Applied Data Science Capstone

Introduction

This is a project for week 4 of IBM Applied Data Science Caption.
For this particular project I am about to implement a hypothetical scenario for a concept that there may not be enough Greek Restaurants in Toronto Area. It is widely known that many Greek people moved to Canada in order to have a job. Toronto and Ottawa are the two Canadian cities with most Greeks in Canada. Apart from their history Greeks are also well known for their particular sense of having fun. One of the most important things to succeed it is the good food. So for this project I am about to locate the areas of Toronto with the least Greek restaurants and try to recommend some areas that a Greek entrepreneur might open a traditional restaurant.

Business Problem

The objective of this capstone project is to find the most suitable location for the entrepreneur to open a new Greek Restaurant in Toronto, Canada. By using data science methods and tools along with machine learning algorithms such as clustering, this project aims to provide solutions to answer the business question : Where is the best place to open a Greek restaurant in Toronto? This will happen by examining all the territories of Toronto and locate Greek restaurants that already exist.

Target Audience

The target audience of this project are every person who wants to open a restaurant with Greek cuisine in Toronto.

Data

The most valuable thing that we need is good and accurate data. So to be precise, for this project there are two data sources that are going to be used. The first containing information about the different areas of Toronto (i.e. postal code, city areas and broughs). This dataset is available on Wikipedia and it also used in the previous weeks. This data are going to be used to navigate in Toronto with the different area names.
Once this is possible there will be the need of some extra information about each Neighborhood. This is information is necessary to find out how many restaurants are located in each area. Foursquare is the solution to this problem as it provides information for every area only by getting the coordinates od areas name.

So to sum up, this project requires:
-List o Neighborhoods of Toronto, Canada
-Coordinates of these neighborhoods
-Venue data related to Greek restaurants. This will help us find the neighborhoods that are more suitable to open an Greek Restaurant

Extracting The Data

- Scrapping Wikipedia webpage to retrieve Toronto neighborhoods
- Getting Latitude and Longitude data of these neighborhoods via geocoder package
- Using Foursquare API to get venue data related to these Neighborhoods

Methodology

The first thing it needs to be done in this problem is the creation of the dataset on which the whole process will be based. The first features will be scraped from Wikipedia
https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M
(the first table) which contains Toronto's Broughs and Neighborhoods grouped by their postal codes.

The goal of this project is to find and cluster all the Neighborhoods with Greek restaurants in Toronto. In order to succeed such a thing apart

from the Wikipedia data there is a need of all venues and their coordinates. The coordinated of each borough can be retrieved by the use of python's geocoder package. So at this point the dataset contains Toronto's Broughs, Neighborhoods and their coordinates.

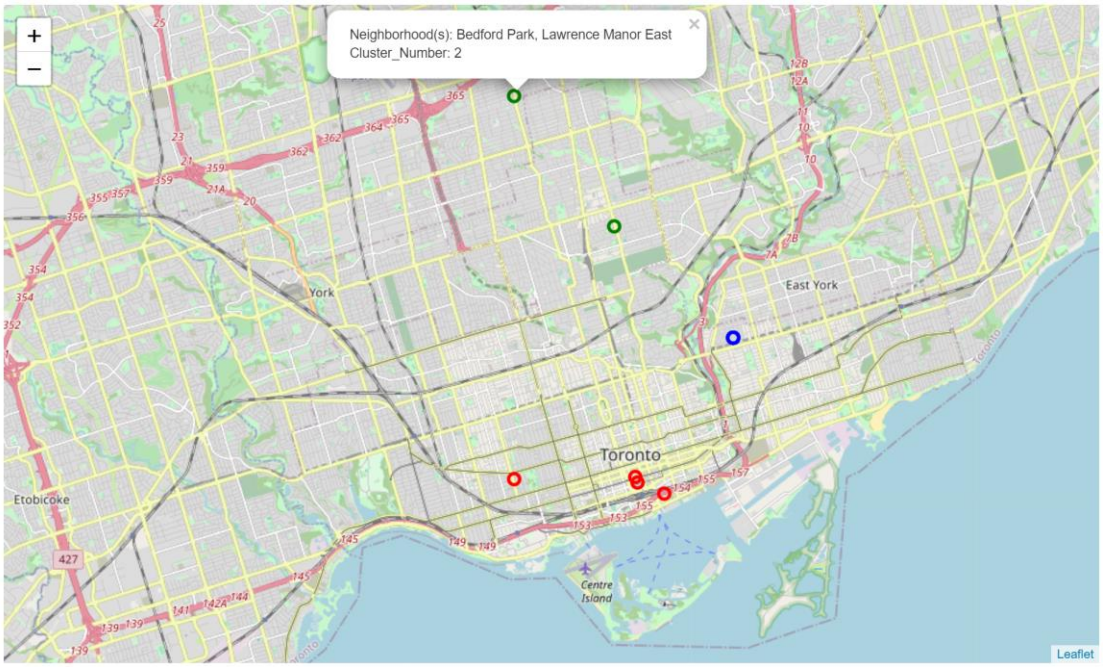
Now it is essential to locate all the venues in Toronto and filter them to find the Greek restaurants. This is possible to happen with the use of Foursquare, which provides all the necessary information for each of the available coordinates. All it demands is to send a request with the coordinates of each area set the range and it will return all the information as a json file. Foursquare is pretty easy to use as it has an API to do the hard job. The next step is to store the data in a data frame and apply one hot encoding to it in order to use it for the machine learning algorithm. Because the goal is to Cluster the Neighborhoods and not the restaurants the calculation of the mean value of each Neighborhood will help to succeed it (this is necessary because more than one restaurants might be in the same neighborhood). The next step is to get only the Greek restaurant column.

Then with a small dataset which only contains the Neighborhoods and the Greek restaurant density on each neighborhood it is time to fit the data in a ML algorithm to cluster the neighborhoods. The algorithm is K-Means with the number of k (number of clusters) equal to 3. So there will be 3 clusters of neighborhoods. So now for each neighborhood there is a cluster number that it belongs to.

Finally this cluster number is added as a separate column in the main data set with Neighborhoods, Venues and coordinates in order to visualize the clusters on a map and calculate which cluster contains the least Greek restaurants. So the cluster with least Greek restaurants will be recommended.

Results

The Results of this project can be visible by the following image.



What can be seen is that there are 3 clusters.

- Its seems that the most (**8**) Greek restaurants are placed in cluster 1 on The Danforth West, Riverdale neighborhoods.

- Up next there other biggest cluster is 0 with **4** restaurants on Berczy Park, First Canadian Place, Underground city, Little Portugal, Trinity Toronto Dominion Centre and Design Exchange neighborhoods.

- Finally the least restaurants are placed in cluster **2** on Bedford Park, Lawrence Manor East and Davis Ville.

Discussion

As it seems on above image the restaurants are on very specific areas on the map. Cluster 1 contains only two Neighborhoods (they belong on the same borough that's why there is only one mark on the map) but it has the most restaurants. The recommendation is based on the number of restaurants per neighborhood. The following table shows

the final merged data frame with each row represents all the information for every Greek restaurant.

	Neighbourhood	Greek Restaurant	Cluster	Neighbourhood Latitude	Neighbourhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Berczy Park	0.017241	0	43.644771	-79.373306	Alexandro's World Famous Gyros	43.641663	-79.375214	Greek Restaurant
1	First Canadian Place, Underground city	0.010000	0	43.648429	-79.382280	Estiatorio Volos	43.650329	-79.384533	Greek Restaurant
2	Little Portugal, Trinity	0.023256	0	43.647927	-79.419750	Mamakas Taverna	43.645908	-79.419654	Greek Restaurant
3	Toronto Dominion Centre, Design Exchange	0.010000	0	43.647177	-79.381576	Estiatorio Volos	43.650329	-79.384533	Greek Restaurant
4	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Pantheon	43.677621	-79.351434	Greek Restaurant
5	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Mezes	43.677962	-79.350196	Greek Restaurant
6	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Messini Authentic Gyros	43.677704	-79.350480	Greek Restaurant
7	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Christina's On The Danforth	43.678240	-79.349185	Greek Restaurant
8	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Astoria Shish Kebob House	43.677596	-79.351738	Greek Restaurant
9	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Alexandros	43.678304	-79.349486	Greek Restaurant
10	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Athen's Pastries	43.678166	-79.348927	Greek Restaurant
11	The Danforth West, Riverdale	0.190476	1	43.679557	-79.352188	Kalyvia	43.677973	-79.351208	Greek Restaurant
12	Bedford Park, Lawrence Manor East	0.043478	2	43.733283	-79.419750	Karbouzi Greek Taverna	43.736204	-79.420359	Greek Restaurant
13	Davisville	0.027778	2	43.704324	-79.388790	souvlaki express	43.707378	-79.389848	Greek Restaurant

Conclusion

Baring in mind the above map and table the final recommendation for someone who wants to open a Greek restaurant in Toronto is cluster 2. Now as it concerns the neighborhood Davis Ville seems to be the best choice as it's density value ('Greek Restaurant' column) is the lowest of this cluster. **So the best choice for someone who wants to open a restaurant the best place is Davis Ville Neughborhood.**