THE BATTLE OF NEIGHBORHOODS AND VENUES

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1. INTRODUCTION

1.1. Introduction / Business Problem

Toronto is the provincial capital of Ontario and the most populous city in Canada, with a population of 2,731,571 as of 2016. The city is an international center of business, finance, arts, and culture, and is recognized as one of the most multicultural and cosmopolitan cities in the world.

There are some people interested to invest in a **small business or shop** in Toronto but they don't have sufficient information such as better neighborhoods, common venues, and what category of the venue there is not in a specific place. To answer all those doubts we can use modern computer techniques such as data analysis.

1.2. Data

The data used to solve the problem are from 3 main sources:

1. Wikipedia: In this web site, there is a list of Postal Codes from Toronto with its boroughs and neighborhoods. The file used is in format HTML. The data is cleaned for some Postal Codes that have not assigned yet but they are not relevant for our results.

2. Geospatial Coordinates file: This data corresponds to the coordinates of Postal Codes or neighborhoods of Toronto. The data is in CSV format and is joined with the list of Postal Codes data to obtain the main table with coordinates of each neighborhood.

3. Foursquare API: This API provides information-based experiences of people of places like venues of the neighborhoods that are analyzed in the present project.

2. METHODOLOGY

In this section, it will represent the main component of the report where it is discussing and described the exploratory data analysis that is done, and the machine learning technique that was used to cluster the data.

A first data frame was merging and preparing using a table of List of Postal Codes and geospatial coordinates of Toronto. The main characteristics or attributes that the data frame contain are Borough, Neighborhood, Latitude, and Longitude.

|	Borough	Neighborhood	Latitude	Longitude
0	North York	Parkwoods	43.753259	-79.329656
1	North York	Victoria Village	43.725882	-79.315572
2	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
3	North York	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
4	Downtown Toronto	Queen's Park, Ontario Provincial Government	43.662301	-79.389494

Next, it has used the folium library to visualize geographically Toronto and mark the neighborhoods studied and obtained from the data above. With this data, in advance, it will create clusters to know economic activities or categories of venues. The next image shows the main locations of the neighborhoods of Toronto. For reference, the coordinates of Toronto obtained are 43.6534817, -79.3839347.
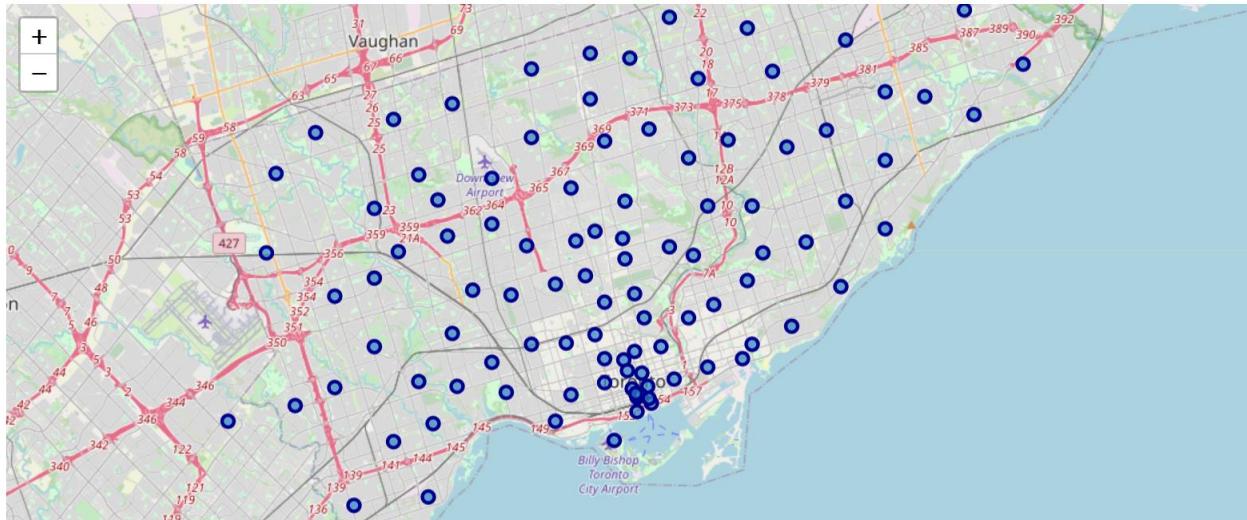

Using a machine learning technique, clustering, we obtained the next image where shows a map where the near neighborhoods are grouped. The yellow circles show a more density of neighborhoods of Toronto, it can be said the places with more density of people
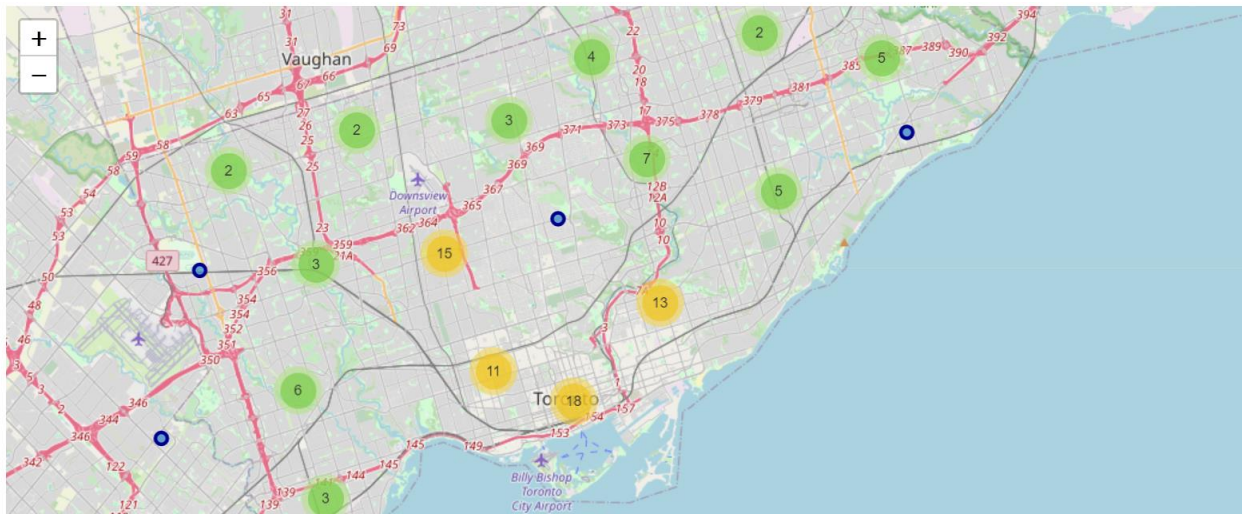
The Foursquare API provides location-based experiences with diverse information about venues, users, photos, and check-ins. This API helps us to build audience segments or clusters for analysis and measurement. In the project, Foursquare API was used to explore the venues of the neighborhoods studied. For example, in the next image, we can notice that there is a more density of venues to the same places with more density of neighborhoods. It's an indicator of a neighborhood more concurrent.
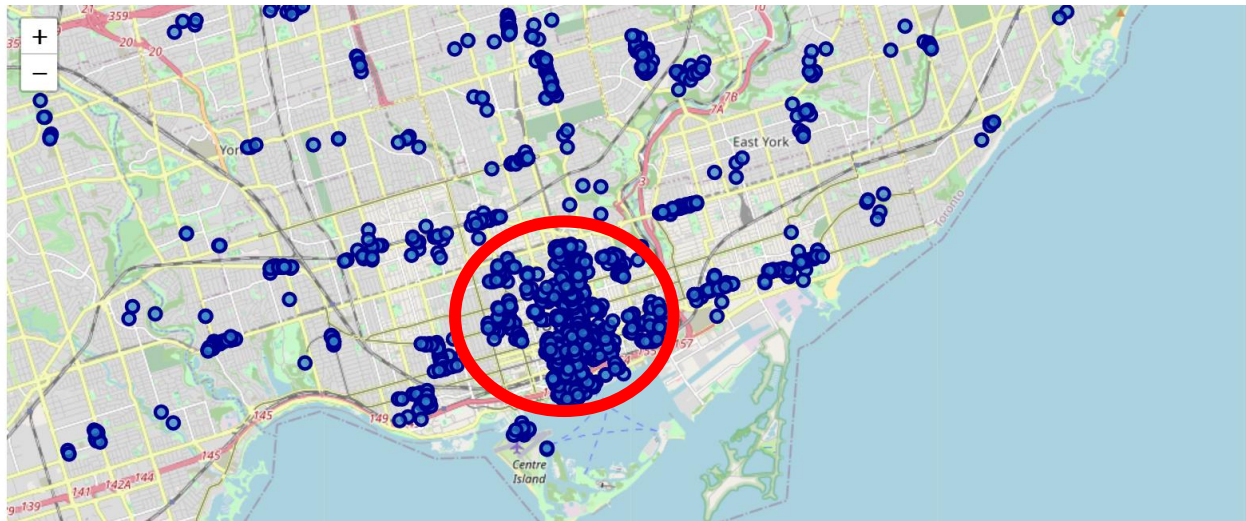
In summary, 2118 venues were returned by Foursquare. From the data obtained, it shows a vertical bar graph where there are the top 10 neighborhoods with more venues, for example, the first 5 exceed to 100 venues near to 500 meters.

Top 10 neighborhoods with more venues
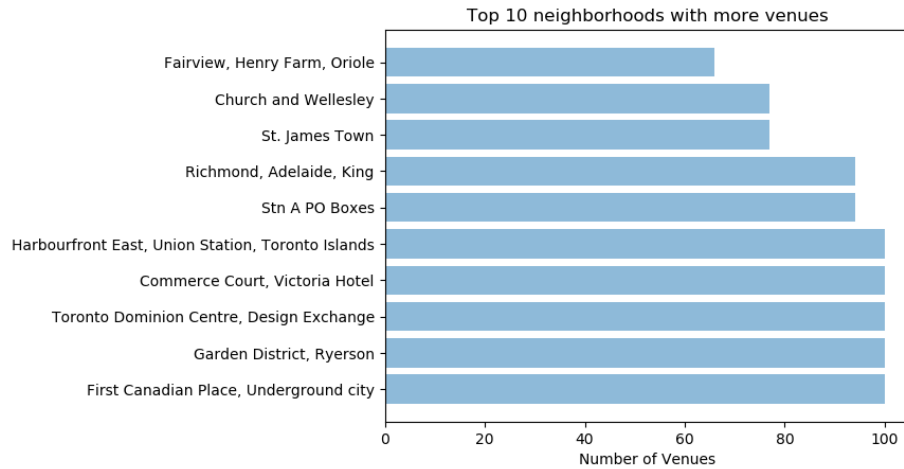
For example, the next picture was taken from Google Streets of one place of the list above: Toronto Dominion Centre.

Now, we need to know what kind or category of venues there is in Toronto to know the tendency or habits of people. According to Foursquare, there are 264 unique categories of venues, the next graph shows the top 20 categories of venues.

Top 20 category of venues of Toronto
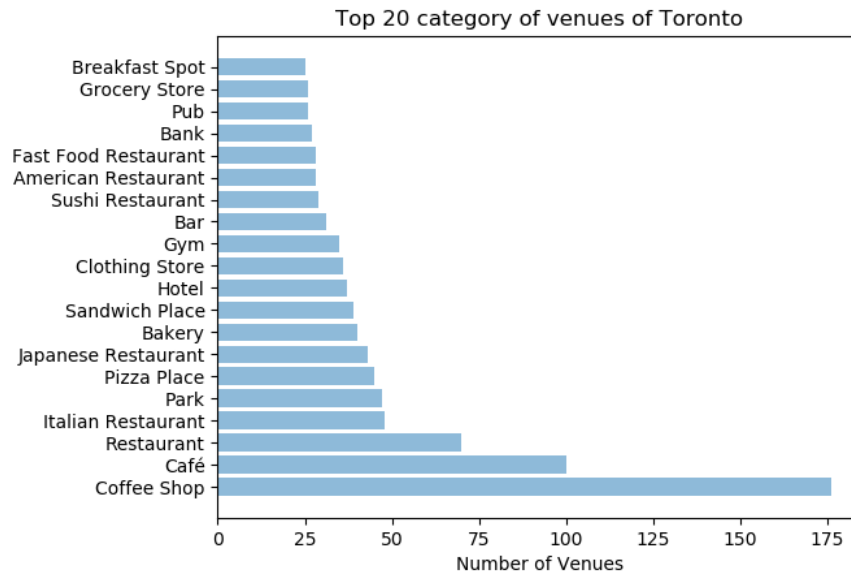
According to the results, we can see possible categories of venues to invest in. Coffee shops, restaurants, and places of fast food are more common.

The machine learning technique used is k-Means what was used to cluster categories of venues of certain neighborhoods. This technique is used mainly for segmentation that is to find clusters or groups of objects similar to each other. Clustering is an unsupervised technique that can group data, based on the similarity of data to each other.

3. RESULTS

Let's discuss the results. According to the next graph, we can notice that the neighborhoods more valuated in Toronto are: First Canadian Place, Underground city, Garden District, Ryerson, and Toronto Dominion Centre.

Top 10 neighborhoods with more venues
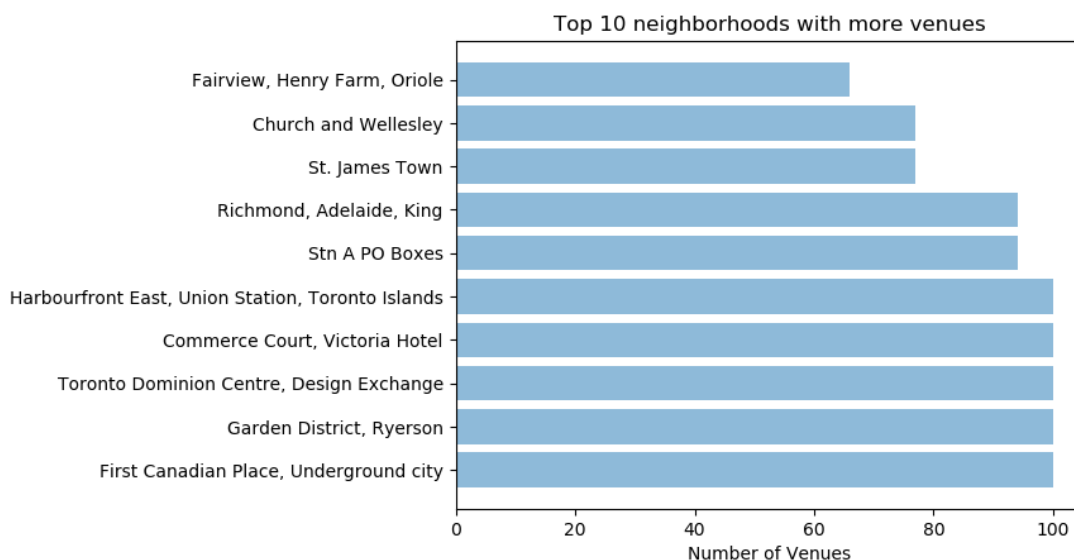
According to the next graph, we see common categories of venues in Toronto such as coffee shops, restaurants, and other places to eat such as pizza, bakeries, and so on.

Top 20 category of venues of Toronto

Category	Number of Venues
Breakfast Spot	~25
Grocery Store	~25
Pub	~26
Bank	~27
Fast Food Restaurant	~28
American Restaurant	~28
Sushi Restaurant	~29
Bar	~31
Gym	~35
Clothing Store	~36
Hotel	~37
Sandwich Place	~39
Bakery	~41
Japanese Restaurant	~43
Pizza Place	~45
Park	~47
Italian Restaurant	~48
Restaurant	~70
Café	~100
Coffee Shop	~175
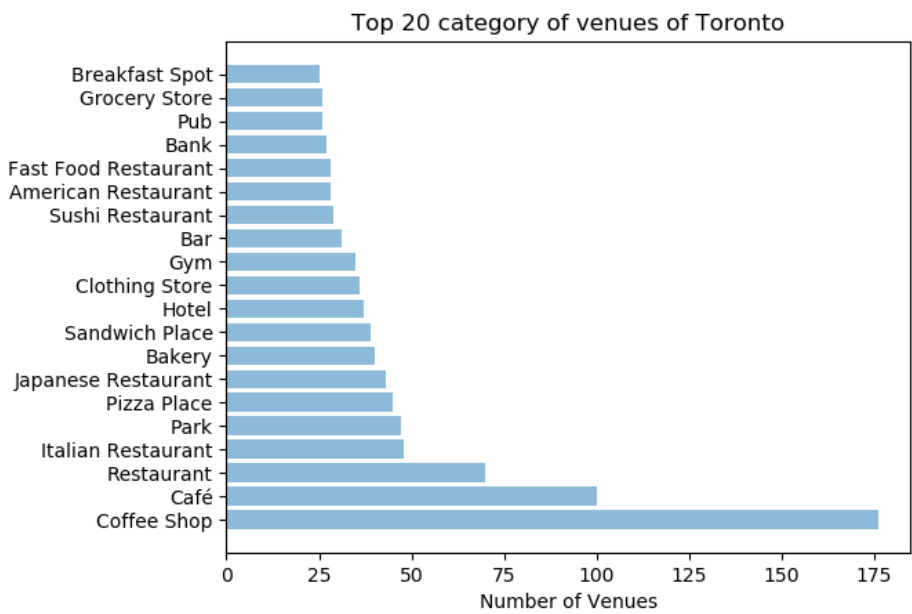
Finally, the last result that is important to make a better decision is the top 10 categories of venue from each neighborhood. The next graph is an example of some neighborhoods.

	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	Agincourt	Latin American Restaurant	Clothing Store	Lounge	Breakfast Spot	Skating Rink	Comfort Food Restaurant	Dessert Shop	Electronics Store	Eastern European Restaurant	Drugstore
1	Alderwood, Long Branch	Pizza Place	Gym	Athletics & Sports	Pharmacy	Pub	Sandwich Place	Skating Rink	Coffee Shop	Creperie	Distribution Center
2	Bathurst Manor, Wilson Heights, Downsview North	Coffee Shop	Bank	Fried Chicken Joint	Shopping Mall	Diner	Restaurant	Bridal Shop	Deli / Bodega	Ice Cream Shop	Supermarket
3	Bayview Village	Chinese Restaurant	Café	Japanese Restaurant	Bank	Distribution Center	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Women's Store
4	Bedford Park, Lawrence Manor East	Italian Restaurant	Coffee Shop	Juice Bar	Sandwich Place	Sushi Restaurant	Pub	Butcher	Café	Indian Restaurant	Pizza Place

4. DISCUSSION

Based on the results, the next observations noted, and recommendations are presented below. It highlights that the recommendations are for people who want to invest in a Business or Venue in Toronto.

1. Top 10 neighborhoods with more venues

At this point, we analyze the top 10 neighborhoods obtained from the Foursquare API. It used Google Streets to know how are these neighborhoods and was obtained three main places:

- First Canadian Place, that is the Financial District of Toronto
- Underground City, that is a path of shops, restaurants, businesses, and so on.

- Garden District, that is the main neighborhood of Downton Toronto whit an indoor botanical garden.

We can recommend investing in one of these neighborhoods.

2. Top 20 categories of venues

In this point, we analyze the top 20 categories of venues more common in Toronto obtained according to Foursquare API. We can recommend investing in two kinds of venues, the most common that are coffee shops, and the second is a restaurant or a venue to eat something such as pizza, bakery, and so on. We have to take into account is one of the most multicultural and cosmopolitan cities in the world.

3. Top 10 categories of venue from each neighborhood

Finally, we obtained the top ten common venues for the three main neighborhoods mentioned in point 1.

	Cluster Labels	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
29	1	First Canadian Place, Underground city	Coffee Shop	Café	Restaurant	Hotel	Gym	Japanese Restaurant	Deli / Bodega	Salad Place	Steakhouse	Seafood Restaurant
31	1	Garden District, Ryerson	Clothing Store	Coffee Shop	Italian Restaurant	Restaurant	Bubble Tea Shop	Café	Japanese Restaurant	Cosmetics Shop	Middle Eastern Restaurant	Bookstore
83	1	Toronto Dominion Centre, Design Exchange	Coffee Shop	Café	Hotel	Restaurant	Seafood Restaurant	Salad Place	Japanese Restaurant	Italian Restaurant	American Restaurant	Tea Room

Finally, we can see the frequency of the three neighborhoods studied.

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----First Canadian Place, Underground city----
              venue  freq
0       Coffee Shop  0.10
1              Café  0.08
2               Gym  0.04
3             Hotel  0.04
4  Japanese Restaurant  0.04
5        Restaurant  0.04
6  Seafood Restaurant  0.03
7        Salad Place  0.03
8      Deli / Bodega  0.03
9         Steakhouse  0.03
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```
----Garden District, Ryerson----
              venue  freq
0     Clothing Store  0.09
1        Coffee Shop  0.08
2    Bubble Tea Shop  0.03
3              Café  0.03
4     Cosmetics Shop  0.03
5  Japanese Restaurant  0.03
6   Italian Restaurant  0.03
7         Restaurant  0.03
8  Middle Eastern Restaurant  0.03
9          Bookstore  0.02
```

```
----Toronto Dominion Centre, Design Exchange----
              venue  freq
0       Coffee Shop  0.10
1              Café  0.07
2             Hotel  0.06
3        Restaurant  0.05
4   Italian Restaurant  0.03
5  Japanese Restaurant  0.03
6  Seafood Restaurant  0.03
7  American Restaurant  0.03
8        Salad Place  0.03
9          Tea Room  0.02
```

5. CONCLUSION

As a result of this report, people who are interested to invest in a business in Toronto, we obtained main neighborhoods to invest according to the number of its venues: First Canadian Place, Underground City, and Garden District.

Based on the results, we noted that the main categories of venues or kind of business to invest in Toronto are coffee shops and restaurants. We have to take into account that Toronto is one of the most multicultural and cosmopolitan cities in the world.

Finally, this study can be done for a specific venue to know about the competence near the place based on the frequency and what is lacking. According to the frequency of the three tables showed above and the other results obtained, it can recommend investing in a "Coffee Shop" in "Garden District, Ryerson".