

# OPENING BEVERAGE DISTRIBUTION WAREHOUSES IN THE STATEN ISLAND

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A Capstone Project - The Battle of the Neighborhoods

By IBM Applied Data Science Capstone

# INTRODUCTION

## Business Problem:

- ▶ No central warehouse in the Staten Island and the distribution takes place from other boroughs of New York City
- ▶ Distribution of beverages to restaurants, coffee shops and bars
  - ❑ time consuming
  - ❑ Inefficient
  - ❑ costly

## Objective:

- Find some optimal locations for warehouse to deliver beverages to nearby restaurants, coffee shops and bars

# DATA SOURCES

Data needed for Staten Island include:

- List of neighborhoods with coordinate information in the Staten Island
- Venue data, particularly related to restaurants, coffee shops and bars
- ▶ The data for Staten Island obtained from [https://geo.nyu.edu/catalog/nyu\\_2451\\_34572](https://geo.nyu.edu/catalog/nyu_2451_34572)
- ▶ Foursquare API provides information on:
  - Restaurants
  - Coffee shops
  - Bars

# METHODOLOGY

Restaurants:

-There are total of 160 restaurants in Staten Island

Locations of Restaurants includes information:

- ▶ Venue Name
- ▶ Venue Latitude
- ▶ Venue Longitude
- ▶ Venue Category

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
2	St. George	40.644982	-74.079353	Beso	40.643306	-74.076508	Tapas Restaurant
5	St. George	40.644982	-74.079353	Enoteca Maria	40.641941	-74.077320	Italian Restaurant
8	St. George	40.644982	-74.079353	The Gavel Grill	40.642157	-74.076674	American Restaurant
14	St. George	40.644982	-74.079353	The Burrito Shoppe	40.643639	-74.077919	Fast Food Restaurant
18	St. George	40.644982	-74.079353	Not Guilty Deli	40.641867	-74.077016	American Restaurant
34	Stapleton	40.626928	-74.077902	Lakruwana	40.625654	-74.075174	Sri Lankan Restaurant
36	Stapleton	40.626928	-74.077902	Vida	40.628723	-74.079802	Restaurant
37	Stapleton	40.626928	-74.077902	Bay House Bistro	40.627827	-74.076244	Asian Restaurant
39	Stapleton	40.626928	-74.077902	Campo Bello Restaurante	40.624463	-74.079652	Spanish Restaurant
43	Stapleton	40.626928	-74.077902	El Patron Restaurant & Lounge Inc.	40.629154	-74.076541	Mexican Restaurant

# METHODOLOGY

## Coffee Shops :

-There are total of 12 Coffee Shops in Staten Island

Locations of Coffee Shops includes information:

- ▶ Venue Name
- ▶ Venue Latitude
- ▶ Venue Longitude
- ▶ Venue Category

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
90	West Brighton	40.631879	-74.107182	Fab Cup	40.630129	-74.109486	Coffee Shop
91	West Brighton	40.631879	-74.107182	Starbucks	40.630320	-74.106087	Coffee Shop
94	West Brighton	40.631879	-74.107182	Beans & Leaves	40.630718	-74.103376	Coffee Shop
175	New Springville	40.594252	-74.164960	Barnes & Noble Cafe	40.592385	-74.162901	Coffee Shop
264	Eltingville	40.542231	-74.164331	Country Donuts	40.545532	-74.160893	Coffee Shop
306	Woodrow	40.541968	-74.205246	Starbucks	40.542153	-74.207067	Coffee Shop
367	Park Hill	40.609190	-74.080157	Starbucks	40.606393	-74.078682	Coffee Shop
383	Arlington	40.635325	-74.165104	Unique Coffee Roasters	40.637370	-74.162424	Coffee Shop
589	Charleston	40.530531	-74.232158	Starbucks	40.528280	-74.233315	Coffee Shop
614	Arden Heights	40.549286	-74.185887	APlus at Sunoco	40.551233	-74.184030	Coffee Shop

# METHODOLOGY

## Bars:

-There are total of 24 Bars in Staten Island

Locations of Bars includes information:

- ▶ Venue Name
- ▶ Venue Latitude
- ▶ Venue Longitude
- ▶ Venue Category

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
6	St. George	40.644982	-74.079353	Steiny's Pub	40.642185	-74.076599	Bar
9	St. George	40.644982	-74.079353	Ruddy & Dean	40.644074	-74.076683	Bar
38	Stapleton	40.626928	-74.077902	The Hop Shoppe	40.629034	-74.079758	Beer Bar
40	Stapleton	40.626928	-74.077902	Vinum Wine Bar & Cafe	40.624853	-74.074890	Bar
100	West Brighton	40.631879	-74.107182	Jody's Club Forest	40.630894	-74.101912	Bar
107	West Brighton	40.631879	-74.107182	Better Gourmet Health Kitchen	40.630881	-74.102813	Juice Bar
109	West Brighton	40.631879	-74.107182	Liberty Tavern	40.630929	-74.102130	Bar
152	Port Ivory	40.639683	-74.174645	Jonesys Tavern	40.639640	-74.171252	Bar
165	Castleton Corners	40.613336	-74.119181	Danny Boy's	40.613212	-74.123846	Bar
178	New Springville	40.594252	-74.164960	1001 Nights Cafe	40.598126	-74.162204	Hookah Bar

# METHODOLOGY

k-means clustering:

- Minimize the distance of each point in a cluster from the centroid of the cluster
- The cluster points of the k-means algorithm will be at the minimum distance of the determined centroid.

k-means clustering Provides:

- 5 zones representing their centers

# RESULTS

Locations of Venues in the Staten Island:

- Restaurants – red circle
- Coffee Shops – blue circle
- Bars – green circle



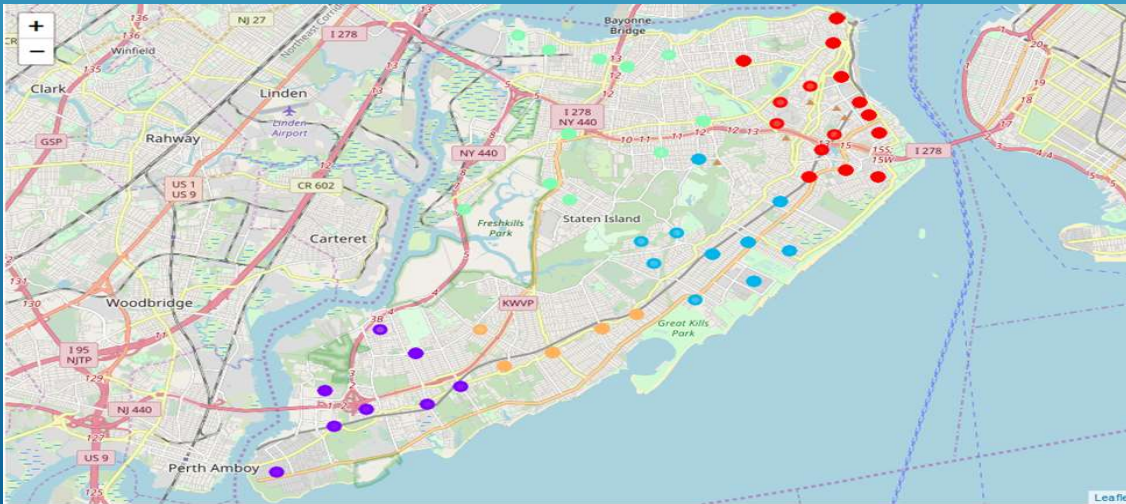


# RESULTS

The 5 clusters of the venues indicated by different colors

Each cluster includes:

- Restaurants
- Coffee Shops
- Bars



# RESULTS

Detail location information of 5 warehouses for Beverages in the Staten Island

Address of Warehouse - the addresses can be extracted from the location's latitude and longitude values.

Coverage Area - the area of each cluster was measured by calculating the mean radius of each cluster.

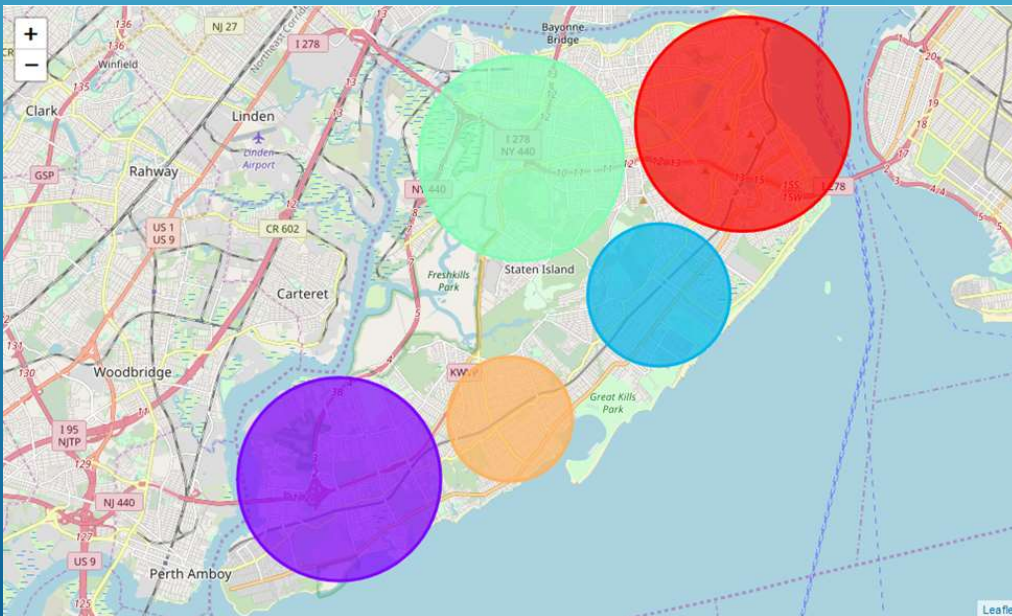
Density served by Warehouse - the density of each cluster was calculated from the number of venues based on the total area of each cluster.

Cluster Number	Color of Cluster	Location Center		Mean Radius (KM)	Area (KM <sup>2</sup> )	Number of Venues	Density
		Latitude	Longitude				
Warehouse 1	Red	40.6199	-74.0823	2.07	121.31	77	0.63
Warehouse 2	Purple	40.5304	-74.2161	1.96	108.91	20	0.18
Warehouse 3	Blue	40.5768	-74.1099	1.38	53.50	38	0.71
Warehouse 4	Green	40.6114	-74.1557	1.98	110.68	32	0.29
Warehouse 5	Orange	40.5455	-74.1592	1.20	40.96	29	0.71

# RESULTS

## Overlay of Cluster Area in the Staten Island Map

- Each warehouse will be responsible for the venues lying at the area indicated by the corresponding circle.



# DISCUSSION

The clustering map shows the distribution of restaurants, coffee shops, and bars in the Staten Island area in five clustering zones.

- Red, purple and green clusters hold the larger area ranging from 109~121 sq. km.
- Blue and orange clusters hold the smaller area ranging from 41~54 sq. km.
- The red cluster contains the largest number of restaurants, coffee shops, and bars than each of other four clusters.
- Green and purple clusters contain relatively less number of restaurants, coffee shops, and bars.

# RECOMMENDATION

Based on the observation, the following recommendations are listed below:

- The number of trucks, employees, and drivers should be chosen based on the number of venues in each cluster
- The size of the warehouse in the red clustering zone would be bigger than any other warehouses
- The number of trucks, employees, and drivers in red clustering zone would be at least double than the number of any warehouses

# CONCLUSION

- This project was able to locate the location of the warehouses, their size, and the number of employees and truck drivers in each warehouse needed.
- Final decision on optimal location will be made by the client based on specific characteristics of neighborhoods.
- Additional Consideration to choose the Warehouse locations:
  - proximity to major roads
  - real estate availability
  - prices
  - social and economic dynamics of every neighborhood etc.