

The Battle of Neighborhoods

Choose a Greater Toronto Area neighborhood to start business under the coronavirus pandemic in year 2020

1. Introduction:

Greater Toronto Area



Greater Toronto Area (GTA) is the most populous area in Canada, it has a population of around 6.5 million that occupies more than 20% of Canada's total population. From economy aspect, GTA produces nearly 20% of the entire nation's GDP with \$323 billion. Due to its large population and developed economy activities, the Greater Toronto Area is one of the worthiest places to live and start business in North America.

However, in an ongoing pandemic of COVID-19, Greater Toronto Area is also the most severely affected areas. According to the CBC News, by 27 May 2020, Toronto and its neighborhoods account for 76% of all confirmed cases in Ontario.

For new immigrants and business owners, it is important for them to find a place in Canada where is not far away from the GTA and have less confirmed cases of coronavirus.

2. Data Selection:

In order to find out the city near GTA that has less confirmed cases, the csv file "Confirmed Positive Cases of COVID-19 in Ontario" is downloaded from the official website of the Ontario Government with url: <https://data.ontario.ca/dataset/f4112442-bdc8-45d2-be3c-12efae72fb27/resource/455fd63b-603d-4608-8216-7d8647f43350/download/conposcovidloc.csv>

The dataset constitutes the following features: approximation of onset date, age group, patient gender, case acquisition information, patient outcome, reporting Public Health Unit (PHU), postal code, website, longitude, and latitude of PHU. It looks like:

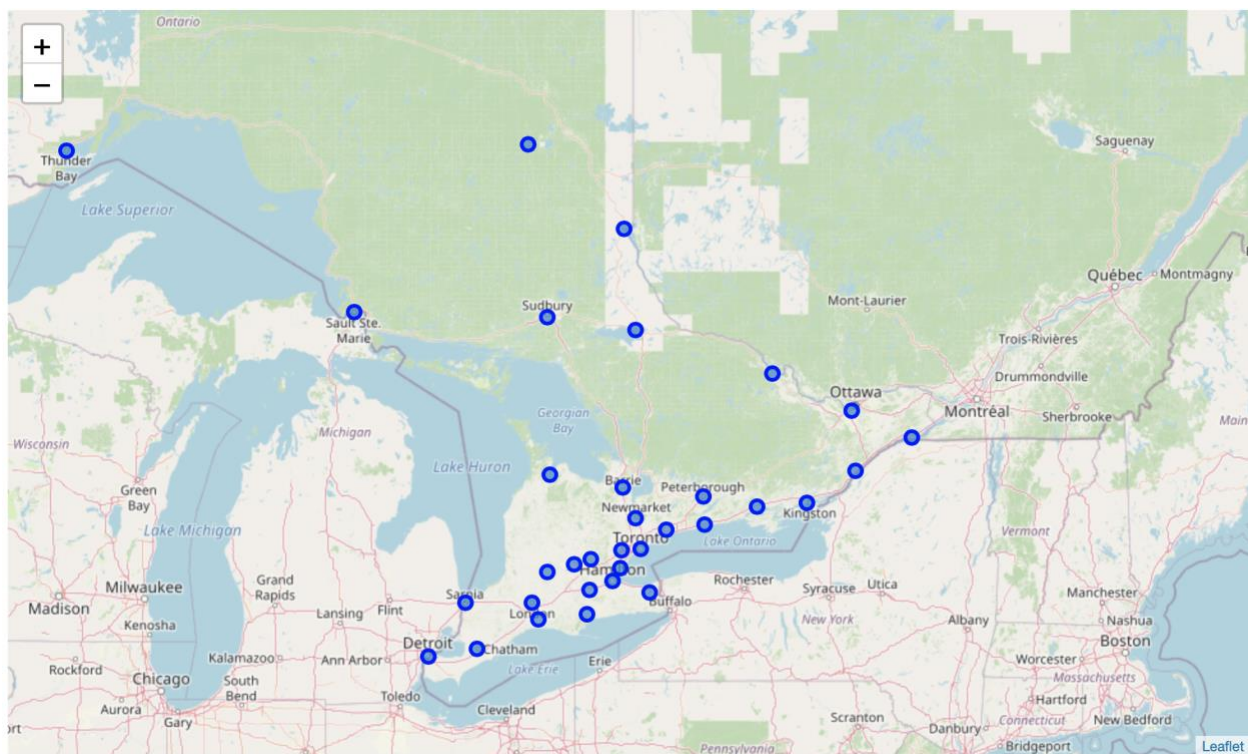
Row_ID	Accurate_Episode_Date	Age_Group	Client_Gender	Case_AcquisitionInfo	Outcome1	Outbreak_Related	Reporting_PHU	Reporting_PHU_Address
1	2020-04-29	50s	FEMALE	Neither	Resolved	Yes	Peel Public Health	7120 Hurontario Street
2	2020-05-09	20s	FEMALE	Information pending	Resolved	Yes	Peel Public Health	7120 Hurontario Street
3	2020-05-23	50s	MALE	Information pending	Not Resolved	Yes	York Region Public Health Services	17250 Yonge Street
4	2020-05-17	30s	FEMALE	Contact of a confirmed case	Not Resolved	Yes	Renfrew County and District Health Unit	7 International Drive
5	2020-05-17	30s	FEMALE	Contact of a confirmed case	Not Resolved	Yes	Toronto Public Health	277 Victoria Street, 5th Floor

Row_ID	Accurate_Episode_Date	Age_Group	Client_Gender	Case_AcquisitionInfo	Outcome1	Outbreak_Related	Reporting_PHU	Reporting_PHU_Address
1	2020-04-29	50s	FEMALE	Neither	Resolved	Yes	Peel Public Health	7120 Hurontario Street
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4	2020-05-17	30s	FEMALE	Contact of a confirmed case	Not Resolved	Yes	Renfrew County and District Health Unit	7 International Drive
5	2020-05-17	30s	FEMALE	Contact of a confirmed case	Not Resolved	Yes	Toronto Public Health	277 Victoria Street, 5th Floor

The following table shows top 10 cities in Ontario have the most confirmed coronavirus cases:

	Reporting_PHU_City	Number of Cases
0	Toronto	9555
1	Mississauga	4054
2	Newmarket	2285
3	Ottawa	1917
4	Whitby	1399
5	Waterloo	1050
6	Windsor	910
7	Hamilton	642
8	Thorold	630
9	Oakville	623

And the following map shows cities in Ontario that have confirmed coronavirus cases:

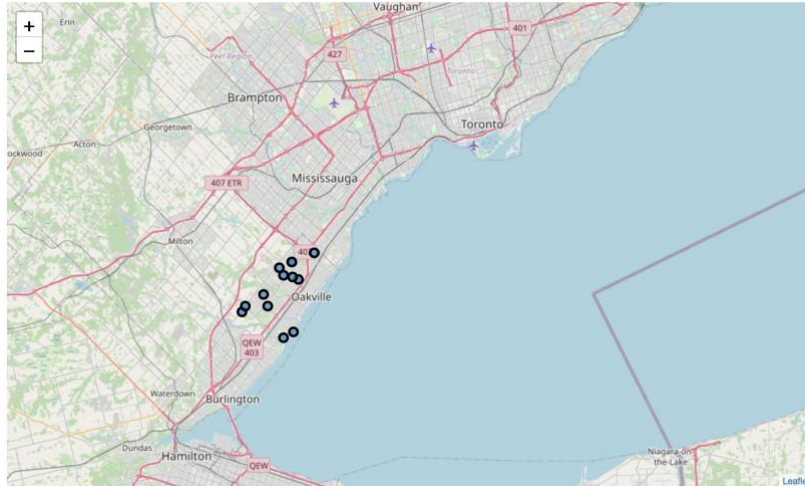


3. The Choice of City – Oakville:

From all the information above, we choose the city of Oakville to conduct the neighborhood analysis. Oakville located in Halton Region on Lake Ontario, and halfway between Toronto and Hamilton. It will only take half an hour for people to drive from Oakville to the downtown of Toronto.

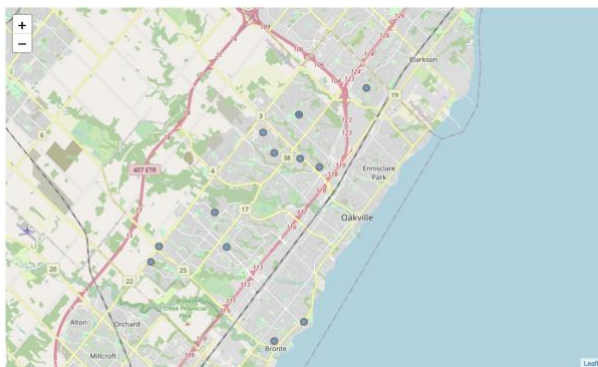
In COVID-19 pandemic, Oakville has a relatively small number of confirmed cases.

The map below illustrates the relative location of Oakville in GTA and geographical distribution of its neighborhoods:



4. Neighborhood Analysis:

4.1 Introduction of Neighborhoods:



Old Oakville
Kerr Village
Bronte
Eastlake
Clearview
College Park
Iroquois Ridge North
Iroquois Ridge South
Glen Abbey
Palermo
River Oaks
Uptown Core
West Oak Trails

4.2 The Most Common Venue for Each Neighborhood:

Using the latitude and longitude dataset of each neighborhood in Oakville, by connecting with the Foursquare API, we could find all the venues for each neighborhood within a 500 meters radius. In total, there are 110 different venues in 61 unique categories.

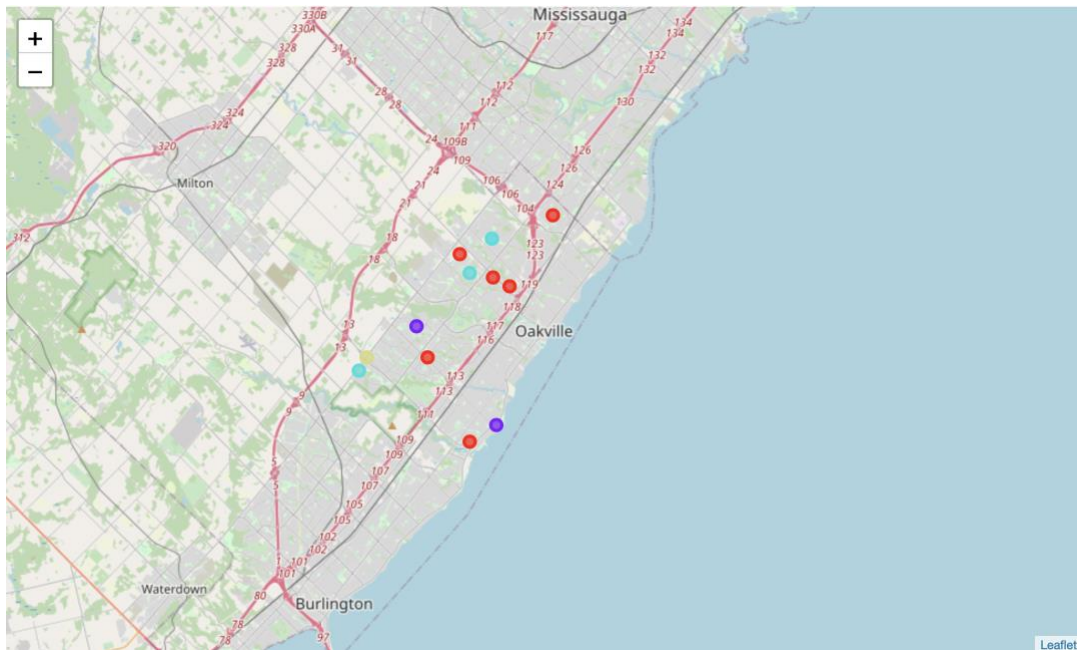
One hot encoding is used to preprocess our dataset by getting dummy variables to each venue according to their venue category. And then, all the data are grouped by the *Neighborhood* column and the mean of venues' dummy variables. This process would help us reorganize our data and provide with us the most common venue in each neighborhood.

	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	Bronte	Restaurant	Gourmet Shop	Thai Restaurant	Coffee Shop	Italian Restaurant	Café	French Restaurant	Pizza Place	Cuban Restaurant	Pharmacy
1	Clearview	Pizza Place	Asian Restaurant	Park	Portuguese Restaurant	Deli / Bodega	Construction & Landscaping	Convenience Store	Cosmetics Shop	Cuban Restaurant	Video Game Store
2	College Park	Restaurant	Pizza Place	Deli / Bodega	Bus Station	Burrito Place	Pub	College Bookstore	Sandwich Place	Bookstore	Sports Bar
3	Eastlake	Pizza Place	Sandwich Place	Health Food Store	Fast Food Restaurant	Mediterranean Restaurant	Coffee Shop	Gastropub	Gas Station	Swim School	Bank
4	Glen Abbey	Gym	Pharmacy	Sandwich Place	Fast Food Restaurant	Ice Cream Shop	Convenience Store	Restaurant	Pizza Place	Beer Store	Bank
5	Iroquois Ridge North	Playground	Pizza Place	Dog Run	Pool	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Deli / Bodega
6	Iroquois Ridge South	Playground	Pizza Place	Dog Run	Pool	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Deli / Bodega
7	Kerr Village	Playground	Home Service	Stables	Coffee Shop	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run
8	Old Oakville	Park	Construction & Landscaping	Video Game Store	Grocery Store	Gastropub	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store
9	Palermo	Gastropub	Middle Eastern Restaurant	Video Game Store	Grocery Store	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run
10	River Oaks	Playground	Sandwich Place	Coffee Shop	Gastropub	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run
11	Uptown Core	Electronics Store	Clothing Store	Fast Food Restaurant	Falafel Restaurant	Massage Studio	Liquor Store	Indian Restaurant	Ice Cream Shop	Grocery Store	Video Game Store
12	West Oak Trails	Park	Video Game Store	Grocery Store	Gastropub	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run

4.3 Cluster Analysis by K-Means Algorithm:

To help new business owners find similar neighborhoods in Oakville area, K-Means algorithm will be applied to our preprocessed dataset. In this report, all 13 of Oakville neighborhoods will be clustered into 4 different groups.

After adding all clustering labels into our dataset, we could visualize results of clustering.



5. Results:

Cluster 1: Bronte, Eastlake, Clearview, College Park, Glen Abbey and Uptown Core

	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
2	Bronte	Restaurant	Gourmet Shop	Thai Restaurant	Coffee Shop	Italian Restaurant	Café	French Restaurant	Pizza Place	Cuban Restaurant	Pharmacy
3	Eastlake	Pizza Place	Sandwich Place	Health Food Store	Fast Food Restaurant	Mediterranean Restaurant	Coffee Shop	Gastropub	Gas Station	Swim School	Bank
4	Clearview	Pizza Place	Asian Restaurant	Park	Portuguese Restaurant	Deli / Bodega	Construction & Landscaping	Convenience Store	Cosmetics Shop	Cuban Restaurant	Video Game Store
5	College Park	Restaurant	Pizza Place	Deli / Bodega	Bus Station	Burrito Place	Pub	College Bookstore	Sandwich Place	Bookstore	Sports Bar
8	Glen Abbey	Gym	Pharmacy	Sandwich Place	Fast Food Restaurant	Ice Cream Shop	Convenience Store	Restaurant	Pizza Place	Beer Store	Bank
11	Uptown Core	Electronics Store	Clothing Store	Fast Food Restaurant	Falafel Restaurant	Massage Studio	Liquor Store	Indian Restaurant	Ice Cream Shop	Grocery Store	Video Game Store

Cluster 1 is the biggest group with 6 of 13 neighborhoods in Oakville. The most common venues in this group are restaurants, fast food restaurants and stores.

Cluster 2: Old Oakville and West Oak Trails

	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	Old Oakville	Park	Construction & Landscaping	Video Game Store	Grocery Store	Gastropub	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store
12	West Oak Trails	Park	Video Game Store	Grocery Store	Gastropub	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run

Cluster 2 has 2 of 13 neighborhoods in Oakville. Park, Landscaping and Gas Station are more common in this neighborhood.

Cluster 3: Kerr Village, Iroquois Ridge North and Iroquois Ridge South

	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
1	Kerr Village	Playground	Home Service	Stables	Coffee Shop	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run
6	Iroquois Ridge North	Playground	Pizza Place	Dog Run	Pool	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Deli / Bodega
7	Iroquois Ridge South	Playground	Pizza Place	Dog Run	Pool	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Deli / Bodega
10	River Oaks	Playground	Sandwich Place	Coffee Shop	Gastropub	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run

Cluster 3 has 4 of 13 neighborhoods in Oakville. These neighborhoods have more entertainment facilities, such as park, swimming pool and playground.

Cluster 4: Palermo

	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
9	Palermo	Gastropub	Middle Eastern Restaurant	Video Game Store	Grocery Store	Gas Station	French Restaurant	Fast Food Restaurant	Falafel Restaurant	Electronics Store	Dog Run

Cluster 4 only has one neighborhood. Pubs are popular than restaurants in here, and there is few outdoor facilities.

6. Conclusion:

In this project, based on the current situation of COVID-19 pandemic, we choose a city in Greater Toronto Area with less confirmed cases to analyze its neighborhoods. K-Mean algorithm helps me to cluster neighborhoods into four groups which could help new immigrants or people who want to start a new business making decisions more accurately.