

EXPLORING TORONTO- By Yaswanth Gummadi

Background:

Toronto is the provincial capital of Ontario and the most populous city in Canada, with a population of 2,731,571 as of 2016. Current to 2016, the Toronto census metropolitan area (CMA), of which the majority is within the Greater Toronto Area (GTA), held a population of 5,928,040, making it Canada's most populous CMA. The city is the anchor of the Golden Horseshoe, an urban agglomeration of 9,245,438 people (as of 2016) surrounding the western end of Lake Ontario. Toronto is an international centre of business, finance, arts, and culture, and is recognized as one of the most multicultural and cosmopolitan cities in the world.

People have travelled through and inhabited the Toronto area, located on a broad sloping plateau interspersed with rivers, deep ravines, and urban forest, for more than 10,000 years. After the broadly disputed Toronto Purchase, when the Mississauga surrendered the area to the British Crown, the British established the town of York in 1793 and later designated it as the capital of Upper Canada. During the War of 1812, the town was the site of the Battle of York and suffered heavy damage by United States troops. York was renamed and incorporated in 1834 as the city of Toronto. It was designated as the capital of the province of Ontario in 1867 during Canadian Confederation. The city proper has since expanded past its original borders through both annexation and amalgamation to its current area of 630.2 km² (243.3 sq mi).

The diverse population of Toronto reflects its current and historical role as an important destination for immigrants to Canada. More than 50 percent of residents belong to a visible minority population group, and over 200 distinct ethnic origins are represented among its inhabitants. While the majority of Torontonians speak English as their primary language, over 160 languages are spoken in the city.

Toronto is a prominent centre for music, theatre, motion picture production, and television production, and is home to the headquarters of Canada's major national broadcast networks and media outlets. Its varied cultural institutions, which include numerous museums and galleries, festivals and public events, entertainment districts, national historic sites, and sports activities, attract over 43 million tourists each year. Toronto is known for its many skyscrapers and high-rise buildings, in particular the tallest free-standing structure in the Western Hemisphere, the CN Tower.

The city is home to the Toronto Stock Exchange, the headquarters of Canada's five largest banks, and the headquarters of many large Canadian and multinational corporations. Its economy is highly diversified with strengths in technology, design, financial services, life sciences, education, arts, fashion, business services, environmental innovation, food services, and tourism.

Introduction of the Business Problem:

Creative Arts Inc. is a global company dedicated to the world of creative arts. In this modern age of 21st century driven by technology and blue-collar jobs, the world of creative arts is shrinking rapidly. The awareness among general population for the creative arts domain as a whole is decreasing. This is due to the lack of time in their busy schedules. The entire world is being driven on engineering, technology, healthcare etc. No one is being encouraged to the art of writing, painting, photography etc. Creative Arts Inc. was formed to revive the Creative arts domain. Here artists are encouraged to follow their passion and their work is displayed throughout the world at different events, conventions etc for fund raising, training and selling of

the work of artists. They leverage technology to get funds and revenues and to increase the awareness of the Creative Arts among general populace.

XYZ is a company based in Toronto for organizing events, currently it works on a project for Creative Arts Inc. to organize an event for 5 days for a group of artists from all over the world. The company has to put a good program, including a hotel of residence, a hall for meetings, places of landscape to visit, stores for shopping, restaurants and cafes. Artists generally prefer to get inspiration from their visits through the city. For example, parks or different landscapes have inspired many artists to capture the moments through photography, poetry and painting. So the company's purpose is to make a list of places of landscape in Toronto, including the nearest restaurants, cafes, and shopping stores for each place.

The ultimate challenge in this scenario is identifying places with close proximities. That means rather going to a park in a solitary location, artists would prefer to visit a park in the vicinity of restaurants, cafeterias, shopping malls etc so that they have huge activity in those places to derive proper inspiration and let their imagination go wild.

The stake holders in this project are diverse. The artists are obviously the main stakeholders. They would prefer to have info about places with common hangout spots. The general population would also prefer active places for hanging out or even for interacting with the artists. The client- Creative Arts Inc. would be having sufficient opportunities to display the work of their artists to larger client base and gather more sales. Even the hotels or any such new businesses would be preferring a larger footfall for their new business.

So our solution would be presentable to all the above stake holders.

Data Description

We would use many kinds of data for solving this problem. Most of the data is retrieved using the Foursquare API location Data.

For starters, we need Toronto location data. We would be getting the coordinates of the city of Toronto using the geopy package in Python.

Then using those coordinates as reference points, we would be using the Foursquare API to retrieve different locations of hotels, parks, restaurants, cafeterias etc. Using the Foursquare API, we can get a wide range of information about any particular location. This info consists of category, perks, id, country, city, street, distance from the reference coordinates, address, latitude, longitude, neighbourhood, state, postal code, name, referral_id, venue page_id etc.

We obviously don't need all that info for our exploration project. So we would be taking only required information like name, category, address, country, city, street, distance, latitude, longitude, neighbourhood, and state. These geographic attributes should tell us everything we need to know about a place for our solution.

The important thing about our solution is its customizability i.e. it can be changed according to user requirements. For example in our solution, we are looking at Toronto city, for hotels in 0.5 km radius for our event space, parks in 10 km radius, restaurants in 10 km radius, cafeteria in 10 km radius and shopping in 1 km radius. That is keeping in mind that we would prefer to hold the sale events as close to city center- hence the 0.5 km radius for hotels. The parks, restaurants, cafeteria are the places where artists and tourists attending the event can visit for official purpose or for tourism purpose- hence the 10 km radius. The shopping in 1 km radius is for obvious tourism purposes. The point is these things can be changed. For example, we can do the same for New York city or London city or Tokyo. All these are possible thanks to the geopy package and Foursquare API.

Then finally we would be plotting those points on a map using Folium package in Python to identify places with maximum activity/footprint for the artists attending the event and also for tourism purposes.

Methodology

Lets look at the process we followed to arrive at the solution. We are working purely on Python code.

1. We start by importing the required packages for our solution. They would include numpy, pandas, json, geopy, matplotlib, folium.
2. We define our Foursquare credentials for using the solution.
3. We define the city and get its latitude and longitude using geopy package.
4. We search for hotels in 500m radius with reference to city's latitude and longitude using Foursquare API explore option.
5. We export the results into a json file and assign the relevant part of the json file into a dataframe.
6. We clean the dataframe to keep only relevant location data for each venue in the dataframe. Then we proceed to deal with column names, dropping unnecessary columns, removing null values, removing duplicate records, and ensure that the category of venue in our dataframe is either a hotel or an event space.
7. Finally we have a list of hotels and event spaces in a dataframe. Now the final step in our data cleaning is we look for hotels and event spaces in the same postal code- we want them as near to each other as possible and we end up with only 2 venues which are almost adjacent.

	name	categories	address	lat	lng	postalCode	state
0	Sheraton Centre Toronto Hotel	Hotel	123 Queen Street West	43.651144	-79.384329	M5H 2M9	ON
21	Grand Ballroom	Event Space	123 Queen St. W	43.651217	-79.383771	M5H 2M9	ON

8. Now lets look at Parks, Restaurants and Cafeterias in a 10km radius to the city's latitude and longitude using the Foursquare API explore option.
9. We export the results into a json file and assign the relevant part of the json file into respective dataframes.
10. We clean the dataframe to keep only relevant location data for each venue in the dataframe. Then we proceed to deal with column names, dropping unnecessary columns, removing null values, removing duplicate records, and ensure that the category of venue in our dataframe is either park, restaurant or a cafeteria.
11. Finally we have a list of restaurants, parks and cafeterias in respective dataframes.

	name	categories	address	lat	lng	postalCode	state
5	Queen's Park	Park	University Ave.	43.663946	-79.392180	M5R 2E8	ON
9	Bellevue Square Park	Park	btwn Bellevue & Augusta Ave.	43.653610	-79.402199	M5T 2N4	ON
11	Trinity Bellwoods Park	Park	1053 Dundas St. W.	43.647072	-79.413756	M5H 2N2	ON
16	Canoe Landing Park	Park	50 Fort York Blvd	43.638762	-79.397067	M5V 3Z1	ON
17	High Park	Park	1873 Bloor St. W	43.646479	-79.463425	M6R 2Z3	ON
20	Riverdale Park West	Park	500 Gerrard St.	43.666048	-79.360941	M5A 2H3	ON
21	Barbara Hall Park	Park	519 Church St	43.666879	-79.381068	M4Y 2K9	ON

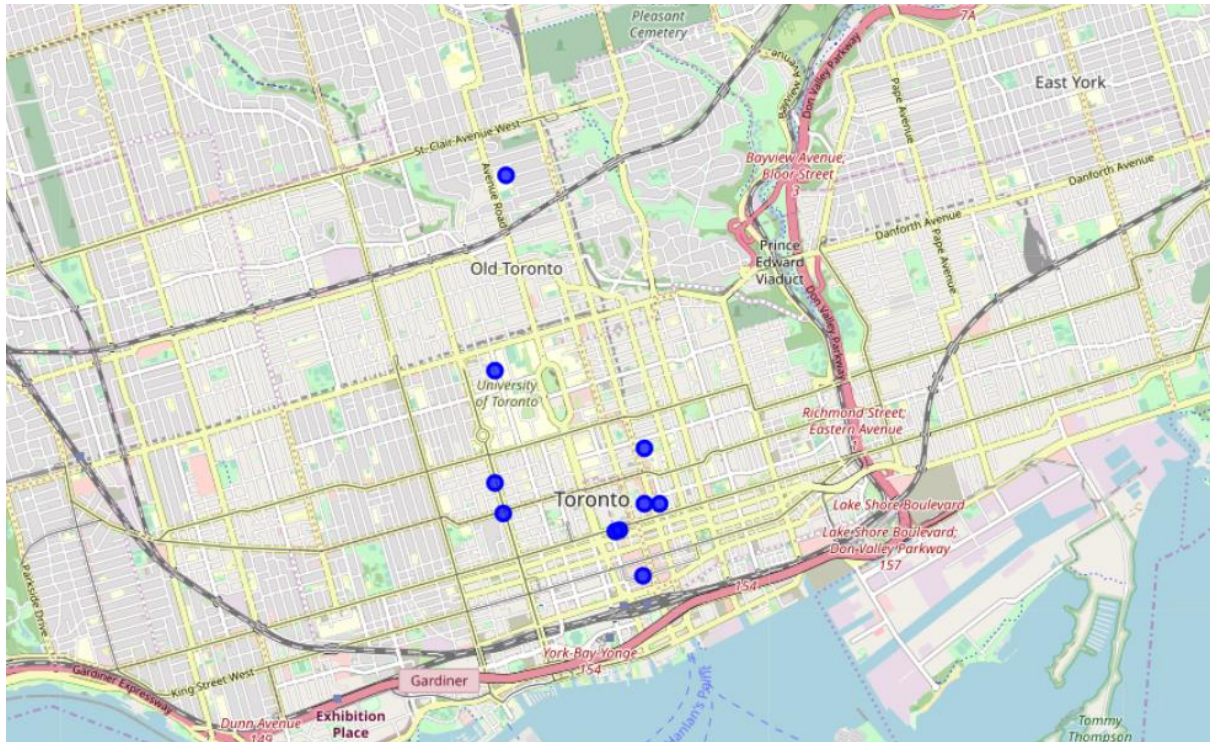
	name	categories	address	lat	lng	postalCode	state
0	Hemispheres Restaurant & Bistro	American Restaurant	110 Chestnut Street	43.654884	-79.385931	M5G 1R3	ON
1	Azure Restaurant & Bar	Restaurant	225 Front St W	43.644749	-79.385113	M5V 2X3	ON
2	Rol San Restaurant 龍笙棧	Dim Sum Restaurant	323 Spadina Ave.	43.654318	-79.398650	M5T 2E9	ON
3	360 Restaurant	Wine Bar	301 Front St W	43.642537	-79.387042	M5V 2T6	ON
4	Swatow Restaurant 汕頭小食家	Chinese Restaurant	309 Spadina Ave.	43.653866	-79.398334	M5T 2E6	ON
5	Victor Restaurant & Bar	Bar	30 Mercer Street	43.645634	-79.391125	M5V 1H3	ON
6	Goldstone Noodle Restaurant 金石	Noodle House	266 Spadina Ave	43.652278	-79.398039	M5T 2E4	ON
7	New Sky Restaurant 小沙田食家	Chinese Restaurant	353 Spadina Ave.	43.655337	-79.398897	M5T 2G3	ON
8	Victoria's Restaurant	Restaurant	37 King Street East	43.649298	-79.376431	M5C 1E9	ON
9	The Hot House Restaurant & Bar	American Restaurant	35 Church St	43.648824	-79.373702	M5E 1T3	ON
10	Aroma Fine Indian Restaurant	Indian Restaurant	287 King St. W	43.646463	-79.389644	M5V 1J5	ON
11	Ka Chi Korean Restaurant	Korean Restaurant	8 St Andrew St.	43.654307	-79.399277	M5T 1K6	ON
13	Green Tea Restaurant Downtown	Chinese Restaurant	261 Spadina Avenue. Upper level	43.652488	-79.397501	M5T 2E3	ON
15	Tasty's Caribbean Restaurant & Catering	Caribbean Restaurant	405 Spadina Ave	43.656794	-79.399251	M5T 2G6	ON
16	Hong Shing Chinese Restaurant	Chinese Restaurant	195 Dundas St W	43.654925	-79.387089	M5G 1C7	ON
18	Insomnia Restaurant and Lounge	Restaurant	563 Bloor St West	43.665180	-79.410966	M5S 1Y6	ON
19	Woodlot Restaurant & Bakery	New American Restaurant	293 Palmerston Ave.	43.655765	-79.409929	M6J 2J3	ON
21	El Rancho Restaurant & Night Club	Nightclub	430 College St.	43.656673	-79.407101	M5T 1T3	ON
22	Sassafras Cafe Restaurant Private Events	Event Space	100 Cumberland Street	43.670342	-79.391041	M5R 1A6	ON
23	Studio Restaurant	Breakfast Spot	389 Church St.	43.661500	-79.379319	M5B	ON
24	Kensington Cornerstone Restaurant	Breakfast Spot	2A Kensington Ave.	43.652803	-79.399958	M5T 2J7	ON
25	The Lakeview Restaurant	Diner	1132 Dundas St. W	43.649435	-79.420390	M6J 1X2	ON
27	Mapo Korean BBQ Restaurant 마포상회	Korean Restaurant	680 Bloor St W	43.664096	-79.416738	M6G 1L2	ON
29	Cottage Restaurant & Lounge	Thai Restaurant	338 Jarvis St.	43.662770	-79.376894	M4Y 2G6	ON

	name	categories	address	lat	lng	postalCode	state
1	Stay Cafeteria 慢走	Asian Restaurant	388 Spadina Ave	43.655454	-79.399163	M5T 2G5	ON
7	De La Salle College Cafeteria	College Cafeteria	131 Farnham Avenue	43.683003	-79.397815	M4V 1H7	ON
20	The Hub	College Cafeteria	350 Victoria St.	43.658585	-79.380622	M5B 2K3	ON
21	Marketeria	Restaurant	30 Bond St.	43.653585	-79.378843	M5B 1W8	ON
25	Innis College	Student Center	2 Sussex Ave	43.665556	-79.399298	M5S 1J5	ON
29	6th Floor Cafeteria 12 Concorde Place	Café	12 Concorde Place	43.721861	-79.329339	m3c 3k7	ON

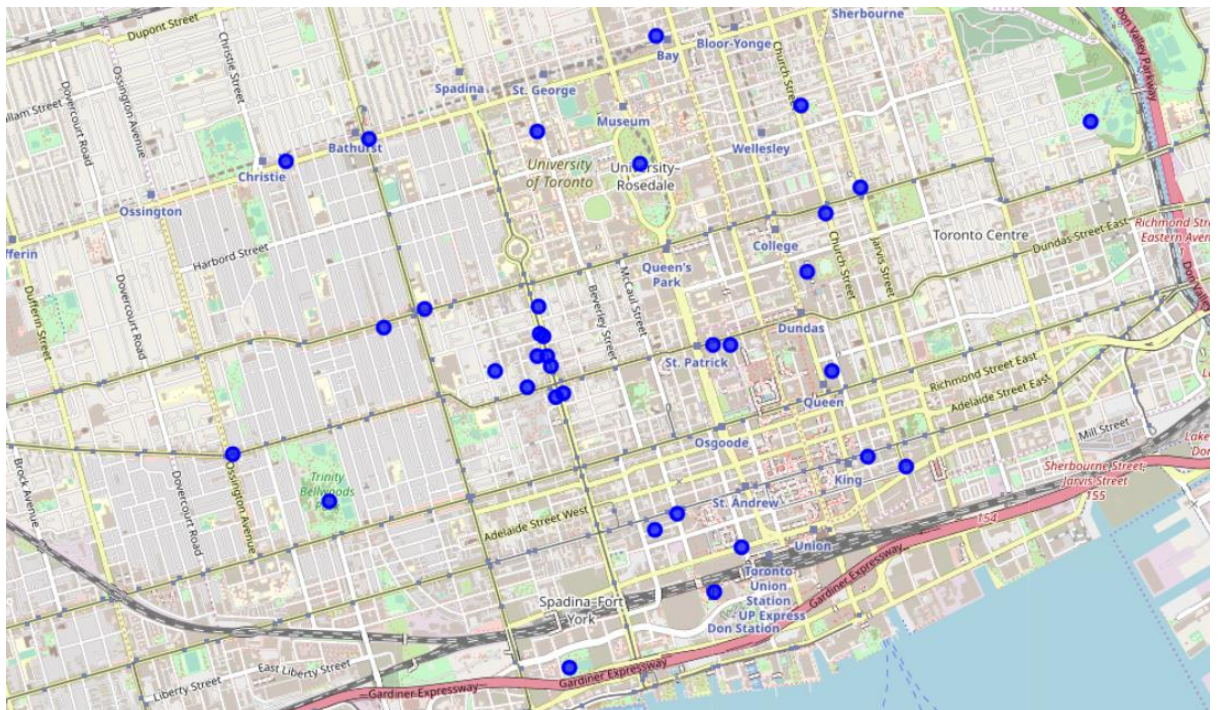
12. Now we deal with Shopping malls in 1km radius. Like explained in the data description section, this is for both professional and tourism purposes.
13. We proceed to use the Foursquare API explore option and export the data into json file and transfer the relevant data into a dataframe and proceed to clean it until we have a list of shopping malls.

	name	categories	address	lat	lng	postalCode	state
0	Dragon City Shopping Mall 龍城	Shopping Mall	280 Spadina Ave	43.652774	-79.398222	M5T 3A5	ON
1	CF Toronto Eaton Centre	Shopping Mall	220 Yonge St	43.653594	-79.380611	M5B 2H1	ON
2	TD Centre Shopping Concourse	Shopping Mall	66 Wellington St W	43.647184	-79.380932	M5K 1A1	ON

14. Now we need to look at the clusters of Hotels, cafeterias and shopping malls for tourism purposes. This is so that the artists and the tourists visiting the event at the hotel/even space would be interested in touring the city for a bit and do a fair bit of shopping.
15. So we merge the dfs of hotels, cafeterias and shopping malls into a dataframe and plot the locations on a map using Folium package.



16. Now let's look at the cluster of parks, restaurants and cafeterias. This is mainly for the artists who are looking for inspiration to perform their magic of art. Similar to what we did earlier, we merge the dfs of parks, restaurants and cafeterias into a single dataframe and plot it on the map using Folium package.



Our solution methodology is complete at this point. Let's proceed to look at the results and analyse them.

Results

We have two sets of clustered dataframes finally.

The dataframe consists of parks, restaurants and cafeterias.

	name	categories	address	lat	lng	postalCode	estate
0	Queen's Park	Park	University Ave.	43.663946	-79.392180	M5R 2E8	ON
1	Bellevue Square Park	Park	btwn Bellevue & Augusta Ave.	43.653610	-79.402199	M5T 2N4	ON
2	Trinity Bellwoods Park	Park	1053 Dundas St. W.	43.647072	-79.413756	M5H 2N2	ON
3	Canoe Landing Park	Park	50 Fort York Blvd	43.638762	-79.397067	M5V 3Z1	ON
4	High Park	Park	1873 Bloor St. W	43.646479	-79.463425	M6R 2Z3	ON
5	Riverdale Park West	Park	500 Gerrard St.	43.666048	-79.360941	M5A 2H3	ON
6	Barbara Hall Park	Park	519 Church St	43.666879	-79.381068	M4Y 2K9	ON
7	Hemispheres Restaurant & Bistro	American Restaurant	110 Chestnut Street	43.654884	-79.385931	M5G 1R3	ON
8	Azure Restaurant & Bar	Restaurant	225 Front St W	43.644749	-79.385113	M5V 2X3	ON
9	Rol San Restaurant 龍三樓	Dim Sum Restaurant	323 Spadina Ave.	43.654318	-79.398650	M5T 2E9	ON
10	360 Restaurant	Wine Bar	301 Front St W	43.642537	-79.387042	M5V 2T8	ON
11	Swallow Restaurant 汕頭小食家	Chinese Restaurant	309 Spadina Ave.	43.653866	-79.398334	M5T 2E6	ON
12	Victor Restaurant & Bar	Bar	30 Mercer Street	43.645634	-79.391125	M5V 1H3	ON
13	Goldstone Noodle Restaurant 金石	Noodle House	266 Spadina Ave	43.652278	-79.398039	M5T 2E4	ON
14	New Sky Restaurant 小炒食家	Chinese Restaurant	353 Spadina Ave.	43.655337	-79.398897	M5T 2G3	ON
15	Victoria's Restaurant	Restaurant	37 King Street East	43.649298	-79.376431	M5C 1E9	ON
16	The Hot House Restaurant & Bar	American Restaurant	35 Church St	43.648824	-79.373702	M5E 1T3	ON
17	Aroma Fine Indian Restaurant	Indian Restaurant	287 King St. W	43.646463	-79.389644	M5V 1J5	ON
18	Ka Chi Korean Restaurant	Korean Restaurant	8 St Andrew St.	43.654307	-79.399277	M5T 1K6	ON
19	Green Tea Restaurant Downtown	Chinese Restaurant	261 Spadina Avenue, Upper level	43.652488	-79.397501	M5T 2E3	ON
20	Tasty's Caribbean Restaurant & Catering	Caribbean Restaurant	405 Spadina Ave	43.656794	-79.399251	M5T 2G8	ON
21	Hong Shing Chinese Restaurant	Chinese Restaurant	195 Dundas St W	43.654925	-79.387089	M5G 1C7	ON
22	Insomnia Restaurant and Lounge	Restaurant	563 Bloor St West	43.665180	-79.410966	M5S 1Y6	ON
23	Woodlot Restaurant & Bakery	New American Restaurant	293 Palmerston Ave.	43.655765	-79.409929	M6J 2J3	ON
24	El Rancho Restaurant & Night Club	Nightclub	430 College St.	43.656673	-79.407101	M5T 1T3	ON
25	Sassafras Cafe Restaurant Private Events	Event Space	100 Cumberland Street	43.670342	-79.391041	M5R 1A6	ON
26	Studio Restaurant	Breakfast Spot	389 Church St.	43.661500	-79.379319	M5B	ON
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28	The Lakeview Restaurant	Diner	1132 Dundas St. W	43.649435	-79.420390	M6J 1X2	ON
29	Mapo Korean BBQ Restaurant 마포상회	Korean Restaurant	680 Bloor St W	43.664096	-79.416738	M6G 1L2	ON
30	Cottage Restaurant & Lounge	Thai Restaurant	338 Jarvis St.	43.662770	-79.376894	M4Y 2G8	ON
31	Stay Cafeteria 饗宴	Asian Restaurant	388 Spadina Ave	43.655454	-79.399163	M5T 2G5	ON
32	De La Salle College Cafeteria	College Cafeteria	131 Farnham Avenue	43.683003	-79.397815	M4V 1H7	ON
33	The Hub	College Cafeteria	350 Victoria St.	43.658585	-79.380622	M5B 2K3	ON
34	Marketeria	Restaurant	30 Bond St.	43.653585	-79.378843	M5B 1W8	ON
35	Innis College	Student Center	2 Sussex Ave	43.665556	-79.399298	M5S 1J5	ON
36	6th Floor Cafeteria 12 Concorde Place	Café	12 Concorde Place	43.721861	-79.329339	m3c 3k7	ON

These are the places of interest for artists and tourists. Artists to draw inspiration for their respective arts while tourists can enjoy the culture of the city.

The dataframe consists of hotels/event spaces, cafeterias and shopping malls.

	name	categories	address	lat	lng	postalCode	state
0	Sheraton Centre Toronto Hotel	Hotel	123 Queen Street West	43.651144	-79.384329	M5H 2M9	ON
1	Grand Ballroom	Event Space	123 Queen St. W	43.651217	-79.383771	M5H 2M9	ON
2	Stay Cafeteria 慢走	Asian Restaurant	388 Spadina Ave	43.655454	-79.399163	M5T 2G5	ON
3	De La Salle College Cafeteria	College Cafeteria	131 Farnham Avenue	43.683003	-79.397815	M4V 1H7	ON
4	The Hub	College Cafeteria	350 Victoria St.	43.658585	-79.380622	M5B 2K3	ON
5	Marketeria	Restaurant	30 Bond St.	43.653585	-79.378843	M5B 1W8	ON
6	Innis College	Student Center	2 Sussex Ave	43.665556	-79.399298	M5S 1J5	ON
7	6th Floor Cafeteria 12 Concorde Place	Café	12 Concorde Place	43.721861	-79.329339	m3c 3k7	ON
8	Dragon City Shopping Mall 龍城	Shopping Mall	280 Spadina Ave	43.652774	-79.398222	M5T 3A5	ON
9	CF Toronto Eaton Centre	Shopping Mall	220 Yonge St	43.653594	-79.380611	M5B 2H1	ON
10	TD Centre Shopping Concourse	Shopping Mall	66 Wellington St W	43.647184	-79.380932	M5K 1A1	ON

These are the places for holding the events and encouraging artists and clients to explore the city outside their event. They can relax at a café or shop at a shopping mall.

Discussion

Now lets look at our results closely and try to form a conclusion. We have a five day event at say Grand Ballroom. The artists can be being accommodated at Sheraton Centre Toronto Hotel. The hotel can be recommended for any clientele arriving exclusively for our event. They can have their meals at any of the cafes available in the list. They are fairly closeby and we have three shopping malls where they can proceed for their trip memories and souvenirs.

Now the artists or tourists can plan their days through out first dataset. For example, we have a Bellevue Square Park, Rol San Restaurant, Shadow Restaurant, Goldstone Noodle Restaurant, New Sky Restaurant, Ka Chi Korean Restaurant, Green Tea Restaurant Downtown, Tasty's Caribbean Restaurant, El Rancho Restaurant & Night Club, Kensington Cornerstone Restaurant and Stay Cafeteria in a close proximities. Artists and clients can start their day with a breakfast at Kensington Cornerstone Restaurant, proceed to the park, have lunch at any of the above listed places and end the day at El Rancho Restaurant & Night Club. They had a productive day.

These are just a few recommendations and many such recommendations can be made based on the available list of places and their location data.

Conclusion

We as XYZ event organizers created a customized solution for exploring a city based on client preferences. We achieved the solution using Python and used Foursquare Location Data to arrive at the solution. In this case, the client happens to be a Creative Arts Inc and we executed the solution for Toronto City for one of their art conference and exhibitions.

