

# **1.Introduction/Business Problem**

Toronto is the provincial capital of Ontario and the most populous city in Canada, with a population of 2,731,571 in 2016. Current to 2016, the Toronto census metropolitan area (CMA), of which the majority is within the Greater Toronto Area (GTA), held a population of 5,928,040, making it Canada's most populous CMA. Toronto is the anchor of an urban agglomeration, known as the Golden Horseshoe in Southern Ontario, located on the north western shore of Lake Ontario. Toronto is an international centre of business, finance, arts, and culture, and is recognized as one of the most multicultural and cosmopolitan cities in the world.

The objective of the project is to suggest the top 10 venues to visit in the city of Toronto, Canada. The different venues are suggested on the basis of its popularity at that point of time and can vary accordingly.

Divide the neighbourhoods into cluster and suggest users which cluster to visit based on the number of venues available to visit.

## **2.DATA**

The location data for the chosen location can be obtained as a .json file along with the API data.

The json files can be obtained online from several sources like [https://geo.nyu.edu/catalog/nyu\\_2451\\_34572](https://geo.nyu.edu/catalog/nyu_2451_34572). According to the desired location .json files can be obtained containing its neighbourhoods.

The foursquare API calls can be used to identify the nearby venues and takes in the location from the .json files according to the need. These calls can then be used to identify the venues available and can be categorized on their genre.

Thus the top 10 venues can be retrieved and suggested to the users.

### **3.METHODOLOGY**

In this project I have used the basic concepts taught in week 3 of this course

Started out with the following dataframe (only 10 rows are printed out of 103):

It consists of all the Boroughs in Canada with all its neighbourhoods include

	Postcode	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Harbourfront, Regent Park
3	M6A	North York	Lawrence Heights, Lawrence Manor
4	M7A	Queen's Park	Not assigned
5	M9A	Etobicoke	Islington Avenue
6	M1B	Scarborough	Rouge, Malvern
7	M3B	North York	Don Mills North
8	M4B	East York	Woodbine Gardens, Parkview Hill
9	M5B	Downtown Toronto	Ryerson, Garden District
10	M6B	North York	Glencairn

I have found addresses into their equivalent latitude and longitude values. These values are input to the dataframe corresponding to their postal codes (only 5 shown here):

	Postal Code	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

Now we filter out only the Borough of Central Toronto, West Toronto, East Toronto, Downtown Toronto. Their latitudes and longitudes of the corresponding postal areas in the above mentioned boroughs are added to the dataframe:

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M5A	Downtown Toronto	Harbourfront, Regent Park	43.654260	-79.360636
1	M5B	Downtown Toronto	Ryerson, Garden District	43.657162	-79.378937
2	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
3	M5E	Downtown Toronto	Berczy Park	43.644771	-79.373306
4	M5G	Downtown Toronto	Central Bay Street	43.657952	-79.387383
5	M5G	Downtown Toronto	Christie	43.669542	-79.422564
6	M5H	Downtown Toronto	Adelaide, King, Richmond	43.650571	-79.384568
7	M5J	Downtown Toronto	Harbourfront East, Toronto Islands, Union Sta...	43.640816	-79.381752
8	M5K	Downtown Toronto	Design Exchange, Toronto Dominion Centre	43.647177	-79.381576
9	M5L	Downtown Toronto	Commerce Court, Victoria Hotel	43.648198	-79.379817
10	M5S	Downtown Toronto	Harbord, University of Toronto	43.662696	-79.400049
11	M5T	Downtown Toronto	Chinatown, Grange Park, Kensington Market	43.653206	-79.400049
12	M5V	Downtown Toronto	CN Tower, Bathurst Quay, Island airport, Harb...	43.628947	-79.394420
13	M4W	Downtown Toronto	Rosedale	43.679563	-79.377529
14	M5W	Downtown Toronto	Stn A PO Boxes 25 The Esplanade	43.646435	-79.374846
15	M4X	Downtown Toronto	Cabbagetoyn, St. James Town	43.667967	-79.367675
16	M5X	Downtown Toronto	First Canadian Place, Underground city	43.648429	-79.382280
17	M4Y	Downtown Toronto	Church and Wellesley	43.665860	-79.383160
18	M4N	Central Toronto	Lawrence Park	43.728020	-79.388790
19	M5N	Central Toronto	Rosedale	43.711695	-79.418936
20	M4P	Central Toronto	Davisville North	43.712701	-79.390197
21	M5P	Central Toronto	Forest Hill North, Forest Hill West	43.696948	-79.411307
22	M4R	Central Toronto	North Toronto West	43.715383	-79.405678
23	M5R	Central Toronto	The Annex, North Midtown, Yorkville	43.672710	-79.405678
24	M4S	Central Toronto	Davisville	43.704324	-79.388790
25	M4T	Central Toronto	Moore Park, Summerhill East	43.689574	-79.383160
26	M4V	Central Toronto	Deer Park, Forest Hill SE, Rathnelly, South H...	43.685412	-79.400049
27	M4E	East Toronto	The Beaches	43.676357	-79.293031
28	M4K	East Toronto	The Danforth West, Riverdale	43.679557	-79.352188
29	M4L	East Toronto	The Beaches West, India Bazaar	43.668999	-79.315572
30	M4M	East Toronto	Studio District	43.659526	-79.340923
31	M7Y	East Toronto	Business Reply Mail Processing Centre 969 Eas...	43.662744	-79.321558
32	M6H	West Toronto	Dovercourt Village, Dufferin	43.669005	-79.442259
33	M6J	West Toronto	Little Portugal, Trinity	43.647927	-79.419750
34	M6K	West Toronto	Brockton, Exhibition Place, Parkdale Village	43.636847	-79.428191
35	M6P	West Toronto	High Park, The Junction South	43.661608	-79.464763
36	M6R	West Toronto	Parkdale, Roncesvalles	43.648960	-79.456325
37	M6S	West Toronto	Runnymede, Swansea	43.651571	-79.484450

The different neighbourhoods of Toronto, Canada is plotted in a map with the help of python code.

The map looks like this:



Then the 10 most venues to visit is found out using Foursquare queries and python. The venues are stored into a dataframe for each neighbourhood in Toronto, Canada:

	Neighbourhood	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	Adelaide, King, Richmond	Coffee Shop	Café	Thai Restaurant	Bar	Steakhouse	Burger Joint	Cosmetics Shop	Restaurant	Hotel	American Restaurant
1	Berczy Park	Coffee Shop	Cocktail Bar	Steakhouse	Cheese Shop	Café	Bakery	Farmers Market	Seafood Restaurant	Beer Bar	Restaurant
2	Brockton, Exhibition Place, Parkdale Village	Breakfast Spot	Café	Coffee Shop	Intersection	Falafel Restaurant	Convenience Store	Burrito Place	Stadium	Caribbean Restaurant	Bar
3	Business Reply Mail Processing Centre 969 Eas...	Light Rail Station	Yoga Studio	Auto Workshop	Garden Center	Garden	Fast Food Restaurant	Farmers Market	Comic Shop	Pizza Place	Restaurant
4	CN Tower, Bathurst Quay, Island airport, Harb...	Airport Service	Airport Lounge	Airport Terminal	Boutique	Plane	Coffee Shop	Sculpture Garden	Boat or Ferry	Bar	Harbor / Marina

## 4.RESULT

**K-Mean Cluster** used to cluster data and show the 10 most venues to visit in each cluster

The map after clustering:





The different clusters with the 10 most venues to visit are:

## CLUSTER 0

	Borough	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
0	Downtown Toronto	0	Coffee Shop	Café	Pub	Park	Bakery	Gym / Fitness Center	Breakfast Spot	Theater	Mexican Restaurant	Italian Restaurant
1	Downtown Toronto	0	Coffee Shop	Clothing Store	Cosmetics Shop	Café	Fast Food Restaurant	Lingerie Store	Bubble Tea Shop	Pizza Place	Diner	Italian Restaurant
2	Downtown Toronto	0	Coffee Shop	Café	Restaurant	Hotel	Italian Restaurant	Bakery	Cocktail Bar	Gastropub	Breakfast Spot	Beer Bar
3	Downtown Toronto	0	Coffee Shop	Cocktail Bar	Steakhouse	Cheese Shop	Café	Bakery	Farmers Market	Seafood Restaurant	Beer Bar	Restaurant
4	Downtown Toronto	0	Coffee Shop	Café	Ice Cream Shop	Italian Restaurant	Sandwich Place	Burger Joint	Sushi Restaurant	Bubble Tea Shop	Restaurant	Chinese Restaurant
5	Downtown Toronto	0	Grocery Store	Café	Park	Convenience Store	Nightclub	Baby Store	Athletics & Sports	Italian Restaurant	Restaurant	Diner
6	Downtown Toronto	0	Coffee Shop	Café	Thai Restaurant	Bar	Steakhouse	Burger Joint	Cosmetics Shop	Restaurant	Hotel	American Restaurant
7	Downtown Toronto	0	Coffee Shop	Aquarium	Hotel	Italian Restaurant	Café	Scenic Lookout	Bakery	Sporting Goods Shop	Brewery	Pizza Place
8	Downtown Toronto	0	Coffee Shop	Café	Hotel	Restaurant	Italian Restaurant	Gastropub	Bar	Gym	American Restaurant	Deli / Bodega
9	Downtown Toronto	0	Coffee Shop	Café	Hotel	American Restaurant	Restaurant	Gastropub	Deli / Bodega	Bakery	Steakhouse	Gym
10	Downtown Toronto	0	Café	Bookstore	Japanese Restaurant	Bakery	Bar	Restaurant	Italian Restaurant	Beer Bar	Beer Store	Sandwich Place
11	Downtown Toronto	0	Café	Vegetarian / Vegan Restaurant	Chinese Restaurant	Vietnamese Restaurant	Mexican Restaurant	Bakery	Dumpling Restaurant	Bar	Coffee Shop	Cocktail Bar
12	Downtown Toronto	0	Airport Service	Airport Lounge	Airport Terminal	Boutique	Plane	Coffee Shop	Sculpture Garden	Boat or Ferry	Bar	Harbor / Marina
14	Downtown Toronto	0	Coffee Shop	Café	Restaurant	Hotel	Beer Bar	Fast Food Restaurant	Cocktail Bar	Seafood Restaurant	Breakfast Spot	Farmers Market
15	Downtown Toronto	0	Coffee Shop	Convenience Store	Pub	Bakery	Market	Café	Restaurant	Italian Restaurant	Pizza Place	Park
16	Downtown Toronto	0	Coffee Shop	Café	Restaurant	Steakhouse	Hotel	Gastropub	Bar	Deli / Bodega	Gym	American Restaurant
17	Downtown Toronto	0	Coffee Shop	Gay Bar	Japanese Restaurant	Sushi Restaurant	Restaurant	Men's Store	Mediterranean Restaurant	Gym	Gastropub	Fast Food Restaurant
20	Central Toronto	0	Hotel	Breakfast Spot	Gym	Park	Sandwich Place	Clothing Store	Food & Drink Shop	Yoga Studio	Dumpling Restaurant	Dog Run

22	Central Toronto	0	Coffee Shop	Yoga Studio	Sporting Goods Shop	Gym / Fitness Center	Furniture / Home Store	Fast Food Restaurant	Mexican Restaurant	Diner	Dessert Shop	Park
23	Central Toronto	0	Coffee Shop	Café	Sandwich Place	Pizza Place	BBQ Joint	Indian Restaurant	Jewish Restaurant	Liquor Store	Cosmetics Shop	Park
24	Central Toronto	0	Pizza Place	Sandwich Place	Dessert Shop	Coffee Shop	Café	Italian Restaurant	Sushi Restaurant	Gym	Fried Chicken Joint	Seafood Restaurant
26	Central Toronto	0	Coffee Shop	Pub	Pizza Place	Fried Chicken Joint	Restaurant	Liquor Store	Sports Bar	Supermarket	Sushi Restaurant	Bagel Shop
28	East Toronto	0	Greek Restaurant	Coffee Shop	Italian Restaurant	Ice Cream Shop	Furniture / Home Store	Yoga Studio	Pizza Place	Bookstore	Brewery	Bubble Tea Shop
29	East Toronto	0	Italian Restaurant	Board Shop	Sushi Restaurant	Sandwich Place	Brewery	Movie Theater	Fish & Chips Shop	Pub	Ice Cream Shop	Fast Food Restaurant
30	East Toronto	0	Café	Coffee Shop	Italian Restaurant	Bakery	American Restaurant	Gastropub	Cheese Shop	Stationery Store	Fish Market	Latin American Restaurant
31	East Toronto	0	Light Rail Station	Yoga Studio	Auto Workshop	Garden Center	Garden	Fast Food Restaurant	Farmers Market	Comic Shop	Pizza Place	Restaurant
32	West Toronto	0	Bakery	Pharmacy	Supermarket	Pizza Place	Liquor Store	Fast Food Restaurant	Middle Eastern Restaurant	Discount Store	Music Venue	Park
33	West Toronto	0	Bar	Coffee Shop	Asian Restaurant	Men's Store	Restaurant	Café	Pizza Place	Cocktail Bar	Bakery	New American Restaurant
34	West Toronto	0	Breakfast Spot	Café	Coffee Shop	Intersection	Falafel Restaurant	Convenience Store	Burrito Place	Stadium	Caribbean Restaurant	Bar
35	West Toronto	0	Bar	Café	Mexican Restaurant	Arts & Crafts Store	Cajun / Creole Restaurant	Bakery	Fried Chicken Joint	Furniture / Home Store	Italian Restaurant	Diner
36	West Toronto	0	Breakfast Spot	Gift Shop	Bookstore	Movie Theater	Dog Run	Bar	Restaurant	Italian Restaurant	Dessert Shop	Eastern European Restaurant
37	West Toronto	0	Café	Pizza Place	Coffee Shop	Sushi Restaurant	Italian Restaurant	Pharmacy	Diner	Bookstore	Sandwich Place	Burrito Place

## CLUSTER 1

	Borough	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
19	Central Toronto	1	Garden	Yoga Studio	Discount Store	Farmers Market	Falafel Restaurant	Event Space	Ethiopian Restaurant	Electronics Store	Eastern European Restaurant	Dumpling Restaurant

## CLUSTER 2

	Borough	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
27	East Toronto	2	Health Food Store	Neighborhood	Trail	Pub	Falafel Restaurant	Event Space	Ethiopian Restaurant	Electronics Store	Eastern European Restaurant	Dumpling Restaurant

## CLUSTER 3

	Borough	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
13	Downtown Toronto	3	Park	Playground	Trail	Building	Yoga Studio	Discount Store	Falafel Restaurant	Event Space	Ethiopian Restaurant	Electronics Store
21	Central Toronto	3	Park	Trail	Sushi Restaurant	Jewelry Store	Yoga Studio	Discount Store	Falafel Restaurant	Event Space	Ethiopian Restaurant	Electronics Store
25	Central Toronto	3	Summer Camp	Playground	Park	Tennis Court	Yoga Studio	Dive Bar	Dog Run	Doner Restaurant	Donut Shop	Eastern European Restaurant

## CLUSTER 4

	Borough	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
18	Central Toronto	4	Photography Studio	Park	Swim School	Bus Line	Discount Store	Falafel Restaurant	Event Space	Ethiopian Restaurant	Electronics Store	Eastern European Restaurant

**Based on these cluster people visiting Toronto should visit CLUSTER 1 as it has more options for places to visit.**

## 5.DISCUSSION

In this section, I would be discussing the observations I have noted and the recommendation that I can make based on the results.

This analysis is performed on limited data. This may be right or may be wrong. But if good amount of data is available there is scope to come up with better results.

There is less number of places to visit in cluster 1,2,4. Cluster 0 has the most number of places to visit in Toronto followed by cluster 3



## **6.CONCLUSION**

Although all of the goals of this project were met there is definitely room for further improvement and development. However, the goals of the project were met and, with some more work, could easily be developed into a fully working application that could suggest users places to visit all throughout the world. The code can be used further to develop application of business where users and the collected venues can interact for services.