INTRODUCTION

- Toronto is the 4th largest city in North America.
- This is probably caused by the immigrants who moved decades ago.
- Specifically East Asia (China, Japan, and Korea)
- Hence, cuisines like Japanese cuisines become very popular among the people of Toronto.
- Opening location is critical upon building a strong base to determine the success of the restaurant.

Business Problem

- Japanese dishes require high standards in terms of ingredients and spices.
- Since Toronto is not surrounded by seas or waters, **import is the only way to acquire the best ingredients**.
- High traffic locations greatly impact the number of customers who walk in into the restaurant.
- On the other hand, if a more quiet environment is more preferable, a location that is quite far from the cities with beautiful sceneries is also a good idea.

Data

1. The list of neighborhood in Canada
   (https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M)

2. Longitude and Latitude information according to postal code
   (http://cocl.us/Geospatial_data)

Data Cleaning & Selection

- Scrape the data from the Wikipedia page
- Convert it into a DataFrame

	Postalcode	Borough	Neighborhood
0	M1A	Not assigned	Not assigned
1	M2A	Not assigned	Not assigned
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Regent Park, Harbourfront

	Postalcode	Latitude	Longitude
0	M1B	43.806686	-79.194353
1	M1C	43.784535	-79.160497
2	M1E	43.763573	-79.188711
3	M1G	43.770992	-79.216917
4	M1H	43.773136	-79.239476

Data Cleaning & Selection

- Remove 'Not assigned' borough.
- Take only the 'Toronto' borough.
- Merge both DataFrames according to their postal codes.
- The final dataset has 39 rows

(39, 5)

	Postalcode	Latitude	Longitude	Borough	Neighborhood
37	M4E	43.676357	-79.293031	East Toronto	The Beaches
41	M4K	43.679557	-79.352188	East Toronto	The Danforth West, Riverdale
42	M4L	43.668999	-79.315572	East Toronto	India Bazaar, The Beaches West
43	M4M	43.659526	-79.340923	East Toronto	Studio District
44	M4N	43.728020	-79.388790	Central Toronto	Lawrence Park

Methodology

1. Foursquare API to lookup longitudes and latitudes according to the 'Toronto' neighborhoods.
2. Apply one-hot encoding to convert labels into categorical variables.
3. Search for similar neighbors.
4. Explore the most crowded venues.
5. The most crowded venues is the most preferred location.

Foursquare API (Longitudes & Latitudes)

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	The Beaches	43.676357	-79.293031	Glen Manor Ravine	43.676821	-79.293942	Trail
1	The Beaches	43.676357	-79.293031	Kew-Balmy Beach	43.667372	-79.295312	Beach
2	The Beaches	43.676357	-79.293031	Glen Stewart Park	43.675278	-79.294647	Park
3	The Beaches	43.676357	-79.293031	Grover Pub and Grub	43.679181	-79.297215	Pub
4	The Beaches	43.676357	-79.293031	Ivan Forrest Gardens	43.671669	-79.292573	Park

Apply one-hot Encoding

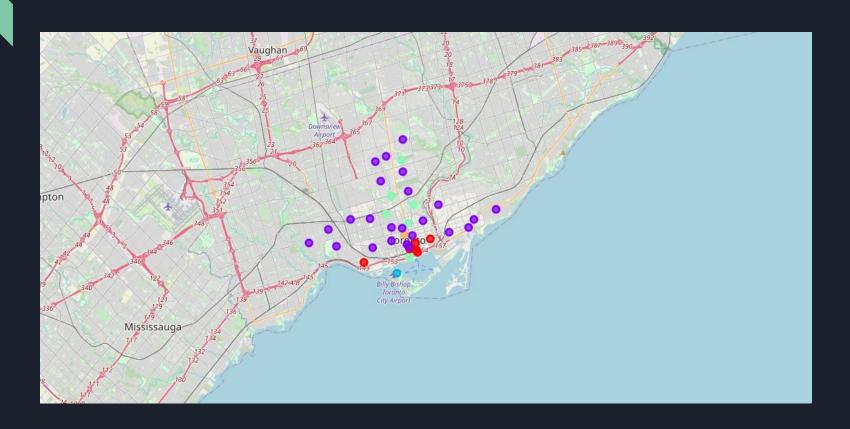|	Neighborhood	ATM	Accessories Store	Adult Boutique	Advertising Agency	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airport Service	Airport Terminal	Alternative Healer	American Restaurant	Antique Shop	Arcade	Argentinian Restaurant	Art Gallery	Arts & Crafts Store	Arts & Entertainment	Asian Restaurant	Assisted Living	Athletics & Sports	Audi
0	The Beaches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	The Beaches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	The Beaches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	The Beaches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	The Beaches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Search for 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
0	Berczy Park	Office	Building	Parking	Tech Startup	Residential Building (Apartment / Condo)	Breakfast Spot	Korean Restaurant	Movie Theater	Assisted Living	Hotel
1	Brockton, Parkdale Village, Exhibition Place	Office	Residential Building (Apartment / Condo)	Tech Startup	Conference Room	Building	Advertising Agency	Café	Bar	Coworking Space	Convenience Store
2	Business reply mail Processing Centre, South C...	Building	Office	Light Rail Station	Convenience Store	Medical Center	Butcher	Fast Food Restaurant	Theater	Restaurant	Gym / Fitness Center
3	CN Tower, King and Spadina, Railway Lands, Har...	Airport Gate	Airport Service	Moving Target	Airport Terminal	Park	Airport Lounge	Harbor / Marina	Airport	Boat or Ferry	General Travel
4	Central Bay Street	Hospital	Hospital Ward	Medical Center	Office	Emergency Room	Coffee Shop	Pharmacy	Deli / Bodega	Food Court	Fast Food Restaurant

The Labeled Clusters

	Postalcode	Latitude	Longitude	Borough	Neighborhood	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	10th Most Common Venue
37	M4E	43.676357	-79.293031	East Toronto	The Beaches	1	School	Park	Building	Playground	Laundry Service	Residential Building (Apartment / Condo)	Jewelry Store	Salon / Barbershop	Doctor's Office	Martial Arts School
41	M4K	43.679557	-79.352188	East Toronto	The Danforth West, Riverdale	1	Greek Restaurant	Spa	Salon / Barbershop	Miscellaneous Shop	Gym / Fitness Center	Women's Store	Office	Health Food Store	Pharmacy	Fruit & Vegetable Store
42	M4L	43.668999	-79.315572	East Toronto	India Bazaar, The Beaches West	1	Convenience Store	Park	Office	Laundry Service	Pet Store	Rental Car Location	Church	Car Wash	Light Rail Station	Pizza Place
43	M4M	43.659526	-79.340923	East Toronto	Studio District	1	Building	Office	Automotive Shop	Coffee Shop	Restaurant	Nail Salon	Spa	Seafood Restaurant	Furniture / Home Store	Moving Target
44	M4N	43.728020	-79.388790	Central Toronto	Lawrence Park	1	College Classroom	College Auditorium	School	Housing Development	Fast Food Restaurant	Building	Bus Line	Park	College Theater	Parking

Results (Map)

Results (1st Cluster)

	Latitude	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	10th Most Common Venue
53	43.654260	0	Office	Automotive Shop	Furniture / Home Store	Building	Coffee Shop	Art Gallery	Food Truck	Italian Restaurant	Light Rail Station	Auto Dealership
55	43.651494	0	Office	Residential Building (Apartment / Condo)	Event Space	Building	Coffee Shop	Spa	Church	Nightclub	Clothing Store	Rental Car Location
56	43.644771	0	Office	Building	Parking	Tech Startup	Residential Building (Apartment / Condo)	Breakfast Spot	Korean Restaurant	Movie Theater	Assisted Living	Hotel
60	43.647177	0	Office	Coffee Shop	Building	Café	Park	Restaurant	Pharmacy	Italian Restaurant	Coworking Space	Event Space
61	43.648198	0	Office	Coffee Shop	Financial or Legal Service	Salon / Barbershop	Food Court	Bagel Shop	Restaurant	Bus Stop	Building	Dentist's Office
69	43.646435	0	Office	Building	Tech Startup	Residential Building (Apartment / Condo)	Gym	Bar	Pub	Hotel	Gym / Fitness Center	Café
78	43.636847	0	Office	Residential Building (Apartment / Condo)	Tech Startup	Conference Room	Building	Advertising Agency	Café	Bar	Coworking Space	Convenience Store

Results (2nd Cluster)

Latitude	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	10th Most Common Venue
37	43.676357	1	School	Park	Building	Playground	Laundry Service	Residential Building (Apartment / Condo)	Jewelry Store	Salon / Barbershop	Doctor's Office	Martial Arts School
41	43.679557	1	Greek Restaurant	Spa	Salon / Barbershop	Miscellaneous Shop	Gym / Fitness Center	Women's Store	Office	Health Food Store	Pharmacy	Fruit & Vegetable Store
42	43.668999	1	Convenience Store	Park	Office	Laundry Service	Pet Store	Rental Car Location	Church	Car Wash	Light Rail Station	Pizza Place
43	43.659526	1	Building	Office	Automotive Shop	Coffee Shop	Restaurant	Nail Salon	Spa	Seafood Restaurant	Furniture / Home Store	Moving Target
44	43.728020	1	College Classroom	College Auditorium	School	Housing Development	Fast Food Restaurant	Building	Bus Line	Park	College Theater	Parking
46	43.715383	1	Shoe Store	Clothing Store	Men's Store	Furniture / Home Store	Health & Beauty Service	Cosmetics Shop	Marijuana Dispensary	Metro Station	Accessories Store	General Entertainment
47	43.704324	1	Café	Coffee Shop	Dessert Shop	Italian Restaurant	French Restaurant	Bookstore	Spa	Salon / Barbershop	Antique Shop	Laundry Service
48	43.689574	1	Office	Building	Residential Building (Apartment / Condo)	Park	Bridge	Gym	Bank	Tennis Court	Trail	Gym / Fitness Center
51	43.667967	1	Café	Flower Shop	Coffee Shop	Office	Pharmacy	Pizza Place	Restaurant	Indian Restaurant	Bakery	Tech Startup
54	43.657162	1	College Lab	College Administrative Building	University	College Arts Building	General College & University	Parking	College Academic Building	Coffee Shop	Student Center	College Communications Building
58	43.650571	1	Office	Coffee Shop	Café	Building	Vegetarian / Vegan Restaurant	Food Court	Pool	Italian Restaurant	Hotel	Bike Rental / Bike Share
63	43.711695	1	Office	Dentist's Office	Playground	General Entertainment	Gym	Spa	Doctor's Office	Medical Center	Residential Building (Apartment / Condo)	Italian Restaurant
64	43.696948	1	Office	Doctor's Office	Medical Center	Dentist's Office	General Entertainment	Tech Startup	Gym / Fitness Center	Park	Lawyer	Student Center
66	43.662696	1	College Residence Hall	Student Center	Food Truck	College Classroom	College Library	College Academic Building	College Gym	College Auditorium	College Lab	Church
67	43.653206	1	Thrift / Vintage Store	Boutique	Salon / Barbershop	Art Gallery	Vietnamese Restaurant	Bar	Chinese Restaurant	Karaoke Bar	Farmers Market	Residential Building (Apartment / Condo)
70	43.648429	1	Office	Coffee Shop	Bakery	Dentist's Office	Clothing Store	Health & Beauty Service	Paper / Office Supplies Store	Cosmetics Shop	Professional & Other Places	Men's Store
75	43.669542	1	Office	Café	Design Studio	Furniture / Home Store	Residential Building (Apartment / Condo)	Laundry Service	Grocery Store	Gym / Fitness Center	Yoga Studio	Bank
76	43.669005	1	Automotive Shop	Park	Church	Office	Portuguese Restaurant	Furniture / Home Store	Convenience Store	Salon / Barbershop	Café	Factory
77	43.647927	1	Bar	Art Gallery	Coffee Shop	Lounge	Boutique	Office	Bakery	Japanese Restaurant	Salon / Barbershop	Nail Salon
82	43.661608	1	Church	Office	Government Building	Building	Chiropractor	Park	Parking	Post Office	College Classroom	Residential Building (Apartment / Condo)
83	43.648960	1	Office	Coffee Shop	Residential Building (Apartment / Condo)	Building	Spa	Bar	Art Gallery	Convenience Store	Park	Music Venue
84	43.651571	1	Dentist's Office	Medical Center	Salon / Barbershop	Sushi Restaurant	Office	Doctor's Office	Furniture / Home Store	Veterinarian	Spa	Bakery
85	43.662301	1	Government Building	Medical Center	Building	Office	Capitol Building	Restaurant	Medical Lab	College Library	Hospital	Doctor's Office
87	43.662744	1	Building	Office	Light Rail Station	Convenience Store	Medical Center	Butcher	Fast Food Restaurant	Theater	Restaurant	Gym / Fitness Center

Results (3rd Cluster)

	Latitude	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	10th Most Common Venue
68	43.628947	2	Airport Gate	Airport Service	Moving Target	Airport Terminal	Park	Airport Lounge	Harbor / Marina	Airport	Boat or Ferry	General Travel

Results (4th Cluster)

	Latitude	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	10th Most Common Venue
45	43.712751	3	Residential Building (Apartment / Condo)	Office	Gym	Strip Club	Dog Run	Medical Center	Building	Italian Restaurant	Tea Room	Flower Shop
49	43.686412	3	Residential Building (Apartment / Condo)	Office	Building	Doctor's Office	Dentist's Office	Medical Center	Light Rail Station	Government Building	Embassy / Consulate	Café
50	43.679563	3	Residential Building (Apartment / Condo)	Office	Park	Trail	Building	Bridge	Music Venue	Dog Run	Salon / Barbershop	Conference Room
52	43.665860	3	Residential Building (Apartment / Condo)	Office	Spa	Building	Gym	Doctor's Office	Bubble Tea Shop	Hotel	Thrift / Vintage Store	Pub
59	43.640816	3	Residential Building (Apartment / Condo)	Office	Coffee Shop	Building	Light Rail Station	Parking	Doctor's Office	Fried Chicken Joint	Tea Room	Bank
65	43.672710	3	Residential Building (Apartment / Condo)	Office	Bed & Breakfast	Building	General Entertainment	Gym	Metro Station	Medical Center	Café	Hotel

Results (5th Cluster)

	Latitude	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	10th Most Common Venue
57	43.657952	4	Hospital	Hospital Ward	Medical Center	Office	Emergency Room	Coffee Shop	Pharmacy	Deli / Bodega	Food Court	Fast Food Restaurant

Discussion

- According to the results, the clusters can be divided into 5: office, restaurants & cafes, airport, residential building, and hospital.
- Restaurants & cafes cluster has more venues compared to other 4 clusters.
- However, most of the venues are not placed nearby with each other (only venues that are in the middle of the city).
- The best location is either the 1st cluster (office) or the 2nd cluster (restaurants & cafes) while on the other hand, the worst possible location for opening the Japanese restaurant is in the 3rd (airport) and 4th (hospital) cluster.

Conclusion

- Clustering algorithms like K-means clustering can gather (cluster) neighbors according to their positions (latitudes and longitudes).
- In addition, with the help of Foursquare API, we can directly request which venues are visited the most in each neighbor.
- Then, looking at the clusters and venues result, we can determine in which location should the restaurant operate.