Comparing Canadian Cities

Introduction

- - What determines how similar Canadian cities are to each other (in terms of what types of businesses they attract)? Is it geographic location or city size?
- - Are large cities across Canada more similar to each other? Or are they more similar to smaller cities within the same province?
- - For example, is Toronto (largest city in Ontario) more similar to Vancouver (largest city in British Columbia) or to Peterborough (smaller city in Ontario).

Background

- - A successful business owner runs his business in a large Canadian city. He wants to expand to a new location in a new city.
- - Is his business more likely to succeed in a smaller city closer to the original location?
- - Or is it more likely to succeed in another large city, farther away?

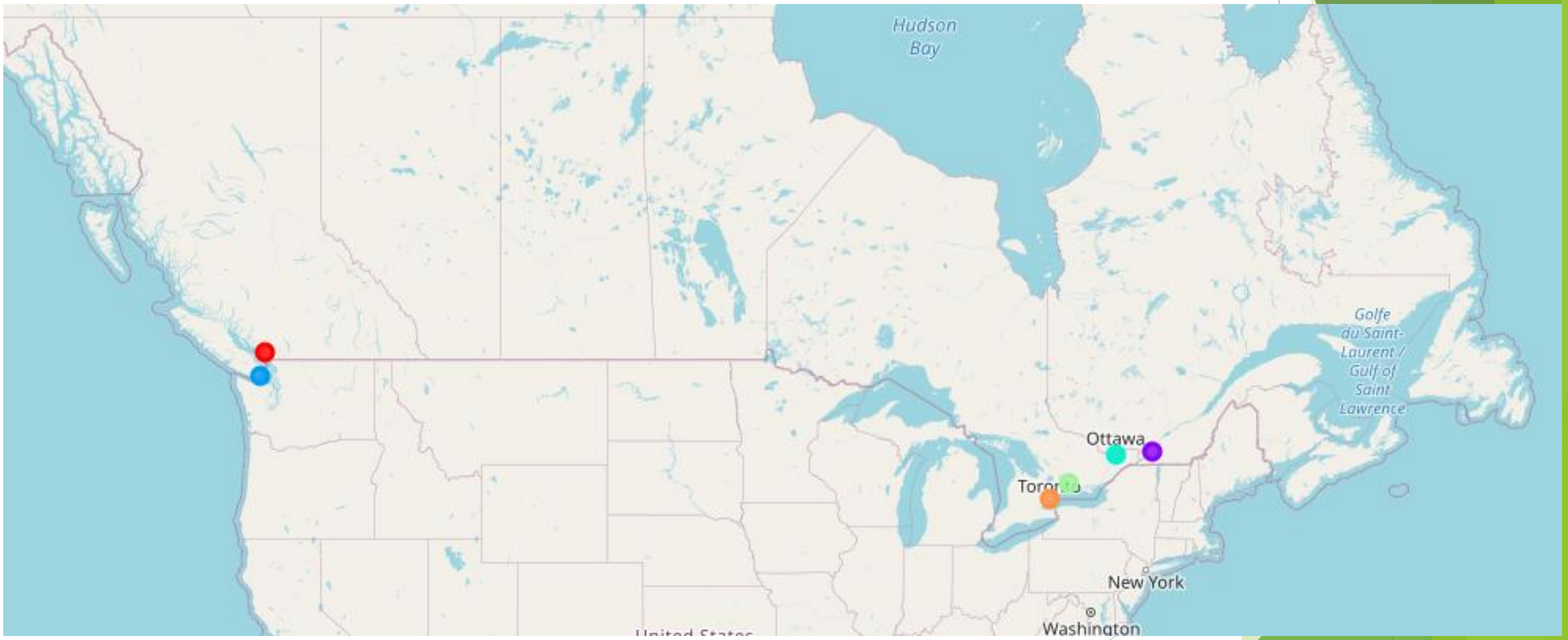
Data and Methodology

- Dataset and using Foursquare location data:
  - Foursqaure data will need to be used to determine what types of businesses are located within each examined city.
  - Business data from three large cities (Toronto, Vancouver, Montreal) as well as three smaller cities within the same province as each larger city (Peterborough, Victoria, Gatineau) will be used.

- Exploratory Data:
  - I looked at population sizes of Canadian cities to find the 3 largest cities in the Country as well as a smaller city in each corresponding province.
  - I downloaded business data from Foursqaure API to identify most common business categories in each city.

- Techniques:
  - I conducted k-Means analysis to identify similar clusters of cities based on businesses.
  - I mapped the cities.
  - I conducted One-Hot Encoding in order to convert categorical variables into a form that can be used by Machine Learning Algorithms.

Analysis


Hudson Bay
Golfe du Saint-Laurent / Gulf of Saint Lawrence
Ottawa
New York
Washington

Analysis

	City	American Restaurant	Art Museum	Arts & Crafts Store	Asian Restaurant	BBQ Joint	Bagel Shop	Bakery	Bank	Bar	...	Thai Restaurant	Theater	Toy / Game Store	Turkish Restaurant
0	Gatineau, Quebec	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.148148	...	0.037037	0.000000	0.000000	0.00
1	Montreal, Quebec	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.00
2	Peterborough, Ontario	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.020408	0.040816	0.040816	...	0.020408	0.000000	0.000000	0.00
3	Toronto, Ontario	0.023529	0.011765	0.000000	0.000000	0.00	0.000000	0.000000	0.011765	0.023529	...	0.011765	0.023529	0.011765	0.00
4	Vancouver, British Columbia	0.013333	0.000000	0.013333	0.013333	0.00	0.026667	0.000000	0.013333	0.013333	...	0.000000	0.000000	0.000000	0.00
5	Victoria, British Columbia	0.020000	0.000000	0.000000	0.020000	0.01	0.000000	0.040000	0.000000	0.020000	...	0.020000	0.000000	0.000000	0.01

Analysis

```
top_10_clusters = list()
for dfs in list_cluster:
    temp_list = list()
    for col in range(1, 5):
        for i in range(0, dfs.shape[0]):
            temp_list.append(dfs.iloc[i,col])
    top_10_clusters.append(temp_list)
```

```
from collections import Counter
df_clusters = list()
for k in range(6):
    each_cluster = Counter(top_10_clusters[k])
    temp_df = pd.DataFrame.from_dict(each_cluster, orient='index').reset_index()
    col = ['Type of Venue', 'Number of Venues']
    temp_df.columns = col
    temp_df.sort_values(by=['Number of Venues'], inplace=True)
    df_clusters.append(temp_df)
```

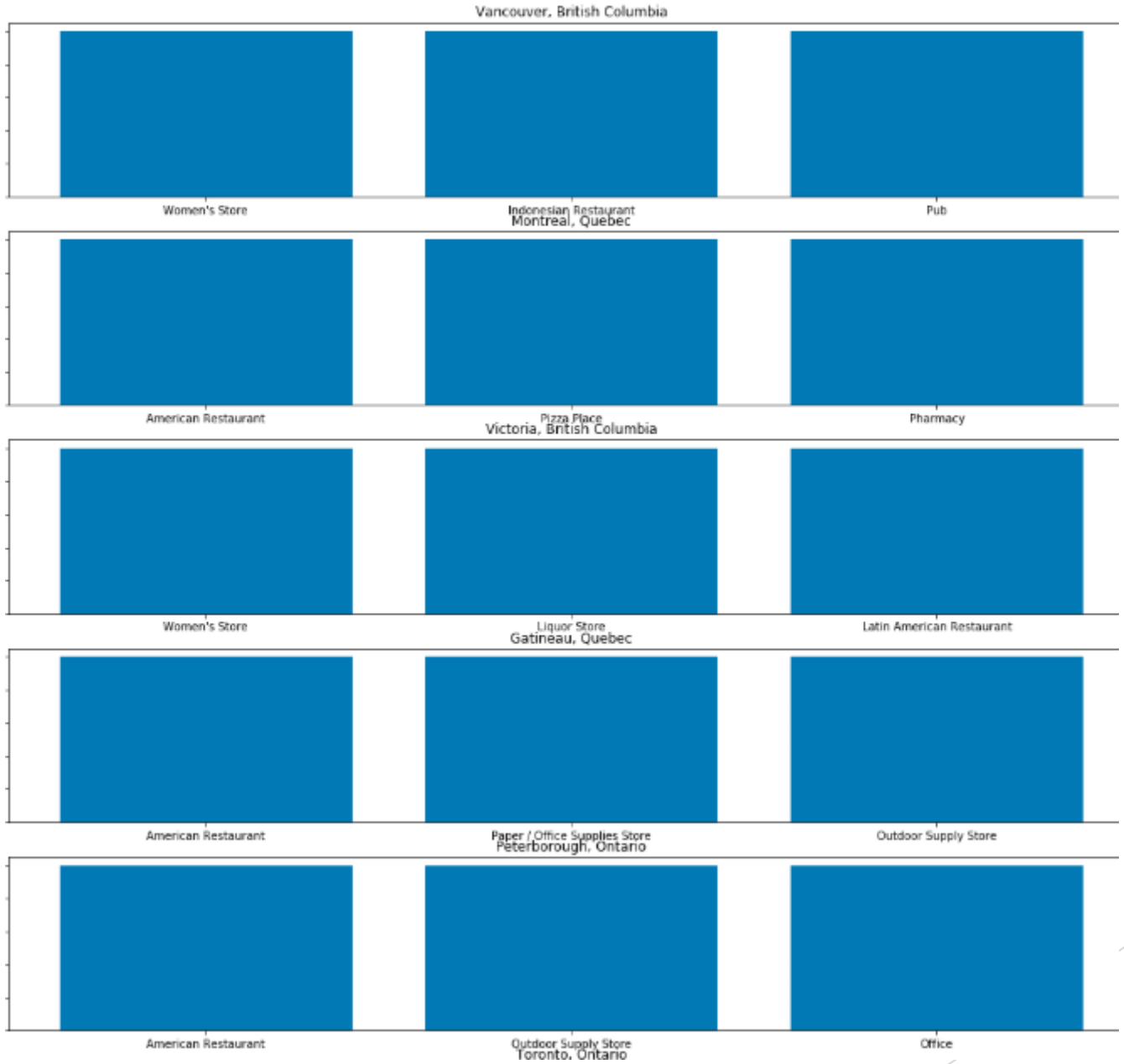
```
import matplotlib.pyplot as plt
fig, axs = plt.subplots(6, 1, figsize=(18, 20), constrained_layout=False)

for ax, k in zip(axs, range(6)):
    ax.bar(df_clusters[k].iloc[1:,0], df_clusters[k].iloc[1:,1])
    ax.set_title(titles[k])
```

Results

	City	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	Gatineau, Quebec	American Restaurant	Paper / Office Supplies Store	Outdoor Supply Store	Office	Noodle House	Nightclub	New American Restaurant	Neighborhood	Music Venue	Monument / Landmark
1	Montreal, Quebec	American Restaurant	Pizza Place	Pharmacy	Performing Arts Venue	Park	Paper / Office Supplies Store	Outdoor Supply Store	Office	Noodle House	Nightclub
2	Peterborough, Ontario	American Restaurant	Outdoor Supply Store	Office	Noodle House	New American Restaurant	Neighborhood	Museum	Monument / Landmark	Modern European Restaurant	Miscellaneous Shop
3	Toronto, Ontario	Italian Restaurant	French Restaurant	Frozen Yogurt Shop	Gaming Cafe	Garden	Rock Club	Residential Building (Apartment / Condo)	Greek Restaurant	Grocery Store	Record Shop
4	Vancouver, British Columbia	Women's Store	Indonesian Restaurant	Pub	Record Shop	Hotel	History Museum	Historic Site	Hardware Store	Gym / Fitness Center	Residential Building (Apartment / Condo)
5	Victoria, British Columbia	Women's Store	Liquor Store	Latin American Restaurant	Karaoke Bar	Jewelry Store	Sports Bar	Wine Shop	History Museum	Gym / Fitness Center	Shopping Mall

Results


Vancouver, British Columbia
Women's Store
Indonesian Restaurant
Pub
Montreal, Quebec
American Restaurant
Pizza Place
Pharmacy
Victoria, British Columbia
Women's Store
Liquor Store
Latin American Restaurant
Gatineau, Quebec
American Restaurant
Paper / Office Supplies Store
Outdoor Supply Store
Peterborough, Ontario
American Restaurant
Outdoor Supply Store
Office
Toronto, Ontario

Results

- The 3 top venues in each city were:
  - Vancouver: Women's Store, Indonesian Restaurant, Pub
  - Victoria: Women's Store, Liquour Store, Latin American Restuarant
  - Montreal: American Restaurant, Pizza Place, Pharmacy
  - Gatineau: American Restaurant, Paper/Office Supplies Store, Outdoor Supply Store
  - Toronto: Italian Restaurant, French Restaurant, Frozen Yogurt Shop
  - Peterborough: American Restaurant, Outdoor Supply Store, Office

Results

- Large Cities:
  - Vancouver: Women's Store, Indonesian Restaurant, Pub
  - Victoria: Women's Store, Liquour Store, Latin American Restuarant
  - Montreal: American Restaurant, Pizza Place, Pharmacy
- Small Cities:
  - Gatineau: American Restaurant, Paper/Office Supplies Store, Outdoor Supply Store
  - Toronto: Italian Restaurant, French Restaurant, Frozen Yogurt Shop
  - Peterborough: American Restaurant, Outdoor Supply Store, Office

Conclusion

- Although there are no clear trends, it does appear that smaller cities are more likely to have stores as their most common venue, while larger cities are more likely to have restaurants as their most common venue.