

Capstone Project

# **The Battle of Neighborhoods**

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## Introduction

Early Learners Inc is interested in exploring the location and distribution of non-private schools in Toronto, as part of an ongoing product development effort.

This study therefore seeks to explore the distribution of non-private schools across Toronto region. It analyses each neighborhood and identifies the leading location in terms of count and how these helps to group the schools for the purpose of further research works.

## Data

**School Data:** For the purpose of this project, I sourced the school data from Toronto open data web page. It is a geographical file covering the City of Toronto that contains all the point location of schools, including private schools. The data was last refreshed on Feb 4, 2019.

**Postal Code:** I got the Toronto Postal Codes from [Wikipedia](#).

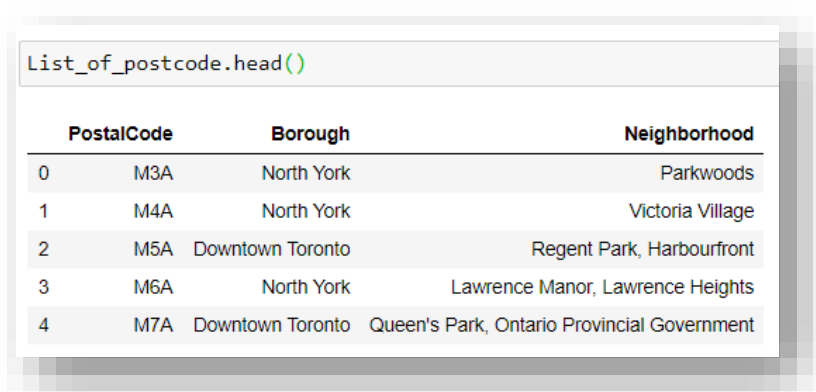
**Venue Data:** I used the Foursquare API to get the common venues based on the borough and neighborhood.

## Methodology

Using Python development environment, I managed my code changes using GitHub version control features.

The list of postal codes for Toronto Region from Wikipedia, shows the Borough, Neighborhood and corresponding Postal Codes.

Figure 1:



```
List_of_postcode.head()
```

	PostalCode	Borough	Neighborhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Regent Park, Harbourfront
3	M6A	North York	Lawrence Manor, Lawrence Heights
4	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government

The Toronto school schedule listed 42 Private and 56 Non-private school type. Total school count was 99.

Analysis below shows the number of schools based on municipality and sorted in descending order:

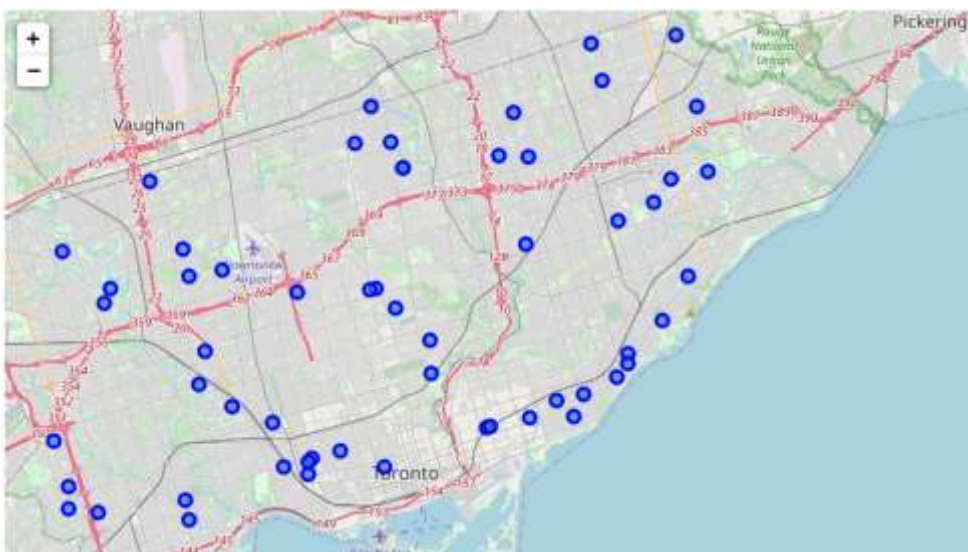
Figure 2

```
school_type.sort_values(by=['municipality','count_of_schools'], ascending = False)
```

	municipality	school_type_desc	count_of_schools
8	former Toronto	Non Private	15
9	former Toronto	Priv	12
6	York	Non Private	2
7	York	Priv	2
4	Scarborough	Non Private	16
5	Scarborough	Priv	5
3	North York	Priv	23
2	North York	Non Private	13
1	Etobicoke	Non Private	9
0	East York	Non Private	2

Next, I merged the list of non-private schools with the postal code data and using the python folium library I visualized the school locations as shown in figure 3 below.

Figure 3:



**Exploring Venue Categories:** I explored further by getting the list and categories of the venues in each location. A staggering 2,028 venues were returned by Foursquare, and these contains 235 unique venue categories. We could easily review each category based on our interest, for instance I listed venues in the “Bookstore” category as follows:

```
nps_nearby_venues_grouped = nps_nearby_venues_merged[nps_nearby_venues_merged['categories'] == 'Bookstore'].reset_index(drop=True)
nps_nearby_venues_grouped
```

	name	categories	lat	lng	srclatitude	srclongitude	srcpostalcode	srcBorough	srcNeighborhood
0	Indigo	Bookstore	43.727006	-79.451883	43.726614	-79.444255	M6A	North York	Lawrence Manor, Lawrence Heights
1	Chapters	Bookstore	43.727127	-79.451858	43.726614	-79.444255	M6A	North York	Lawrence Manor, Lawrence Heights
2	The Comic Room	Bookstore	43.754258	-79.244319	43.762576	-79.244883	M1H	Scarborough	Cedarbrae
3	Swipe Books on Advertising & Design	Bookstore	43.648156	-79.394070	43.655774	-79.395708	M5T	Downtown Toronto	Kensington Market, Chinatown, Grange Park
4	Monocle	Bookstore	43.654839	-79.420559	43.662430	-79.419834	M6G	Downtown Toronto	Christie
5	Another Story Bookshop	Bookstore	43.648544	-79.449827	43.655866	-79.451811	M6P	West Toronto	High Park, The Junction South
6	A Good Read	Bookstore	43.649470	-79.450339	43.655866	-79.451811	M6P	West Toronto	High Park, The Junction South
7	Circus Books and Music	Bookstore	43.679894	-79.340049	43.671815	-79.338479	M4J	East York	East Toronto, Broadview North (Old East York)
8	Circus Books and Music	Bookstore	43.679894	-79.340049	43.672564	-79.336621	M4J	East York	East Toronto, Broadview North (Old East York)

**Exploring the Top Venues:** I extracted the top 5 venues per neighborhood and their respective frequencies for the purpose of in-depth review, (see the excerpt below).

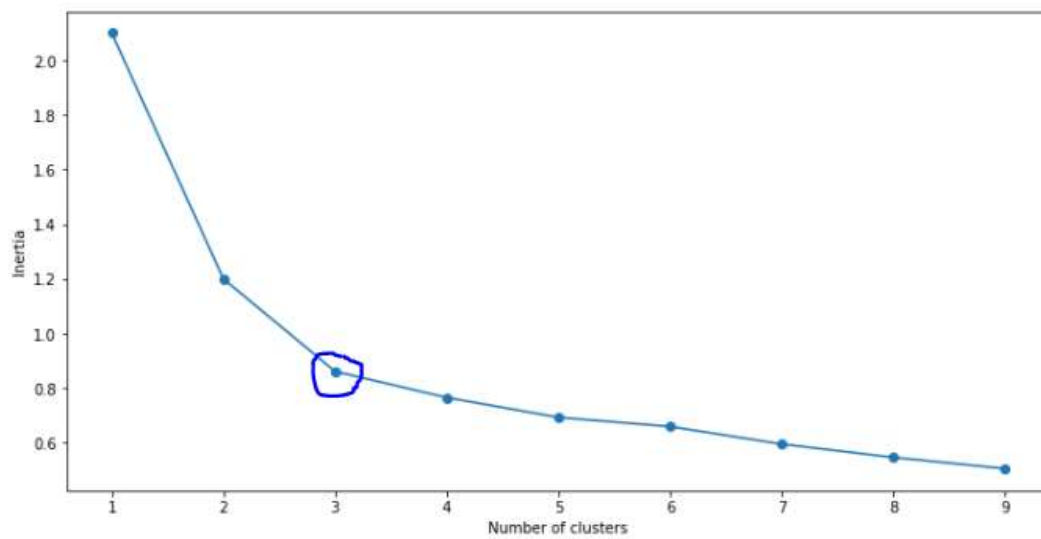
```
top5_venues_df[:5]
```

	hood	TopVenue1 freq	TopVenue2 freq	TopVenue3 freq	TopVenue4 freq	TopVenue5 freq
0	Bayview Village	Café 0.1	Coffee Shop 0.06	Clothing Store 0.06	Restaurant 0.04	Shopping Mall 0.04
1	Bedford Park, Lawrence Manor East	Sushi Restaurant 0.07	Coffee Shop 0.06	Bakery 0.06	Italian Restaurant 0.06	Sandwich Place 0.04
2	Birch Cliff, Cliffside West	Coffee Shop 0.06	Park 0.08	Gym 0.04	Pizza Place 0.04	Grocery Store 0.04
3	Cedarbrae	Indian Restaurant 0.11	Coffee Shop 0.11	Bank 0.08	Bakery 0.08	Gas Station 0.05
4	Christie	Café 0.11	Korean Restaurant 0.1	Coffee Shop 0.05	Grocery Store 0.04	Cocktail Bar 0.03

**Clustering:** From the sklearn module, I used the k-Means clustering functionality which adopts an unsupervised learning approach, to detect and present clusters of schools based on the characteristics of their location or neighborhood. Using the merged dataset of the schools and neighborhoods, we now have some location features for these schools that could be used for the clustering exercise.

For the purpose of this analysis, I decided to use the elbow method for selecting my number of clusters. It appears 3 is a recommended number of clusters to adopt based on this outcome. This is shown below:

Text(0, 0.5, 'Inertia')



## Results

The map below is the visualization of the clusters of schools based on the k-Mean clustering algorithm. I have also shown the list of the schools that belong in each cluster.



```

# -----
Number of schools in Cluster 1: 1
# -----
11      Ben Heppner Vocal Music Academy

# -----
Number of schools in Cluster 2: 1
# -----
33      Blessed Pier Giorgio Frassati Catholic Element...

# -----
Number of schools in Cluster 3: 55
# -----

0              Avondale Public School
1      Avondale Secondary Alternative School
2              Bala Avenue Community School
3              Balmy Beach Community School
4              Banting and Best Public School
5              Baycrest Public School
6              Bayview Middle School
7              Beaches Alternative Jr School
8      Beaumonde Heights Jr Middle School
9              Bedford Park Public School
10             Bellmere Jr Public School
12      Bendale Business and Technical Institute
13              Bendale Jr Public School
14      Bennington Heights Elementary School
15              Berner Trail Jr Public School
16      Bessborough Drive Elementary and Middle School
17              Beverley Heights Middle School
18              Beverley School
19              Beverly Glen Jr Public School
20              Bickford Centre
21              Birch Cliff Heights Public School
22              Birch Cliff Public School
23      Birchmount Park Collegiate Institute
24              Bishop Allen Academy
25      Bishop Marrocco Thomas Merton Catholic Seconda...
26              Blacksmith Public School
27              Blake St Jr Public School
28              Blantyre Public School
29              Blaydon Public School
30      Blessed Archbishop Romero Catholic Secondary S...
31      Blessed Cardinal Newman Catholic High School
32      Blessed Margherita of Citta Di Castello Cathol...
34      Blessed Pope Paul VI Catholic Elementary School
35      Blessed Sacrament Catholic Elementary School
36      Blessed Trinity Catholic Elementary School
37              Bliss Carman Sr Public School
38              Bloor Collegiate Institute
39              Bloordale Middle School
40              Bloorlea Middle School
41              Blythwood Jr Public School
42      Bon Berger Catholic Elementary School
43      Bowmore Road Jr and Sr Public School
44              Boys Leadership Academy
45              Braeburn Jr School
46              Brain Public School

```

47	Brebeuf College School
48	Briarcrest Jr School
49	Bridlewood Jr Public School
50	Sunnylea Jr School
51	Brimwood Boulevard Jr Public School
52	Broadacres Jr School
53	Broadlands Public School
54	Brock Jr Public School
55	Brockton Learning Centre
56	Brookhaven Public School

## Discussion

It is pleasing to know that most of the schools were grouped into one large category. Only two schools (Blessed Pier Catholic Elementary School and Ben Heppner Vocal Music Academy) were alone in two remaining groups respectively. These two schools will be studied on their own merit to understand the specific features that make them unique.

## Conclusion

The categorization does not reveal any major divergence among the non-private schools in Toronto region, based on neighborhood characteristics.

Overall, this preliminary analysis provides a very useful and strong support to the ongoing research at Early Learners Inc, Canada. After a critical review of the results, we should be able to make a better decision regarding the new product development and delivery channels in the most optimal way to serve these no-private schools.