Decision making tool for selecting great event spaces in Toronto, Canada

Table of Contents

1. Project description: business problem and interested audience in this project
2. Data requirements
3. Methodology
4. Results
5. Discussion and conclusion

1. Project Description:

According to "The 2016 Event Professionals of Tomorrow Report", selecting an event space is often reported as one of the most important and challenging aspect in the planning process. The location of the event venue is crucial for optimizing event attendance and should be an appropriate place for the target audience. The type of facility components in the chosen venue should also fit the event. Moreover, suitable lodging accommodations within a reasonable distance of the event and nearby organic event networking opportunities increase the success of the event.

This project aims to find great venues nearby available event facilities in a city that fulfill the types of events and their requirements. FourSquare data and folium's visualizing aid as well as data analysis and clustering techniques will solve the problem discussed in this the project.

The interested audiences are event coordinators looking for great venue that not only sets the scene but also comply with requirements of the event and experiences of the participants.

2. Data requirements

The main dataset regarding the available event facilities in Toronto city are obtained from the official webpage https://www.toronto.ca/city-government/data-research-maps/open-data. This database is a compilation of all event spaces within the 44 City wards in Toronto city, available on a rental basis, for performances, exhibitions, visual arts, screen based performances, heritage events etc. The fields in the dataset are: FACILITY NAME, Full Address, Street #, Street Name, Suite, City, Province, Postal Code, Ward, type of space and ownership of facilities.

The neighborhood data for the city of Toronto is also needed. However, the data is not readily available. Instead it has to be scrapped form a Wikipedia page at https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M , cleaned and put in to a dataframe.

For exploring and recommending event facilities across different venues in Toronto city, the FourSquare API interface is also used. The data gathered are then arranged in a dataframe for clustering and visualization.

3. Methodology

The aim of the project is to develop a decision-making tool for great event space selection in Toronto city. The tool is composed of three modules (Fig.1): one module is preliminary analysis of all event space in Toronto city by type and location. This module deals with data wrangling and preprocessing to make it suitable for the next stage. Following the data preprocessing, location information (Latitude and Longitude) for event facilities would be made available to Foursquare API server as HTTP requests using zip codes of the Toronto city streets. Foursquare API search feature would then be used to gather relevant information regarding nearby venues of the city streets. The http request limitations for the number of venues and radius of nearby places are considered.

The second module is the territorial diagnosis based on a clustering analysis of the city addressed. Unsupervised K-mean clustering algorithm is carried out to cluster categories of venues nearby a given event locations. Folium is used to visualize the street venue cluster over an interactive map.

A final module known as the recommendations module derive insights for selecting great venues and draw conclusions.

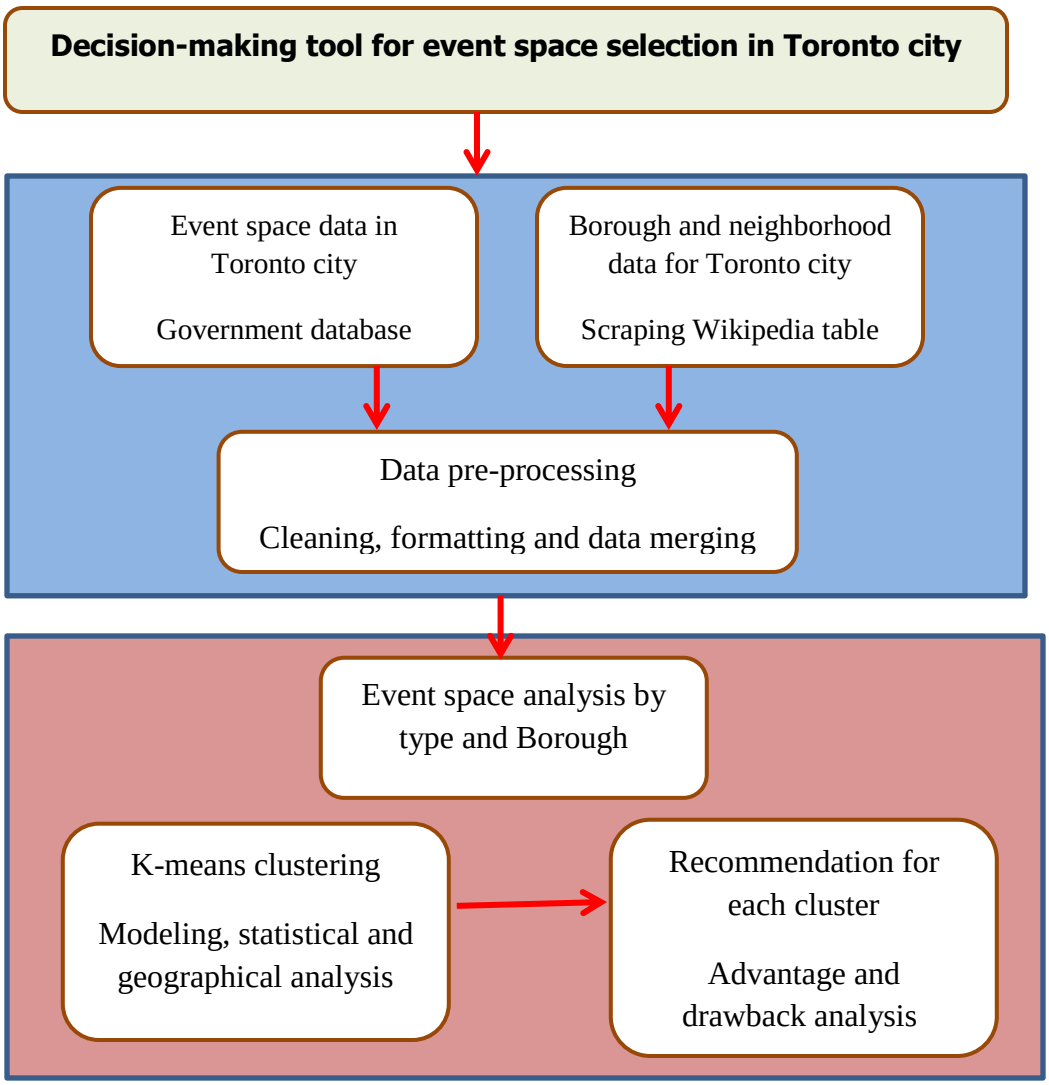


Fig. 1. Structure of the decision-making tool for event space selection in Toronto city

Module 1: preliminary analysis of event spaces in Toronto

Before anything, let us load the main event space dataset form https://www.toronto.ca/city-government/data-research-maps/. his database is a compilation of all event spaces within the 44 City wards in Toronto city, available on a rental basis, for performances, exhibitions, visual arts, screen based performances, heritage events etc. The fields in the dataset are: FACILITY NAME, Full Address, Street #, Street Name, Suite, City, Province, Postal Code, Ward, type of space and ownership of facilities. There are 1397 event spaces in Toronto city with 16 data fields.

	FACILITY NAME	Full Address	Street #	Street Name	Suite	City	Province	Postal Code	Ward	Performance	Exhibition / Visual Arts	Screen Based	Library	Multipurpose	Heritage	OWNERSHIP
0	Thistletown CC	925 Albion Road, Toronto, ON	925	Albion Road	0	Toronto	ON	M9V	1	1.0	0.0	0.0	0.0	1.0	0.0	City Operated
1	Albion Pool & Health Club	1485 Albion Road, Toronto, ON	1485	Albion Road	0	Toronto	ON	M9V	1	0.0	0.0	0.0	0.0	1.0	0.0	City Owned
2	Albion Branch (TPL)	1515 Albion Road, Toronto, ON	1515	Albion Road	0	Toronto	ON	M9V	1	1.0	0.0	0.0	1.0	1.0	0.0	City Operated

The neighborhood data for the city of Toronto is not readily available. Instead it has to be scrapped form a Wikipedia page at https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M , cleaned and put in to a dataframe.

	Postal Code	Borough	Neighbourhood
0	M1B	Scarborough	Rouge,Malvern
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union
2	M1E	Scarborough	Guildwood,Morningside,West Hill
3	M1G	Scarborough	Woburn
4	M1H	Scarborough	Cedarbrae

The above two dataset are then merged to enable further analysis by type of event space in each neighborhood and borough in Toronto city.

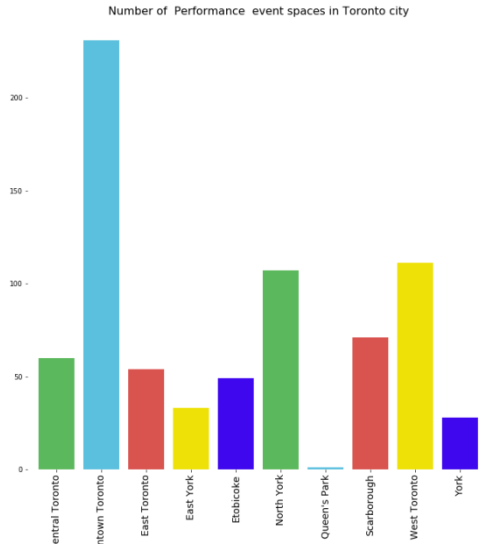
	FACILITY NAME	Full Address	Postal Code	Performance	Exhibition / Visual Arts	Screen Based	Library	Multipurpose	Borough	Neighbourhood	Latitude	Longitude
0	Thistletown CC	925 Albion Road, Toronto, Ontario	M9V	1.0	0.0	0.0	0.0	1.0	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.735450	-79.562527
1	Albion Pool & Health Club	1485 Albion Road, Toronto, Ontario	M9V	0.0	0.0	0.0	0.0	1.0	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.739613	-79.580608
2	Albion Branch (TPL)	1515 Albion Road, Toronto, Ontario	M9V	1.0	0.0	0.0	1.0	1.0	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.739871	-79.584810
4	Humber Arboretum Gardens	203 Humber College Boulevard, Toronto, Ontario	M9W	0.0	0.0	0.0	0.0	1.0	Etobicoke	Northwest	43.744627	-79.583575
5	Thistletown Baptist Church	2534 Kipling Avenue, Toronto, Ontario	M9V	0.0	0.0	0.0	0.0	1.0	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.747668	-79.586106

Now, it is possible to see the number of different event space types in each neighborhood and borough.

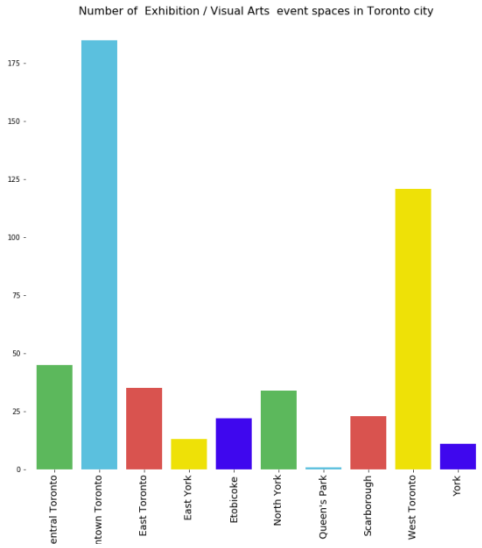
Postal Code	Performance	Exhibition / Visual Arts	Screen Based	Library	Multipurpose
\nM4	1	1	1	1	1
M1B	9	9	9	9	9
M1C	11	11	11	11	11
M1E	11	11	11	11	11
M1G	5	5	5	5	5

Borough	Performance	Exhibition / Visual Arts	Screen Based	Library	Multipurpose
Central Toronto	60.0	45.0	8.0	8.0	45.0
Downtown Toronto	231.0	185.0	55.0	10.0	154.0
East Toronto	54.0	35.0	11.0	8.0	47.0
East York	33.0	13.0	1.0	5.0	31.0
Etobicoke	49.0	22.0	6.0	13.0	60.0
North York	107.0	34.0	6.0	18.0	97.0
Queen's Park	1.0	1.0	0.0	0.0	1.0
Scarborough	71.0	23.0	4.0	21.0	102.0
West Toronto	111.0	121.0	21.0	10.0	79.0
York	28.0	11.0	0.0	6.0	41.0

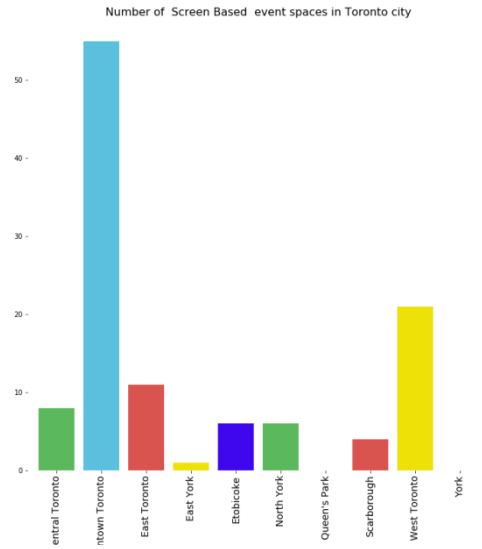
It is also possible to do a comparative analysis of the distribution of event space types in each borough (Fig. 2 a-e). Downtown Toronto has by far many event space facilities than the rest of boroughs in Toronto city. On the other hand, Scarborough has facilities for organizing library related events.


Number of Performance event spaces in Toronto city
200
150
100
50
0
East Toronto
East York
Etobicoke
North York
Queen's Park
Scarborough
West Toronto
York

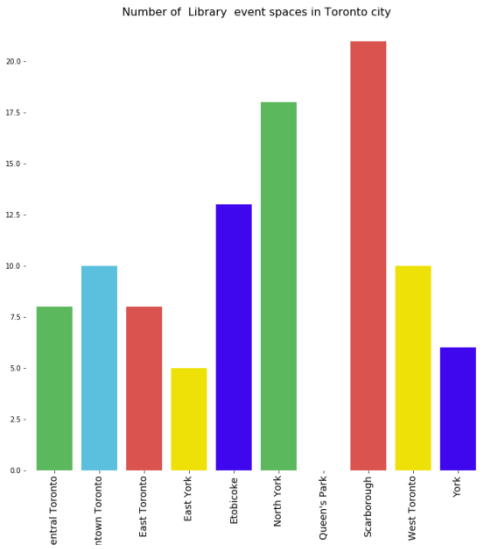
(a)


Number of Exhibition / Visual Arts event spaces in Toronto city
175
150
125
100
75
50
25
0
East Toronto
East York
Etobicoke
North York
Queen's Park
Scarborough
West Toronto
York

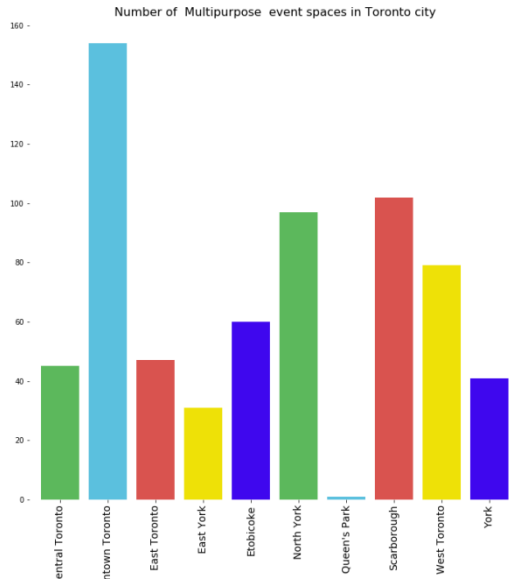
(b)


Number of Screen Based event spaces in Toronto city
50
40
30
20
10
0
East Toronto
East York
Etobicoke
North York
Queen's Park
Scarborough
West Toronto
York

(b)


Number of Library event spaces in Toronto city
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
East Toronto
East York
Etobicoke
North York
Queen's Park
Scarborough
West Toronto
York

(d)



(e)

Fig. 2 statistical distribution of event space types in each borough for (a) performance. (b) Exhibition/visual arts, (c) screen based (d) library and (e) multipurpose.

Module 2: spatial clustering for finding great event spaces

Since the available data relate to neighborhood and borough in Toronto city, it is better to do the clustering analysis in that level. For the sake of illustration, let's focus on "Multipurpose" facilities in Etobicoke borough which resulted in 60 available facilities. Next, let's get the location of each event space using Nominatim(). Then the resulting dataset is merged to the selected facilities dataset and cleaned to keep the relevant terms.

	FACILITY NAME	Full Address	Postal Code	Borough	Neighbourhood	Latitude	Longitude	Performance	Exhibition / Visual Arts	Screen Based	Library	Multipurpos
0	Thistletown CC	925 Albion Road, Toronto, Ontario	M9V	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.735450	-79.562527	1.0	0.0	0.0	0.0	1.
1	Albion Pool & Health Club	1485 Albion Road, Toronto, Ontario	M9V	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.739613	-79.580608	0.0	0.0	0.0	0.0	1.
2	Albion Branch (TPL)	1515 Albion Road, Toronto, Ontario	M9V	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.739871	-79.584810	1.0	0.0	0.0	1.0	1.
4	Humber Arboretum Gardens	203 Humber College Boulevard, Toronto,	M9W	Etobicoke	Northwest	43.744627	-79.583575	0.0	0.0	0.0	0.0	1.

Folium is used to create a map of Toronto with the facilities' location superimposed on top (Fig. 3)

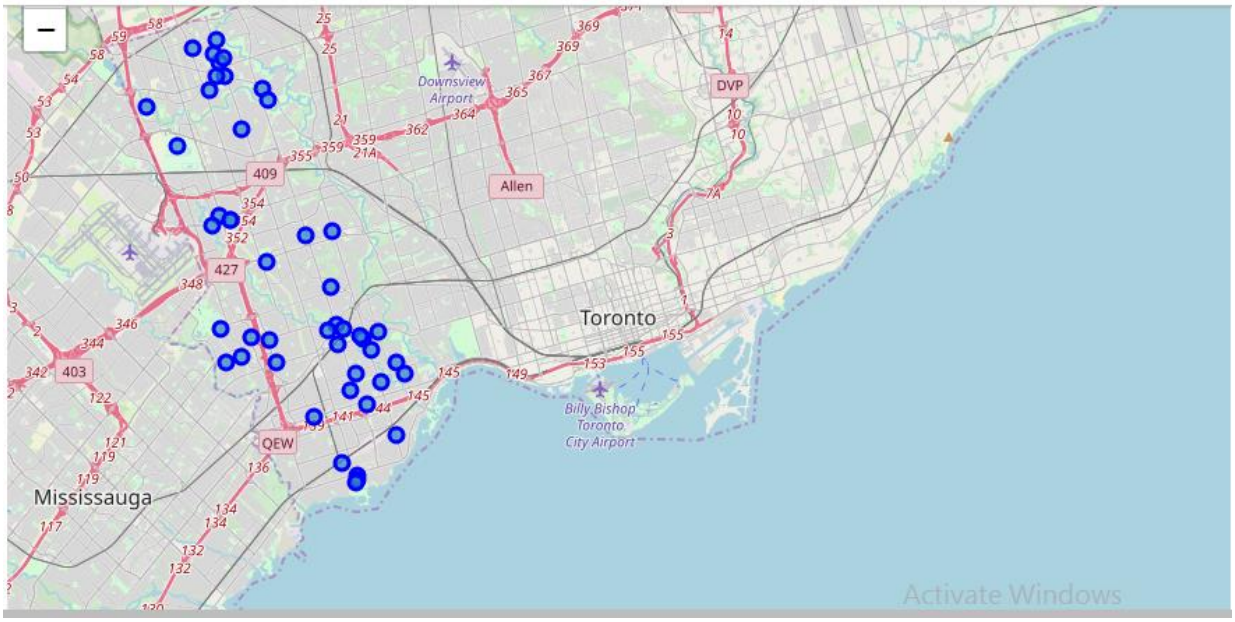


Fig. 3 map of Toronto with the facilities' location superimposed on top

We will next examine the Target event space location geolocation data and perform clustering for optimizing event attendance and selecting appropriate place for the target audience. This enables matching the type of facility components in the chosen venue with the event. Moreover, it helps in identifying suitable lodging accommodations within a reasonable distance of the event and nearby organic event networking opportunities that might increase the success of the event.

The analysis resulted in 120 unique categories of the total 510 location venues. Then we proceed to find the top ten venues that are nearby the chosen event space facilities. After investigation of venues nearby event spaces in Toronto London, we could begin clustering the. Before clustering however let's find the optimum number of cluster using the Elbow Curve method

The Elbow method is a means that explain and validate the consistency within cluster analysis design. The method also indicates the optimum number of clusters in a dataset. It does this by evaluating the percentage of variance given as a function of the number of clusters. The programmer then select the number of clusters in such a way that adding another cluster doesn't improve the cluster modeling of the data. Fig. 4 depicts the result of the explained procedure. The optimum number of cluster chosen is three and Fig. 5 visually depicts the resulting clusters.

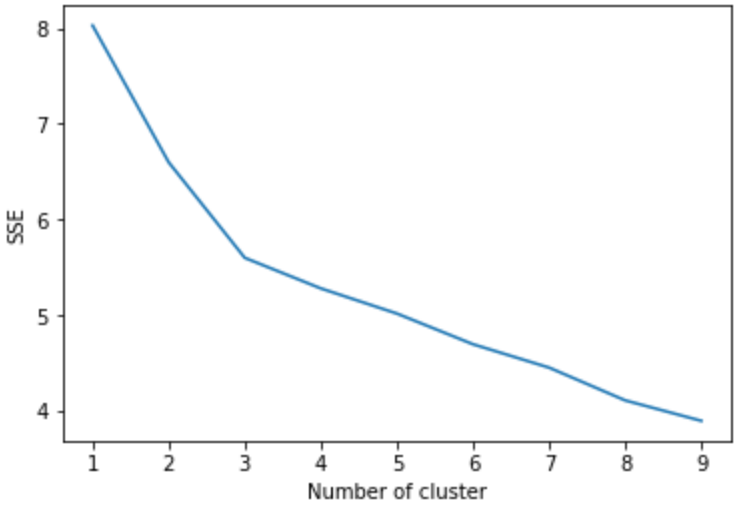


Fig. 4 Elbow method for finding optimum number of clusters

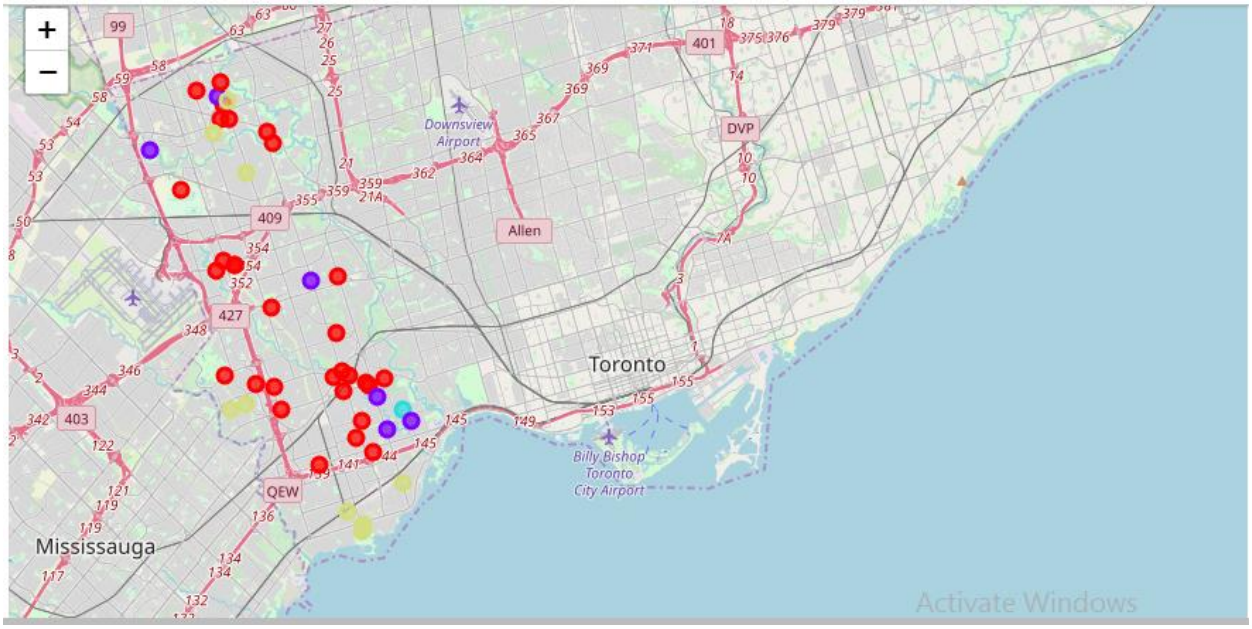


Fig. 5 Clustering of venues nearby event space facilities

4. Results

Module 3: recommendations module

The resulting clusters are very insightful in arriving at the appropriate event spaces that suits the participants. Let's consider them in detail:

Cluster 1: These event spaces are suitable for:

- Celebrations
- Receptions,
- Small-scale live performance
- Cocktail and dinner parties

Key characteristics:

- Extra convenience and increased access to resource to participants
- Availability of rooms for rent and nearby restaurants
- Modern architectures add coziness and intimate feeling to event attendees.
- There might be parking constraint as it is the most eventful venue

Cluster 2: These event spaces are suitable for:

- Luncheons
- Conferences
- Workshops
- Networking
- Team building
- Live music

Key characteristics:

- Usher a mix of socializing and business atmosphere
- Diversity of popular venues that can be provide customizable event space
- Popular venues have several social hubs that could facilitate organic networking

Cluster 3: These event spaces are suitable for:

- Company retreats
- Fund raisers
- Corporate meetings
- Galas
- Themed parties
- Private performance

Key characteristics:

- Less eventful venues that are dominated by parks, home services and auto workshops
- Venues best reached by car since there is low density of public transport
- There is however ample parking space

5. Discussion and conclusion

An effort has been made to facilitate decision regarding even space in Toronto city. The procedure was to get information regarding all available facilities such as type of facility and full address. This was combined with another dataset that contained neighborhood and borough information. The latter dataset helps in the decision process to enable selection of facilities in each region. This decision information together with the type of event space is used to find popular venues near the selected regions that consist of the desired venue spaces.

Finally, it was possible to analyze the results according to three optimum clusters. The Clusters gave out popular venues that could help achieve great event space. One could see, that a pattern emerges in direct relation to the busy-ness of the venue and the type of services available.

In conclusion, this project successfully finds and cluster great venues nearby available event facilities in a city that fulfill the types of events and their requirements. In addition, emerging patterns in cluster could be used as prime indicators to select great venue spaces that facilitated decision for event coordinators.