PREDICTING NEW LOCATIONS TO START A FAST-FOOD RESTURANTS

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Contents

1 Introduction

1.1 Background

The renowned fast-food company ‘Chicken is Good’ is well known in United States for their fried chicken. Their business is having a rapid growth since the inception last year. They are looking for opportunities to expand to new markets and Canada is identified by their sales team as a potential place to expand their business. Canada is close to US so their distribution network can easily expand to Canada without much of the hassle. They have identified Toronto as a good place to start their business because it has large working population, which is their most profitable market segment in US. However, as there are lot of competitors already operating in Toronto, they want to find the best places to establish their two branches is vital. They want to find most profitable neighbourhoods to start their business.

1.2 Problem

The main problem this project aims to solve is to find best Toronto neighbourhoods to start their first few initial fast-food branches. Factors to consider are a smaller number of competitors and potential to attract lot of customers.

1.3 Interest

Chicken is good company wants to make a huge impact in the Canada market. To do that identifying most profitable location is essential as it will make a huge impression to the new customers in Canada.

2 Data acquisition and cleaning

2.1 Data sources

The main aim of the analysis is to find the best profitable neighbourhoods in Toronto to start a fast-food restaurant in the city of Toronto. To do the analysis we have to identify what types of restaurants already there in the neighbourhoods in Toronto. Also, demographic profiles of the neighbourhoods will be considered in the analysis. Mainly the population of each neighbourhood will be used as a feature in the clustering step.

Data	**Source**
Different neighbourhoods in Toronto	Scraping Wikipedia website page to get the information https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M
Different Venues and Details in the Toronto Neighbourhoods	Use Foursquare api to get the venue information
Neighbourhood locations (lng,lat) values	Use google maps API get latitude and longitude information
Demographic details (population) of Toronto Neighbourhoods	Scraping Wikipedia website page to get the information https://en.wikipedia.org/wiki/Demographics_of_Toronto_neighbourhoods

2.2 Data Cleaning

The neighbourhood data set is scraped from a table in the Wikipedia. There are several Postal Codes with ‘Not assigned’ Borough details. There were removed from the list of neighbourhoods.

In the demographic table that was extracted from Wikipedia following data cleaning steps were applied. The raw table have numbers as text and also SecondLng Column needs splitting to the Language and the corresponding percentage. So, the dataset was cleaned by removing and converting numeric columns.

1. Remove empty lines in the dataset.
2. Remove the summary column at the bottom of the table.
3. Replace Municipality code with the name.
4. Split SecondLng to two columns.
5. Convert all numbers to float values by removing commas in the string.

3 Methodology

3.1 Exploratory Data Analysis

3.1.1 Neighbourhoods in Toronto

Following map shows the neighbourhood map of the Toronto. There are 103 Neighbourhoods in the Toronto Region.

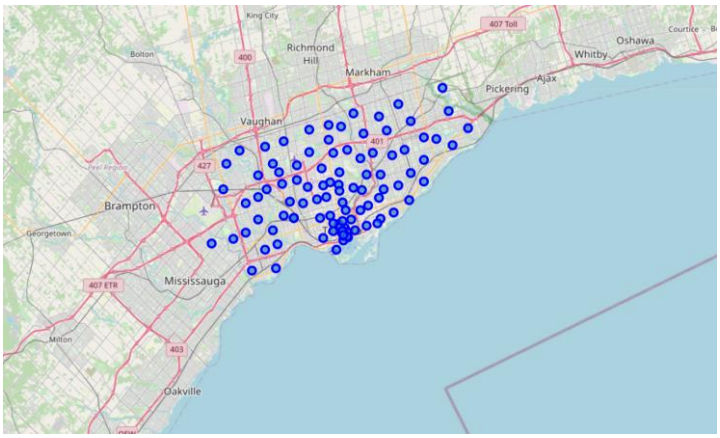

Figure 1: Neighbourhoods in Toronto

3.1.2 Neighbourhoods with fast food restaurants

Above figure shows all the neighbourhoods regardless of venue types they have in them. But as the goal of the project is to analyse potential locations to start a fast-food restaurant, it is important to know which neigh hoods currently have at least one fast food restaurant.

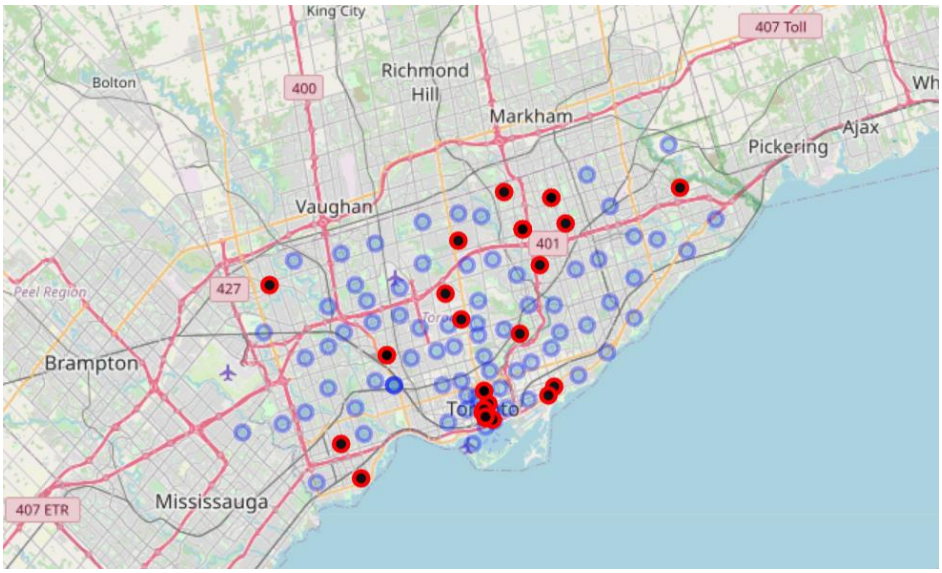

Figure 2 Neighbourhoods with fast-food restaurants (red circles)

We can see that existing fast-food locations are most situated in the city centre where there are many people. These fast-food restaurants are located in the 26 separate neighbourhoods in Toronto.

3.1.3 Current fast-food restaurant chains operating in Toronto Region.

There are 32 fast food restaurants that are operating in the Toronto region. McDonalds have the greatest number of branches (8) which is followed by KFC with 4 branches and Crepe Delicious with 4 branches. Following table provide the full list of restaurants currently operating in Toronto.

Venue	Number of Restaurants
McDonald's	8
KFC	4
Crepe Delicious	4
iQ Food Co	3
The Burger's Priest	3
A&W	3
Wendy’s	2
New York Fries	1
New York Fried Chicken	1
Fit For Life	1
Chick-n-Joy	1
Bourbon St. Grill	1

3.2 Finding best neighbourhoods to start the new fast-food branches

3.2.1 Machine Learning modelling approach

In order to find the best locations for the restaurant, we find the neighbourhoods (without fast food restaurants) which are similar to the neighbourhoods that already have fast food restaurants. The rational behind this is that similar neighbourhoods have similar kind of customer profiles that will like fast food restaurants. Therefore, if we can identify neighbourhoods that don’t have fast food neighbourhoods with similar profiles, they are the ideal locations to establish new branches.

3.2.2 Clustering approach

To find similar neighbourhoods, K-Means clustering was used. Number of clusters was set to 30 and population and existing venues in the neighbourhoods were used as the features into the clustering model. There were 286 features in the final training set.

4 Results and Discussions

There are 30 cluster after the model execution. Among them only 12 clusters contained at least one fast-food restaurant. Following table summarizes the results of the clustering for those 12 clusters.

Cluster	Number of Neighbourhoods in the cluster	Number of Neighbourhoods with fast-food restaurants	Rank Based on number fast food restaurants in all neighbourhoods in the cluster	Number of Neighbourhoods that can be used to establish new branches
15.0	1	1	1	0
4.0	4	2	2	2
1.0	37	12	3	25
0.0	7	3	4	4
14.0	2	1	5	1
24.0	2	1	6	1
16.0	4	1	7	3
8.0	1	1	8	0
22.0	2	1	9	1
7.0	3	1	10	2
18.0	2	1	11	1
10.0	4	1	12	3

Based on the clustering, ***Cluster 15*** is the best place to start a new fast-food restaurant. However, that cluster only has one neighbourhood and it already have several fast-food restaurants. Therefore, we must use the next cluster which is the ***Cluster 4***.

Fortunately, in the **Cluster 4,** we have **2 neighbourhoods without any fast food restaurants.** These 2 neighbourhoods are the ideal places to start the new fast-food restaurants.

4.1 Best Places to start fast-food restaurants

Following table summarizes the neighbourhoods in the cluster 4 and also highlights two potential neighbourhoods for the new fast-food restaurants.

Cluster	Postal Code	Borough	Neighbourhood	Population	Number of Fast-Food restaurants
4.0	M9B	Etobicoke	West Deane Park, Princess Gardens, Martin Grove, Islington, Cloverdale	13683.0	0
4.0	M4G	East York	Leaside	13876.0	0
4.0	M5M	North York	Bedford Park, Lawrence Manor East	13749.0	1
4.0	M4Y	Downtown Toronto	Church and Wellesley	13397.0	2

Therefore, according to the above table most suitable locations to start new fast-food restaurant of the ‘Chicken is good’ company are,

- **Neighbourhood**: West Deane Park, Princess Gardens, Martin Grove, Islington, Cloverdale | **Borough**: Etobicoke
- **Neighbourhood**: Leaside | **Borough**: East York

Following figure shows the locations of these potential locations (Blue Circles) and also existing fast food restaurant locations (Red Circles).

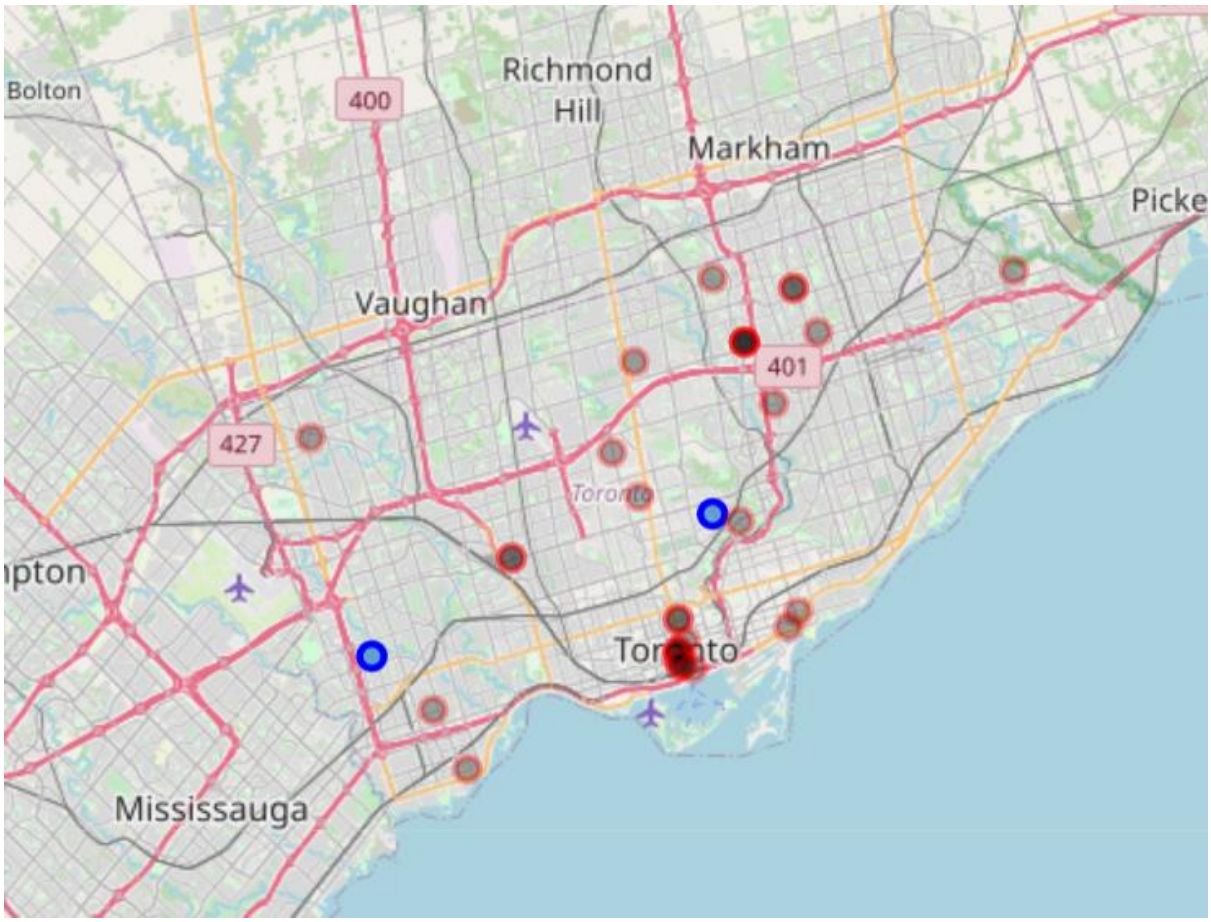

Figure 3 : Best Locations to start new fast-food restaurant branches (blue circles)

Among the 2 potential locations West Deane Park, Princess Gardens, Martin Grove, Islington, Cloverdale Neighbourhoods in the Etobicoke Borough is the best place as it is closer to a Airport and there are no competitors near those locations. However, Leaside is also a viable solution as its Neighbourhood profile have high potential and its closer to the city centre.

5 Conclusion

The ‘Chicken is Good’ company wanted to expand their business to Canada. It wanted to identify neighbourhoods with high potential to attract customers to their renowned fast-food offerings. We have used clustering to identify neighbourhoods with similar profiles to neighbourhoods with fast-food restaurants. We fed existing venue types and the population of the neighbourhood as features to the clustering model.

Based on the clustering results we could identify two potentials neighbourhoods in Toronto for the new branches of the ‘Chicken is good’ Fast food restaurant chain.