

Spatial Location of Restaurants in Toronto and Possible Location for a New Site

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1 Introduction/Business Problem

1.1 Introduction

The decision making on opening a new restaurant is always difficult problem for an individual owner or a company. Usually, deciding the location of the new restaurant or shop involves intensive data analysis not only on the location but also other aspects, such as the size of existing shops, demographic and transportation aspects of the surrounding area of the potential target location. However, in its early stage of the decision making process, a quick and basic graphical representation of data would give the stakeholders useful intuitions on the feasibility of opening-up a new restaurant.

1.2 Business Problem

It is natural to assume that the location of restaurants differs depending on the types of restaurants. In addition to the difference between fine and casual dining restaurant, difference in ethnic restaurants is necessary to be considered. In this process, the locations of ethnic enclaves in Toronto need to be considered. For example, there should be many Chinese restaurants in Chinatown and may be relatively large number of Japanese restaurants in Little Tokyo area. In this assignment, simple spatial distributions of several types of restaurant in Toronto downtown area will be shown based on the data from Foursquare and the difference will be discussed according to the type. Then, based on the basic comparison, one type of restaurant, for example

Italian restaurant, will be focused and the possible strategy for the location of a new shop based on the data.

2 Data

2.1 Target Data

For comparing several types of restaurants' locational data, three types of restaurants located in the same area will be searched, which will be Chinese, Italian, and Japanese. The target area will be the downtown area of Toronto, which will be circular area with radius of 2000 meters from the point of "Toronto, ON" generated by geolocator (43.6534817, -79.3839347) in this assignment.

2.2 Usage of Data

2.2.1 Target Area

This report focuses on downtown Toronto and several types of ethnic restaurants and target areas of this report will be discussed. There are two restrictions for the analysis in this report. One is the size of areas defined by radius from its center point and another is the numbers of venues within that area extracted via Foursquare API, which is 100 for free user. By looking at downtown area of Toronto considering ethnic enclaves, Chinese and Japanese restaurants' location of in this area may be affected because many ethnic restaurants tend to be densely located in these areas (see figure 1)¹. In addition, its radius should be less than 2 km (12.4Miles) because the area of Lake Ontario will be contained if we put its radius longer than 2 km.

The number of data points extracted from Foursquare by changing the value of radius is shown in the figure . Maximum number of the data here is limited to 100 so the Chinese and Japanese restaurants' plots are not accurate in larger number of radius; however, the purpose of this map is showing overall difference and influence of ethnic enclaves can be seen. Japanese restaurants are densely located close to the center of this area and it could be because there is Little Tokyo area within this area. Many Chinese restaurants are located close to Chinatown so the steep increase can be seen in the

¹<https://www.mapdevelopers.com/draw-circle-tool.php>

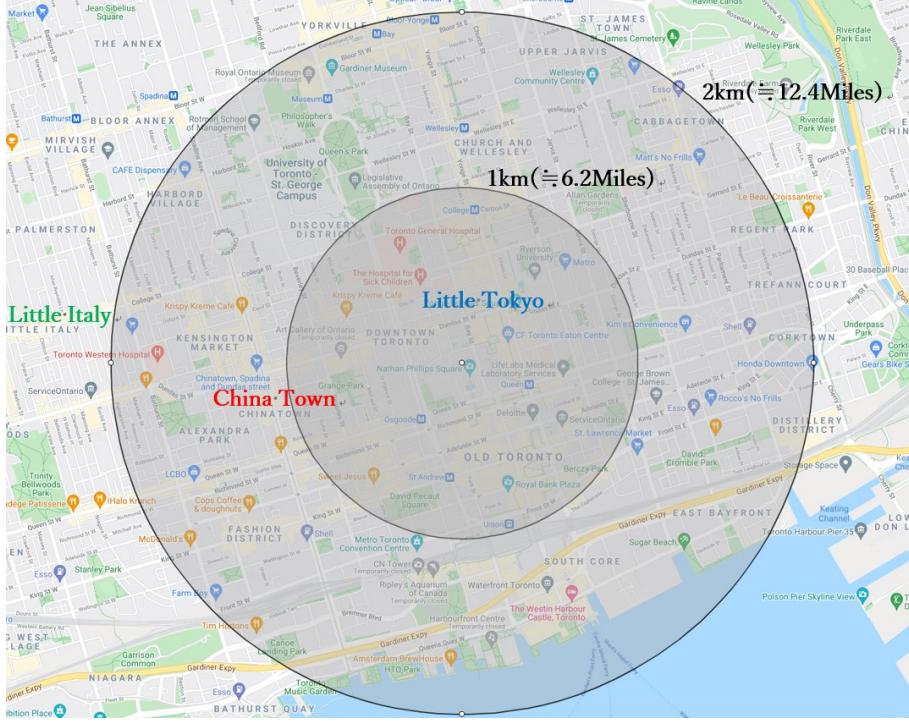


Figure 1: Target Areas by Radius

area with radius greater than 1 km. As the only small portion of Little Italy is included in the target area, the number of venues goes up gradually until radius becomes 1.9 km (see also figure 2). This report will focus on the locational data of Italian restaurants because the distribution of Italian restaurants can be said that spread within the target area and there will not be strong bias during the analysis(see also figure 3).

2.2.2 Simple 2D Plot

By plotting the locational data, the difference in spetial distribution will be observed.

By looking at the plot of Chinese restaurants, it is obvious that the red circles are densely located in the Chinatown area and relatively sparsely located in other areas. More Italian restaurants locate in Southern part of the target area; however, in general, the venues are spread in the target area. Although the distribution of Japanese restaurants seems not to have strong

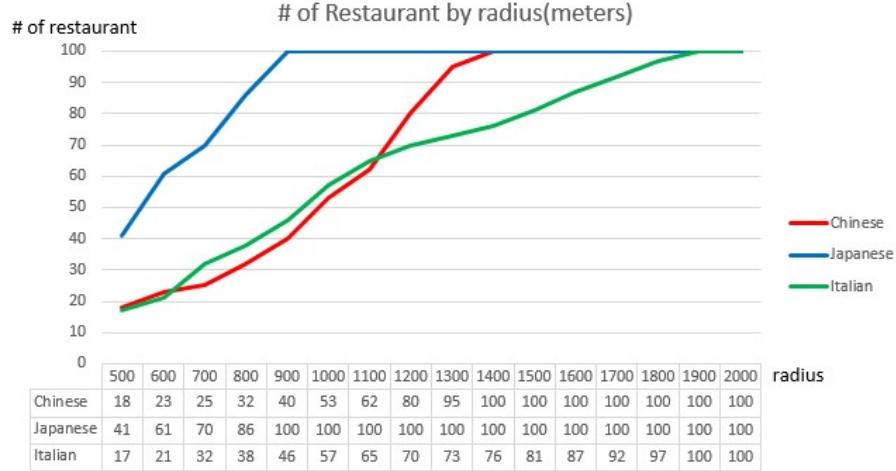


Figure 2: Number of Restaurants by Radius

visible tendency, many of them are located in the center of the target area as shown in figure 2. The location of Little Tokyo may contribute to this distribution.

3 Methodology

Based on the basic comparison discussed above, two dimensional Voronoi diagram will be used for illustrates theoretical trade area of each shop for the purpose of discussing the possible location of a new site. This analysis will be conducted by using the locational data of Italian restaurants.

3.1 Two Dimensional Voronoi Diagram

Voronoi Diagram has been used as a tool for a basic theoretical analysis for spatial distribution². It is used for geographical data and its library is available for Python as a part of Sci-py package. Assuming that the target area contains a certain type of sites which provide same kind of service, basically, the diagram shows the nearest site from a certain point in the target area.

²See also https://en.wikipedia.org/wiki/Voronoi_diagram

For the purpose of explanation, Italian restaurants are extracted from Foursquare in a restricted part of area in Toronto and the generated Volonoi diagram is shown in figure 4. For example, the area within the polygon around the point shown as Adro, the nearest restaurant from any point within the area is Ardo. Based on the attribute, each polygon shows the trade area or market share of its corresponding shop if we assume that customers are located uniformly within the area and the customers visit nearest shop from their point.

In terms of strategy for opening a new site, vertices on the diagram, which are indicated as orange points in the figure 4 are very important. For example, the orange point located inside of Ardo, Fusaro's and Café Oro diNapoli is the most and equally distant point from these three venues. This means that, if a business owner can open a new shop on the point, the owner will get the largest area within this local area, which is theoretical market share of the new shop.

Figure 5 shows the overlay of the map and the Vonoloi diagram³. Based on the discussion above, for example, the orange point close to Moss Park seems to be attractive. In reality, the distribution in Moss Park is not the same as other surrounding area so this point may not be suitable point for a new shop. On the other hand, there are not a few other types of shops around this area, so this area is commercially attractive because of this area is facing Queen Street. In sum, the vertices would be the starting point for decision makers to discuss possible location for a new site.

4 Results

Based on the preparation above, all data in the target area of this report will be analyzed. As same as the sample data in the previous section, the Volonoi diagram and map are combined as figure 6.

Even though a precise evaluation needs the distance from each vertex to its corresponding sites, several examples with the large-enough distance will be discussed in the following section. It is because, even if we pick up a vertex with the largest distance to its corresponding restaurants, the point can be physically unable to open a new site.

³This type of maps in this report were not created by Matplotlib but using external applications.

5 Discussion

As mentioned in 2.2.2 above, relatively large number of Italian restaurants are located in the Southern part of the target area. As a result, some places with large polygon, which indicate there are no other Italian restaurants around the area, are located in the Northern part of the area.

Two possible areas for considering opening a new shop will be discussed below and, in addition, the problems about the underlying assumption of this analysis will be discussed.

5.1 U of T Area

Although the area of Moss Park discussed in the sample analysis could be a possible target area for opening a new site, the area around University of Toronto St. George Campus seems to be attractive with several vertices with reasonably distant from surrounding Italian restaurants as figure 7.

Yet several possible locations can be considered, all of these locations have problems for opening a new restaurant because these are either surrounded by campus buildings or the middle of a spaces owned by the university. It would be difficult to go on to the intense discussion for opening a new site.

5.2 Allan Gardens Area

Another possible area based on the diagram would be the area close to Allan Gardens as shown in figure 8.

Even though there are not so many other types of shops in the area, which means there may not be enough customer walking around the area, it would be one possible area that the decision maker can go on to thorough examination of other economic aspects of surrounding areas.

5.3 Discussion on Assumptions

As already discussed in 3.1, this analysis by using Volonoi diagram is based on very strong assumptions. In reality, customers will not necessarily visit their closest Italian restaurant; thus, the trade area of a restaurants cannot be shown as a simple polygon.

Another strong underlying assumption is that the quality of all restaurants is the same, in other words, based on this strong hypothesis, the con-

dition that a customer goes to one's nearest shop can hold. But in reality, for example, a Chinese restaurants with moderate quality will not survive in the middle of China town where severe competition would occur among best Chinese restaurants in Toronto. Furthermore, the actual data derived from Foursquare contains various types of shops and restaurants, such as pizza shops and Italian café.

Considering these problems above, this report focused on downtown area where relatively far from Little Italy so the bias caused by ethnic enclave on this analysis is limited; however, these strong assumptions must be taken into consideration in the following decision making steps.

6 Conclusion

This report extracted several types of ethnic restaurants in Toronto downtown area and focused on Italian restaurants for opening a new restaurants in the target area by utilizing the result of Volonoi diagram. Even though the analysis is based on strong assumptions; the result could give a business owner or a company to start discussing the strategy for opening a new site. It is very important to evaluate the possible location and its surrounding area and the thorough investigation on various aspects other than a simple geographical location of other competitors in the target area.

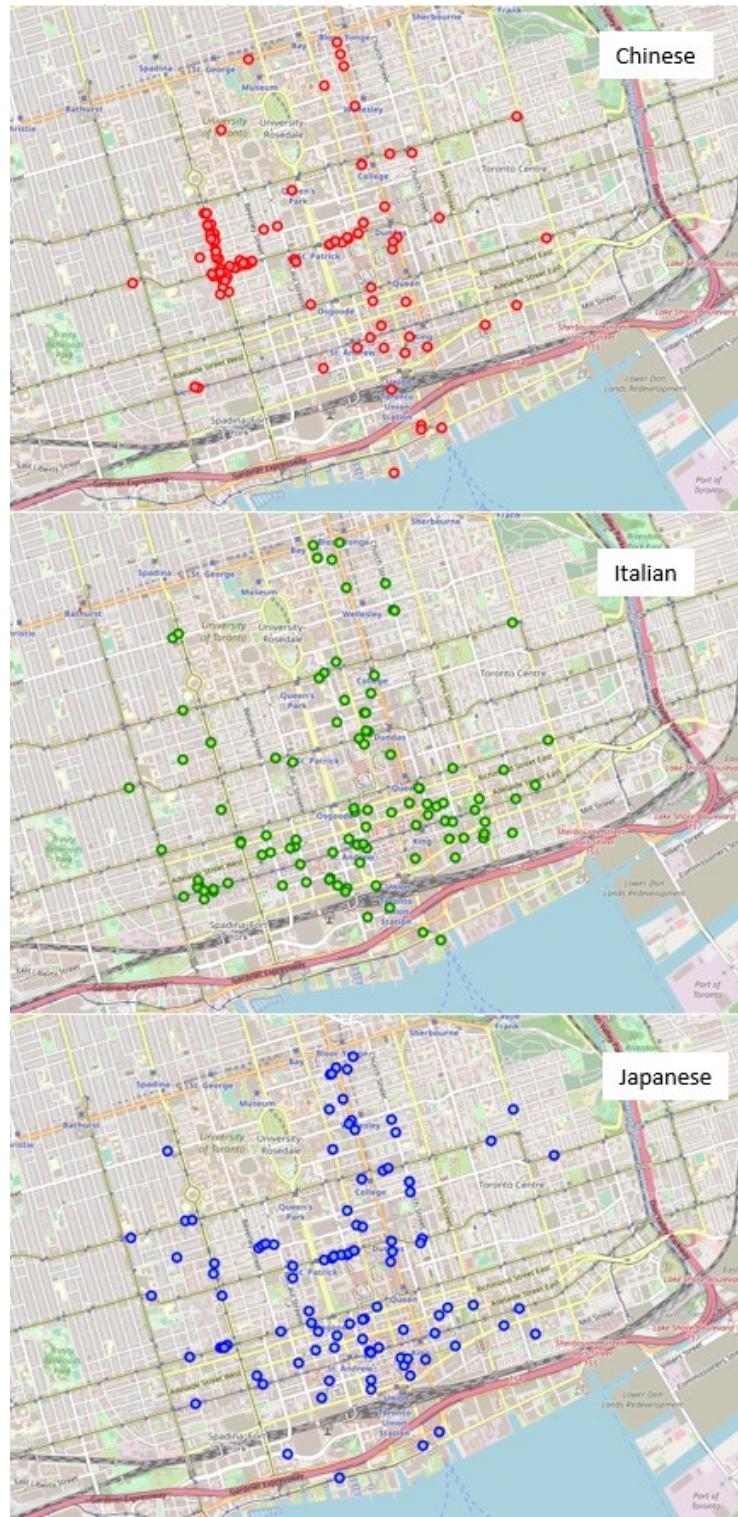


Figure 3: Spatial Distribution of Three Types

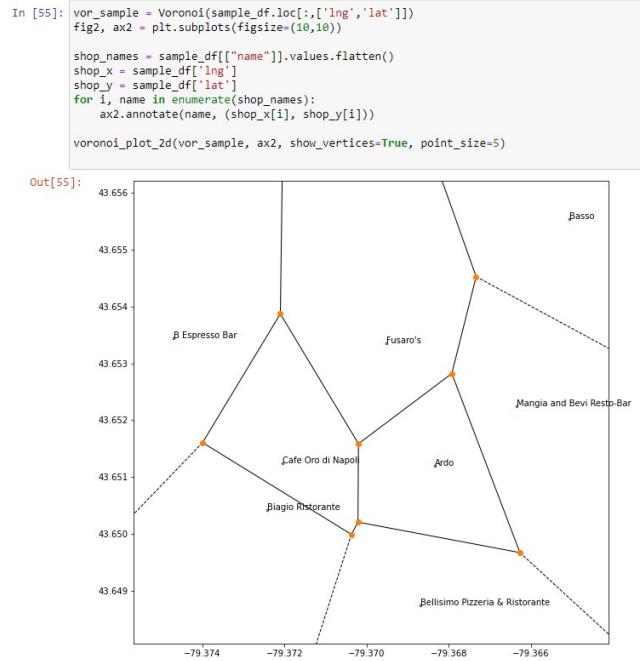


Figure 4: Volonoi Diagram for Sample Data



Figure 5: Map and Volonoi Diagram

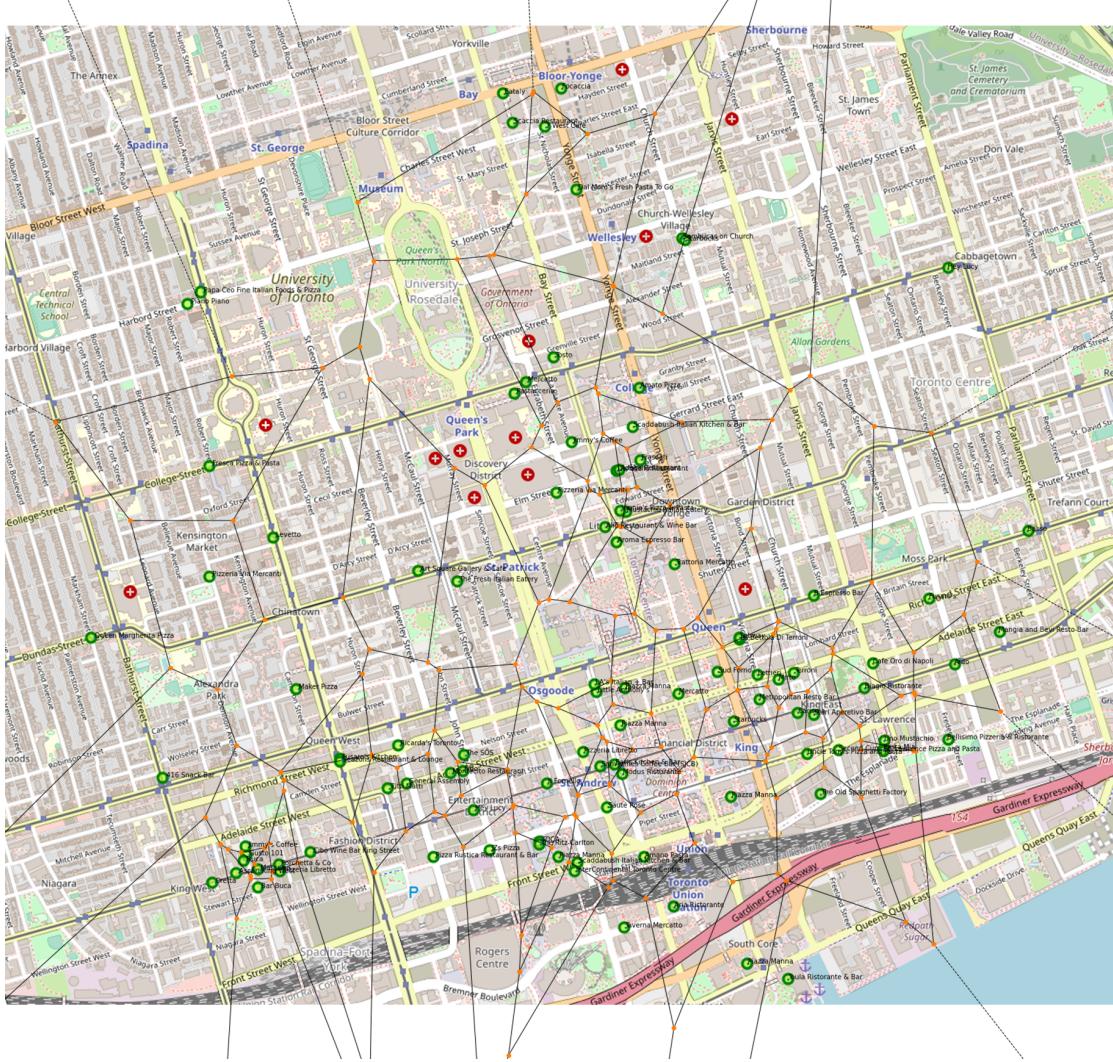


Figure 6: Map and Volonoi Diagram (All)

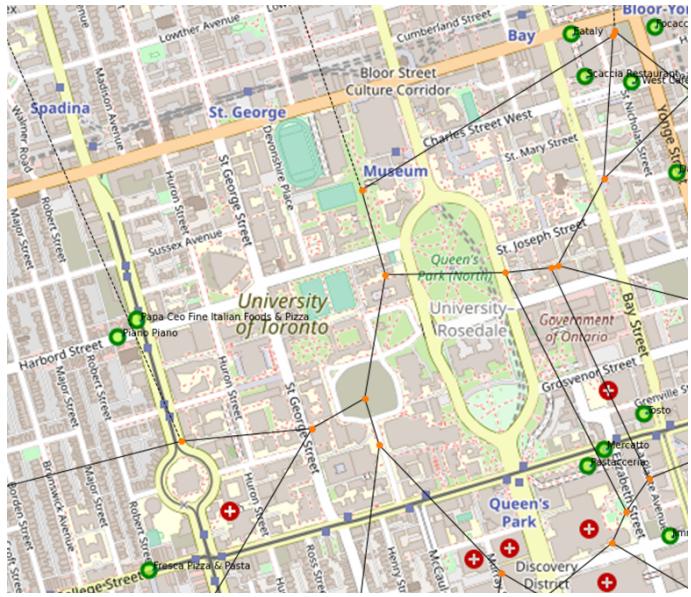


Figure 7: University of Toronto Area

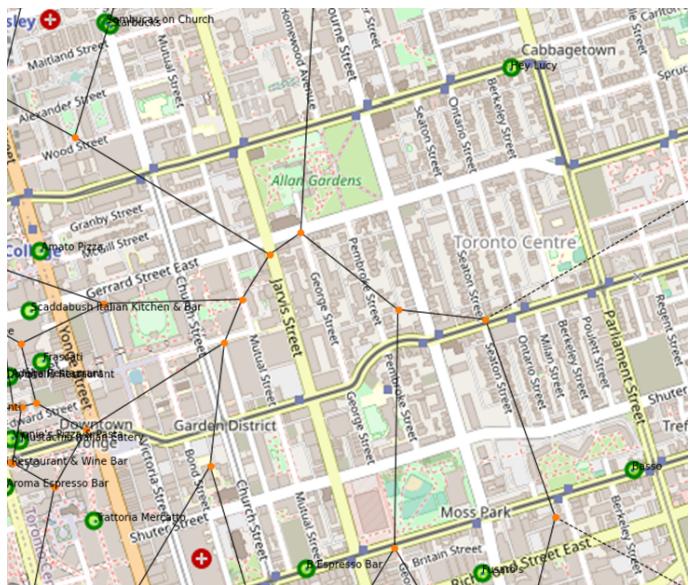


Figure 8: Allan Gardens Area