Finding the best location for a veterinary service in Toronto

February 5, 2021

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The Problem and How to Solve it

The problem:

Choosing an area that isn't saturated with clinics and with lots of pets.

The Solution:

Use data science to:

1. Find locations with no veterinary clinics or low number of veterinary services compared to number of pets.
2. Calculate the average YoY % increase rate as an additional parameter for detecting a good location.
3. Use exploratory tools (Folium maps, matplotlib and Pandas libraries) to visualize the data and analyze the results.

The Data Source

To solve the business problem, the following data is used:

- The licensed dogs and cats report by forward station area (FSA) from the Toronto Open Data Portal.
  https://open.toronto.ca/dataset/licensed-dogs-and-cats-reports

- List of Toronto neighborhoods from Wikipedia
  https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M

- FourSquare API to get the number and location of existing veterinary clinics in each neighborhood.
  https://developer.foursquare.com

Sample data:

FSA	CAT	DOG	Total
M1A	0	1	1
M1B	236	511	747
M1C	264	700	964
M1E	415	803	1,218
M1G	169	325	494

	FSA	Borough	Neighborhood
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Regent Park
5	M6A	North York	Lawrence Manor
6	M7A	Downtown Toronto	Queen's Park

Data Cleaning

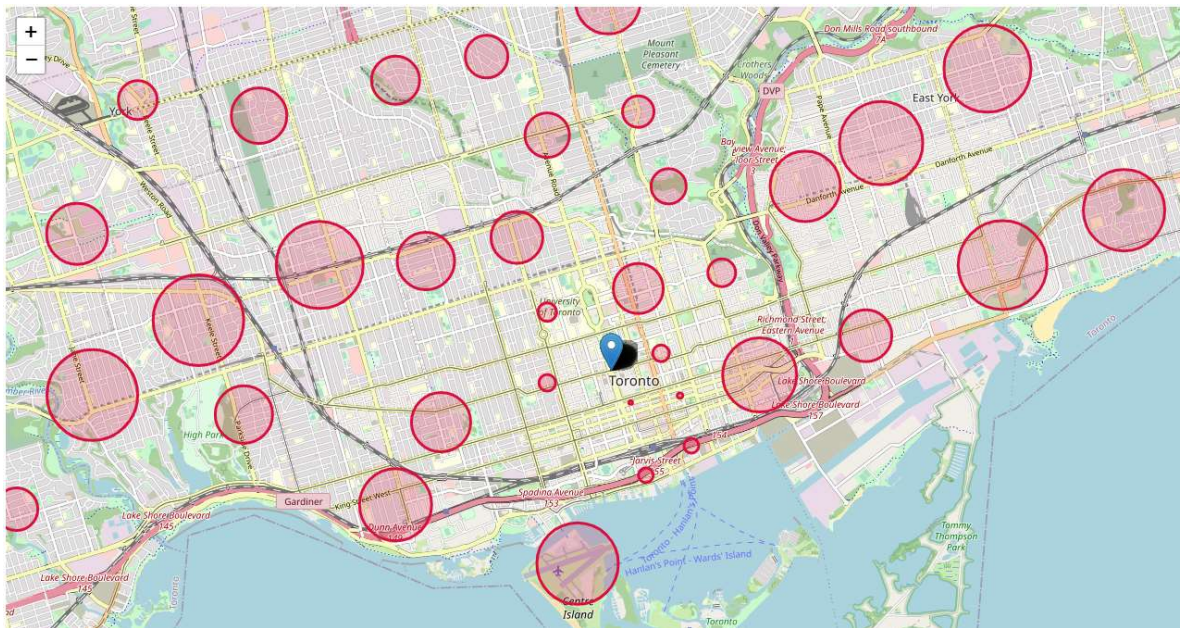Removed the outliers from cats and dogs data:

FSA	CAT	DOG	Total
M1A	0	1	1
M1B	236	511	747
M1C	264	700	964
M1E	415	803	1,218
M1G	169	325	494

Removed not assigned neighborhoods to FSA code:

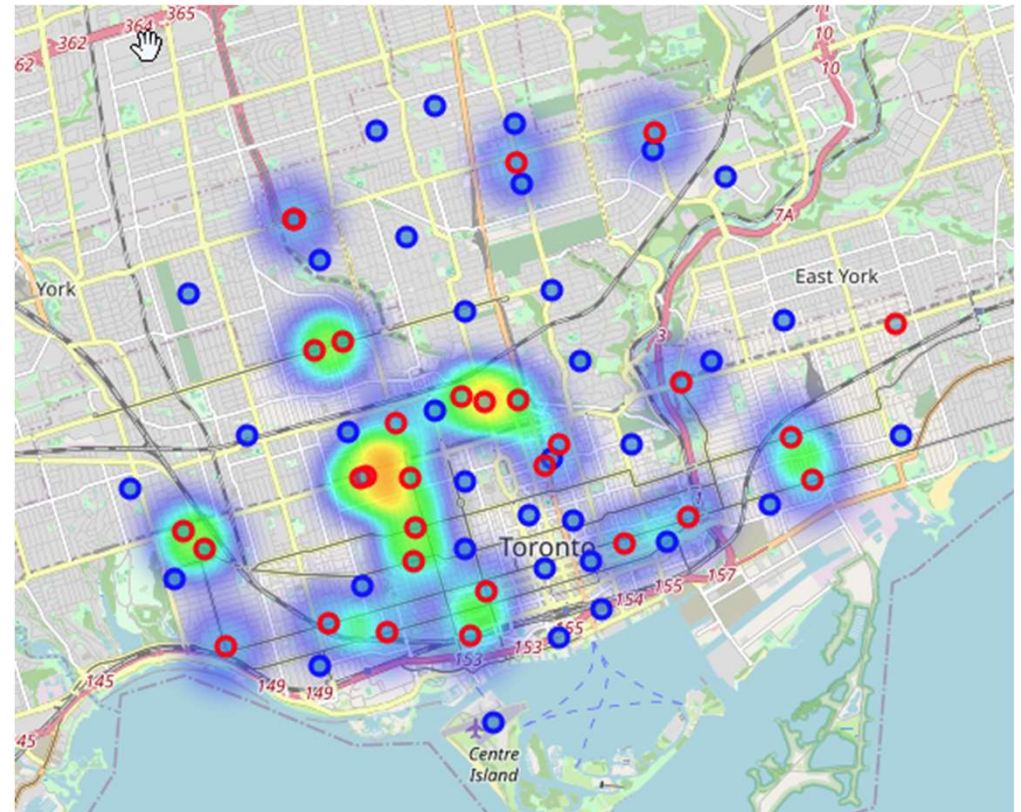|	Postal Code	Borough	Neighborhood
1	M1A\n	Not assigned\n	Not assigned\n
2	M2A\n	Not assigned\n	Not assigned\n
3	M3A\n	North York\n	Parkwoods\n
4	M4A\n	North York\n	Victoria Village\n
5	M5A\n	Downtown Toronto\n	Regent Park, Harbourfront\n

Data Visualization

Displaying the cleaned data on a map using Folium maps library

Size of each circle indicates the number of registered cats and dogs in the neighborhood.
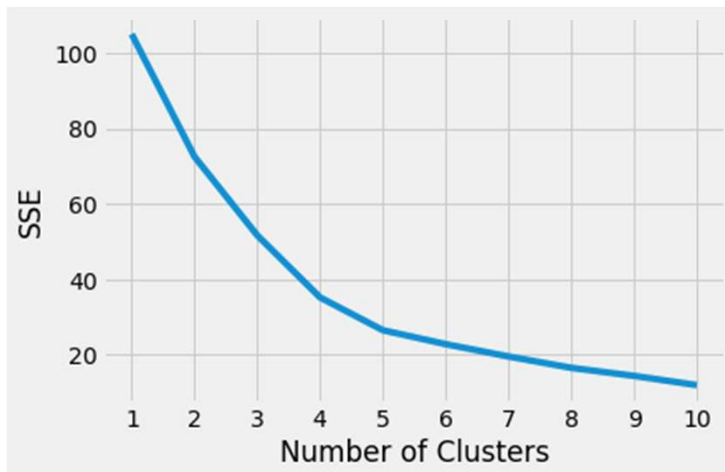
FourSquare API

- Used FourSquare API to get veterinary clinics in each Toronto neighborhood.

- Displayed neighborhood centers and veterinary venues on a map.

- Used Folium's heat map feature to visualize density of the veterinary venues.
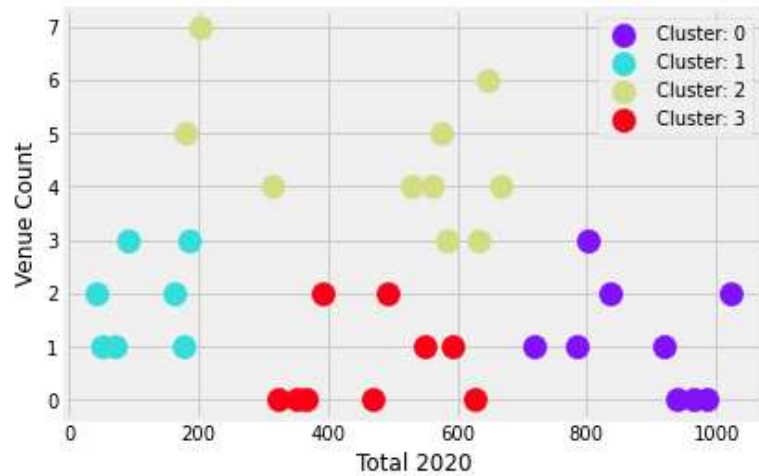
Data Clustering

- Clustering model: K-Means, since the data is unlabeled.

- Features: Number of Pets and number of veterinary venues.

- Number of clusters: 4 – determined using the "Elbow" method.

Cluster Analysis

- **Cluster 0:** The largest number of pets and low number of venues.
- **Cluster 1:** Low density of venues and small number of pets.
- **Cluster 2:** High density of venues and moderate number of licensed pets.
- **Cluster 3:** Low density of venues and moderate number of licensed pets.

Location candidates:

Cluster 0:

FSA	Borough	Neighborhood	Total_2020	Venue Count	Venue Density	avg_roc
M5V	Downtown Toronto	CN Tower	918.0	1.0	0.108932	5.613540
M4J	East York	East Toronto	939.0	0.0	0.000000	-2.918603
M6H	West Toronto	Dufferin	966.0	0.0	0.000000	-1.241449
M4L	East Toronto	India Bazaar	985.0	0.0	0.000000	-1.675971

Cluster 3:

FSA	Borough	Neighborhood	Total_2020	Venue Count	Venue Density	avg_roc
M5N	Central Toronto	Roselawn	324.0	0.0	0.000000	-1.178214
M4R	Central Toronto	North Toronto West	367.0	0.0	0.000000	-0.237512

Results

CN Tower neighborhood

- Close to the major highways Gardiner and Don Valley Parkway. 918 registered pets in 2020, only one existing veterinary venue

- YoY rate of change: 5.61%. Definitely a good location for a veterinary service.

India Bazaar

- The average YoY rate of pets registration: -1.68%.

- No other venues nearby and the number of registered pets: 985. Close to the major highways. A good veterinary venue location.

Dufferin

- The number of registered cats and dogs: 966. The average YoY rate of change in pets registration: -1.24%

- No venues nearby. This is clearly a good location to open a veterinary venue.

East Toronto

- Registered cats and dogs: 939. YoY rate of change in pets registration: -2.92

- No venues nearby. This is a good location for a veterinary venue.

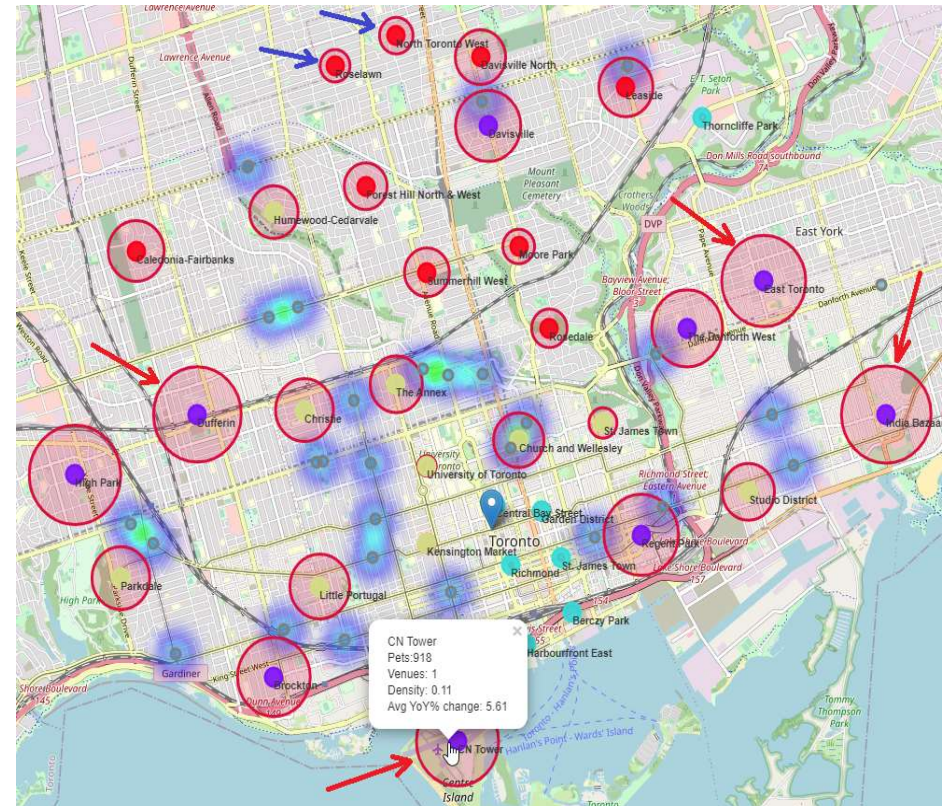**North Toronto West and Roselawn**

- Low density of veterinary venues. The number of registered pets: 367 and 324, respectively. YoY rate is close to 0.

- Disadvantage: Far from downtown Toronto compared to other locations

Conclusion

Using the licensed dogs and cats report by forward station area (FSA) from the Toronto Open Data Portal, list of Toronto neighborhoods with FSA from Wikipedia, FourSquare API, K-Means clustering algorithm and data exploration and analysis, the following neighborhoods were identified as locations that the stakeholders should be using as a starting point for the final exploration and decision:

CN Tower, India Bazaar, Dufferin and **East Toronto**.

The stakeholders should also explore the **North Toronto West** and **Roselawn** neighborhoods in the central Toronto area. These locations are relatively far from downtown Toronto compared to other good locations that we found but there are no veterinary venues nearby and the commercial rent could be significantly lower in this area.

Future Works

Improve the accuracy of the model by including the commercial rent and demographics data that can be obtained from Statistics Canada. Commercial rents indexes for retail, office and industrial buildings is important information as well as the population density, structure, and growth.