



THE BATTLE OF NEIGHBORHOODS: SETTING UP YOGA STUDIOS IN DOWNTOWN TORONTO

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1. Introduction/Business understanding

1.1. Background

A healthy lifestyle is one of the most important trends for a modern person. It involves a balanced diet and physical exercise aimed at strengthening health. A modern person wishes to be energized in order to achieve their goals, and a healthy lifestyle contributes to this. That is why the sport venues industry is one of the most developing and popular.

One of the perspective directions is yoga studios. Multiple health benefits related to yoga, celebrity endorsement & promotion of yogic practices, as well as the initiation of international yoga day and other supportive government initiatives drive the growth of the global yoga market. On the other hand, mental benefits to deal with a hectic lifestyle and increase in stress present new opportunities for the market across the world.

As it is known, a majority of people practicing yoga are vegetarian, as this is one of the principles of yoga (Principle of ethical attitude to the world and of avoiding violence). Additionally, an increase of plant-based food in the diet leads to a high flexibility, as magnesium (which is found in rice, nuts, and beans) makes tendons more elastic. Vegetarians are an important potential group of clients of yoga studios.

1.2. Business problem description

The aim of this project is opening two yoga studios in Downtown Toronto.

Why exactly in Downtown Toronto? Downtown Toronto is a dynamically developing area with a huge potential, due to the fact that a large number of people who monitor their health and wish to live a healthy lifestyle live, work, and study there.

Brief description of Down Toronto.

Downtown Toronto is the main central business district of Toronto, Ontario, Canada. Located entirely within the district of Old Toronto, it is approximately 17 square kilometers in area.

In recent years the area has been experiencing a renaissance as the Business Improvement Area (BIA) has brought in new retail and improved the cleanliness. The area has also seen the opening of the Dundas Square public Square, a public space for holding performances and art displays. The area includes several live theatres, a movie complex at Dundas Square and the historic Massey Hall. Historical sites and landmarks include the Arts & Letter Club, the Church of the Holy Trinity, Mackenzie House, Maple Leaf Gardens, Old City Hall, and the Toronto Police Museum and Discovery Centre.

The Financial District, centered on the intersection of Bay Street and King Street is the center of Canada's financial industry. It contains the Toronto Stock Exchange, which is the largest in Canada and seventh in the world by market capitalization. The construction of skyscrapers in downtown Toronto had started to rapidly increase since the 1960s.

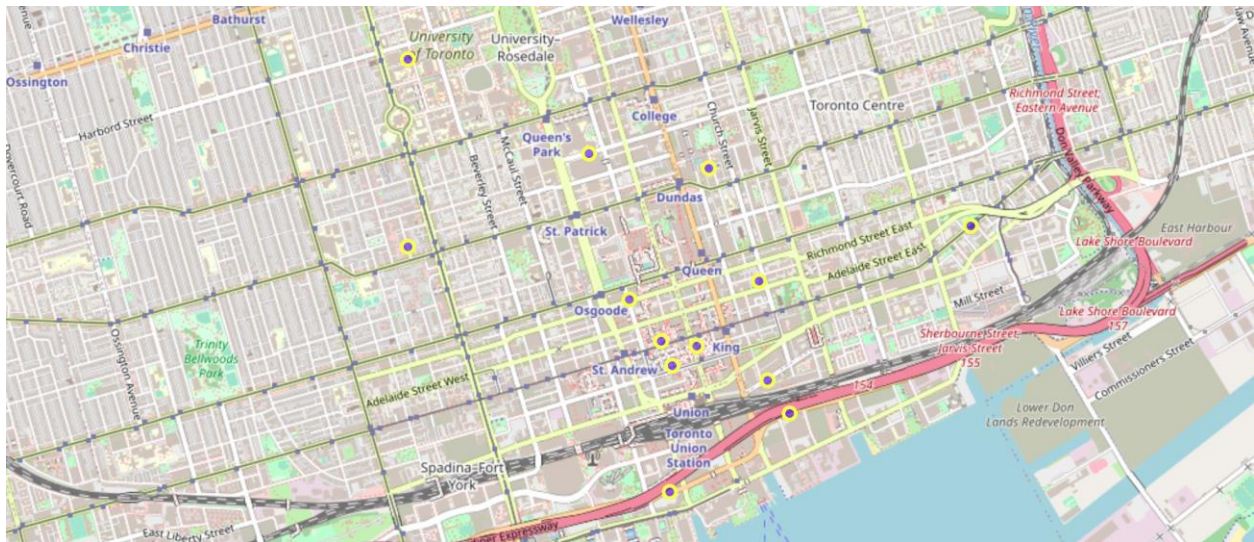
Downtown Toronto is home to three public universities, OCAD University, Ryerson University, and the University of Toronto.

Among many aspects in decision making we need to consider:

- 1. Which neighborhoods of Downtown Toronto are the best for opening yoga studios?**
- 2. Which neighborhoods venues can affect decision making?**

1. We will make an analysis of the neighborhoods of Downtown Toronto and carry out clustering, and define how many sport venues already exist in downtown Toronto.

(More detailed analysis in Data section)



2. That is, placing a yoga studio next to a vegetarian restaurant will allow us to attract our target audience. As a result, we will also research the locations of vegetarian restaurants in neighborhoods of downtown Toronto.

1.3. Target Audience

This project will serve two groups of audience:

1. People who live in Downtown Toronto and travelers: Inform them about sporting venues in their neighborhoods.
2. Business Person: Provide useful information which help them to make decisions about where to open yoga studios in Downtown Toronto.

2. DATA

In order to realize our project we need information about the following data:

1. List of neighborhoods of Downtown Toronto
2. Geographical coordinates of neighborhoods locations
3. List of all venues located in above neighborhoods

2.1. List of neighborhoods of Downtown Toronto

We retrieve the URL from Wikipedia:

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

and create a BeautifulSoup object using [Beautiful soup python library](#) which help us extract the table and table data containing postal code, boroughs and neighborhoods of Toronto. Then convert it to data frame.

2.2. Geographical coordinates of neighborhoods locations

We use [geopy.geocoders](#) from [GeoPy](#) library in python to find geographical locations of boroughs and neighborhoods.

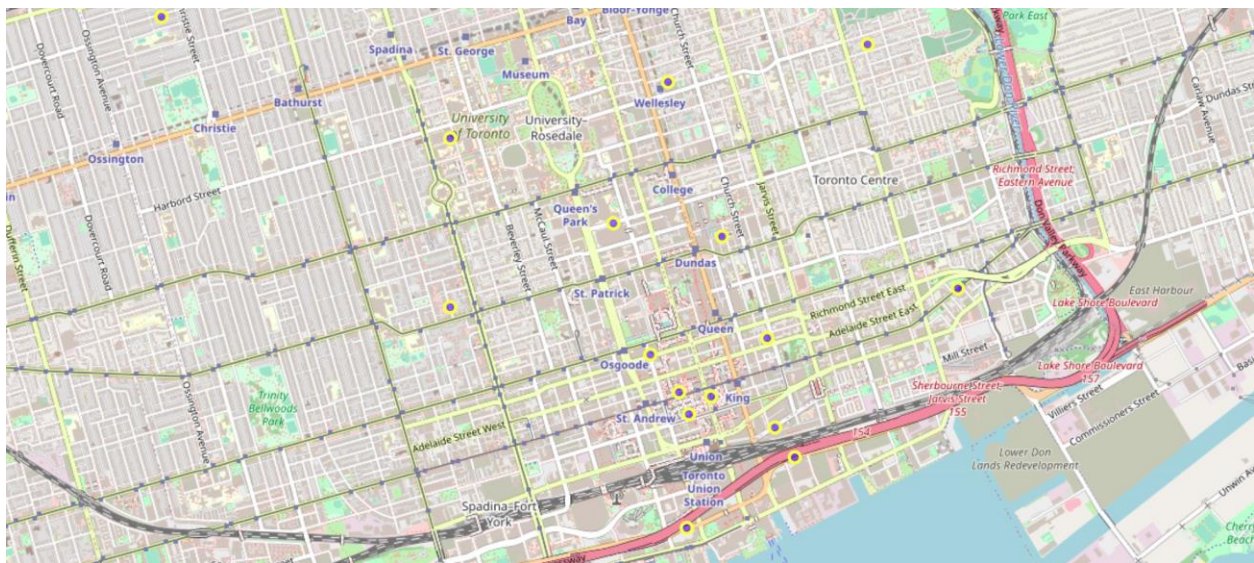
(Extraction below)

	PostalCode	Borough	Neighborhood	Latitude	Longitude
0	M3A	North York	Parkwoods	43.753259	-79.329656
1	M4A	North York	Victoria Village	43.725882	-79.315572
2	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
3	M6A	North York	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
4	M7A	Queen's Park	Ontario Provincial Government	43.662301	-79.389494

We work with only borough that contain the word 'Downtown Toronto' in its name.

	PostalCode	Borough	Neighborhood	Latitude	Longitude
0	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
1	M5B	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937
2	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
3	M5E	Downtown Toronto	Berczy Park	43.644771	-79.373306
4	M5G	Downtown Toronto	Central Bay Street	43.657952	-79.387383
5	M6G	Downtown Toronto	Christie	43.669542	-79.422564
6	M5H	Downtown Toronto	Richmond, Adelaide, King	43.650571	-79.384568
7	M5J	Downtown Toronto	Harbourfront East, Union Station, Toronto Islands	43.640816	-79.381752
8	M5K	Downtown Toronto	Toronto Dominion Centre, Design Exchange	43.647177	-79.381576
9	M5L	Downtown Toronto	Commerce Court, Victoria Hotel	43.648198	-79.379817
10	M5S	Downtown Toronto	University of Toronto, Harbord	43.662696	-79.400049
11	M5T	Downtown Toronto	Kensington Market, Chinatown, Grange Park	43.653206	-79.400049
12	M5V	Downtown Toronto	CN Tower, King and Spadina, Railway Lands, Har...	43.628947	-79.394420
13	M4W	Downtown Toronto	Rosedale	43.679563	-79.377529
14	M5W	Downtown Toronto Stn A	Enclave of M5E	43.646435	-79.374846
15	M4X	Downtown Toronto	St. James Town, Cabbagetown	43.667967	-79.367675
16	M5X	Downtown Toronto	First Canadian Place, Underground city	43.648429	-79.382280
17	M4Y	Downtown Toronto	Church and Wellesley	43.665860	-79.383160

We visualize our data using [folium library](#). It help us to create map of Toronto with all neighborhoods in Downtown Toronto.



2.3. List of all venues located in neighborhoods of Downtown Toronto

Now we apply to **Foursquare API** which is location data provider and provide information about venue names, locations, reviews. In order to do this we need to obtain account and appropriate credentials.

```
CLIENT_ID = 'JQ5MTMI2KD4L5A0ZMGPSNM5IFLLKJXMLW3NWKZHZMY2BLDDCY' # your Foursquare ID
CLIENT_SECRET = 'VDOGQGZHGHNICON2W0INR1ITG32N2ZR2WFKWMTXGFD3HYWSD' # your Foursquare Secret
ACCESS_TOKEN = 'JBZIHJ2Q4NKN2XC2VRCNGCSLN0XRLLKHQVBEANML3UWM10IY' # your Foursquare Access Token
VERSION = '20180604'
LIMIT = 30
print('Your credentials:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET: ' + CLIENT_SECRET)
```

```
Your credentials:
CLIENT_ID: JQ5MTMI2KD4L5A0ZMGPSNM5IFLLKJXMLW3NWKZHZMY2BLDDCY
CLIENT_SECRET: VDOGQGZHGHNICON2W0INR1ITG32N2ZR2WFKWMTXGFD3HYWSD
```

So we can receive information about all venues located in Downtown Toronto neighborhoods. The information obtained per venue contain:

1. Neighborhood
2. Neighborhood Latitude
3. Neighborhood Longitude
4. Venue
5. Name of the venue
6. Venue Latitude
7. Venue Longitude
8. Venue Category

```
toronto_downtown_venues.head()
```

6]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Regent Park, Harbourfront	43.65426	-79.360636	Roselle Desserts	43.653447	-79.362017	Bakery
1	Regent Park, Harbourfront	43.65426	-79.360636	Tandem Coffee	43.653559	-79.361809	Coffee Shop
2	Regent Park, Harbourfront	43.65426	-79.360636	Cooper Koo Family YMCA	43.653249	-79.358008	Distribution Center
3	Regent Park, Harbourfront	43.65426	-79.360636	Body Blitz Spa East	43.654735	-79.359874	Spa
4	Regent Park, Harbourfront	43.65426	-79.360636	Impact Kitchen	43.656369	-79.356980	Restaurant

3. Methodology

1. We explore neighborhoods of Downtown Toronto to find differences and similarities between neighborhoods. What venues are most popular or common in these neighborhoods using **One Hot encoding**.
And then apply k-means clustering algorithm. K-means is a centroid-based algorithm, or a distance-based algorithm, where we calculate the distances to assign a point to a cluster. In K-Means, each cluster is associated with a centroid. For this purpose we use scikit-learn library in Python.

- We analyze already existed sporting venues, their number and location. Visualizing them using [folium library](#).
We do the same with vegetarian restaurants. Using the idea that placing a yoga studio next to a vegetarian restaurant will allow us to attract this target audience, find appropriate neighborhoods for location 2 new yoga studios.

3.1. One hot encoding and k-means clustering for exploring data

We define top 10 categories of venues:

```
Out[18]: Café 46
Coffee Shop 38
Restaurant 17
Park 15
Japanese Restaurant 14
Bakery 14
Hotel 11
Gastropub 11
Seafood Restaurant 10
Farmers Market 8
Art Gallery 8
Beer Bar 8
Pizza Place 7
Thai Restaurant 7
Italian Restaurant 7
American Restaurant 6
Pub 6
Dessert Shop 6
Sandwich Place 6
Vegetarian / Vegan Restaurant 6
Cocktail Bar 6
Concert Hall 5
Grocery Store 5
Comfort Food Restaurant 5
Creperie 5
Mexican Restaurant 5
Theater 5
Gym / Fitness Center 5
```

And most common venues in each neighborhood (fragment below)

	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	Berczy Park	Seafood Restaurant	Farmers Market	Coffee Shop	Cocktail Bar	Fountain	Bakery	French Restaurant	Park	Cheese Shop	Museum
1	CN Tower, King and Spadina, Railway Lands, Har...	Airport Service	Airport Lounge	Airport Terminal	Sculpture Garden	Coffee Shop	Airport	Airport Food Court	Airport Gate	Boat or Ferry	Harbor / Marina
2	Central Bay Street	Coffee Shop	Café	Italian Restaurant	Yoga Studio	Dessert Shop	Park	Modern European Restaurant	Pizza Place	Middle Eastern Restaurant	Poke Place
3	Christie	Grocery Store	Café	Park	Coffee Shop	Candy Store	Nightclub	Italian Restaurant	Restaurant	Baby Store	Athletics & Sports
4	Church and Wellesley	Sushi Restaurant	Pub	Dessert Shop	Juice Bar	Burger Joint	Salon / Barbershop	Beer Bar	Breakfast Spot	Japanese Restaurant	Pizza Place
5	Commerce Court, Victoria Hotel	Café	Hotel	Gastropub	Coffee Shop	Restaurant	American Restaurant	Japanese Restaurant	Museum	Pub	Deli / Bodega
6	Enclave of M5E	Seafood Restaurant	Farmers Market	Café	Creperie	Beer Bar	Cocktail Bar	Fountain	Museum	Restaurant	Vegetarian / Vegan Restaurant
7	First Canadian Place, Underground city	Café	Restaurant	Coffee Shop	Seafood Restaurant	Steakhouse	Gym / Fitness Center	Concert Hall	Japanese Restaurant	Sandwich Place	Bakery

Now we can conduct clustering of Downtown Toronto and see how differ clusters.

	PostalCode	Borough	Neighborhood	Latitude	Longitude	cluster	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	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636	5	Coffee Shop	Park	Bakery	Café	Breakfast Spot	Distribution Center	Performing Arts Venue	Pub	Restaurant	Mexican Restaurant
1	M5B	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937	3	Café	Theater	Burrito Place	Ramen Restaurant	Comic Shop	Japanese Restaurant	Coffee Shop	Sandwich Place	Music Venue	Plaza
2	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418	0	Gastropub	Café	Coffee Shop	Farmers Market	BBQ Joint	Park	New American Restaurant	Middle Eastern Restaurant	Cosmetics Shop	Restaurant
3	M5E	Downtown Toronto	Berczy Park	43.644771	-79.373306	0	Seafood Restaurant	Farmers Market	Coffee Shop	Cocktail Bar	Fountain	Bakery	French Restaurant	Park	Cheese Shop	Museum
4	M5G	Downtown Toronto	Central Bay Street	43.657952	-79.387383	5	Coffee Shop	Café	Italian Restaurant	Yoga Studio	Dessert Shop	Park	Modern European Restaurant	Pizza Place	Middle Eastern Restaurant	Poke Place
5	M6G	Downtown Toronto	Christie	43.669542	-79.422564	2	Grocery Store	Café	Park	Coffee Shop	Candy Store	Nightclub	Italian Restaurant	Restaurant	Baby Store	Athletics & Sports

3.2. Exploring sporting venues and vegetarian restaurants

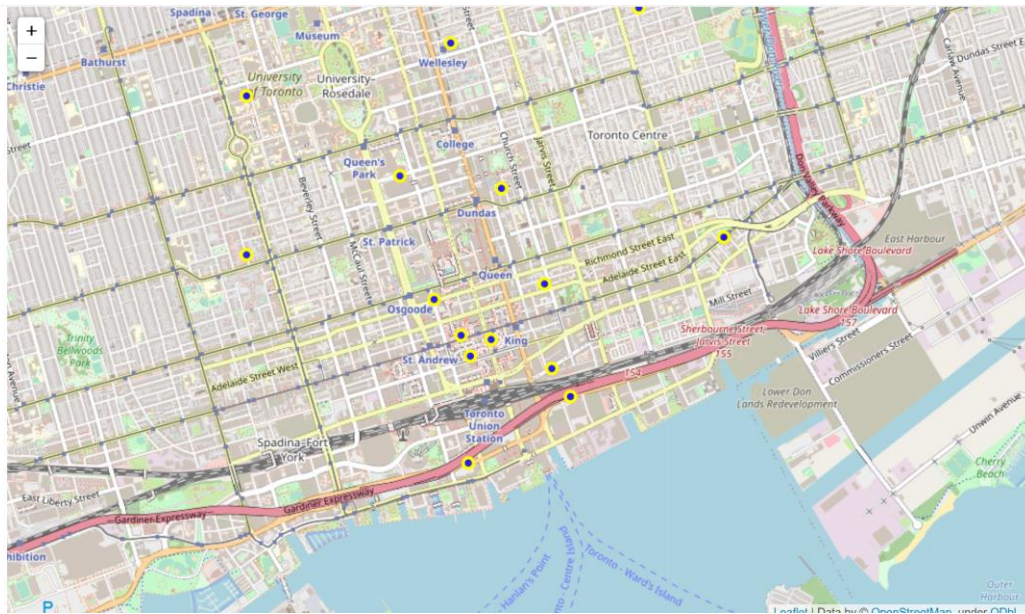
Now we can explore all sport venues in Downtown Toronto and using folium find their location.

List of sport venues already existing in Downtown Toronto. We can notice that it still lacks yoga studios in comparison to other sporting venues in neighborhoods of Downtown

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
24	Regent Park, Harbourfront	43.654260	-79.360636	The Yoga Lounge	43.655515	-79.364955	Yoga Studio
143	Central Bay Street	43.657952	-79.387383	The Yoga Sanctuary	43.661499	-79.383636	Yoga Studio
290	University of Toronto, Harbord	43.662696	-79.400049	Sivananda Yoga Centre	43.662754	-79.402951	Yoga Studio
68	St. James Town	43.651494	-79.375418	GoodLife Fitness Toronto 137 Yonge Street	43.651242	-79.378068	Gym
226	Toronto Dominion Centre, Design Exchange	43.647177	-79.381576	Equinox Bay Street	43.648100	-79.379989	Gym
257	Commerce Court, Victoria Hotel	43.648198	-79.379817	Equinox Bay Street	43.648100	-79.379989	Gym
426	First Canadian Place, Underground city	43.648429	-79.382280	Equinox Bay Street	43.648100	-79.379989	Gym
7	Regent Park, Harbourfront	43.654260	-79.360636	The Extension Room	43.653313	-79.359725	Gym / Fitness Center
177	Richmond, Adelaide, King	43.650571	-79.384568	Adelaide Club Toronto	43.649279	-79.381921	Gym / Fitness Center
233	Toronto Dominion Centre, Design Exchange	43.647177	-79.381576	Adelaide Club Toronto	43.649279	-79.381921	Gym / Fitness Center
259	Commerce Court, Victoria Hotel	43.648198	-79.379817	Adelaide Club Toronto	43.649279	-79.381921	Gym / Fitness Center
427	First Canadian Place, Underground city	43.648429	-79.382280	Adelaide Club Toronto	43.649279	-79.381921	Gym / Fitness Center

Using folium library we can visualize distribution of sporting venues among neighborhoods.

Out[32]:



List of vegan restaurants already existing in Downtown Toronto.

Out[33]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
92	Berczy Park	43.644771	-79.373306	Fresh On Front	43.647815	-79.374453	Vegetarian / Vegan Restaurant
137	Central Bay Street	43.657952	-79.387383	Vegetarian Haven	43.656016	-79.392758	Vegetarian / Vegan Restaurant
167	Richmond, Adelaide, King	43.650571	-79.384568	Rosalinda	43.650252	-79.385156	Vegetarian / Vegan Restaurant
340	Kensington Market, Chinatown, Grange Park	43.653206	-79.400049	Hibiscus	43.655454	-79.402439	Vegetarian / Vegan Restaurant
365	Enclave of M5E	43.646435	-79.374846	Fresh On Front	43.647815	-79.374453	Vegetarian / Vegan Restaurant
444	First Canadian Place, Underground city	43.648429	-79.382280	Rosalinda	43.650252	-79.385156	Vegetarian / Vegan Restaurant

And now merge sporting venues and vegan restaurants data sets to find in which neighborhoods with vegan restaurants already exist yoga studios.

	Neighborhood	Venue Category_x	Venue Category_y
0	Central Bay Street	Yoga Studio	Vegetarian / Vegan Restaurant
1	First Canadian Place, Underground city	Gym	Vegetarian / Vegan Restaurant
2	First Canadian Place, Underground city	Gym / Fitness Center	Vegetarian / Vegan Restaurant
3	Richmond, Adelaide, King	Gym / Fitness Center	Vegetarian / Vegan Restaurant

Using the idea that placing a yoga studio next to a vegetarian restaurant will allow us to attract this target audience we can define place for our 2 new yoga studios near vegan restaurants in locations which currently lack yoga studios. For instance, it may be Richmond and First Canadian Place.

4. Results

Now we can summarize our findings.

First, it still lacks yoga studios in comparison to other sporting venues in neighborhoods of Downtown Toronto and opening them is seen as profitable.

Second, location of new yoga studios near the vegetarian restaurants will allow us to attract their visitors as potential clients of yoga studios because according to many researches vegetarians prefer yoga to other sport activities.

Third, after analyzing neighborhoods we can define 2 appropriate locations such as Richmond and First Canadian Place as first candidates for opening yoga studios.

5. Discussion

This project can be continued for finding best location to yoga studios.

We considered only one factor which can affect decision making and many other factors are left f.i. size of community in each neighborhood, land price, transport availability, legislation requirement and etc. for comprehensive consideration.

6. Conclusion

Machine learning techniques and algorithms help us process big data sets comprehensively and allow to make correct business decisions in a short time. Python libraries such as sklearn for clustering and modeling process, geospy for finding geographical coordinates, folium library for visualization data location and applying Foursquare API make process easy and effective for analyzing and decision making process.