

# **IBM Data Science Professional - Capstone Project – Week 5**

## **The Battle of Neighborhoods**

### **Report**

#### **A. Introduction**

The city of Toronto is recognized as the financial capital of Canada. People from around the world have settled here, making it a vibrant multi-cultural society, representing very diverse population. It respects and celebrates multiple cultures from East & South Asia, Middle East, Europe, Africa, Caribbean islands, Latin America and many other regions. Toronto offers many business opportunities as the population keeps growing due to the liberal immigration policy of the government. Real estate in Toronto, both residential and commercial has shown over 8-10% increase in price per sq. ft. year over year, making it lucrative and at the same time highly competitive and risky to start a new business. Any new business opportunity needs to be analysed carefully to mitigate potential risks and to make an informed prudent decision to ensure decent Return on Investment (ROI).

#### **B. Business Problem**

Toronto celebrates cuisines and cultures from around the world. Restaurants offering international cuisines have sprung up all around the city. There is now a restaurant at every block in most business districts and affluent residential hubs. Especially Indian restaurants offering tasty and spicy food have become very popular in recent years. Starting a new restaurant offering Indian cuisine can be a good business opportunity, but will it survive in the long-run in post COVID-19 environment? The hospitality industry has been adversely affected in 2020. Selecting the right location to start a new restaurant in Greater Toronto Area (GTA) is the most important decision.

#### **C. Finding the right location**

As a Marketing Guru would say... The most important criteria for a restaurant to succeed in the long run after quality of food served is "Location, Location, Location". It is important to strategically determine the location of the restaurant which can be frequented not only by South Asians but also from people from around the world who enjoy good tasty food. Should it be opened near a business district, tourist destination, neighbourhood with dense Asian population, Shopping Malls, Entertainment district? OR is there any other criteria? The options are many but, the main question is where can you make maximum ROI? Many factors need to be considered to decide the right location.

#### **D. Target Audience**

My client wants to open business especially in the affluent "North York" area within the Greater Toronto Area (GTA), so the focus is on this area during my analysis. The objective of this exercise is to recommend the best location in the "North York" area to start the new restaurant offering Indian cuisine. This report aims to provide rationale along with the recommendation to make an informed decision.

## E. Data

Information from sources linked below have been used to determine the best location to start the new Indian restaurant in North York, Toronto, ON, Canada.

To segment the neighbourhoods and explore them, we will need the latitudes and longitudes of each neighbourhood in the Toronto area. This data is readily available on the web on Wikipedia.

1. The Toronto neighbourhood data is available from this web location for free: URL: [https://en.wikipedia.org/wiki/List\\_of\\_postal\\_codes\\_of\\_Canada:\\_M](https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M) . This is the same data as used in earlier assignment.
2. The Geospatial data is available from this web location. URL: [http://cocl.us/Geospatial\\_data](http://cocl.us/Geospatial_data)

In order to segment the neighborhoods and explore them, longitude and latitude data of each Toronto neighborhood is required. The region of interest in Toronto has 10 Boroughs and 103 Neighborhoods.

	Postal Code	Borough	Neighborhood	Latitude	Longitude
0	M1B	Scarborough	Malvern, Rouge	43.806686	-79.194353
1	M1C	Scarborough	Rouge Hill, Port Union, Highland Creek	43.784535	-79.160497
2	M1E	Scarborough	Guildwood, Morningside, West Hill	43.763573	-79.188711
3	M1G	Scarborough	Woburn	43.770992	-79.216917
4	M1H	Scarborough	Cedarbrae	43.773136	-79.239476

3. The neighborhood data was used in the Clustering and Segmenting assignment in the previous week and the CSV file already created was reused for this assignment.
4. Foursquare Venues categories will be used from this URL location:

Toronto city's geographical co-ordinates data can be utilized to pass through the APIs offered by Foursquare. This will be use to obtain venues information from Foursquare.

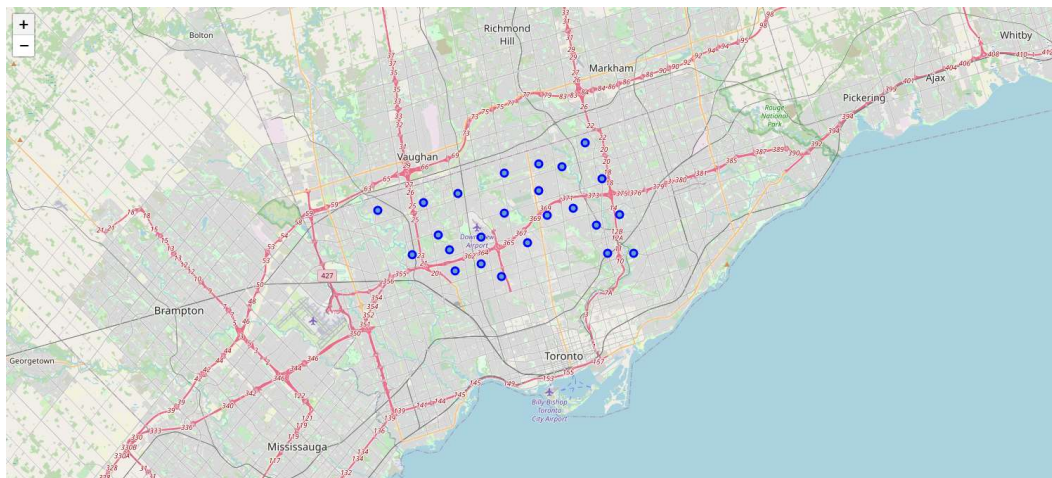
URL : <https://developer.foursquare.com/docs/build-with-foursquare/categories/>

In addition, the category ID for Indian restaurant is used: 4bf58dd8d48988d10f941735

## F. Methodology

In this project methodology used in the previous week (Week 3) lab will be used. The first 5 rows of the neighborhood data is shown below.

	Postal Code	Borough	Neighborhood	Latitude	Longitude
0	M2H	North York	Hillcrest Village	43.803762	-79.363452
1	M2J	North York	Fairview, Henry Farm, Oriole	43.778517	-79.346556
2	M2K	North York	Bayview Village	43.786947	-79.385975
3	M2L	North York	York Mills, Silver Hills	43.757490	-79.374714
4	M2M	North York	Willowdale, Newtonbrook	43.789053	-79.408493

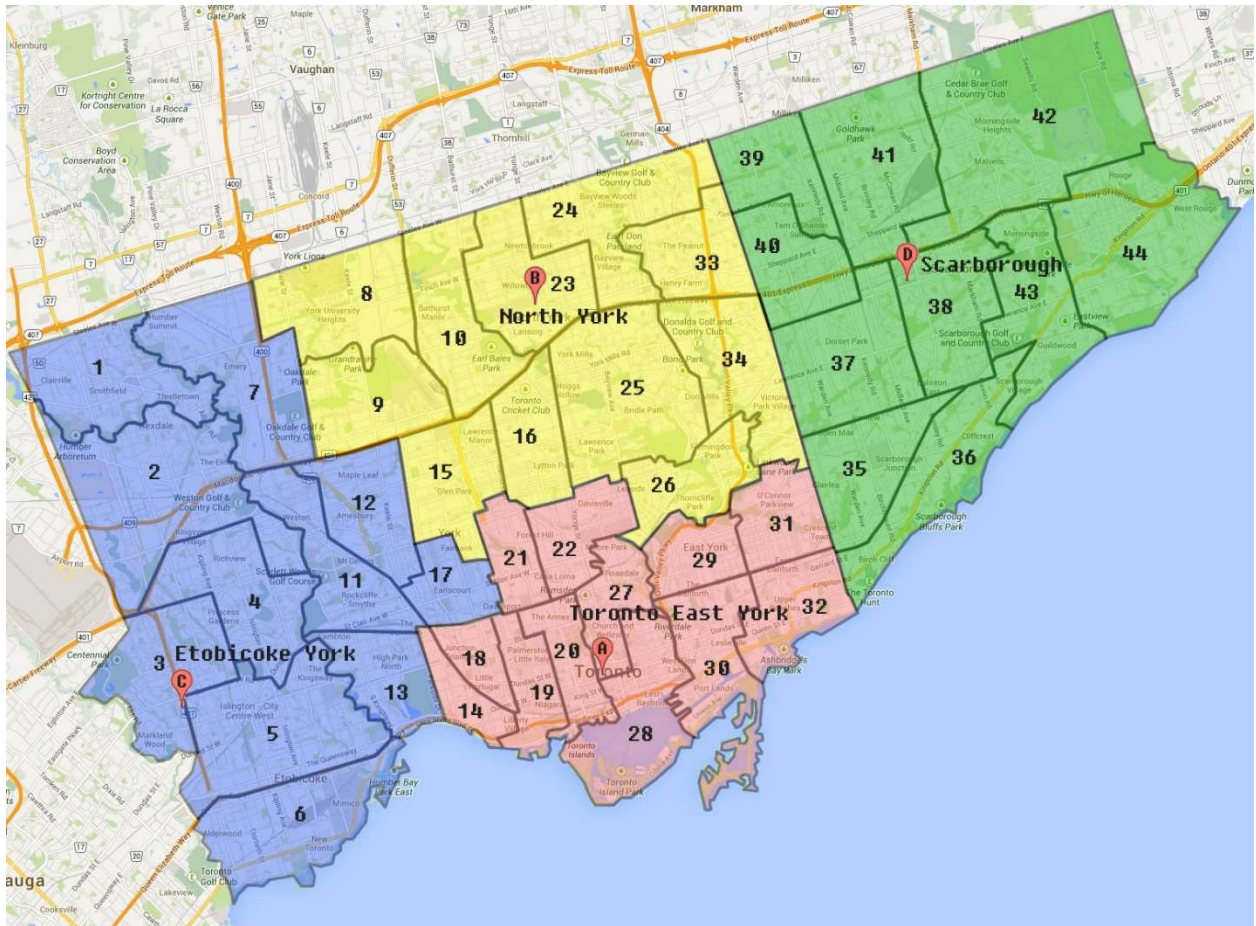


**Neighbourhoods of interest in North York, Toronto**



**Zoom-In view of locations of interest in North York, Toronto**





**Geographic boundaries of North York region in the Greater Toronto Area (GTA)**

Source: <https://urbantoronto.ca/news/2016/09/toronto-seeking-publics-comments-ward-boundary-review>

Combining data from the above database and information obtained from Foursquare was used. Feature provided by Foursquare APIs was used to produce results for specific Boroughs in “North York”, Toronto. This is the region my assumed client is interested in opening a new restaurant. Thereafter, Explore function in Foursquare API was used to get Indian Restaurants in each neighborhood.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Fairview, Henry Farm, Oriole	43.778517	-79.346556	Good Karma	43.778239	-79.343575	Indian Restaurant
1	Fairview, Henry Farm, Oriole	43.778517	-79.346556	Vatica	43.775762	-79.330994	Chaat Place
2	Fairview, Henry Farm, Oriole	43.778517	-79.346556	Iqbal Kebab & Sweets Centre	43.774032	-79.341003	Indian Restaurant
3	Willowdale, Newtonbrook	43.789053	-79.408493	Earth Indian Restaurant	43.787524	-79.417466	Indian Restaurant
4	Willowdale, Newtonbrook	43.789053	-79.408493	Tandori Indian Cuisine	43.780807	-79.416185	Indian Restaurant

### Data dimensions

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NorthYork_venues_IndianRestaurant.shape
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(24, 7)

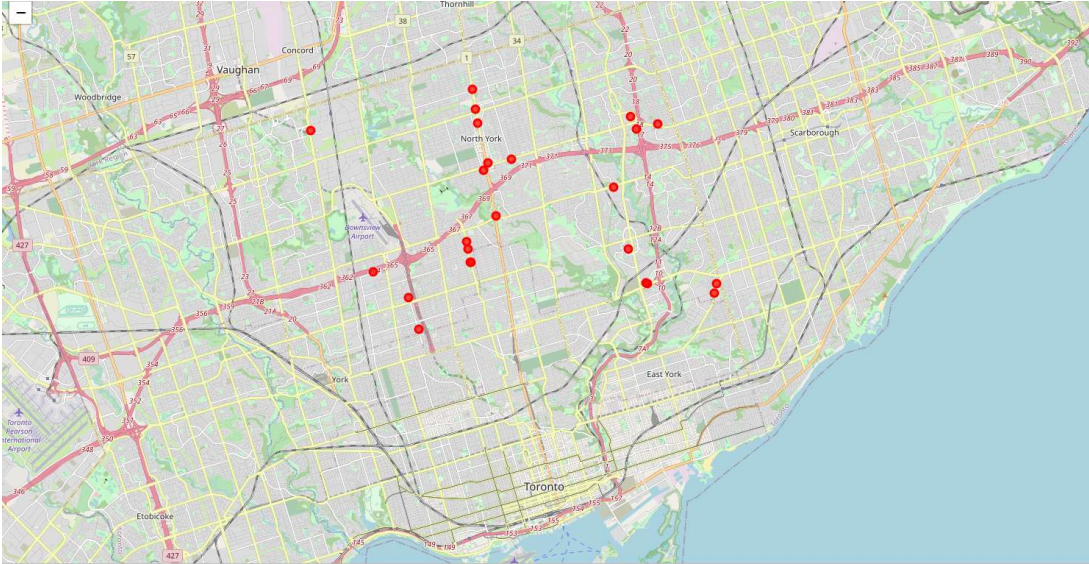
Neighborhoods and Venues of interest grouped according to geographic location to determine accuracy:

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Bedford Park, Lawrence Manor East	4	4	4	4	4	4
Don Mills	4	4	4	4	4	4
Fairview, Henry Farm, Oriole	3	3	3	3	3	3
Glencairn	2	2	2	2	2	2
Lawrence Manor, Lawrence Heights	1	1	1	1	1	1
Northwood Park, York University	1	1	1	1	1	1
Victoria Village	2	2	2	2	2	2
Willowdale, Newtonbrook	2	2	2	2	2	2
Willowdale, Willowdale East	3	3	3	3	3	3
York Mills West	2	2	2	2	2	2

In addition to Indian Restaurant, Indian Chinese Restaurant and Chaat Place were other popular venues in the region. Indian Chinese Restaurant offer Chinese dishes added with Indian spice and masala taste. Chaat Place are another Fast Food variety of Indian cuisine, more eaten as snacks.

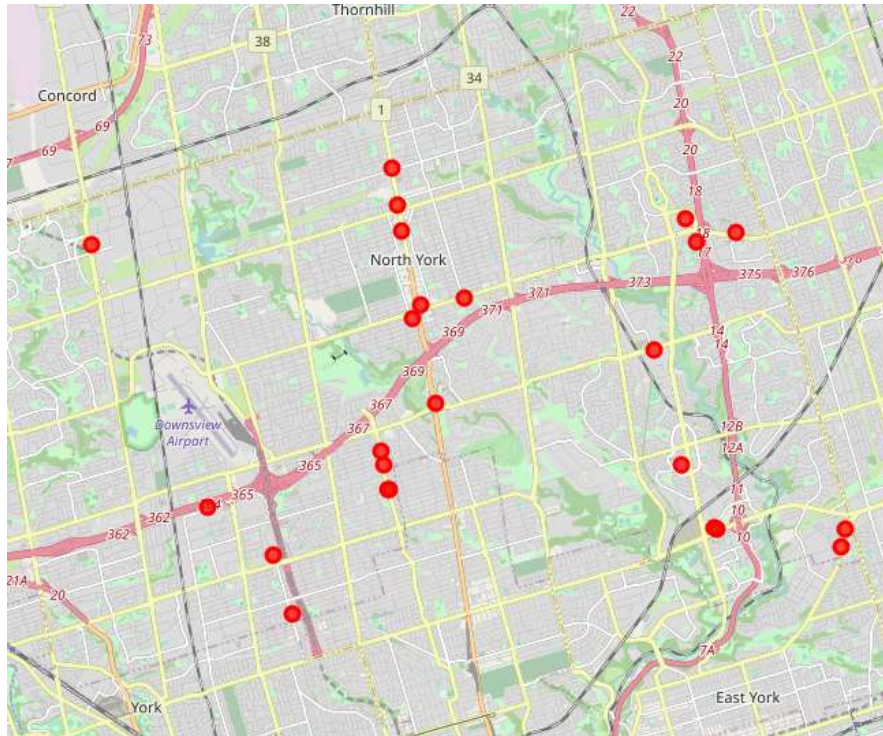
	Neighborhood	Chaat Place	Indian Chinese Restaurant	Indian Restaurant
0	Fairview, Henry Farm, Oriole	0	0	1
1	Fairview, Henry Farm, Oriole	1	0	0
2	Fairview, Henry Farm, Oriole	0	0	1
3	Willowdale, Newtonbrook	0	0	1
4	Willowdale, Newtonbrook	0	0	1

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
0	Bedford Park, Lawrence Manor East	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
1	Don Mills	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
2	Fairview, Henry Farm, Oriole	Indian Restaurant	Chaat Place	Indian Chinese Restaurant
3	Glencairn	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
4	Lawrence Manor, Lawrence Heights	Indian Restaurant	Indian Chinese Restaurant	Chaat Place



Locations of existing Indian Restaurants in North York, Toronto





**Zoom-in view of Locations of existing Indian Restaurants in North York, Toronto**

	Neighborhood	Chaat Place	Indian Chinese Restaurant	Indian Restaurant
0	Bedford Park, Lawrence Manor East	0.000000	0.000000	1.000000
1	Don Mills	0.000000	0.000000	1.000000
2	Fairview, Henry Farm, Oriole	0.333333	0.000000	0.666667
3	Glencairn	0.000000	0.000000	1.000000
4	Lawrence Manor, Lawrence Heights	0.000000	0.000000	1.000000
5	Northwood Park, York University	0.000000	0.000000	1.000000
6	Victoria Village	0.000000	0.000000	1.000000
7	Willowdale, Newtonbrook	0.000000	0.000000	1.000000
8	Willowdale, Willowdale East	0.000000	0.333333	0.666667
9	York Mills West	0.000000	0.000000	1.000000

## G. Results

Further, K-means clustering algorithm is used to group the neighborhoods into clusters. Also, the Folium library is used to visualize the neighborhoods in North York.

K-means algorithm to cluster data area with less number of Indian Restaurants:

### Cluster 0

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
4	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
6	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
9	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
10	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
12	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
17	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
18	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
19	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place
20	North York	0.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place

### Cluster 1

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
5	North York	1.0	Indian Restaurant	Indian Chinese Restaurant	Chaat Place

### Cluster 2

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
1	North York	2.0	Indian Restaurant	Chaat Place	Indian Chinese Restaurant

### Cluster 3

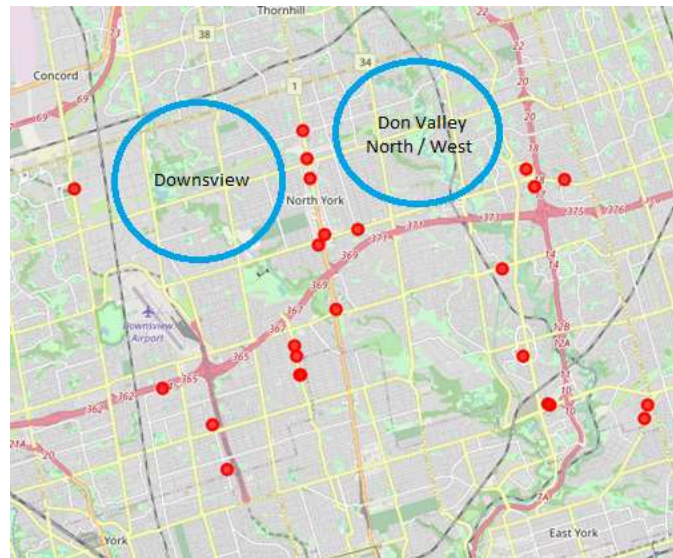
Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
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### Cluster 4

Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
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Based on above cluster analysis, Downsview and Don Valley North, Don Valley West are the best locations to open a new Indian Restaurant.



## H. Discussion

Here are some observations and some recommendations that I can make on the outcome of this Capstone project.

This analysis is based on data available in the public domain. The results depend on the accuracy of the data available. Also, the results are based on Indian restaurants. People may also prefer to experience other international cuisines. This competitive analysis has not been made in this project.

Anecdotally, I am aware that the Downsview area is not a very affluent area. This area could be dropped from further consideration. No specific household income information has been objectively analyzed for different North York neighborhoods as part of this project.

## I. Conclusion

The analysis and recommendation made in this report are based on the quality of data available through the public sources referred in this analysis.

Based on the recommendation of the clusters identified, a venue with lowest competition can be identified for investment in the Don Valley North / Don Valley West neighborhoods. It is expected that a new Indian Restaurant in this area may prove to be a sound investment.

The methodology used in this Capstone project could be leveraged to determine appropriate location for other kind of businesses.