IBM/COURSERA APPLIED DATA SCIENCE CAPSTONE PROJECT

BATTLE OF NEIGHBORHOODS

COMPARING TORONTO AND VANCOUVER NEIGHBORHOODS FOR FILIPINO IMMIGRANTS

Submitted by Lisa Cabalu | May 9, 2020

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I. Introduction

In the past decade, Canada has been attracting huge numbers of migrants all over the globe due to its high Global Liveability Index, an assessment by the Economist Intelligence Unit of various cities based on various factors such as stability, healthcare, culture and environment, education and infrastructure.¹ In fact, 3 Canadian cities made it to the top 10 list: Toronto, Vancouver and Calgary.²

¹ https://www.eiu.com/topic/liveability

² https://www.businessinsider.com/most-livable-cities-in-the-world-2018-8

Immigrants form a large part of the Canadian population. From Canada's 2016 Census, 7.5 million people migrated to Canada, representing 1 in 5 of people in Canada. The Filipino population in Canada has been steadily growing since 1996, and more than 188,805 Filipino immigrants have been recorded in the 2016 census.³ Filipinos make up the third-largest Asian group in Canada and is the 7th largest ethnic group in the country.⁴ Filipinos are spread out in Canada, but the largest communities are concentrated in Toronto and Vancouver.⁵

This report aims to explore the cities of Toronto and Vancouver, both listed as top liveable cities and top immigration destinations for Filipinos. As each city is composed of several neighborhoods, the goal of this report is to assist future Filipino immigrants in choosing a place of residence or neighborhood considering the (a) availability of Filipino stores, and (b) variety and accessibility to essential stores. Furthermore, Canadians relocating to/from the two cities would find it interesting to discover what kinds of stores or amenities are available in their prospective neighborhood.

II. Data

For this report, we used neighborhood data of Toronto⁶ and Vancouver⁷.

To map out the neighborhoods, geographic locations (latitudes and longitudes) were obtained from the GeoPy library and marked on maps using **Folium**.

³ https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2017028-eng.htm

⁴ https://en.wikipedia.org/wiki/Ethnic origins of people in Canada#Evolution from 1996 to 2016

⁵ https://en.wikipedia.org/wiki/Filipino Canadians

⁶ https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M

⁷ https://en.wikipedia.org/wiki/List of neighbourhoods in Vancouver

Toronto neighborhoods from dataframe:

	Neighborhood	Latitude	Longitude
0	Parkwoods	43.753259	-79.329656
1	Victoria Village	43.725882	-79.315572
2	Regent Park, Harbourfront	43.654260	-79.360636
3	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
4	Queen's Park, Ontario Provincial Government	43.662301	-79.389494

Vancouver neighborhoods from dataframe:

	Neighborhood	Latitude	Longitude
0	Arbutus Ridge, Vancouver	49.240968	-123.167001
1	Downtown, Vancouver	49.283393	-123.117456
2	Dunbar-Southlands, Vancouver	49.253460	-123.185044
3	Fairview, Vancouver	49.264113	-123.126835
4	Grandview-Woodland, Vancouver	49.270559	-123.067942

To explore the venues/locations in each neighborhood, venue data from the Foursquare API was utilized. It is important to note that the analysis will only factor in the venues listed in Foursquare, and this report may not be as "holistic" as desired, as there may be other factors in choosing a neighborhood, such as work opportunities and transportation, that are outside the scope of available data. Similarly, the popularity/ranking of venues is based on the current Foursquare data and customer reviews at the time of this report and may vary at other points in time.

Toronto venues from dataframe:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Parkwoods	43.753259	-79.329656	Brookbanks Park	43.751976	-79.332140	Park
1	Parkwoods	43.753259	-79.329656	Variety Store	43.751974	-79.333114	Food & Drink Shop
2	Parkwoods	43.753259	-79.329656	TTC stop - 44 Valley Woods	43.755402	-79.333741	Bus Stop
3	Victoria Village	43.725882	-79.315572	Victoria Village Arena	43.723481	-79.315635	Hockey Arena
4	Victoria Village	43.725882	-79.315572	Tim Hortons	43.725517	-79.313103	Coffee Shop

Vancouver venues from dataframe:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Arbutus Ridge, Vancouver	49.240968	-123.167001	Butter Baked Goods	49.242209	-123.170381	Bakery
1	Arbutus Ridge, Vancouver	49.240968	-123.167001	The Haven	49.241377	-123.166331	Spa
2	Arbutus Ridge, Vancouver	49.240968	-123.167001	Barktholomews Pet Supplies	49.242746	-123.170193	Pet Store
3	Arbutus Ridge, Vancouver	49.240968	-123.167001	The Dragon's Layer	49.238518	-123.169029	Nightlife Spot
4	Arbutus Ridge, Vancouver	49.240968	-123.167001	The Heights Market	49.237902	-123.170949	Grocery Store

III. Methodology

To analyze each neighborhood, we first took the frequency of the mean of each category and grouped the results per neighborhood, and created a new dataframe consisting of the top 10 venues/locations in each neighborhood.

Toronto top 10 venues dataframe:



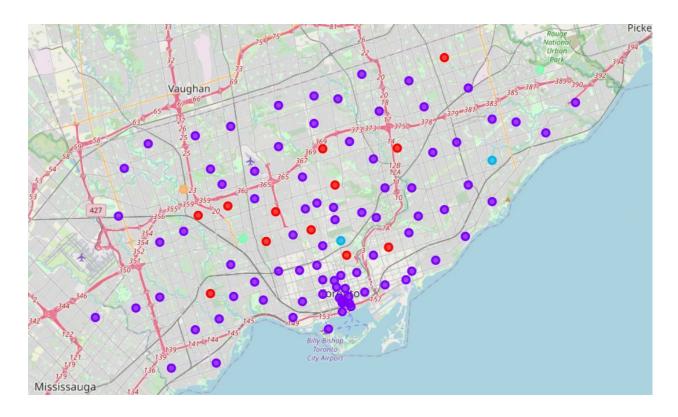
Vancouver top 10 venues dataframe:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Arbutus Ridge, Vancouver	Grocery Store	Pet Store	Nightlife Spot	Bakery	Spa	Falafel Restaurant	Food & Drink Shop	Food	Flower Shop	Filipino Restaurant
1	Downtown, Vancouver	Hotel	Coffee Shop	Food Truck	Restaurant	Seafood Restaurant	Concert Hall	Steakhouse	Clothing Store	Bookstore	Sandwich Place
2	Dunbar-Southlands, Vancouver	Italian Restaurant	Sushi Restaurant	Indian Restaurant	Japanese Restaurant	Liquor Store	Pizza Place	Coffee Shop	Salon / Barbershop	Sporting Goods Shop	Ice Cream Shop
3	Fairview, Vancouver	Coffee Shop	Pharmacy	Asian Restaurant	Park	Sushi Restaurant	Szechuan Restaurant	Salon / Barbershop	Malay Restaurant	Restaurant	Camera Store
4	Grandview-Woodland, Vancouver	Coffee Shop	Italian Restaurant	Sushi Restaurant	Indian Restaurant	Japanese Restaurant	Park	Café	Pizza Place	Clothing Store	Burger Joint

Next, the similar neighborhoods were clustered using K-Means (k = 5) for easier analysis, and marked on the map.

Toronto clusters:

Neighborhood	Latitude	Longitude	Cluster Labels
Parkwoods	43.753259	-79.329656	0.0
Victoria Village	43.725882	-79.315572	1.0
Regent Park, Harbourfront	43.654260	-79.360636	1.0
Lawrence Manor, Lawrence Heights	43.718518	-79.464763	1.0
Queen's Park, Ontario Provincial Government	43.662301	-79.389494	1.0



Cluster 1 (red in map):

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Parkwoods	0.0	Park	Food & Drink Shop	Bus Stop	College Rec Center	Dance Studio	Eastern European Restaurant	Drugstore	Donut Shop	Doner Restaurant	Dog Run
10	Glencairn	0.0	Park	Pub	Metro Station	Japanese Restaurant	Women's Store	Dim Sum Restaurant	Dance Studio	Deli / Bodega	Department Store	Dessert Shop
21	Caledonia-Fairbanks	0.0	Park	Pool	Women's Store	Afghan Restaurant	Ethiopian Restaurant	Eastern European Restaurant	Drugstore	Donut Shop	Doner Restaurant	Dog Run
35	East Toronto	0.0	Park	Coffee Shop	Convenience Store	Discount Store	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Distribution Center
49	North Park, Maple Leaf Park, Upwood Park	0.0	Park	Construction & Landscaping	Bakery	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Distribution Center	Dance Studio
61	Lawrence Park	0.0	Park	Swim School	Bus Line	Drugstore	Donut Shop	Doner Restaurant	Dog Run	Distribution Center	Ethiopian Restaurant	Diner
64	Weston	0.0	Park	Curling Ice	Electronics Store	Eastern European Restaurant	Drugstore	Donut Shop	Doner Restaurant	Dog Run	Distribution Center	Discount Store
66	York Mills West	0.0	Park	Bank	Convenience Store	Discount Store	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Distribution Center	Dance Studio
68	Forest Hill North & West	0.0	Trail	Jewelry Store	Sushi Restaurant	Park	Drugstore	Donut Shop	Doner Restaurant	Dog Run	Distribution Center	Curling Ice
85	Milliken, Agincourt North, Steeles East, L'Amo	0.0	Park	Bakery	Playground	Discount Store	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Distribution Center
91	Rosedale	0.0	Park	Trail	Playground	Discount Store	Dance Studio	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner
98	The Kingsway, Montgomery Road, Old Mill North	0.0	Park	River	Cupcake Shop	Drugstore	Donut Shop	Doner Restaurant	Dog Run	Distribution Center	Discount Store	Diner

Cluster 2 (purple in map):

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Victoria Village	1.0	French Restaurant	Coffee Shop	Hockey Arena	Portuguese Restaurant	Dim Sum Restaurant	Curling Ice	Dance Studio	Deli / Bodega	Department Store	Dessert Shop
2	Regent Park, Harbourfront	1.0	Coffee Shop	Park	Pub	Bakery	Café	Theater	Restaurant	Breakfast Spot	Yoga Studio	Event Space
3	Lawrence Manor, Lawrence Heights	1.0	Clothing Store	Accessories Store	Event Space	Shoe Store	Vietnamese Restaurant	Miscellaneous Shop	Coffee Shop	Boutique	Arts & Crafts Store	Furniture / Home Store
4	Queen's Park, Ontario Provincial Government	1.0	Coffee Shop	Sushi Restaurant	Burger Joint	Bar	Beer Bar	Italian Restaurant	Juice Bar	Sandwich Place	Distribution Center	Restaurant
7	Don Mills	1.0	Coffee Shop	Asian Restaurant	Beer Store	Japanese Restaurant	Gym	Restaurant	Bike Shop	Italian Restaurant	Discount Store	Sporting Goods Shop
8	Parkview Hill, Woodbine Gardens	1.0	Pizza Place	Fast Food Restaurant	Bank	Gym / Fitness Center	Athletics & Sports	Pet Store	Gastropub	Pharmacy	Intersection	Dim Sum Restaurant
9	Garden District, Ryerson	1.0	Clothing Store	Coffee Shop	Café	Bubble Tea Shop	Japanese Restaurant	Cosmetics Shop	Restaurant	Middle Eastern Restaurant	Italian Restaurant	Hotel
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Cluster 3 (**blue** in map):

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
32	Scarborough Village	2.0	Convenience Store	Playground	Women's Store	Discount Store	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Distribution Center
83	Moore Park, Summerhill East	2.0	Playground	Women's Store	Discount Store	Dance Studio	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Distribution Center

Cluster 4 (cyan in map):

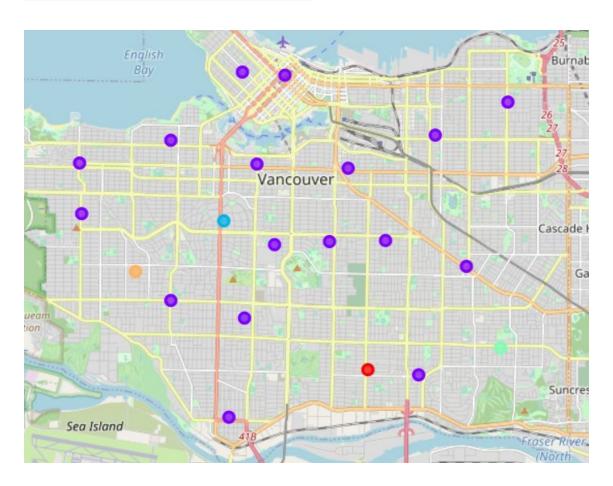
	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
6	Malvern, Rouge	3.0	Fast Food Restaurant	Women's Store	Curling Ice	Eastern European Restaurant	Drugstore	Donut Shop	Doner Restaurant	Dog Run	Distribution Center	Discount Store
56	Del Ray, Mount Dennis, Keelsdale and Silverthorn	3.0	Fast Food Restaurant	Fried Chicken	Sandwich Place	Bar	Department	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Distribution

Cluster 5 (orange in map):

81	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue		5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
57	Humberlea,	4.0	Baseball Field	Women's Store	Dance Studio	Electronics Store	Eastern European	Drugstore	Donut Shop	Doner Restaurant	Dog Run	Distribution Center

Vancouver clusters:

Neighborhood	Latitude	Longitude	Cluster Labels
Arbutus Ridge, Vancouver	49.240968	-123.167001	4.0
Downtown, Vancouver	49.283393	-123.117456	1.0
Dunbar-Southlands, Vancouver	49.253460	-123.185044	1.0
Fairview, Vancouver	49.264113	-123.126835	1.0
Grandview- Woodland, Vancouver	49.270559	-123.067942	1.0



Cluster 1 (red in map):

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
18	Sunset, Vancouver	0.0	Indian Restaurant	Cosmetics Shop	Dessert Shop	South Indian Restaurant	Falafel Restaurant	Food & Drink Shop	Food	Flower Shop	Filipino Restaurant	Fast Food Restaurant

Cluster 2 (purple in map):

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Downtown, Vancouver	1.0	Hotel	Coffee Shop	Food Truck	Restaurant	Seafood Restaurant	Concert Hall	Steakhouse	Clothing Store	Bookstore	Sandwich Place
2	Dunbar-Southlands, Vancouver	1.0	Italian Restaurant	Sushi Restaurant	Indian Restaurant	Japanese Restaurant	Liquor Store	Pizza Place	Coffee Shop	Salon / Barbershop	Sporting Goods Shop	Ice Cream Shop
3	Fairview, Vancouver	1.0	Coffee Shop	Pharmacy	Asian Restaurant	Park	Sushi Restaurant	Szechuan Restaurant	Salon / Barbershop	Malay Restaurant	Restaurant	Camera Store
4	Grandview-Woodland, Vancouver	1.0	Coffee Shop	Italian Restaurant	Sushi Restaurant	Indian Restaurant	Japanese Restaurant	Park	Café	Pizza Place	Clothing Store	Burger Joint
5	Hastings-Sunrise, Vancouver	1.0	Vietnamese Restaurant	Coffee Shop	Liquor Store	Gas Station	Event Space	Sandwich Place	Bakery	Park	Sushi Restaurant	Food Truck
6	Kensington-Cedar Cottage, Vancouver	1.0	Coffee Shop	Vietnamese Restaurant	Chinese Restaurant	Filipino Restaurant	Bus Stop	Ice Cream Shop	Malay Restaurant	Convenience Store	Electronics Store	Restaurant
7	Kerrisdale, Vancouver	1.0	Chinese Restaurant	Coffee Shop	Tea Room	Sandwich Place	Sushi Restaurant	Pharmacy	Bubble Tea Shop	Café	Portuguese Restaurant	Hobby Shop
9	Kitsilano, Vancouver	1.0	American Restaurant	Coffee Shop	Sushi Restaurant	Japanese Restaurant	French Restaurant	Food Truck	Tea Room	Thai Restaurant	Bakery	Ice Cream Shop
10	Marpole, Vancouver	1.0	Pizza Place	Sushi Restaurant	Chinese Restaurant	Dessert Shop	Japanese Restaurant	Bubble Tea Shop	Vietnamese Restaurant	Coffee Shop	Falafel Restaurant	Sporting Goods Shop
11	Mount Pleasant, Vancouver	1.0	Coffee Shop	Diner	Thrift / Vintage Store	Sandwich Place	Breakfast Spot	Sushi Restaurant	Indian Restaurant	Vietnamese Restaurant	Brewery	Arts & Crafts Store
12	Oakridge, Vancouver	1.0	Convenience Store	Park	Fast Food Restaurant	Sushi Restaurant	Sandwich Place	Food	Concert Hall	Vietnamese Restaurant	Diner	Discount Store
13	Renfrew-Collingwood, Vancouver	1.0	Vietnamese Restaurant	Chinese Restaurant	Pharmacy	Discount Store	Café	Fried Chicken Joint	Cantonese Restaurant	Gas Station	Supermarket	Bank
14	Riley Park, Vancouver	1.0	Japanese Restaurant	Coffee Shop	Restaurant	Café	Grocery Store	Thai Restaurant	Chinese Restaurant	Lounge	Pub	Sushi Restaurant

Cluster 3 (**blue** in map):

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
15	Shaughnessy, Vancouver	2.0	French Restaurant	Bus Stop	Park	Diner	Discount Store	Donut Shop	Electronics Store	Ethiopian Restaurant	Event Space	Food Truck

Cluster 4 (cyan in map):

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
8 Killarney, Vancouver	3.0	Italian Restaurant	Pool	Track	Gym	Event Space	Food	Flower Shop	Filipino Restaurant	Fast Food Restaurant	Farmers Market

Cluster 5 (orange in map):

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
Arbutus Ridge, Vancouver	4.0	Grocery Store	Pet Store	Nightlife Spot	Bakery	Spa	Falafel Restaurant	Food & Drink Shop	Food	Flower Shop	Filipino Restaurant

IV. Results

Looking at the clusters, we see that there are Filipino restaurants are not popular in Toronto, so we would want to check again if there are Filipino restaurants in the city. After checking our data, we find that there are Filipino restaurants in the neighborhoods of **Kensington Market**, **Chinatown** and **Grange Park**, which belong in Cluster 2.

	Neighborhood	Filipino Restaurant
43	Kensington Market, Chinatown, Grange Park	0.017857
0	Agincourt	0.000000
61	Parkwoods	0.000000
70	Scarborough Village	0.000000
69	Runnymede, The Junction North	0.000000

On the other hand, in Vancouver, 4 out of the 5 clusters have Filipino Restaurants. Among these clusters, there are 5 neighborhoods with popular Filipino Restaurants: **Sunset** in Cluster 1; **Kensington-Cedar Cottage** and **Victoria-Fraserview** in Cluster 2; **Killarney** in Cluster 4; and **Arbutus Ridge** in Cluster 5.

	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Arbutus Ridge, Vancouver	49.240968	-123.167001	4.0	Grocery Store	Pet Store	Nightlife Spot	Bakery	Spa	Falafel Restaurant	Food & Drink Shop	Food	Flower Shop	Filipino Restaurant
8	Killarney, Vancouver	49.224274	-123.046250	3.0	Italian Restaurant	Pool	Track	Gym	Event Space	Food	Flower Shop	Filipino Restaurant	Fast Food Restaurant	Farmers Market
6	Kensington-Cedar Cottage, Vancouver	49.247632	-123.084207	1.0	Coffee Shop	Vietnamese Restaurant	Chinese Restaurant	Filipino Restaurant	Bus Stop	Ice Cream Shop	Malay Restaurant	Convenience Store	Electronics Store	Restaurant
18	Sunset, Vancouver	49.219593	-123.090239	0.0	Indian Restaurant	Cosmetics Shop	Dessert Shop	South Indian Restaurant	Falafel Restaurant	Food & Drink Shop	Food	Flower Shop	Filipino Restaurant	Fast Food Restaurant
19	Victoria-Fraserview, Vancouver	49.218416	-123.073287	1.0	Sandwich Place	Convenience Store	Pizza Place	Fast Food Restaurant	Gas Station	Ethiopian Restaurant	Flower Shop	Filipino Restaurant	Farmers Market	Falafel Restaurant

V. Discussion

Based on our results, while Toronto has a bigger area and a bigger population of Filipino immigrants, Vancouver has more Filipino restaurants. It can also be noted that Cluster 2 of both cities appears to be more diverse compared to other clusters due to the variety of cuisines available in their respective neighborhoods. In terms of availability of Filipino stores and overall diversity, Vancouver would be a reasonable choice of residence for Filipino immigrants, specifically the neighborhoods of Kensington-Cedar Cottage and Victoria-Fraserview, which are both in Cluster 2.

On the other hand, it can be observed that Toronoto has more parks compared to Vancouver. In this case, a Cluster 2 neighborhood (diversity of venues and cuisines) that is in near proximity to a Cluster 1 neighborhood (accessibility to parks) would be an excellent selection.

Looking at the problem a different way, the places *without* Filipino restaurants and communities can be seen as growth opportunities for business owners as these areas are far from being market-saturated.

VI. Conclusion

As more and more Filipinos (and people from other Third-World countries) search for better opportunities across the globe, Canada continuously proves itself to be a melting pot of different cultures, as evidenced by two of its major cities. In this study, we explored the neighborhoods of Toronto and Vancouver to find the ideal location or residence for Filipino immigrants. While we have narrowed down the results to a few neighborhoods, it is important to note how the study can be further improved using additional information on cost of living per city, education and most importantly, employment opportunities for immigrants.