

Report on
Location Suggestion for an Ice-Cream
Parlour in Brooklyn, New York

Yudhishthira Sapru

28 January 2020

1 Introduction

1.1 New York City

New York City is not only the most populous city of the United States of America but it also the most densely populated city in the country. It had an estimated population of 8.4 million in 2018 over an area of 784 square kilometres. The city is located at the southern tip of the state of New York. The city is often referred to as the cultural, financial, and media capital of the world, and commands a very high impact upon commerce, entertainment, research, technology, education, politics, tourism, art, fashion, and sports.

New York is situated on one of the world's largest natural harbours. New York City consists of five boroughs, each of which is a separate county of the State of New York.

The five boroughs –

- i. Brooklyn,
- ii. Queens,
- iii. Manhattan,
- iv. The Bronx, and
- v. Staten Island

Tourism is a vital industry for New York City, which has witnessed a growing combined volume of international and domestic tourists.

1.2 Brooklyn Borough

Brooklyn (Kings County) is situated on the western tip of Long Island. It is new York's most populous borough.

Brooklyn is known for its cultural, social, and ethnic diversity, an independent art scene, distinct neighbourhoods, and a distinctive architectural heritage. Downtown Brooklyn is the largest central core neighbourhood in the outer boroughs. The borough has a long beachfront shoreline including Coney Island.

1.3 Brooklyn Ice-Creams

A small ice-cream parlour was opened in 2012 by a local resident Mr. Ridley Johnson in the Bay Ridge area of Brooklyn. Bay Ridge is a residential neighbourhood in the southwest corner of the New York City borough of Brooklyn. Being nearer to the coast, the area received high number of footfalls during the day which further increased during the night. Key attractors were the fruit flavoured ice creams which were loved by kids, adults and older people. Soon

the business flourished and Mr. Johnson moved to a bigger parlour in the town centre in 2015 and named it 'Brooklyn Ice-Creams'. Since then the business has increased and daily footfall is 500 which includes not only people from the neighbourhood but lovers of the ice-cream from other parts of Brooklyn and Manhattan.

1.4 The Business Problem

Ever since, Mr Jonson moved to bigger place, the response to the parlour had increased. The unique flavours of the ice-crèmes with local recipe appealed to all. However, Mr. Johnson had been thinking of opening an extension in Brooklyn area down south.

He has engaged Mr. Natham Wright who is a renowned commercial property dealer in Brooklyn and is personally know to Mr. Johnson. He had explored some places near the cost side and found that economical shops would be available in the following six areas

1. Sea Gate
2. Coney Island
3. Brighton Beach
4. Manhattan Beach
5. Sheepshed Bay
6. Gerritsen

Moving to the new area shall attract tourists also. Based upon the experience, Mr. Johnson feels that the following two factors shall be considered while selecting a neighbourhood:

1. Neighbourhood should be similar to the Bay Ridge area as people with similar lining and neighbourhood locations shall increase the chance of success
2. The neighbourhood should not have ice-creame as among the most common venues

Mr. Ridley Johnson the owner of Brooklyn Ice-Creams wants the help of data in finding the next best locality for his shop. The research problem can be stated as **“To suggest an appropriate location for an extension branch of Brooklyn Ice-Creams in in Brooklyn area down south.”**

1.5 The Target Audience

The target audience is clearly Mr. Ridley Johnson who is looking to find a new and an appropriate place for opening up of his ice-cream parlour. The information also concerns Mr.

Natham Wright who has been engaged by Mr. Johnson to find a suitable place to expand the venture.

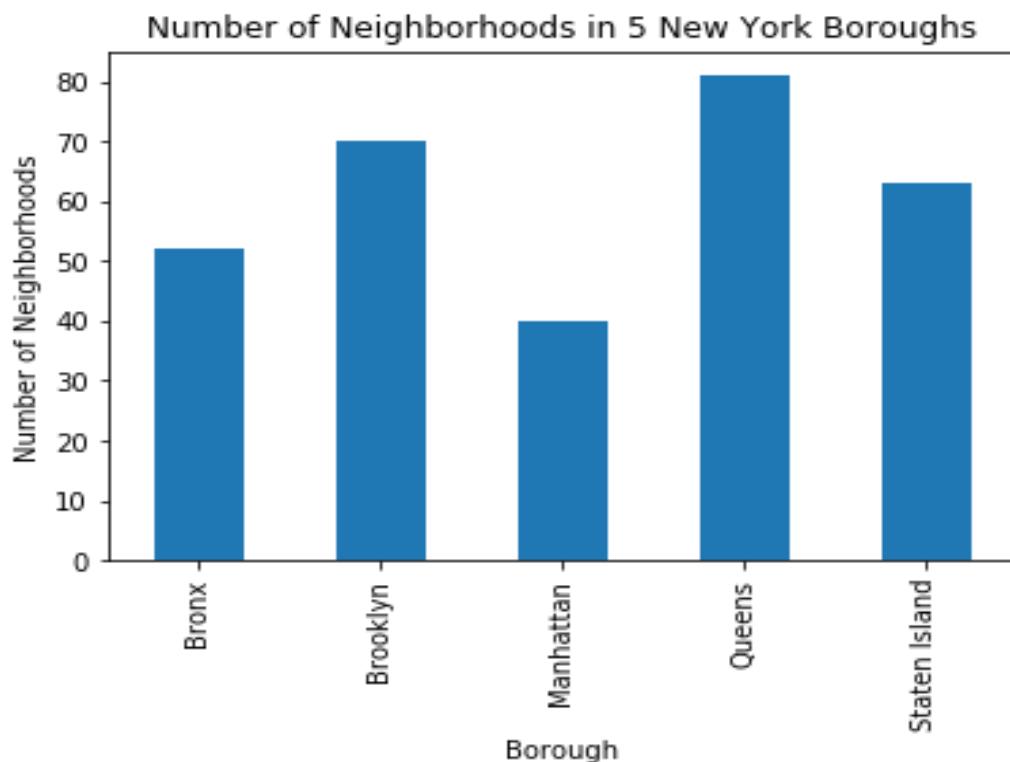
2 Data

2.1 Data Source

Twofold data is basically required for the project.

1. Brooklyn, New York neighbourhood data.
2. Nearby places data of each Brooklyn neighbourhood.

A Jason file named '*newyork_data.json*' was available to the author at the web address :- https://cocl.us/new_york_dataset. The dataset included some 306 neighbourhood of the 5 boroughs of New York City including those in the Brooklyn borough. Further data revealed that information about 70 neighbourhood in Brooklyn area was available in the dataset.



Since, it also important to study the neighbourhoods, Foursquare location data would be used to explore and cluster the neighbourhoods.

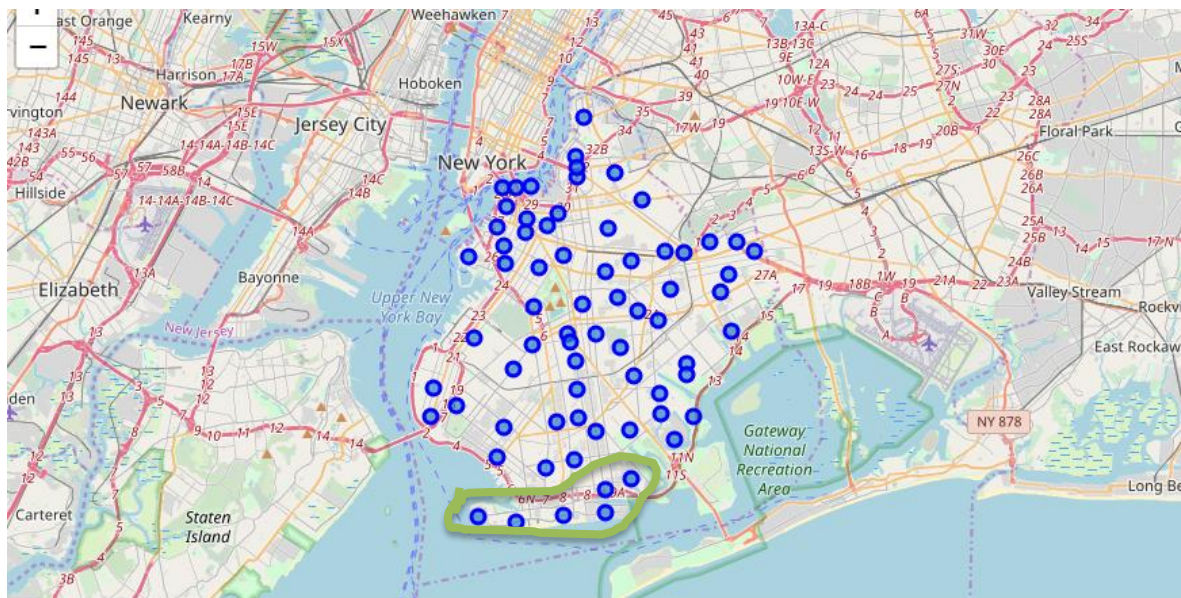
2.2 Approach to solving research problem

As highlighted in the research problem that Mr. Johnson has been looking for similar area to the Bay Ridge area but on the south side. Therefore, it was considered appropriate to undertake Cluster analysis to cluster Brooklyn's 70 neighbourhoods and especially analyse the cluster which is having the Bay Ridge neighbourhood and see if more neighbourhoods especially those in the research problem do lie in this same cluster or not. 5 clusters of the Brooklyn area were considered appropriate which is neither too small a number of clusters nor too large a number.

Thereafter, clusters were analysed and most common venues (top 5) were reviewed to take a decision on the appropriate neighbourhood. Neighbourhoods not having Ice Crème venues in top 5 most common venues were deemed to be appropriate.

2.3 Brooklyn Neighbourhoods

Brooklyn, New York neighbourhood data was prepared using the New York json file. It contained information on latitude and longitude of each location which was helpful later on while fetching the nearby venues using FourSquare API. The following map depicts the 70 neighbourhoods of Brooklyn area:



Data was obtained for following neighbourhoods:

- | | |
|----------------|-------------------|
| 1. Bay Ridge | 4. Greenpoint |
| 2. Bensonhurst | 5. Gravesend |
| 3. Sunset Park | 6. Brighton Beach |

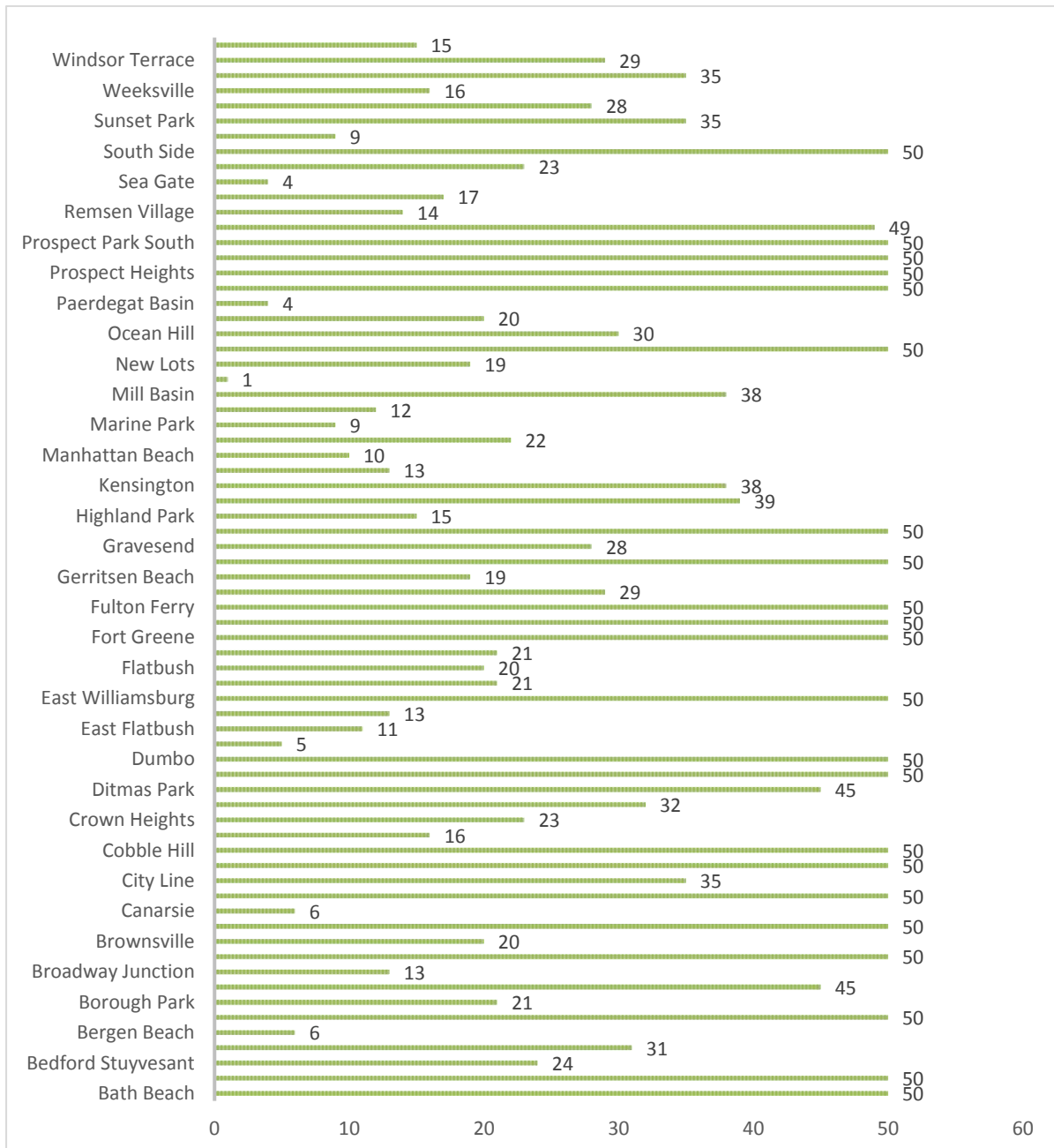
- | | | | |
|-----|--------------------|-----|---------------------------|
| 7. | Sheepshead Bay | 39. | Clinton Hill |
| 8. | Manhattan Terrace | 40. | Sea Gate |
| 9. | Flatbush | 41. | Downtown |
| 10. | Crown Heights | 42. | Boerum Hill |
| 11. | East Flatbush | 43. | Prospect Lefferts Gardens |
| 12. | Kensington | 44. | Ocean Hill |
| 13. | Windsor Terrace | 45. | City Line |
| 14. | Prospect Heights | 46. | Bergen Beach |
| 15. | Brownsville | 47. | Midwood |
| 16. | Williamsburg | 48. | Prospect Park South |
| 17. | Bushwick | 49. | Georgetown |
| 18. | Bedford Stuyvesant | 50. | East Williamsburg |
| 19. | Brooklyn Heights | 51. | North Side |
| 20. | Cobble Hill | 52. | South Side |
| 21. | Carroll Gardens | 53. | Ocean Parkway |
| 22. | Red Hook | 54. | Fort Hamilton |
| 23. | Gowanus | 55. | Ditmas Park |
| 24. | Fort Greene | 56. | Wingate |
| 25. | Park Slope | 57. | Rugby |
| 26. | Cypress Hills | 58. | Remsen Village |
| 27. | East New York | 59. | New Lots |
| 28. | Starrett City | 60. | Paerdegat Basin |
| 29. | Canarsie | 61. | Mill Basin |
| 30. | Flatlands | 62. | Fulton Ferry |
| 31. | Mill Island | 63. | Vinegar Hill |
| 32. | Manhattan Beach | 64. | Weeksville |
| 33. | Coney Island | 65. | Broadway Junction |
| 34. | Bath Beach | 66. | Dumbo |
| 35. | Borough Park | 67. | Homecrest |
| 36. | Dyker Heights | 68. | Highland Park |
| 37. | Gerritsen Beach | 69. | Madison |
| 38. | Marine Park | 70. | Erasmu |

The neighbourhoods in the green curve are the locations of interest as identified in the business problem.

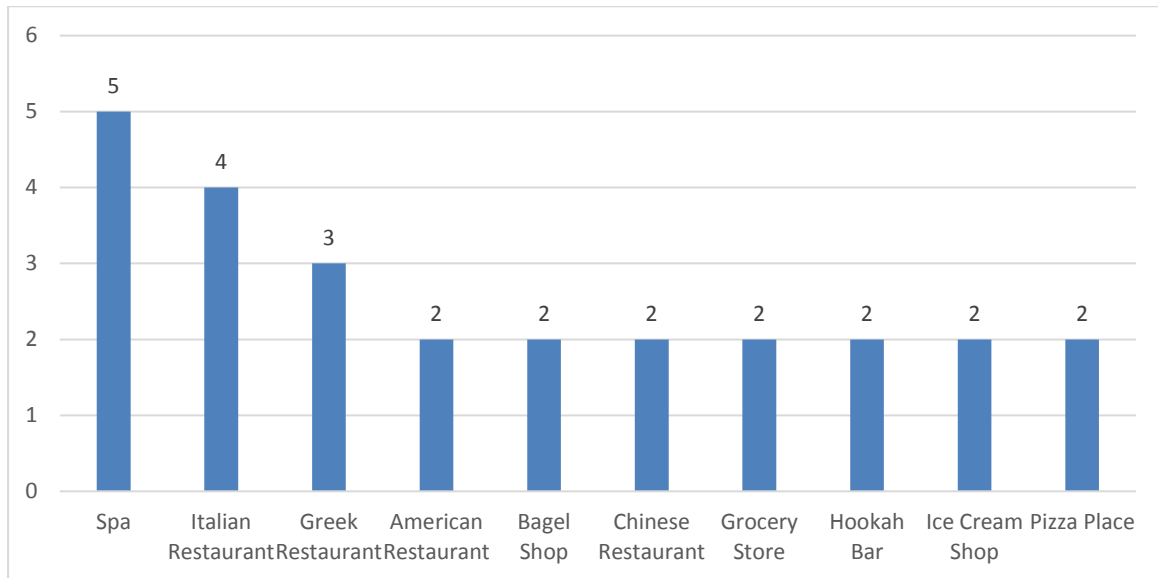
In order to explore the Brooklyn neighbourhood Four Square API was used to fetch venues in each neighbourhood. While limit was set to 50 venues per neighbourhood within a radius of 500 m. In all 2128 venues were found. The Four-Square API helped in fetching the data in the below format:

Neighbourhood	Venue	Venue Category
Bay Ridge	Pilo Arts Day Spa and Salon	Spa
Bay Ridge	Bagel Boy	Bagel Shop
Bay Ridge	Pegasus Cafe	Breakfast Spot
Bay Ridge	Cocoa Grinder	Juice Bar
Bay Ridge	Ho' Brah Taco Joint	Taco Place

Data provided was very useful as venue categories were made available for each of the 70 neighbourhoods. As shown in figure below, venues upto 50 were found for neighbourhoods:



2.4 Bay Ridge Area Top Venues



The display above shows the most common venues in the Bay Ridge area. Clustering would be used to find similar neighbourhoods in Brooklyn to meet the criteria as identified in the research problem. As can be seen Ice Cream shop does figure in the list of common venues (>1).

3 Methodology

Data from New York json file was converted into a Brooklyn neighbourhood data frame which also contained geographical coordinates of each neighbourhood. Thereafter, using Four Square nearby API, 50 venues within 500 m radius of neighbourhood were fetched and further used to derive clustering model.

As there was a requirement of clustering the neighbourhoods, it was considered appropriate to deploy K-Means Clustering. K-Means clustering is one of the simplest and popular unsupervised machine learning algorithms. A cluster usually refers to a collection of data points aggregated together because of certain similarities and in this case, we were looking for similar neighbourhoods.

Before Clustering was undertaken, it was importing to explore data to get insights into it.

3.1 Exploring Data

The Four-Square API was able to return more than 2000 venues in the 70 neighbourhoods and there were 267 unique categories of venues. Thereafter, an analysis of each neighbourhood was

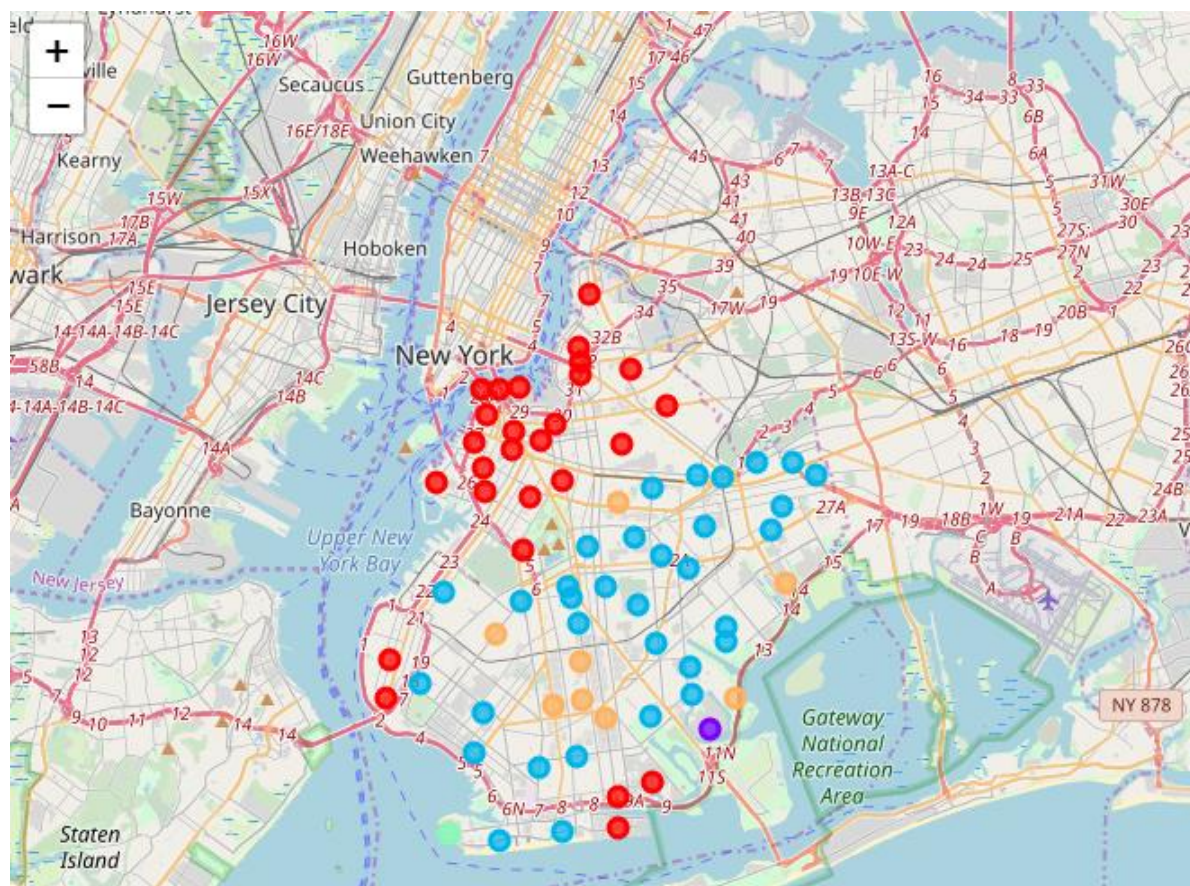
undertaken and most common 5 venues were arrived at. A table below depicts results for five of the neighbourhoods:

Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Bath Beach	Pizza Place	Pharmacy	Chinese Restaurant	Fast Food Restaurant	Bubble Tea Shop
Bay Ridge	Spa	Italian Restaurant	Greek Restaurant	Ice Cream Shop	Pizza Place
Bedford Stuyvesant	Bar	Café	Pizza Place	Coffee Shop	Japanese Restaurant
Bensonhurst	Park	Ice Cream Shop	Donut Shop	Bakery	Italian Restaurant
Bergen Beach	Harbor / Marina	Baseball Field	Athletics & Sports	Playground	Donut Shop

It was noted that Ice Cream Shop was one of the most common venues in the Bay Ridge area. Thereafter, a K-Means cluster analysis was undertaken on the Brooklyn neighbourhood data with a view to identify five unique clusters in the borough.

4 Results

The map below depicts the results of running the cluster analysis on the Brooklyn neighbourhood data provided by the Four-Square API:



As evident from the figure above, there were 5 clusters. Each cluster have been depicted in colours. The following table shows the summary of results:

Name of the Cluster	Colour Depiction	Number of Neighbourhoods
Cluster-1	Red	27
Cluster-2	Purple	1
Cluster-3	Blue	33
Cluster-4	Green	1
Cluster-5	Orange	8

The details of the clusters are as below. Neighbourhoods of interest have been highlighted in Yellow Colours below.

Cluster 1:

Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Bay Ridge	Spa	Italian Restaurant	Greek Restaurant	Ice Cream Shop	Pizza Place
Greenpoint	Bar	Cocktail Bar	Coffee Shop	Pizza Place	Boutique
Sheepshead Bay	Dessert Shop	Turkish Restaurant	Sandwich Place	Yoga Studio	Grocery Store
Windsor Terrace	Deli / Bodega	Diner	Grocery Store	Plaza	Park
Prospect Heights	Bar	Cocktail Bar	Ice Cream Shop	Wine Shop	American Restaurant
Williamsburg	Bar	Coffee Shop	Bagel Shop	Yoga Studio	Burger Joint
Bushwick	Bar	Mexican Restaurant	Coffee Shop	Bakery	Italian Restaurant
Bedford Stuyvesant	Bar	Café	Pizza Place	Coffee Shop	Japanese Restaurant
Brooklyn Heights	Yoga Studio	Park	Pet Store	Bakery	Bar
Cobble Hill	Yoga Studio	Bar	Cocktail Bar	Italian Restaurant	Playground
Carroll Gardens	Italian Restaurant	Coffee Shop	Bar	Wine Shop	Wine Bar
Red Hook	Seafood Restaurant	Park	American Restaurant	Art Gallery	Bar
Gowanus	Italian Restaurant	Bar	Furniture / Home Store	Wine Shop	Art Gallery
Fort Greene	Italian Restaurant	Coffee Shop	Cocktail Bar	Playground	French Restaurant
Park Slope	Italian Restaurant	Coffee Shop	Japanese Restaurant	Bagel Shop	Bakery
Manhattan Beach	Bus Stop	Café	Ice Cream Shop	Beach	Sandwich Place
Gerritsen Beach	Ice Cream Shop	Bar	Pizza Place	American Restaurant	Convenience Store
Clinton Hill	Italian Restaurant	Thai Restaurant	Wine Shop	Restaurant	Yoga Studio
Downtown	Chinese Restaurant	Thai Restaurant	Sandwich Place	Bar	Performing Arts Venue

Boerum Hill	Bar	Coffee Shop	Furniture / Home Store	Yoga Studio	Sandwich Place
East Williamsburg	Bar	Coffee Shop	Bakery	Concert Hall	Cocktail Bar
North Side	Yoga Studio	South American Restaurant	Jewelry Store	Seafood Restaurant	Vegetarian / Vegan Restaurant
South Side	Bar	Wine Bar	Pizza Place	Yoga Studio	Burger Joint
Fort Hamilton	Sandwich Place	Bank	Steakhouse	Gym / Fitness Center	Italian Restaurant
Fulton Ferry	Park	Scenic Lookout	American Restaurant	Ice Cream Shop	Café
Vinegar Hill	Food Truck	Wine Shop	Art Gallery	Café	Coffee Shop
Dumbo	Coffee Shop	Bakery	Park	Gym	Scenic Lookout

Cluster 2

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Mill Island	Pool	Fast Food Restaurant	Event Service	Event Space	Factory

Cluster 3

Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Bensonhurst	Park	Ice Cream Shop	Donut Shop	Bakery	Italian Restaurant
Sunset Park	Latin American Restaurant	Bakery	Bank	Pizza Place	Mexican Restaurant
Gravesend	Pizza Place	Lounge	Italian Restaurant	Bakery	Donut Shop
Brighton Beach	Russian Restaurant	Restaurant	Beach	Eastern European Restaurant	Bank
Flatbush	Coffee Shop	Caribbean Restaurant	Bank	Mexican Restaurant	Pizza Place
East Flatbush	Caribbean Restaurant	Hardware Store	Food	Fast Food Restaurant	Chinese Restaurant
Kensington	Grocery Store	Thai Restaurant	Ice Cream Shop	Pizza Place	Pharmacy
Brownsville	Restaurant	Chinese Restaurant	Moving Target	Farmers Market	Park
Cypress Hills	Latin American Restaurant	Pizza Place	Fried Chicken Joint	Ice Cream Shop	Chinese Restaurant
East New York	Deli / Bodega	Fried Chicken Joint	Gym	Bus Stop	Fast Food Restaurant
Canarsie	Deli / Bodega	Thai Restaurant	Gym	Chinese Restaurant	Asian Restaurant
Flatlands	Pharmacy	Fried Chicken Joint	Fast Food Restaurant	Caribbean Restaurant	Deli / Bodega

Coney Island	Caribbean Restaurant	Baseball Stadium	Monument / Landmark	Fried Chicken Joint	Food Stand
Bath Beach	Pizza Place	Pharmacy	Chinese Restaurant	Fast Food Restaurant	Bubble Tea Shop
Dyker Heights	Plaza	Cosmetics Shop	Bagel Shop	Burger Joint	Golf Course
Marine Park	Ice Cream Shop	Chinese Restaurant	Pizza Place	Baseball Field	Deli / Bodega
Prospect Lefferts Gardens	Bakery	Café	Pizza Place	Caribbean Restaurant	Ice Cream Shop
Ocean Hill	Deli / Bodega	Playground	Convenience Store	Bus Stop	Southern / Soul Food Restaurant
City Line	Donut Shop	Shoe Store	Pharmacy	Mobile Phone Shop	Flower Shop
Prospect Park South	Caribbean Restaurant	Women's Store	Pizza Place	Mobile Phone Shop	Grocery Store
Georgetown	Bank	Pharmacy	Donut Shop	Breakfast Spot	Pet Store
Ditmas Park	Women's Store	Pizza Place	Donut Shop	Caribbean Restaurant	Liquor Store
Wingate	Fried Chicken Joint	Bus Station	Fast Food Restaurant	Donut Shop	BBQ Joint
Rugby	Caribbean Restaurant	Supermarket	Bank	Mobile Phone Shop	Grocery Store
Remsen Village	Caribbean Restaurant	Fast Food Restaurant	Supermarket	Breakfast Spot	Salad Place
New Lots	Pizza Place	Grocery Store	Fried Chicken Joint	Asian Restaurant	Bank
Paerdegat Basin	Asian Restaurant	Food	Auto Garage	Harbor / Marina	Women's Store
Mill Basin	Pizza Place	Japanese Restaurant	Sushi Restaurant	Bank	Cosmetics Shop
Weeksville	Discount Store	Donut Shop	Cocktail Bar	Lounge	Liquor Store
Broadway Junction	Donut Shop	Diner	Ice Cream Shop	Burger Joint	Fried Chicken Joint
Homecrest	Bank	Chinese Restaurant	Donut Shop	Sandwich Place	Mexican Restaurant
Highland Park	Deli / Bodega	Metro Station	Gym / Fitness Center	Supermarket	Garden
Erasmus	Caribbean Restaurant	Ice Cream Shop	Grocery Store	Pizza Place	Pharmacy

Cluster 4

Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Sea Gate	Bus Station	Spa	Home Service	Beach	Women's Store

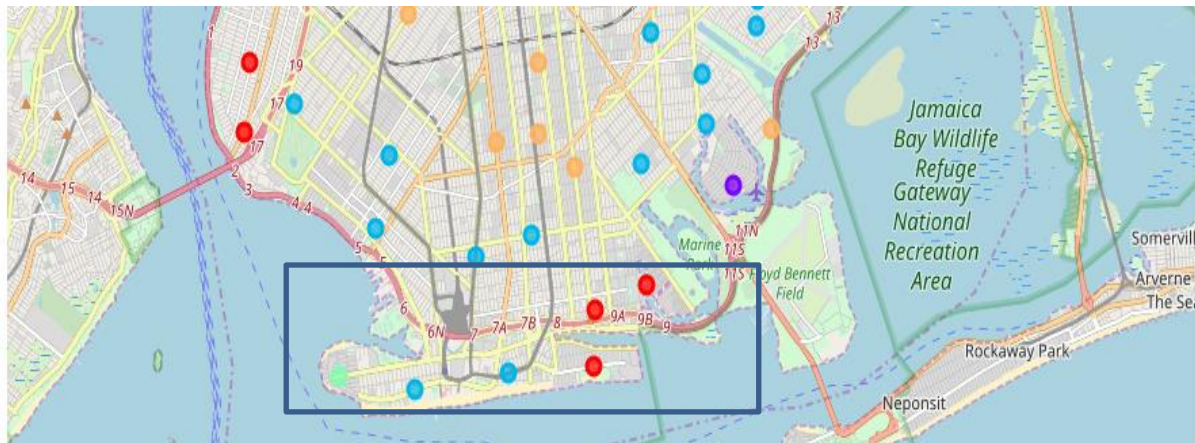
Cluster 5

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Manhattan Terrace	Pizza Place	Donut Shop	Ice Cream Shop	Restaurant	Jazz Club

Crown Heights	Pizza Place	Bagel Shop	Museum	Café	Deli / Bodega
Starrett City	Supermarket	Pizza Place	American Restaurant	Caribbean Restaurant	Convenience Store
Borough Park	Bank	Pizza Place	Deli / Bodega	Pharmacy	Toy / Game Store
Bergen Beach	Harbor / Marina	Baseball Field	Athletics & Sports	Playground	Donut Shop
Midwood	Pizza Place	Ice Cream Shop	Electronics Store	Convenience Store	Bakery
Ocean Parkway	Pizza Place	Restaurant	Bagel Shop	Spa	Food & Drink Shop
Madison	Deli / Bodega	Bagel Shop	Pizza Place	Italian Restaurant	Spa

5 Discussions

The picture below shows the areas of interest with the 6 neighbourhoods surrounded in a curve for presentation purposes:



As evident, from the depiction only three out 6 tentative neighbourhoods lie in cluster 1 which has Bay Ridge where currently the Ice-Parlour is present. Thus, it was concluded that , Bay Ridge, Sheepshead Bay, Manhattan Beach, Gerritsen Beach have similar neighbourhood and thus can be explored further for opening the shop.

The following tables summarizes the areas of interest:

Cluster	Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Bay Ridge	Spa	Italian Restaurant	Greek Restaurant	Ice Cream Shop	Pizza Place
1	Sheepshead Bay	Dessert Shop	Turkish Restaurant	Sandwich Place	Yoga Studio	Grocery Store
1	Manhattan Beach	Bus Stop	Café	Ice Cream Shop	Beach	Sandwich Place
1	Gerritsen Beach	Ice Cream Shop	Bar	Pizza Place	American Restaurant	Convenience Store

Cluster	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
3	Brighton Beach	Russian Restaurant	Restaurant	Beach	Eastern European Restaurant	Bank
3	Coney Island	Caribbean Restaurant	Baseball Stadium	Monument / Landmark	Fried Chicken Joint	Food Stand
4	Sea Gate	Bus Station	Spa	Home Service	Beach	Women's Store

However, it was noted that Manhattan Beach has ice cream as the third most common venue and Gerritsen Beach had Ice-Cream venues as the most common. Thus, only Sheepshead Bay was found to be appropriate for opening of new outlet of Brooklyn Ice-Creams.

6 Conclusion

It was therefore recommended that Mr. Johnson and Mr. Wright should explore appropriate location Sheepshead Bay areas as it met their requirements of similar neighbourhood and lesser number of existing ice-cream shops.