A RECOMMENDER SYSTEM FOR GROCERIES CONTRACTOR

Applied Data Science Capstone
IBM Data Science Professional Certificate

Synopsis

- **Part 1: Problem Description**

There is a groceries contractor in one of the boroughs of Toronto (Scarborough). This contractor provides places such as: Different types of Restaurants, Bakery, Breakfast Spot, Brewery and Café with fresh and high-quality groceries. The contractor wants to build a warehouse for the groceries it buys from villagers and farmers inside the borough, so that they will support more customers and bring better "Quality of Service" to the old customers.

Synopsis

- **Part 2: Data We Need**

a) We will need geo-locational information about that specific borough and the neighborhoods in that borough. We assume it is "Scarborough" in Toronto. This is easily provided for us by the contractor, because the contractor has already made up his mind about the borough.

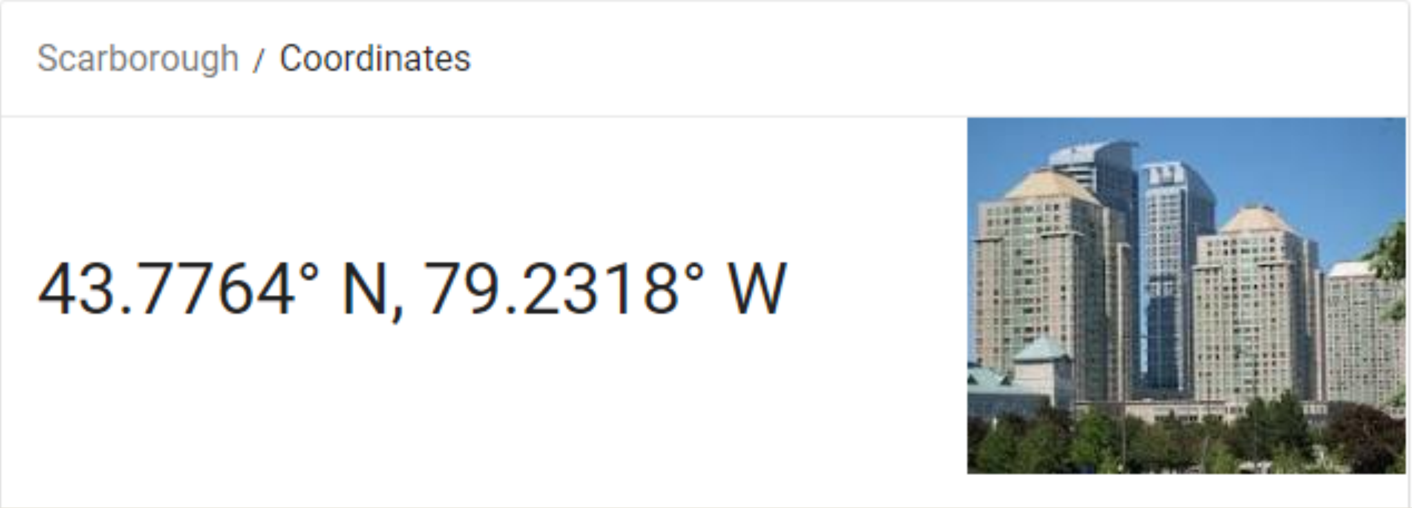


image is retrieved from google.com

Synopsis

◦ **Part 2: Data We Need**

b) We will need data about different venues in different neighborhoods of that specific borough. In order to gain that information, we will use "Foursquare" locational information. A typical request from Foursquare will provide us with the following information:

	Postal Code	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Summary	Venue Category	Distance
0	M1W	Steeles West	43.799525	-79.318389	Mr Congee Chinese Cuisine 龍粥記	This spot is popular	Chinese Restaurant	72
1	M1W	Steeles West	43.799525	-79.318389	Agincourt Bakery	This spot is popular	Bakery	759
2	M1W	Steeles West	43.799525	-79.318389	Little Sheep Mongolian Hot Pot 小肥羊	This spot is popular	Hotpot Restaurant	972
3	M1W	Steeles West	43.799525	-79.318389	Phoenix Restaurant 金鳳餐廳	This spot is popular	Chinese Restaurant	147
4	M1W	Steeles West	43.799525	-79.318389	Price Chopper	This spot is popular	Grocery Store	16

Main Article

- **Part 1: Identifying Postal Codes (and then Neighborhoods) in "Scarborough"**

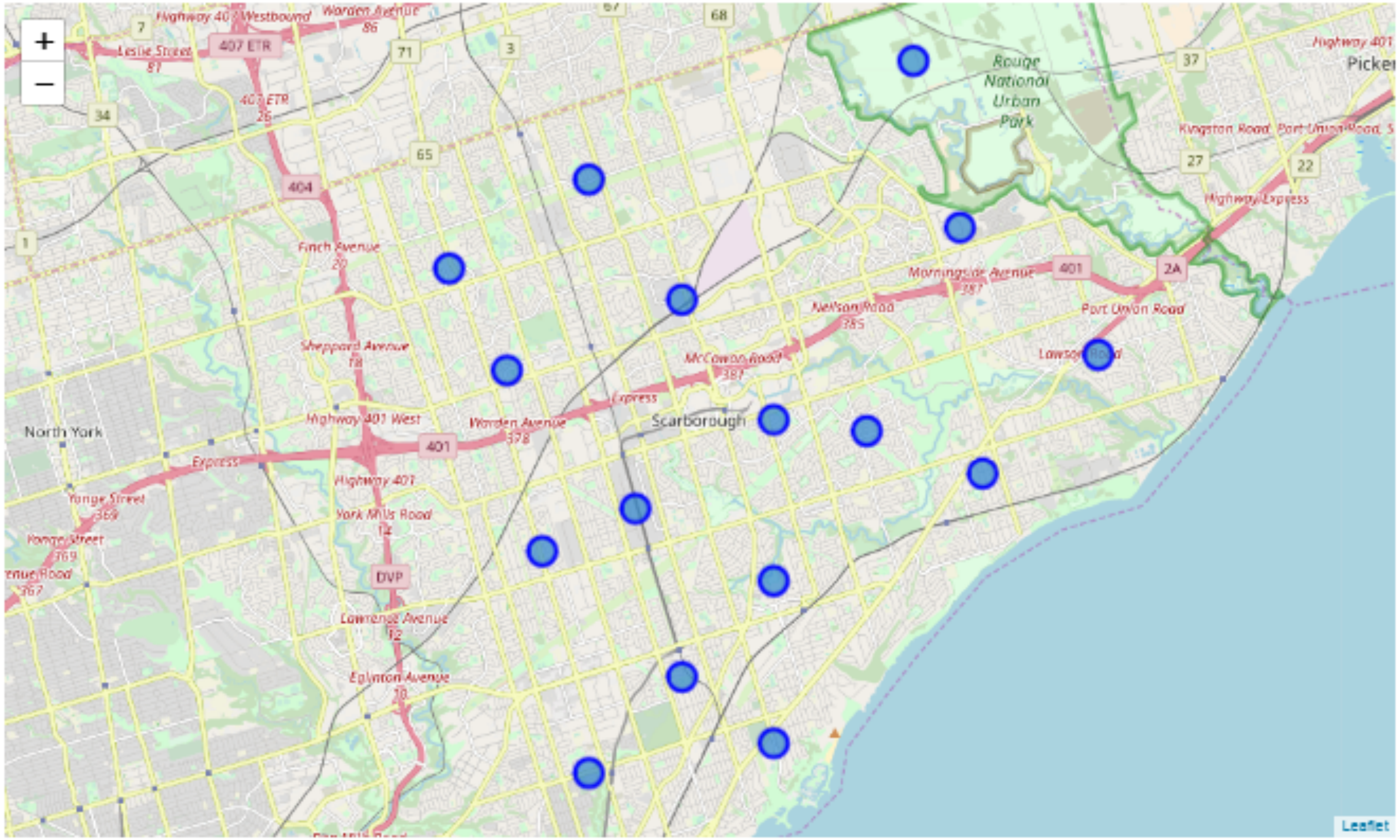
```
scarborough_data
```

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M1W	Scarborough	Steeles West	43.799525	-79.318389
1	M1J	Scarborough	Scarborough Village	43.744734	-79.239476
2	M1G	Scarborough	Woburn	43.770992	-79.216917
3	M1C	Scarborough	Highland Creek, Rouge Hill, Port Union	43.784535	-79.160497
4	M1N	Scarborough	Birch Cliff	43.692657	-79.264848
5	M1R	Scarborough	Maryvale, Wexford	43.750072	-79.295849
6	M1V	Scarborough	Agincourt North, Milliken	43.815252	-79.284577
7	M1H	Scarborough	Cedarbrae	43.773136	-79.239476
8	M1T	Scarborough	Tam O'Shanter	43.781638	-79.304302
9	M1M	Scarborough	Cliffcrest, Cliffside	43.716316	-79.239476
10	M1E	Scarborough	Morningside, West Hill	43.763573	-79.188711
11	M1B	Scarborough	Rouge, Malvern	43.806686	-79.194353
12	M1S	Scarborough	Agincourt	43.794200	-79.262029
13	M1K	Scarborough	Ionview, Kennedy Park	43.727929	-79.262029
14	M1P	Scarborough	Dorset Park, Scarborough Town Centre, Wexford ...	43.757410	-79.273304
15	M1X	Scarborough	Upper Rouge	43.836125	-79.205636
16	M1L	Scarborough	Clairlea, Golden Mile, Oakridge	43.711112	-79.284577

Main Article

◦ **Part 1: Identifying Postal Codes (and then Neighborhoods) in "Scarborough"**

```
The geograpical coordinate of "Scarborough" are: 43.773077, -79.257774.
```



Main Article

- **Part 2: Connecting to Foursquare and Retrieving Locational Data for Each Venue in Every Neighborhood**

After finding the list of neighborhoods, we then connect to the Foursquare API to gather information about venues inside each and every neighborhood. For each neighborhood, we have chosen the radius to be 1000 meter. It means that we have asked Foursquare to find venues that are at most 1000 meter far from the center of the neighborhood.

Main Article

- **Part 3: Processing the Retrieved Data and Creating a DataFrame for All the Venues inside the Scarborough**

When the data is completely gathered, we will perform processing on that raw data to find our desirable features for each venue. Our main feature is the category of that venue. After this stage, the column "Venue's Category" will be One-hot encoded and different venues will have different feature-columns. After On-hot encoding we will integrate all restaurant columns to one column "Total Restaurants" and all food joint columns to "Total Joints" column.

Main Article

- **Part 3: Processing the Retrieved Data and Creating a DataFrame for All the Venues inside the Scarborough**

```
scarborough_venues.head()
```

	Postal Code	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Summary	Venue Category	Distance
0	M1W	Steeles West	43.799525	-79.318389	Mr Congee Chinese Cuisine 龍粥記	This spot is popular	Chinese Restaurant	72
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Now, the dataset is fully ready to be used for machine learning (and statistical analysis) purposes.

```
scarborough_onehot
```

Neighborhood	Bakery	Breakfast Spot	Diner	Fish Market	Food & Drink Shop	Fruit & Vegetable Store	Grocery Store	Noodle House	Pizza Place	Sandwich Place	Total Restaurants	Total Joints
Agincourt	2	1	0	0	0	0	0	1	1	2	21	0
Agincourt North, Milliken	1	0	0	0	0	0	0	1	2	0	13	2
Birch Cliff	0	0	1	0	0	0	0	0	0	0	2	0
Cedarbrae	3	0	0	0	0	0	1	0	1	0	7	3
Clairlea, Golden Mile, Oakridge	2	0	1	0	0	0	1	0	1	1	1	0
Cliffcrest, Cliffside	0	0	0	0	0	0	0	0	3	0	1	1
Dorset Park, Scarborough Town Centre, Wexford Heights	2	0	0	0	0	0	1	0	1	1	14	3
Highland Creek, Rouge Hill, Port Union	0	1	0	0	0	0	0	0	0	0	1	1
Ionview, Kennedy Park	0	0	0	0	0	0	2	0	1	1	6	1
Maryvale, Wexford	0	1	0	1	0	0	3	0	3	0	8	1
Morningside, West Hill	0	0	0	0	1	0	0	0	1	1	3	3
Rouge, Malvern	1	0	0	0	0	1	0	0	0	1	7	0
Scarborough Village	0	0	0	0	0	0	0	0	1	1	3	0
Steeles West	2	1	0	0	0	0	1	0	1	1	7	1
Tam O'Shanter	1	0	0	0	0	0	0	1	2	2	13	1
Woburn	0	0	0	0	0	0	0	0	0	0	3	0

Main Article

- **Part 4: Applying one of Machine Learning Techniques (K-Means Clustering)**

```
# import k-means from clustering stage
from sklearn.cluster import KMeans

# run k-means clustering
kmeans = KMeans(n_clusters = 5, random_state = 0).fit(scarborough_onehot)
```

	Bakery	Breakfast Spot	Diner	Fish Market	Food & Drink Shop	Fruit & Vegetable Store	Grocery Store	Noodle House	Pizza Place	Sandwich Place	Total Restaurants	Total Joints	Total Sum
G5	2.000000	1.000000	0.000000	0.0	0.000000	0.00	0.000000	1.000000	1.000000	2.000000	21.000000	0.000000	28.000000
G1	1.333333	0.000000	0.000000	0.0	0.000000	0.00	0.333333	0.666667	1.666667	1.000000	13.333333	2.000000	20.333333
G4	0.000000	1.000000	0.000000	1.0	0.000000	0.00	3.000000	0.000000	3.000000	0.000000	8.000000	1.000000	17.000000
G3	1.500000	0.250000	0.000000	0.0	0.000000	0.25	1.000000	0.000000	0.750000	0.750000	6.750000	1.250000	12.500000
G2	0.285714	0.142857	0.285714	0.0	0.142857	0.00	0.142857	0.000000	0.857143	0.428571	2.000000	0.714286	5.000000

Decision Making and Results

Now, we focus on the centers of clusters and compare them for their "Total Restaurants" and their "Total Joints". The group which its center has the highest "Total Sum" will be our best recommendation to the contractor. {Note: Total Sum = Total Restaurants + Total Joints.} This algorithm although is pretty straightforward yet is strongly powerful.

Decision Making and Results

Result:

Best Group is G5;

Second Best Group is G1;

Third Best Group is G4;

Inserting "kmeans.labels_" into the Original Scarborough DataFrame

Finding the Corresponding Group for Each Neighborhood.

Decision Making and Results

	Neighborhood	Group
0	Agincourt	5
1	Agincourt North, Milliken	1
2	Birch Cliff	2
3	Cedarbrae	3
4	Clairlea, Golden Mile, Oakridge	2
5	Cliffcrest, Cliffside	2
6	Dorset Park, Scarborough Town Centre, Wexford ...	1
7	Highland Creek, Rouge Hill, Port Union	2
8	Ionview, Kennedy Park	3
9	Maryvale, Wexford	4
10	Morningside, West Hill	2
11	Rouge, Malvern	3
12	Scarborough Village	2
13	Steeles West	3
14	Tam O'Shanter	1
15	Woburn	2

Decision Making and Results

Best Neighborhood Is ...

```
neigh_summary[neigh_summary['Group'] == 5]
```

	Neighborhood	Group
0	Agincourt	5

```
name_of_neigh = list(neigh_summary[neigh_summary['Group'] == 5]['Neighborhood'])[0]
scarborough_venues[scarborough_venues['Neighborhood'] == name_of_neigh].iloc[0,1:5].to_dict()
```

```
{'Postal Code': 'M1S',
 'Neighborhood': 'Agincourt',
 'Neighborhood Latitude': 43.7942003,
 'Neighborhood Longitude': -79.26202940000002}
```

Thank you!