Supply Chain Analytics: Warehouse Strategic Location

Introduction

Maple syrup is considered the greatest thing made by tree. It is use as a condiment for pancakes, waffles, and French toast. Currently, Canada is the largest maple syrup producer in the world. In fact, 80% of the global supply is coming from Canada. The country produces around 80 million kg of maple syrup annually.

The Problem

A Canadian company, CAPLE, is planning to invest on this industry. They plan to source and manufacture the maple syrup in Quebec and distribute it to consumers. Based on their estimate, 80% of their products will be for export and the remainder will be allocated for Canadian market.

Since the province with the largest population is Ontario, they're thinking to build a distribution center that is strategically located in the area. It is crucial that the distribution center is located strategically to minimize the last-mile delivery cost. Hence, it should be within the city center wherein groceries and shopping centers are located.

The supply chain analytics division of the company is tasked to choose the strategic location for their distribution center. Distribution center should be located at the heart of the city wherein the population is high. Thus, more customers and accounts.

Data Description

The team will identify which among the area in Ontario is highly populated. Highly populated area would mean higher number of customers and accounts. Thus, lesser last mile delivery cost. The demographic of Ontario can be found in the following link wherein the census data can be found:
https://en.wikipedia.org/wiki/Demographics_of_Ontario

City	2016 [19]	2011 [20]	2006 [21]	2001 [22]	1996 [23]	1991 [23]
Toronto	5,928,040	5,583,064	5,113,149	4,682,897	4,263,757	3,898,933
Ottawa-Gatineau	1,323,783	1,236,324	1,130,761	1,063,664	1,010,498	941,814
Hamilton	747,545	721,053	692,911	662,401	624,360	599,760
Kitchener-Cambridge-Waterloo	523,894	477,160	451,235	414,284	382,940	356,421
London	494,069	474,786	457,720	432,451	398,616	381,522
St. Catharines-Niagara	406,074	392,184	390,317	377,009	372,406	364,552
Oshawa	379,848	356,177	330,594	296,298	268,773	240,104
Windsor	329,144	319,246	323,342	307,877	278,685	262,075
Barrie	197,059	187,013	177,061	148,480	118,695	97,150
Greater Sudbury	164,689	160,770	158,258	155,601	160,488	157,613
Kingston	161,175	159,561	152,358	146,838	143,416	136,401
Guelph	151,984	141,097	127,009	117,344	105,420	97,667
Brantford	134,203	135,501	124,607	86,417	100,238	97,106
Peterborough	121,721	118,975	|102,423	100,193	98,060	-
Thunder Bay	121,621	121,596	122,907	121,986	125,562	124,925
Belleville	103,472	101,668	91,518	87,395	87,871	-

Moreoverwill use the Foursquare API to map out the location of groceries and shopping centers. From these data, the strategic location of the warehouse will be identified. The longitude and latitude data will be extracted from the Toronto Clustering exercised that was done in the previous week.

Geographic Data

The team from supply chain division will utilize the geographic data of Toronto from previous week's assignment.

	PostalCode	Borough	Neighbourhood	Latitude	Longitude
0	M1B	Scarborough	Malvern / Rouge	43.64869	-79.38544
1	M1C	Scarborough	Rouge Hill / Port Union / Highland Creek	43.64869	-79.38544
2	M1E	Scarborough	Guildwood / Morningside / West Hill	43.64869	-79.38544
3	M1G	Scarborough	Woburn	43.64869	-79.38544
4	M1H	Scarborough	Cedarbrae	43.64869	-79.38544

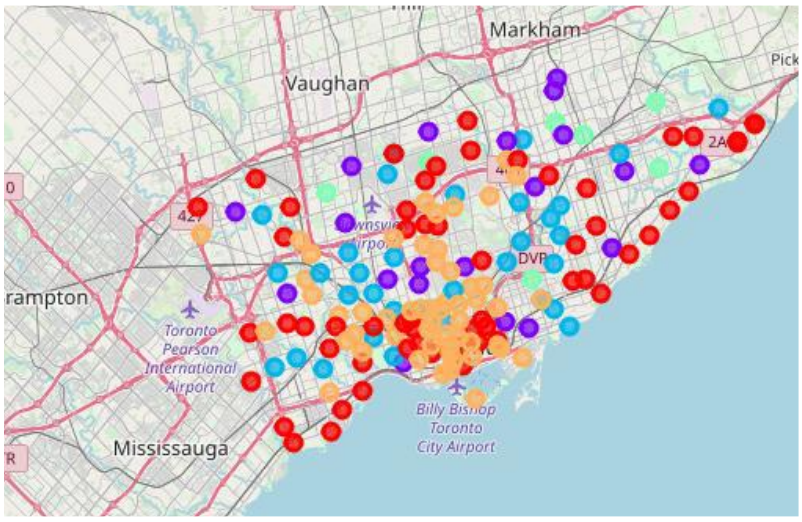
Methodology

The population data will be scrapped from Wikipedia using the beautiful soup library. It is crucial for the supply chain division to determine which among the areas have the highest number of populations since high population would mean higher number of consumers and retail accounts. Thus, lesser last mile delivery cost for Caple company. The coordinates of the neighborhood will be determined using geocoder API. These coordinates will be used in determining location information in the Foursquare API. Once these data are identified, the team will cluster the neighborhood to determine the number of distribution centers that needs to be built.

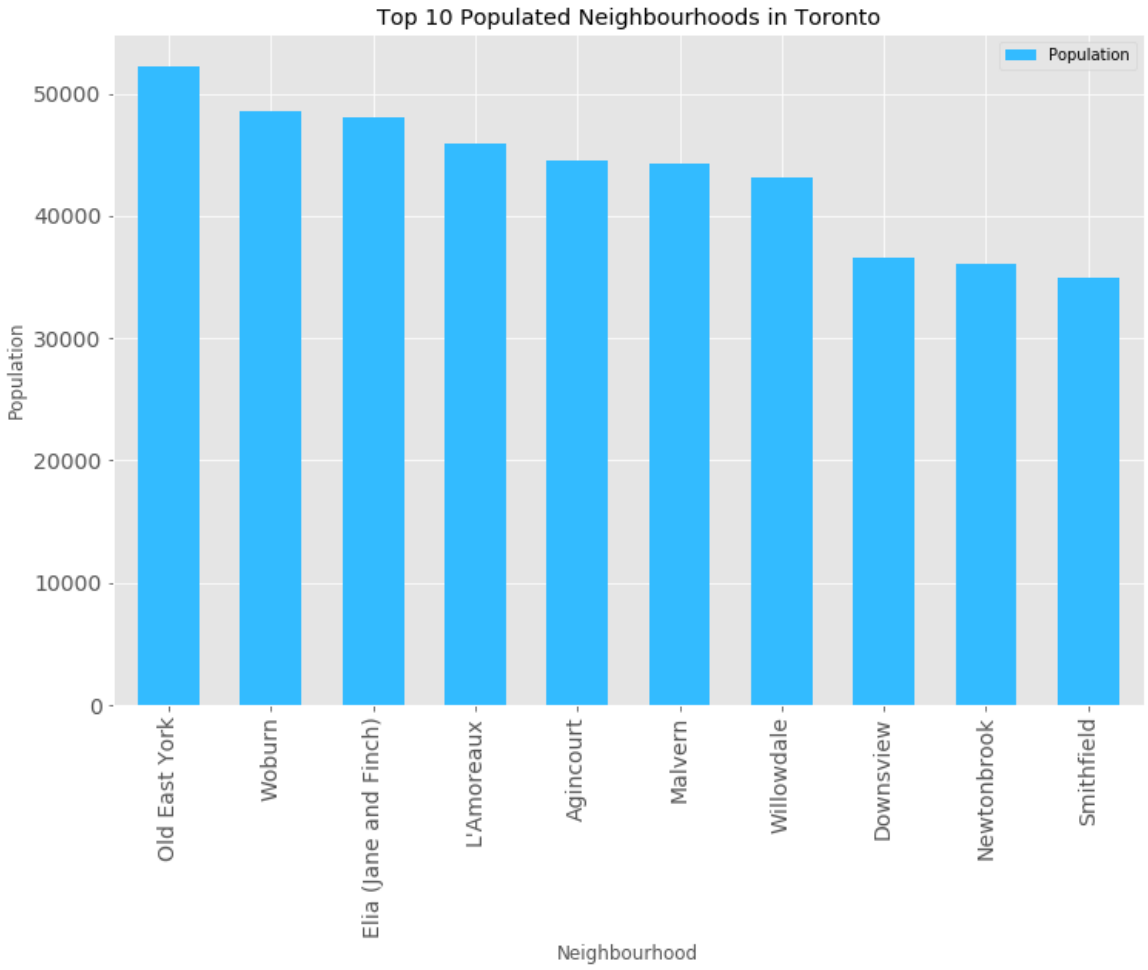
Once the number of distribution center is identified. The team will use the foursquare API to map the location where most groceries and shopping centers are located.

Results

With K-Means clustering technique, the top 5 clusters of similar neighborhoods have been apparent in the result, see below. Since the intra-cluster distance in 3rd cluster (orange) are shorter it is recommended to build the distribution in this region.



With bar chart visualization technique, we can easily tell what are the top population (i.e. higher number of residences) in the neighborhood cluster. This is also critical as we will like to recommend to the management of Caple of the neighborhood with the higher number of population so that there will be a higher demand for their service offering and lesser last mile delivery cost. The top 10 neighborhoods with highest number of populations are as follows.



With Foursquare.com API, we are also able to leverage on the data to find out which among the area has a high concentration of shopping centers. It is ideal that our accounts are strategically located near each other.

Discussion

Based on the analysis, we found out that intra-cluster distance in 3rd cluster (orange) are shorter. Thus, high number of similar neighborhoods are situated in one area. In this cluster, Humbermade is the most populated neighborhood. Thus, higher demand for their service offering, more shopping centers and lesser last mile delivery cost

	Neighbourhood	Population	Income	Commuting	2nd Language	2nd Language %	Latitude	Longitude	Population Score	Venue Score	Total Score
60	Humbermede	14778	24,297	11.8	Punjabi (9.7%)	09.7% Punjabi	43.7421	-79.5407	0.611729	0.0	0.305865
61	St. James Town	14666	22,341	27.4	Filipino (8.1%)	08.1% Filipino	43.6709	-79.3733	0.607093	0.0	0.303547
62	Cliffcrest	14531	38,182	12.5	Tamil (1.5%)	01.5% Tamil	43.7249	-79.2263	0.601505	0.0	0.300752
63	Humber Valley Village	14453	80,618	12.0	Ukrainian (3.9%)	03.9% Ukrainian	43.6671	-79.528	0.598276	1.0	0.799138
64	Harbourfront / CityPlace	14368	69,232	16.0	Unspecified Chinese (2.4%)	02.4% Unspecified Chinese	43.6416	-79.3902	0.594758	0.6	0.597379

Conclusion

Building the distribution center strategically would incur a lot of savings for the Caple company. Based on analysis, it is strategic to place the distribution center in Humbermede wherein there's a large population and high number of similar neighbors in the area. This would lessen the last mile delivery cost for the company.