Finding an optimal location for an Italian Restaurant

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Introduction

- There is a great number of restaurants in Toronto (~1300 Within 6km area from Downtown).
- In this project we will try to find an optimal location for a restaurant. Specifically, this report will be targeted to stakeholders interested in opening an Italian restaurant in Toronto, Canada.
- Since there are lots of restaurants in Toronto we will try to detect:
  - Locations that are not already crowded with restaurants
  - We are also particularly interested in areas with minimum or no Italian restaurants in vicinity.
  - We would also prefer locations as close to Down Town as possible, assuming that first two conditions are met.

Data acquisition:

- Based on definition of our problem, factors that will influence our decision are:
  - number of existing restaurants in the neighborhood (any type of restaurant)We are also particularly interested in areas with minimum or no Italian restaurants in vicinity.
  - number of and distance to Italian restaurants in the neighborhood, if any
  - distance of neighborhood from Down Town

- Every Neighborhood name of Toronto, Canada will be obtained using this data set ‘https://www.toronto.ca/ext/open_data/catalog/data_set_files/2016_neighbourhood_profiles.csv’.

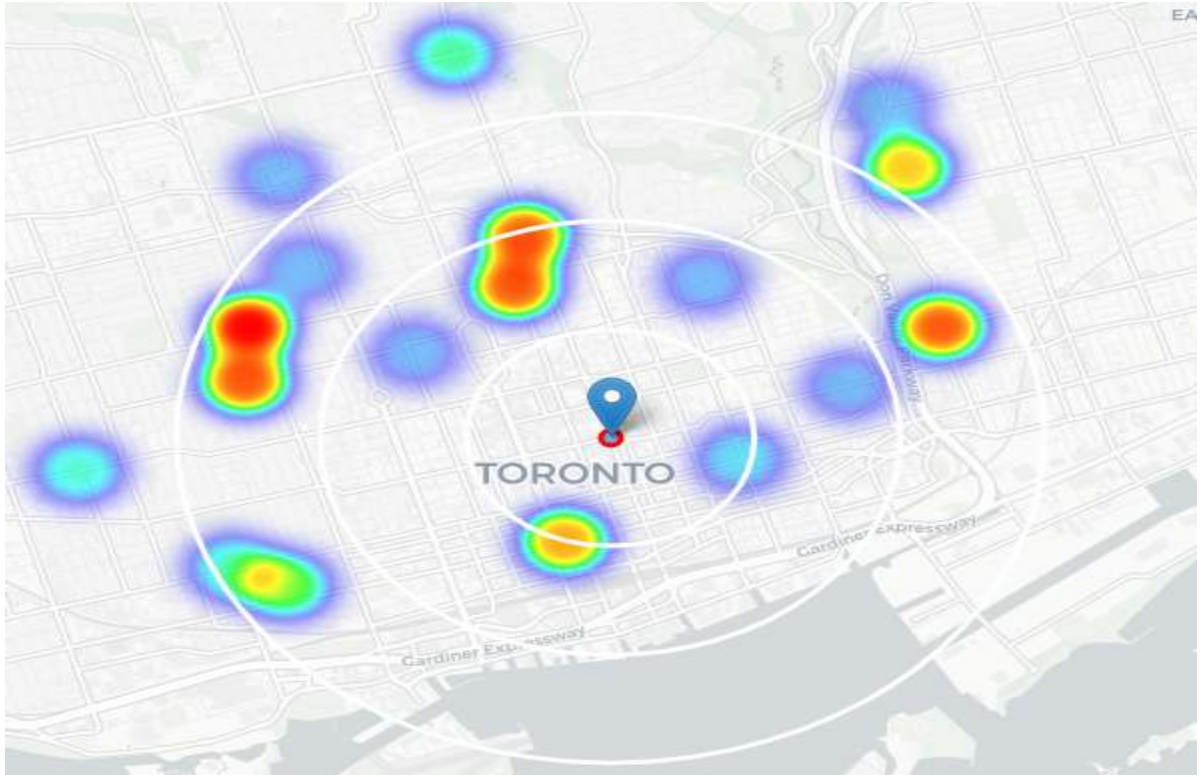
- Every Neighborhood location(latitude, longitude) will be obtained using (geopy)python library.
- To accurately calculate distances we need to create our grid of locations in Cartesian 2D coordinate system which allows us to calculate distances in meters (not in latitude/longitude degrees). Then we'll project those coordinates back to latitude/longitude degrees to be shown on Folium map. So I created functions to convert between WGS84 spherical coordinate system (latitude/longitude degrees) and UTM Cartesian coordinate system (X/Y coordinates in meters).

- Then I calculated the distance from Downtown to each neighborhood.

- I utilized the Foursquare API to explore the boroughs and segment them. I designed the limit as 100 venues and the radius 500 meter for each Neighborhood from their given latitude and longitude information. Here is a head of the list Venues name, category, latitude and longitude information from Foursquare API.

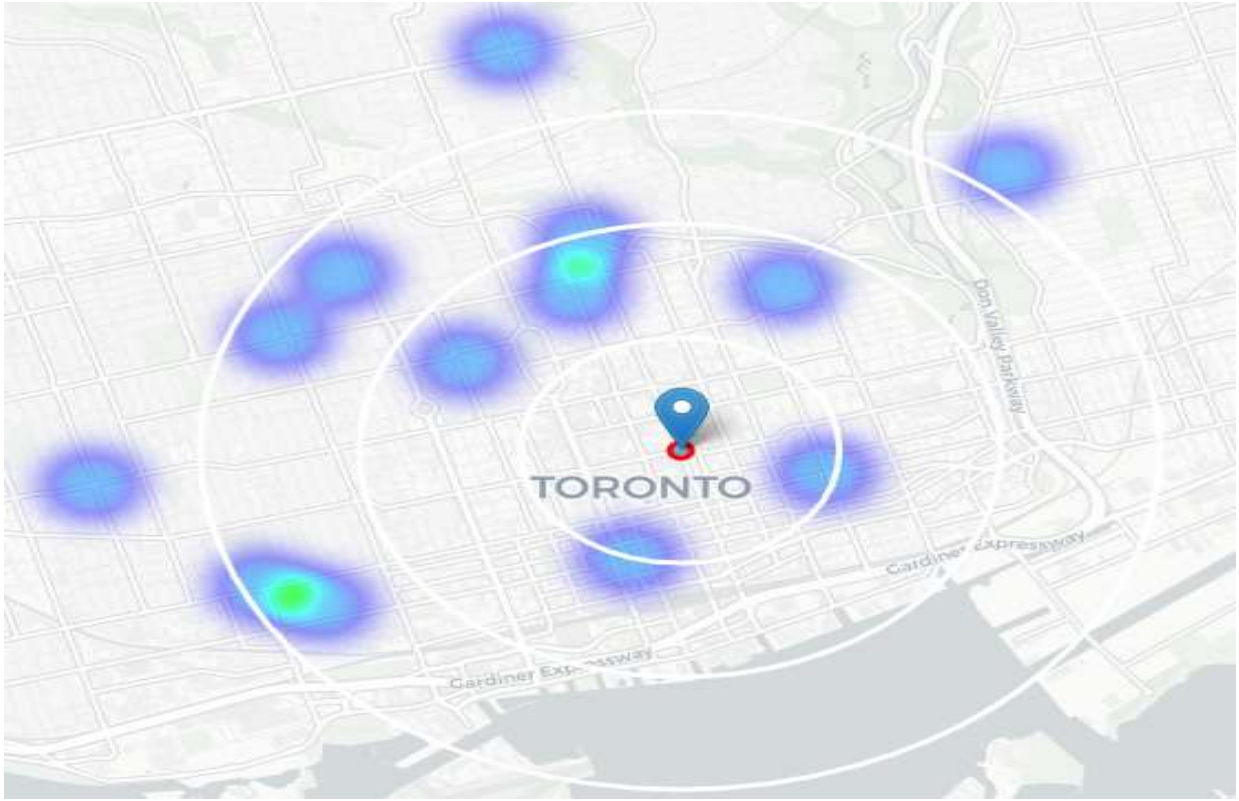
Using the python **folium** library to visualize geographic details of Toronto and its Neighborhoods and I created a map of Toronto with Neighborhoods superimposed on top(Downtown with the **red** color and the other neighborhood with **blue** color). I used latitude and longitude values to get the visual as below:

Using heatmaps : a- heatmap/density of all restaurants:



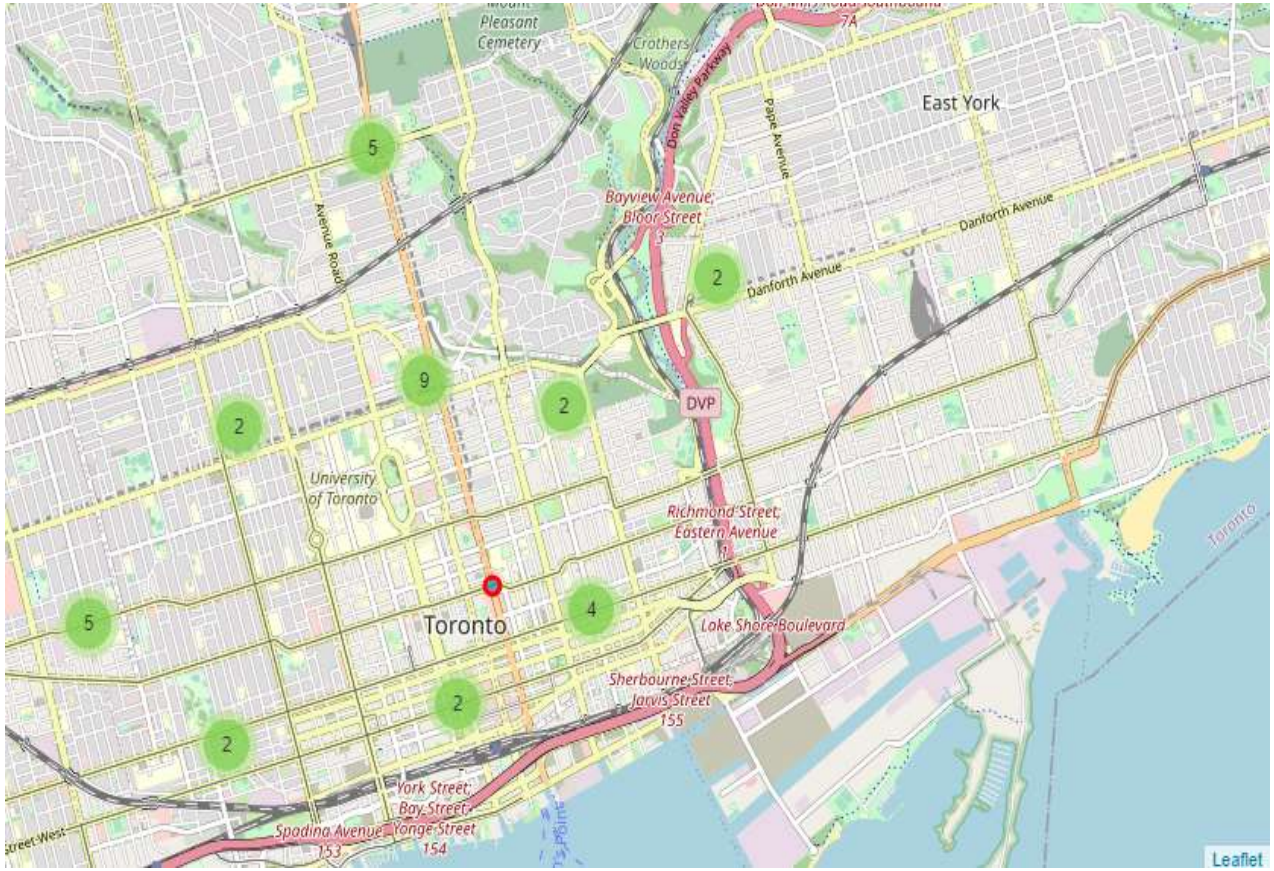
a- heatmap/density of all restaurants:

Using heatmaps : b- heatmap/density of italian restaurants only:

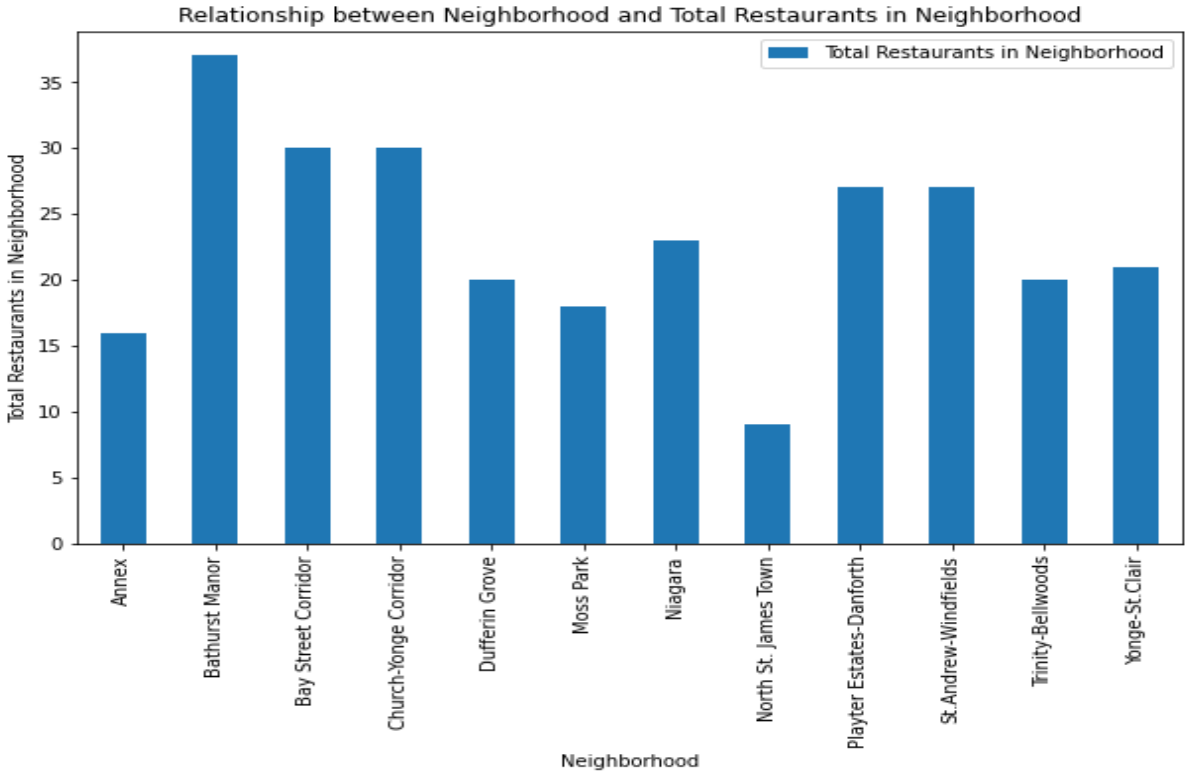


b- heatmap/density of italian restaurants only

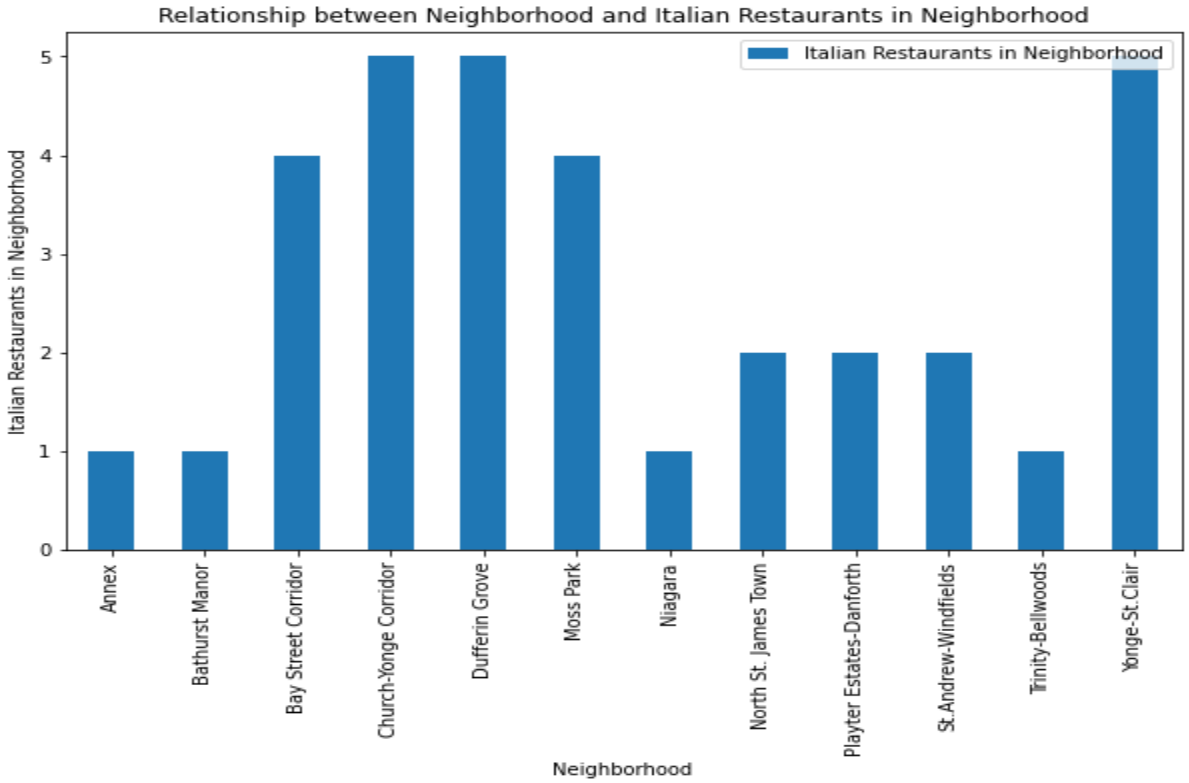
Distribution of the Italian Restaurants:



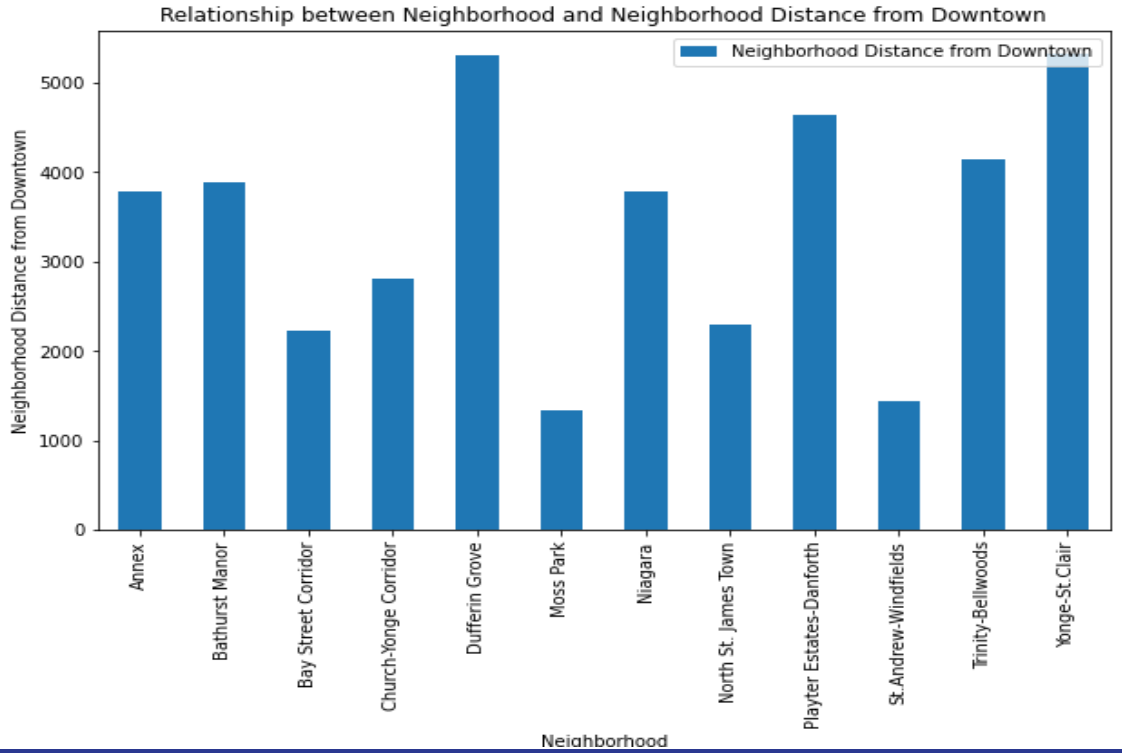
Relationship between Neighborhood and Total Restaurants in Neighborhood:



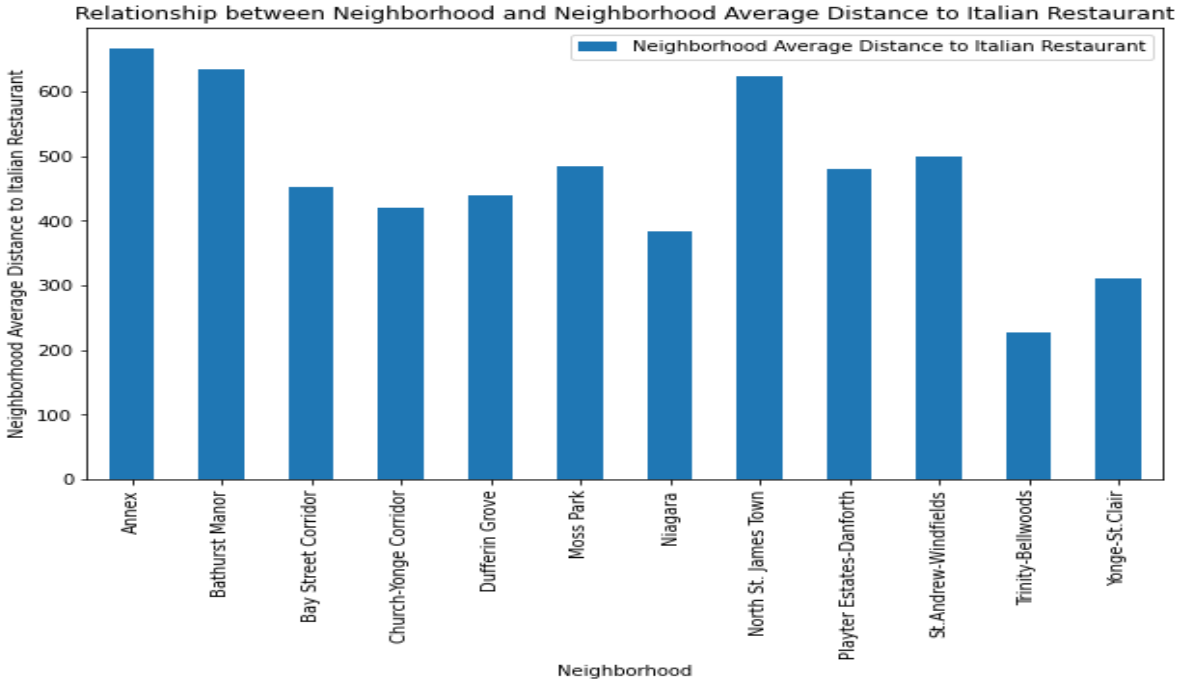
Relationship between Neighborhood and Total Restaurants in Neighborhood:



Relationship between Neighborhood and Neighborhood Distance from Downtown:

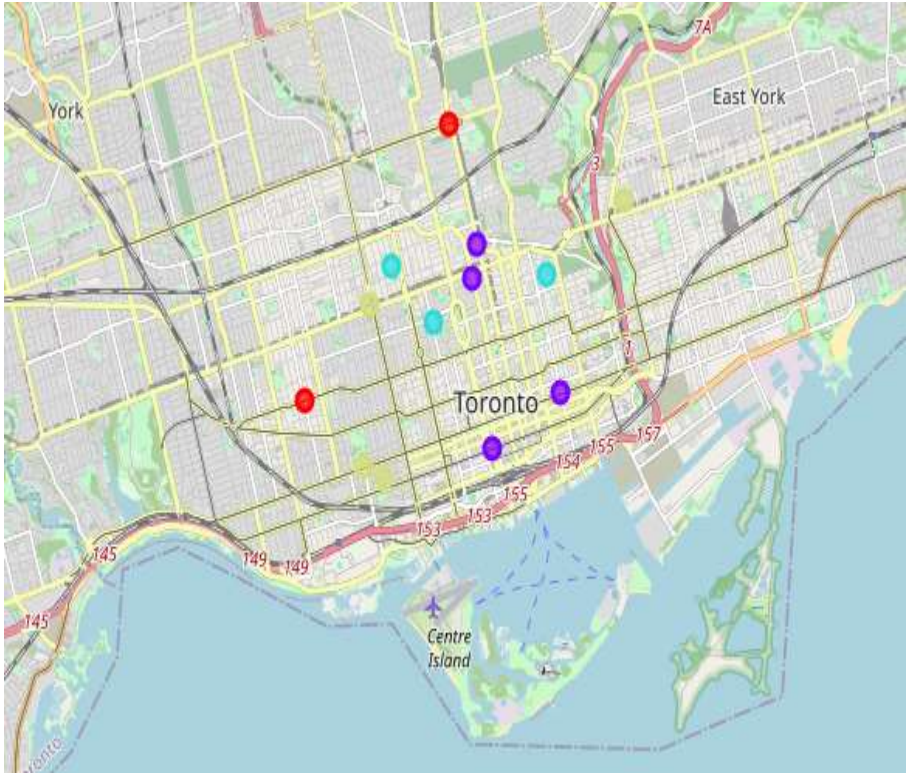


Relationship between Neighborhood and Neighborhood Average Distance to Italian Restaurant:



In third and final step we will focus on most promising areas and within those create **clusters of locations that meet some basic requirements** established in discussion with stakeholders: we will take into consideration locations with **smaller** distances from Downtown, **Larger** average distances to Italian restaurant, **smaller** numbers of Italian restaurants and **smaller** total numbers of restaurants.

We will present map of all such locations but also create clusters (using **k-means clustering**) of those locations



Results and Discussion:

- Our analysis shows that although there is a great number of restaurants in Toronto (~1300 Within 6km area from Downtown), there are pockets of low restaurant density fairly close to Downtown. Highest concentration of restaurants was detected north and west from Downtown, so we focused our attention to areas south, south-east and east.We considered only the neighborhoods within the range of 2.5km from Downtown, then we considered only the neighborhoods within **two or less** Italian restaurants, then we selected only neighborhoods with the minimum total numbers of restaurants.

we will filter our results to contains only neighborhoods with two or less italian restaurants and within the range of 2.5km

```
[45]: df_good_locations = df_Neiborhood[(df_Neiborhood['Italian Restaurants in Neighborhood'] <= 2) & (df_Neiborhood['Neighborhood D
df_good_locations
```

[45]:

	Neighborhood	Neighborhood Distance from Downtown	Neighborhood Average Distance to Italian Restaurant	Italian Restaurants in Neighborhood	Total Restaurants in Neighborhood
7	North St. James Town	2300.852910	623.328355	2	9
9	St.Andrew-Windfields	1440.871436	500.231430	2	27

we find that **North St. James Town** neighborhood is a good location as it has **smaller** total number of Restaurants in Neighborhood and **larger** average distance to the Italian Restaurants within a neighborhood

Conclusion:

Purpose of this project was to identify Toronto areas close to Downtown with low number of restaurants (particularly Italian restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new Italian restaurant. By calculating restaurant density distribution from Foursquare. Clustering of those locations was then performed in order to create major zones of interest for final exploration by stakeholders.
Final decision on optimal restaurant location will be made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone, taking into consideration additional factors like attractiveness of each location (proximity to park or water), levels of noise / proximity to major roads, real estate availability, prices, social and economic dynamics of every neighborhood etc.