Exploring the venues to create an effective travel itinerary

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1. Introduction

1.1   Background

Travel plans are an integral component of any successful trip. Modern itinerary-making tools, from websites to mobile apps, allow travelers to build colorful trip timelines and share their travel plans with loved ones. But the ability to engineer an effective, seamless itinerary requires more than just bells and whistles—and well-laid travel plans are an integral component of any successful trip.

1.2   Problem

Tom is a data scientist work & live in Manhattan for almost 5 years. Tom likes to explore & visit new places. During this time, he was very familiar with the neighborhoods of Manhattan. For the upcoming Christmas holidays he & his friend would like to explore an another borough "Brooklyn".

Tom & his friends have never been to Brooklyn before so they are not sure about the venues, venue names, venue category etc.

Brooklyn is completely new to Tom & his friends. They are facing difficulty in planning their trip.

They need our help to:
- Explore the neighborhoods of Brooklyn
- Provide them the list of neighborhood which are having the most & least venues.

2. Data acquisition & approach

2.1   Data Sources

For this project we need the following data:

- New York City data that contains list Boroughs, Neighborhoods along with their latitude and longitude
- Data source : https://cocl.us/new_york_dataset.
- Description: This data set contains the required information. And we will use this data set to explore various neighborhoods of New York city.
- Data source: Foursquare API.
- Description: By using this API we will get all the venues in each neighborhood.

2.2   Approach
- Collect the New York city data from https://cocl.us/new_york_dataset
- Filter out the data only for Brooklyn borough
- Using Foursquare API we will explore the venues for each neighborhood.
- Analyze each neighborhood by most common venues.
- Cluster neighborhoods.
- Visualize the resulting cluster.
- Examining the clusters

3. Data Transformation & Analysis for each neighborhood

3.1   Download Dataset
Download the data from *https://cocl.us/new_york_dataset* . The dataset contains the 5 boroughs and 306 neighborhoods as well as the latitude and longitude coordinates of each neighborhood.
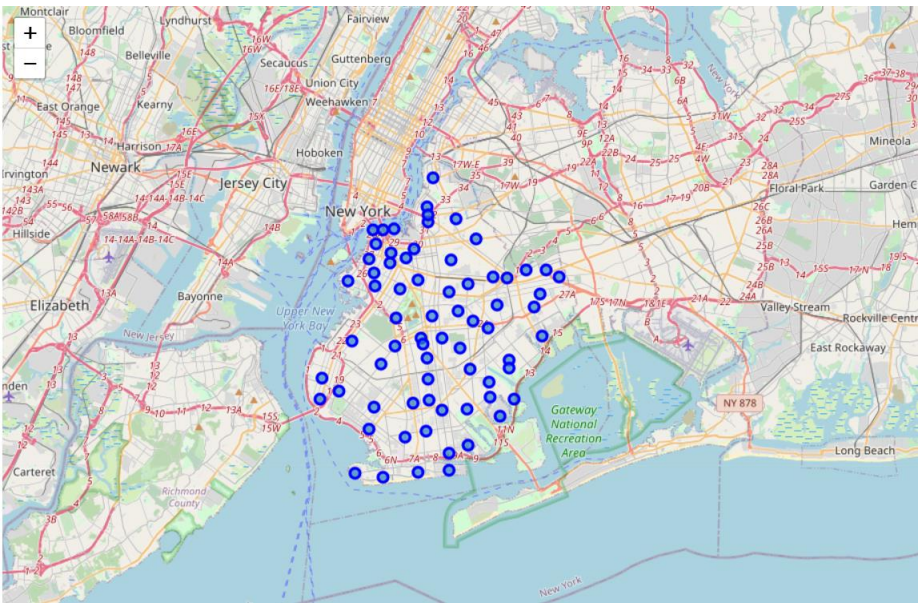
3.2   Transform the data into a pandas data frame
It is essentially transforming the data of nested Python dictionaries into a pandas data frame. It start by creating an empty data frame with columns then loop through the data & fill the dataframe one raw at a time.

For limiting the data to borough Brooklyn only. Slice the original NY data frame & create a new data frame of the Brooklyn data

3.3 Visualizing the Brooklyn neighborhood

Using the geopy library get the coordinates (longitude & latitudes) of Brooklyn. Then plot the neighborhoods on the map as sown below

3.4 Exploring neighborhoods using Foursquare API

In this step we will be using foursquare APIs to explore the neighborhoods & segment them Define the foursquare credentials, then send the GET request by using URL *"'https://api.foursquare.com/v2/venues/explore?"*

Convert the result into a new data frame then group by neighborhood as shown below

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Bath Beach	50	50	50	50	50	50
Bay Ridge	87	87	87	87	87	87
Bedford Stuyvesant	28	28	28	28	28	28
Bensonhurst	36	36	36	36	36	36
Bergen Beach	7	7	7	7	7	7
Boerum Hill	93	93	93	93	93	93
Borough Park	16	16	16	16	16	16
Brighton Beach	44	44	44	44	44	44
Broadway Junction	17	17	17	17	17	17
Brooklyn Heights	100	100	100	100	100	100
Brownsville	15	15	15	15	15	15
Bushwick	75	75	75	75	75	75
Canarsie	7	7	7	7	7	7
Carroll Gardens	100	100	100	100	100	100
City Line	43	43	43	43	43	43

3.5 Analyzing each neighborhood

In this section, the data frame if further analyzed & explore by using one hot encoding function then grouping by neighborhood.

Convert the resulting dataset into pandas data frame & display the top 10 venues for each neighborhood as shown below

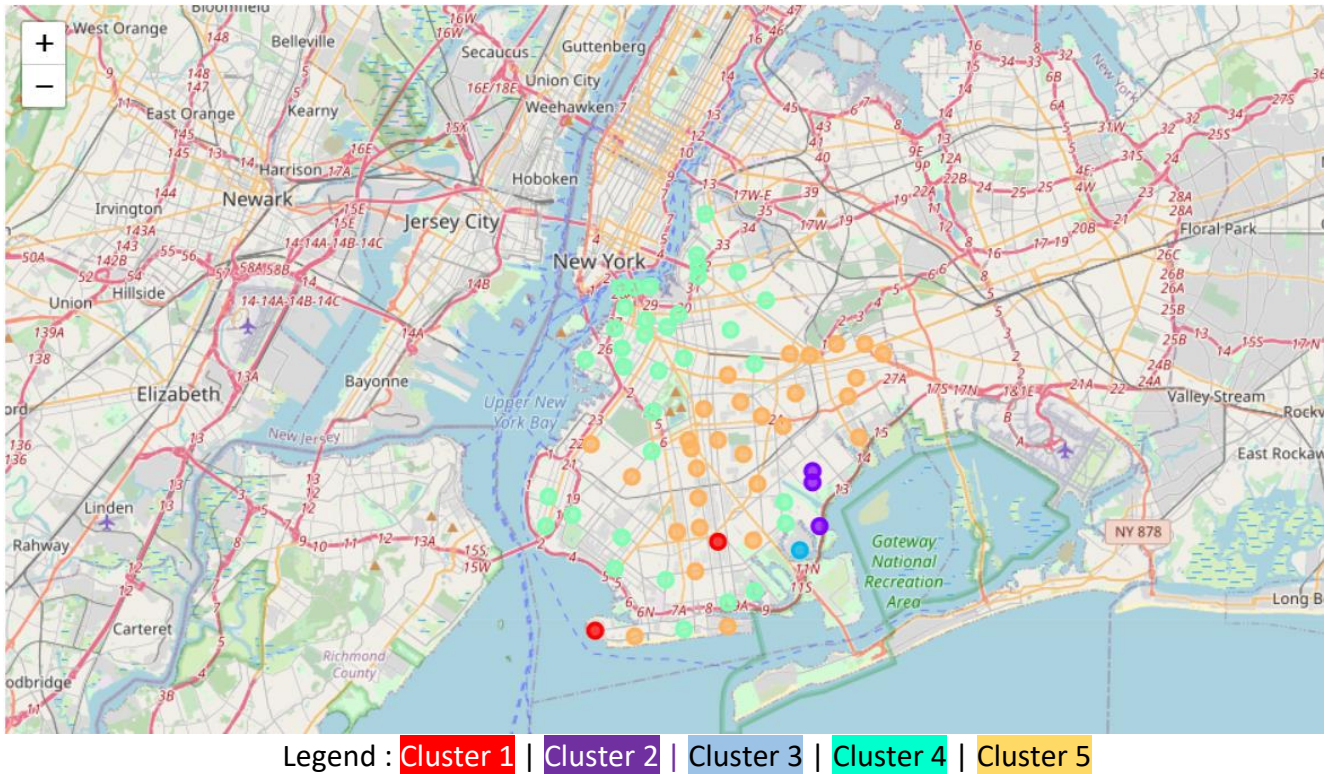|	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Bath Beach	Chinese Restaurant	Pharmacy	Gas Station	Bubble Tea Shop	Pizza Place	Italian Restaurant	Halal Restaurant	Fast Food Restaurant	Cantonese Restaurant	Russian Restaurant
1	Bay Ridge	Spa	Italian Restaurant	Pizza Place	Greek Restaurant	Grocery Store	Bar	American Restaurant	Pharmacy	Sandwich Place	Hookah Bar
2	Bedford Stuyvesant	Coffee Shop	Café	Pizza Place	Bar	Discount Store	Gourmet Shop	Bagel Shop	Juice Bar	Basketball Court	New American Restaurant
3	Bensonhurst	Pizza Place	Ice Cream Shop	Italian Restaurant	Sushi Restaurant	Donut Shop	Chinese Restaurant	Grocery Store	Dessert Shop	Spa	Liquor Store
4	Bergen Beach	Harbor / Marina	Donut Shop	Baseball Field	Playground	Park	Athletics & Sports	Field	Falafel Restaurant	Farm	Farmers Market

4. Clustering neighborhoods

Here we run the K-means to cluster the neighborhoods into 5 clusters, convert the results into a new data frame with a new column of Cluster labels as shown below

	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	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	Mc Comm Ver
0	Brooklyn	Bay Ridge	40.625801	-74.030621	0	Spa	Italian Restaurant	Pizza Place	Greek Restaurant	Grocery Store	Bar	American Restaurant	Pharmacy	Sandwich Place	Hool
1	Brooklyn	Bensonhurst	40.611009	-73.995180	0	Pizza Place	Ice Cream Shop	Italian Restaurant	Sushi Restaurant	Donut Shop	Chinese Restaurant	Grocery Store	Dessert Shop	Spa	Liqu St
2	Brooklyn	Sunset Park	40.645103	-74.010316	1	Pizza Place	Latin American Restaurant	Mexican Restaurant	Bank	Bakery	Gym	Pharmacy	Mobile Phone Shop	Fried Chicken Joint	Wome St
3	Brooklyn	Greenpoint	40.730201	-73.954241	0	Bar	Pizza Place	Cocktail Bar	Coffee Shop	Yoga Studio	Grocery Store	Café	Sushi Restaurant	French Restaurant	Mexic Restaura
4	Brooklyn	Gravesend	40.595260	-73.973471	0	Pizza Place	Lounge	Chinese Restaurant	Bakery	Italian Restaurant	Record Shop	Martial Arts Dojo	Baseball Field	Bar	G

5. Result

Finally, visualize the resulting clusters on a map created using folium library

Legend : Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5

6. Discussion & Conclusion

In this study, we explore & analyzed the neighborhood of Brooklyn borough then cluster & segment the neighborhoods. As per the above 5 cluster map we recommend the neighborhoods which falls under the Cluster 4 & Cluster 5 to Tom & his friends to explore as it has the most venues & categories.

The following is the list of clusters of neighborhood which are having most & least neighborhoods

Least Neighborhood Cluster 3 (Neighborhood Count = 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
30	Mill Island	Pool	Women's Store	Filipino Restaurant	Factory	Falafel Restaurant	Farm	Farmers Market	Fast Food Restaurant	Field	Fish & Chips Shop

Most Neighborhood Cluster 4 (Neighborhood Count = 35)

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	Greek Restaurant	Gym / Fitness Center	Bar	American Restaurant	Playground	Thai Restaurant
1	Bensonhurst	Flower Shop	Bakery	Dessert Shop	Ice Cream Shop	Italian Restaurant	Sushi Restaurant	Donut Shop	Smoke Shop	Butcher
3	Greenpoint	Bar	Pizza Place	Cocktail Bar	Coffee Shop	Yoga Studio	Mexican Restaurant	Sushi Restaurant	Grocery Store	Café
4	Gravesend	Italian Restaurant	Pizza Place	Lounge	Bus Station	Bakery	Pharmacy	Donut Shop	Eastern European Restaurant	Chinese Restaurant
5	Brighton Beach	Beach	Russian Restaurant	Restaurant	Eastern European Restaurant	Gourmet Shop	Sushi Restaurant	Bank	Mobile Phone Shop	Convenience Store
6	Sheepshead Bay	Dessert Shop	Turkish Restaurant	Sandwich Place	Chinese Restaurant	Park	Outlet Store	Restaurant	Russian Restaurant	Grocery Store
11	Kensington	Thai Restaurant	Grocery Store	Ice Cream Shop	Pizza Place	Restaurant	Outdoors & Recreation	Donut Shop	Gas Station	Spa
12	Windsor Terrace	Café	Diner	Park	Grocery Store	Bagel Shop	Middle Eastern Restaurant	Salad Place	Bookstore	Chinese Restaurant
13	Prospect Heights	Bar	Mexican Restaurant	Café	Thai Restaurant	Cocktail Bar	Gourmet Shop	Wine Shop	Bakery	American Restaurant
15	Williamsburg	Coffee Shop	Bar	Bagel Shop	Yoga Studio	Food Truck	Taco Place	Latin American Restaurant	Steakhouse	Liquor Store
16	Bushwick	Bar	Deli / Bodega	Coffee Shop	Mexican Restaurant	Bakery	Pizza Place	Discount Store	Thrift / Vintage Store	Vegetarian / Vegan Restaurant
17	Bedford Stuyvesant	Bar	Pizza Place	Café	Coffee Shop	Gift Shop	Gourmet Shop	New American Restaurant	Fruit & Vegetable Store	Boutique
18	Brooklyn Heights	Deli / Bodega	Yoga Studio	Park	Pizza Place	Italian Restaurant	Gym	Bakery	Cosmetics Shop	Bar
19	Cobble Hill	Pizza Place	Bar	Playground	Coffee Shop	Cocktail Bar	Ice Cream Shop	Italian Restaurant	Deli / Bodega	Yoga Studio
20	Carroll Gardens	Italian Restaurant	Coffee Shop	Pizza Place	Bakery	Cocktail Bar	Bar	Wine Shop	Spa	Bank
21	Red Hook	Seafood Restaurant	Bar	Park	Art Gallery	Flower Shop	Pizza Place	Bagel Shop	Farm	New American Restaurant
22	Gowanus	Furniture / Home Store	Italian Restaurant	Bar	Coffee Shop	Art Gallery	Hardware Store	Wine Shop	Pizza Place	Deli / Bodega
23	Fort Greene	Italian Restaurant	Wine Shop	Flower Shop	Opera House	Theater	French Restaurant	Coffee Shop	Cocktail Bar	Grocery Store
24	Park Slope	Coffee Shop	Burger Joint	Italian Restaurant	Bagel Shop	Bookstore	Pet Store	Pizza Place	Pub	Vietnamese Restaurant
33	Bath Beach	Pharmacy	Pizza Place	Chinese Restaurant	Gas Station	Fast Food Restaurant	Sushi Restaurant	Italian Restaurant	Bubble Tea Shop	Asian Restaurant
35	Dyker Heights	Grocery Store	Dance Studio	Golf Course	Burger Joint	Park	Food	Bagel Shop	Fast Food Restaurant	Falafel Restaurant
36	Gerritsen Beach	Ice Cream Shop	Pizza Place	Bar	Department Store	Boat or Ferry	Gas Station	Seafood Restaurant	Bagel Shop	Restaurant
38	Clinton Hill	Italian Restaurant	Pizza Place	Thai Restaurant	Wine Shop	Chinese Restaurant	Mexican Restaurant	Indian Restaurant	Japanese Restaurant	Restaurant
40	Downtown	Burger Joint	Coffee Shop	Sandwich Place	Pizza Place	Chinese Restaurant	Bar	Juice Bar	Bank	Bakery
41	Boerum Hill	Coffee Shop	Bar	Dance Studio	Furniture / Home Store	Arts & Crafts Store	French Restaurant	Bakery	Sandwich Place	Spa
48	Georgetown	Bank	Pharmacy	American Restaurant	Donut Shop	Bagel Shop	Cosmetics Shop	Coffee Shop	Burger Joint	Mexican Restaurant
49	East Williamsburg	Bar	Deli / Bodega	Cocktail Bar	Bakery	Coffee Shop	Mexican Restaurant	Music Venue	Concert Hall	Café
50	North Side	Coffee Shop	Pizza Place	Yoga Studio	American Restaurant	Wine Bar	Bar	Jewelry Store	Vegetarian / Vegan Restaurant	Bakery
51	South Side	Coffee Shop	Bar	American Restaurant	Pizza Place	Yoga Studio	Breakfast Spot	Wine Bar	Mexican Restaurant	South American Restaurant
53	Fort Hamilton	Deli / Bodega	Italian Restaurant	Pharmacy	Sandwich Place	Chinese Restaurant	Steakhouse	Pizza Place	Bagel Shop	Cocktail Bar
60	Mill Basin	Pizza Place	Japanese Restaurant	Cosmetics Shop	Bank	Bagel Shop	Chinese Restaurant	Ice Cream Shop	American Restaurant	Liquor Store
61	Fulton Ferry	Park	Scenic Lookout	American Restaurant	Coffee Shop	Bridge	Roof Deck	Bakery	Pizza Place	Boat or Ferry
62	Vinegar Hill	Food Truck	Coffee Shop	Café	Art Gallery	Spa	Park	Bookstore	Scenic Lookout	Bike Rental / Bike Share
63	Weeksville	Chinese Restaurant	Discount Store	Fried Chicken Joint	Donut Shop	Liquor Store	Gas Station	Grocery Store	Park	Cocktail Bar
65	Dumbo	Coffee Shop	Park	Scenic Lookout	Bakery	Art Gallery	Italian Restaurant	Boxing Gym	Pizza Place	Gym