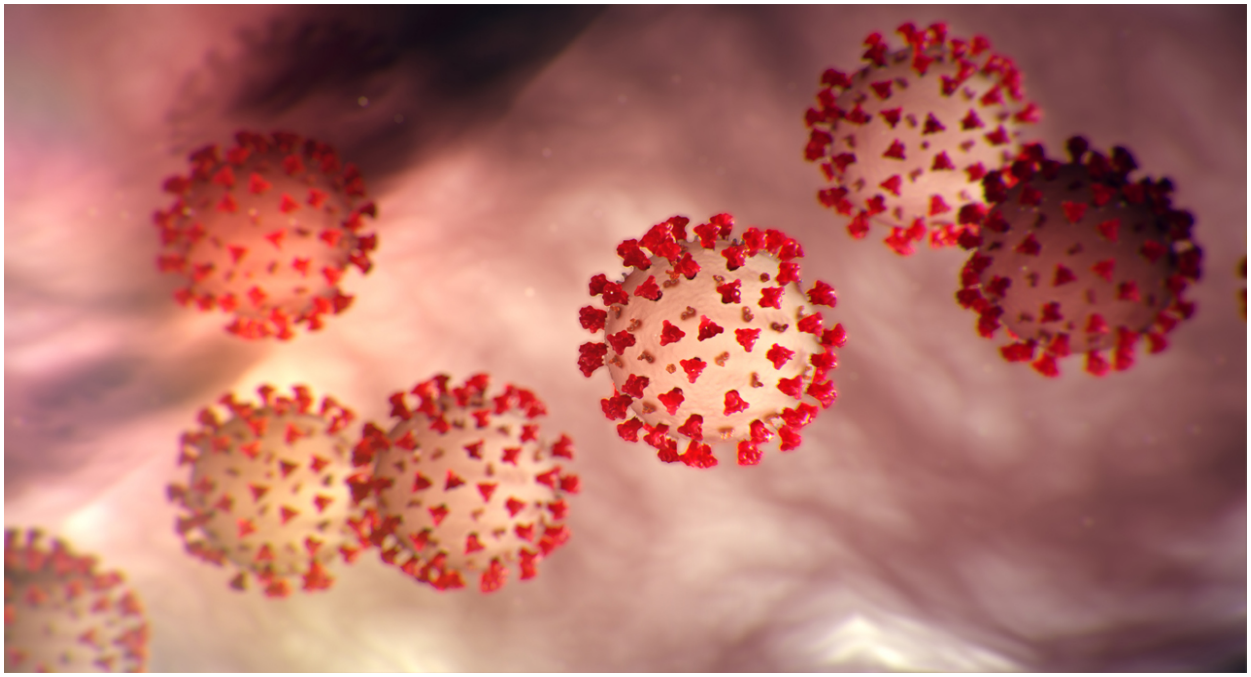
CAPSTONE PROJECT

Toronto COVID Preparedness & Mobility



Introduction

It is well known that COVID -19 is a highly transmittable Disease and now declared as pandemic by WHO (World Health Organisation). Many countries have adopted the strategy of locking down their respective countries and limiting the human to human contact and hence thereby restricting the growth of virus cases among the citizens of their countries.

Japan and South Korea have already shown positive results by following this strategy and hence has been highly advocated by the WHO chief.

Objective

The objective for the Capstone Project is understanding the City of Toronto's preparedness and Mobility strategies in this scenario if the Canada Government also chooses lockdown strategy for handling COVID-19 situation.

Lockdown strategy involves closing off all the shops and businesses except for the Essential services and asking people to not to come out of their houses, so that there will not be spread of virus through human interactions.

In this case, project involves

a) assessing whether all the areas in the City of Toronto are covered by the essential services.
b) What mobility strategies need to be implemented to ensure that all the citizens of the city are not cutdown from essential services and also ensuring that there is minimum level of activity so that chances of Virus spread are minimised.

Target Audience

The Canada Government at Central level and the local Government of the City of Toronto will be the Target Audience, as the project analysis will help them to assess the existing infrastructure and creating accurate mobilisation strategy to control the Virus spread during Lockdown Period.

Data

For this Project Analysis, we need the following data:

- List of Neighbourhoods in the city of Toronto
- Latitude and Longitudinal coordinates of those neighbourhoods
- Establishments data, Name, location of Essential service providing establishments like Hospitals, Pharmacy and Grocery Shops.

Sources of Data

The Wikipedia page (https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M') contains the list of the Neighbourhoods in Canada along with their Postal codes and Borough they belong to, the following is the example of the data available

Postal code	Borough	Neighborhood
M1A	Not assigned	NaN
M2A	Not assigned	NaN
M3A	North York	Parkwoods
M4A	North York	Victoria Village
M5A	Downtown Toronto	Regent Park / Harbourfront

Then the Geographical data that is the location Latitudes and Longitudes Coordinates need to sourced, for that a CSV file is uploaded and the link is https://cocl.us/Geospatial_data'. Here the Latitudes and Longitudes are provided with respect to each Postal code as follows

Postal Code	Latitude	Longitude
M1B	43.806686	-79.194353
M1C	43.784535	-79.160497
M1E	43.763573	-79.188711
M1G	43.770992	-79.216917
M1H	43.773136	-79.239476

After that, Foursquare API is used to get the Establishment details for those neighbourhoods. Foursquare has one of the largest databases of 105+ million places and is used by many developers across the world.

Foursquare API will provide details of lot of establishments, among these Essential Services establishments/venues will be segregated and utilised for the Project analysis.

Assumptions

Foursquare has the accurate and complete information of all the establishments in the city of Toronto.

Further, essential services are defined differently by each country, for the purpose of the Project, it is assumed that Hospitals, Pharmacy and Grocery Shops are only defined to be essential Services for the city of Toronto.

Methodology

First, the data of Boroughs, Neighbourhoods and the respective Postal Codes are extracted from the website (https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M') and the data is cleaned and wrangled to make it useful for the project.

2. The Geographical data that is the location Latitudes and Longitudes Coordinates are sourced from the CSV file from the link https://cocl.us/Geospatial_data' and is also cleaned and streamlined to make it useful for the project.

3. After getting the data, Plotting this data to get a view of the Neighbourhoods in the City of Toronto.

4. Now, Foursquare API call of exploration is made to get the top 100 Venues and Neighbourhoods within the radius of 600mts of Toronto.

5. Since there will be Multiples Venues in the same neighbourhood, The data retrieved from the call is grouped on the basis of Neighbourhood and a Database is created using Pandas functions.

6. Now from the Grouped Data, all the Neighbourhoods can be analysed with respect to the different establishments (Venues) that are available in those Neighbourhoods.

7. After the analysis, this data is condensed further using the Mean function to establish how many of each category type venue exists based on Neighbourhood.

8. Then we shall select the Essential Service Establishments (Hospital, Pharmacy and Farmer Stores). Farmer stores are selected as Essential service

establishment instead of Grocery store since there will not be any middlemen for the sales that happen through Farmer stores. The more persons involved in an activity the higher the chances of Virus spread, Hence keeping in line with the goal of the Project, Farmer stores are selected. Now a new database of Neighbourhood, mean of Hospitals, Farmer Markets and pharmacies that exist in each Neighbourhood is created.

9. Finally we perform the clustering on the data by using K-means clustering algorithm. We will cluster the neighbourhoods into 3 clusters based on the availability of these essential services establishments. These clusters will give us information about how these service establishments are panned out in these neighbourhoods in the City of Toronto.

Results

The following data is extracted as follows for our examination

Cluster 1

	Borough	ClusterLabels	Hospital	Pharmacy	Farmers Market
0	Downtown Toronto	0	0.00	0.000000	0.017544
3	Downtown Toronto	0	0.00	0.000000	0.020000
5	Downtown Toronto	0	0.00	0.000000	0.022472
15	East Toronto	0	0.00	0.000000	0.031250
26	Central Toronto	0	0.00	0.020833	0.020833
30	Downtown Toronto	0	0.01	0.000000	0.020000
34	Downtown Toronto	0	0.00	0.000000	0.020000
38	East Toronto	0	0.00	0.000000	0.040000

Cluster 2

	Borough	ClusterLabels	Hospital	Pharmacy	Farmers Market
1	Downtown Toronto	1	0.0	0.016949	0.0
2	Downtown Toronto	1	0.0	0.000000	0.0
4	East Toronto	1	0.0	0.000000	0.0
6	Downtown Toronto	1	0.0	0.010000	0.0
7	Downtown Toronto	1	0.0	0.000000	0.0
8	Downtown Toronto	1	0.0	0.000000	0.0
10	Downtown Toronto	1	0.0	0.000000	0.0
11	West Toronto	1	0.0	0.000000	0.0
12	East Toronto	1	0.0	0.000000	0.0
13	Downtown Toronto	1	0.0	0.000000	0.0
14	West Toronto	1	0.0	0.024390	0.0
16	Downtown Toronto	1	0.0	0.000000	0.0
17	East Toronto	1	0.0	0.000000	0.0
18	Central Toronto	1	0.0	0.000000	0.0
19	Central Toronto	1	0.0	0.000000	0.0
21	Central Toronto	1	0.0	0.000000	0.0
22	West Toronto	1	0.0	0.000000	0.0
23	Central Toronto	1	0.0	0.000000	0.0
24	Central Toronto	1	0.0	0.028571	0.0
25	West Toronto	1	0.0	0.000000	0.0
27	Downtown Toronto	1	0.0	0.013699	0.0
28	West Toronto	1	0.0	0.000000	0.0
29	Central Toronto	1	0.0	0.000000	0.0
31	Central Toronto	1	0.0	0.019231	0.0
32	Downtown Toronto	1	0.0	0.000000	0.0

Cluster 3

	Borough	ClusterLabels	Hospital	Pharmacy	Farmers Market
9	West Toronto	2	0.0	0.095238	0.0
20	Central Toronto	2	0.0	0.071429	0.0

Plotting these clusters on the map of city of Toronto looks as follows

Discussion

As we analyse the clusters, it is clear that Cluster 1 has many Farmers Market, so that in case of lockdowns, Local government can ensure that all the essential basic food items can be supplied through these markets and also in these clusters wherever there is shortage of Pharmacy, essential medicines should can also be made available for sale from the same. So local government can plan their strategy around these Farmers Markets in this Cluster Neighbourhoods. In Cluster 2 and 3, there is shortage of Farmers markets, so these pharmacies should be utilised for sale of essential food items. There is huge shortage of Hospitals, except for in cluster 1 in both Clusters 2 & 3, so here also to overcome this problem the Local Governments should ensure that Pharmacies be equipped with necessary First aid kits and staff. Further basing on the visual map it is clear that as you move away from

the coast the clusters expand thereby showcasing the need to establish sufficient number of camps to overcome the COVID Difficulties.

Conclusion

In this project, we have scrapped the data about the Neighbourhoods and the location Coordinates from different sources and used Foursquare API to link this database to the various Essential Service establishments by extracting them from the total establishments. This data enables the Target Audience to assess their Lockdown preparedness and creation of mitigation strategies as stated in our objectives.

Suggestions for future Research

In this analysis, we have not included the population in each Neighbourhood, as the number of Essential service establishments may have to be increased with more number of people staying in that Neighbourhood.

Along with it if the current demand for these services is also included, then more appropriate advice can be presented.