

The Best Place to Open a Restaurant in Toronto

1 Introduction

1.1 Business Problem

Toronto is the capital city of Ontario in Canada. It is not only one of the most populous cities in Canada, but it is one of the most multicultural and cosmopolitan cities in the world with a 2.7 million population as in 2016. This high population and population density make this crowded city attractive to investors. One business is always relevant to number of populations, and that is the restaurant business.

A restaurant, depending on the choice of its location, can be a great success or complete failure. Therefore, it is worth studying the best place to open a restaurant in Toronto. With all the existing data we explored in Module 3, we can find various types of information and relations between neighborhood and restaurants. We propose to use these data as instructional experience to choose the best place to open a restaurant.

1.2 Data Description

In Module 3, we explored the city of Toronto and segmented and clustered their neighborhoods. The grouped data with the Foursquare location dataset contains the frequencies of different restaurants in each area. There are several essential factors we consider for choosing the best place to open a restaurant:

- a. The rank of total restaurants in each neighborhood indicates if the place has high competition or high success.
- b. The total frequency of each restaurant opened in each neighborhood reflects investors' general favor opening a restaurant in this area. We consider this as an important feature.
- c. There are various types of restaurants, i.e., Asian restaurants, American restaurants, Bakery, etc. A neighborhood with multiple types of restaurants indicates a better chance of success because it means people in this area can accept different cuisines. These data are also useful for analyzing business competitions from other types of restaurants in an area.

2 Methodology

Based on work we had done in the Module 3, we generate the following Toronto map with marked neighborhoods. (figure 1)

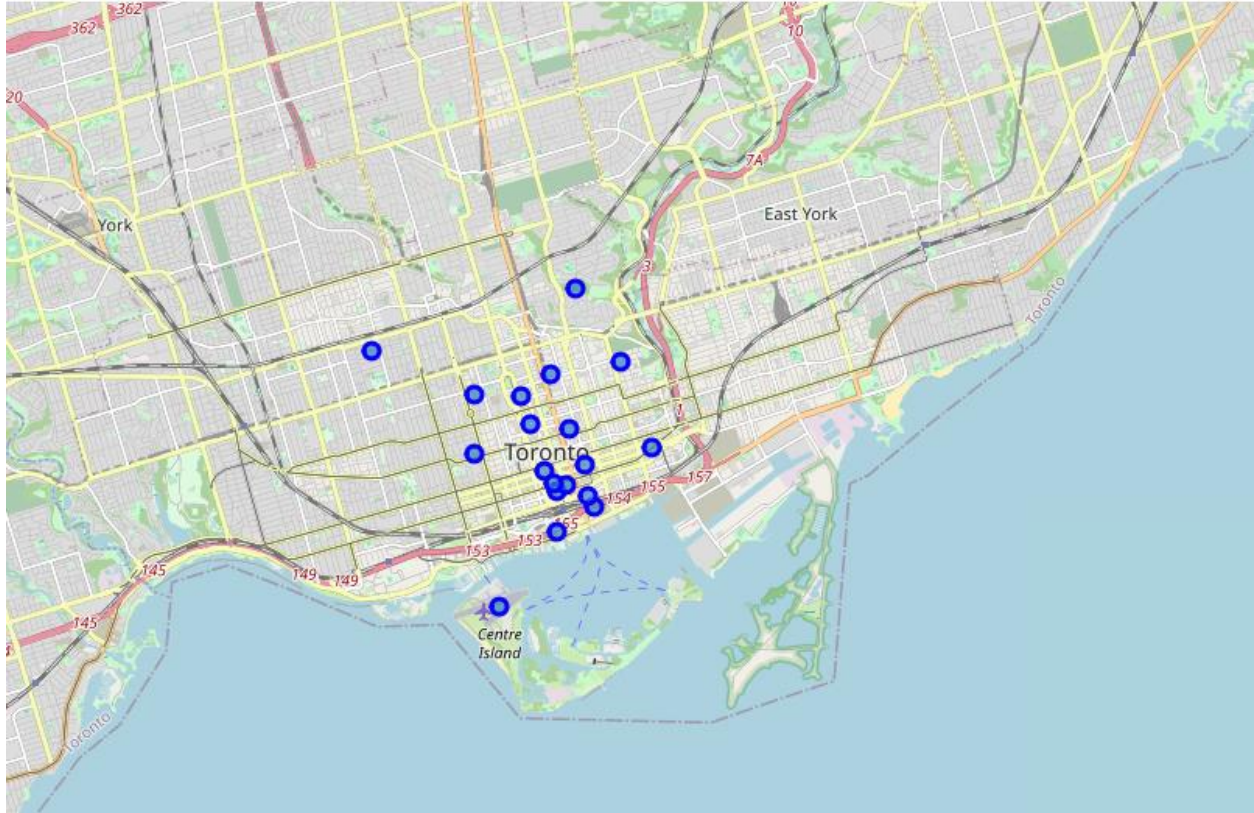


Figure 1 Neighborhoods in Toronto

To determine the best place to open a restaurant in Toronto, we divide our solution into 2 steps. In the first step, we rank the total frequencies of all different restaurants (can be seen as restaurant densities) in Toronto as shown in table 1. This rank indicates that the overall operating status of these restaurants in each neighborhood in Toronto. The more restaurants exist there, the more possible for a new restaurant survive like other restaurants there. Regardless of restaurant type, we assume that it is easier to survive for a new restaurant if it is in a neighborhood with a high restaurant density. We make this assumption since intuitively, a neighborhood with more restaurants implies that it is suitable to support restaurant business; few or no restaurant implies the neighborhood is not appropriate for restaurant business.

Top 5 neighborhood by total restaurants

	Neighborhood	Restaurant Total
4	Church and Wellesley	0.325000
5	Commerce Court, Victoria Hotel	0.310000
6	First Canadian Place, Underground city	0.300000
9	Kensington Market, Chinatown, Grange Park	0.295082
14	St. James Town	0.269231

Table 1 Top 5 neighborhoods with high total restaurants

From table 1, we see that the top 5 neighborhoods with the most restaurants are 1. Church and Wellesley, 2. Commerce Court/Victoria Hotel, 3. First Canadian Place/Underground City, 4. Kensington Market/Chinatown/Grange Park, and 5. St. James Town. They are all good choices for opening a new restaurant.

Also, in the first step, we rank the variety of restaurants in each neighborhood and get a different rank list with restaurant densities. This provides a different aspect of the data from the restaurant variety. We assume that if a neighborhood has more types of restaurant, then it is more likely for a new type of restaurant to survive there. Because higher restaurant variety implies more cultures and higher acceptance of the neighborhood. The restaurant variety can also be seen as a confidence index of the restaurant density, i.e., if two neighborhoods have the same restaurant density, then the neighborhood with high variety is a better choice for opening any type of restaurant in general. But if a neighborhood has many restaurants with a few types, then it can still be a good choice to open a specific kind of restaurant.

Top 5 neighborhood by variety

	Neighborhood	Restaurant Total	Restaurant Variety
12	Richmond, Adelaide, King	0.244681	16
6	First Canadian Place, Underground city	0.300000	16
14	St. James Town	0.269231	15
17	Toronto Dominion Centre, Design Exchange	0.260000	14
4	Church and Wellesley	0.325000	14

Table 2. Top 5 neighborhoods with high restaurant variety

From the table 2, we see that the top 5 neighborhoods with the most variety are 1. Richmond/Adelaide/King, 2. First Canadian Place/Underground City, 3. St. James Town, 4. Toronto Dominion Centre/Design Exchange, and 5. Church and Wellesley. Combining the neighborhoods with high total restaurants and high restaurant variety, the following neighborhoods are good places for opening a new restaurant.

- *Church and Wellesley*
- *First Canadian Place, Underground city*
- *St. James Town*

For the second step, we do an unsupervised clustering by using the density of every different restaurants in each neighborhood. We try to see if they can be clustered in some pattern, which can help us to pick a certain type of restaurant to open. First, we dropped the neighborhoods data with no restaurants, which are CN Tower/King and Spadina/Railway Lands, and Rosedale. For the rest 19 neighborhoods, we use K-means algorithm on them.

To determine the best choice of number of clusters, we use the elbow method. We use the distortion metric from sklearn and plot a distortion-cluster curve. According to our curve (figure 2), we choose k to be 4 as the optimal number of clusters.

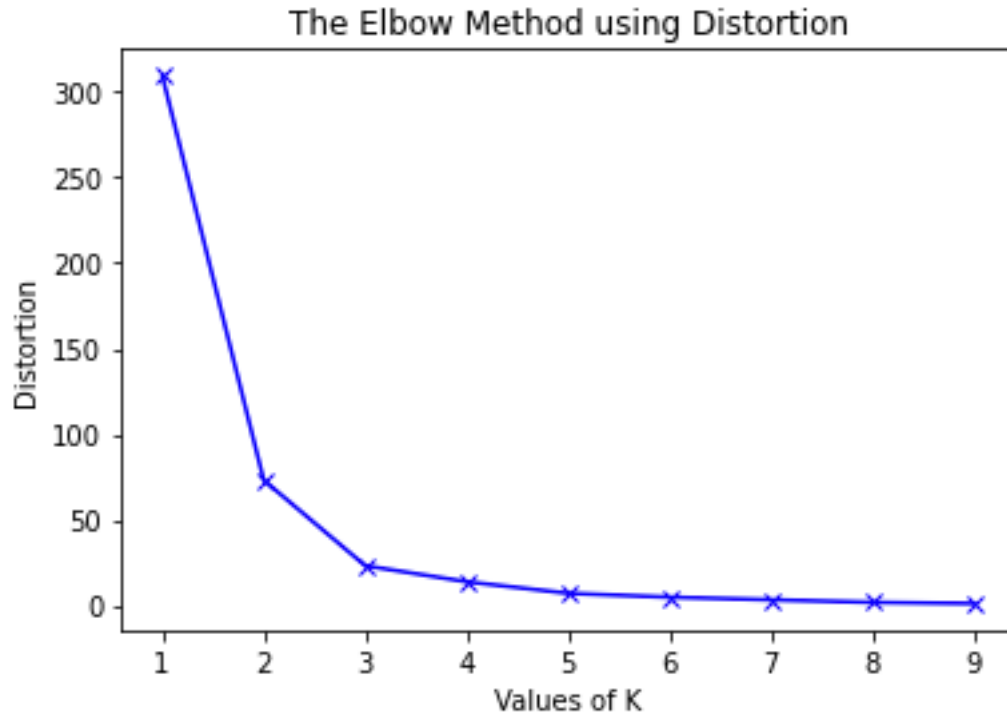
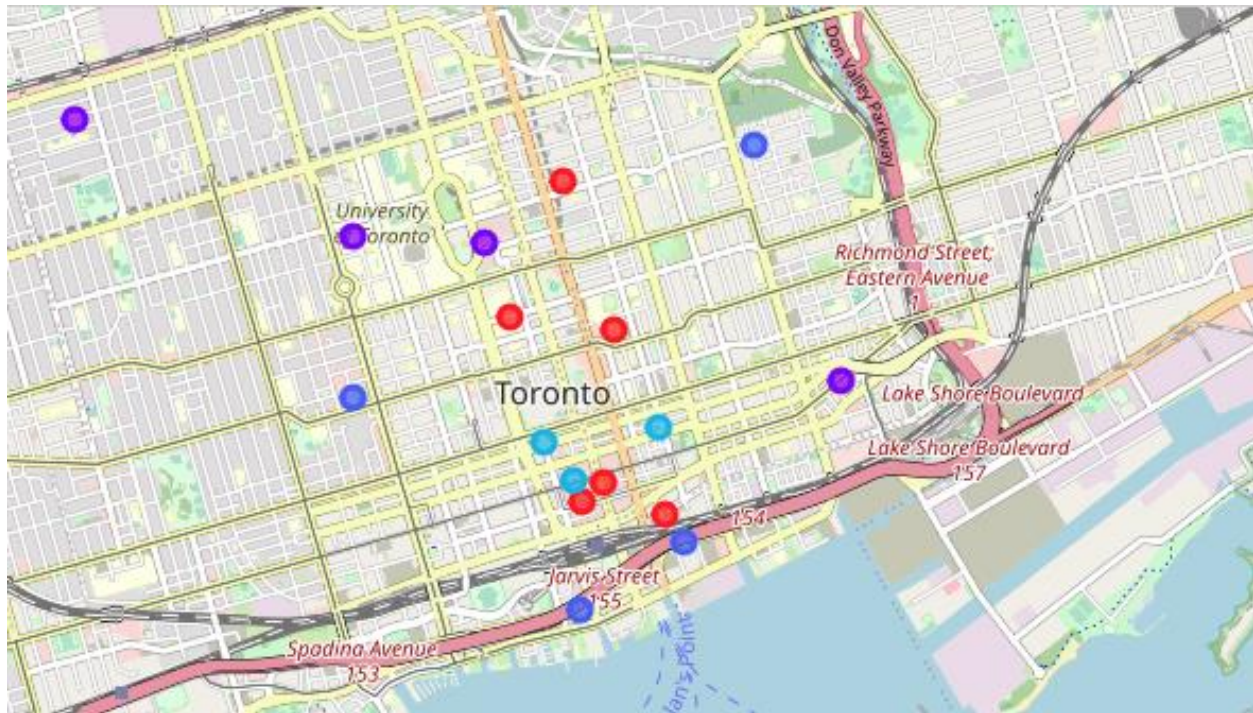


Figure 2 The best K clusters by using elbow method

3 Results

There are 4 clusters have been separated. Church and Wellesley belongs to cluster 1, First Canadian Place, Underground city belongs to cluster 4 and St. James Town belongs to cluster 3. And 4 clusters of neighborhoods with 4 different colors have been shown in the figure below.



4 clusters of neighborhoods marked in the map

For cluster 1, it contains 6 neighborhoods, which are ‘Garden District, Ryerson’, ‘Central Bay Street’, ‘Toronto Dominion Centre, Design Exchange’, ‘Commerce Court, Victoria Hotel’, ‘Stn A PO Boxes’, *‘Church and Wellesley’*. And the top four types of restaurant in this cluster are shown in figure 3, which are

- Italian restaurant
- Japanese restaurant
- Seafood restaurant
- unclassified restaurant

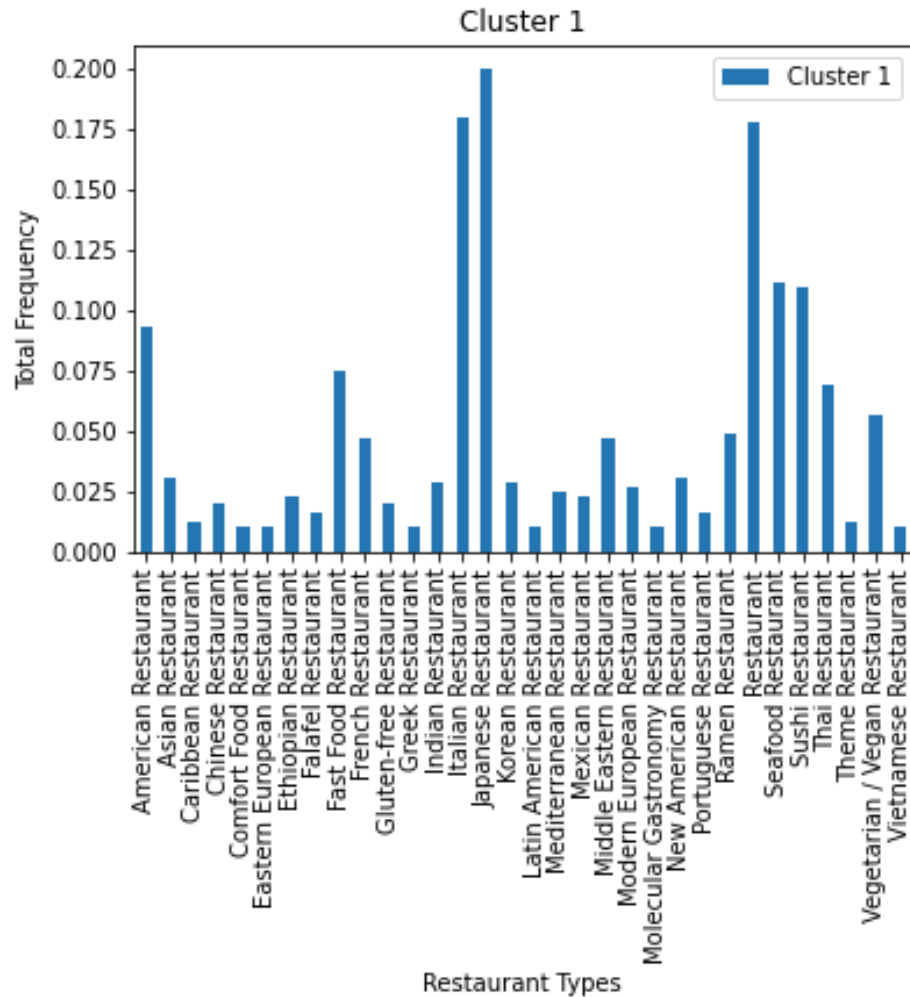


Figure 3 Densities of different restaurants in cluster 1

For cluster 2, it contains 4 neighborhoods, which are ‘Regent Park, Harbourfront’, ‘Queen's Park, Ontario Provincial Government’, ‘Christie’, ‘University of Toronto, Harbord’. And the top four types of restaurant in this cluster are shown in figure 4, which are

- Italian restaurant
- Japanese restaurant
- Unclassified restaurant
- Sushi restaurant

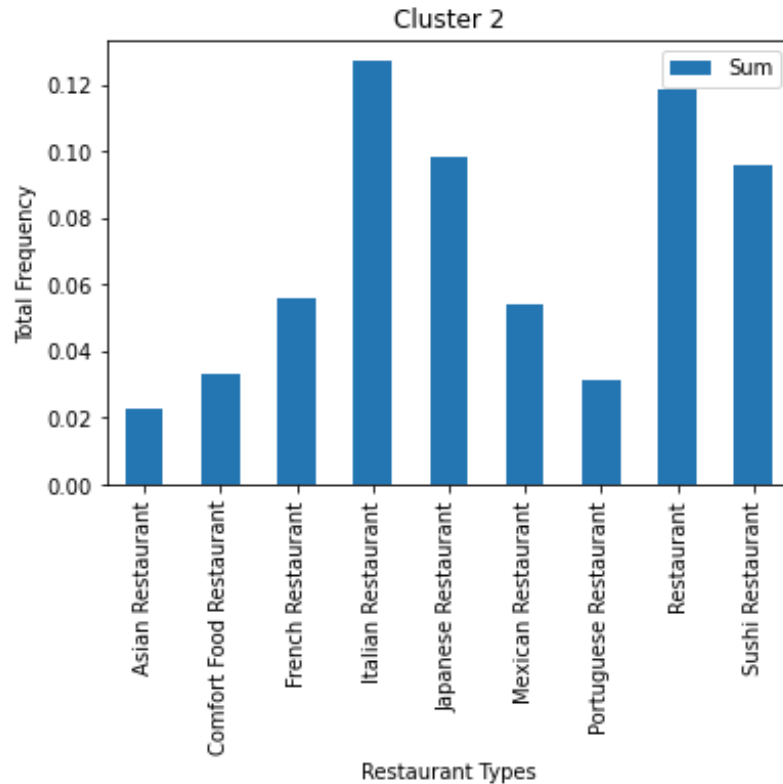


Figure 4 Densities of different restaurants in cluster 2

For cluster 3, it contains 4 neighborhoods, which are ‘Berczy Park’, ‘Harbourfront East, Union Station, Toronto Islands’, ‘Kensington Market, Chinatown, Grange Park’, ‘*St. James Town, Cabbagetown*’. And the top four types of restaurant in this cluster are shown in figure 5, which are

- Unclassified restaurant
- Italian restaurant
- Japanese restaurant
- Vegetarian/Vegan restaurant

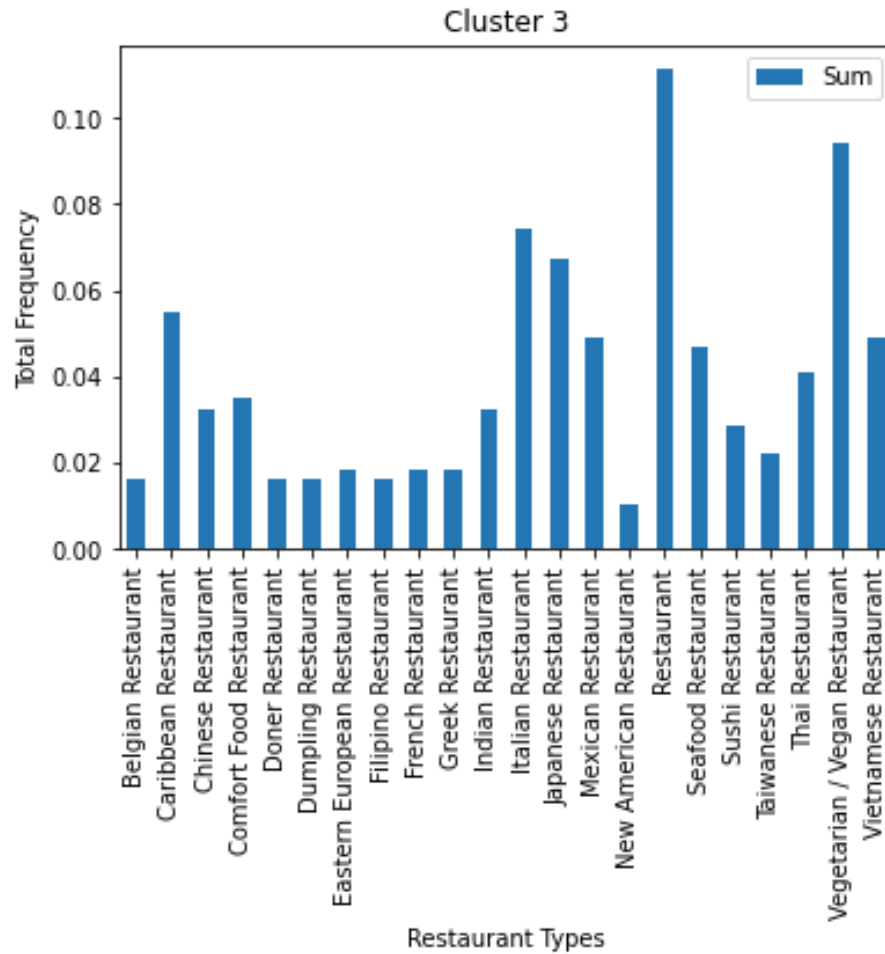


Figure 5 Densities of different restaurants in cluster 3

For cluster 4, it contains 3 neighborhoods, which are 'St. James Town', 'Richmond, Adelaide, King', 'First Canadian Place, Underground city'. And the top four types of restaurant in this cluster are shown in figure 6, which are

- Unclassified restaurant
- American restaurant
- Seafood restaurant
- Japanese restaurant

Based on this analysis, we'd like to give following suggestion for investors to open a certain type restaurant.

Neighborhoods	Church and Wellesley	St. James Town	First Canadian Place, Underground city
Types of restaurant	Italian restaurant	Italian restaurant	American restaurant
	Japanese restaurant	Japanese restaurant	Seafood restaurant
	Seafood restaurant	Vegetarian/Vegan restaurant	Japanese restaurant

Table 3 Suggestions for different neighborhoods

4 Discussion

In our solution, we make several assumptions that are open to discussion. The first assumption states that the chance of success correlates to the restaurant densities. This is generally true, but one can also argue that a high restaurant density also indicates more competition in the neighborhood. We do not include this in our project since we do not have access to such data. But it is a worthy direction to use more complex models to approximate the relationship between existing restaurant densities and future success.

Another assumption is that high restaurant variety can also imply a higher chance of success. This can be seen as a simplified factor about how region and culture affect the success of restaurants. We assume that a neighborhood with multiple types of restaurants tends to accept a new restaurant easily. But it is a very complex problem. Since our project is to find the best place to open a restaurant in general, we cannot include every possibility in terms of different cultures. We aim to provide basic analysis for those who want insights to open a restaurant in Toronto, and for those who want to thoroughly study this problem to build upon.

5 Conclusion

In our project, we study the Foursquare dataset which contains the restaurant density data of each neighborhood in Toronto and determine the best places to open a certain type of restaurant.