



Recommendation System for Apartment Seekers in the GTA

Troy Gloyn

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Purpose

- Reduce time and provide a more personalized location for prospective buyers/renters in the general Toronto area (GTA)
- Take users' venue preference information to suggest neighborhoods they might like to live in
- Allow more turnover of buying/selling properties



Data Acquisition and Cleaning

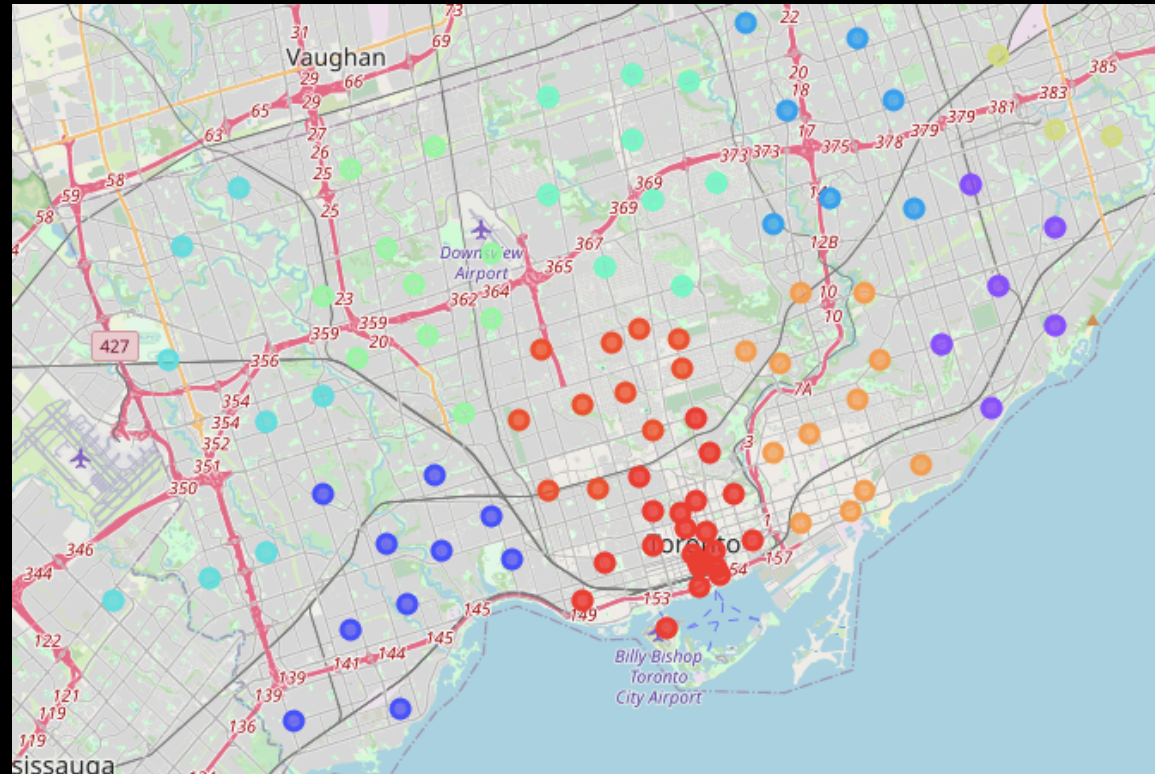
- Toronto neighborhood postal code data
 - https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M
- Geospatial data of each neighborhood (latitude & longitude)
 - http://cocl.us/Geospatial_data
- Foursquare API calls to retrieve venue information and location for each neighborhood (limit=100; radius=500m)

	Postal Code	Borough	Neighbourhood	Latitude	Longitude
0	M3A	North York	Parkwoods	43.753259	-79.329656
1	M4A	North York	Victoria Village	43.725882	-79.315572
2	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
3	M6A	North York	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
4	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government	43.662301	-79.389494

- Data frame encompassing Neighborhood postal data and geospatial data

K-Means Clustering

- Organize neighborhoods into 10 clusters for easy grouping



Foursquare Venue Location Data

- Category label used to characterize what is offered within each neighborhood

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Parkwoods	43.753259	-79.329656	Brookbanks Park	43.751976	-79.332140	Park
1	Parkwoods	43.753259	-79.329656	Variety Store	43.751974	-79.333114	Food & Drink Shop
2	Victoria Village	43.725882	-79.315572	Victoria Village Arena	43.723481	-79.315635	Hockey Arena
3	Victoria Village	43.725882	-79.315572	Portugril	43.725819	-79.312785	Portuguese Restaurant
4	Victoria Village	43.725882	-79.315572	Tim Hortons	43.725517	-79.313103	Coffee Shop

Binary Venue Profile for Each Neighborhood

Neighborhood	Yoga Studio	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Antique Shop	Aquarium	Art Gallery	Art Museum	Arts & Crafts Store	Re
Agincourt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alderwood, Long Branch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bathurst Manor, Wilson Heights, Downsview North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bayview Village	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bedford Park, Lawrence Manor East	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

- 266 unique venue categories

Randomly Generated 'User'

	Yoga Studio	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Antique Shop	Aquarium	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant
0	0.94	0.97	0.44	0.15	0.73	0.04	0.27	0.76	0.65	0.37	0.97	0.77	0.79	0.09	0.67	0.0

- User weights among each category randomly generated
 - 1 = absolutely required
 - 0 = not necessary



Binary Venue Profile & User score to generate Recommended Neighborhoods

```
Neighborhood
Harbourfront East, Union Station, Toronto Islands 0.426327
Commerce Court, Victoria Hotel 0.425089
Stn A PO Boxes 0.417660
Toronto Dominion Centre, Design Exchange 0.410463
First Canadian Place, Underground city 0.410385
dtype: float64
```

- Similarity score of 0.426 for the neighborhoods Harbourfront East, Union Station, and Toronto Islands is the top result for this User

Conclusion & Further Directions

- Recommendation system used to suggest locations for a prospective buyer/renter to look based on weighted preference data
- Can expand the algorithm to include venue ratings to attain higher quality filtering of venue information
- Ideally saves time when seeking out apartments, while getting better venue specifications for each user