

COURSERA CAPSTONE PROJECT

Battle of Neighbourhoods

Vishwan

/

Capstone Project Week 5 Report

Introduction & Business Problem

The city of Toronto is one of the most iconic and populated cities in the world. Downtown Toronto is a prime location for both tourists and locals to take full advantage of the countless amenities the city has to offer. The diversity in Toronto is evident through the distinctive restaurants and local businesses that can be seen throughout the city. With numerous amenities located within close proximities from one another, downtown Toronto is often an attractive location for people to live in. University of Toronto (UofT) St. George located in Downtown Toronto, is one of the top universities in the world. Due to its notoriety and facilities, UofT is home to many international students. However, because Toronto is a prime location for many to reside in, the cost of living is extremely high, especially for students. It often becomes extremely difficult for students to find affordable housing near their University with basic amenities. Therefore, the target audience for this project will be university students attending UofT. The analysis conducted in this project will help students grasp the best areas in which they can find affordable housing for themselves.

We at ABC company are realtors that strive to help our clients find housing that fit their needs at an affordable cost. Our clients are 2 students from Australia seeking housing (2 bedroom) within 2km distance from UofT. The maximum budget in total among the two students is \$6000 per month (or \$3000 per student per month). The ideal spot must also be located within close distance to amenities such as restaurants.

Data

Data pertaining to the different neighbourhoods in downtown Toronto will be used. The following links will be used to extract the downtown neighbourhoods, and their geo spatial data (similar to Week 3):

1. https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M
2. https://cocl.us/Geospatial_data

Data regarding the different rental properties in downtown Toronto will also be used. To obtain this data, different rental sites will be used to gather information on current 2 bedroom properties. The information will then be compiled into an excel file which stores basic information such as the address, postal code and price of the listing for the 2 bedroom apartments. Current listings can be found through the links below:

1. <https://property.trovit.ca/for-rent-university-toronto-2-bedroom-apartment>
2. <https://www.point2homes.com/CA/2-Bedroom-Apartments-For-Rent/ON/Toronto/Downtown-Toronto/University.html>
3. <http://www.freerentads.com/2-bedroom-apartments-for-rent-university-of-toronto-105-george-st-toronto-ontario-canada-QQNA178-UofT99>

Using the collected data, we will able to determine the different neighbourhoods located in downtown Toronto, and visually depict the ones close to University of Toronto St. George campus. From there we will then be able to find information on potential listings in those neighbourhoods after we pinpoint the ones that are close to the university. Afterwards, Foursquare API will then be used to identify which listings/neighbourhoods are closest to a cluster of amenities such as restaurants, as per our clients' specifications. Through data scraping and analysis techniques, we will be able to provide our clients with the necessary information needed to make an informed decision on the best listing for them.

Methodology

In order to complete our objective, a variety of data scraping and data analysis techniques were used to obtain the information we desired. Many of the techniques and libraries we used were consistent with the ones that were used in previous projects. A pandas data frame was constructed that consisted of the different neighbourhoods in Toronto and their respective postal codes using data from Wikipedia. The data was then cleaned so that only boroughs in "Downtown Toronto" were selected and stored in a new data frame with their respective geospatial coordinates. Our reference coordinates were set to [43.656997372, -79.390331772], representing the location of University of Toronto St. George campus. A folium map was then constructed to visually depict a point in each of the 19 different neighbourhoods in downtown Toronto.

The next step involved getting information on the different venues available in these neighbourhoods, as the clients would like to live near different restaurants. To do this, we had to connect to Foursquare's API using our Client ID and secret ID. We used a 1km radius to find the top 10 venues in each neighbourhood. One hot encoding was then used to see the different types of venues in each neighbourhood, in order to determine the different restaurants in each one. For general information purposes, the top 10 venues in each neighbourhood (not limited to restaurants), were also determined to see each areas diversity. In terms of machine learning techniques, k means clustering was used with a cluster size of 5, in order to group the different neighbourhoods based on the different venues.

The next step involved using pandas to read a csv file consisting of some rental listings in Downtown Toronto. These listings were obtained using online real estate websites, and uploaded to the Github repository. The new data frame contained the addresses of the listing, postal code, latitude and longitude. It is important to note that all the listings in the table were for 2 bedroom apartments that are less than \$6000 per month. For data visualization purposes, a folium map was created of the 19 different downtown Toronto neighborhoods, with the number of clusters set to 5. Another folium map was created, however this time containing both the rental listings and downtown Toronto neighbourhoods. The use of these data analysis and visualization techniques provide us with the necessary tools for determining the best possible rental location for the two students.

Results

	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

Figure 1: Table of the different neighbourhoods in Downtown Toronto.

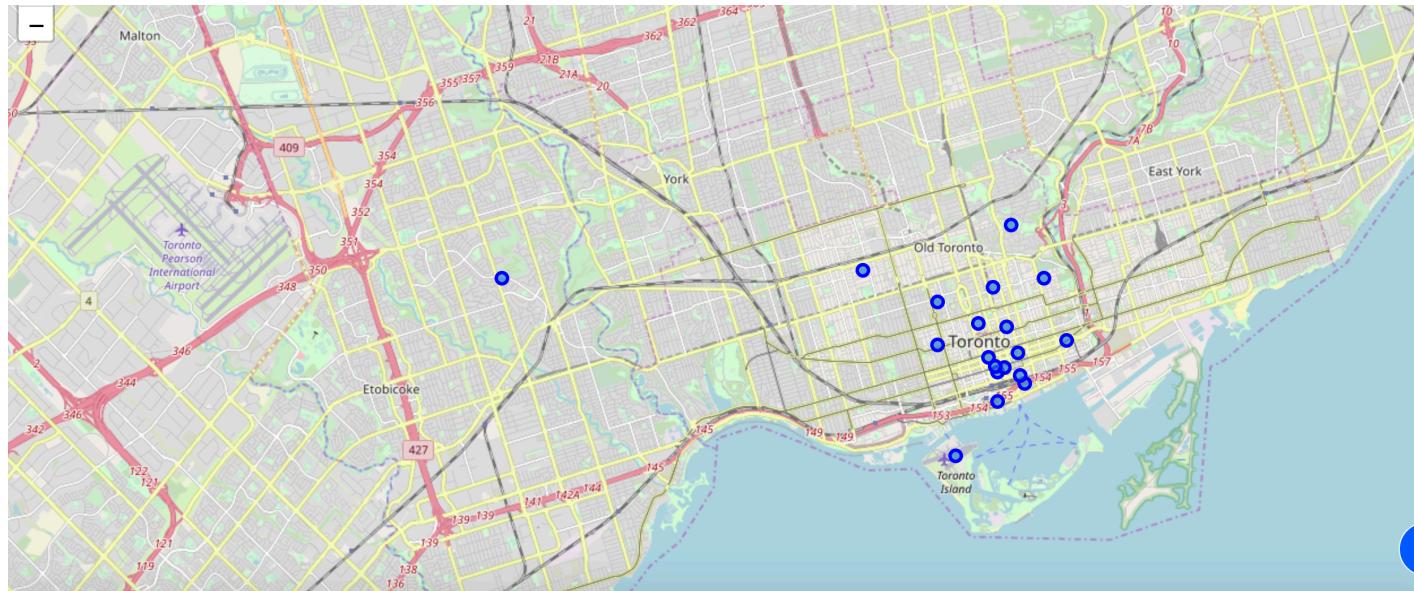


Figure 2: Downtown Toronto neighbourhoods folium map.

Out[48]:

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 Str A PO Boxes 25 The Esplanade	Farmers Market	Café	Cocktail Bar	Beer Bar	Seafood Restaurant	Park	Museum	Concert Hall	Jazz Club	Hotel

Figure 3: Top 10 venues for each of the neighbourhoods located in Downtown Toronto.

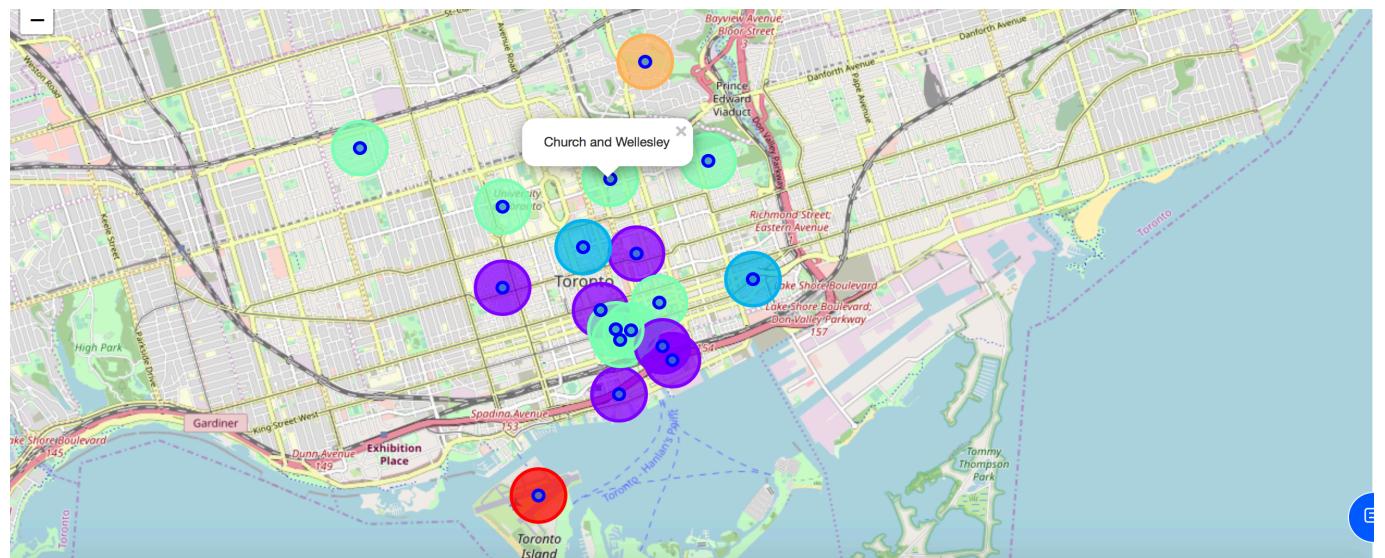


Figure 4: Folium map of Toronto neighbourhoods with venue clusters (number of clusters = 5).

	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

Figure 5: Table of rental listings with their price and coordinates, extracted from a csv file.

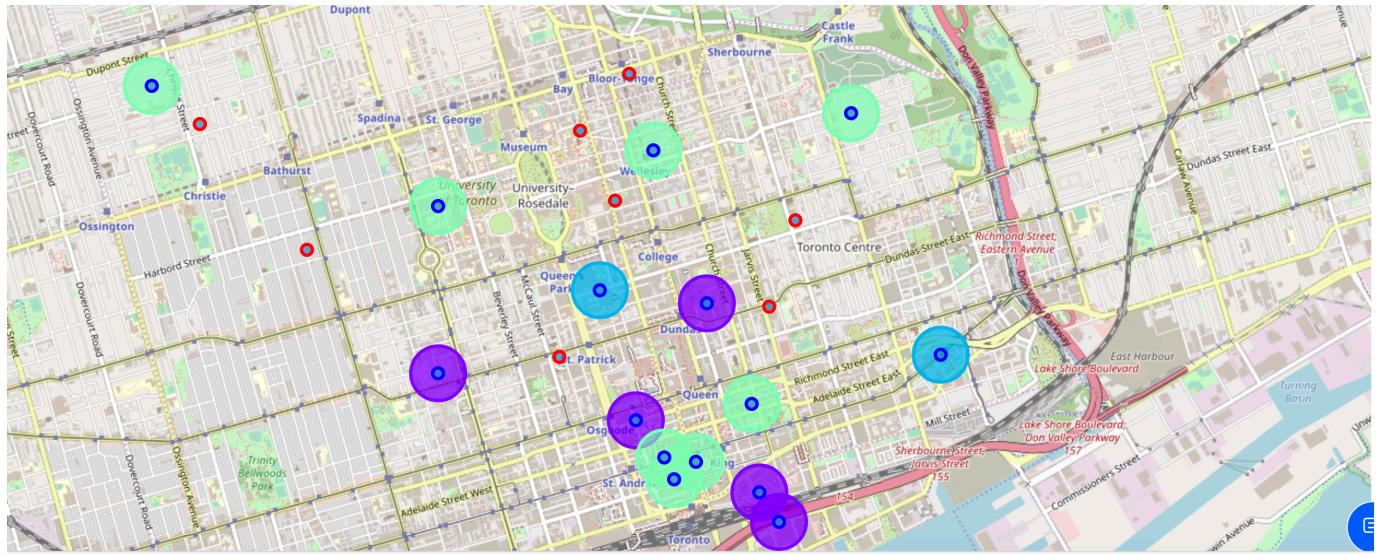


Figure 6: Folium map consisting of neighbourhood clusters and rental listings near University of Toronto.

Discussion

Examining our results, we can determine which neighbourhoods and listings are the most suitable for the clients. In Figure 4, it is evident that the closest neighbourhoods to University of Toronto were Central Bay, Church & Wellesley and Harbord, University of Toronto. The different colours in Figure 4 represent the different cluster of venues in each neighbourhood. Figure 3 shows the top 10 venues in each neighbourhood. The clients preferred to be situated in a location that had a few diverse restaurants. The Central Bay neighbourhood consists of an Italian, European and Ramen restaurants as well as a café and sandwich place. Church and Wellesley also has a Ramen restaurant as well as a pizza place and burger joint. Lastly, Harbord has a Japanese and Italian

restaurant to go along with a bakery and a comfort food place. Therefore, as proven by our results, all three neighbourhoods provide great access to a diversity of restaurants. In addition to the restaurants, these three neighbourhoods also provide access to other venues such as book stores, coffee shops and spas in which the students can take advantage of.

Figure 5 shows the different rental postings that were compiled and aligned with the students' specifications. The red circles in Figure 6 give a visual depiction of these rental listings with reference to the different Toronto neighbourhoods. The results indicate that listings 4 and 7 are the closest to the University of Toronto St. George. The close proximity to the University is reflected in the high price, although well within the set budget. Listing #4 has a price of \$2700 per month, whereas listing #7 has a price of \$2450 per month. Lower listings can be found as you move further away from the University. The next two closest listings were #5 and #6. Listing #5 was \$2250 per month and #6 has a rate of \$850 per month.

Overall, listing #7 would be the best listing for our clients. This listing is within walking distance to both the University as well as many restaurants and other amenities in the area. In addition, listing #7 is also more centrally located to the campus, making it easier for the students. Listing #7 also has a slightly lower rent than listing #4. However, with that being said both listings are well within the students' specifications and would be ideal neighbourhoods for them.

Conclusion

By using data analysis and exploratory techniques, we were able to identify potential rental listings for our clients near University of Toronto. These techniques allowed us to identify the best neighbourhoods near University of Toronto that had a diversity of restaurants. Our results also revealed other amenities within these neighbourhoods that the students can benefit from. Clustering was used to cluster the different neighbourhoods based on their venues using Foursquare's API. With the help of data visualization tools in the form of folium maps, we were able to illustrate our results. Our results indicated that listings 4 and 7 were the closest listings to the university, with #7 being the top choice for the students. In future cases, these techniques along with the Foursquare API can be used to provide more insight to clients such as nearby public transportation, libraries, specific grocery stores etc.