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IBM DATA SCIENCE PROFESSIONAL CERTIFICATE

CAPSTONE PROJECT

A COMPARISON OF THE MOST
COMMON VENUES IN
NEIGHBORHOODS AROUND
MANHATTAN AND TORONTO - BEST
BUSINESSES TO OPEN IN BOTH CITIES.

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INTRODUCTION

New York City and Toronto are financial capitals of the two biggest countries in North America. These cities will be great places to invest for anyone looking to start a business. The purpose of this project is to use clustering algorithm to look into the similarity and differences of these two cities, and to ultimately determine the best businesses to open in New York City and Toronto. This kind of analysis will prove invaluable to any person or organization looking into small business opportunities in these cities.

DATA ACQUISITION

For this project, geospatial coordinates of neighborhoods in New York and Toronto will be sourced from already processed json files and scraping a Wiki page respectively. Below shows a sample of the data frame showing the geospatial coordinates of neighborhoods in New York City.

Borough	Neighborhood	Latitude	Longitude
Bronx	Wakefield	40.894705	-73.847201
Bronx	Co-op City	40.874294	-73.829939
Bronx	Eastchester	40.887556	-73.827806
Bronx	Fieldston	40.895437	-73.905643
Bronx	Riverdale	40.890834	-73.912585

Because of the size of the different boroughs in both cities, Manhattan will be used for the New York City case study while boroughs that have names with Toronto in them will be used for the Toronto Case study.

In addition to the geospatial data, FOURSQUARE API will be used to determine the popularity and frequency of visits to different venues in the neighborhoods around these cities. Below is an example of the venue and venue category data in NYC that can be sourced from the FOURSQUARE API data.

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Marble Hill	40.876551	-73.91066	Arturo's	40.874412	-73.910271	Pizza Place
Marble Hill	40.876551	-73.91066	Bikram Yoga	40.876844	-73.906204	Yoga Studio
Marble Hill	40.876551	-73.91066	Tibbett Diner	40.880404	-73.908937	Diner
Marble Hill	40.876551	-73.91066	Starbucks	40.877531	-73.905582	Coffee Shop
Marble Hill	40.876551	-73.91066	Dunkin'	40.877136	-73.906666	Donut Shop

METHODOLOGY

In the pursuit of looking into the similarities and differences of these cities and ultimately deciding the best business opportunities in the cities, a clustering approach was used.

K-means clustering was chosen because of its ease and efficiency in producing spheres of clusters. Prior to using this ML clustering approach, the data of the different neighborhoods in the cities and their geospatial coordinates was combined with the data of the different venues around the neighborhoods as obtained from FOURSQUARE API.

The joint data/table was then grouped by the neighborhoods and the average number of occurrence of each venue in the neighborhoods. The resulting data was then refined to

Neighborhood	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	American Restaurant	Antique Shop	Argentinian Restaurant	Art Gallery	Art Museum	C
Battery Park City	0.0	0.0	0.0	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	
Carnegie Hill	0.0	0.0	0.0	0.000000	0.011494	0.0	0.011494	0.000000	0.022989	
Central Harlem	0.0	0.0	0.0	0.069767	0.046512	0.0	0.000000	0.046512	0.000000	
Chelsea	0.0	0.0	0.0	0.000000	0.030000	0.0	0.000000	0.040000	0.000000	
Chinatown	0.0	0.0	0.0	0.000000	0.030000	0.0	0.000000	0.000000	0.000000	

list the top ten most common venues around the neighborhoods based on the average occurrence. See above, the final table that was modeled by k-means clustering.

In addition, the folium package was used to visualize the different clusters on the respective maps of these cities. Finally, a word cloud was then used to visually inspect the frequency of the different venues in each cluster.

RESULTS AND DISCUSSION

CLUSTERING RESULTS AND RESULTING MAPS

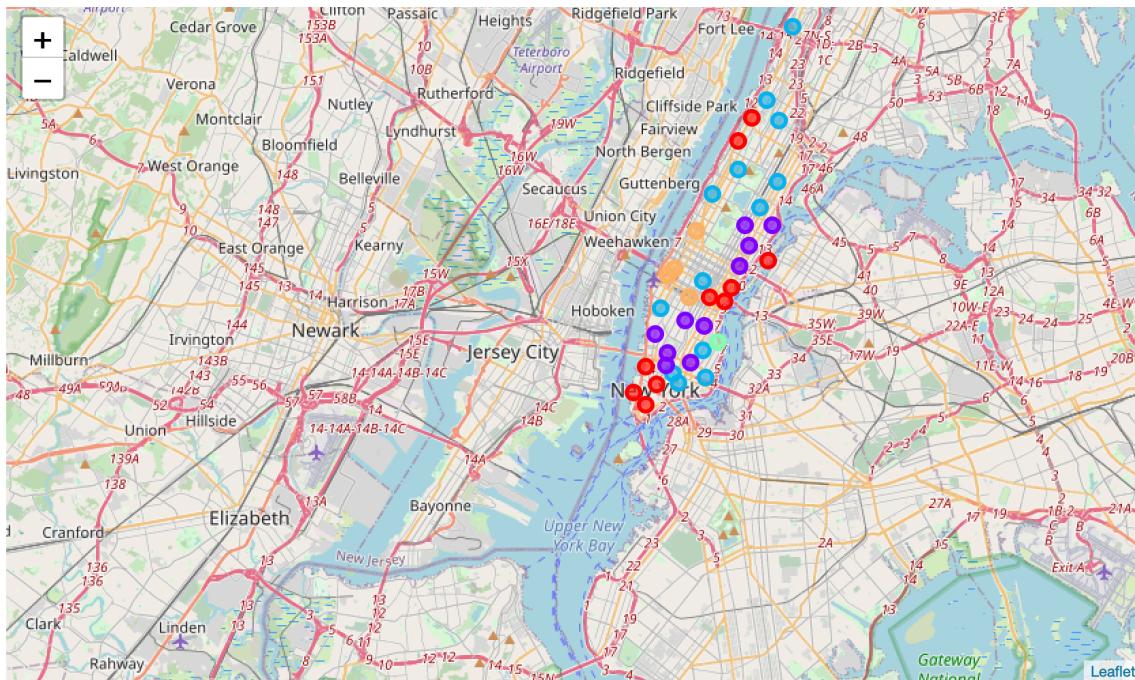
After using k-means clustering to cluster the 40 neighborhoods in Manhattan with 332 event venues, the five clusters had 11, 10, 14, 1, and 4 neighborhoods respectively. Unlike Manhattan, the neighborhoods from the Toronto boroughs had 39 neighborhoods and 214 different venues. For Toronto, the use of five clusters in the k-means algorithm gave five clusters of 31, 1, 5, 1, and 1 neighborhoods in each of the cluster. Based on this result, it was decided to reduce the number of clusters for the neighborhoods in the Toronto boroughs from five to three. See below a table showing the most popular venues in Manhattan and the boroughs of Toronto in this study.

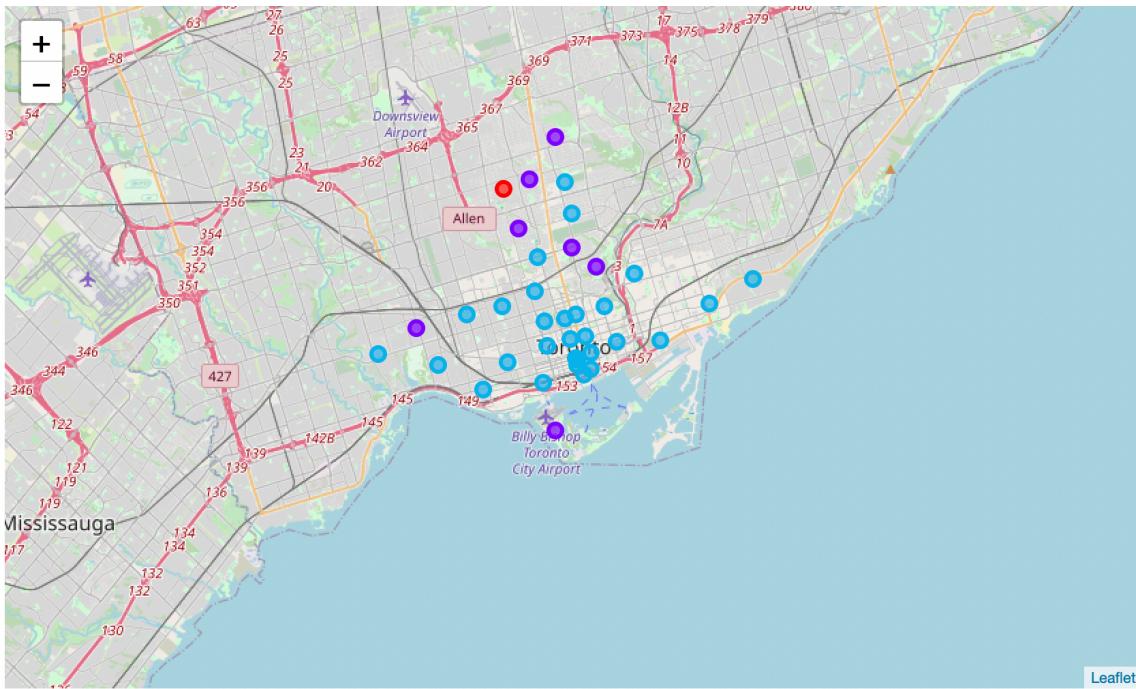
Borough	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue
Manhattan	Marble Hill	40.876551	-73.910660	0	Discount Store	Gym	Sandwich Place	Coffee Shop	Yoga Studio	Big Box Store	Supplement Shop	Tennis Stadium
Manhattan	Chinatown	40.715618	-73.994279	2	Chinese Restaurant	Bakery	Dessert Shop	Cocktail Bar	Shanghai Restaurant	Spa	American Restaurant	Optical Shop
Manhattan	Washington Heights	40.851903	-73.936900	2	Café	Bakery	Grocery Store	Mobile Phone Shop	Sandwich Place	Chinese Restaurant	Coffee Shop	Tapas Restaurant
Manhattan	Inwood	40.867684	-73.921210	2	Mexican Restaurant	Lounge	Restaurant	Café	Bakery	Park	Frozen Yogurt Shop	Deli / Bodega
Manhattan	Hamilton Heights	40.823604	-73.949688	2	Pizza Place	Coffee Shop	Café	Deli / Bodega	Mexican Restaurant	Liquor Store	Indian Restaurant	Sushi Restaurant

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
East Toronto	The Beaches	43.6784	-79.2941	2	Pub	Health Food Store	Trail	Bakery	Gastropub	Yoga Studio	Dumpling Restaurant	Fish Market	Fish & Chips Shop
East Toronto	The Danforth West, Riverdale	43.6803	-79.3538	2	Greek Restaurant	Ice Cream Shop	Restaurant	Coffee Shop	Italian Restaurant	Café	Bubble Tea Shop	Juice Bar	Fruit & Vegetable Store
East Toronto	India Bazaar, The Beaches West	43.6693	-79.3155	2	Fast Food Restaurant	Park	Sandwich Place	Restaurant	Movie Theater	Fish & Chips Shop	Liquor Store	Brewery	Steakhouse
East Toronto	Studio District	43.6561	-79.3406	2	Baseball Field	Coffee Shop	Coworking Space	Park	Diner	Gym	Garden Center	Flower Shop	Fish Market
Central Toronto	Lawrence Park	43.7301	-79.3935	1	Photography Studio	Park	Lawyer	Yoga Studio	Eastern European Restaurant	Flower Shop	Fish Market	Fish & Chips Shop	Fast Food Restaurant

The three clusters from the Toronto boroughs had 31, 7 and 1 neighborhoods in each of them. The cluster size here is much larger than the biggest cluster size (14) for the Manhattan clusters. This can be indicative of a more diverse concentration of event venues in Manhattan compared to the Toronto boroughs.

Visualization of the different clusters in the two cities is shown below. First map is that of Manhattan, while the second is that of Toronto





The maps clearly show a much heterogeneous mix of event venues with clusters for Manhattan. The map for Toronto shows a much homogeneous mix of event venues over the large area.

THE FIVE MANHATTAN CLUSTERS

Results from the k-means clustering, show cluster label 0 has mostly gyms and parks while cluster label 1 has the highest percentage of Italian restaurants, with the 1st most

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
Marble Hill	Discount Store	Gym	Sandwich Place	Coffee Shop	Yoga Studio	Big Box Store	Supplement Shop	Tennis Stadium	Shopping Mall	Steakhouse
Manhattanville	Coffee Shop	Seafood Restaurant	Deli / Bodega	Italian Restaurant	Mexican Restaurant	Plaza	Supermarket	Boutique	Spanish Restaurant	Bus Station
Roosevelt Island	Park	Pizza Place	Gym / Fitness Center	Gym	Outdoors & Recreation	Soccer Field	Liquor Store	Coffee Shop	Sandwich Place	Scenic Lookout
Murray Hill	Coffee Shop	Sandwich Place	American Restaurant	Hotel	Bar	Japanese Restaurant	Burger Joint	Gym / Fitness Center	Jewish Restaurant	Bakery
Tribeca	Park	Italian Restaurant	Wine Bar	American Restaurant	Spa	Café	Coffee Shop	Scenic Lookout	Bakery	Playground
Morningside Heights	Coffee Shop	Bookstore	American Restaurant	Park	Burger Joint	Café	Pub	Pizza Place	Seafood Restaurant	Sandwich Place
Battery Park City	Park	Coffee Shop	Hotel	Memorial Site	Clothing Store	Gym	Plaza	Food Court	Gourmet Shop	Burger Joint
Financial District	Coffee Shop	Bar	Cocktail Bar	American Restaurant	Italian Restaurant	Gym / Fitness Center	Gym	Pizza Place	Café	Mexican Restaurant
Civic Center	Coffee Shop	Gym / Fitness Center	Spa	Hotel	Cocktail Bar	French Restaurant	Yoga Studio	Sushi Restaurant	Park	American Restaurant
Turtle Bay	Coffee Shop	Italian Restaurant	Hotel	Sushi Restaurant	Seafood Restaurant	Japanese Restaurant	Ramen Restaurant	Deli / Bodega	Park	Sandwich Place
Tudor City	Park	Café	Mexican Restaurant	Deli / Bodega	Coffee Shop	Sushi Restaurant	Greek Restaurant	Pizza Place	Gym	Wine Shop

Cluster
label 0

common venue been mostly Italian restaurants. Cluster label 2 on the other hand has coffee shops, cafes, and a variety of ethnic restaurants as the first and second most common venues.

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
Chinatown	Chinese Restaurant	Bakery	Dessert Shop	Cocktail Bar	Shanghai Restaurant	Spa	American Restaurant	Optical Shop	Hotpot Restaurant	Ice Cream Shop
Washington Heights	Café	Bakery	Grocery Store	Mobile Phone Shop	Sandwich Place	Chinese Restaurant	Coffee Shop	Tapas Restaurant	Bank	Park
Inwood	Mexican Restaurant	Lounge	Restaurant	Café	Bakery	Park	Frozen Yogurt Shop	Deli / Bodega	Pizza Place	Chinese Restaurant
Hamilton Heights	Pizza Place	Coffee Shop	Café	Deli / Bodega	Mexican Restaurant	Liquor Store	Indian Restaurant	Sushi Restaurant	Cocktail Bar	Sandwich Place
Central Harlem	African Restaurant	Chinese Restaurant	Cosmetics Shop	French Restaurant	Seafood Restaurant	Bar	Art Gallery	American Restaurant	Bookstore	Fried Chicken Joint
East Harlem	Mexican Restaurant	Deli / Bodega	Bakery	Thai Restaurant	Latin American Restaurant	Sandwich Place	Grocery Store	Beer Bar	Liquor Store	Taco Place
Upper West Side	Wine Bar	Bar	Italian Restaurant	Bakery	Café	Breakfast Spot	French Restaurant	Bagel Shop	Gym / Fitness Center	Seafood Restaurant
Midtown	Hotel	Coffee Shop	Clothing Store	Theater	Steakhouse	Café	Sporting Goods Shop	Bookstore	Gym	Bakery
Chelsea	Coffee Shop	Bakery	French Restaurant	Art Gallery	Ice Cream Shop	Wine Shop	Seafood Restaurant	American Restaurant	Cupcake Shop	Café
East Village	Bar	Pizza Place	Mexican Restaurant	Cocktail Bar	Korean Restaurant	Coffee Shop	Vietnamese Restaurant	Salon / Barbershop	Wine Bar	Bagel Shop
Lower East Side	Chinese Restaurant	Café	Bakery	Latin American Restaurant	Japanese Restaurant	Art Gallery	Coffee Shop	Filipino Restaurant	Bar	Tennis Court
Little Italy	Bakery	Chinese Restaurant	Café	Cocktail Bar	Hotel	Bubble Tea Shop	Sandwich Place	Salon / Barbershop	Italian Restaurant	Mediterranean Restaurant
Manhattan Valley	Coffee Shop	Yoga Studio	Bar	Thai Restaurant	Indian Restaurant	Mexican Restaurant	Pizza Place	Falafel Restaurant	Café	Caribbean Restaurant
Carnegie Hill	Coffee Shop	Bar	Café	Yoga Studio	Gym	French Restaurant	Pizza Place	Bookstore	Cosmetics Shop	Wine Shop

Cluster label 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
Upper East Side	Italian Restaurant	Coffee Shop	Exhibit	Bakery	Gym / Fitness Center	Spa	French Restaurant	Juice Bar	Yoga Studio	American Restaurant
Yorkville	Italian Restaurant	Coffee Shop	Bar	Gym	Sushi Restaurant	Deli / Bodega	Wine Shop	Japanese Restaurant	Diner	Bagel Shop
Lenox Hill	Italian Restaurant	Sushi Restaurant	Cocktail Bar	Coffee Shop	Pizza Place	Gym / Fitness Center	Burger Joint	Gym	Café	Thai Restaurant
Greenwich Village	Italian Restaurant	Sushi Restaurant	Clothing Store	Café	Indian Restaurant	American Restaurant	Gym	Dessert Shop	Boutique	Chinese Restaurant
Soho	Clothing Store	Italian Restaurant	Boutique	Coffee Shop	Mediterranean Restaurant	French Restaurant	Salon / Barbershop	Bakery	Sporting Goods Shop	Hotel
West Village	Italian Restaurant	American Restaurant	Cocktail Bar	New American Restaurant	Cosmetics Shop	Wine Bar	Park	Coffee Shop	French Restaurant	Bookstore
Gramercy	Bar	Bagel Shop	Italian Restaurant	American Restaurant	Pizza Place	Grocery Store	Mexican Restaurant	Playground	Cocktail Bar	Park
Noho	Italian Restaurant	Coffee Shop	Mexican Restaurant	Art Gallery	Bookstore	Grocery Store	Hotel	Pizza Place	French Restaurant	Sushi Restaurant
Sutton Place	Italian Restaurant	Coffee Shop	Park	Gym / Fitness Center	Pizza Place	Gym	Furniture / Home Store	Mediterranean Restaurant	Thai Restaurant	Bakery
Flatiron	Japanese Restaurant	New American Restaurant	Gym / Fitness Center	American Restaurant	Italian Restaurant	Mediterranean Restaurant	Gym	Coffee Shop	Furniture / Home Store	Sporting Goods Shop

Cluster label 1

For cluster label 3 which has one neighborhood, the most common venues does not include a restaurant in any of its ten most common venues.

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	Cluster label 3
Stuyvesant Town	Park	Bar	Coffee Shop	Baseball Field	Skating Rink	Cocktail Bar	Heliport	Gym / Fitness Center	Farmers Market	Bistro	

Just like cluster label 3, for cluster label 4 which has four neighborhoods most of its 1st, 2nd and 3rd most common venues are not restaurants. The most common venues comprises of a lot of Theater, Gyms/Fitness Center, Spas.

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
Lincoln Square	Café	Gym / Fitness Center	Plaza	Italian Restaurant	Concert Hall	Performing Arts Venue	Theater	Indie Movie Theater	Wine Shop	Gym
Clinton	Theater	Italian Restaurant	Gym / Fitness Center	Coffee Shop	Gym	American Restaurant	Sandwich Place	Hotel	Cocktail Bar	Spa
Midtown South	Korean Restaurant	Hotel	Hotel Bar	Gym / Fitness Center	Coffee Shop	Burger Joint	Bakery	Japanese Restaurant	Dessert Shop	Café
Hudson Yards	Gym / Fitness Center	Hotel	American Restaurant	Café	Italian Restaurant	Restaurant	Park	Dog Run	Coffee Shop	Gym

THE FIVE MANHATTAN CLUSTERS - WORD CLOUD

The word cloud shows that cluster label 0, has a large mix of venues with high frequency. Just like the results from the clustering, word cloud shows that for cluster label 1, the



Word Cloud for Manhattan V.



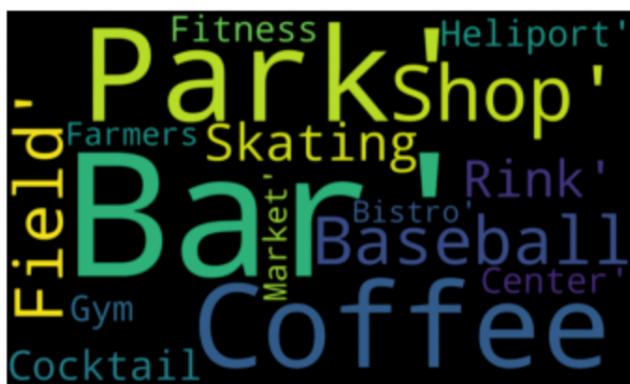
an Vanues, Cluster Label 1



Word Cloud for Manhattan Vanues, Cluster Label 2

Italian restaurants have highest frequency of common venues.

The word cloud shows that for cluster label 2, the restaurants, bakery, and coffee shops have highest frequency of venues. For cluster label 3, the bars have highest frequency of venues while for cluster 4, the Gym/Fitness center, theater, cafe have highest frequency of venues.



Word Cloud for Manhattan Vanues, Cluster Label 3



Word Cloud for Manhattan Vanues, Cluster Label 4

THE THREE TORONTO CLUSTERS

For the Toronto named boroughs, the results from the k-means clustering show cluster label 0 with one neighborhood has spa and yoga studio been the most 1st and 2nd common venue.

Borough	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
Central Toronto	Photography Studio	Park	Lawyer	Yoga Studio	Eastern European Restaurant	Flower Shop	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market
Central Toronto	Playground	Gym Pool	Park	Garden	Dumpling Restaurant	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant
Central Toronto	Park	Playground	Thai Restaurant	Gym	Grocery Store	Trail	Yoga Studio	Event Space	Eastern European Restaurant	Electronics Store
Downtown Toronto	Playground	Candy Store	Park	Grocery Store	Dumpling Restaurant	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant
Downtown Toronto	Music Venue	Harbor / Marina	Café	Park	Yoga Studio	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant
Central Toronto	Home Service	Park	Trail	Electronics Store	Dumpling Restaurant	Flower Shop	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market
West Toronto	Park	Yoga Studio	Eastern European Restaurant	Food & Drink Shop	Flower Shop	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant

On the other hand, cluster label 1 with 7 neighborhoods, has a lot of fish and chips places.

Borough	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	Cluster label 0
Central Toronto	Spa	Yoga Studio	Eastern European Restaurant	Food & Drink Shop	Flower Shop	Fish Market	Fish & Chips Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant	

For cluster label 2, restaurants, cafes and coffee shops are the most common venues.

Borough	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	Cluster label 3
East Toronto	Pub	Health Food Store	Trail	Bakery	Gastropub	Yoga Studio	Dumpling Restaurant	Fish Market	Fish & Chips Shop	Fast Food Restaurant	
East Toronto	Greek Restaurant	Ice Cream Shop	Restaurant	Coffee Shop	Italian Restaurant	Café	Bubble Tea Shop	Juice Bar	Fruit & Vegetable Store	Brewery	
East Toronto	Fast Food Restaurant	Park	Sandwich Place	Restaurant	Movie Theater	Fish & Chips Shop	Liquor Store	Brewery	Steakhouse	Coffee Shop	
East Toronto	Baseball Field	Coffee Shop	Coworking Space	Park	Diner	Gym	Garden Center	Flower Shop	Fish Market	Fish & Chips Shop	
Central Toronto	Bus Line	Department Store	Breakfast Spot	Park	Food & Drink Shop	Gym / Fitness Center	Dog Run	Yoga Studio	Ethiopian Restaurant	Flower Shop	
Central Toronto	Café	Coffee Shop	Italian Restaurant	Dessert Shop	Sandwich Place	Restaurant	Gas Station	Fast Food Restaurant	Thai Restaurant	Indian Restaurant	
Central Toronto	Coffee Shop	Light Rail Station	Liquor Store	Supermarket	Electronics Store	Food & Drink Shop	Flower Shop	Fish Market	Fish & Chips Shop	Fast Food Restaurant	
Downtown Toronto	Café	Restaurant	Coffee Shop	Pet Store	Pizza Place	Italian Restaurant	Bakery	Playground	Plaza	Market	
Downtown Toronto	Japanese Restaurant	Coffee Shop	Sushi Restaurant	Gay Bar	Fast Food Restaurant	Restaurant	Hotel	Mediterranean Restaurant	Men's Store	Café	
Downtown Toronto	Coffee Shop	Breakfast Spot	Yoga Studio	Theater	Distribution Center	Pub	Restaurant	Electronics Store	Event Space	Food Truck	
Downtown Toronto	Coffee Shop	Clothing Store	Japanese Restaurant	Hotel	Cosmetics Shop	Café	Middle Eastern Restaurant	Movie Theater	Theater	Ramen Restaurant	
Downtown Toronto	Café	Coffee Shop	Seafood Restaurant	Italian Restaurant	Gastropub	Bakery	Cocktail Bar	Hotel	American Restaurant	Lingerie Store	
Downtown Toronto	Coffee Shop	Hotel	Café	Seafood Restaurant	Bakery	Japanese Restaurant	Restaurant	Beer Bar	Cocktail Bar	Sporting Goods Shop	
West Toronto	Coffee Shop	Eastern European Restaurant	Sushi Restaurant	Gift Shop	American Restaurant	Bookstore	Bakery	Breakfast Spot	Café	Food & Drink Shop	
West Toronto	Café	Pizza Place	Coffee Shop	Bank	Sushi Restaurant	Electronics Store	Pub	Falafel Restaurant	Italian Restaurant	Restaurant	
Downtown Toronto	Sushi Restaurant	Coffee Shop	Japanese Restaurant	Bubble Tea Shop	Café	Martial Arts School	Fast Food Restaurant	Mexican Restaurant	Ethiopian Restaurant	Creperie	
East Toronto	Coffee Shop	Restaurant	Italian Restaurant	Yoga Studio	Martial Arts School	Japanese Restaurant	Sushi Restaurant	Bank	Bookstore	Salad Place	

Downtown Toronto	Coffee Shop	Restaurant	Middle Eastern Restaurant	Pizza Place	Italian Restaurant	Bubble Tea Shop	Sandwich Place	Clothing Store	Café	Juice Bar
Downtown Toronto	Café	Coffee Shop	Gym	Restaurant	Hotel	Asian Restaurant	Thai Restaurant	Steakhouse	Salad Place	American Restaurant
Downtown Toronto	Coffee Shop	Hotel	Café	American Restaurant	Japanese Restaurant	Seafood Restaurant	Salad Place	Restaurant	Sporting Goods Shop	Beer Bar
Downtown Toronto	Coffee Shop	Hotel	Café	Restaurant	Gym	American Restaurant	Seafood Restaurant	Salad Place	Asian Restaurant	Steakhouse
Central Toronto	Café	Coffee Shop	Sandwich Place	Park	Furniture / Home Store	Pub	Italian Restaurant	French Restaurant	Donut Shop	Indian Restaurant
Downtown Toronto	Café	Bookstore	Japanese Restaurant	Bakery	Yoga Studio	Beer Bar	Noodle House	Comfort Food Restaurant	Pub	College Gym
Downtown Toronto	Café	Vegetarian / Vegan Restaurant	Coffee Shop	Mexican Restaurant	Gaming Cafe	Vietnamese Restaurant	Caribbean Restaurant	Grocery Store	Farmers Market	Dessert Shop
Downtown Toronto	Coffee Shop	Italian Restaurant	Gym / Fitness Center	Café	Bar	Speakeasy	Restaurant	Park	French Restaurant	Bakery
Downtown Toronto	Coffee Shop	Restaurant	Hotel	Gym	Café	Sporting Goods Shop	Deli / Bodega	Italian Restaurant	Japanese Restaurant	Hotel Bar
Downtown Toronto	Coffee Shop	Hotel	Café	Restaurant	Gym	American Restaurant	Seafood Restaurant	Salad Place	Asian Restaurant	Steakhouse
Downtown Toronto	Café	Grocery Store	Playground	Candy Store	Park	Athletics & Sports	Baby Store	Coffee Shop	Electronics Store	Fish Market
West Toronto	Bakery	Park	Furniture / Home Store	Bus Line	Café	Smoke Shop	Middle Eastern Restaurant	Brazilian Restaurant	Pool	Pizza Place
West Toronto	Bar	Bakery	Restaurant	Cocktail Bar	Vegetarian / Vegan Restaurant	Coffee Shop	Asian Restaurant	Yoga Studio	Seafood Restaurant	Café
West Toronto	Coffee Shop	Café	Breakfast Spot	Thrift / Vintage Store	Gift Shop	Diner	Pizza Place	Pet Store	Mexican Restaurant	Liquor Store

Cluster label 3

THE THREE TORONTO CLUSTERS - WORD CLOUD

The word cloud shows cluster label 0 having a large mix of venues with high frequency primarily due to the fact that these are all in one neighborhood.



Word Cloud for Toronto Venues, Cluster Label 0



Word Cloud for Toronto Venues, Cluster Label 1



Word Cloud for Toronto Venues, Cluster Label 2

As seen from the data resulting in the tables shown above, cluster label 1 has a couple of fish and chip places. Just as expected, cluster label 3 with all of the venues from 31 neighborhoods as a large variety of venues that include restaurants, Cafes, Coffee Shops, Stores, e.t.c

CONCLUSIONS

From our results, it is clear that while Toronto and New York City are financial capitals of the two biggest countries in the North America, the venues around the neighborhoods of these cities as seen in Manhattan and Toronto named boroughs are different.

These differences are seen in the heterogeneity of the venues around Manhattan leading to a larger number of clusters when modeled by k-means clustering compared to Toronto named neighborhoods. Whilst the neighborhoods in Manhattan have quite a number of restaurants, cafes and coffee shops look to be more common in the Toronto based boroughs.

For a small business looking to choose between Toronto and New York City for a new restaurant, the recommendation will be to open restaurant in Toronto especially downtown Toronto where there will be few competing restaurants. If a restaurant has to be opened in New York City, neighborhoods around Murray Hill, Financial district, Civic Center and Turtle bay will be ideal.