Location Proposal for a New Greek Restaurant in Downtown Toronto

1. Preface

1.1. Background

A business owner who holds a chain of Greek restaurants wishes to open a new restaurant in the Downtown Toronto area. As there are existing and similar restaurants in this area, the business owner wants to find the ideal spot for starting his new flagship.

1.2. Problem

Downtown Toronto area is densely populated with restaurants from different cuisines and hence it is very difficult to determine the right location for offering specific food types. As the queried results from exploring the Foursquare show, there are 23 unique restaurant categories in the first top-rated 50 restaurant venues.

Therefore, for the success of this particular business type, it is of crucial importance to place the Greek restaurant in the area in which Greek or similar food, i.e. Italian or the Mediterranean is offered.

1.3. Interest

Placing the context to the above problem, the Business owner has great interest in further exploring Downtown Toronto and discovering the right location for his new restaurant.

2. Data mining and cleaning

2.1. Data sources

Data needed for solving this problem is provided by Foursquare API as well as GeoPy's geocoders in order to locate coordinates for Downtown Toronto which is in the client's focus.

2.2. Data cleaning

Data acquired via Foursquare API hold all necessary information in regards to solving this problem. Most of the data is not needed, so it needs to be cleaned from unnecessary fields. In addition, there are certain venues that do not hold an address, so return NaN values. Such venues are not included in this analysis.

2.3. Feature selection

After the cleaning of the data, there are 42 (out of 50) valid venues in all restaurants category and 48 (out of 50) valid venues in the specific restaurant categories which is 84% and 96% success rate respectively, enough for the accuracy of this analysis.

Following are the important fields which are needed for the analysis purpose:

- Restaurant name
- Restaurant category
- Address
- Distance from the location
- Restaurant coordinates

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng
0	Opa! Souvlaki of Greece	Greek Restaurant	10 Dundas St. E.	CA	Toronto	Canada	2nd Floor in Yonge Dundas Square	15	[10 Dundas St. E. (2nd Floor in Yonge Dundas S...	[{'label': 'display', 'lat': 43.65618684017071...	43.656187	-79.380921
1	Jimmy The Greek	Greek Restaurant	220 Yonge St.	CA	Toronto	Canada	in Urban Eatery, Toronto Eaton Centre	202	[220 Yonge St. (in Urban Eatery, Toronto Eaton...	[{'label': 'display', 'lat': 43.6545029224916,...	43.654503	-79.380888
2	Elm Street Italian Deli	Italian Restaurant	15 Elm Street	CA	Toronto	Canada	NaN	197	[15 Elm Street, Toronto ON M5G 1G7, Canada]	[{'label': 'display', 'lat': 43.65769, 'lng': ...	43.657690	-79.382480
3	Villa Madina	Restaurant	220 Yonge St, Toronto Eaton Centre	CA	Toronto	Canada	Eaton Centre	251	[220 Yonge St, Toronto Eaton Centre (Eaton Cen...	[{'label': 'display', 'lat': 43.654064, 'lng':...	43.654064	-79.380696
4	Osmow's	Mediterranean Restaurant	NaN	CA	Toronto	Canada	NaN	286	[Toronto ON M5G 1S6, Canada]	[{'label': 'display', 'lat': 43.658694, 'lng':...	43.658694	-79.382291
5	Trattoria Mercatto	Italian Restaurant	220 Yonge St.	CA	Toronto	Canada	in Toronto Eaton Centre	208	[220 Yonge St. (in Toronto Eaton Centre), Toro...	[{'label': 'display', 'lat': 43.65445314470199...	43.654453	-79.380974
6	Sauté Rosé	Italian Restaurant	10 Dundas St. E	CA	Toronto	Canada	at Yonge St.	16	[10 Dundas St. E (at Yonge St.), Toronto ON M5...	[{'label': 'display', 'lat': 43.65617906966643...	43.656179	-79.380863

3. Exploratory Data Analysis

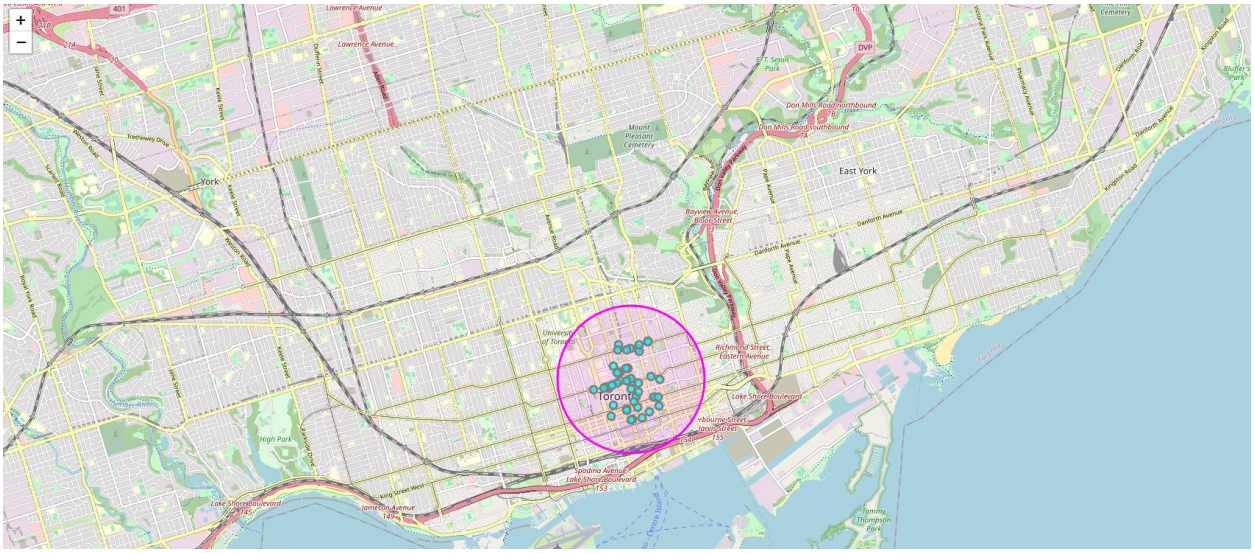
3.1. All categories

For the purpose of this analysis Foursquare API calls were made in order to obtain the following data:

- Data for the top 50 restaurants from all categories in radius of 700m from the Downtown Toronto
- Data for top 50 Greek, Italian and Mediterranean restaurants in the same radius from the Downtown Toronto

The received data in .json format was converted into data-frames for the purpose of future data wrangling.

Received data for all restaurants was grouped by the restaurant categories and further plotted on the map of Downtown Toronto. The map clearly shows positions (and clusters) where existing restaurants are located.



From the dataset of 42 restaurants in all categories, 23 unique groups were established, pointing to vast cuisine offered in a 700m radius from Downtown Toronto. In addition, the dataset clearly shows that there are no Greek or Mediterranean restaurants in the first 50 endpoints which do not mean that they do not exist, but rather they are not that popular with the Foursquare users; the later required further analysis of the data provided by Foursquare.

American Restaurant	2		
Asian Restaurant	3	Japanese Restaurant	2
Bistro	1	Lounge	1
Breakfast Spot	1	Modern European Restaurant	1
Caribbean Restaurant	2	Movie Theater	1
Chinese Restaurant	4	New American Restaurant	4
Dim Sum Restaurant	1	Restaurant	9
Diner	3	Sandwich Place	1
Fast Food Restaurant	2	Sushi Restaurant	2
Gastropub	1	Thai Restaurant	2
Indian Restaurant	3	Theme Restaurant	1
Italian Restaurant	2	Vietnamese Restaurant	1

3.2. Specific categories

For the deepening of the analysis, another API call was made to Foursquare, but this time, with only three endpoint categories:

- Greek restaurants

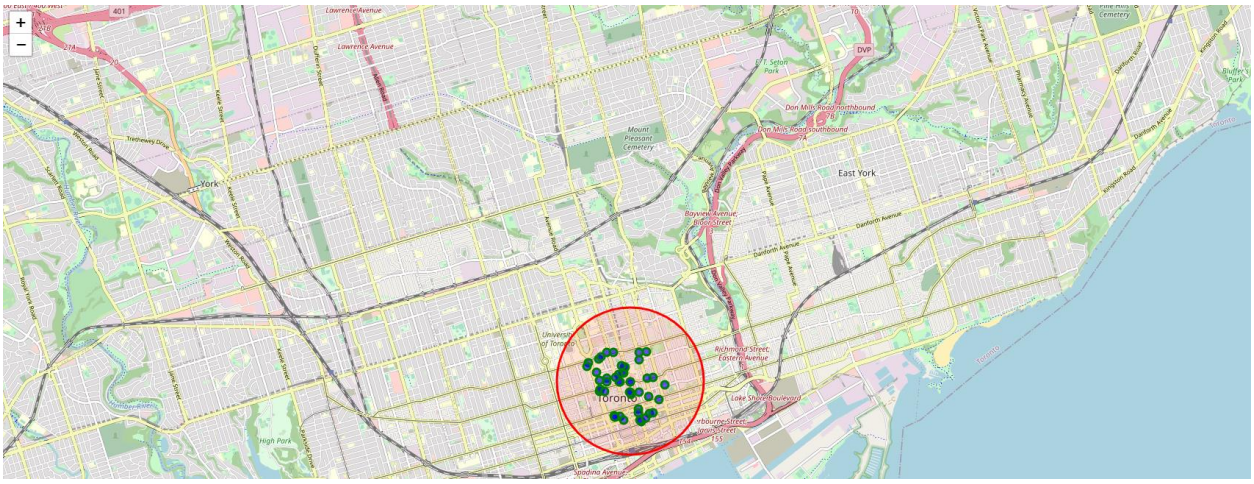
- Italian restaurants and
- Mediterranean restaurants

The specific categories (cuisines) were chosen based on the similarity of food offered as well as guests' tastes. It is expected that people who fancy Italian or Mediterranean food like Greek food also.

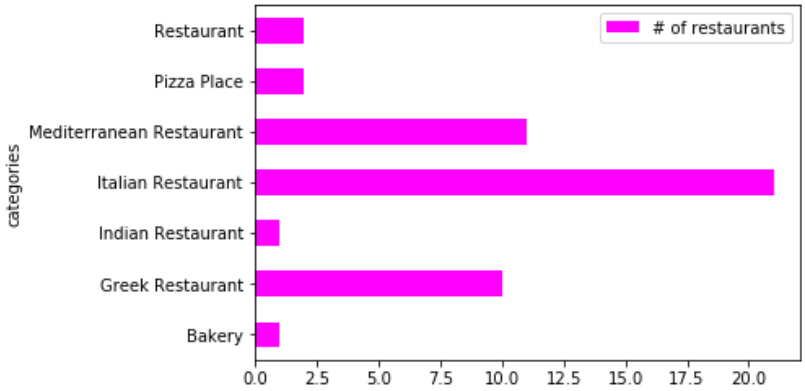
Foursquare returned the following dataset (again, after .json data was conveyed to panda's data-frames):

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	neighborhood	postalCode	state	id
0	Opa! Souvlaki of Greece	Greek Restaurant	10 Dundas St. E.	CA	Toronto	Canada	2nd Floor in Yonge Dundas Square	15	[10 Dundas St. E. (2nd Floor in Yonge Dundas S...	[{'label': 'display', 'lat': 43.65618684017071...	43.656187	-79.380921	NaN	M5B 2G9	ON	4bce340fb6c49c74c8c79691
1	Jimmy The Greek	Greek Restaurant	220 Yonge St.	CA	Toronto	Canada	in Urban Eatery, Toronto Eaton Centre	202	[220 Yonge St. (in Urban Eatery, Toronto Eaton...	[{'label': 'display', 'lat': 43.6545029224916,...	43.654503	-79.380888	NaN	M5B 2H1	ON	4e8889c961afee1b75b4cc4a
2	Elm Street Italian Deli	Italian Restaurant	15 Elm Street	CA	Toronto	Canada	NaN	197	[15 Elm Street, Toronto ON M5G 1G7, Canada]	[{'label': 'display', 'lat': 43.65769, 'lng': ...	43.657690	-79.382480	NaN	M5G 1G7	ON	5e594c8a3de308000870c948
3	Villa Madina	Restaurant	220 Yonge St, Toronto Eaton Centre	CA	Toronto	Canada	Eaton Centre	251	[220 Yonge St, Toronto Eaton Centre (Eaton Cen...	[{'label': 'display', 'lat': 43.654064, 'lng':...	43.654064	-79.380696	NaN	M5B 2H1	ON	5372b900498e1ecf3da2bcaa
4	Osmow's	Mediterranean Restaurant	NaN	CA	Toronto	Canada	NaN	286	[Toronto ON M5G 1S6, Canada]	[{'label': 'display', 'lat': 43.658694, 'lng':...	43.658694	-79.382291	NaN	M5G 1S6	ON	5f139353a225501a63789b1e

Plotting the received data on a map shows again the exact locations of these restaurants as well as certain clusters that are visually distinct.



Further data-wrangling provided 7 large restaurant types from the requested cuisine. It is clear that the Italian restaurants are mostly present (23) with almost equal presence of Mediterranean (11) and Greek (10):



3.3. Clustering

As the requested API call to Foursquare returned 7 restaurant types for three cuisine categories, the received data were clustered into 7 clusters based on the restaurant categories and addresses on top of which k-means clustering was run.


```
In [213]: # set number of clusters
          kclusters = 7

          tor_grouped_clustering = tor_grouped.drop('categories', 1)

          # run k-means clustering
          kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(tor_grouped_clustering)

          # check cluster labels generated for each row in the dataframe
          kmeans.labels_[0:10]

Out[213]: array([2, 5, 1, 6, 0, 3, 4], dtype=int32)
```

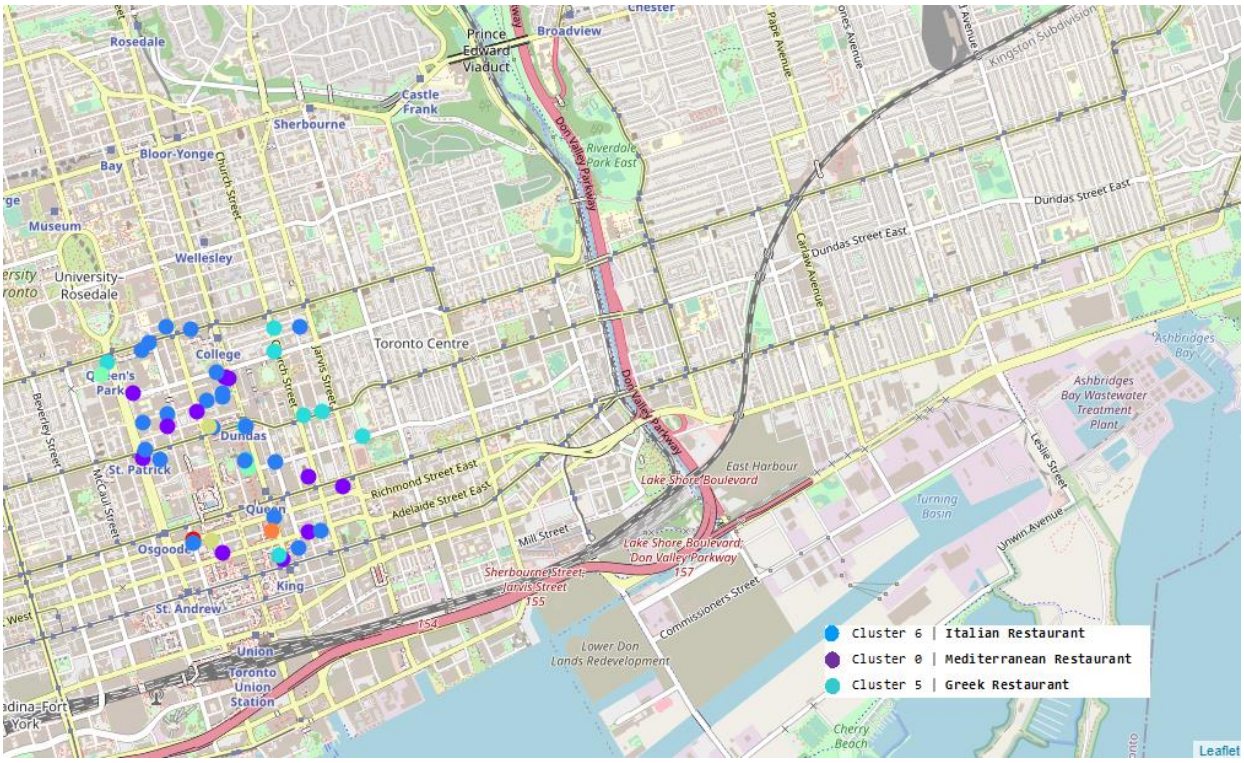
```
In [214]: # add clustering labels
          tor_grouped.insert(0, 'Cluster Labels', kmeans.labels_)

          tor_merged = tor_food_filtered

          # merge toronto_grouped with toronto_data to add latitude/longitude for each neighborhood
          tor_merged = tor_merged.join(tor_grouped.set_index('categories'), on='categories')

          tor_merged.head(50) # check the last columns!
```

The 7 clusters were finally plotted on a map to show clear positions of the three clusters which are of our interest – Cluster 6, 0 and 5:



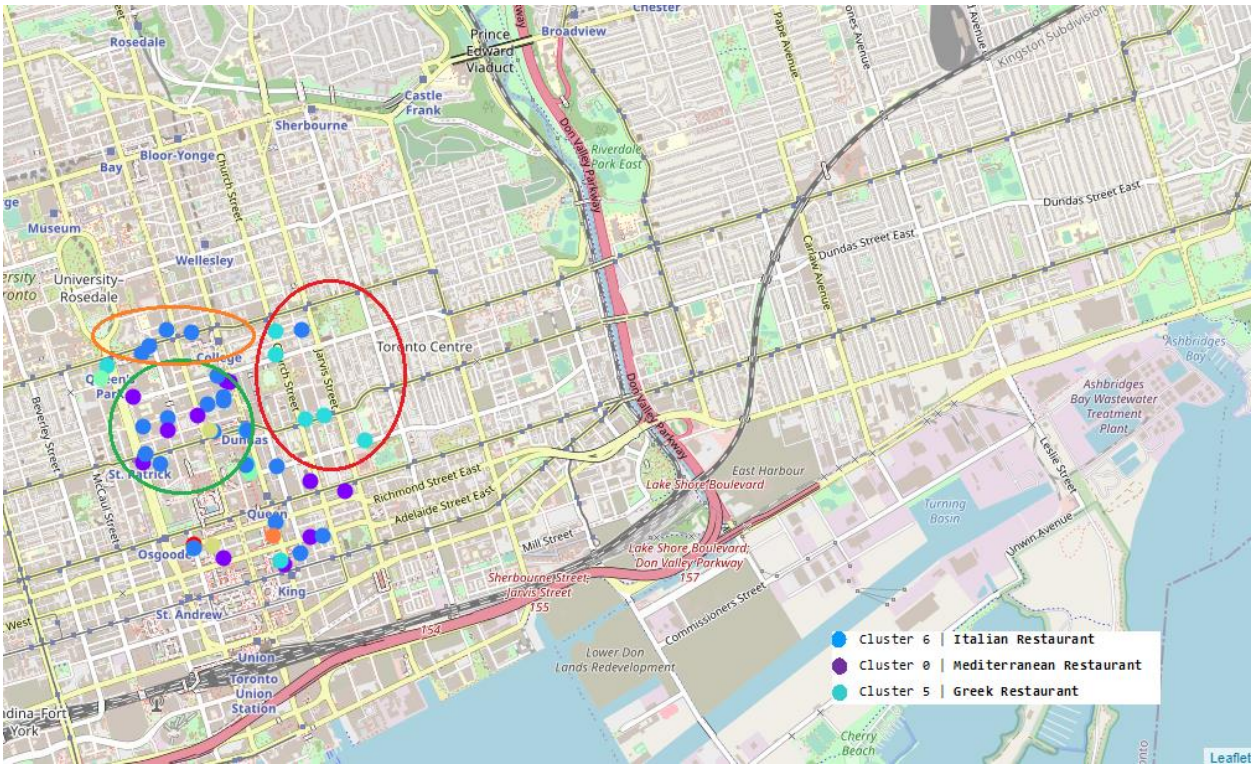
4. Conclusions

The above-posted map and clusters on it show that there is a specific distance between different restaurant categories i.e. there is a clear distinction of areas where Italian, Greek, and Mediterranean restaurants are located. In addition, there is an insignificant mixing of restaurants of different types in the same area i.e. there are not that many areas where you can find all three restaurant types near at once.

5. Proposals

Based on this short location analysis of restaurants in Downtown Toronto, three main location proposals could be offered:

- **Location 1 (red circle)** – the opening of a new Greek restaurant in the area where only Greek restaurants can be found
- **Location 2 (orange circle)** – the opening of a new Greek restaurant in the area where only Italian restaurants can be found and
- **Location 3 (green circle)** – the opening of a new Greek restaurant in the area where Italian and Mediterranean, but no Greek restaurants can be found.



Based on these location proposals, in conjunction with other available data such as location rents, accessibility, logistic support etc. and client's knowledge of the market features (i.e. why there are no Greek restaurants in the same area with Italian and Mediterranean), the business owner should have enough data to make a sound decision for his future success story.