Study of the impact of the removal of movie theaters on neighboring venues and neighborhoods

IBM Data Science Professional Certificate

Capstone Project

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1. Introduction

Due to the current COVID-19 pandemic, businesses have to reinvent themselves to adapt to the situation and minimize their losses. In recent months, the social and entertainment activities such as restaurants, coffee shops, museums and others have seen drastic decline is customers. However, even with the recent decline, it is still expected that these industries will recover thanks to the government's subsidies and their recent successes in adapting to the situation (e.g. outdoor dining, delivery, virtual events, etc.). Movie theaters on the other hand have been undergoing a difficult transition as their whole business model runs on joining people together in a room to watch a movie. Due to social distancing criteria and difficulty of enforcing masks (or completely removing the ability to eat), movie theaters are forced to close with no sign of recovery. Even following the pandemic, their appeal has been diminishing for years with the arrival of streaming services which have shown especially during the pandemic their ability to premiere movies and charge a premium without needing to rely on an intermediate.

With that, in the next years, we are expecting movie theaters to be phased out of the country as many of them will go bankrupt along with many retail experiences that are no longer relevant and were not able to adapt to the current situation. In this situation, the problem statement looks at understanding the impact of removing movie theaters in an area and whether there are enough venues to take on the load of an entertainment sector business gone bankrupt. Hence, this analysis' objective is to possibly predict the future of those venues and whether they will be replaced or completely removed with no impact on their surroundings.

2. Data Extraction

This report will be built using the location data provided by Foursquare. This data includes information on the geographical locations, venues and types of businesses in the area. Precise information such as business details but also public spaces can be related to another to understand the impact of one to another.

3. Methodology

To analyze the impact of removing movie theaters, it is important to cluster the different types of venues together and analyze their proximity to the movie theaters with the center of the clusters being the movie theaters. In a second part of the study, the movie theaters will be removed and the clusters will be formed to understand the impact that removing the movie theaters had on the clusters.

This two part analysis will study the current mode of operation of the neighborhood versus the future mode of operation of the neighborhood to better understand its impact on its surroundings. This simulation will be looking at variables such as type of venue, relative cost of each venue, typical time spent in an area, population density, number of theaters in the same area and proximity of the clusters.

To accomplish this, the K-means clustering technique was used as it is the simplest while being effective method to approach this problem.

3. Results

The following results are tables of data that show the area and the movie theaters. To start off, the first table contains information regarding the neighborhoods and some movie theaters.

Table 1: Movie Theaters per Neighborhood

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
87	Chinatown	40.715618	-73.994279	Metrograph	40.714999	-73.991035	Indie Movie Theater
164	Chinatown	40.715618	-73.994279	Regal Essex 14 & RPX	40.718133	-73.987895	Movie Theater
1150	Roosevelt Island	40.762160	-73.949168	CMX CineBistro	40.761338	-73.960406	Movie Theater
1180	Upper West Side	40.787658	-73.977059	AMC Loews 84th Street 6	40.786770	-73.977608	Movie Theater
1284	Lincoln Square	40.773529	-73.985338	Walter Reade Theater	40.773783	-73.983924	Indie Movie Theater
1288	Lincoln Square	40.773529	-73.985338	Film at Lincoln Center	40.773609	-73.983571	Indie Movie Theater
1299	Lincoln Square	40.773529	-73.985338	Elinor Bunin Munroe Film Center	40.773709	-73.983489	Indie Movie Theater
1307	Lincoln Square	40.773529	-73.985338	AMC Lincoln Square 13	40.775063	-73.982095	Movie Theater
1831	Greenwich Village	40.726933	-73.999914	Film Forum	40.728462	-74.004423	Indie Movie Theater
1849	Greenwich Village	40.726933	-73.999914	IFC Center	40.731167	-74.001339	Indie Movie Theater
2000	Lower East Side	40.717807	-73.980890	Regal Essex 14 & RPX	40.718133	-73.987895	Movie Theater
2469	West Village	40.734434	-74.006180	IFC Center	40.731167	-74.001339	Indie Movie Theater
2808	Battery Park City	40.711932	-74.016869	Regal Battery Park	40.715004	-74.014935	Movie Theater
3176	Noho	40.723259	-73.988434	Regal Essex 14 & RPX	40.718133	-73.987895	Movie Theater

In *Table 1*, it is interesting to note that there are neighborhood latitudes and neighborhood longitudes that can be cross-referenced with the venue latitude and longitude to study how those would impact their surroundings.

Following that, every neighborhood was analyzed to study the different venues in each area and the number of venues in each of those areas. It was placed into a matrix so that it can then be clustered together. *Figure 1* shows a snippet of what it looks like (refer to notebook for a more clear image).

	Neighborhood	Accessories Store	Adult Boutique	African Restaurant	American Restaurant	Antique Shop	Argentinian Restaurant	Art Ga
0	Marble Hill	0	0	0	0	0	0	
1	Marble Hill	0	0	0	0	0	0	
2	Marble Hill	0	0	0	0	0	0	
3	Marble Hill	0	0	0	0	0	0	
4	Marble Hill	0	0	0	0	0	0	
...	...	...	...	...	...	...	...	
95	Chinatown	0	0	0	0	0	0	
96	Chinatown	0	0	0	0	0	0	
97	Chinatown	0	0	0	0	0	0	
98	Chinatown	0	0	0	0	0	0	
99	Chinatown	0	0	0	0	0	0	

100 rows × 311 columns

Figure 1: Venues per neighborhood set up to prepare for frequency study of each category

Once grouped, the data was presented in the following way as seen below. The following figure shows three examples of cities where the frequency of each venue is sorted from largest to smallest. It is interesting to note that there are no movie theaters in the top venues.

```
----Battery Park City--
          venue  freq
0          Park  0.09
1   Coffee Shop  0.07
2         Hotel  0.03
3           Gym  0.03
4  Burger Joint  0.03
```

```
----Carnegie Hill----
                  venue  freq
0           Coffee Shop  0.06
1                 Café  0.06
2          Yoga Studio  0.04
3  Gym / Fitness Center  0.04
4               Bakery  0.04
```

```
----Chinatown----
                  venue  freq
0               Bakery  0.05
1      Ice Cream Shop  0.05
2  Chinese Restaurant  0.04
3               Café  0.04
4        Cocktail Bar  0.04
```

Figure 2: Most frequent venues per neighborhood

This data was then compiled and clustered to study the effects of the different venues on each other. *Figure 3* shows five different clusters and the most common venues in each. It is interesting that in all clusters, movie theaters are not part of the top venues.

	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
5	Manhattanville	Coffee Shop	Park	American Restaurant	Italian Restaurant	Mexican Restaurant	Theater	Café	Seafood Restaurant	Lounge	Tennis Court
6	Central Harlem	Southern / Soul Food Restaurant	Café	Seafood Restaurant	Gym / Fitness Center	Sushi Restaurant	Lounge	French Restaurant	Bar	Theater	Cocktail Bar
13	Lincoln Square	French Restaurant	Performing Arts Venue	Coffee Shop	Plaza	Theater	Jazz Club	Italian Restaurant	Gym / Fitness Center	Concert Hall	Indie Movie Theater
14	Clinton	Theater	Hotel	Coffee Shop	American Restaurant	Gym / Fitness Center	Bar	Gift Shop	Burger Joint	Wine Shop	Italian Restaurant
15	Midtown	Theater	Plaza	Steakhouse	Sushi Restaurant	Hotel	Cuban Restaurant	Gym	Coffee Shop	Pizza Place	Concert Hall
39	Hudson Yards	Gym / Fitness Center	Hotel	Coffee Shop	Theater	Lounge	Italian Restaurant	Gym	American Restaurant	Cocktail Bar	Art Gallery

Figure 3.1: This data is a snippet of cluster 1 where the most common venues are used as denominators to cluster the neighborhoods together

	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	Park	Café	Pizza Place	Donut Shop	Spanish Restaurant	Sandwich Place	Mexican Restaurant	Bus Station	Scenic Lookout	Bakery
2	Washington Heights	Pizza Place	Bakery	Latin American Restaurant	Café	Coffee Shop	Spanish Restaurant	Mexican Restaurant	Tapas Restaurant	Mobile Phone Shop	Bar
3	Inwood	Latin American Restaurant	Deli / Bodega	Mexican Restaurant	Pizza Place	Restaurant	Wine Bar	Spanish Restaurant	Café	Park	Chinese Restaurant
4	Hamilton Heights	Coffee Shop	Mexican Restaurant	Bar	Café	Chinese Restaurant	Park	Deli / Bodega	Cocktail Bar	Yoga Studio	Sushi Restaurant
7	East Harlem	Café	Pizza Place	Mexican Restaurant	Bakery	Deli / Bodega	Italian Restaurant	Thai Restaurant	Fountain	Gym	Cocktail Bar

Figure 3.2: This data is a snippet of cluster 2 where the most common venues are used as denominators to cluster the neighborhoods together

	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	Bakery	Ice Cream Shop	Coffee Shop	Café	Wine Bar	Chinese Restaurant	Sandwich Place	Cocktail Bar	Optical Shop	Bar
8	Upper East Side	Exhibit	Italian Restaurant	Bakery	Gym / Fitness Center	Coffee Shop	Hotel	French Restaurant	Yoga Studio	Playground	Pizza Place
17	Chelsea	Art Gallery	Coffee Shop	Bakery	Seafood Restaurant	American Restaurant	Italian Restaurant	New American Restaurant	Cosmetics Shop	Bagel Shop	Salon / Barbershop
18	Greenwich Village	Italian Restaurant	Spa	Coffee Shop	Pizza Place	Sushi Restaurant	American Restaurant	Sandwich Place	Cosmetics Shop	Gym	Salon / Barbershop
21	Tribeca	Park	Hotel	Spa	Coffee Shop	Steakhouse	Men's Store	Art Gallery	Gym / Fitness Center	Sushi Restaurant	American Restaurant
22	Little Italy	Clothing Store	Bakery	Optical Shop	Café	Dessert Shop	Women's Store	Sandwich Place	Hotel	Asian Restaurant	Chinese Restaurant
23	Soho	Italian Restaurant	Bakery	Café	Clothing Store	Dessert Shop	Mediterranean Restaurant	Optical Shop	Cosmetics Shop	Women's Store	Jewelry Store
24	West Village	Italian Restaurant	American Restaurant	Park	Cocktail Bar	Wine Bar	Coffee Shop	Gym	New American Restaurant	French Restaurant	Café
28	Battery Park City	Park	Coffee Shop	Memorial Site	Wine Shop	Pizza Place	Burger Joint	Playground	Plaza	Sandwich Place	Hotel
29	Financial District	Coffee Shop	Pizza Place	Hotel	Cocktail Bar	Gym / Fitness Center	American Restaurant	Café	Memorial Site	Italian Restaurant	Jewelry Store
31	Noho	Japanese Restaurant	Cocktail Bar	Asian Restaurant	Coffee Shop	Italian Restaurant	French Restaurant	Hotel	Pizza Place	Cosmetics Shop	Flower Shop
32	Civic Center	Coffee Shop	Spa	Hotel	Chinese Restaurant	Café	French Restaurant	Men's Store	Cocktail Bar	Asian Restaurant	Bakery
34	Sutton Place	Gym	Hotel	American Restaurant	Gym / Fitness Center	Park	Italian Restaurant	Mediterranean Restaurant	Spa	Salon / Barbershop	Bakery
35	Turtle Bay	Coffee Shop	American Restaurant	Bakery	Park	Juice Bar	Sushi Restaurant	Seafood Restaurant	Hotel	Wine Bar	French Restaurant
38	Flatiron	Gym / Fitness Center	New American Restaurant	Japanese Restaurant	Yoga Studio	Italian Restaurant	Cosmetics Shop	Café	Furniture / Home Store	Park	Wine Shop

Figure 3.3: This data is a snippet of cluster 3 where the most common venues are used as denominators to cluster the neighborhoods together

	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
9	Yorkville	Ice Cream Shop	Italian Restaurant	Japanese Restaurant	Gym	Bar	Pizza Place	Coffee Shop	Wine Shop	Indian Restaurant	Gym / Fitness Center
10	Lenox Hill	Italian Restaurant	Cocktail Bar	Sushi Restaurant	Gym / Fitness Center	Coffee Shop	Café	Burger Joint	French Restaurant	Wine Bar	Gym
11	Roosevelt Island	Park	Coffee Shop	Pizza Place	Cocktail Bar	Sushi Restaurant	Greek Restaurant	Café	Tennis Court	Deli / Bodega	Mexican Restaurant
12	Upper West Side	Bakery	Italian Restaurant	Coffee Shop	Café	Sushi Restaurant	Mediterranean Restaurant	American Restaurant	Wine Bar	Ice Cream Shop	Bar
19	East Village	Wine Bar	Coffee Shop	Cocktail Bar	Pizza Place	Bar	Korean Restaurant	Dessert Shop	Ice Cream Shop	Garden	Japanese Restaurant
20	Lower East Side	Café	French Restaurant	Pizza Place	Wine Bar	Italian Restaurant	Coffee Shop	Asian Restaurant	Art Gallery	Mexican Restaurant	Food Court
25	Manhattan Valley	Coffee Shop	Grocery Store	Park	Mexican Restaurant	Pizza Place	Playground	Bar	Wine Shop	Ice Cream Shop	Indian Restaurant
26	Morningside Heights	Coffee Shop	Italian Restaurant	Park	Mexican Restaurant	American Restaurant	Bakery	Chinese Restaurant	Playground	Bookstore	Wine Shop
27	Gramercy	American Restaurant	New American Restaurant	Coffee Shop	Juice Bar	Wine Shop	Indian Restaurant	Italian Restaurant	Mediterranean Restaurant	Hotel	Park
30	Carnegie Hill	Café	Coffee Shop	Yoga Studio	Bakery	Gym / Fitness Center	Art Museum	Cocktail Bar	Bookstore	Pizza Place	Gym
36	Tudor City	Coffee Shop	Grocery Store	Sushi Restaurant	Japanese Restaurant	Pizza Place	Park	Café	Gym	Taco Place	Jewish Restaurant
37	Stuyvesant Town	Bar	Pizza Place	Park	Coffee Shop	Cocktail Bar	Bagel Shop	Italian Restaurant	Gourmet Shop	Juice Bar	Gym / Fitness Center

Figure 3.4: This data is a snippet of cluster 4 where the most common venues are used as denominators to cluster the neighborhoods together

	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	Korean Restaurant	Gym / Fitness Center	Japanese Restaurant	Gourmet Shop	Pizza Place	Coffee Shop	Hotel	Bakery	Building	Steakhouse
33	Midtown South	Korean Restaurant	Gym / Fitness Center	Hotel	Café	Italian Restaurant	Coffee Shop	Dessert Shop	Bakery	Pizza Place	New American Restaurant

Figure 3.5: This data is a snippet of cluster 5 where the most common venues are used as denominators to cluster the neighborhoods together

5. Discussion

The study of the impact of movie theaters in New York City is interesting at it gives a perspective as to what their removal will result in. To build this study, the neighborhoods in New York City were studied and it was interesting that even though each neighborhood was different, entertainment venues were not as present as venues that included food or treats. It is not surprising as those are usually less costly or are used by some as a food source (instead of cooking).

Regardless, there were some other categories that were included that were not always related to restaurants and coffee shops. Most of those are parks and garden. It is interesting to notice that these outdoor activities were more popular than gym and fitness centers. This makes sense as cost has an impact. The presence of these is especially more popular in less fortunate neighborhoods where people have a lower source of income.

These pieces of information are crucial to understand the impact of movie theaters on the neighborhoods. As mentioned in the results section, it is interesting that movie theaters are not as present in the top venues even though they used to be one of the main entertainment venues when they were came out. It seems that venues where people are either socializing or using as a necessity to the daily lives are more present. This can potentially be explained by the fact that when people are home, they have access to visual entertainment; hence when they are out of the house, they are seeking live situations where they are participating in the event or being a part of something that they cannot do on their own in the comfort of their home.

With that being said, with this data and the results, it is evident that the removal of movie theaters will have little to no impact on the neighborhood venues because those have already adapted to that reality. Movie theaters are not disappearing at their peak; they have been gradually being withdrawn from society as other priorities are taking over. Hence, coffee shops, restaurants and even parks are at the top of the venue lists because they have become the areas of social interactions instead of only places to grab food to eat.

The clusters allow us to see this better as the behavior of every cluster, even though they are different from one another is repetitive where regardless of what neighborhood you are in or the preferences, movie theaters are no longer at the top of the list and the most popular options are the cheapest and most convenient places to go to meet others.

Art museums and theaters have a similar tendency but due to their offering of an “experience” that cannot be had at home alone, their disappearance would create a void that would need to be filled contrarily to move theaters that have already been in replaced.

6. Conclusion

All in all, the objective of this study was to understand the impact of removing movie theaters in New York City. This was done using a k-means clustering technique where different neighborhoods were clustered together depending on the venues that were most popular in each. The purpose of this was to understand how each neighborhood varied in relation to another and how removing movie theaters would impact each cluster. In reality, while studying it, movie theaters were actually one of the least popular venues and were already in the process of being removed and replaced by other venues (such as restaurants, parks, coffee shops).

With that being said, this analysis showed through clustering and through analyzing the top venues per neighborhood that movie theaters are not as popular anymore and could potentially be removed with little to no consequence as the process of replacement has already started many years ago. This study is not fully conclusive though as it does not cover all the basis; however it servers as a good introduction to the subject and can become a basis of a future full-blown analysis as to the impact even at the minimal scale of each neighborhood.