

Analysis of NYC Boroughs to Buy a House

New York City encompasses five county-level administrative divisions called boroughs: Bronx, Brooklyn, Manhattan, Queens, and Staten Island. Boroughs have existed since the consolidation of the city in 1898, when the city and each borough assumed their current boundaries. There are hundreds of distinct neighborhoods throughout the five boroughs of New York City, many with a definable history and character to call their own. The below image shows boroughs of NYC in a map.



Introduction:

The objective of this project is to study all five boroughs of NYC to find the best borough to buy a house. I am interested in a borough which is currently developing as the property prices will be low and the property will give good ROI in future. I would give high weightage to a borough in which maximum new buildings are being built. The different types of venues in a borough are important especially if you are going to live there.

For this analysis I have used following data:

- (1) NYC Department of Building Permit Issuance
 - I have used this dataset to find out in which borough what type of construction is going on.
- (2) Location Data using Foursquare API
 - I have used Foursquare API to get different types of venues in different boroughs using location longitudes and latitudes. The most frequent types of venues tell us distinct characteristics of a borough.

Analysis:

1. DOB Permit Issuance Dataset:

The Department of Buildings (DOB) issues permits for construction and demolition activities in the City of New York. The construction industry must submit an application to DOB with details of the construction job they would like to complete. Each record in this dataset represents the life cycle of one permit for one work type.

This Dataset has 3.5 Million observations and 60 variables. For this analysis I have considered only those records whose Permit expiration date is later than today and whose permit issuance application is under process as I am not interested into those buildings whose construction is already completed.

I have used only 14 variables out of 60 variables after studying all of the variables. I feel only these 14 variables are useful for my analysis.

2. Intuitive Hypotheses

Without looking at the dataset I can make three hypotheses.

- If in a particular borough most of the buildings are being renovated, we can say that the borough is urbanizing and the property prices in a same borough would be very high.
- If in a particular borough most of the buildings are being newly built, we can say that the borough is developing and property prices should be low compared to other boroughs.
- If a borough has maximum number of residential buildings, it will also have a greater number of parks, restaurants and other places for entertainment.

3. Findings and Interpretations

The *Figure 1* shows the number of permits either issued or in process for buildings of different boroughs. We can see that most of the permits are issued from Manhattan. This tells us that Manhattan is rapidly urbanizing.

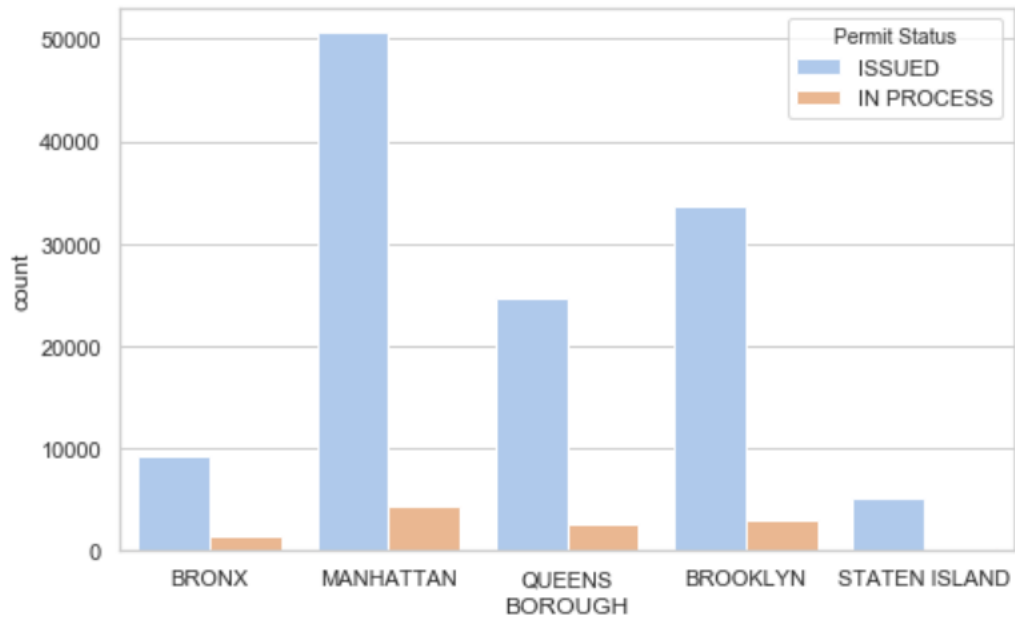


Figure 1



Figure 2

In Manhattan most of the permits are issued for considerable alterations in buildings followed by minor and most alterations. The permits issued for new buildings are very less which tells us that this borough is developed from the long time and buying a property here will be costly. Since many alterations are going on, there will be a considerable noise pollution as well in this borough.

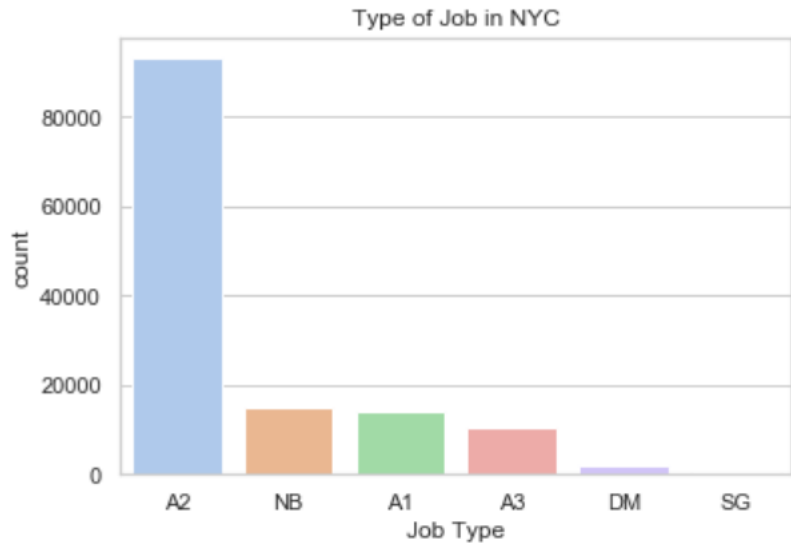


Figure 3

We can see that most of the permits are issued for considerable alterations in whole NYC. The permits issued for alteration is very high compared to permits issued for new buildings. This tells us that the rate of Urbanization in NYC is very high compared to rate of development.

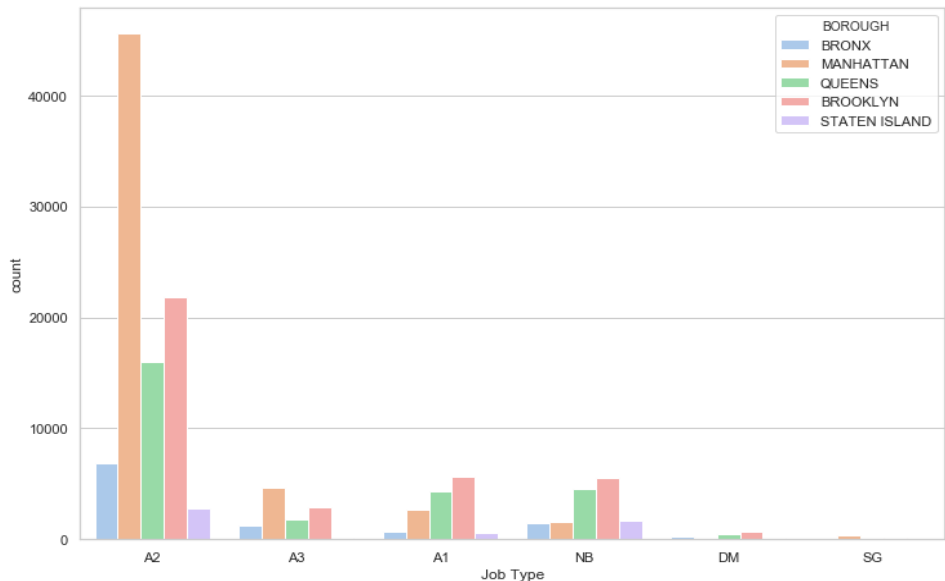


Figure 4

Figure 4 shows that in Brooklyn and Queens most of the permits issued are for New Building (NB). This also tells us that people are immigrating to these boroughs which created a need for new buildings. Figure 5 also shows that new buildings are being built more around Brooklyn and Queens boroughs.

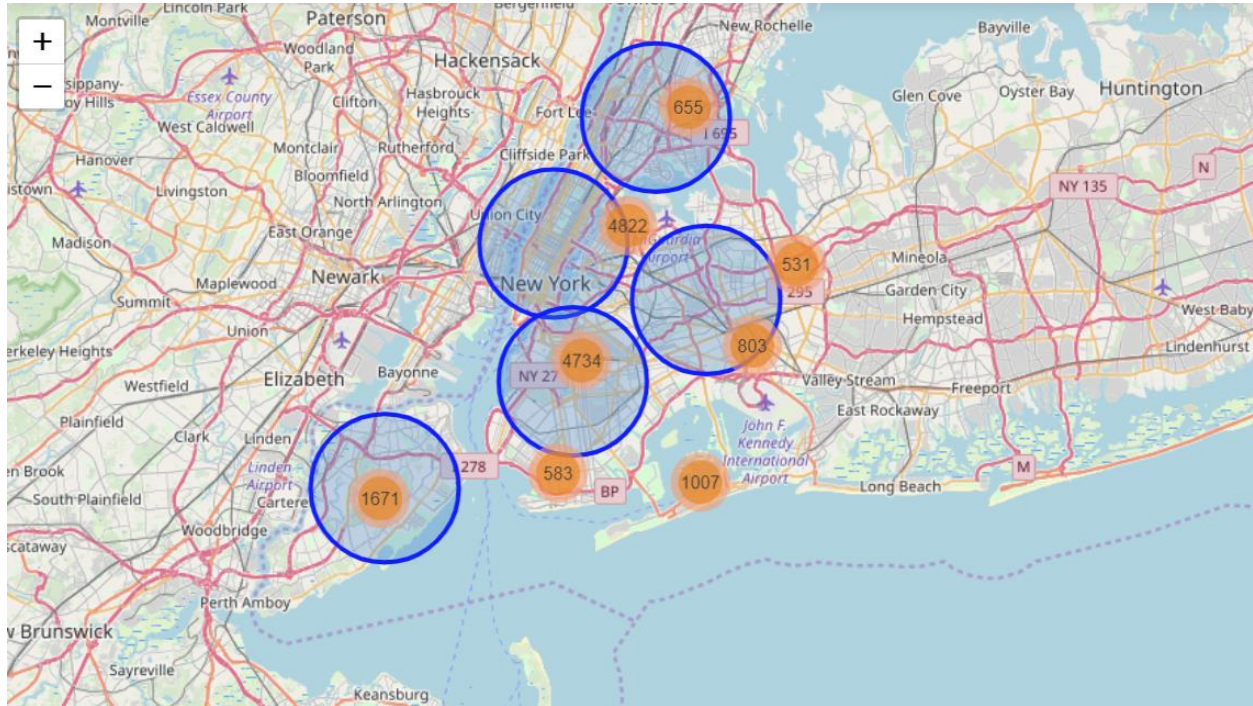


Figure 5

From Permit Issue Date and Permit Expiration Date we can find out the average time length for which the permit is issued. Figure 6 shows the description of Permit Length in terms of mean, min, max and quantiles.

```
count    122744.000000
mean      330.916216
std       604.072007
min        8.000000
25%       317.000000
50%       365.000000
75%       365.000000
max      73551.000000
Name: Permit Length, dtype: float64
```

Figure 6

As we can see that most of the permits are issued for 365 days or 1 year. Using this variable we can also find outliers and treat them well.

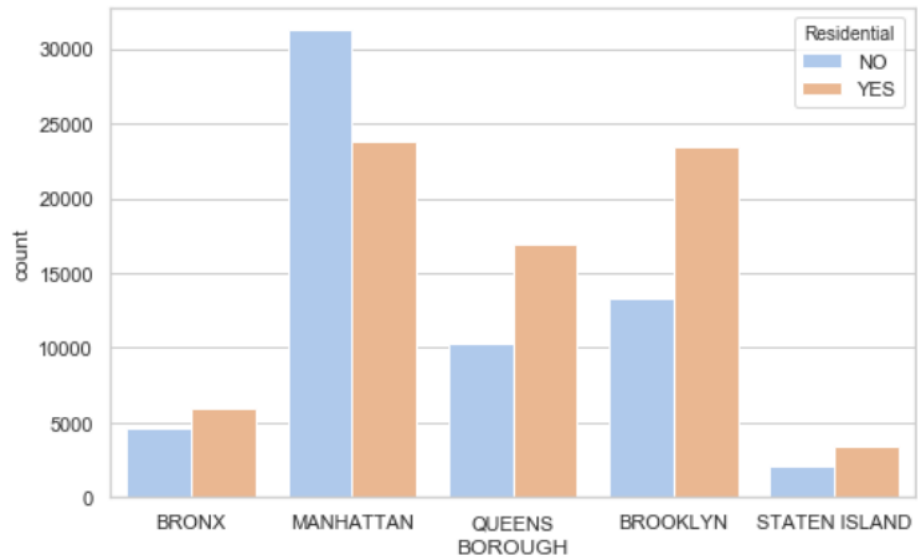


Figure 7

Figure 7 shows the number of residential buildings in boroughs. Brooklyn and Queens have more residential buildings compared to commercial buildings. Also, Manhattan has more commercial buildings which justifies the maximum alterations going on there. Usually companies cluster in a location which exists from a long time for an ease of business and people settle around that location.

Figure 8 shows the residential buildings in the map.

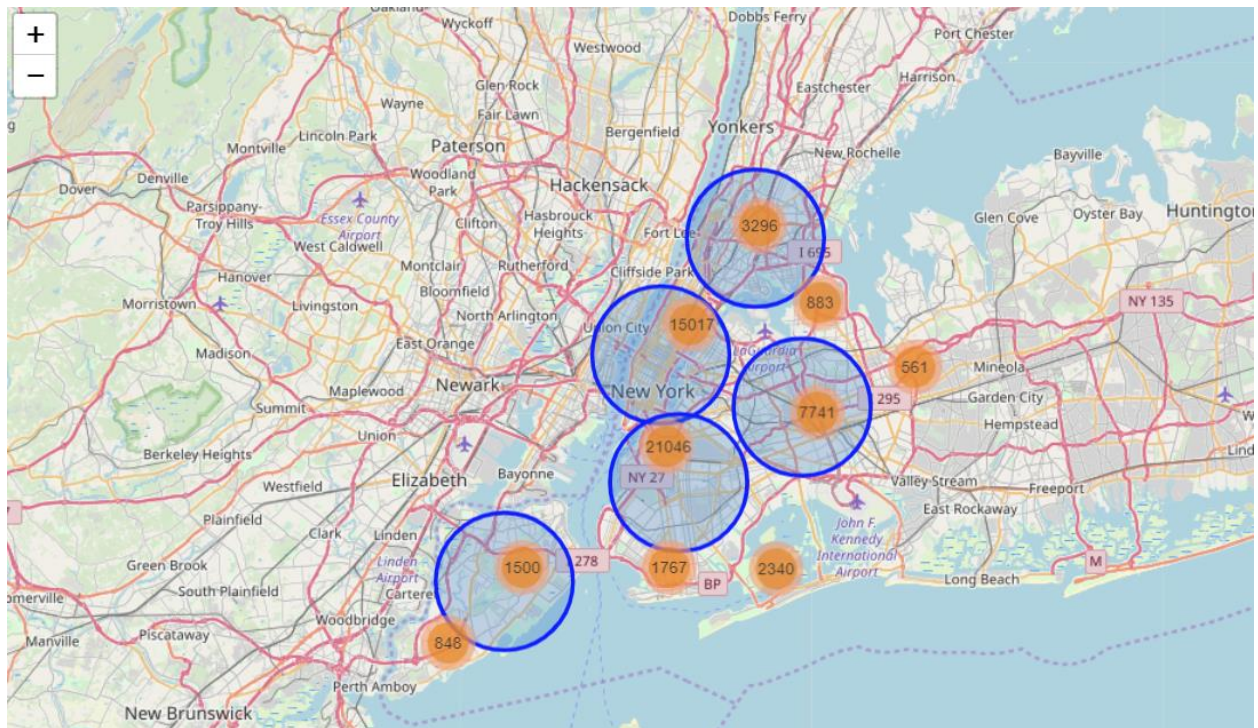


Figure 8

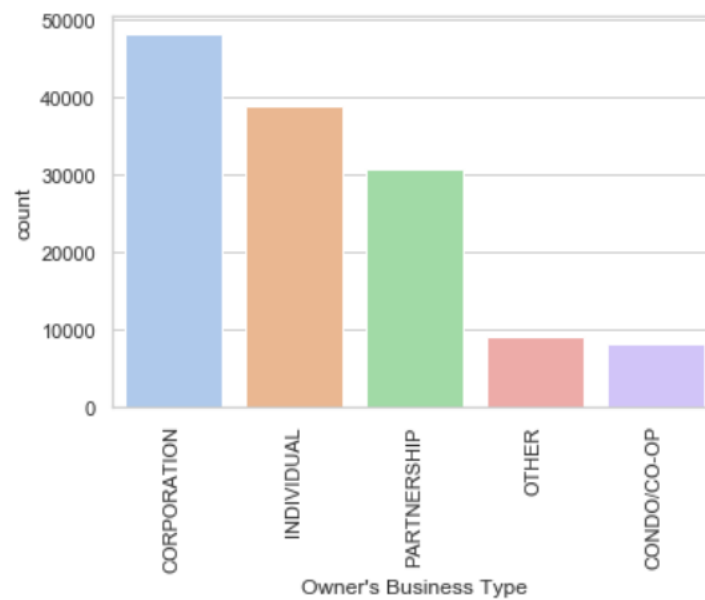


Figure 9

Figure 9 shows the business type of the owner of the buildings for which either the permits are issued or under process.

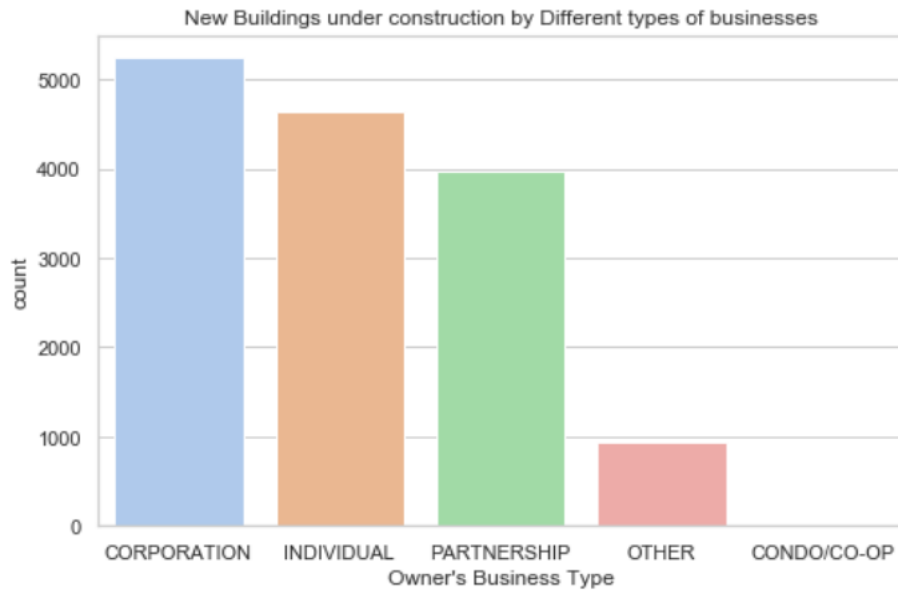


Figure 10

Figure 10 shows the business type of the owner of the new buildings under construction. The permits issued by corporations are highest followed by Individual and Partnership which means more commercial buildings are under construction. We can infer from this that companies/business are clustering in NYC and buying a commercial property in NYC can be a beneficial investment in the future.

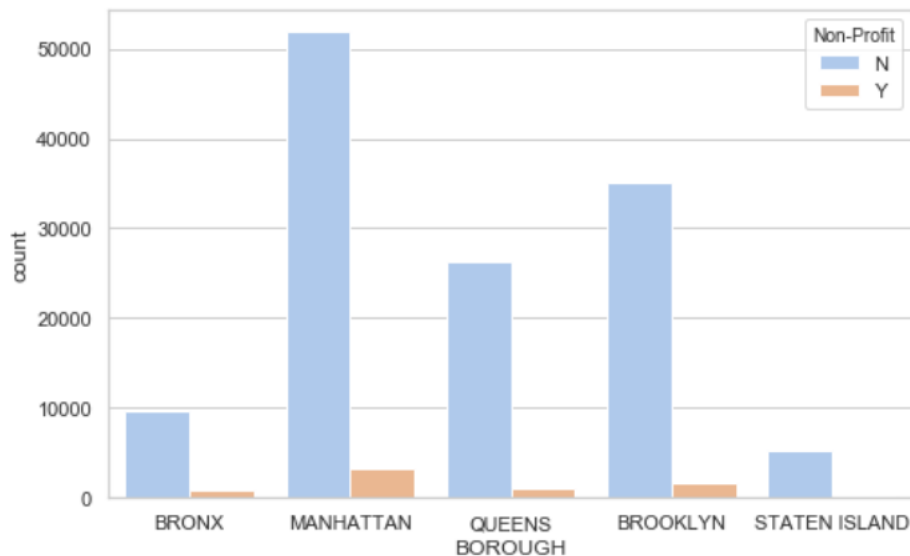


Figure 11

Figure 11 shows the permits of buildings used for non-profit. The distribution of non-profit organizations' buildings is not significantly different in different boroughs. Figure 12 shows buildings used for non-profit in a map and we can see that they have high density in Manhattan area.

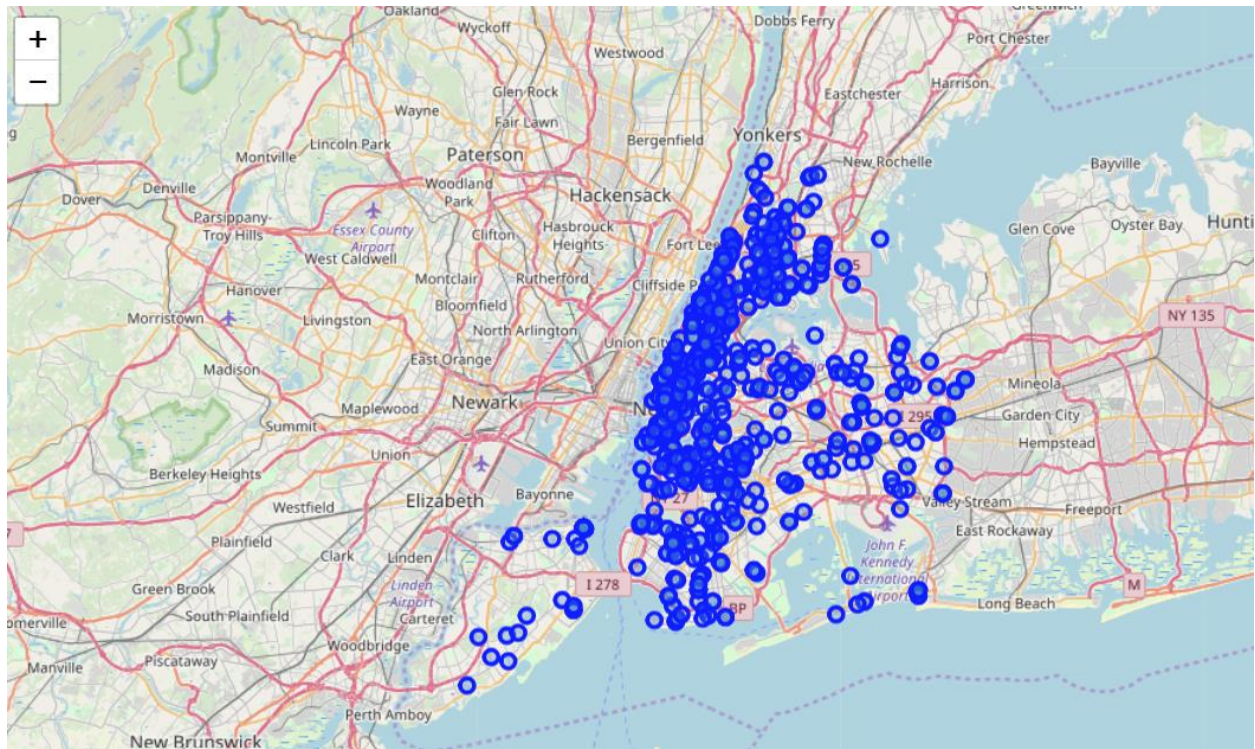


Figure 12

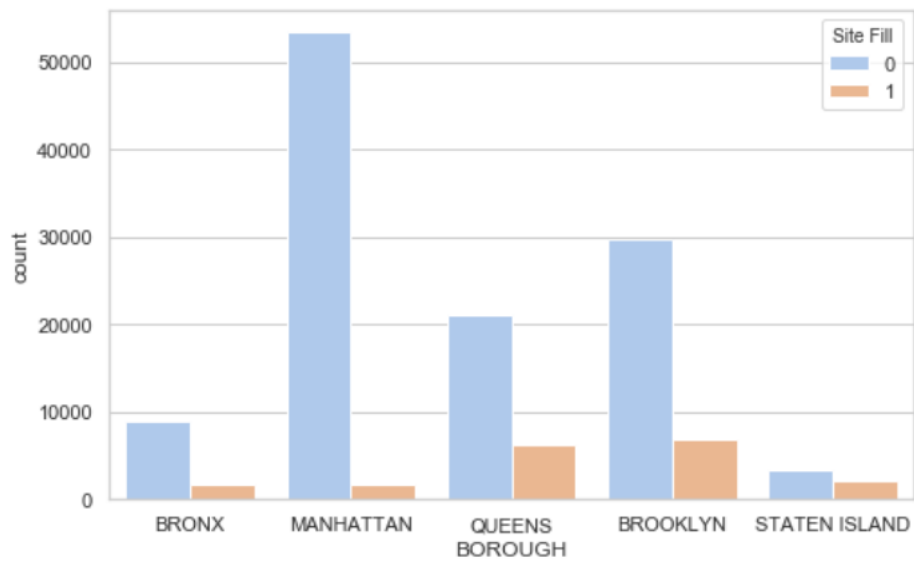


Figure 13

Figure 13 shows the number of places where fill dirt will be used for construction purposes. The fill dirt is mostly used for the construction of new buildings. Queens and Brooklyn have a good number of places where fill dirt will be used which correlates with a greater number of new buildings under construction.

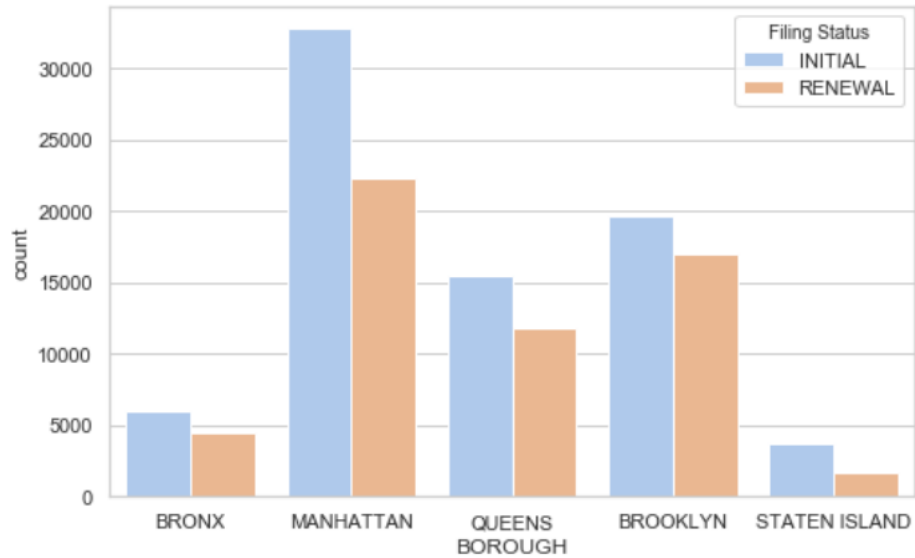


Figure 14

Figure 14 shows the permits issued for the first time or they are renewed. The distribution in different borough is almost similar and we cannot infer anything from it.

4. Hypothesis after analysis

- The buildings in same borough have similar characteristics.

To test this hypothesis, I performed K-means clustering of the data for $k = 5$. If buildings of same borough have similar characteristics, they will be clustered together in the same group as Euclidean distance between them will be small.

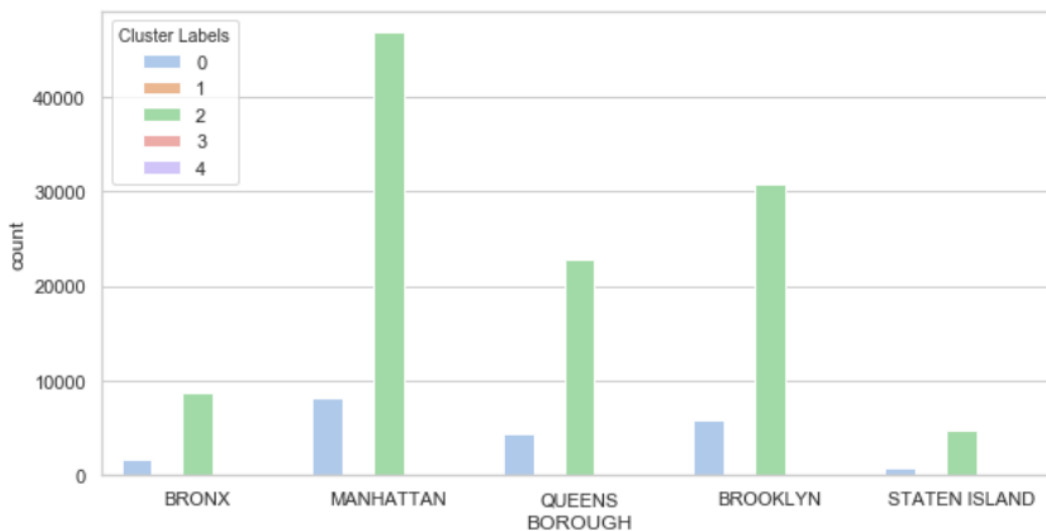


Figure 15

The 5 clusters are shown borough wise. From *Figure 15* it is clear that the buildings from same boroughs do not have similar characteristics.

5. Foursquare API

Foursquare City Guide, commonly known as Foursquare, is a local search-and-discovery mobile app which provides search results for its users. The app provides personalized recommendations of places to go near a user's current location based on users' previous browsing history and check-in history. Foursquare provides an API through which we can get the venues and related data based on location longitudes and latitudes.

6. Venues in different boroughs

Bronx

Top 5 places in Bronx are:

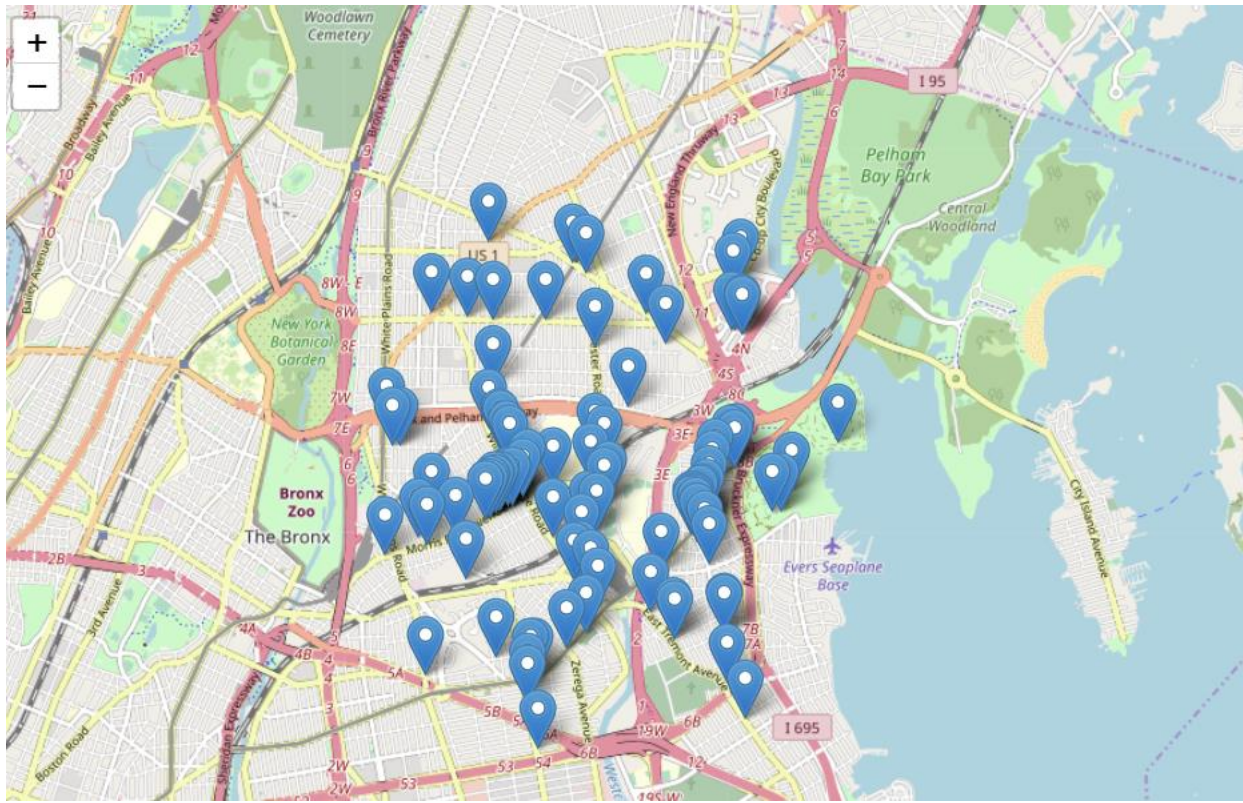
	name	categories	lat	lng
0	Residence Inn by Marriott New York The Bronx a...	Hotel	40.849325	-73.842534
1	LA Fitness	Gym / Fitness Center	40.849739	-73.841949
2	Starbucks	Coffee Shop	40.851371	-73.844087
3	Zeppieri & Sons Italian Bakery	Bakery	40.847119	-73.832057
4	Franks Pizza	Pizza Place	40.843550	-73.836006

The 10 most frequent venues from 100 venues in Bronx

Pizza Place	13
Italian Restaurant	8
Coffee Shop	5
Spanish Restaurant	4
Deli / Bodega	4
Mexican Restaurant	4
Bakery	4
Gym	3
Diner	3
American Restaurant	3

Name: categories, dtype: int64

We can see that Bronx has many restaurants and food places. This can be a good borough to buy a house. Though it lacks parks and entertainment places. The 100 venues in Bronx are shown below.



Manhattan

Top 5 places in Manhattan are:

	name	categories	lat	lng
0	North Meadow	Park	40.792027	-73.959853
1	East Meadow	Field	40.790160	-73.955498
2	The Jewish Museum	Museum	40.785276	-73.957411
3	Da Capo	Café	40.787679	-73.953899
4	Jacqueline Kennedy Onassis Reservoir	Reservoir	40.785153	-73.962935

The 10 most frequent venues from 100 venues in Manhattan

```

Park      8
Exhibit   6
Coffee Shop 4
Bakery    4
Wine Shop 4
Bookstore 3
Art Museum 3
Yoga Studio 3
Seafood Restaurant 3
Garden    3
Name: categories, dtype: int64

```


We can see that Manhattan has very different types of venues from parks, museums to wine shops. These types of venues show that the location is costly in terms of property prices. The 100 venues in Manhattan are shown below.



Brooklyn

Top 5 places in Brooklyn are:

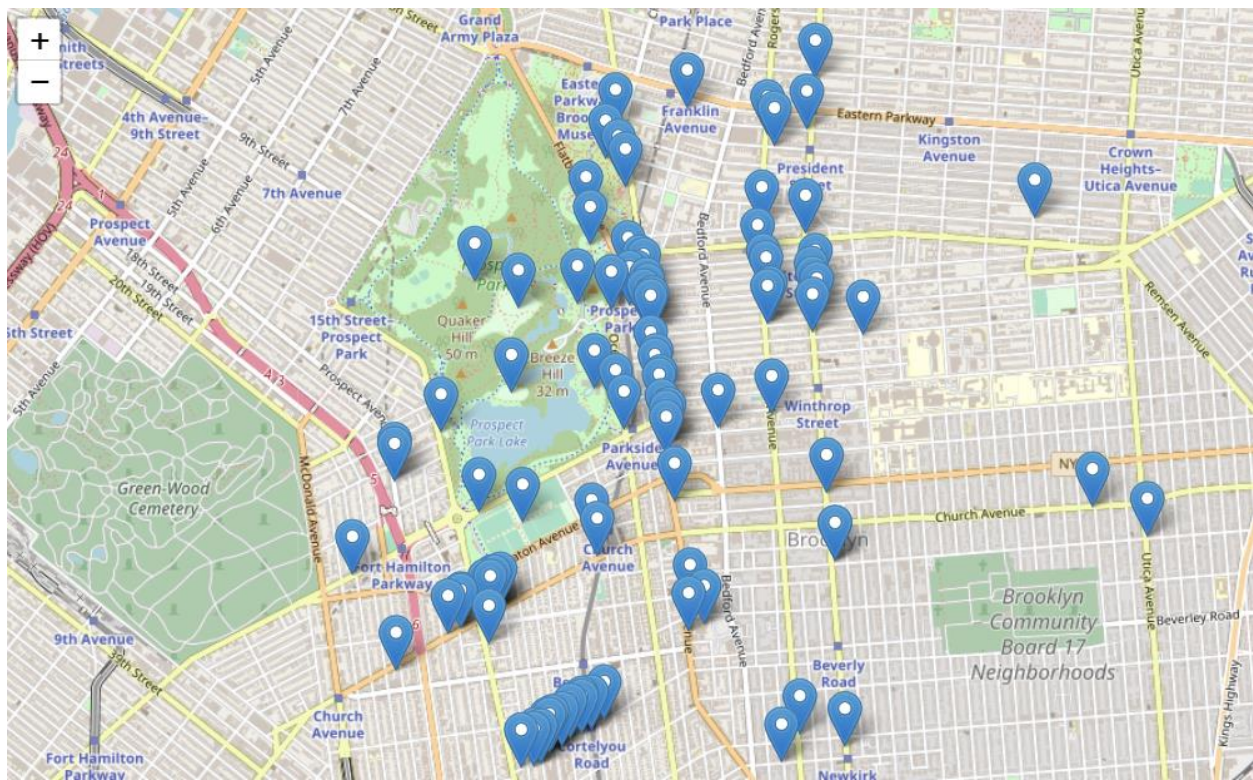
	name	categories	lat	lng
0	Exquisite Delight	Caribbean Restaurant	40.649091	-73.949243
1	Jus Juice	Juice Bar	40.652208	-73.949723
2	Kings Theatre	Theater	40.646110	-73.957175
3	Gandhi Fine Indian Cuisine	Indian Restaurant	40.655168	-73.956325
4	Nostrand Health Foods	Juice Bar	40.649092	-73.949243

The 10 most frequent venues from 100 venues in Brooklyn

Caribbean Restaurant	11
Café	5
Bakery	4
Park	4
Cocktail Bar	4
Coffee Shop	3
Liquor Store	2
Music Venue	2
Wine Shop	2
Grocery Store	2

Name: categories, dtype: int64

We can see that Brooklyn has many Caribbean restaurants. It also has parks, cafes and grocery stores. This can be a good borough to buy a house. The 100 venues in Brooklyn are shown below.



Queens

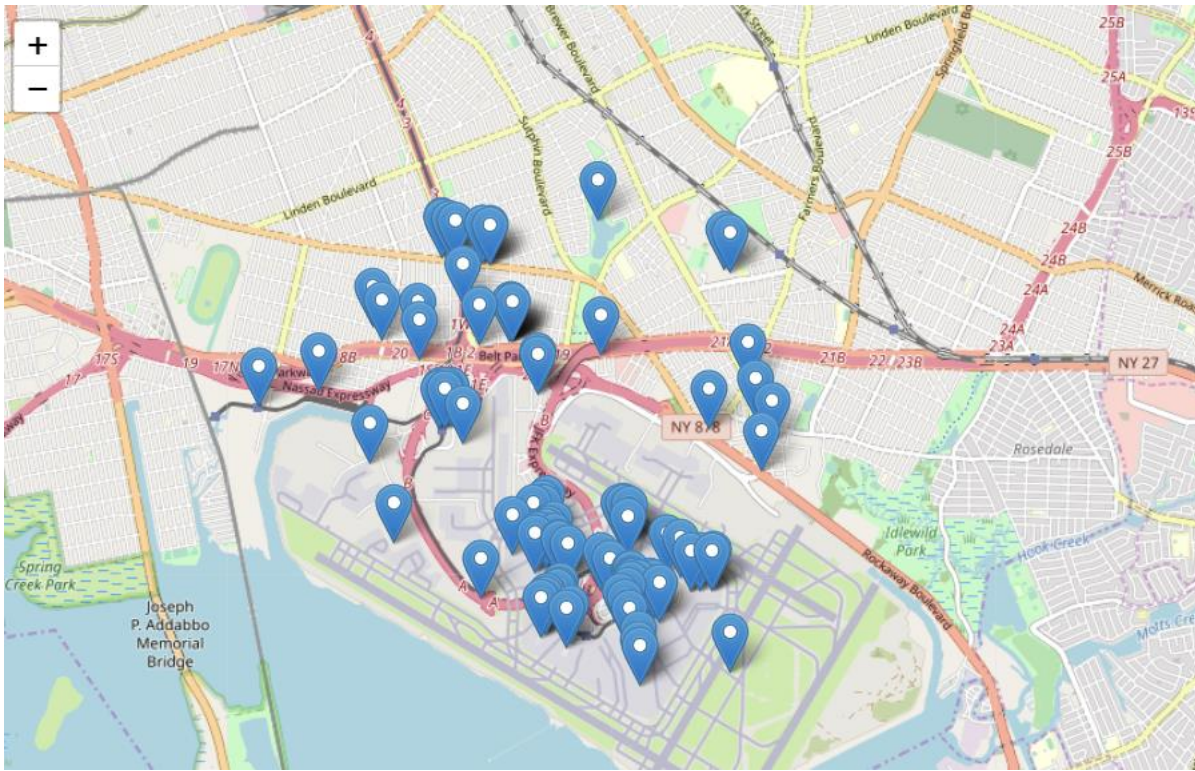
Top 5 places in Queens are:

	name	categories	lat	lng
0	L'Occitane en Provence	Cosmetics Shop	40.650343	-73.792202
1	American Airlines Flagship Lounge	Airport Lounge	40.648101	-73.791583
2	Shake Shack	Burger Joint	40.642284	-73.783273
3	Starbucks	Coffee Shop	40.650657	-73.791711
4	TWA Flight Center	Historic Site	40.643573	-73.782032

The 10 most frequent venues from 100 venues in Queens

Airport Lounge	9
Rental Car Location	7
Cosmetics Shop	6
Coffee Shop	5
Donut Shop	4
Southern / Soul Food Restaurant	3
Food Truck	3
Airport Service	3
Caribbean Restaurant	3
Ice Cream Shop	3
Name: categories, dtype: int64	

We can see that Queens has many airport lounges, rental car location, coffee shops and airport services. This can be a good borough to buy a house if you are frequent traveler because of ease of access to an airport. The 100 venues in Queens are shown below.



Staten Island

Top 5 places in Staten Island are:

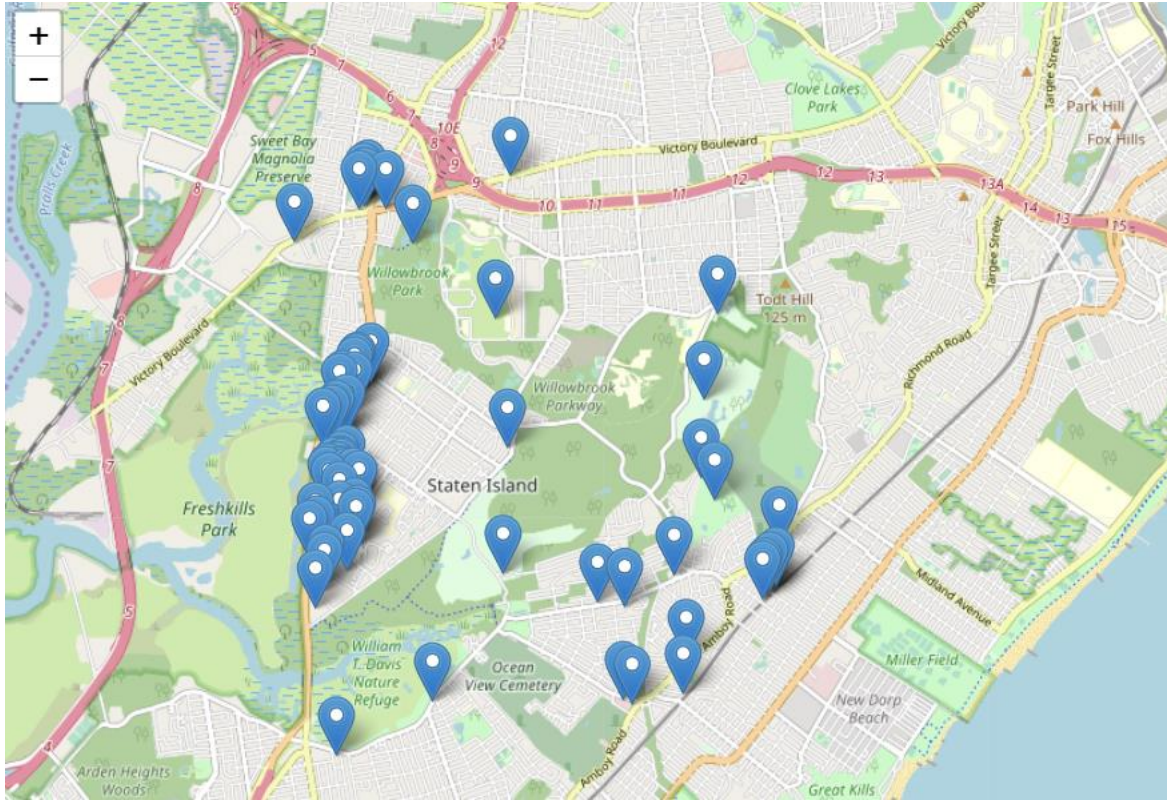
	name	categories	lat	lng
0	Greenbelt Nature Center	Trail	40.586616	-74.146917
1	LaTourette Park & Golf Course	Golf Course	40.575603	-74.147487
2	Trader Joe's	Grocery Store	40.589997	-74.165715
3	Bath & Body Works	Cosmetics Shop	40.582460	-74.165753
4	Disney store	Toy / Game Store	40.581963	-74.166272

The 10 most frequent venues from 100 venues in Staten Island

Italian Restaurant	5
Clothing Store	4
Department Store	3
Restaurant	3
Furniture / Home Store	3
Spa	2
Campground	2
Bagel Shop	2
Bakery	2
Cosmetics Shop	2

Name: categories, dtype: int64

We can see that Staten Island has different types of venues food places, furniture stores, Spa, cosmetic shops etc. These venues are perfect for residential buildings as we can satisfy our day to day needs easily. The 100 venues in Staten Island are shown below.



Conclusion and Future Work:

1. Potential Conclusion

- With high confidence I can tell that Brooklyn and Queens are good boroughs to buy a property for residential use.
- Manhattan would be the perfect location to buy a property for commercial use.
- Buildings of same locations do not have similar characteristics.
- Bronx and State Island have less permits compared to other boroughs which tells us that they are developing but at a slower rate. We can buy a property there for the sole purpose of Investment only. Since, the NYC is urbanizing these boroughs will also start developing in future.
- Different boroughs have different venues at the center of them. Most of the time centers of boroughs are well developed. So, we cannot judge a borough from 100 venues. If I had neighborhoods along with boroughs, better analysis could be done.
- If I had variables such as rejects of Permits, neighborhoods of boroughs, area and capacity of a building, I could have done better analysis.

2. Future Work

- Incorporate crime data of boroughs to find out which borough is the safest for living.
- Consider property prices in different neighborhoods of NYC to increase confidence of our results.
- Incorporate different types of companies in different neighborhoods to find out best location for a business headquarter.
- Develop a tool/website for easier analysis of NYC boroughs for future NYC immigrants.