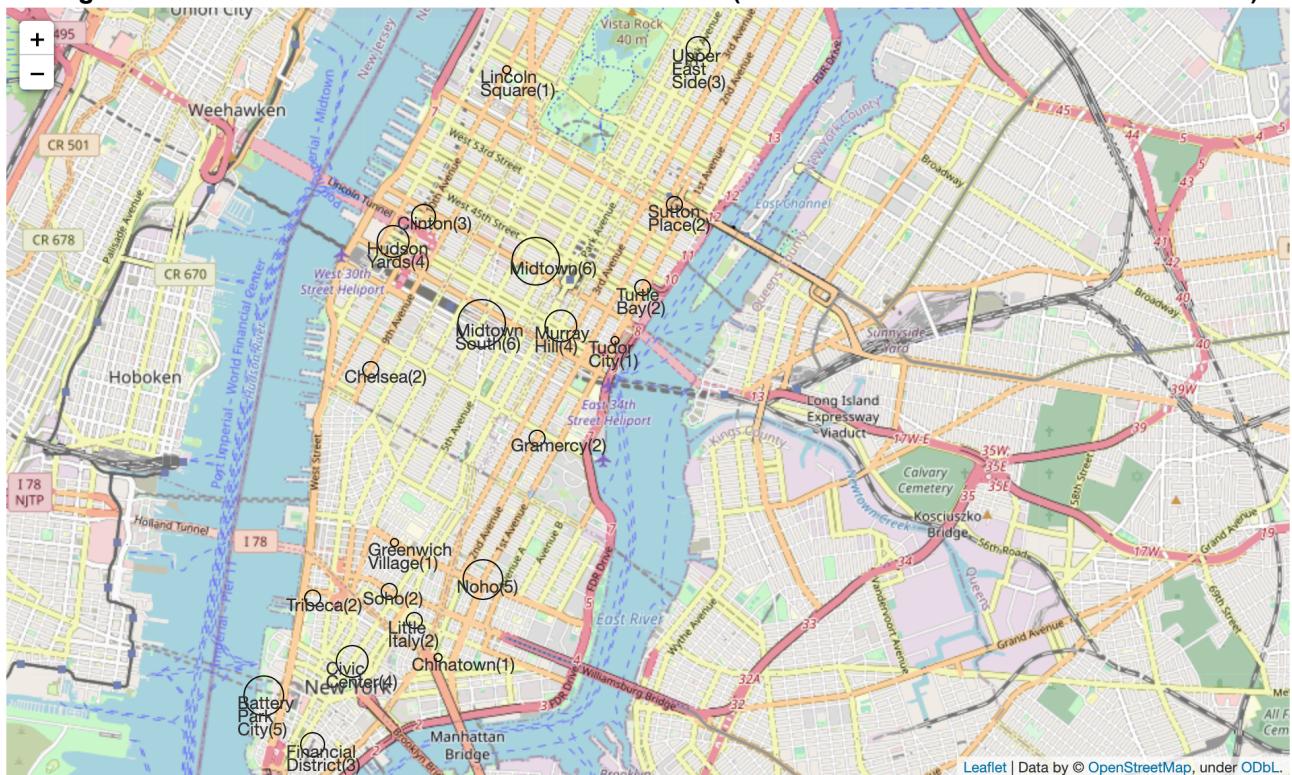
In summary of this data 63 hotels were returned by Foursquare. Here is a head of the list of Venues name (Hotel name), category (Hotel only), latitude and longitude informations from Foursquare API.

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category	
23	Chinatown	40.715618	-73.994279	Hotel 50 Bowery	40.715936	-73.996789	Hotel
466	Upper East Side	40.775639	-73.960508	The Mark Hotel	40.775274	-73.963383	Hotel
469	Upper East Side	40.775639	-73.960508	The Carlyle	40.774413	-73.963301	Hotel
488	Upper East Side	40.775639	-73.960508	The Surrey	40.774415	-73.963889	Hotel
866	Upper West Side	40.787658	-73.977059	The Lucerne Hotel	40.783427	-73.978495	Hotel

## 1. Popular areas for a hotel location

I used the Folium library to visualize the neighborhoods where more than one hotel is located.

Neighborhoods in Manhattan where hotels are located (Size of circle indicates number of hotels)



Neighborhoods that have more than 3 hotels are listed here:

	Neighborhood	No Hotels	Borough	Latitude	Longitude
12	Midtown	6	Manhattan	40.754691	-73.981669
13	Midtown South	6	Manhattan	40.748510	-73.988713
0	Battery Park City	5	Manhattan	40.711932	-74.016869
15	Noho	5	Manhattan	40.723259	-73.988434
14	Murray Hill	4	Manhattan	40.748303	-73.978332
4	Civic Center	4	Manhattan	40.715229	-74.005415
9	Hudson Yards	4	Manhattan	40.756658	-74.000111
21	Upper East Side	3	Manhattan	40.775639	-73.960508
5	Clinton	3	Manhattan	40.759101	-73.996119
6	Financial District	3	Manhattan	40.707107	-74.010665

## 2. Most common venue categories near each hotel

I utilized the Foursquare API to explore each Hotel to get the most common venue categories near each hotel. I designed the limit 100 and radius 500 meter for each Hotel from their given latitude and longitude informations.

In summary of this data 6068 venues were returned by Foursquare. Here is a head of the list of Neighborhood (Name of Hotel), Venues name, category, latitude and longitude informations from Foursquare API.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Hotel 50 Bowery	40.715936	-73.996789	Zu Yuan Spa	40.715469	-73.998627	Spa
1	Hotel 50 Bowery	40.715936	-73.996789	Hotel 50 Bowery	40.715936	-73.996789	Hotel
2	Hotel 50 Bowery	40.715936	-73.996789	The Original Chinatown Ice Cream Factory	40.715521	-73.998145	Ice Cream Shop
3	Hotel 50 Bowery	40.715936	-73.996789	Xi'an Famous Foods	40.715232	-73.997263	Chinese Restaurant
4	Hotel 50 Bowery	40.715936	-73.996789	Alimama	40.715854	-73.999139	Dessert Shop

I created a table that contains the mean of the frequency of occurrence of each category near the each hotel used for K-means clustering.

	Hotel	Yoga Studio	Accessories Store	Adult Boutique	American Restaurant	Animal Shelter	Antique Shop	Arepas Restaurant	Argentinian Restaurant	Art Gallery	... Video Game Store	Video Store	Vietnamese Restaurant	Volleyball Court	Watch Shop	...
0	AKA Sutton Place	0.00	0.0	0.01	0.03	0.0	0.0	0.0	0.0	0.00	...	0.0	0.0	0.00	0.0	0.0
1	AKA Wall Street	0.01	0.0	0.00	0.04	0.0	0.0	0.0	0.0	0.00	...	0.0	0.0	0.00	0.0	0.0
2	Ace Hotel New York	0.01	0.0	0.00	0.01	0.0	0.0	0.0	0.0	0.00	...	0.0	0.0	0.00	0.0	0.0
3	Andaz 5th Avenue - a concept by Hyatt	0.00	0.0	0.00	0.02	0.0	0.0	0.0	0.0	0.01	...	0.0	0.0	0.01	0.0	0.0
4	Andaz Wall Street - a concept by Hyatt	0.00	0.0	0.00	0.04	0.0	0.0	0.0	0.0	0.00	...	0.0	0.0	0.00	0.0	0.0

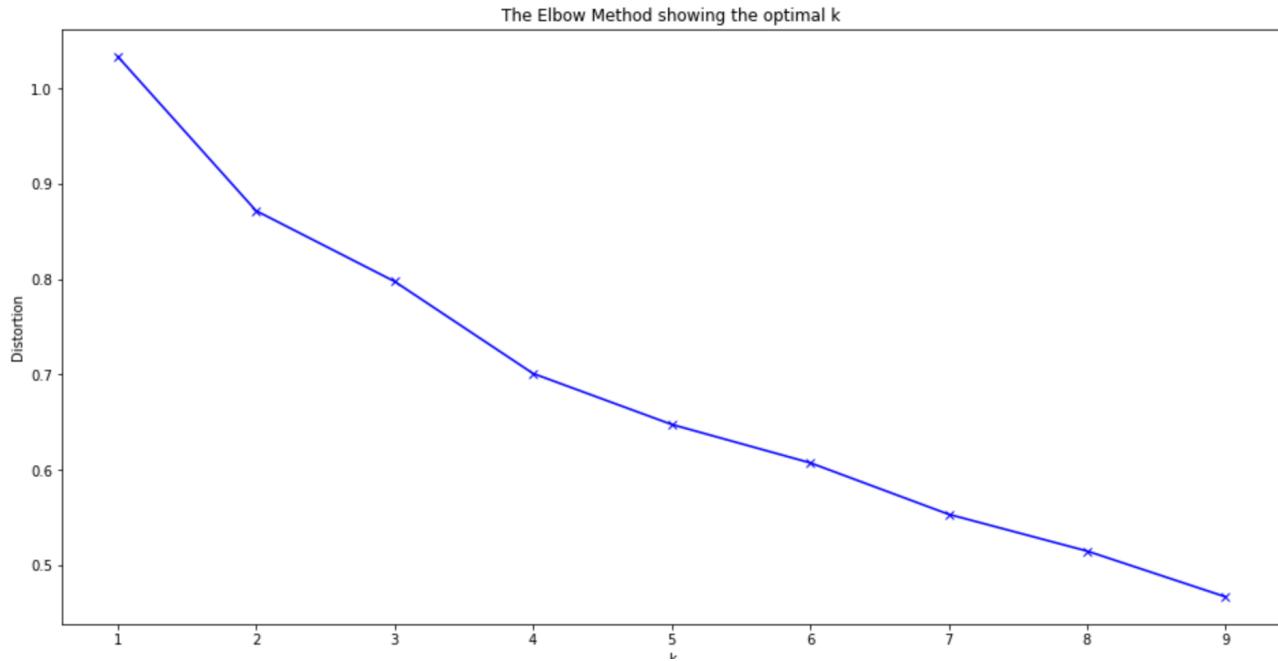
I also created a table that contains top 10 most common venues near the each hotel for discussion.

	Neighborhood	No Hotels	Venue	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	...	
0	Midtown	6	Sofitel New York	1	Theater	Clothing Store	Bakery	Steakhouse	Sushi Restaurant	Plaza	Sporting Goods Shop	Bookstore	American Restaurant	...	
1	Midtown	6	Andaz 5th Avenue - a concept by Hyatt	1	Bakery	Coffee Shop	Clothing Store	Sporting Goods Shop	Mediterranean Restaurant	Grocery Store	Steakhouse	Bookstore	Sushi Restaurant	...	
2	Midtown	6	The Algonquin Hotel, Autograph Collection	1	Theater	Clothing Store	Bakery	Sporting Goods Shop	Bookstore	Steakhouse	American Restaurant	Plaza	Coffee Shop	...	
3	Midtown	6	Bryant Park Hotel	1	Bakery	Clothing Store	Sandwich Place	Café	Theater	American Restaurant	Gym / Fitness Center	Coffee Shop	Steakhouse	Me	...
4	Midtown	6	Hyatt Centric Times Square New York	2	Theater	Cosmetics Shop	Bookstore	Cuban Restaurant	Italian Restaurant	Sushi Restaurant	Plaza	Steakhouse	Bakery	...	...

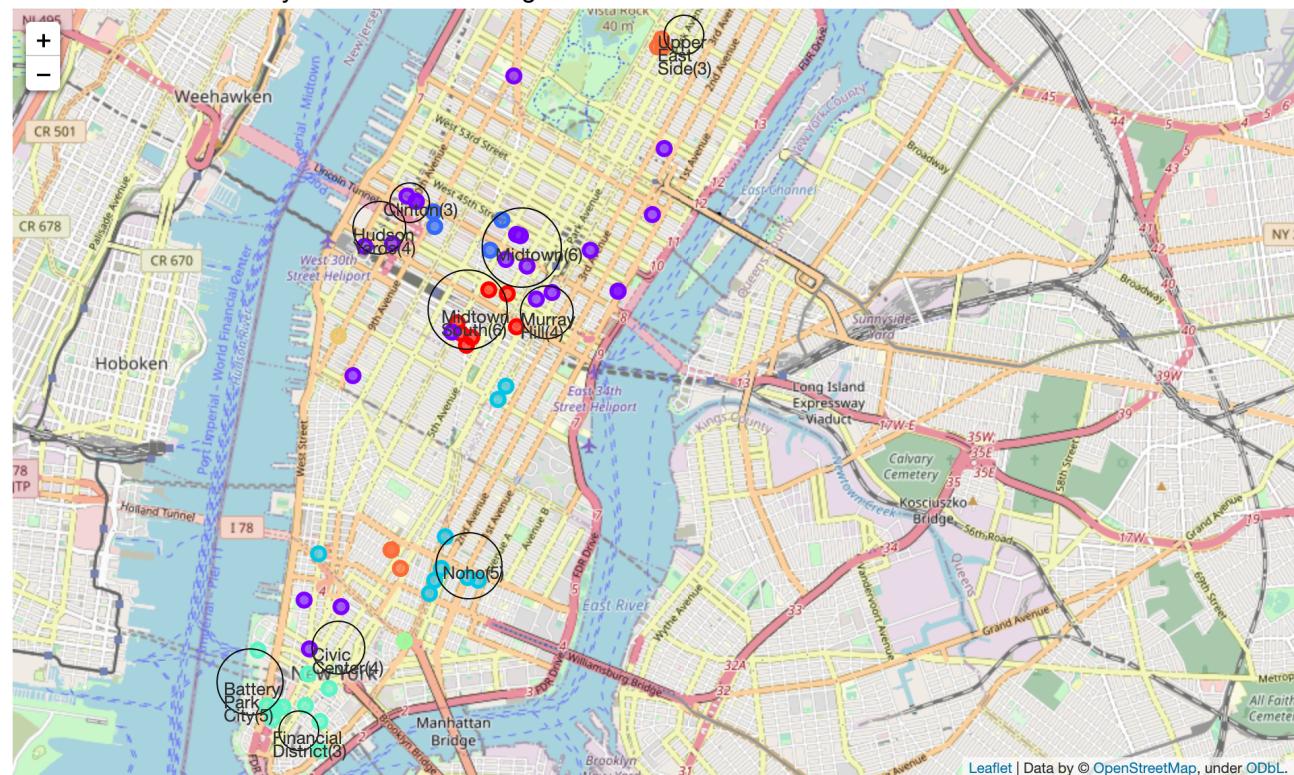
### 3. Neighborhoods analysis of each hotel in the popular areas

I used K-means clustering algorithm in order to analyze the common venue categories found near each hotel. Then examined cluster and determine the discriminating venue categories that distinguish each cluster.

I run K-Means to cluster the hotels into 8 clusters because when I analyze the K-Means with elbow method I didn't observe that the "elbow" up 40 so I selected 8 to make the analysis clear with maximum optimal result.



I used the Folium library to visualize the neighborhoods where more than one hotel is located.



## Results

By conducting k-mean clustering of each hotel, 6 areas categorized 3 groups were identified:

## Group 1: Theater area

Group 1 (Theater) consists of 3 areas, Area 1 as a busy commercial area where a variety food and retail shops can be found, Area 2 as more quiet where Gym/Fitness center and Spa and coffee shops can be found, and Area 3 as more casual places such as bakery and coffee shops can be found.

### Area 1: Cluster 1 in Midtown and Murray Hill (Purple)

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
Midtown	Theater	Clothing Store	Bakery	Steakhouse	Sushi Restaurant	Plaza	Sporting Goods Shop	Bookstore	American Restaurant	Coffee Shop
Midtown	Bakery	Coffee Shop	Clothing Store	Sporting Goods Shop	Mediterranean Restaurant	Grocery Store	Steakhouse	Bookstore	Sushi Restaurant	Café
Midtown	Theater	Clothing Store	Bakery	Sporting Goods Shop	Bookstore	Steakhouse	American Restaurant	Plaza	Coffee Shop	Sushi Restaurant
Midtown	Bakery	Clothing Store	Sandwich Place	Café	Theater	American Restaurant	Gym / Fitness Center	Coffee Shop	Steakhouse	Mediterranean Restaurant
Murray Hill	Coffee Shop	Japanese Restaurant	Bakery	American Restaurant	Sandwich Place	Gym	Gourmet Shop	Burger Joint	Café	Sushi Restaurant
Murray Hill	Bakery	Gym / Fitness Center	Sandwich Place	Coffee Shop	Japanese Restaurant	Spa	Restaurant	Gourmet Shop	Bar	American Restaurant

### Area 2: Cluster 1 in Hudson Yards and Clinton (Purple)

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
Hudson Yards	Theater	Gym / Fitness Center	American Restaurant	Coffee Shop	Wine Shop	Sandwich Place	Cocktail Bar	Italian Restaurant	French Restaurant	Spa
Hudson Yards	Park	Art Gallery	American Restaurant	Coffee Shop	Theater	Cocktail Bar	Grocery Store	Lounge	Gym / Fitness Center	Café
Hudson Yards	Italian Restaurant	Gym / Fitness Center	Gym	American Restaurant	Thai Restaurant	Furniture / Home Store	Coffee Shop	Burger Joint	Art Gallery	Park
Hudson Yards	Theater	Gym / Fitness Center	Coffee Shop	American Restaurant	Gym	Italian Restaurant	Spa	Sandwich Place	Ethiopian Restaurant	Dive Bar
Clinton	Theater	Gym / Fitness Center	American Restaurant	Coffee Shop	Wine Shop	Sandwich Place	Cocktail Bar	Italian Restaurant	French Restaurant	Spa

### Area 3: Cluster 2 in Midtown and Clinton (Blue)

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
Midtown	Theater	Cosmetics Shop	Bookstore	Cuban Restaurant	Italian Restaurant	Sushi Restaurant	Plaza	Steakhouse	Bakery	Toy / Game Store
Midtown	Theater	Bakery	Steakhouse	Coffee Shop	Cuban Restaurant	Mediterranean Restaurant	Salad Place	Plaza	Cosmetics Shop	Toy / Game Store
Clinton	Theater	Italian Restaurant	Burger Joint	American Restaurant	Gym / Fitness Center	Bakery	Sandwich Place	Coffee Shop	Thai Restaurant	Park
Clinton	Theater	Dance Studio	Coffee Shop	Gym / Fitness Center	Italian Restaurant	Indie Theater	Bakery	Burger Joint	Thai Restaurant	Pizza Place

## Group 2: Food area

Group 2 (Food) consists of 2 areas, Area 4 with Korean and ethnic food restaurants and Area 5 with Mexican and Italian restaurants, both of them have a variety of restaurants.

### Area 4: Cluster 0 in Midtown South and Murray Hill (Red)

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
Midtown South	Korean Restaurant	Café	Dessert Shop	Spa	Gym / Fitness Center	New American Restaurant	Cosmetics Shop	Coffee Shop	Bakery	Japanese Restaurant
Midtown South	Korean Restaurant	Café	Coffee Shop	Hotel Bar	Dessert Shop	New American Restaurant	Lounge	Spa	Gym / Fitness Center	Italian Restaurant
Midtown South	Korean Restaurant	Coffee Shop	Gym / Fitness Center	Hotel Bar	Café	Japanese Restaurant	Dessert Shop	Italian Restaurant	Bar	Bakery
Midtown South	Korean Restaurant	Coffee Shop	Italian Restaurant	Café	Japanese Restaurant	New American Restaurant	Sandwich Place	Gym / Fitness Center	Hotel Bar	American Restaurant
Midtown South	Korean Restaurant	Bakery	Japanese Restaurant	Coffee Shop	Cosmetics Shop	Mediterranean Restaurant	Fried Chicken Joint	Café	Sandwich Place	Bookstore
Murray Hill	Korean Restaurant	Bakery	Coffee Shop	American Restaurant	Gym / Fitness Center	Japanese Restaurant	Steakhouse	Vegetarian / Vegan Restaurant	Fried Chicken Joint	Cuban Restaurant
Murray Hill	Korean Restaurant	Café	Spa	Bar	Gym / Fitness Center	Italian Restaurant	Japanese Restaurant	Bakery	Salad Place	Pizza Place

### Area 5: Cluster 3 in Noho (Light Blue)

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
Noho	Mexican Restaurant	Italian Restaurant	Coffee Shop	French Restaurant	Sandwich Place	Wine Shop	Bookstore	Café	Bakery	Vietnamese Restaurant
Noho	Mexican Restaurant	Sandwich Place	Italian Restaurant	French Restaurant	Coffee Shop	Bakery	Ice Cream Shop	Pizza Place	Cocktail Bar	Yoga Studio
Noho	Italian Restaurant	Bookstore	Coffee Shop	Cocktail Bar	Japanese Restaurant	French Restaurant	Cosmetics Shop	Wine Shop	Sandwich Place	Bakery
Noho	Italian Restaurant	Bar	American Restaurant	Coffee Shop	Yoga Studio	Sushi Restaurant	Art Gallery	Japanese Restaurant	Pizza Place	Mexican Restaurant
Noho	Café	Cocktail Bar	Coffee Shop	Italian Restaurant	Pizza Place	Ice Cream Shop	Mediterranean Restaurant	Cosmetics Shop	Rock Club	Jewelry Store

### Group 3: Park and exhibit area

Group 3 (Park) has 2 areas, Area 6 with casual meals and coffee shops and Area 7 with exhibit, art space and coffee shops.

#### Area 6: Cluster 4 in Battery Park City, Financial District and Civic Center(Light Green)

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
Battery Park City	Park	Coffee Shop	Playground	Burger Joint	Deli / Bodega	Memorial Site	Gym	Food Court	Sandwich Place	Steakhouse
Battery Park City	Park	Coffee Shop	Memorial Site	Gym	Pizza Place	Gourmet Shop	Plaza	Gym / Fitness Center	Café	Shopping Mall
Battery Park City	Coffee Shop	Park	Pizza Place	Memorial Site	Gourmet Shop	Sandwich Place	Ice Cream Shop	Bar	Falafel Restaurant	Plaza
Battery Park City	Coffee Shop	Pizza Place	Memorial Site	Gym / Fitness Center	Clothing Store	Sandwich Place	Gourmet Shop	Shopping Mall	Park	Monument / Landmark
Battery Park City	Park	Coffee Shop	Pizza Place	Memorial Site	Mexican Restaurant	Clothing Store	Steakhouse	Gym	Gourmet Shop	Café
Civic Center	Coffee Shop	Sandwich Place	Café	Gym	Memorial Site	American Restaurant	Shopping Mall	Gym / Fitness Center	Falafel Restaurant	Pizza Place
Civic Center	Sandwich Place	Coffee Shop	Gym	Wine Shop	Pizza Place	Falafel Restaurant	Deli / Bodega	Plaza	Italian Restaurant	Indian Restaurant
Financial District	Coffee Shop	Pizza Place	Memorial Site	Park	Sandwich Place	Jewelry Store	Clothing Store	Café	Gym / Fitness Center	Wine Shop
Financial District	Coffee Shop	American Restaurant	Pizza Place	Falafel Restaurant	Steakhouse	Sandwich Place	Juice Bar	Café	Jewelry Store	Park
Financial District	Coffee Shop	Cocktail Bar	American Restaurant	Salad Place	Gym	Bar	Falafel Restaurant	Mexican Restaurant	Gym / Fitness Center	Steakhouse

#### Area 7: Cluster 7 in Upper East Side (Orange)

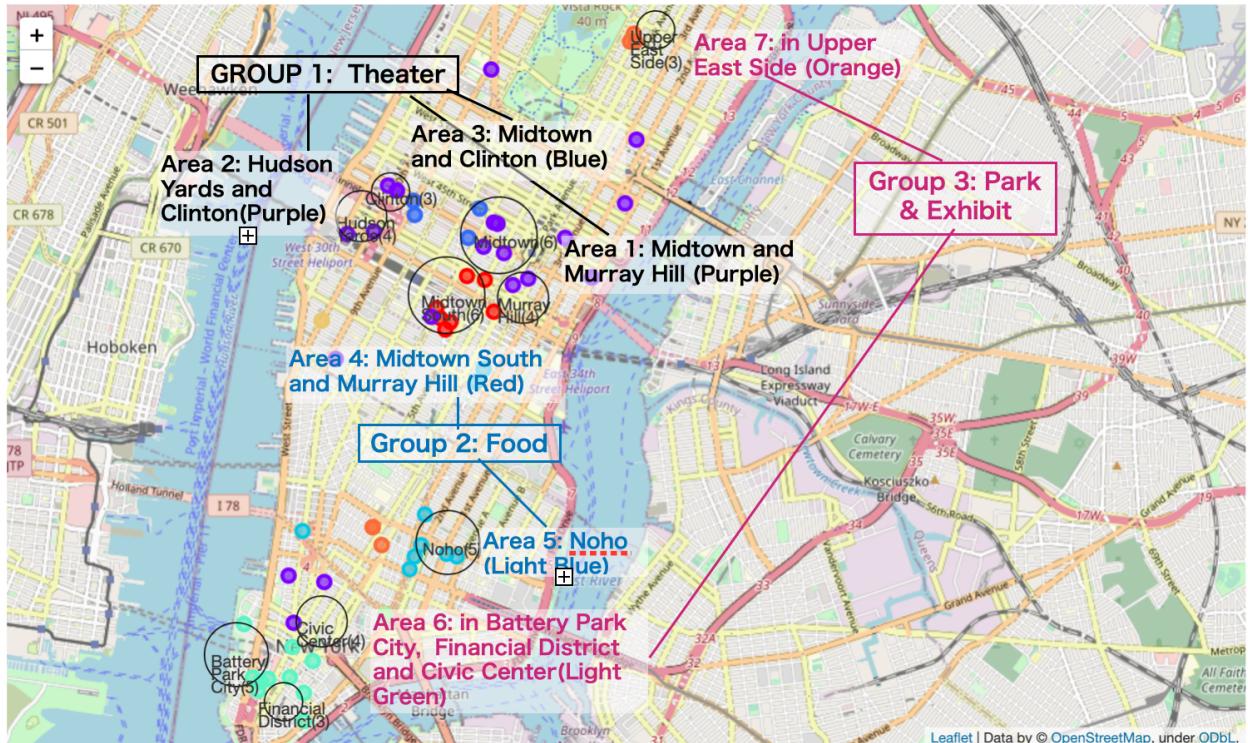
Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
Upper East Side	Exhibit	Coffee Shop	Cosmetics Shop	Outdoor Sculpture	American Restaurant	Italian Restaurant	Art Museum	Bakery	Park	Café
Upper East Side	Italian Restaurant	Coffee Shop	Cosmetics Shop	Boutique	Outdoor Sculpture	Exhibit	Park	French Restaurant	Café	Clothing Store
Upper East Side	Italian Restaurant	Coffee Shop	Exhibit	Art Museum	Cosmetics Shop	Outdoor Sculpture	Boutique	Clothing Store	Park	French Restaurant

## Discussion

By conducting k-mean clustering of each hotel, 6 popular areas for hotel location categorized into 3 groups were identified. Based on more detailed analysis of most common venues, expected customers for targeting segmentation were identified as below:

Group	Area	Cluster	Most common venues	Expected Customer
1. Theater	1: Midtown and Murray Hill	1 (Purple)	Theater, clothing store and coffee shop	Enjoys theater and shopping
	2: Hudson Yards and Clinton	1 (Purple)	Theater, Gym / Fitness Center and coffee shop	Enjoys theater and prefers quieter place (places for locals)
	3: in Midtown and Clinton	2 (Blue)	Theater and Bakery	Enjoys theater and love casual place for light meals
2. Food	4: Midtown South and Murray Hill	0 (Red)	Korean restaurant and other ethnic restaurant	Korean and ethnic food lovers
	5: Noho	3 (Light Blue)	Mexican and Italian restaurant	Mexican and Italian food lovers
3. Park and exhibit	6: Battery Park City, Financial District and Civic Center	4 (Light Green)	Park and coffee shop	Loves park and casual place for light meals.
	7: Upper East Side	7 (Orange)	Exhibit, Italian and coffee shop	Loves arts and coffee.

Plot of Clusters of Hotels in Manhattan and Identified 7 Areas



## Conclusion

I recommend a hotel chain to consider a strategy to enter the areas identified based on the further analysis of competitors' concept and strategy.

If the hotel chain have a strong brand for night life lovers, Area 1 will be their first choice since the area seems to be located in the very busy area near theater. If they have more relaxed and artistic brand, Area 7 might be the best choice since the area seems to be far from busy area but have art and exhibit places near by.