

Capstone Project - The Battle of the Neighborhoods

Applied Data Science Capstone by IBM/Coursera

Table of contents

- Introduction: Business Problem
- Data
- Methodology
- Analysis
- Results and Discussion
- Conclusion

Introduction: Business Problem

In this project we have tried to find an optimal location for a **Café**. Specifically, this report is targeted towards stakeholders interested in opening a **Café** in a neighborhood in **Brooklyn**, New York City.

Four important parameters were considered while selecting the final location for the cafe:

1. Population of the neighborhood
2. Average Household income of the neighborhood
3. Average asking rent PSF (Ground Floor Retail) in the neighborhood
4. Most visited venues in the neighborhood (using Foursquare API)

Due to limited availability of Average asking rent PSF data on the internet, the following **major Brooklyn Corridors** were taken into consideration:

1. Greenpoint
2. Williamsburg
3. DUMBO-Downtown Brooklyn-Boerum Hill
4. Brooklyn Heights-Cobble Hill
5. Prospect Heights
6. Park Slope

7. Bay Ridge-Fort Hamilton

Also, as can be seen above, some of the neighborhoods were combined as one entity as in the geojson file which will be used to plot maps.

Data

Following data sources were used to extract the required information:

1. To obtain the population data, <https://www.worldatlas.com/articles/brooklyn-neighborhoods-by-population.html> was referred.
2. Average Household income data of the neighborhoods was taken from the website <https://www.point2homes.com/US/Neighborhood/NY/Brooklyn-Demographics.html>.
3. Average asking rent PSF (Ground Floor Retail) in the neighborhoods was taken from the website https://www.rebny.com/content/dam/rebny/Documents/PDF/News/Research/Retail%20Reports/2020_Winter_BrooklynRetailReport.pdf. This is the **Winter 2020 report** published on date 17th March, 2020 by **REBNY**.
4. The data of most visited venues in the neighborhoods was obtained using **Foursquare API**.

To generate the dataframes from the information obtained using the websites mentioned above, the data was arranged into a separate excel file for each parameter. These files can be found in the same github folder as this report.

The results from all the four parameters will be combined to get to the final solution, i.e., the most favorable location for opening a Café in Brooklyn.

The results are based on the four parameters stated above, however, some other factors can be taken into consideration according to individual's priorities.

Methodology

The methodology for selection of the optimum location will be as follows:

1. Neighborhoods with larger population will be targeted. This will be visualized with the help of Choropleth map.
2. Neighborhoods with higher Average Household Income will be given preference. A bar Chart will help to make it easy to pick such neighborhoods.
3. Neighborhoods with comparatively lesser Average Asking Rent PSF will be given priority. A bar chart will make this comparison easier.
4. Neighborhoods where Cafés are visited frequently will be favored. This data will be obtained from Foursquare API.

Results from all the four parameters will be combined to reach to the final solution.

The neighborhood which has favorable conditions according to all the four parameters will be selected as the best location for the Café.

Analysis

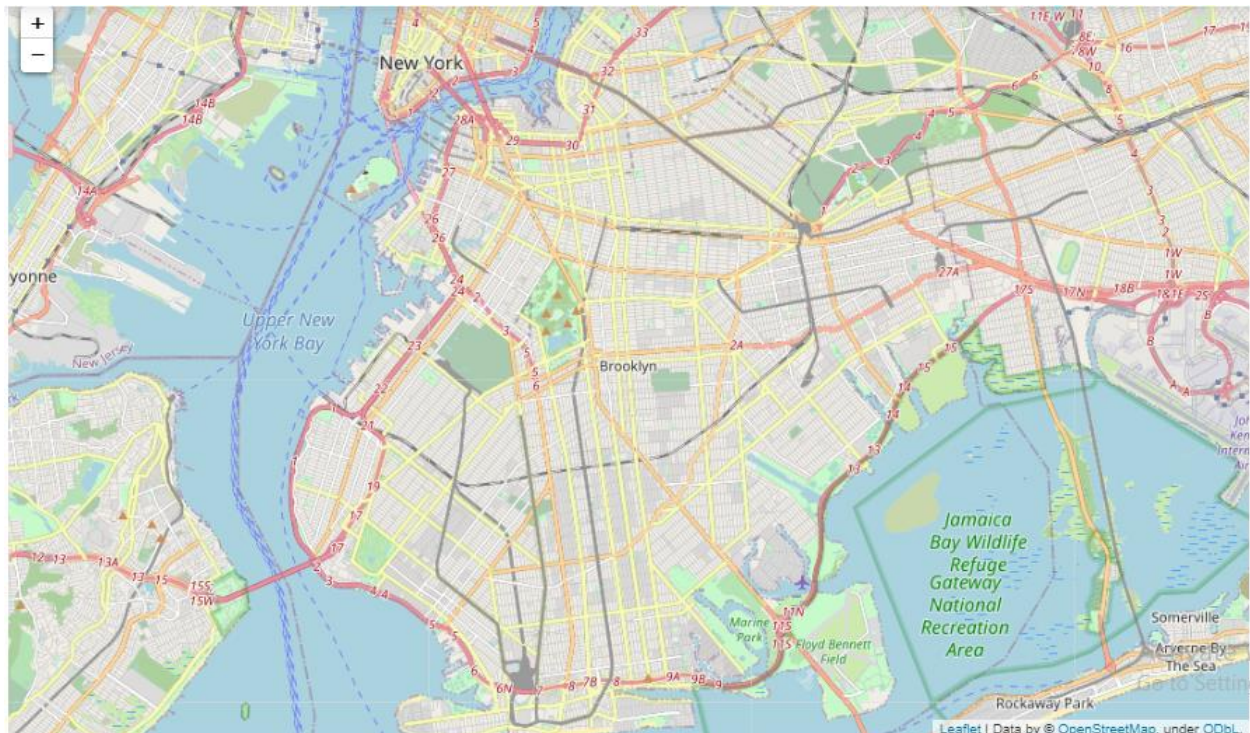
1. Population

Data of population of the neighborhoods obtained from the internet was compiled in an excel file. The excel file is available in the same folder as this report. (File name: Brooklyn Neighborhood Population.xlsx). This file was used to generate the dataframe and the Choropleth map.

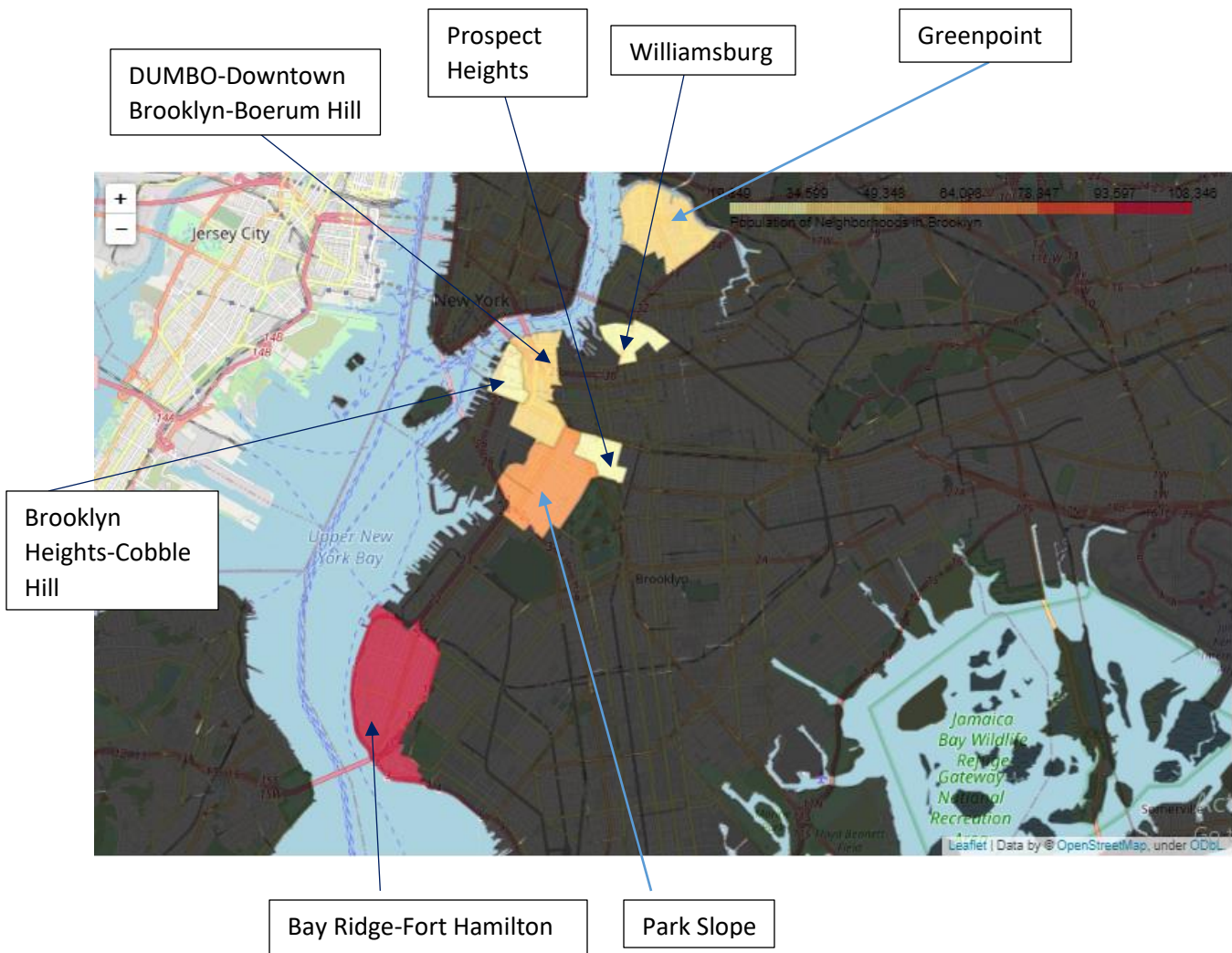
Dataframe for population of the neighborhoods

| | Neighborhood | Population |
|---|-------------------------------------|------------|
| 0 | Greenpoint | 34719 |
| 1 | Williamsburg | 32926 |
| 2 | DUMBO-Downtown Brooklyn-Boerum Hill | 35120 |
| 3 | Brooklyn Heights-Cobble Hill | 28101 |
| 4 | Prospect Heights | 19849 |
| 5 | Park Slope | 65047 |
| 6 | Bay Ridge-Fort Hamilton | 108346 |

Map of Brooklyn



Choropleth Map of Neighborhoods depicting Concentration of Population



From this map, we can see that the neighborhoods Bay Ridge-Fort Hamilton, Park Slope, DUMBO-Downtown Brooklyn-Boerum Hill and Greenpoint have the maximum population.

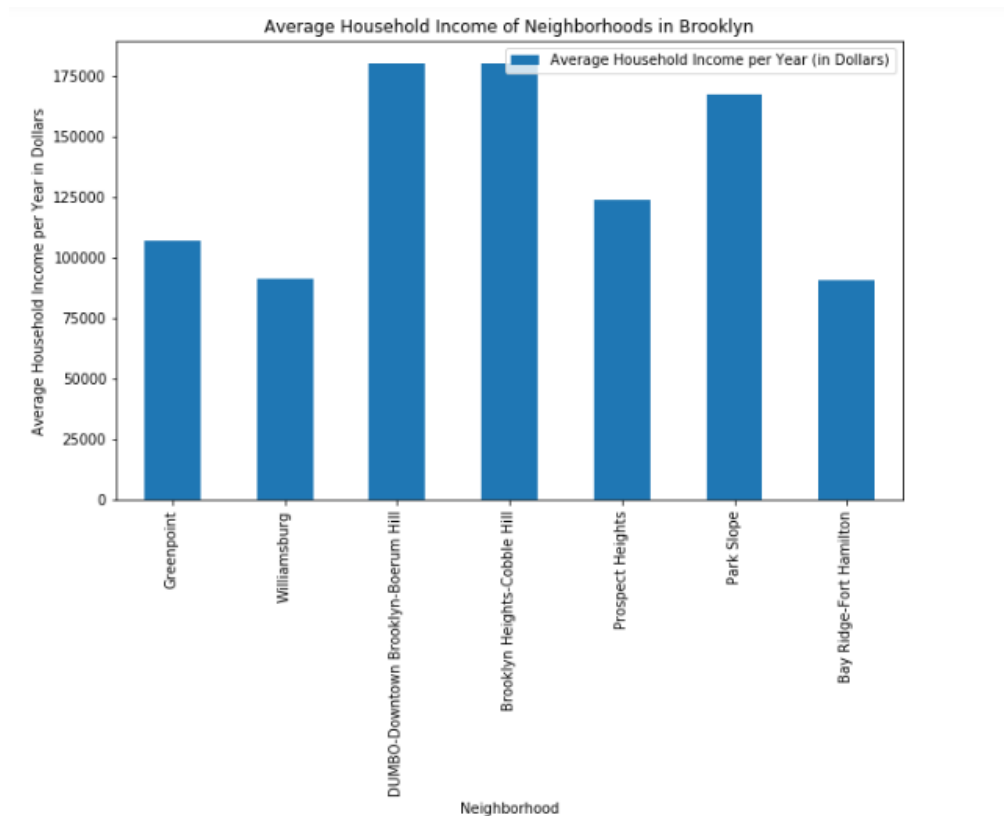
2. Average Household Income

Data of Average Household Income of the neighborhoods obtained from the internet was compiled in an excel file. The excel file is available in the same folder as this report. (File name: Brooklyn Neighborhood Household Income.xlsx). This file was used to generate the dataframe and the Bar Chart.

Dataframe for Average Household Income of Neighborhoods

| | Neighborhood | Average Household Income per Year (in Dollars) |
|---|-------------------------------------|--|
| 0 | Greenpoint | 106860 |
| 1 | Williamsburg | 91311 |
| 2 | DUMBO-Downtown Brooklyn-Boerum Hill | 179785 |
| 3 | Brooklyn Heights-Cobble Hill | 180237 |
| 4 | Prospect Heights | 123950 |
| 5 | Park Slope | 167058 |
| 6 | Bay Ridge-Fort Hamilton | 90551 |

Bar Chart for Average Household Income of Neighborhoods



As per the bar chart, we can see that the neighborhoods DUMBO-Downtown Brooklyn-Boerum Hill, Brooklyn Heights-Cobble Hill, Park Slope and Prospect Heights have a good Average Household Income.

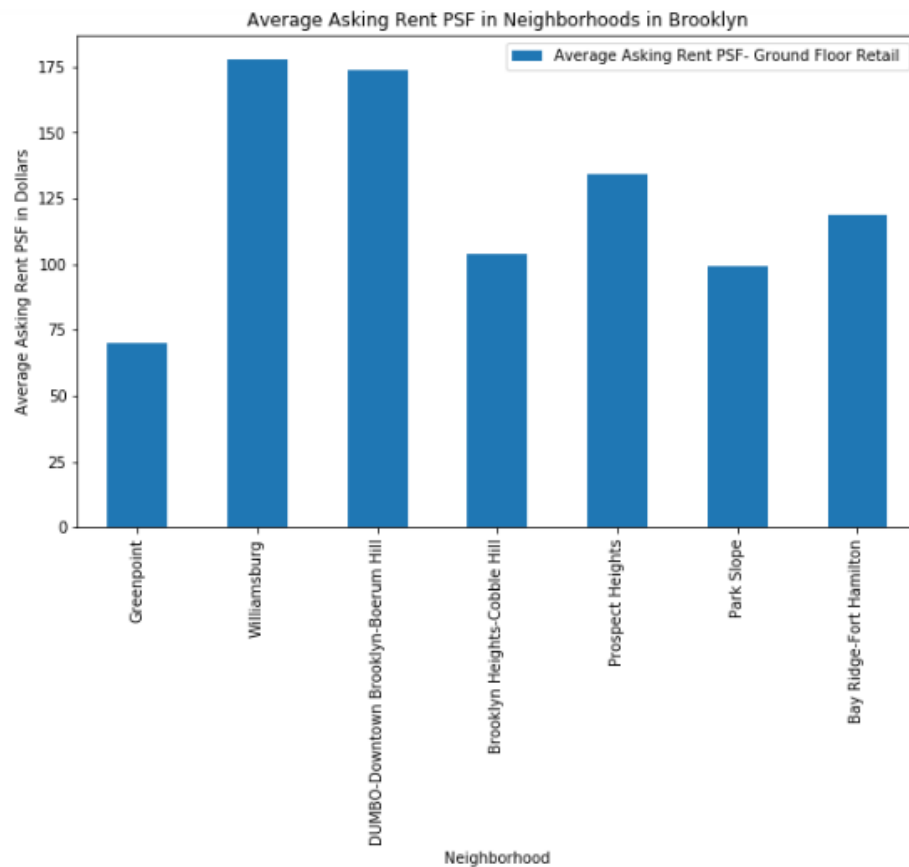
3. Average Asking Rent PSF

Data of Average Asking Rent PSF of the neighborhoods obtained from the internet was compiled in an excel file. The excel file is available in the same folder as this report. (File name: Brooklyn Neighborhood Rent PSF.xlsx). This file was used to generate the dataframe and the Bar Chart.

Dataframe for Average Asking Rent PSF for Neighborhoods

| | Neighborhood | Average Asking Rent PSF- Ground Floor Retail |
|---|-------------------------------------|--|
| 0 | Greenpoint | 70 |
| 1 | Williamsburg | 178 |
| 2 | DUMBO-Downtown Brooklyn-Boerum Hill | 174 |
| 3 | Brooklyn Heights-Cobble Hill | 104 |
| 4 | Prospect Heights | 134 |
| 5 | Park Slope | 99 |
| 6 | Bay Ridge-Fort Hamilton | 119 |

Bar Chart for Average Asking Rent PSF for Neighborhoods



As per the bar chart, we can see that the neighborhoods Greenpoint, Park Slope, Brooklyn Heights-Cobble Hill and Bay Ridge-Fort Hamilton have a low Average Asking Rent PSF.

4. Most Visited Venues Using Foursquare API

Using Foursquare API, most visited venues in each neighborhood were identified. The neighborhoods were clustered in 4 clusters to identify neighborhoods where Cafés are among the most visited venues. A radius of 500 metres and a limit of 50 was set while making the API call. Data of coordinates of the neighborhoods obtained from the internet was compiled in an excel file. The excel file is available in the same folder as this report. (File name: Brooklyn Neighborhood Coordinates.xlsx). This file was used to generate the dataframe and was used for the purpose of clustering.

Dataframe for Geographical Coordinates of the Neighborhoods

| | Neighborhood | Latitude | Longitude |
|----|-------------------|-----------|------------|
| 0 | Greenpoint | 40.730201 | -73.954241 |
| 1 | Williamsburg | 40.707144 | -73.958115 |
| 2 | DUMBO | 40.703176 | -73.988753 |
| 3 | Downtown Brooklyn | 40.690844 | -73.983463 |
| 4 | Boerum Hill | 40.685683 | -73.983748 |
| 5 | Brooklyn Heights | 40.695864 | -73.993782 |
| 6 | Cobble Hill | 40.687920 | -73.998561 |
| 7 | Prospect Heights | 40.676822 | -73.964859 |
| 8 | Park Slope | 40.672321 | -73.977050 |
| 9 | Bay Ridge | 40.625801 | -74.030621 |
| 10 | Fort Hamilton | 40.614768 | -74.031979 |

No. of Venues obtained for each Neighborhood

| Neighborhood | Neighborhood Latitude | Neighborhood Longitude | Venue | Venue Latitude | Venue Longitude | Venue Category |
|-------------------|-----------------------|------------------------|-------|----------------|-----------------|----------------|
| Bay Ridge | 50 | 50 | 50 | 50 | 50 | 50 |
| Boerum Hill | 50 | 50 | 50 | 50 | 50 | 50 |
| Brooklyn Heights | 50 | 50 | 50 | 50 | 50 | 50 |
| Cobble Hill | 50 | 50 | 50 | 50 | 50 | 50 |
| DUMBO | 50 | 50 | 50 | 50 | 50 | 50 |
| Downtown Brooklyn | 50 | 50 | 50 | 50 | 50 | 50 |
| Fort Hamilton | 50 | 50 | 50 | 50 | 50 | 50 |
| Greenpoint | 50 | 50 | 50 | 50 | 50 | 50 |
| Park Slope | 50 | 50 | 50 | 50 | 50 | 50 |
| Prospect Heights | 50 | 50 | 50 | 50 | 50 | 50 |
| Williamsburg | 35 | 35 | 35 | 35 | 35 | 35 |

10 Most Visited Venues in each Neighborhood

| | 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 | Bay Ridge | Spa | Italian Restaurant | Pizza Place | American Restaurant | Hookah Bar | Greek Restaurant | Grocery Store | Bagel Shop | Ice Cream Shop | Bar |
| 1 | Boerum Hill | Bar | Coffee Shop | Furniture / Home Store | French Restaurant | Cosmetics Shop | Sandwich Place | Spa | Yoga Studio | Gift Shop | Indian Restaurant |
| 2 | Brooklyn Heights | Yoga Studio | Park | Ice Cream Shop | Italian Restaurant | Deli / Bodega | Coffee Shop | Gym | Scenic Lookout | Bar | Bakery |
| 3 | Cobble Hill | Cocktail Bar | Yoga Studio | Italian Restaurant | Bookstore | Middle Eastern Restaurant | Restaurant | Bar | Thai Restaurant | Flower Shop | Ice Cream Shop |
| 4 | DUMBO | Park | Coffee Shop | Bakery | Yoga Studio | American Restaurant | Gym | Art Gallery | Boxing Gym | Café | Scenic Lookout |
| 5 | Downtown Brooklyn | Coffee Shop | Sandwich Place | Burger Joint | Grocery Store | Performing Arts Venue | Diner | Burrito Place | Roof Deck | Café | Plaza |
| 6 | Fort Hamilton | Chinese Restaurant | Bank | Sandwich Place | Pizza Place | Steakhouse | Pub | Deli / Bodega | Cocktail Bar | Gym / Fitness Center | Japanese Restaurant |
| 7 | Greenpoint | Bar | Coffee Shop | Cocktail Bar | Pizza Place | Yoga Studio | Café | Mexican Restaurant | Gastropub | Liquor Store | Beer Store |
| 8 | Park Slope | Coffee Shop | Bagel Shop | Pizza Place | Italian Restaurant | Mexican Restaurant | Bakery | Burger Joint | Spa | Furniture / Home Store | Yoga Studio |
| 9 | Prospect Heights | Bar | Cocktail Bar | Thai Restaurant | Mexican Restaurant | Beer Bar | Coffee Shop | Bakery | New American Restaurant | Ice Cream Shop | Wine Shop |
| 10 | Williamsburg | Bar | Coffee Shop | Bagel Shop | Pizza Place | Yoga Studio | Steakhouse | Japanese Restaurant | Clothing Store | Breakfast Spot | Korean Restaurant |

Cluster 1:

| | 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 |
|---|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| 2 | DUMBO | Park | Coffee Shop | Bakery | Yoga Studio | American Restaurant | Gym | Art Gallery | Boxing Gym | Café | Scenic Lookout |
| 5 | Brooklyn Heights | Yoga Studio | Park | Ice Cream Shop | Italian Restaurant | Deli / Bodega | Coffee Shop | Gym | Scenic Lookout | Bar | Bakery |

Cluster 2:

| | 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 | Downtown Brooklyn | Coffee Shop | Sandwich Place | Burger Joint | Grocery Store | Performing Arts Venue | Diner | Burrito Place | Roof Deck | Café | Plaza |
| 4 | Boerum Hill | Bar | Coffee Shop | Furniture / Home Store | French Restaurant | Cosmetics Shop | Sandwich Place | Spa | Yoga Studio | Gift Shop | Indian Restaurant |
| 10 | Fort Hamilton | Chinese Restaurant | Bank | Sandwich Place | Pizza Place | Steakhouse | Pub | Deli / Bodega | Cocktail Bar | Gym / Fitness Center | Japanese Restaurant |

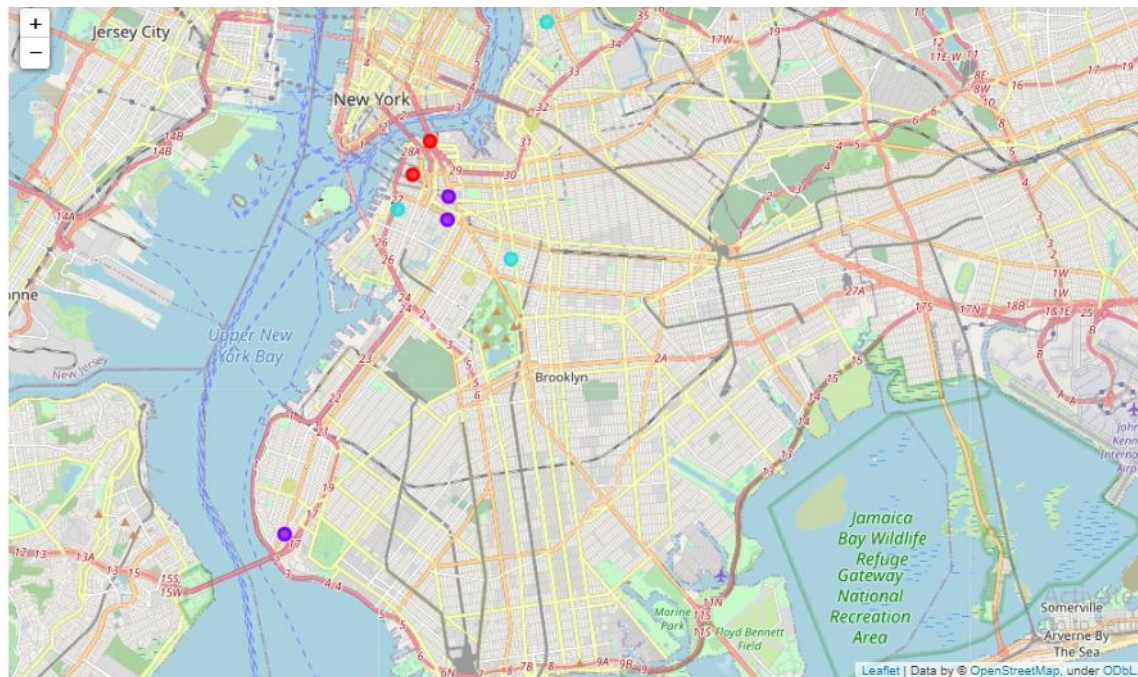
Cluster 3:

| | 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 | Greenpoint | Bar | Coffee Shop | Cocktail Bar | Pizza Place | Yoga Studio | Café | Mexican Restaurant | Gastropub | Liquor Store | Beer Store |
| 6 | Cobble Hill | Cocktail Bar | Yoga Studio | Italian Restaurant | Bookstore | Middle Eastern Restaurant | Restaurant | Bar | Thai Restaurant | Flower Shop | Ice Cream Shop |
| 7 | Prospect Heights | Bar | Cocktail Bar | Thai Restaurant | Mexican Restaurant | Beer Bar | Coffee Shop | Bakery | New American Restaurant | Ice Cream Shop | Wine Shop |

Cluster 4:

| | 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 | Williamsburg | Bar | Coffee Shop | Bagel Shop | Pizza Place | Yoga Studio | Steakhouse | Japanese Restaurant | Clothing Store | Breakfast Spot | Korean Restaurant |
| 8 | Park Slope | Coffee Shop | Bagel Shop | Pizza Place | Italian Restaurant | Mexican Restaurant | Bakery | Burger Joint | Spa | Furniture / Home Store | Yoga Studio |
| 9 | Bay Ridge | Spa | Italian Restaurant | Pizza Place | American Restaurant | Hookah Bar | Greek Restaurant | Grocery Store | Bagel Shop | Ice Cream Shop | Bar |

Map showing the Clusters



(Red: Cluster 1, Purple: Cluster 2, Blue: Cluster 3, Yellow: Cluster 4)

From the above data it can be seen that Coffee Shops and food joints are among the most visited venues in almost every cluster. Also, it can be seen that coffee shops are among top 2 most visited venues in the neighborhoods DUMBO, Downtown Brooklyn, Boerum Hill, Greenpoint, Williamsburg and Park Slope.

Results and Discussion:

From the above analysis, we have obtained the following results:

1. The neighborhoods **Bay Ridge-Fort Hamilton, Park Slope, DUMBO-Downtown Brooklyn-Boerum Hill and Greenpoint** have the **maximum population**. This will ensure a good frequency of customer visits.
2. The neighborhoods **DUMBO-Downtown Brooklyn-Boerum Hill, Brooklyn Heights-Cobble Hill, Park Slope and Prospect Heights** have a **good Average Household Income**. So, the pricing of products will not have too much of restrictions.
3. The neighborhoods **Greenpoint, Park Slope, Brooklyn Heights-Cobble Hill and Bay Ridge-Fort Hamilton** have a **low Average Asking Rent PSF**. Hence, shop rent, which is a major part of expenses, will be lower.
4. Coffee Shops and food joints are among the most visited venues in almost every cluster. Also, **coffee shops are among top 2 most visited venues** in the neighborhoods **DUMBO, Downtown Brooklyn, Boerum Hill, Greenpoint, Williamsburg and Park Slope**. So there are good chances for the Café to be popular.

The neighborhood which satisfies all the above requirements will be chosen as the optimum location for the new Café.

Conclusion:

From the above discussion, we can see that Park Slope fits in all the parameters. Therefore, the **best location** for opening a new Café as per the above analysis would be **Park Slope**. Also, Park Slope is close to DUMBO-Downtown Brooklyn-Boerum Hill where coffee shops and food joints are among the most visited venues.

If Shop Rent is not an issue, the **second best location** for the Café would be **DUMBO-Downtown Brooklyn-Boerum Hill**.

Also, it has to be kept in mind that these results are based on the 4 parameters as listed earlier. More parameters can be considered according to individual's preferences and local requirements, and more filtered results can be obtained which may vary from the result obtained above.