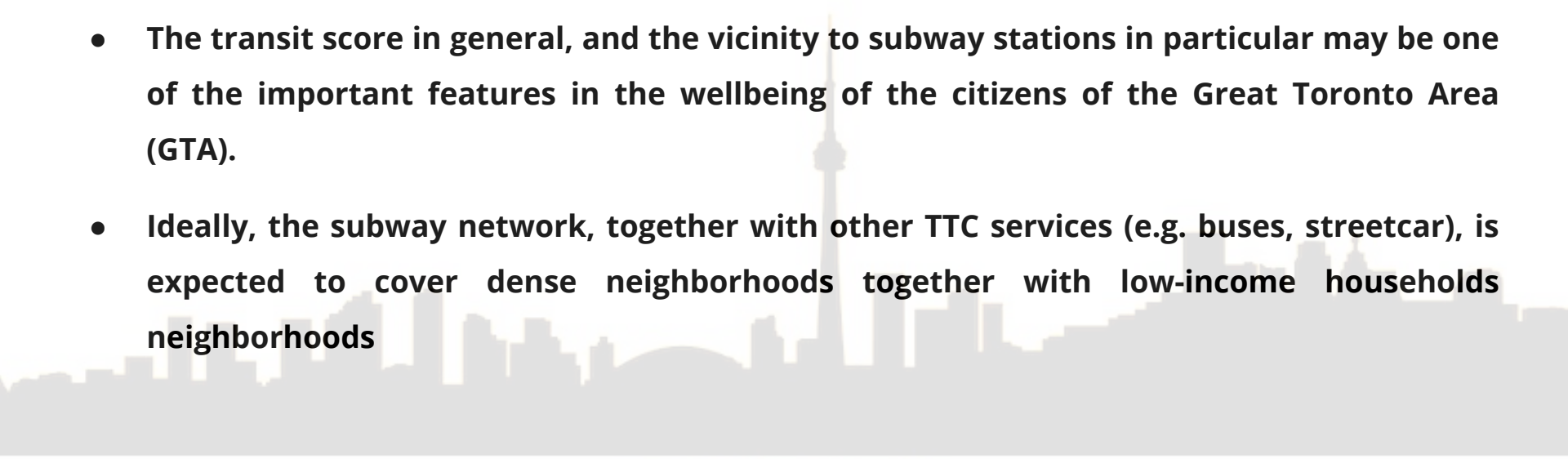


Analyzing Subway Stations in Toronto

Capstone Project - The Battle of Neighborhoods - Coursera - Applied data science - IBM

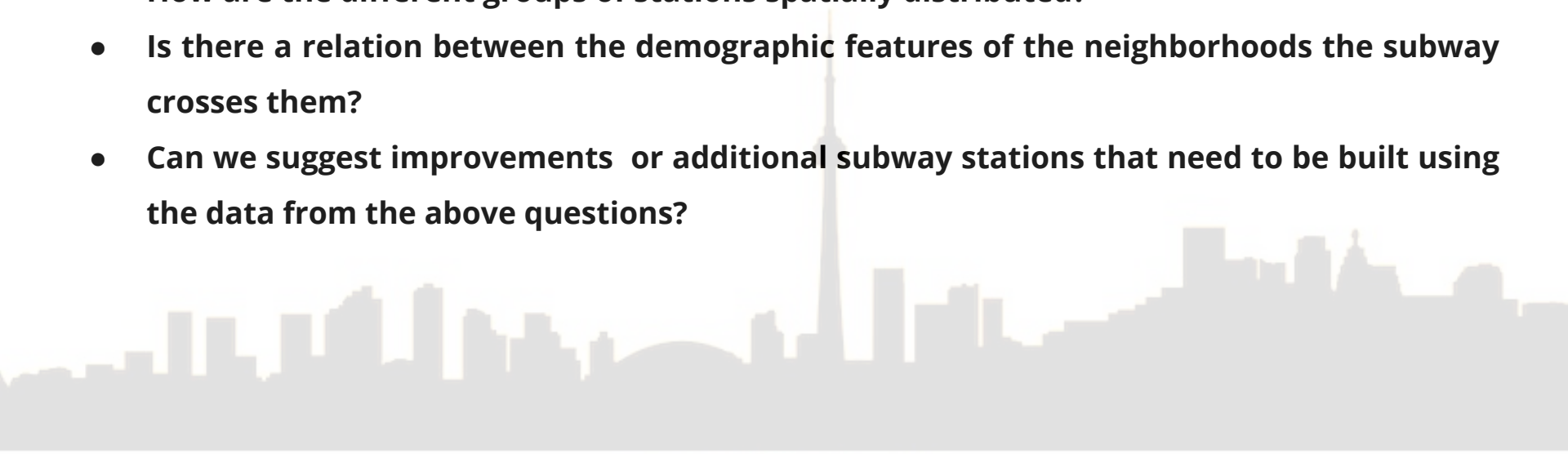


Introduction

- Toronto's main public transportation system is operated by the Toronto transit Commission (TTC).
 - The stations are characteristically different one from the others.
 - The transit score in general, and the vicinity to subway stations in particular may be one of the important features in the wellbeing of the citizens of the Great Toronto Area (GTA).
 - Ideally, the subway network, together with other TTC services (e.g. buses, streetcar), is expected to cover dense neighborhoods together with low-income households neighborhoods
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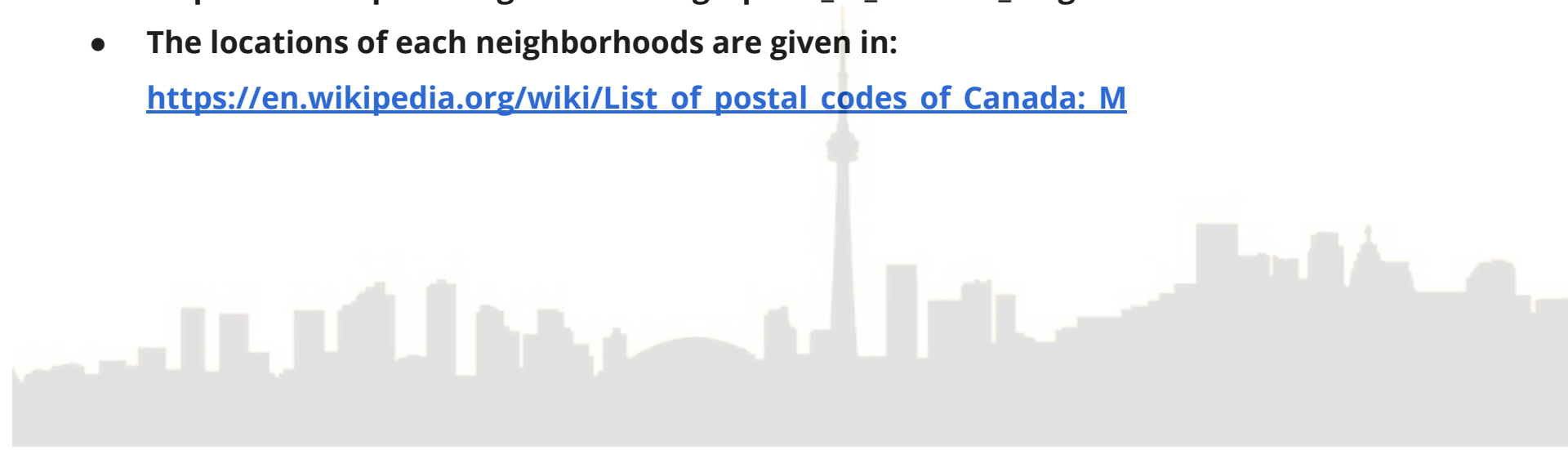
Questions

- What are the main features of the subway stations? (e.g. the group might be end-stations, transfer to other lines stations, stations near unique features such as airport, university, malls)
- How are the different groups of stations spatially distributed?
- Is there a relation between the demographic features of the neighborhoods the subway crosses them?
- Can we suggest improvements or additional subway stations that need to be built using the data from the above questions?



Data

- Location of the subway stations are requested from FourSquares.
- Nearby venues for each subway station are given from FourSquares.
- The demographic features of each neighborhood is from:
https://en.wikipedia.org/wiki/Demographics_of_Toronto_neighbourhoods
- The locations of each neighborhoods are given in:
https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M



Data Example (I): List of subway stations

	name	location.address	location.crossStreet	location.lat	location.lng	location.postalCode
0	Osgoode Subway Station	250 University Ave.	at Queen St. W.	43.650877	-79.386824	M5H 3E5
1	Queen Subway Station	171 Yonge St	at Queen St	43.652373	-79.379191	M5C 2L7
2	Dundas Subway Station	300 Yonge St	under Dundas St	43.656096	-79.380785	M5G 2B3
3	St Patrick Subway Station	449 University Ave.	at Dundas St. W.	43.654818	-79.388331	M5G 1W8
4	St Andrew Subway Station	147 University Ave	at King St W	43.647773	-79.384939	M5H 1J9



Data Example (II):

Subway stations with their common venues and cluster index

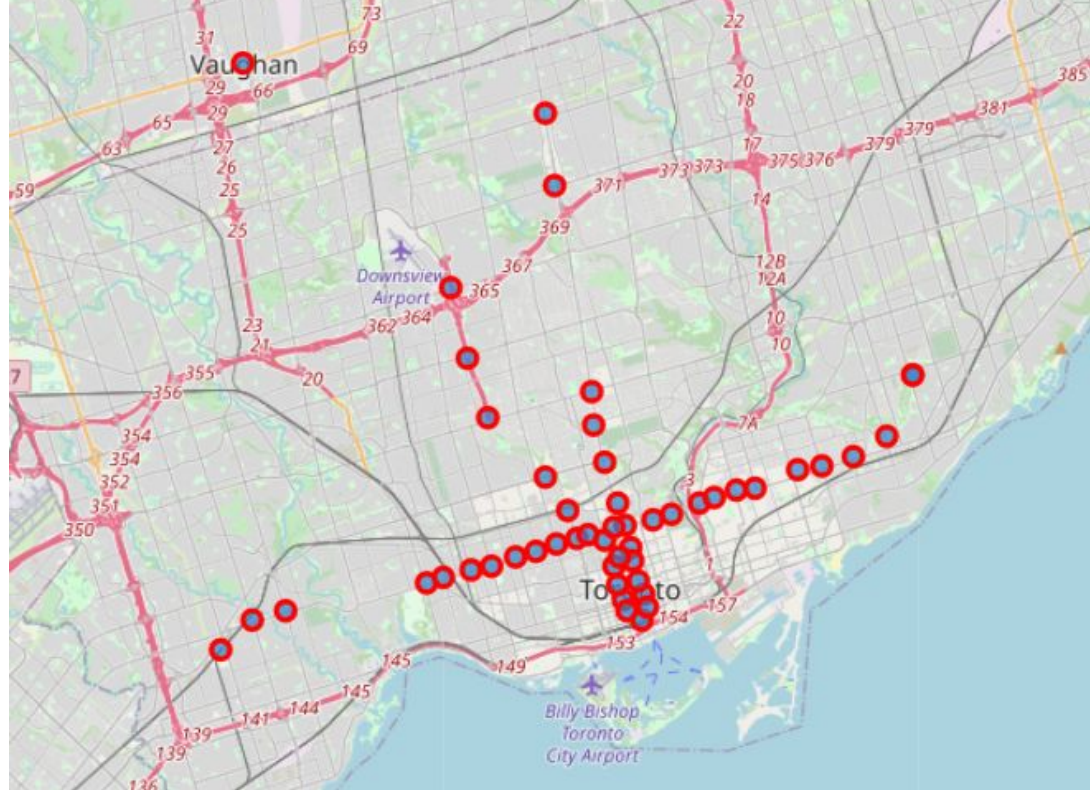
	Cluster Labels	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	0	Bathurst Subway Station	Korean Restaurant	Grocery Store	Bakery	Ice Cream Shop	Mexican Restaurant	Coffee Shop	Eastern European Restaurant	Japanese Restaurant	Bubble Tea Shop	Burrito Place
1	2	Bay Subway Station	Boutique	Italian Restaurant	Coffee Shop	French Restaurant	Hotel	Restaurant	Japanese Restaurant	Spa	Café	Sushi Restaurant
2	2	Bloor-Yonge Subway Station	Coffee Shop	Italian Restaurant	Café	Spa	Sushi Restaurant	Hotel	Japanese Restaurant	Yoga Studio	Boutique	Restaurant
3	2	Broadview Subway Station	Pub	Coffee Shop	Burger Joint	Restaurant	Pizza Place	Convenience Store	Sandwich Place	Café	Rental Car Location	Ramen Restaurant
4	4	Castle Frank Subway Station	Convenience Store	Park	Nightclub	Outdoors & Recreation	Metro Station	Deli / Bodega	Dance Studio	Fish & Chips Shop	Filipino Restaurant	Fast Food Restaurant

Data Example (III): List of neighborhoods with some of their demographic features

	Name	Population	Density (people/km2)	Average Income	Transit Commuting %	Latitude	Longitude
1	Agincourt	44577.0	3580.0	25750.0	11.1	43.794200	-79.262029
7	Bathurst Manor	14945.0	3187.0	34169.0	13.4	43.754328	-79.442259
9	Bayview Village	12280.0	2966.0	46752.0	14.4	43.786947	-79.385975
11	Bedford Park	13749.0	6057.0	80827.0	15.2	43.733283	-79.419750
13	Birch Cliff	12266.0	3525.0	48965.0	11.4	43.692657	-79.264848

Results:

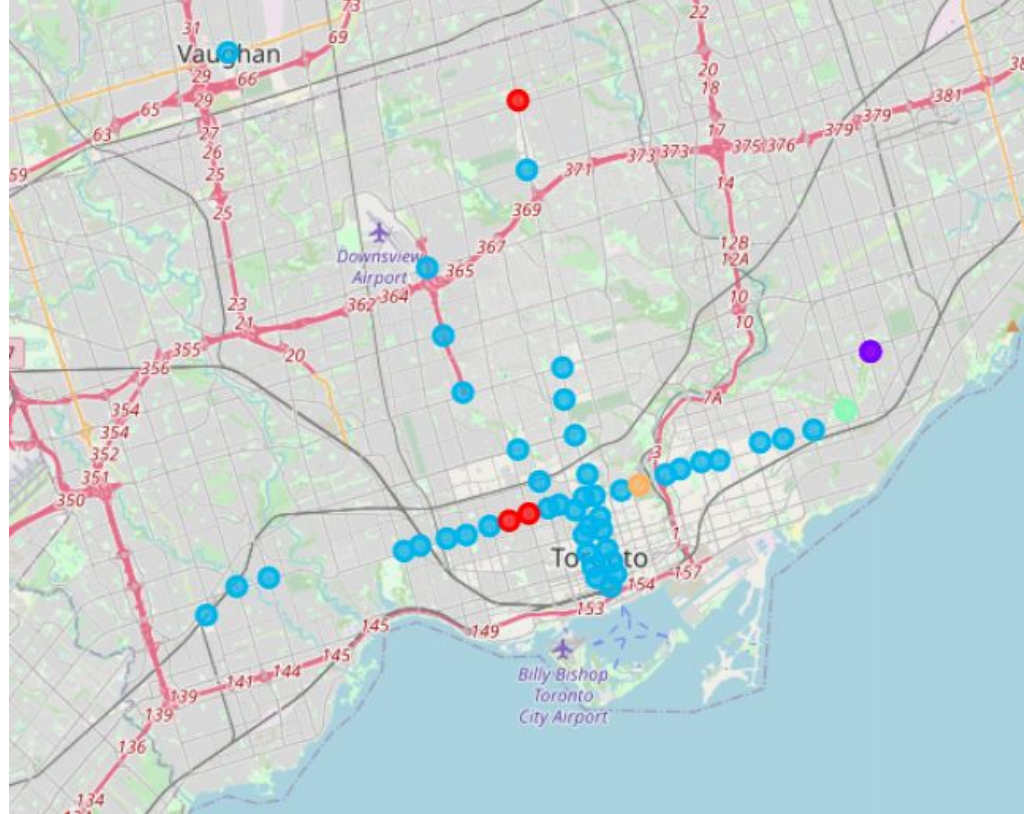
Map of the subway stations.



Results:

Map of the subway stations with their different clusters (represented with different colors)

- Blue: largest cluster. Common venues are Cafes.
- Red: Common venues are Korean restaurants.

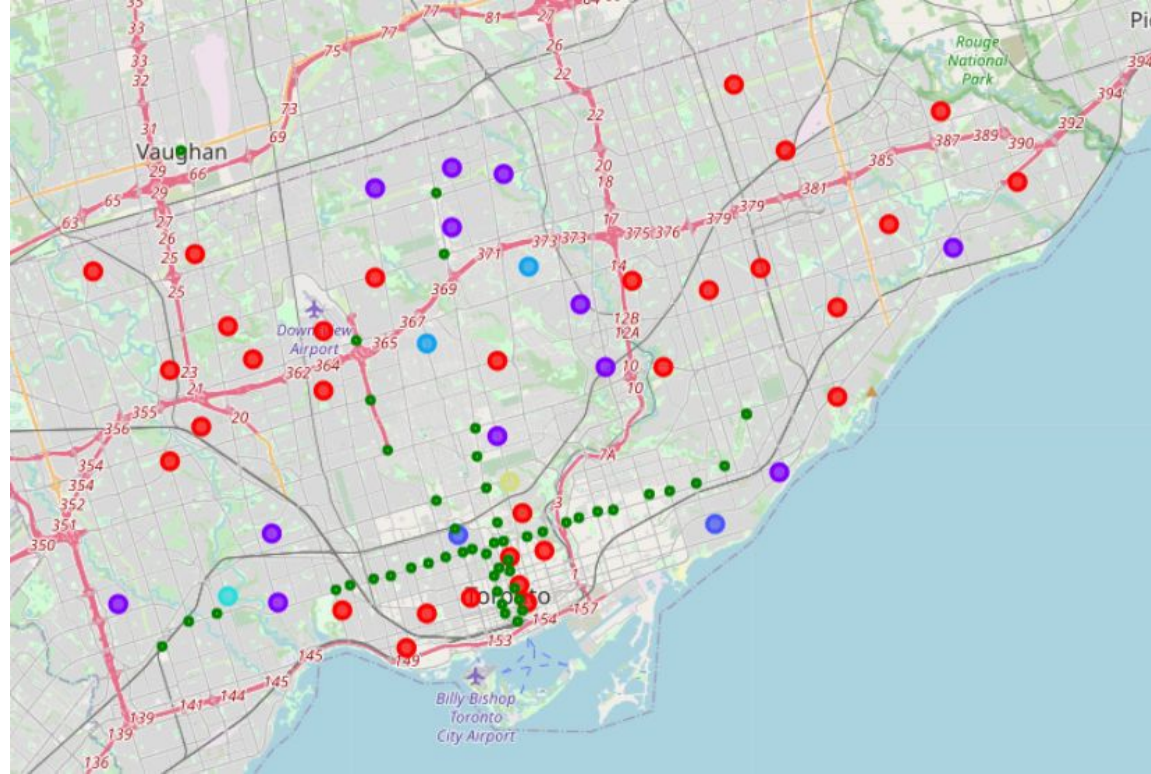


Results:

Subway Stations Locations Compared to Neighborhoods Averaged Income

Color scale:

- Blue: high decile of average income.
- Red: low decile of average income.



Results:

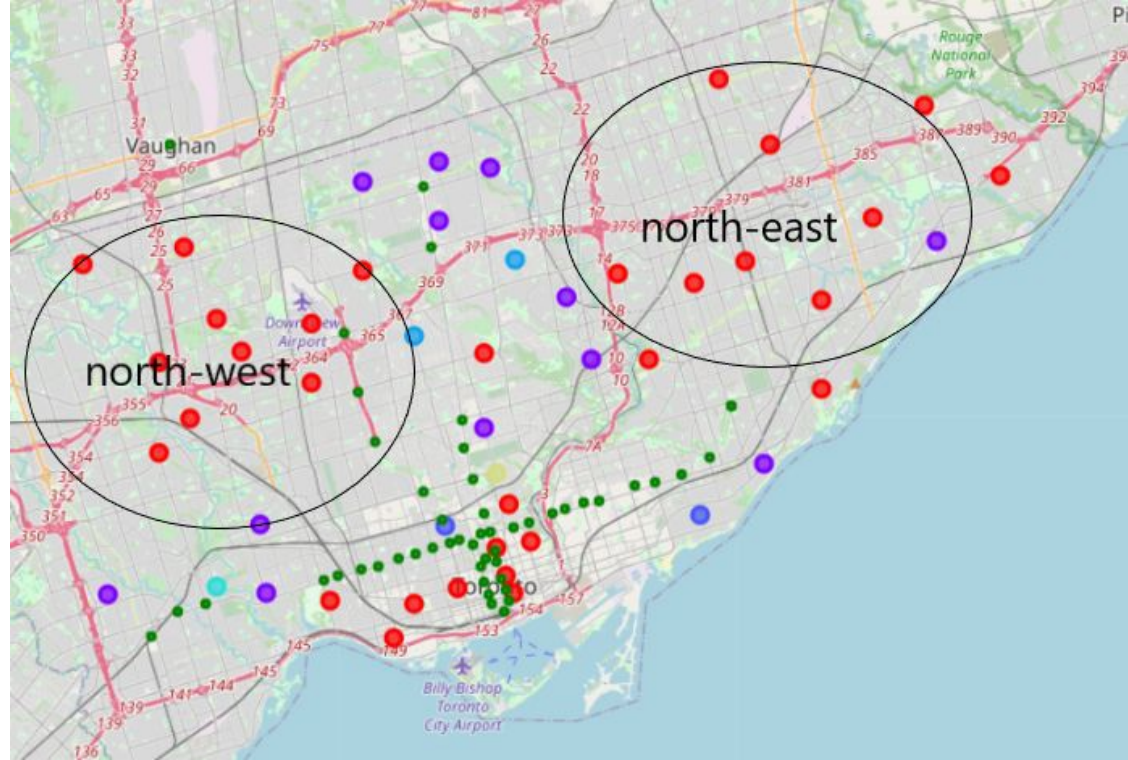
Subway Stations Locations Compared to Neighborhoods Averaged Income

Color scale:

- Blue: high decile of average income.
- Red: low decile of average income.

Conclusions:

- Two most-needed regions (north-east and north-west neighborhoods) do not have access to subway service.,
- the current subway lines cross rear mid- and high-income neighborhoods.

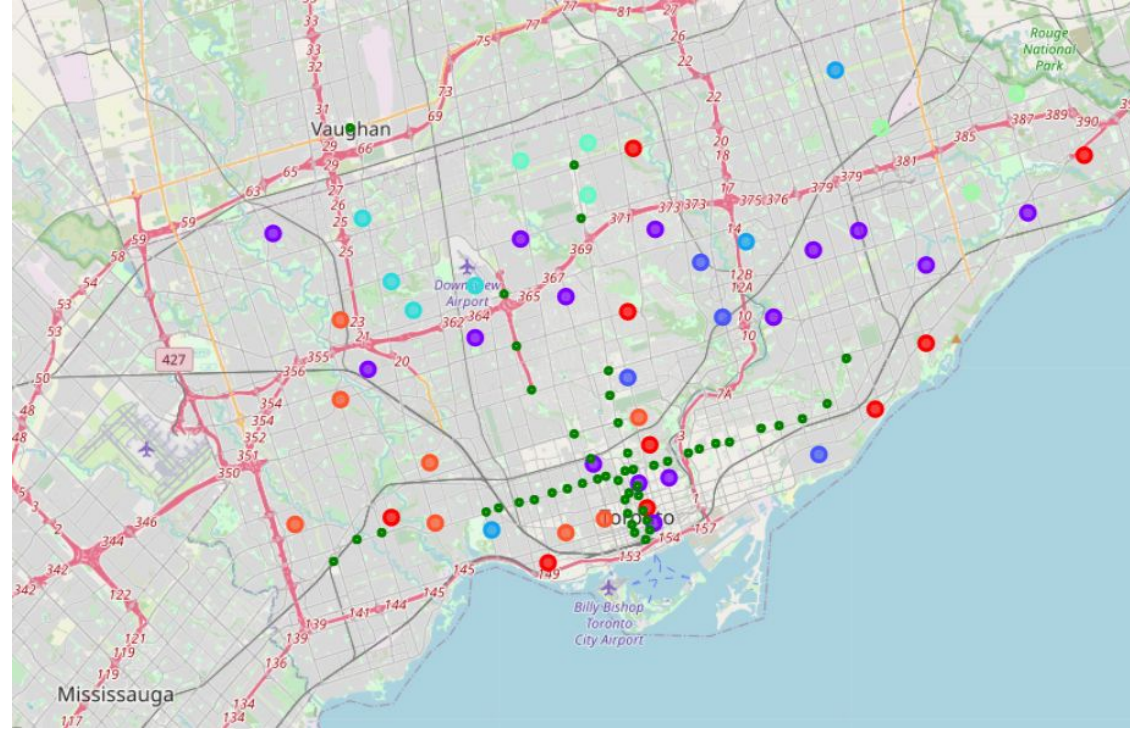


Results:

The density of population
(population/area) for a given
neighborhood.

Color scale:

- Blue: high density.
- Red: low density.

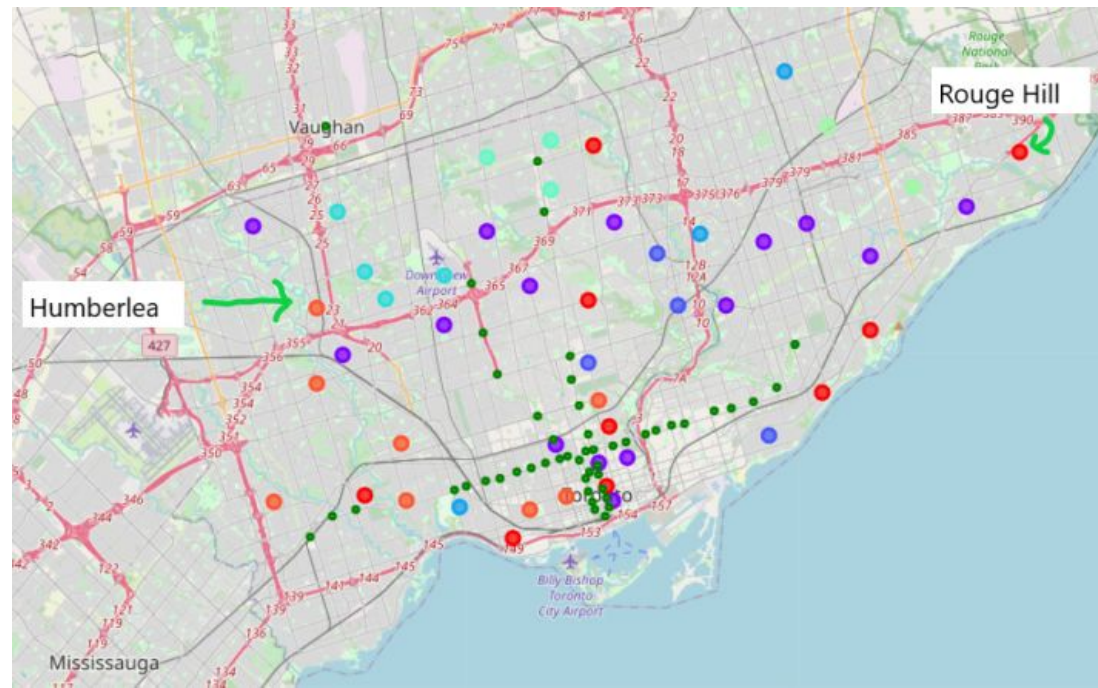


Results:

The density of population (population/area) for a given neighborhood.

Color scale:

- Blue: high density.
- Red: low density.



Conclusions:

- most dense neighborhoods have access to the subway.
- Some high density neighborhoods, including for example Humberlea or Rouge Hill, have no (reasonable) access to subway stations,

Summary and Conclusions:

- I've shown the geographical locations of the subway stations in Toronto,
- Some stations with unique features.
- Low-income regions, i.e. north-east and north-west, have no access to subway stations even though they are in much need.
- Many neighborhoods next to the subway, with higher income on average.
- Some neighborhoods with high density populations are not connected to the subway network.

Suggestions for the future:

- To connect the areas, such as north-east and north-west regions, to the subway network.
- Connecting the neighborhoods with high density to the subway network, where this connection will be highly beneficial

As a general comment I note that all the data here is given from free sources, thus the accuracy of the data is not guaranteed and must be taken with caution.