BATTLE OF THE NEIGHBORHOODS

IBM Applied Data Science Specialization

Coursera Capstone Project

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1. INTORDUCTION

1.1 Scenario

I am an engineer residing in Downtown Singapore. I currently live within walking distance to Downtown Telok Ayer MRT metro station and I enjoy many ammenities and venues in the area, such as various international cousine restaurants, cafes, food shops and entertainment. I have been offered a great opportunity to work for an engineering company in Manhattan, NY. The key question is : How can I find a convenient and enjoyable place similar to mine now in Singapore? Certainly, I can use available real estate apps and Google but the idea is to use and apply myself the learned tools during the course. In order to make a comparison and evaluation of the rental options in Manhattan NY, I must set some basis, therefore the apartment in Manhattan must meet the following demands:

- Apartment must be 2 or 3 bedrooms
- location near a metro station in the Manhattan area and within 1.0 mile (1.6 km) radius
- Rent must not not exceed 7,000 USD per month
- Top ammenities in the selected neighborhood shall be similar to current residence
- Desirable to have venues such as coffee shops, restaurants Asian Thai, wine stores, gym and food shops
- As a reference, I have included a map of venues near current residence in Singapore.

1. INTRODUCTION

1.2 Problem :

The challenge is to find a suitable apartment for rent in Manhattan NY that complies with the demands on location, price and venues. The data required to resolve this challenge is described in section 2

1.3 Interested Audience

I believe this is a relevant challenge with valid questions for anyone moving to other large city in US, EU or Asia. The same methodology can be applied in accordance to demands as applicable. This case is also applicable for anyone interested in exploring starting or locating a new business in any city. Lastly, it can also serve as a good practical exercise to develop Data Science skills.

2. DATA

2.1 Data of Current Situation

I Currently reside in the neighborhood of 'Mccallum Street' in Downtonw Singapore. I use Foursquare to identify the venues around the area of residence which are then shown in the Singapore map shown in methodology and execution in section 3.0 . It serves as a reference for comparison with the desired future location in Manhattan NY

2.2 Data Required to resolve the problem

In order to make a good choice of a similar apartment in Manhattan NY, the following data is required:

- List/Information on neighborhoods form Manhattan with their Geodata (latitud and longitud.
- List/Information about the subway metro stations in Manhattan with geodata.
- Listed apartments for rent in Manhattan area with descriptions (how many beds, price, location, address)
- Venues and amenities in the Manhattan neighborhoods (e.g. top 10)

2. DATA

2.2 Data Requirements

- Geodata for current residence in Singapore with venues established using Foursquare.
- List of Manhattan (MH) neighborhoods with clustered venues established via Foursquare (as in Course Lab). https://en.wikipedia.org/wiki/List_of_Manhattan_neighborhoods#Midtown_neighborhoods
- List of subway metro stations in Manhattan with addresses and geo data (lat,long): https://en.wikipedia.org/wiki/List_of_New_York_City_Subway_stations_in_Manhattan

https://www.google.com/maps/search/manhattan+subway+metro+stations/@40.7837297,-74.1033043,11z/data=!3m1!4b1

- List of apartments for rent in Manhattan area with information on neighborhood location, address, number of beds, area size, monthly rent price and complemented with geo data via Nominatim.

http://www.rentmanhattan.com/index.cfm?page=search&state=results

https://www.nestpick.com/search?city=new-

- Place to work in Manhattan (Park Avenue and 53rd St) for reference

2. DATA

2.3. Data Sources, Data Processing and Tools used

- Singapore data and map is to be created with use of Nominatim , Foursquare and Folium mapping

- Manhattan neighborhoods were obtained from Wikipedia and organized by Neighborhoods with geodata

via Nominatim for mapping with Folium.

- List of Subway stations was obtained via Wikipedia, NY Transit web site and Google map,

- List of apartments for rent was consolidated from web-scraping real estate sites for MH. The geolocation

(lat,long) data was found with algorithm coding and using Nominatim.

- Folium map was the basis of mapping with various features to consolidate all data in ONE map where

one can visualize all details needed to make a selection of apartment

3.METHODOLOGY

The Strategy to find the answer:

The strategy is based on mapping the described data in section 2.0, in order to facilitate the choice of at least two candidate places for rent. The information will be consolidated in ONE MAP where one can see the details of the apartment, the cluster of venues in the neighborhood and the relative location from a subway station and from work place. A measurement tool icon will also be provided. The popups on the map items will display rent price, location and cluster of venues applicable.

The Tools:

Web-scraping of sites is used to consolidate data-frame information which was saved as csv files for convenience and to simply the report. Geodata was obtained by coding a program to use Nominatim to get latitude and longitude of subway stations and also for each of (144 units) the apartments for rent listed. Geopy_distance and Nominatim were used to establish relative distances. Seaborn graphic was used for general statistics on rental data.

Maps with popups labels allow quick identification of location, price and feature, thus making the selection very easy

4. EXECUTION AND RESULTS

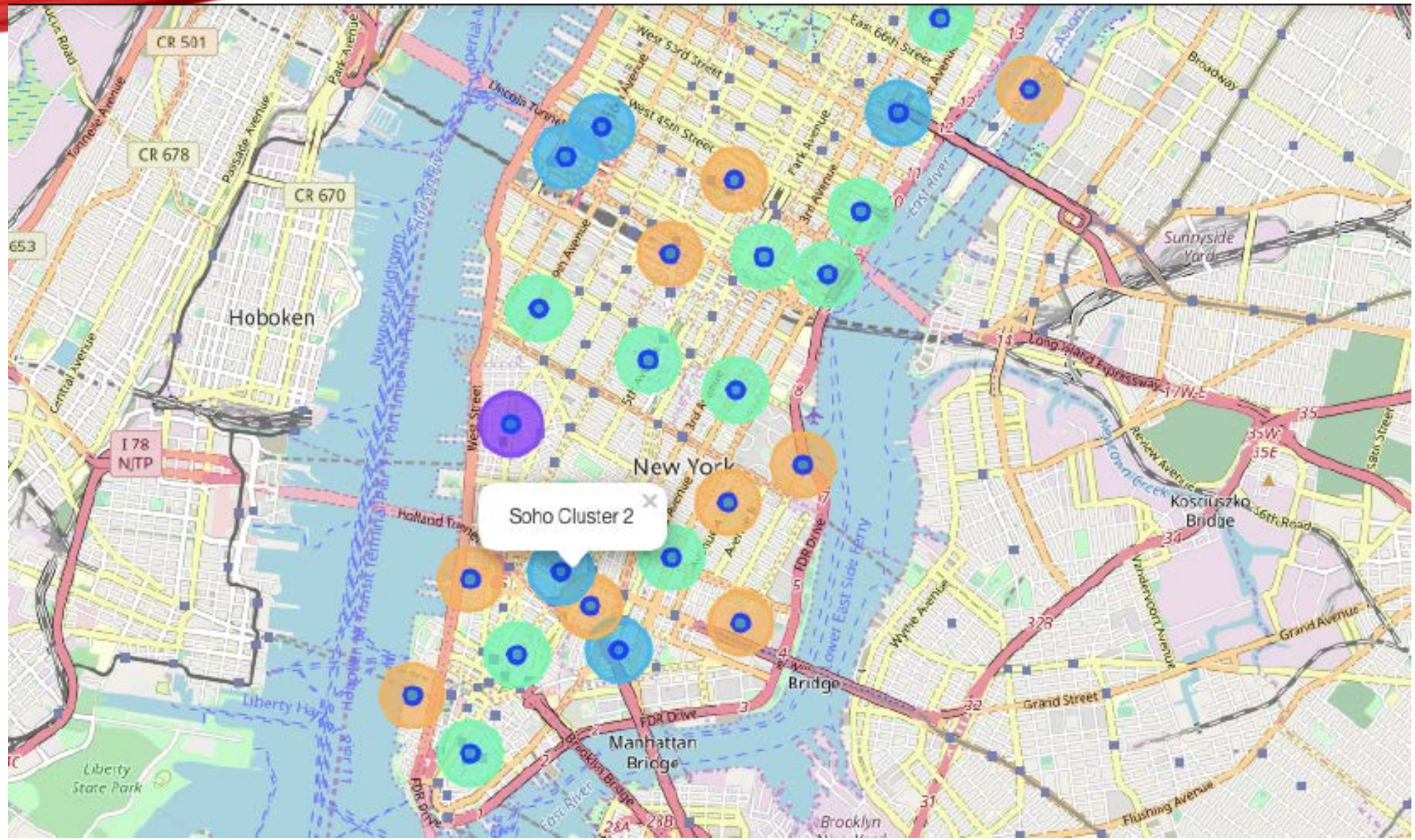
CURRENT RESIDENCE NEIGHBORHOOD IN SINGAPORE

VENUES AROUND NEIGHBORHOON IN SINGAPORE

```
# Venues near current Singapore residence place
SGnearby_venues.head(10)
```

	name	categories	lat	lng
0	Napoleon Food & Wine Bar	Wine Bar	1.279925	103.847333
1	Pepper Bowl	Asian Restaurant	1.279371	103.846710
2	Native	Cocktail Bar	1.280135	103.846844
3	Park Bench Deli	Deli / Bodega	1.279872	103.847287
4	Mellower Coffee	Café	1.277814	103.848188
5	Muchachos	Burrito Place	1.279072	103.847026
6	Dumpling Darlings	Dumpling Restaurant	1.280483	103.846942
7	Sofitel So Singapore	Hotel	1.280017	103.849813
8	PS.Cafe	Café	1.280468	103.846264
9	ShuKuu Izakaya	Japanese Restaurant	1.280111	103.847762

MANHATTAN MAP – NEIGHBNORHOODS ANS CLUSTER VENUES



GEODATA MANHATTAN APARTMENTS FOR RENT

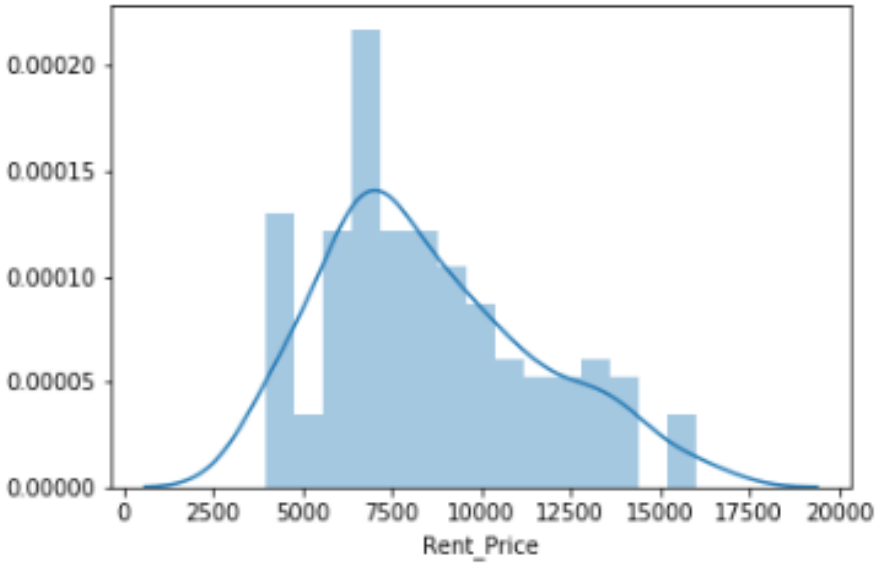
```
1 mh_rent=pd.read_csv('MH_rent_latlong.csv')
2 mh_rent.head()
```

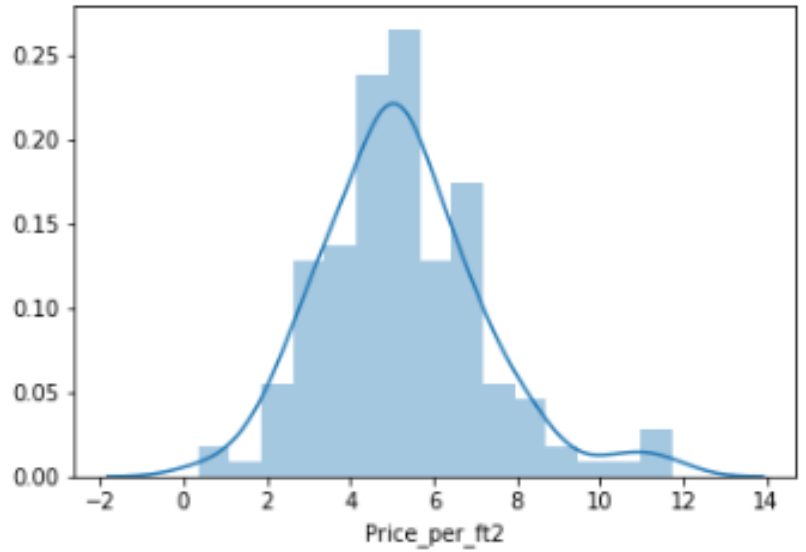
	Address	Area	Price_per_ft2	Rooms	Area-ft2	Rent_Price	Lat	Long
0	West 105th Street	Upper West Side	2.94	5.0	3400	10000	40.799771	-73.966213
1	East 97th Street	Upper East Side	3.57	3.0	2100	7500	40.788585	-73.955277
2	West 105th Street	Upper West Side	1.89	4.0	2800	5300	40.799771	-73.966213
3	CARMINE ST.	West Village	3.03	2.0	1650	5000	40.730523	-74.001873
4	171 W 23RD ST.	Chelsea	3.45	2.0	1450	5000	40.744118	-73.995299

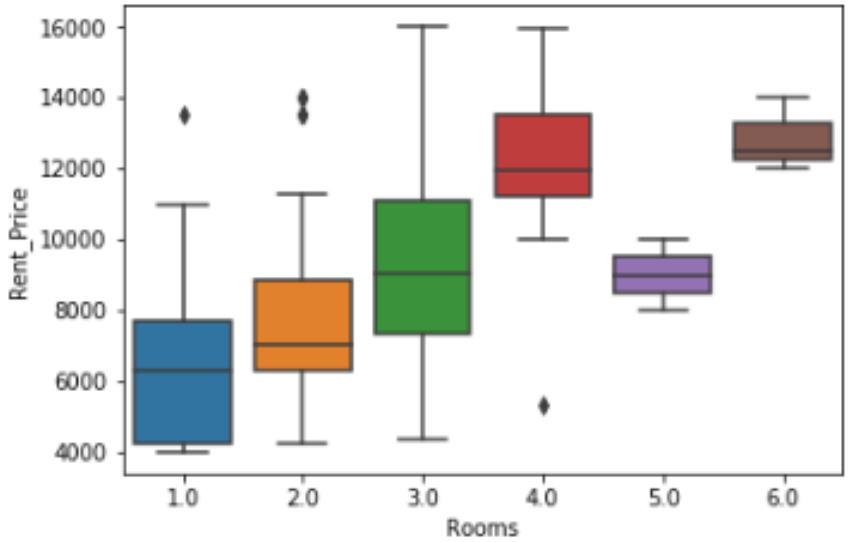
```
1 mh_rent.tail()
```

	Address	Area	Price_per_ft2	Rooms	Area-ft2	Rent_Price	Lat	Long
139	200 East 72nd Street	Rental in Lenox Hill	5.15	3.0	1700	8750	40.769465	-73.960339
140	50 Murray Street	No fee rental in Tribeca	7.11	2.0	1223	8700	40.714051	-74.009608
141	300 East 56th Street	No fee rental in Midtown East	3.87	3.0	2100	8118	40.758216	-73.965190
142	1930 Broadway	No fee rental in Central Park West	5.06	2.0	1600	8095	40.772474	-73.981901
143	33 West 9th Street	Rental in Greenwich Village	6.67	2.0	1500	10000	40.733691	-73.997323

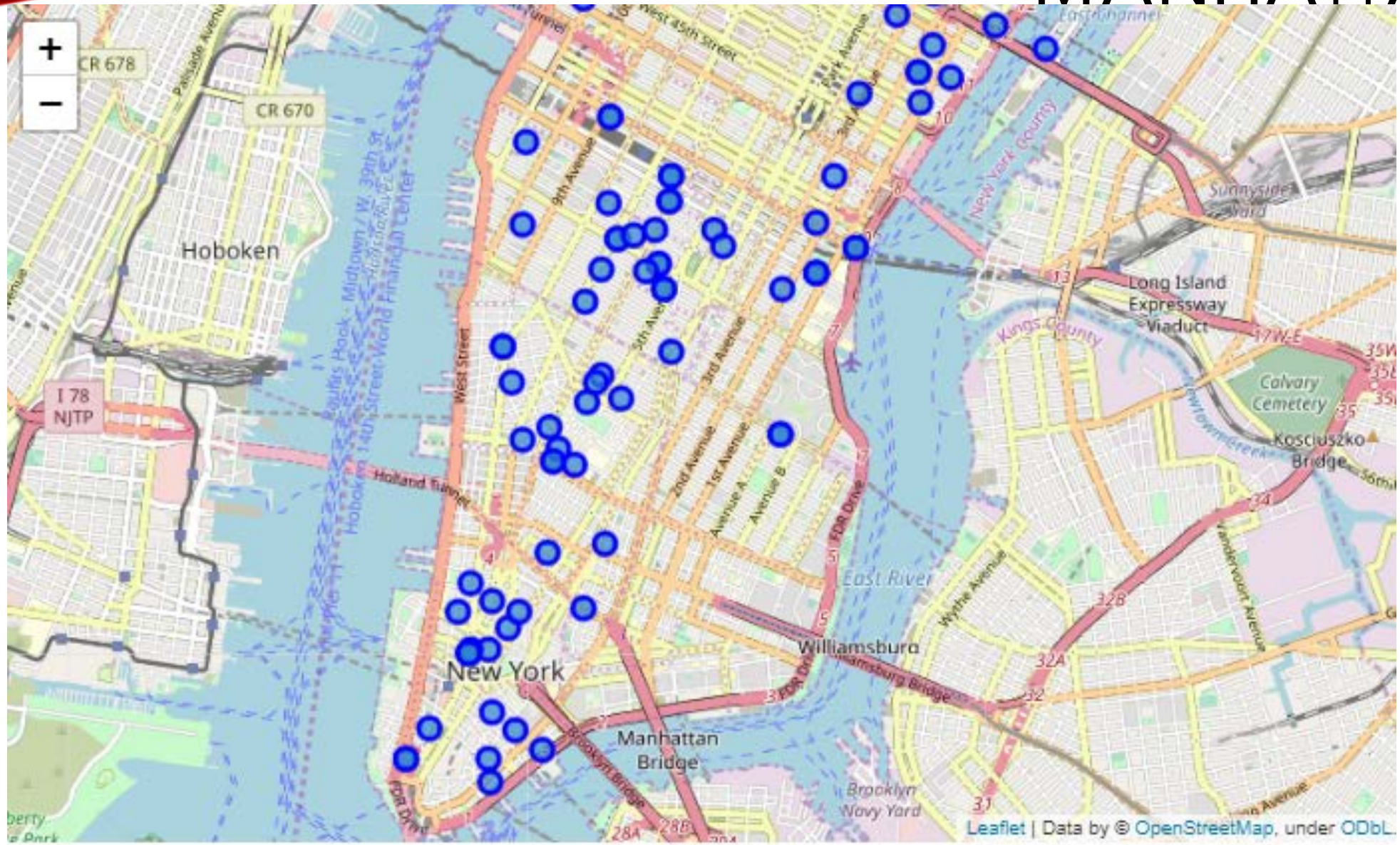
RENTAL PRICE STATISTICS MANHATTAN APTS







APARTMENTS FOR RENT IN MANHATTAN



APTS FOR RENT AND VENUE CLUSTERS

VENUES OF CLUSTER 3

```
## kk is the cluster number to explore
kk = 3
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == kk, manhattan_merged.columns[[1] + list(range(5, manhattan_merged
```

	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
3	Inwood	Mexican Restaurant	Lounge	Pizza Place	Café	Wine Bar	Bakery	American Restaurant	Park	Frozen Yogurt Shop	Spanish Restaurant
5	Manhattanville	Deli / Bodega	Italian Restaurant	Seafood Restaurant	Mexican Restaurant	Sushi Restaurant	Beer Garden	Coffee Shop	Falafel Restaurant	Bike Trail	Other Nightlife
10	Lenox Hill	Sushi Restaurant	Italian Restaurant	Coffee Shop	Gym / Fitness Center	Pizza Place	Burger Joint	Deli / Bodega	Gym	Sporting Goods Shop	Thai Restaurant
12	Upper West Side	Italian Restaurant	Bar	Bakery	Vegetarian / Vegan Restaurant	Indian Restaurant	Coffee Shop	Cosmetics Shop	Wine Bar	Mexican Restaurant	Sushi Restaurant
16	Murray Hill	Sandwich Place	Hotel	Japanese Restaurant	Gym / Fitness Center	Coffee Shop	Salon / Barbershop	Burger Joint	French Restaurant	Bar	Italian Restaurant
17	Chelsea	Coffee Shop	Italian Restaurant	Ice Cream Shop	Bakery	Nightclub	Theater	Art Gallery	Seafood Restaurant	American Restaurant	Hotel
18	Greenwich Village	Italian Restaurant	Sushi Restaurant	French Restaurant	Clothing Store	Chinese Restaurant	Café	Indian Restaurant	Bakery	Seafood Restaurant	Electronics Store
27	Gramercy	Italian Restaurant	Restaurant	Thrift / Vintage Store	Cocktail Bar	Bagel Shop	Coffee Shop	Pizza Place	Mexican Restaurant	Grocery Store	Wine Shop
29	Financial District	Coffee Shop	Hotel	Gym	Wine Shop	Steakhouse	Bar	Italian Restaurant	Pizza Place	Park	Gym / Fitness Center
31	Noho	Italian Restaurant	French Restaurant	Cocktail Bar	Gift Shop	Bookstore	Grocery Store	Mexican Restaurant	Hotel	Sushi Restaurant	Coffee Shop
32	Civic Center	Gym / Fitness Center	Bakery	Italian Restaurant	Cocktail Bar	French Restaurant	Sandwich Place	Coffee Shop	Gym	Yoga Studio	Park
35	Turtle Bay	Italian Restaurant	Coffee Shop	Steakhouse	Wine Bar	Sushi Restaurant	Hotel	Noodle House	Indian Restaurant	Japanese Restaurant	French Restaurant

MANHATTAN SUBWAY STATIONS AND GEODATA

Read csv file that produced the subway stations list with geodata

```
1 mh=pd.read_csv('MH_subway.csv')
2 print(mh.shape)
3 mh.head()
```

```
(76, 4)
```

	sub_station	sub_address	lat	long
0	Dyckman Street Subway Station	170 Nagle Ave, New York, NY 10034, USA	40.861857	-73.924509
1	57 Street Subway Station	New York, NY 10106, USA	40.764250	-73.954525
2	Broad St	New York, NY 10005, USA	40.730862	-73.987156
3	175 Street Station	807 W 177th St, New York, NY 10033, USA	40.847991	-73.939785
4	5 Av and 53 St	New York, NY 10022, USA	40.764250	-73.954525

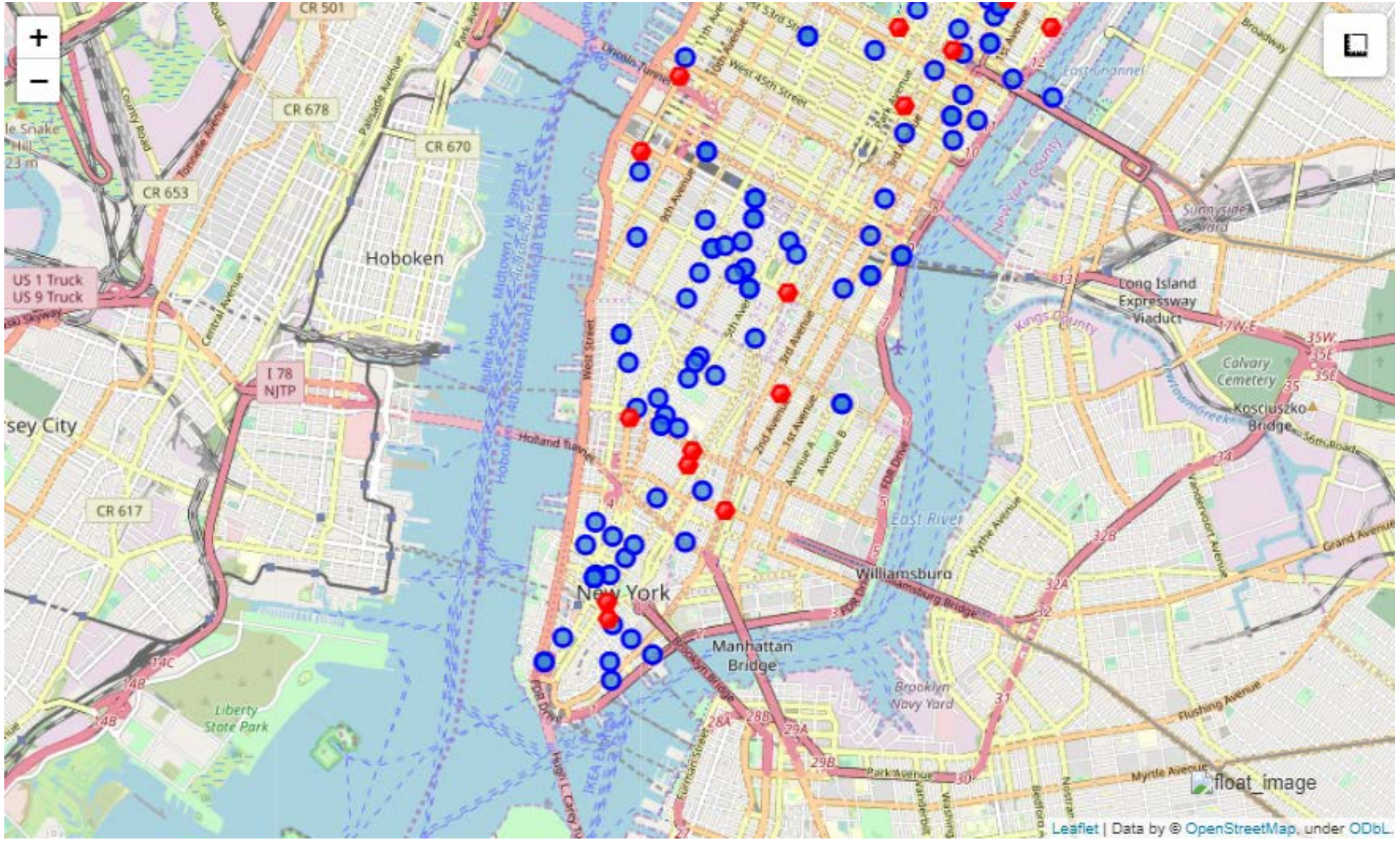
```
1 # removing duplicate rows and creating new set mhsub1
2 mhsub1=mh.drop_duplicates(subset=['lat','long'], keep="last").reset_index(drop=True)
3 mhsub1.shape
```

```
(22, 4)
```

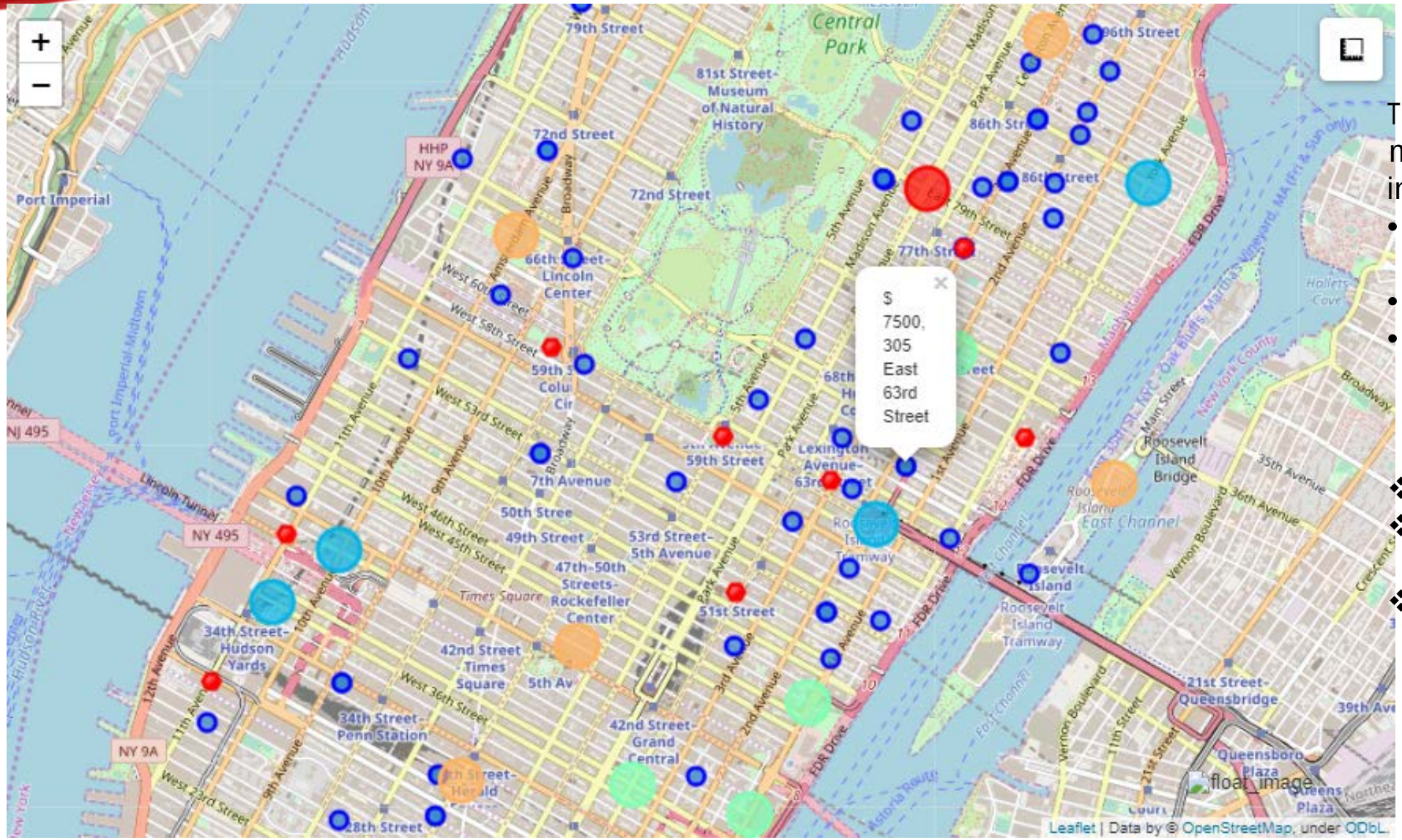
```
1 mhsub1.tail()
```

	sub_station	sub_address	lat	long
17	190 Street Subway Station	Bennett Ave, New York, NY 10040, USA	40.858113	-73.932983
18	59 St-Lexington Av Station	E 60th St, New York, NY 10065, USA	40.762259	-73.966271
19	57 Street Station	New York, NY 10019, United States	40.764250	-73.954525
20	14 Street / 8 Av	New York, NY 10014, United States	40.730862	-73.987156
21	MTA New York City	525 11th Ave, New York, NY 10018, USA	40.759809	-73.999282

APTS FOR RENT – BLUE SUBWAY STATIONS - RED



SELECTED APARTMENT



The ONE consolidated map shows all information for decision:

- Apartments address price
- Neighborhood
- cluster of venues subway station nearby

- ❖ Blue dots=apts
- ❖ Red dots=Subway station
- ❖ Bubbles=Cluster of Venues

SELECTED APARTMENT

Using the "one map" above, I was able to explore all possibilities since the popups provide the information needed for a good decision.

Apartment 1 rent cost is US7500 slightly above the US7000 budget. Apt 1 is located 400 meters from subway station at 59th Street and work place (Park Ave and 53rd) is another 600 meters way. I can walk to work place and use subway for other places around. Venues for this apt are as of Cluster 2 and it is located in a fine district in the East side of Manhattan.

Apartment 2 rent cost is US6935, just under the US7000 budget. Apt 2 is located 60 meters from subway station at Fulton Street, but I will have to ride the subway daily to work , possibly 40-60 min ride. Venues for this apt are as of Cluster 3.

Based on current Singapore venues, I feel that Cluster 2 type of venues is a closer resemblance to my current place. That means that APARTMENT 1 is a better choice since the extra monthly rent is worth the conveniences it provides.

VENUES IN CLUSTER 2 NEAR FUTURE HOME

Venues for Apartment 1 - Cluster 2¶

```
1
2  ## kk is the cluster number to explore
3  kk = 2
4  manhattan_merged.loc[manhattan_merged['Cluster Labels'] == kk, manhattan_merged.columns[[1] + list(range(5, manhattan_merged
```

	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	Coffee Shop	Discount Store	Yoga Studio	Steakhouse	Supplement Shop	Tennis Stadium	Shoe Store	Gym	Bank	Seafood Restaurant
1	Chinatown	Chinese Restaurant	Cocktail Bar	Dim Sum Restaurant	American Restaurant	Vietnamese Restaurant	Salon / Barbershop	Noodle House	Bakery	Bubble Tea Shop	Ice Cream Shop
6	Central Harlem	African Restaurant	Seafood Restaurant	French Restaurant	American Restaurant	Cosmetics Shop	Chinese Restaurant	Event Space	Liquor Store	Beer Bar	Gym / Fitness Center
9	Yorkville	Coffee Shop	Gym	Bar	Italian Restaurant	Sushi Restaurant	Pizza Place	Mexican Restaurant	Deli / Bodega	Japanese Restaurant	Pub
14	Clinton	Theater	Italian Restaurant	Coffee Shop	American Restaurant	Gym / Fitness Center	Hotel	Wine Shop	Spa	Gym	Indie Theater
23	Soho	Clothing Store	Boutique	Women's Store	Shoe Store	Men's Store	Furniture / Home Store	Italian Restaurant	Mediterranean Restaurant	Art Gallery	Design Studio
26	Morningside Heights	Coffee Shop	American Restaurant	Park	Bookstore	Pizza Place	Sandwich Place	Burger Joint	Café	Deli / Bodega	Tennis Court
34	Sutton Place	Gym / Fitness Center	Italian Restaurant	Furniture / Home Store	Indian Restaurant	Dessert Shop	American Restaurant	Bakery	Juice Bar	Boutique	Sushi Restaurant
39	Hudson Yards	Coffee Shop	Italian Restaurant	Hotel	Theater	American Restaurant	Café	Gym / Fitness Center	Thai Restaurant	Restaurant	Gym

5. DISCUSSION

- ✓In general, I am positively impressed with the overall organization, content and lab works presented during the Coursera IBM Certification Course
- ✓I feel this Capstone project presented me a great opportunity to practice and apply the Data Science tools and methodologies learned.
- ✓ I have created a good project that I can present as an example to show my potential.
- ✓I feel I have acquired a good starting point to become a professional Data Scientist and I will continue exploring to creating examples of practical cases.

6. CONCLUSIONS

- I feel rewarded with the efforts, time and money spent. I believe this course with all the topics covered is well worthy of appreciation.
- This project has shown me a practical application to resolve a real situation that has impacting personal and financial impact using Data Science tools.
- The mapping with Folium is a very powerful technique to consolidate information and make the analysis and decision thoroughly and with confidence. I would recommend for use in similar situations.
- One must keep abreast of new tools for DS that continue to appear for application in several business fields.