

INTRODUCTION:

“Acme” is the name of my consulting company. A client has retained Acme to help with relocation to Toronto, Ontario. The client has dozens of people for relocation and need to find suitable neighborhoods to live in the city. This is challenging because the people making the move:

- a) are not familiar with Toronto, and
- b) they have diverse interests.

The diverse interests mean some employees want neighborhoods with lots of local atmosphere and wide variety of restaurants. Other employees want a quieter neighborhood. Additionally, the client wants to keep their employees safe so they asked for crime rates for the different neighborhoods. Because the move is soon, the client asked Acme identify groups of neighborhoods which are similar.

For this project, Acme will deliver:

- a) map of the Toronto identifying different areas in the city,
- b) grouping of similar neighborhoods with a ranking of types of local amenities and crime rates.

By reviewing the map and the groupings, the client’s employees will be able to identify suitable areas to look for homes based on their interests, needs and crime rate.

DATA SOURCES:

Local amenities will be derived from Foursquare’s Venue Data and will be based on Toronto postal codes and within a radius of 500 meters (<https://api.foursquare.com>). For the Toronto Area, 273 “amenities” were found such as: Yoga studios, Gastropubs, Performing Arts Venue and Sports Bars.

2019 Crime Data from the Toronto Police will be used. Unfortunately, the Toronto crime data does not include postal codes and sometimes uses different names for the neighborhoods. The data set needed significant work to determine postal codes for neighborhoods. Those neighborhoods inconsistently named were researched using Zillow.com to determine a common postal code for the area. These were assembled in a Excel spreadsheet, combined with Toronto crime information and uploaded for merging with the Venue data. (<https://data.torontopolice.on.ca>).

Toronto Police group the Crime Data was divided into five types:

- Assault
- Auto Theft
- Break and Enter
- Robbery
- Theft Over (meaning theft over a \$5000 Canadian)

METHODOLOGY

This is an unsupervised machine learning project since the goal is to divide the different Toronto neighborhoods into groups based on commonality of amenities and crime statistics. This suggests a clustering analysis of the combined amenity and crime data. There are several clustering algorithms but decided to use K-means since it is a basic type and is easily interpreted.

Based on previous experience with clustering Foursquare's Toronto amenity data (referred to by Foursquare.com as "venue"), it was determined the number of clusters should be seven. Seven clusters provided a balance between having a reasonable number of members in each cluster while having variation between the clusters.

For each cluster, a ranking was developed for each neighborhood in the cluster. Ranking was based how many times an amenity (venue) showed up in an area, for example: the most common could be a "Pub", the second most common a "Park", the third a "Japanese Restaurant". The 10 most common venues were listed for each area.

It is important to note that crimes could be included in the rankings. Areas with high crimes would show up the different types of crimes showing up in the rankings. For example: in Toronto's Borough of York, the ranking for one neighborhood had "Park" most common followed by "Assault", "Auto Theft", "Break and Enter", "Robbery", "Theft over (\$5000)" followed by "Dog Run". This would be an area the client's employees should avoid.

RESULTS

The Toronto area is shown in Figure 1. The colored dots show the different Neighborhoods around the city, with the same color indicating areas having similar amenities and/or crime information.

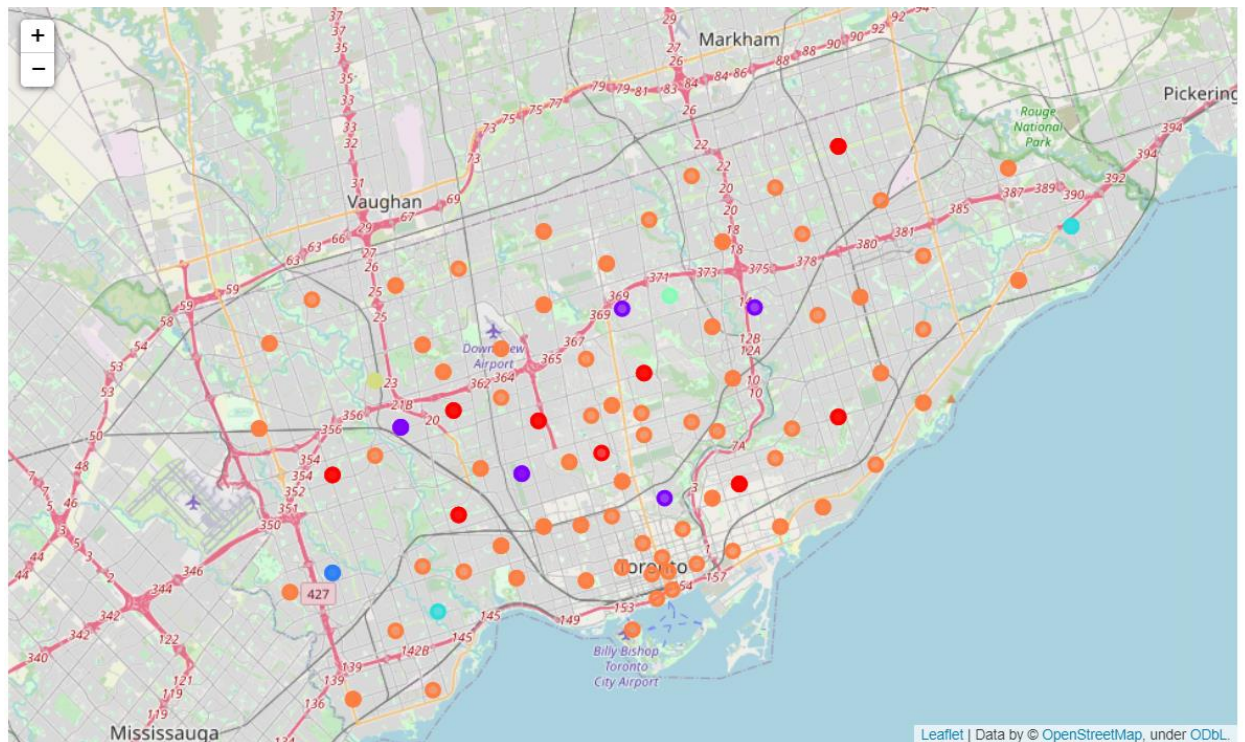


Figure 1. Toronto Map showing Neighborhoods

Figure 1 shows main dots of the same color which indicates these neighborhoods share many of the same amenities and crime rates. Notice there is a high concentration of neighborhoods in Toronto center close to shore of Lake Ontario.

To help the people relocating to Toronto, a descriptive title was given to each grouping. The title describes some of the common features that make each of the grouping unique.

Each groupings of similar neighborhoods (clusters) will be discussed separately.

“Foodie and Nightlife” Neighborhood

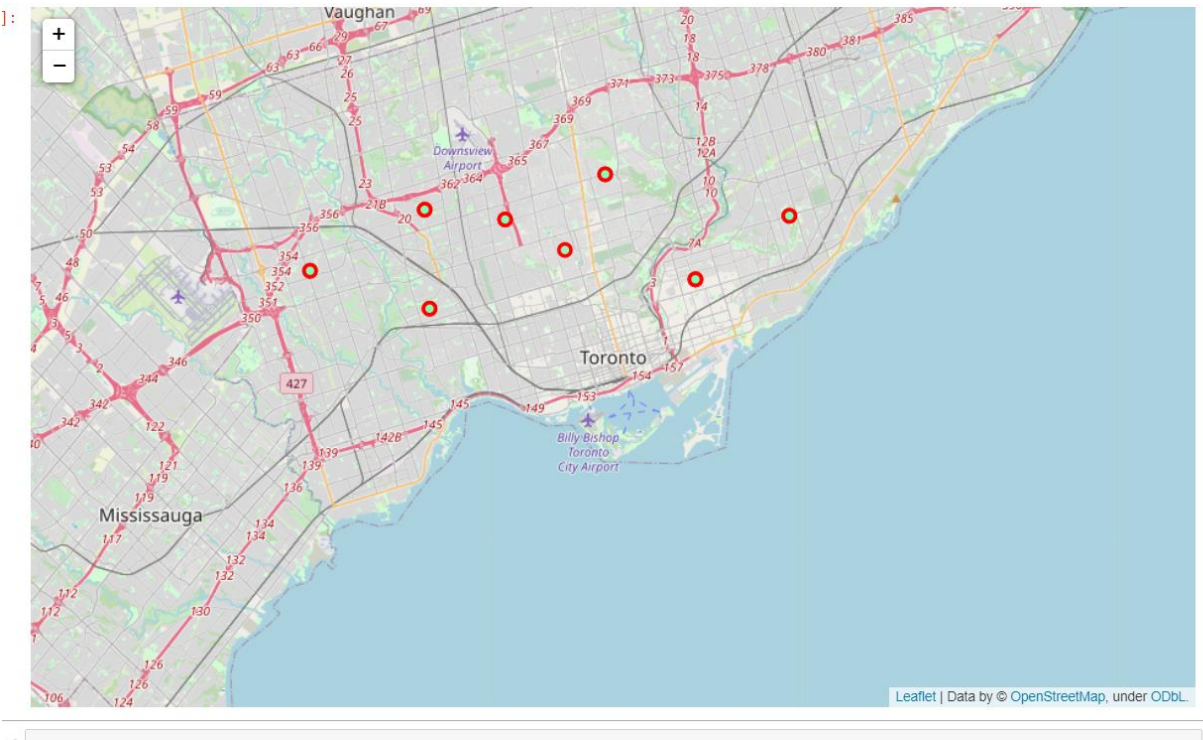


Figure 2. Toronto Map showing “Foodie” Neighborhoods

There are eight neighborhoods in the “Foodie and Nightlife” group as shown in Figure 2.

These neighborhoods are characterized by a wide variety of restaurants including Japanese, Sushi, Greek, Dim Sum, Breakfast Shops, Bakeries etc. Additionally, there are gourmet shops in some of these neighborhoods. For nightlife, there is a high concentration of pubs and breweries in these areas. Another characteristic of these neighborhood is there are large number of parks in a short distance (< 500 meters)

The crime in this area would be medium to low relative to the other neighborhood groupings. The types of crime in these neighborhoods are economically motivated such as Auto Theft, Theft Over \$5000, and Robbery.

Table 1 shows some of the neighborhoods in this grouping.

TABLE 1: Foodie and Nightlife								
Area	1 st most common	2nd most common	3rd most common	4th most common	5 th most common	6th most common	7th most common	8th most common
North York	Pub	Park	Japanese Restaurant	Bakery	Pizza Place	Robbery	Assault	Auto Theft
North York	Pub	Park	Japanese Restaurant	Bakery	Pizza Place	Assault	Theft Over	Robbery
East York	Park	Intersection	Convenience Store	Assault	Theft Over	Robbery	Break and Enter	Auto Theft
East York	Park	Intersection	Convenience Store	Assault	Break and Enter	Robbery	Theft Over	Auto Theft

Outside Entertainment Neighborhood

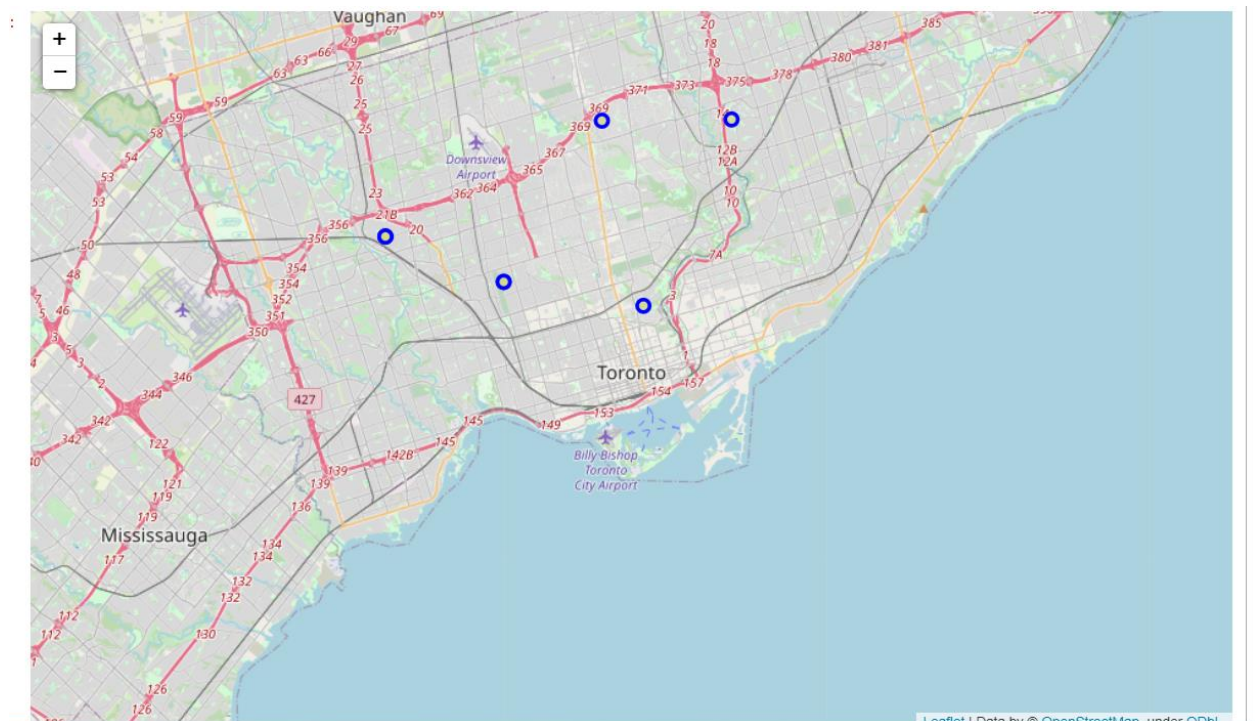


Figure 3. Toronto Map showing “Outside Entertainment” Neighborhoods

There are five neighborhoods in the “Outside Entertainment” group and are shown in Figure 3.

The Outside Entertainment neighborhoods are characterized by having Parks as the most common feature. While parks are the most common feature, there are other types of entertainment including pools and video stores, and in some area “escape rooms”.

The crime in this area would be medium to high relative to the other neighborhood groupings. The types of crime in these neighborhoods are vary economically motivated such as Auto Theft, Theft Over \$5000, and Robbery to assault. The Acme consulting company suggests carefully consider the crime in these areas before moving into these neighborhoods.

Table 2 shows some of the neighborhoods in this grouping. Note that crime is more common in these areas than in the “Foodie and Nightlife” Group.

TABLE 2: Outside Entertainment								
Area	1 st most common	2nd most common	3rd most common	4th most common	5 th most common	6th most common	7th most common	8th most common
North York	Park	Food & Drink Shop	Robbery	Break and Enter	Assault	Auto Theft	Theft Over	Distribution Center
York	Park	Women's Store	Pool	Robbery	Break and Enter	Theft Over	Assault	Auto Theft
York	Park	Women's Store	Pool	Robbery	Assault	Auto Theft	Theft Over	Break and Enter
York	Park	Auto Theft	Assault	Break and Enter	Robbery	Theft Over	Deli / Bodega	Escape Room

Printers Neighborhood

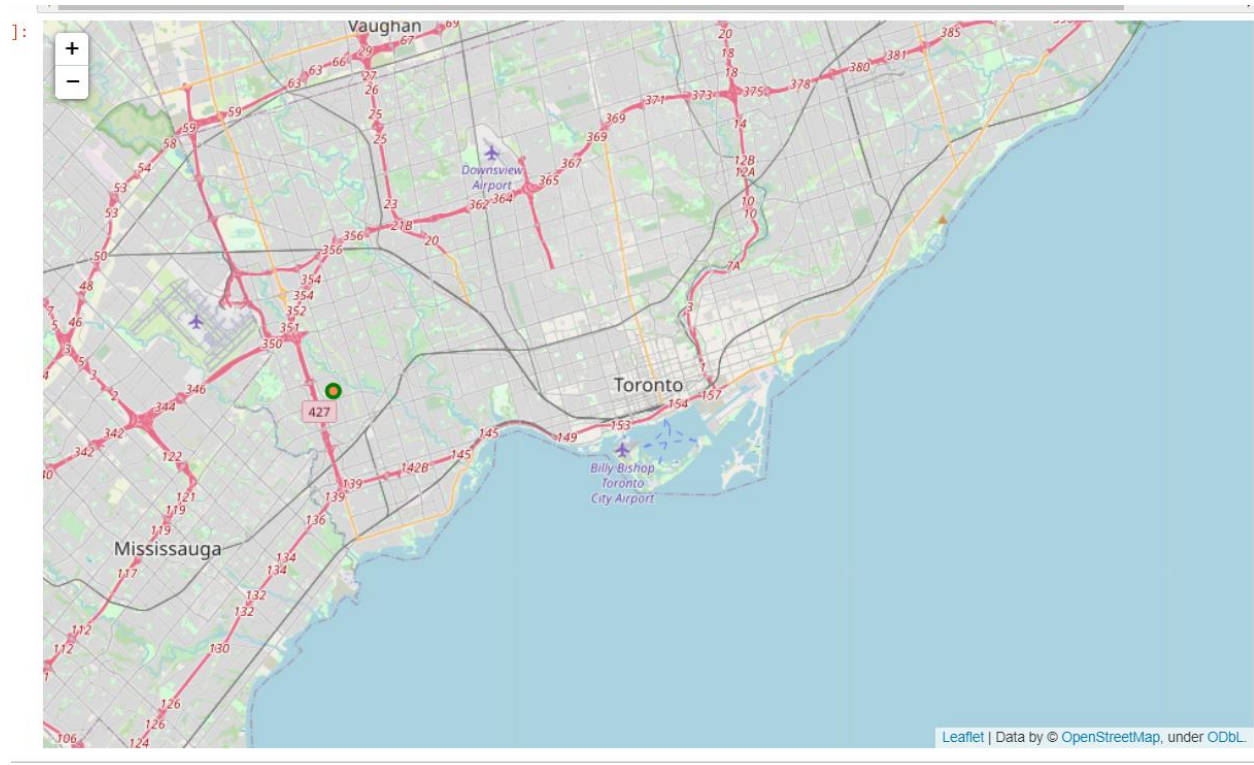


Figure 4. Toronto Map showing “Printer” Neighborhoods

There is one neighborhood in the “Printer” group as shown in Figure 4.

These neighborhoods are characterized Print shops and crime. The crime in this area is relatively high compared to the other neighborhood groupings. The types of crime in these neighborhoods are vary economically motivated such as Auto Theft, Theft Over \$5000, and Robbery to assault. The Acme consulting company suggests carefully consider the crime in these areas before moving into these neighborhoods.

Table 3 shows some of the neighborhoods in this grouping. Note that crime is more common in these areas than in the “Foodie and Nightlife” and the “Outside Entertainment” groups.

TABLE 3: Printer								
Area	1 st most common	2nd most common	3rd most common	4th most common	5 th most common	6th most common	7th most common	8th most common
Etobicoke	Print Shop	Auto Theft	Robbery	Break and Enter	Theft Over	Assault	Dog Run	Dessert Shop
Etobicoke	Print Shop	Auto Theft	Theft Over	Break and Enter	Assault	Robbery	Dog Run	Dessert Shop

“Working Class” Neighborhoods

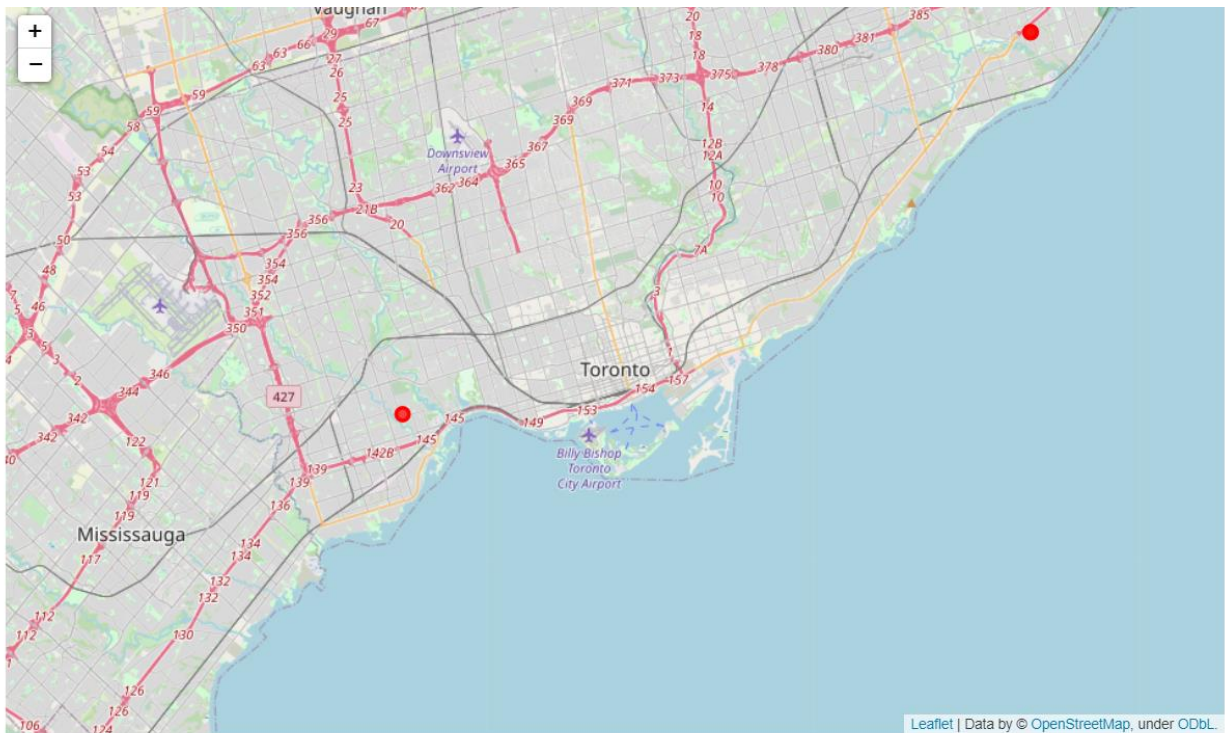


Figure 5. Toronto Map showing “Working Class” Neighborhoods

There are two neighborhoods in the “Working Class” group and are shown in Figure 5.

The Working Class area is characterized by having Bars and Construction/Landscaping businesses. This area also has working class jobs at the distribution center. Example of restaurants in these areas would be Diners and Donut Shops. Employment and amenities suggest a Working Class culture in the neighborhoods.

The crime in this area would be medium to high relative to the other neighborhood groupings. The types of crime in these neighborhoods are vary economically motivated such as Auto Theft, Theft Over \$5000, and Robbery to assault. The Acme consulting company suggests carefully consider the crime in these areas before moving into these neighborhoods.

Table 4 shows some of the neighborhoods in this grouping. Note that crime is more common in these areas than in the “Foodie and Nightlife” Group.

TABLE 4: Working Class								
Area	1 st most common	2nd most common	3rd most common	4th most common	5 th most common	6th most common	7th most common	8th most common
Scarborough	Bar	Construction & Landscaping	Auto Theft	Break and Enter	Assault	Theft Over	Robbery	Diner
Scarborough	Bar	Construction & Landscaping	Auto Theft	Break and Enter	Assault	Robbery	Theft Over	Diner
Etobicoke	Construction & Landscaping	Baseball Field	Break and Enter	Auto Theft	Robbery	Assault	Theft Over	Donut Shop

“Martial Arts” Neighborhood

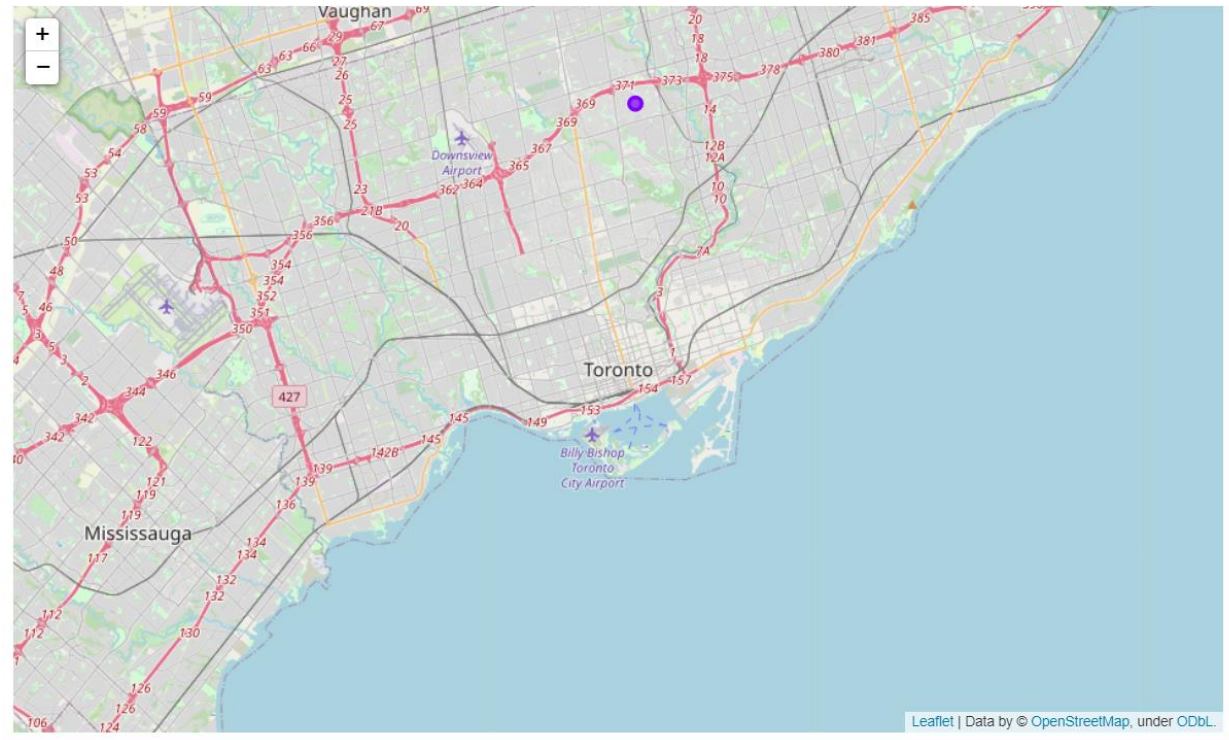


Figure 6. Toronto Map showing “Martial Arts” Neighborhood

There is a single neighborhood in the “Martial Arts” group and it is shown in Figure 6.

The Martial Arts area is characterized by having a Martial Arts School.

The crime is high relative to the other neighborhood groupings. The types of crime in these neighborhoods are vary economically motivated such as Auto Theft, Theft Over \$5000, and Robbery to assault. The Acme consulting company suggests carefully consider the crime in these areas before moving into these neighborhoods.

Table 5 shows the neighborhood in this grouping. Note that crime is more common in these areas than in the “Foodie and Nightlife” Group.

TABLE 5: Martial Arts								
Area	1 st most common	2nd most common	3rd most common	4th most common	5 th most common	6th most common	7th most common	8th most common
North York	Martial Arts School	Break and Enter	Robbery	Theft Over	Assault	Auto Theft	Dim Sum Restaurant	Diner

Baseball Neighborhood

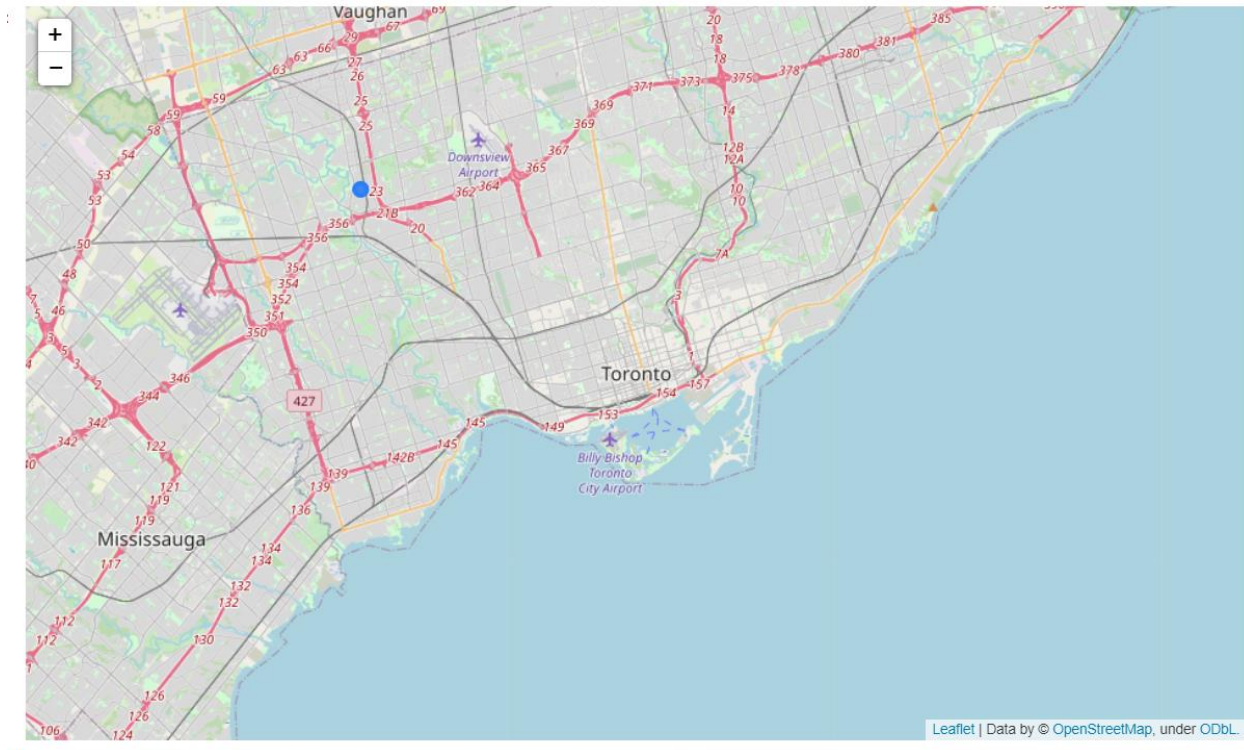


Figure 7. Toronto Map showing “Sports” Neighborhood

There is a single neighborhood in the “Baseball” group shown in Figure 7.

As expected, the Baseball group has a baseball field. Crime in the area is high but it is mainly economically motivated such as Auto Theft, Theft Over \$5000, and Robbery. The Acme consulting company suggests carefully consider the crime in these areas before moving into these neighborhoods.

Table 6 shows the neighborhood in this grouping. Note that crime is more common in these areas than in the “Foodie and Nightlife” Group.

TABLE 6: Baseball								
Area	1 st most common	2nd most common	3rd most common	4th most common	5 th most common	6th most common	7th most common	8th most common
North York	Baseball Field	Auto Theft	Assault	Robbery	Break and Enter	Theft Over	Donut Shop	Dim Sum Restaurant
North York	Baseball Field	Auto Theft	Theft Over	Assault	Break and Enter	Robbery	Donut Shop	Dim Sum Restaurant

Downtown & Shopping Neighborhoods



Figure 8. Toronto Map showing “Downtown and Shopping” Neighborhoods

There are sixty-six neighborhoods in the “Downtown and Shopping” group as shown in Figure 8.

As the group name implies, this includes the Downtown Toronto area but also other similar areas. These neighborhoods are characterized by a wide variety of amenities from restaurants to gyms, from Sporting goods stores to Health food shops. What distinguishes this group from the others is the wide variety of restaurants, entertainment, and places to go coupled with lower crime rates for most neighborhoods in the group.

Beside a wide range in restaurant options, there are department and specialty stores for shopping. Hockey arenas, tennis courts, movie theaters and parks are some of the entertainment options.

The crime in these areas is the lowest relative to the other neighborhood groupings. There are a few neighborhoods with higher crime rates but overall, these are some of the lowest crime rates in the area.

Table 7 shows some of the neighborhoods in this grouping.

TABLE 7: Downtown and Shopping.								
Area	1st most common	2nd most common	3rd most common	4th most common	5th most common	6th most common	7th most common	8th most common
Downtown Toronto	Coffee Shop	Park	Bakery	Pub	Theater	Breakfast Spot	Café	Dessert Shop
North York	Clothing Store	Women's Store	Gift Shop	Vietnamese Restaurant	Accessories Store	Boutique	Coffee Shop	Event Space
Downtown Toronto	Coffee Shop	Creperie	Beer Bar	Bar	Fried Chicken Joint	Mexican Restaurant	Park	Sushi Restaurant
Scarborough	Fast Food Restaurant	Assault	Auto Theft	Robbery	Theft Over	Break and Enter	Doner Restaurant	Dessert Shop

DISCUSSION and CONCLUSIONS

The client's employees will have plenty of options when selecting neighborhoods during the relocation to Toronto. The specific neighborhood chosen will depend on the personality of the employee. Some employees may want to go out in the evening, so either the "Foodie and Nightlife" or "Downtown and Shopping" may be good places to look. Others may want to be close to the Baseball fields so "Baseball" neighborhood may be best for them.

The decision on where to live in Toronto is ultimately up to the employee but this analysis will help reduce the time needed researching areas around the city.