

# COURSERA CAPSTONE PROJECT (APPLIED DATA SCIENCE)

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# Introduction

- Downtown Toronto is one of the most famous cities worldwide.
- Large diversity in amenities for both locals and tourists.
- University of Toronto St. George campus is located in downtown Toronto.
- UofT is one of the most renowned university in the world.
- Many UofT students find housing in downtown Toronto to minimize commuting times.



# Business Problem

- We are realtors at ABC company who help our clients find affordable housing.
- Target Audience: Students attending University of Toronto seeking housing.
- Clients: 2 students from Australia attending UofT this upcoming term.

## **Specifications:**

- 2 bedroom apartment
- Within 2 km from campus
- Maximum budget \$3000 per month (per person)
- Close distance to amenities such as restaurants.

# Data

- Data on the different neighborhoods in Toronto and their geospatial data will be used via online resources (Ex. Wikipedia).
- The data will contain the neighbourhoods, postal codes and their coordinates.
- Potential listings of 2 bedroom apartments will be gathered using different rental websites and compiled into a single Excel file.
- The data will contain the address, price, neighbourhood and the coordinates.

# Downtown Toronto Neighbourhoods

	PostalCode	Borough	Neighbourhood	Latitude	Longitude
50	M4W	Downtown Toronto	Rosedale	43.679563	-79.377529
51	M4X	Downtown Toronto	Cabbagetown,St. James Town	43.667967	-79.367675
52	M4Y	Downtown Toronto	Church and Wellesley	43.665860	-79.383160
53	M5A	Downtown Toronto	Harbourfront	43.654260	-79.360636
54	M5B	Downtown Toronto	Ryerson,Garden District	43.657162	-79.378937
55	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
56	M5E	Downtown Toronto	Berczy Park	43.644771	-79.373306
57	M5G	Downtown Toronto	Central Bay Street	43.657952	-79.387383
58	M5H	Downtown Toronto	Adelaide,King,Richmond	43.650571	-79.384568
59	M5J	Downtown Toronto	Harbourfront East,Toronto Islands,Union Station	43.640816	-79.381752
60	M5K	Downtown Toronto	Design Exchange,Toronto Dominion Centre	43.647177	-79.381576
61	M5L	Downtown Toronto	Commerce Court,Victoria Hotel	43.648198	-79.379817
66	M5S	Downtown Toronto	Harbord,University of Toronto	43.662696	-79.400049
67	M5T	Downtown Toronto	Chinatown,Grange Park,Kensington Market	43.653206	-79.400049
68	M5V	Downtown Toronto	CN Tower,Bathurst Quay,Island airport,Harbour...	43.628947	-79.394420
69	M5W	Downtown Toronto	Stn A PO Boxes 25 The Esplanade	43.646435	-79.374846
70	M5X	Downtown Toronto	First Canadian Place,Underground city	43.648429	-79.382280
75	M6G	Downtown Toronto	Christie	43.669542	-79.422564
93	M9A	Downtown Toronto	Queen's Park	43.667856	-79.532242

# Apartment Listings

	Address	Postal Code	Price	Latitude	Longitude
0	486 Clinton Street	M6G 2Z4	2600.0	43.667381	-79.418765
1	181 Dundas St East	M5A 1Z4	2500.0	43.657034	-79.374045
2	321 Sherbourne St	M5A 2S4	2170.0	43.661899	-79.372021
3	1080 Bay St	M5S 0A5	3950.0	43.666991	-79.388917
4	55 Bloor Street East	M4W 1A9	2700.0	43.670203	-79.385101
5	411 Markham St	M6G 2L1	2250.0	43.660245	-79.410382
6	887 Bay St	M5S 3K4	850.0	43.663020	-79.386136
7	152 St Patrick St	M5T 3J9	2450.0	43.654145	-79.390524

# Methodology

- Conducted data scraping of the Toronto neighbourhoods from online resources and implemented it into a data frame.
- Cleaned the data so that only downtown Toronto neighbourhoods were displayed with their coordinates.
- Constructed a folium map displaying the neighbourhoods using the coordinates of the University as a reference point (43.656997372, -79.390331772).
- Used Fourquare's API to gather venue information on the 19 Toronto neighbourhoods with a 1km radius.
- Stored the top 10 venues for each neighbourhood in a pandas data frame.

# Top 10 Venues

Out[28]:

	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	Adelaide,King,Richmond	Hotel	Asian Restaurant	Steakhouse	Gym / Fitness Center	Speakeasy	Monument / Landmark	Café	Opera House	Coffee Shop	Pizza Place
1	Berczy Park	Café	Beer Bar	Seafood Restaurant	Farmers Market	Fish Market	Basketball Stadium	Concert Hall	Breakfast Spot	Italian Restaurant	Steakhouse
2	CN Tower,Bathurst Quay,Island airport,Harbour...	Airport Lounge	Airport Service	Airport Terminal	Boat or Ferry	Airport	Airport Food Court	Airport Gate	Sculpture Garden	Harbor / Marina	Rental Car Location
3	Cabbagetown,St. James Town	Restaurant	Café	Italian Restaurant	Market	Pub	Butcher	Pet Store	Caribbean Restaurant	Coffee Shop	Park
4	Central Bay Street	Coffee Shop	Italian Restaurant	Bubble Tea Shop	Spa	Park	Café	Modern European Restaurant	Miscellaneous Shop	Ramen Restaurant	Sandwich Place
5	Chinatown,Grange Park,Kensington Market	Café	Vietnamese Restaurant	Mexican Restaurant	Coffee Shop	Grocery Store	Gourmet Shop	Fish Market	Farmers Market	Dessert Shop	Comfort Food Restaurant
6	Christie	Grocery Store	Café	Park	Athletics & Sports	Coffee Shop	Restaurant	Diner	Baby Store	Italian Restaurant	Convenience Store
7	Church and Wellesley	Park	Gay Bar	Restaurant	Ramen Restaurant	Pub	Bookstore	Breakfast Spot	Pizza Place	Bubble Tea Shop	Burger Joint
8	Commerce Court,Victoria Hotel	Café	Restaurant	Deli / Bodega	Gastropub	Coffee Shop	Japanese Restaurant	Gym / Fitness Center	Steakhouse	Beer Bar	Bakery
9	Design Exchange,Toronto Dominion Centre	Coffee Shop	Café	Japanese Restaurant	Deli / Bodega	Restaurant	Steakhouse	Gym	Gastropub	Hotel	Pizza Place
10	First Canadian Place,Underground city	Café	Coffee Shop	Restaurant	Steakhouse	Gym / Fitness Center	Seafood Restaurant	American Restaurant	Art Gallery	Bakery	Deli / Bodega
11	Harbord,University of Toronto	Café	Restaurant	Bookstore	Bakery	Japanese Restaurant	Comfort Food Restaurant	Sandwich Place	Beer Bar	Bar	Italian Restaurant
12	Harbourfront	Coffee Shop	Park	Bakery	Mexican Restaurant	Breakfast Spot	Gym / Fitness Center	French Restaurant	Historic Site	Farmers Market	Dessert Shop
13	Harbourfront East,Toronto Islands,Union Station	Park	Café	Plaza	Hotel	Sports Bar	Performing Arts Venue	Bubble Tea Shop	Lake	Bistro	Salad Place
14	Rosedale	Park	Trail	Playground	College Arts Building	Cosmetics Shop	Convenience Store	Concert Hall	Comic Shop	Comfort Food Restaurant	College Gym
15	Ryerson,Garden District	Café	Sandwich Place	Art Gallery	Beer Bar	Plaza	Pizza Place	Coffee Shop	Clothing Store	Spa	Diner
16	St. James Town	Gastropub	Coffee Shop	Restaurant	Japanese Restaurant	Hotel	Diner	BBQ Joint	Café	Poke Place	Middle Eastern Restaurant
17	Stn A PO Boxes 25 The Esplanade	Farmers Market	Café	Cocktail Bar	Beer Bar	Seafood Restaurant	Park	Museum	Concert Hall	Jazz Club	H

# Methodology continued...

- One hot encoding was conducted to see the different types of venues (Ex. restaurants) and their frequency.
- Neighbourhoods were clustered using the venue information and a cluster size of 5.
- The neighbourhood clusters were then displayed on a folium map, with the different colours representing different clusters.
- Gathered listing data from online resources and compiled them into a single csv file, which was then uploaded to Github.
- Extracted and stored the listing data/coordinates into a new data frame.
- Created a new folium map which contained the listing data and neighbourhood clusters with venue information.

# Results

## ----Central Bay Street----

	venue	freq
0	Coffee Shop	0.24
1	Spa	0.08
2	Italian Restaurant	0.08
3	Bubble Tea Shop	0.08
4	Ramen Restaurant	0.04
5	Sandwich Place	0.04
6	Modern European Restaurant	0.04
7	Miscellaneous Shop	0.04
8	Café	0.04
9	Bar	0.04

## ----Church and Wellesley----

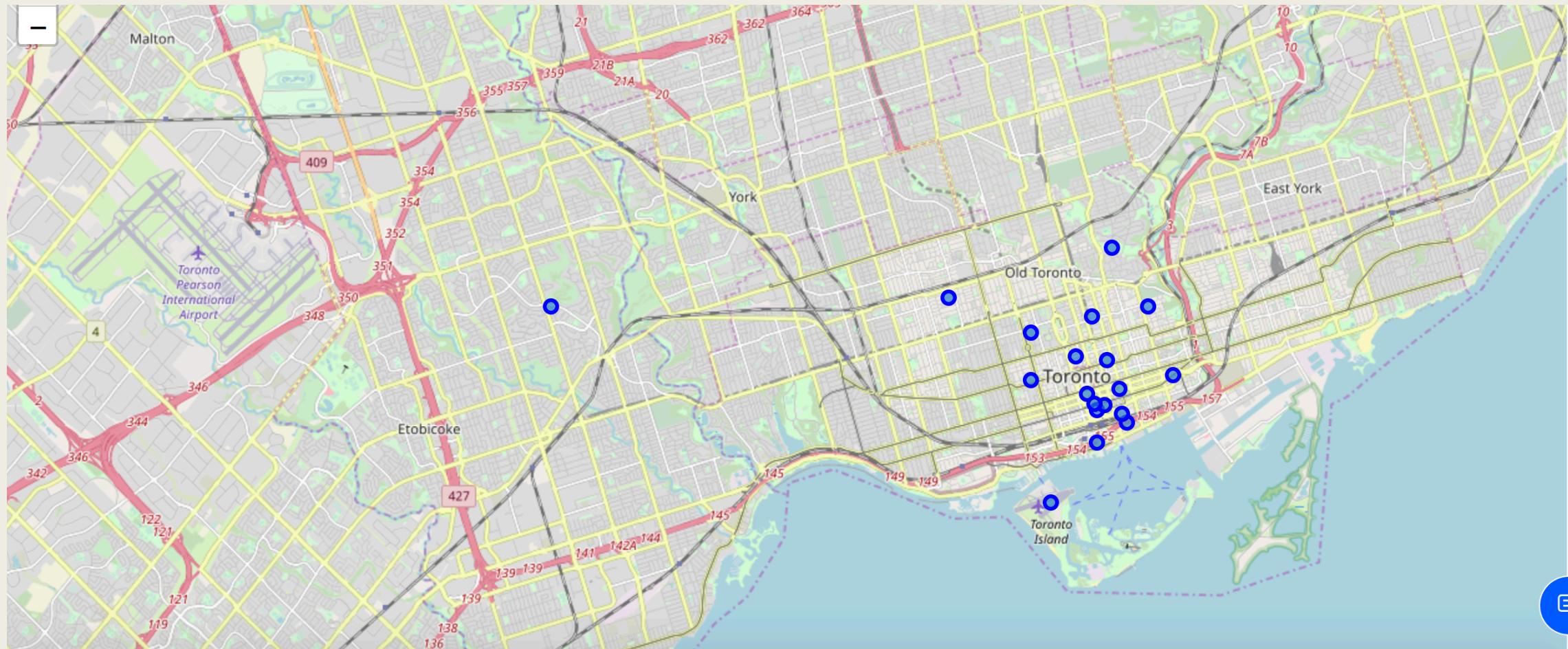
	venue	freq
0	Bookstore	0.04
1	Restaurant	0.04
2	Gastropub	0.04
3	Breakfast Spot	0.04
4	Bubble Tea Shop	0.04
5	Burger Joint	0.04
6	Salon / Barbershop	0.04
7	Ethiopian Restaurant	0.04
8	Diner	0.04
9	Gay Bar	0.04

3 closest neighbourhoods  
to the University

## ----Harbord, University of Toronto----

	venue	freq
0	Café	0.16
1	Bakery	0.08
2	Japanese Restaurant	0.08
3	Bookstore	0.08
4	Restaurant	0.08
5	French Restaurant	0.04
6	Sandwich Place	0.04
7	Beer Bar	0.04
8	Chinese Restaurant	0.04
9	Bar	0.04

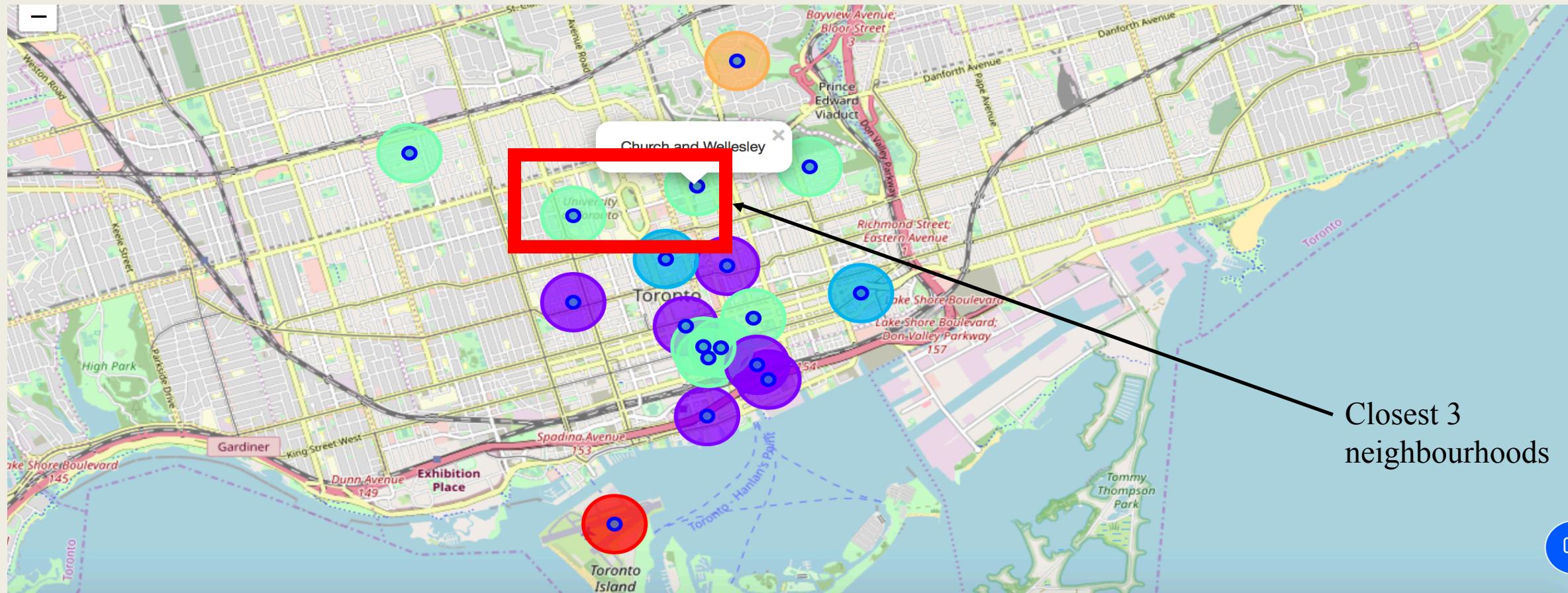
# Map of the 19 Downtown Toronto Neighbourhoods



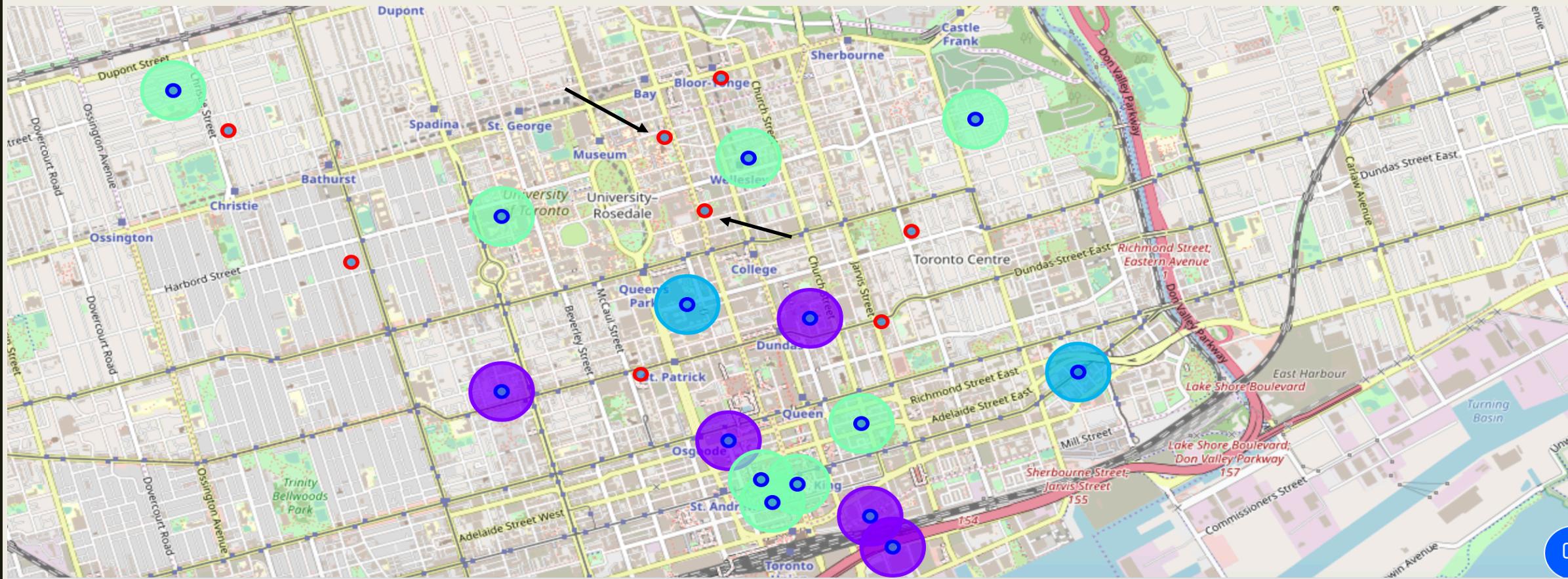
# Venue Information on each neighbourhood via Foursquare

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Adelaide,King,Richmond	25	25	25	25	25	25
Berczy Park	25	25	25	25	25	25
CN Tower,Bathurst Quay,Island airport,Harbourfront West,King and Spadina,Railway Lands,South Niagara	15	15	15	15	15	15
Cabbagetown,St. James Town	25	25	25	25	25	25
Central Bay Street	25	25	25	25	25	25
Chinatown,Grange Park,Kensington Market	25	25	25	25	25	25
Christie	17	17	17	17	17	17
Church and Wellesley	25	25	25	25	25	25
Commerce Court,Victoria Hotel	25	25	25	25	25	25
Design Exchange,Toronto Dominion Centre	25	25	25	25	25	25
First Canadian Place,Underground city	25	25	25	25	25	25
Harbord,University of Toronto	25	25	25	25	25	25
Harbourfront	25	25	25	25	25	25
Harbourfront East,Toronto Islands,Union Station	25	25	25	25	25	25
Rosedale	4	4	4	4	4	4
Ryerson,Garden District	25	25	25	25	25	25
St. James Town	25	25	25	25	25	25
Stn A PO Boxes 25 The Esplanade	25	25	25	25	25	25

# Toronto neighbourhoods with venue clusters



# Rental listings mapped with neighbourhood clusters



# Discussion

- Our results showed the 3 closest neighbourhoods to the University are: Central Bay, Church & Wellesley, and Harbord, University of Toronto.
- Each of these neighbourhoods has a diversity of restaurants as per the clients requests (Japanese, Italian, European etc).
- Additional access to other venues such as bookstores, coffee shops and cafes.
- Rental listings #4 and #7 are the closest to the University (2 bedrooms).
- Listing #4: \$2700 per month, Listing #7: \$2450 per month
- Alternatives that are slightly further: Listing #5 (\$2250 per month), Listing #6 (\$850 per month).

# Conclusion

- Listing #7 would be the best choice for our clients.
- More centrally located to the University, with amenities restaurants and other amenities within walking distance.
- Rent is also slightly lower in listing #7 than listing #4.
- The use of data scraping/analysis techniques along with Foursquare's API provided us with the capabilities to come to this conclusion.
- Future cases: This process can be improved by working with Foursquare's API to find other amenities such as public transportation, grocery stores, libraries etc. for future clients.

THANK YOU