Coursera capstone Project

Open an Italian Restaurant in Manhattan

Manhattan is the most densely populated of the five boroughs of New York City.

The Italian cousin is one of the most appreciate cousin in the world.

We can combine this two things opening an Italian Restaurant in Manhattan

Aim of the project

Find the best neighborhood in Manhattan where open an Italian Restaurant

- **Neighborhoods with less Italian Restaurant**
- **Neighborhoods closest to the central part of Manhattan**

Data

- The New York City dataset that contains Borough, Neighborhoods, Latitudes and Longitudes information. Data were downloaded trough a .csv file from https://data.cityofnewyork.us

- From Foursquare API I will get all the venues in Manhattan neighborhood. I will then filter these venues to get only Italian restaurants.

Data preparation

```
In [1]: # import pandas library
        import pandas as pd

In [2]: # import .csv file of New York data and convert it to Pandas Dataframe
        column_names = ['Borough', 'Neighborhood', 'Latitude', 'Longitude']
        df= pd.read_csv("C:/Coursera/NYD.csv", header = None, names = column_names)
        df
```

	Borough	Neighborhood	Latitude	Longitude
0	Bronx	Wakefield	40.894705	-73.847201
1	Bronx	Co-op City	40.874294	-73.829939
2	Bronx	Eastchester	40.887556	-73.827806
3	Bronx	Fieldston	40.895437	-73.905643
4	Bronx	Riverdale	40.890834	-73.912585
...	...	...	...	...
294	Staten Island	Lighthouse Hill	40.576506	-74.137927
295	Staten Island	Richmond Valley	40.519541	-74.229571
296	Queens	Malba	40.790602	-73.826678
297	Brooklyn	Highland Park	40.682486	-73.890281
298	Brooklyn	Madison	40.609378	-73.948415

299 rows × 4 columns

1. Dataframe with New York Neighborhoods, Boroughs, Latitude and Longitude

```
In [13]: # from the New York data dataframe extract only the neighborhood of Manhattan
         manhattan_data = df[df['Borough'] == 'Manhattan'].reset_index(drop=True)
         manhattan_data.head()

Out[13]:
```

	Borough	Neighborhood	Latitude	Longitude
0	Manhattan	Marble Hill	40.876551	-73.910660
1	Manhattan	Chinatown	40.715618	-73.994279
2	Manhattan	Washington Heights	40.851903	-73.936900
3	Manhattan	Inwood	40.867684	-73.921210
4	Manhattan	Hamilton Heights	40.823604	-73.949688

2. Dataframe with only Neighborhoods of Manhattan

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Battery Park City	65	65	65	65	65	65
Carnegie Hill	87	87	87	87	87	87
Central Harlem	45	45	45	45	45	45
Chelsea	100	100	100	100	100	100
Chinatown	100	100	100	100	100	100
Civic Center	99	99	99	99	99	99
Clinton	100	100	100	100	100	100
East Harlem	40	40	40	40	40	40
East Village	100	100	100	100	100	100
Financial District	100	100	100	100	100	100

3. Dataframe group by Neighborhoods with venues extracted with Foursquare API

Data preparation

```
In [22]: # calculate the mean venues for eahc neighborhood
manhattan_grouped = manhattan_onehot.groupby('Neighborhood').mean().reset_index()
manhattan_grouped
```

Out[22]:

	Neighborhood	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	American Restaurant	Antique Shop	Arcade	Arepa Restaurant	Argentinian Restaurant	...	Video Store	Vietnamese Restaurant	Volleyball Court
0	Battery Park City	0.000000	0.00	0.00	0.000000	0.015385	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
1	Carnegie Hill	0.000000	0.00	0.00	0.000000	0.011494	0.000000	0.000000	0.000000	0.011494	...	0.00	0.022989	0.000000
2	Central Harlem	0.000000	0.00	0.00	0.066667	0.044444	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
3	Chelsea	0.000000	0.00	0.00	0.000000	0.030000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
4	Chinatown	0.000000	0.00	0.00	0.000000	0.030000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.020000	0.000000
5	Civic Center	0.000000	0.00	0.00	0.000000	0.040404	0.010101	0.000000	0.000000	0.000000	...	0.00	0.010101	0.000000
6	Clinton	0.000000	0.00	0.00	0.000000	0.030000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
7	East Harlem	0.000000	0.00	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
8	East Village	0.000000	0.00	0.00	0.000000	0.010000	0.000000	0.000000	0.010000	0.010000	...	0.00	0.020000	0.000000
9	Financial District	0.000000	0.00	0.00	0.000000	0.040000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
10	Flatiron	0.000000	0.00	0.00	0.000000	0.010000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
11	Gramercy	0.000000	0.00	0.00	0.000000	0.036585	0.000000	0.012195	0.000000	0.000000	...	0.00	0.000000	0.000000
12	Greenwich Village	0.000000	0.00	0.00	0.000000	0.010000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.020000	0.000000
13	Hamilton Heights	0.000000	0.00	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
14	Inwood	0.000000	0.00	0.00	0.000000	0.034483	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
15	Lenox Hill	0.000000	0.00	0.01	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
16	Lincoln Square	0.000000	0.00	0.00	0.000000	0.030612	0.000000	0.000000	0.000000	0.000000	...	0.00	0.000000	0.000000
17	Little Italy	0.000000	0.00	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.00	0.010000	0.000000
18	Lower East Side	0.000000	0.00	0.00	0.000000	0.021277	0.000000	0.000000	0.000000	0.021277	...	0.00	0.021277	0.000000

4. Dataframe with mean venues value for each neighborhoods

```
In [23]: # create a dataframe that contains only the mean of Italian Restaurant for each neighborhood
Italian_manhattan = manhattan_grouped[['Neighborhood','Italian Restaurant']]
Italian_manhattan
```

Out[23]:

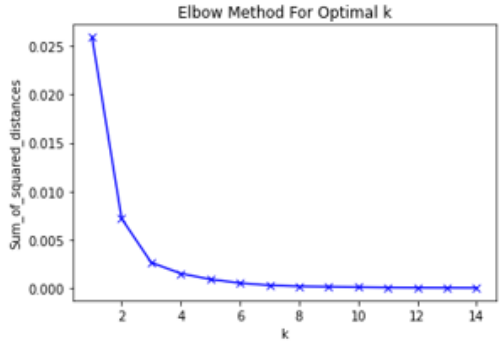
	Neighborhood	Italian Restaurant
0	Battery Park City	0.015385
1	Carnegie Hill	0.034483
2	Central Harlem	0.000000
3	Chelsea	0.020000
4	Chinatown	0.010000
5	Civic Center	0.010101
6	Clinton	0.050000
7	East Harlem	0.000000
8	East Village	0.020000
9	Financial District	0.040000
10	Flatiron	0.040000
11	Gramercy	0.036585
12	Greenwich Village	0.100000
13	Hamilton Heights	0.016393
14	Inwood	0.000000
15	Lenox Hill	0.050000
16	Lincoln Square	0.051020
17	Little Italy	0.040000
18	Lower East Side	0.021277
19	Manhattan Valley	0.025000
20	Manhattanville	0.042553
21	Marble Hill	0.000000

5. Dataframe with mean venues value of Italian restaurants for each neighborhoods in Manhattan

K value and clustering

In [26]:
```
# calculate the best value of k
Sum_of_squared_distances = []
K = range(1,15)
for k in K:
    km = KMeans(n_clusters=k)
    km = km.fit(b)
    Sum_of_squared_distances.append(km.inertia_)
```

In [27]:
```
# plot the k graph to use the elbow method
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
import matplotlib
plt.plot(K, Sum_of_squared_distances, 'bx-')
plt.xlabel('k')
plt.ylabel('Sum_of_squared_distances')
plt.title('Elbow Method For Optimal k')
plt.show()
```



The best value of k is 3

Clusters analysis

Cluster 0

```
In [41]: cluster_0 = manhattan_merged.loc[manhattan_merged['Cluster Labels']== 0]
         cluster_0
```

Out[41]:

	Cluster Labels	Neighborhood	Italian Restaurant	Borough	Latitude	Longitude
1	0	Carnegie Hill	0.034483	Manhattan	40.782683	-73.953256
6	0	Clinton	0.050000	Manhattan	40.758334	-73.996408
9	0	Financial District	0.040000	Manhattan	40.707107	-74.010665
10	0	Flatiron	0.040000	Manhattan	40.739673	-73.990947
11	0	Gramercy	0.036585	Manhattan	40.737210	-73.981376
15	0	Lenox Hill	0.050000	Manhattan	40.768113	-73.958860
16	0	Lincoln Square	0.051020	Manhattan	40.773529	-73.985338
17	0	Little Italy	0.040000	Manhattan	40.719324	-73.997305
20	0	Manhattanville	0.042553	Manhattan	40.816934	-73.957385
26	0	Noho	0.040000	Manhattan	40.723259	-73.988434
30	0	Sutton Place	0.040000	Manhattan	40.760280	-73.963556
31	0	Tribeca	0.053333	Manhattan	40.721522	-74.010683
33	0	Turtle Bay	0.050000	Manhattan	40.752042	-73.967708
35	0	Upper West Side	0.048780	Manhattan	40.787658	-73.977059
38	0	Yorkville	0.060000	Manhattan	40.775930	-73.947118

cluster 0 contains neighborhood with intermediate number of Italian restaurant

Cluster 1

```
In [42]: cluster_1=manhattan_merged.loc[manhattan_merged['Cluster Labels']== 1]
         cluster_1
```

Out[42]:

	Cluster Labels	Neighborhood	Italian Restaurant	Borough	Latitude	Longitude
0	1	Battery Park City	0.015385	Manhattan	40.711932	-74.016869
2	1	Central Harlem	0.000000	Manhattan	40.815976	-73.943211
3	1	Chelsea	0.020000	Manhattan	40.744035	-74.003116
3	1	Chelsea	0.020000	Staten Island	40.594726	-74.189560
4	1	Chinatown	0.010000	Manhattan	40.715618	-73.994279
5	1	Civic Center	0.010101	Manhattan	40.715229	-74.005415
7	1	East Harlem	0.000000	Manhattan	40.792249	-73.944182
8	1	East Village	0.020000	Manhattan	40.727847	-73.982226
13	1	Hamilton Heights	0.016393	Manhattan	40.823604	-73.949688
14	1	Inwood	0.000000	Manhattan	40.867684	-73.921210
18	1	Lower East Side	0.021277	Manhattan	40.717807	-73.980890
19	1	Manhattan Valley	0.025000	Manhattan	40.797307	-73.964286
21	1	Marble Hill	0.000000	Manhattan	40.876551	-73.910660
22	1	Midtown	0.000000	Manhattan	40.754691	-73.981669
23	1	Midtown South	0.010000	Manhattan	40.748510	-73.988713
24	1	Morningside Heights	0.000000	Manhattan	40.808000	-73.963896
25	1	Murray Hill	0.011765	Manhattan	40.748303	-73.978332
25	1	Murray Hill	0.011765	Queens	40.764126	-73.812763
27	1	Roosevelt Island	0.000000	Manhattan	40.762404	-73.949471
29	1	Stuyvesant Town	0.000000	Manhattan	40.731000	-73.974052
32	1	Tudor City	0.013333	Manhattan	40.746917	-73.971219
36	1	Washington Heights	0.011364	Manhattan	40.851903	-73.936900

cluster 1 contains neighborhood with low number of Italian restaurant

Cluster 2

```
In [43]: cluster_2= manhattan_merged.loc[manhattan_merged['Cluster Labels']== 2]
         cluster_2
```

Out[43]:

	Cluster Labels	Neighborhood	Italian Restaurant	Borough	Latitude	Longitude
12	2	Greenwich Village	0.100000	Manhattan	40.726933	-73.999914
28	2	Soho	0.083333	Manhattan	40.722184	-74.000657
34	2	Upper East Side	0.078652	Manhattan	40.775639	-73.960508
37	2	West Village	0.070000	Manhattan	40.734434	-74.006180

cluster 2 contains neighborhood with high number of Italian restaurant

Clusters analysis

Cluster 0

```
In [41]: cluster_0 = manhattan_merged.loc[manhattan_merged['Cluster Labels']== 0]
         cluster_0
```

Out[41]:

	Cluster Labels	Neighborhood	Italian Restaurant	Borough	Latitude	Longitude
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20	0	Manhattanville	0.042553	Manhattan	40.816934	-73.957385
26	0	Noho	0.040000	M		
30	0	Sutton Place	0.040000	M		
31	0	Tribeca	0.053333	M		
33	0	Turtle Bay	0.050000	M		
35	0	Upper West Side	0.048780	M		
38	0	Yorkville	0.060000	M		

cluster 0 con
intermediate number of Italian restaurant

We are interested in cluster 1 since it has low number of Italian Restaurant.

Cluster 1

```
In [42]: cluster_1=manhattan_merged.loc[manhattan_merged['Cluster Labels']== 1]
         cluster_1
```

Out[42]:

	Cluster Labels	Neighborhood	Italian Restaurant	Borough	Latitude	Longitude
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3	1	Chelsea	0.020000	Manhattan	40.744035	-74.003116
3	1	Chelsea	0.020000	Staten Island	40.594726	-74.189560
4	1	Chinatown	0.010000	Manhattan	40.715618	-73.994279
5	1	Civic Center	0.010101	Manhattan	40.715229	-74.005415
7	1	East Harlem	0.000000	Manhattan	40.792249	-73.944182
8	1	East Village	0.020000	Manhattan	40.727847	-73.982226
27	1	Roosevelt Island	0.000000	Manhattan	40.762404	-73.949471
29	1	Stuyvesant Town	0.000000	Manhattan	40.731000	-73.974052
32	1	Tudor City	0.013333	Manhattan	40.746917	-73.971219
36	1	Washington Heights	0.011364	Manhattan	40.851903	-73.936900

cluster 1 contains neighborhood with low number of Italian restaurant

Cluster 2

```
In [43]: cluster_2= manhattan_merged.loc[manhattan_merged['Cluster Labels']== 2]
         cluster_2
```

Out[43]:

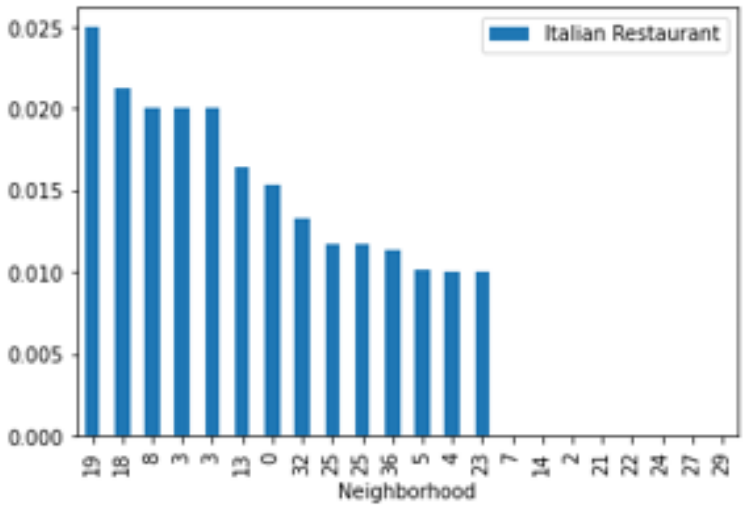
	Cluster Labels	Neighborhood	Italian Restaurant	Borough	Latitude	Longitude
12	2	Greenwich Village	0.100000	Manhattan	40.726933	-73.999914
28	2	Soho	0.083333	Manhattan	40.722184	-74.000657
34	2	Upper East Side	0.078652	Manhattan	40.775639	-73.960508
37	2	West Village	0.070000	Manhattan	40.734434	-74.006180

cluster 2 contains neighborhood with high number of Italian restaurant

Cluster 1 bar graph

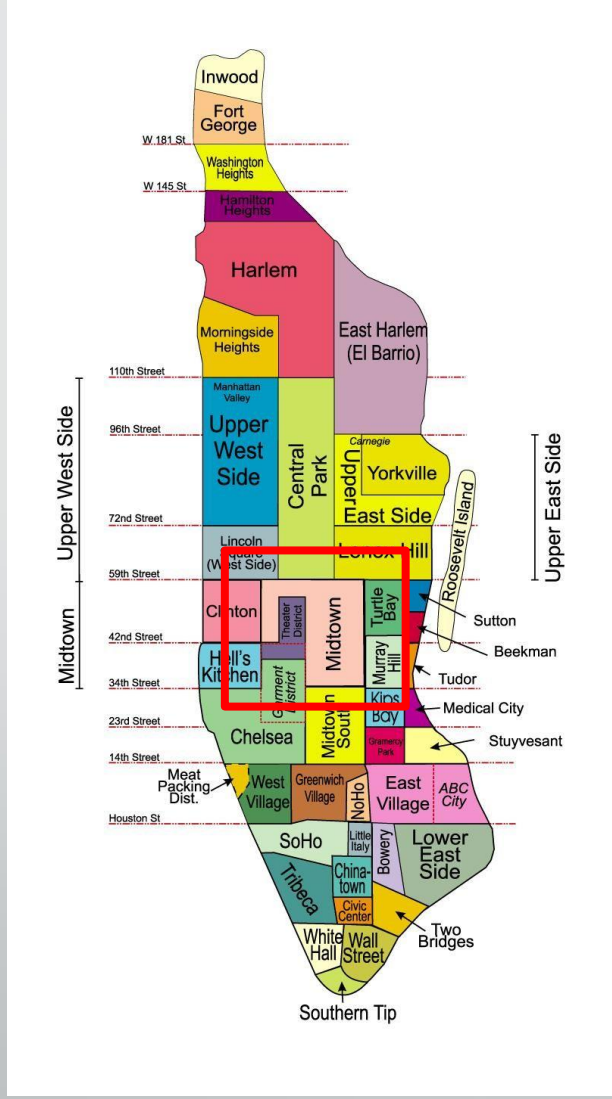
```
In [48]: # create bar graph
         graph.plot(kind = 'bar')
         plt.xlabel('Neighborhood')

Out[48]: Text(0.5, 0, 'Neighborhood')
```



The result of the analysis show that the neighborhoods in Manhattan with less Italian restaurant are: East Harlem, Inwood, Central Harlem, Marble Hill, Midtown, Morningsite Heights, Rooswel Islands, Stuyvesant Town and Rooswelt Island.

The best Neighborhood



If we look at the map of the neighborhoods in Manhattan we found that between the neighborhoods selected in the previous slide the Midtown neighborhood is the closest to the center of Manhattan

Conclusion

Our analysis reveals that the Midtown neighborhood could be the best where to open a new Italian Restaurant because:

- There are no Italian restaurants, so no competition are expected
- It is the closest to the central part of Manhattan so easy to reach from every point of Manhattan