Italian Restaurant location recommendations for Toronto

Introduction

The purpose of this study is to decide which is the best neighborhood for a new Italian restaurant in Toronto. We are advising a chef from another part of Canada on where is the best place in Toronto to open a new restaurant. The audience for this study is anyone who is thinking of opening an Italian cafe or restaurant in Toronto, and needs help deciding where is the best location. The criteria for deciding where to place the new Italian restaurant includes two main points:

1. The new Italian restaurant should not be in the same neighborhood as an existing Italian restaurant
2. The neighborhood chosen should have a lot in common with the neighborhoods that already have Italian restaurants. For example, if we find that it is common for Italian restaurants to be located in neighborhoods that also have Mexican restaurants, then we would like to find a neighborhood with a Mexican restaurant to open our new Italian restaurant.

These two criteria ensure that the new Italian restaurant will be in a location that is similar to the neighborhoods that already have Italian restaurants, but won't be too close to an existing Italian restaurant.

Data

The data for this study comes from Wikipedia, the Python *geocoder* package, and FourSquare. Wikipedia provides names and postcodes for 10 boroughs and 103 neighborhoods in Toronto. The *geocoder* package was used to create the csv file of longitude and latitude values for each Toronto neighborhood, and this csv file was provided by Coursera. Foursquare will be used to look up each neighborhood by it's coordinates and provide a list of all businesses in that area. The Foursquare data will let us see which neighborhoods already have at least one Italian restaurant, and also what other types of businesses may be present.

Wikipedia data

This shows the boroughs and neighborhood names available from Wikipedia. The PostalCode can be joined to the *geocoder* csv output to find longitude and latitude, which allows for *folium* map visualizations

	PostalCode	Borough	Neighbourhood
0	M1B	Scarborough	Malvern / Rouge
1	M1C	Scarborough	Rouge Hill / Port Union / Highland Creek
2	M1E	Scarborough	Guildwood / Morningside / West Hill
3	M1G	Scarborough	Woburn
4	M1H	Scarborough	Cedarbrae

***geocoder* data¶**

This is the Latitude and Longitude values for map plotting

	Postal Code	Latitude	Longitude
0	M1B	43.806686	-79.194353
1	M1C	43.784535	-79.160497
2	M1E	43.763573	-79.188711
3	M1G	43.770992	-79.216917
4	M1H	43.773136	-79.239476

Foursquare

These are the top 10 venue categories in Toronto. Italian restaurants are already in the top 10, so we need to find neighborhoods that don't have one yet. Also, an interesting finding will be to see how Pizza Place trends with Italian restaurant. We will have to decide whether our new restaurant should be in a location that already has a pizza place.

```
Coffee Shop           173
Café                  101
Restaurant             73
Park                   52
Italian Restaurant     51
Pizza Place            47
Hotel                  42
Sandwich Place         40
Japanese Restaurant    39
Bakery                 36
Name: Venue Category, dtype:
```

Methodology

We will use FourSquare data to find which neighborhoods meet the two main criteria of not already having an Italian restaurant in the top 100 results listed, but being similar to neighborhoods that do have one.

1. The first step is to identify which restaurants already have an Italian restaurant in their first 100 FourSquare results. This is straightforward, and can be checked using the one-hot encoded dataset.
2. The second step is to use cosine similarity on the one-hot vectors for each of about 100 neighborhoods to compare each neighborood without an Italian restaurant to each neighborhood that already has an Italian restaurant. Each neighborhood without an Italian restaurant will have one cosine similarity score between itself and each of the neighborhoods with an Italian restaurant. Then, all these scores will be summed for all those neighborhoods without an Italian restaurant to create a final score that will be used to rank that neighborhood's overall similarity with the neighborhoods that do have an Italian restaurant.

The top 10 neighborhoods according to this ranking will be presented to the Italian chefs to help them decide the best location to introduce a new Italian restaurant for the first time for that neighborhood.
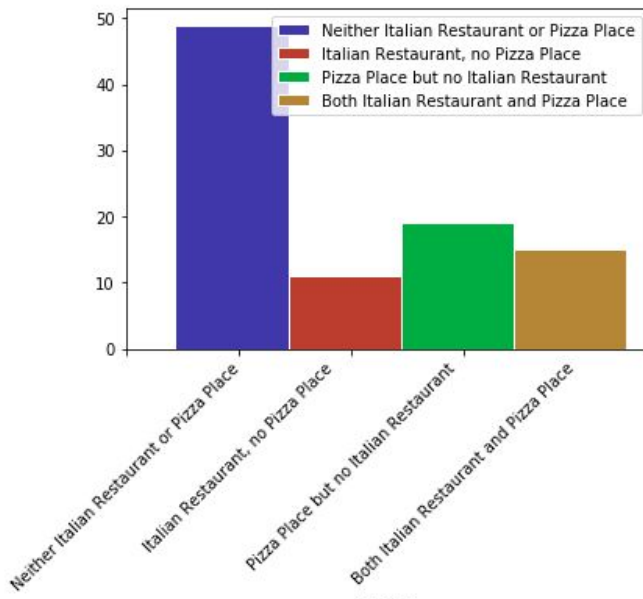
Labeling based on already existing Italian places

We will label each neighborhood based on whether or not it already has at least one Italian restaurant, or at least one Pizza place. Note that we will not consider how many Italian restaurants they are, or what percent of total business are Italian restaurants, just whether or not at least one is present.

	Neighborhood	Italian Restaurant	Pizza Place	Italian_Places	Italian_Labels
0	Agincourt	0.000000	0.0000	0	Neither Italian Restaurant or Pizza Place
1	Alderwood / Long Branch	0.000000	0.2500	2	Pizza Place but no Italian Restaurant
2	Bathurst Manor / Wilson Heights / Downsview North	0.000000	0.0500	2	Pizza Place but no Italian Restaurant
3	Bayview Village	0.000000	0.0000	0	Neither Italian Restaurant or Pizza Place
4	Bedford Park / Lawrence Manor East	0.080000	0.0400	3	Both Italian Restaurant and Pizza Place
5	Berczy Park	0.036364	0.0000	1	Italian Restaurant, no Pizza Place
6	Birch Cliff / Cliffside West	0.000000	0.0000	0	Neither Italian Restaurant or Pizza Place
7	Brockton / Parkdale Village / Exhibition Place	0.043478	0.0000	1	Italian Restaurant, no Pizza Place
8	Business reply mail Processing CentrE	0.000000	0.0625	2	Pizza Place but no Italian Restaurant
9	CN Tower / King and Spadina / Railway Lands / ...	0.000000	0.0000	0	Neither Italian Restaurant or Pizza Place

Preliminary results on neighborhoods by presence of Italian restaurants

Preliminary results show that about half of neighborhoods in Toronto do not have either an Italian restaurant or Pizza place yet, and any of these is a possible candidate for our future Italian restaurant. Also, some neighborhoods do have at least one pizza place, and we will be exploring whether it makes sense to put our Italian restaurant in a neighborhood that already has a pizza place. The neighborhoods that already have Italian restaurants are important to our study because we will use them to find out what characteristics make a neighborhood friendly to Italian restaurants.
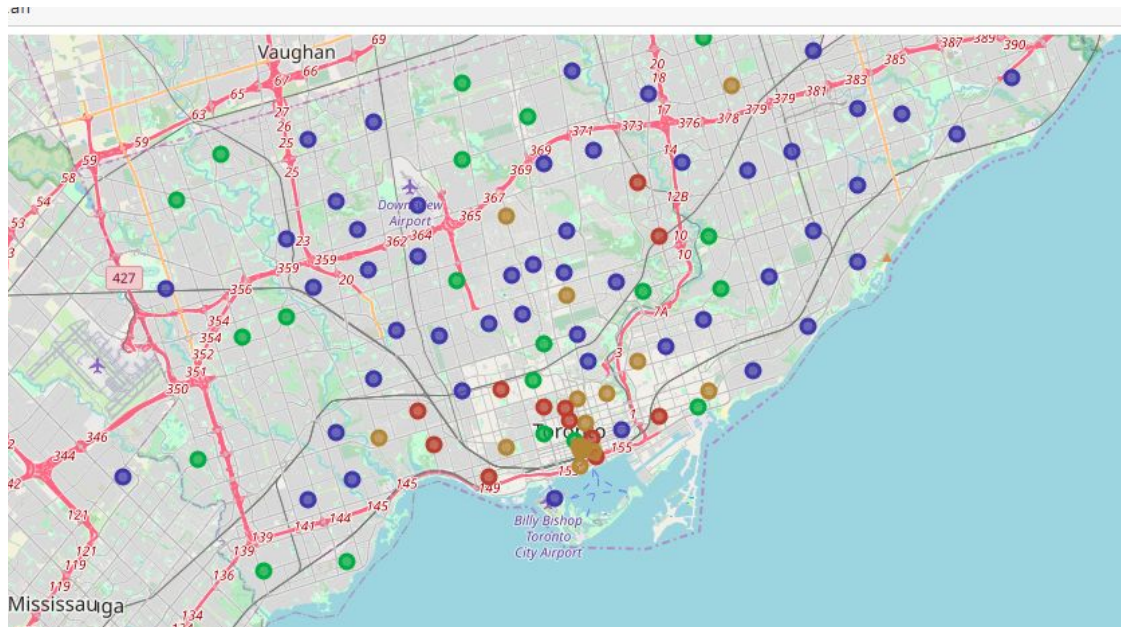

Results

The first step in results is visualizing the locations of neighborhoods with Italian restaurants, pizza places, or both. The orange dots show places with both Italian restaurant and pizza place, and red dots show those with Italian restaurants only. The green dots show neighborhoods with pizza places, but not Italian restaurants. The blue dots have neither Italian restaurants or pizza places. We will use the Italian restaurant neighborhoods (red and orange dots) to determine which neighborhood without an Italian restaurant (blue and green dots) is most likely a good choice to open a first Italian restaurant.

The second step is reviewing the cosine similarity results between the neighborhoods that have Italian restaurants, and those that do not.

Geographical location results

These are results showing all neighborhoods that already have an Italian restaurant in warm colors - red and orange , and orange also has a Pizza Place. The ones we are considering for recommendation that do not have an Italian restaurant yet are in cool colors - blue and green, and green has a pizza place. Italian restaurants tend to be clustered in the city center, but some are more spread out.
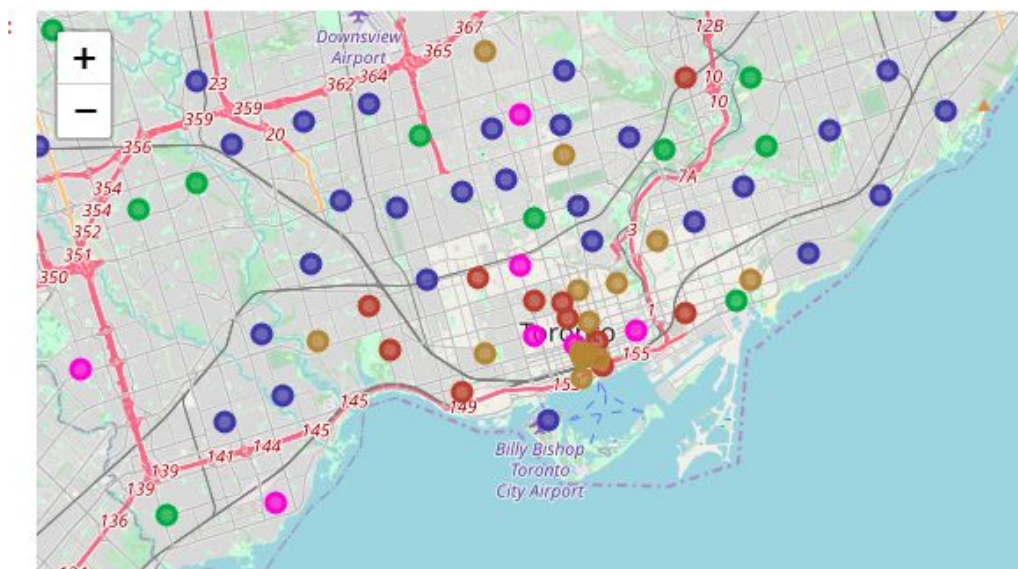
Cosine Similarity calculation results

Now that we've visualized the locations of neighborhoods with and without Italian restaurants, the next step is to inspect the results for which no-Italian-restaurant neighborhoods have the highest sum of cosine similarity scores with Italian-restaurant neighborhoods. From the final top 10 list, it seems that both neighborhoods with and without pizza places could be good candidates for opening up a first-time Italian restaurant.

Neighborhood	Italian_Labels	Cosine_Sim_Scores
Richmond / Adelaide / King	Pizza Place but no Italian Restaurant	13.560804
Regent Park / Harbourfront	Neither Italian Restaurant or Pizza Place	11.731642
Willowdale	Pizza Place but no Italian Restaurant	10.539785
The Annex / North Midtown / Yorkville	Pizza Place but no Italian Restaurant	10.000838
Kensington Market / Chinatown / Grange Park	Pizza Place but no Italian Restaurant	9.924557
North Toronto West	Neither Italian Restaurant or Pizza Place	9.227167
New Toronto / Mimico South / Humber Bay Shores	Pizza Place but no Italian Restaurant	8.302159
Bathurst Manor / Wilson Heights / Downsview North	Pizza Place but no Italian Restaurant	8.239112
Woburn	Neither Italian Restaurant or Pizza Place	8.180041
Eringate / Bloordale Gardens / Old Burnhamthor...	Pizza Place but no Italian Restaurant	8.051736

Top 10 recommended neighborhoods by location

The pink locations below are from our top 10 list, neighborhoods that do not already have an Italian restaurant, but resemble neighborhoods that do.

Top 10 recommended neighborhoods by other businesses

These are the top venue types in each of 3 groups - our top 10 list, the neighborhoods that already have an Italian restaurant, and the neighborhoods without an Italian restaurant that did not make the top 10. Each list is scaled by the number of neighborhoods in the list. For example, the our top 10 list shows that there are an average of 3.2 Coffee Shops per neighborhood in the neighborhoods that made the top 10 list.

```
Recommended for a new Italian Restaurant, n= 10

Coffee Shop             3.2
Café                    2.1
Restaurant              1.1
Pizza Place             1.0
Park                    0.7
Mexican Restaurant      0.6
Sandwich Place          0.6
Bakery                  0.6
Cosmetics Shop          0.5
Pharmacy                0.5
```

```
Already has an Italian restaurant, n= 26

Coffee Shop             4.576923
Café                    2.923077
Restaurant              2.115385
Italian Restaurant      1.961538
Hotel                   1.269231
Japanese Restaurant     1.192308
Bar                     0.923077
Gym                     0.884615
Park                    0.884615
Pizza Place             0.846154
```

```
Doesn't have an Italian restaurant, not in Top 10, n= 58

Coffee Shop             0.379310
Park                    0.379310
Pizza Place             0.258621
Bank                    0.241379
Clothing Store          0.224138
Fast Food Restaurant    0.224138
Sandwich Place          0.224138
Grocery Store           0.189655
Bakery                  0.189655
Pharmacy                0.155172
```

Discussion

The top 10 neighborhoods that were selected as the best places for a new Italian restaurant that don't already have an Italian restaurant showed some interesting results. The locations and characteristics of these neighborhoods can help our audiences learn about what to look for in a neighborhood when deciding to introduce a new Italian restaurant.

Locations

The locations of existing Italian restaurants show that most of them are in the busy city center, with a few scattered out in the suburbs. The top 10 neighborhoods for a new Italian restaurant also showed this trend, with nearly every center city location that did not already have an Italian restaurant being selected, and a few also selected out in the suburbs. This is an interesting result, because distance from city center was not included as a variable. A follow-up study might include this variable to see how the likelihood of finding an Italian restaurant changes as you move away from the center.

Characteristics

An early hypothesis was to see whether presence of a pizza place increased the likelihood of finding an Italian restaurant, and it turns out that 7 of the top 10 recommendations do already have pizza places. But, it turns out pizza place wasn't the strongest trend found. The top 3 types of businesses in neighborhoods with Italian restaurants are Coffee Shop, Cafe, and Restaurant, and it turns out these were also the top 3 business types in the top 10 recommendations. Locations not recommended for Italian restaurants also had Coffee Shops, but were more likely to have Clothing Stores and Banks. It would be interesting to extend this analysis to other cities and see if it's common to find Italian restaurants in the same places as Cafes and Coffee Shops.

Conclusion

In conclusion, the 10 neighborhood recommendations are the best places to start a new Italian restaurant in Toronto, assuming the chef is looking for a place that has never had an Italian restaurant before. We learned that Italian restaurants are usually found in neighborhoods that have cafes, coffee shops, and other restaurants, so the recommendations are based on finding new places that also have these types of businesses.