

Coffee shop expansion in Downtown Toronto

CAPSTONE DATA SCIENCE PROJECT

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Introduction to business problem

- Business owner of a small coffee shop is looking to expand his business to new locations in Downtown Toronto
- Current location of the coffee shop is on Central Bay Street, a neighbourhood of Downtown Toronto
- Due to the complex and varying characteristics of different neighbourhoods in Downtown Toronto, the owner hired a team of data scientists for determining the best locations to open up new coffee shops
- List of criteria for selecting desired neighbourhoods:
 - Popular/high-demand: comparable number of venues to current location
 - Lower competition: lower number of existing coffee shops
 - Similar in characteristics as current location

Project approach and workflow

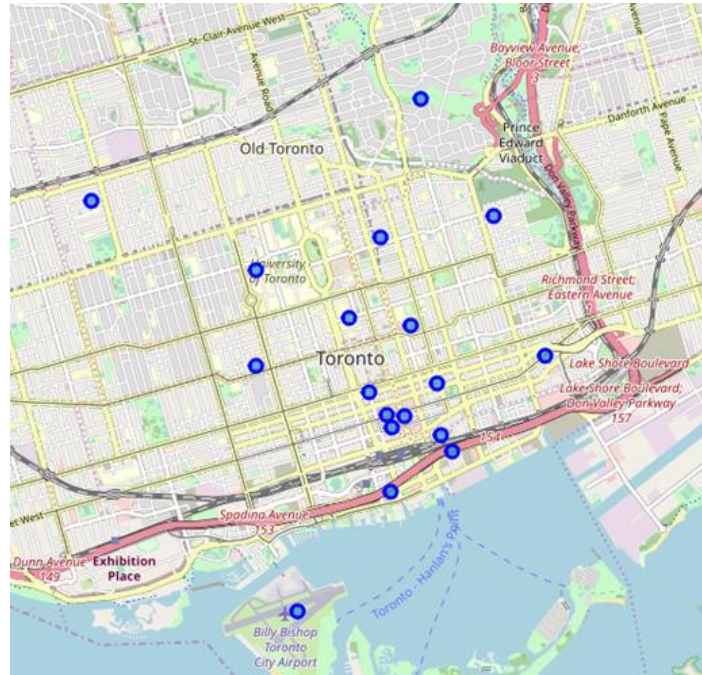
Data acquisition, cleaning, analysis and visualization

- Reliable data sources to conduct data exploration and data analysis:
 - Toronto neighborhood data from Wikipedia ('https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M')
 - Geographical coordinates matching postal codes of Toronto in csv file (provided in Week 3)
 - Foursquare location data (venues) will be used to cluster, segment, target, and position to craft recommendations for determining locations for business expansion
- Retrieve and clean up data (i.e. remove redundancies and irrelevant data)
- Merge and reorganize data (i.e. geographical coordinates and neighbourhood data)
- Analyze data using statistical testing and machine learning methods
- Visualize data using tables, maps and graphs
- Draw conclusions based on results

Exploring Downtown Toronto

Select popular neighbourhoods with high venue counts

- We have compiled a list of 17 neighbourhoods based on postal codes in Downtown Toronto
- After retrieving a list of venues in each neighbourhood, we ranked the neighbourhoods based on the number of venues
- We have selected 11 neighbourhoods (including Central Bay Street) that has a venue count of 87 or higher

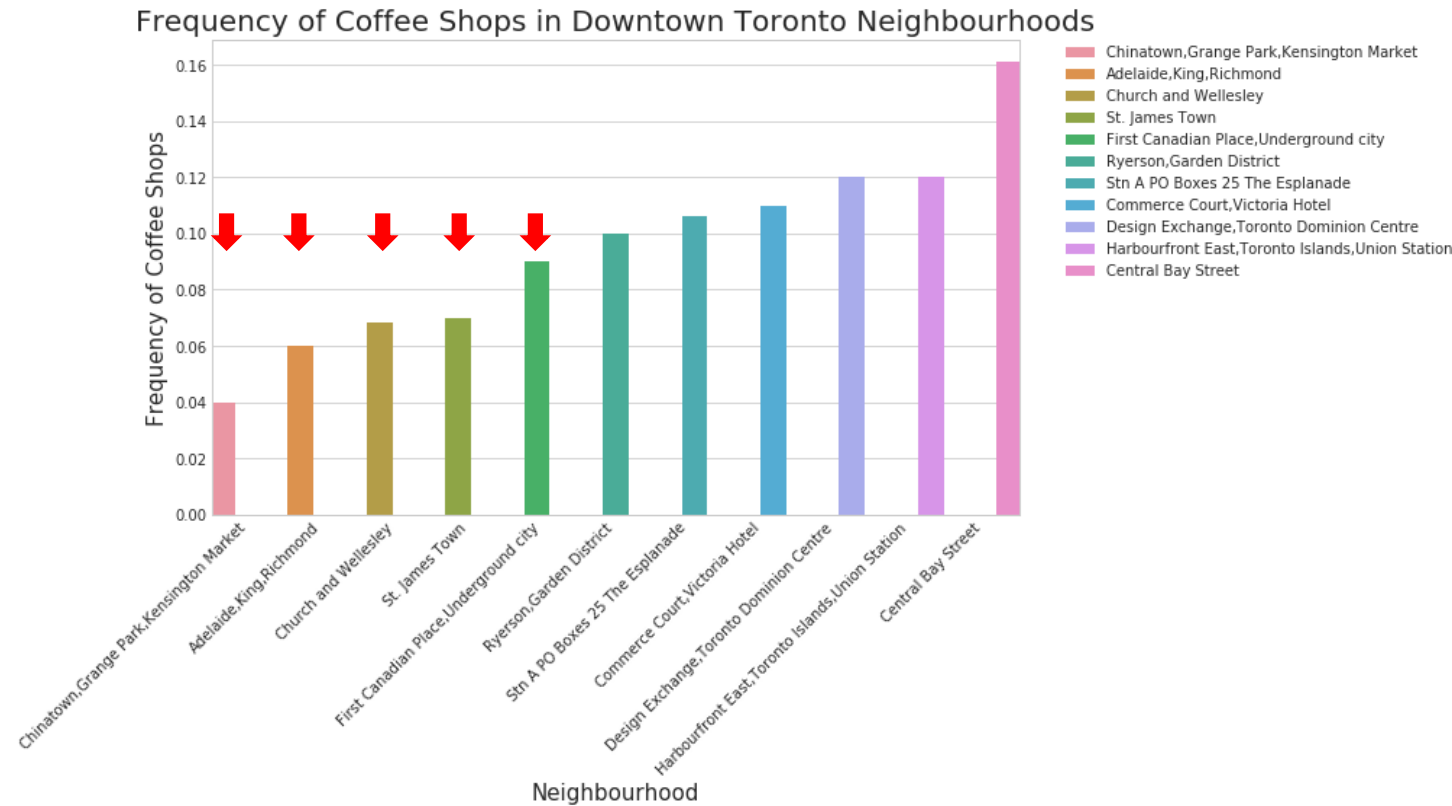


| | Neighbourhood | Venue |
|----|--|-------|
| 0 | Adelaide, King, Richmond | 100 |
| 8 | Commerce Court, Victoria Hotel | 100 |
| 16 | St. James Town | 100 |
| 15 | Ryerson, Garden District | 100 |
| 12 | Harbourfront East, Toronto Islands, Union Station | 100 |
| 10 | First Canadian Place, Underground city | 100 |
| 9 | Design Exchange, Toronto Dominion Centre | 100 |
| 5 | Chinatown, Grange Park, Kensington Market | 100 |
| 17 | Stn A PO Boxes 25 The Esplanade | 94 |
| 7 | Church and Wellesley | 88 |
| 4 | Central Bay Street | 87 |
| 1 | Berczy Park | 55 |
| 13 | Harbourfront, Regent Park | 48 |
| 3 | Cabbagetown, St. James Town | 44 |
| 11 | Harbord, University of Toronto | 34 |
| 6 | Christie | 16 |
| 2 | CN Tower, Bathurst Quay, Island airport, Harbourf... | 14 |
| 14 | Rosedale | 4 |

Eliminating potential competition

Select neighbourhoods with less existing coffee shops

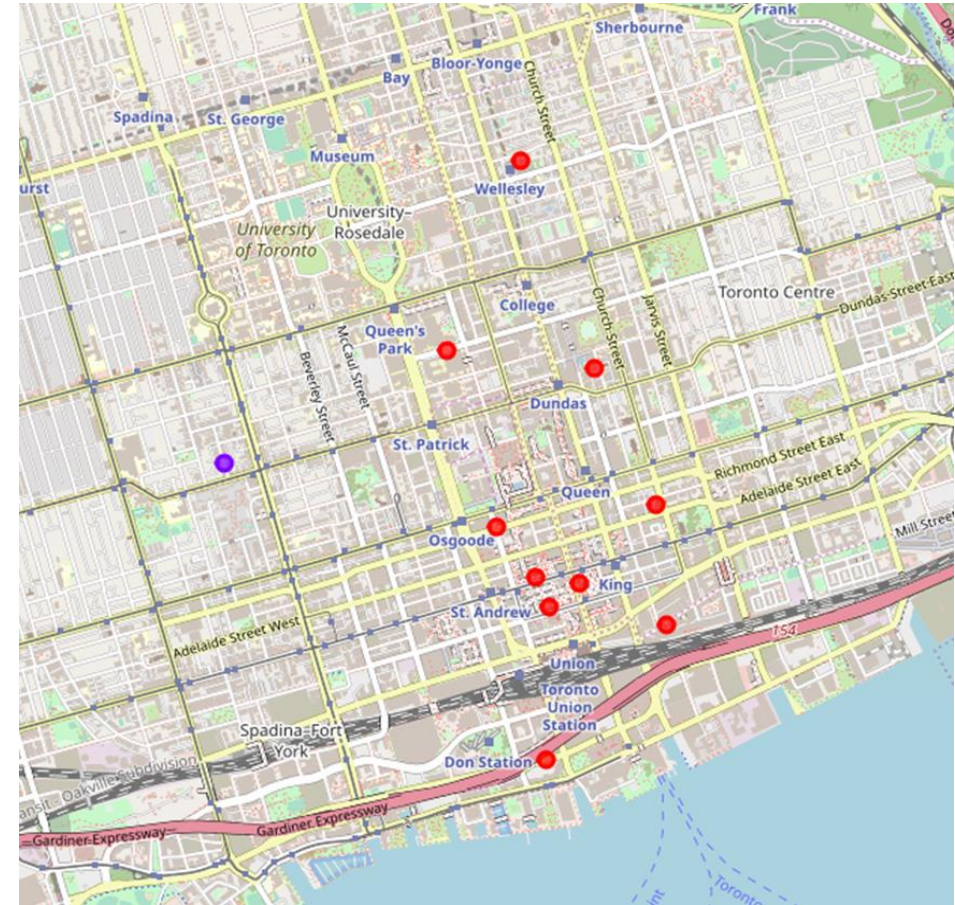
- Using one-hot-encoding, we have retrieved a summary table of venues sorted by category in the selected neighbourhoods
- We have selected the frequency of coffee shops in each neighbourhood
- We have ranked the selected neighbourhoods from the lowest to highest frequency of coffee shops
- We can select the 5 neighbourhoods with the lowest frequencies of coffee shops



Clustering neighbourhoods via k-means

Create clusters of neighbourhoods based on common venues

- Using k-means clustering method, we have categorized the 11 selected neighbourhoods of Downtown Toronto into 2 different clusters based on the most common venues occurring in each
 - Cluster 1: 10 neighbourhoods (red)
 - Cluster 2: 1 neighbourhood (purple)
- Neighbourhoods in Cluster 1 (including Central Bay Street) share similarities with each other



Examining cluster with Central Bay Street

Observe neighbourhoods similar to current business location

- The first cluster contains 10 neighbourhoods including Central Bay Street
- The 9 other neighbourhoods all share similarities with Central Bay Street in terms of the types of venues and how common they are in each neighbourhood
- Interestingly, the 5 neighbourhoods with lower frequencies of coffee shops that we selected previously are all included in this cluster

| | Neighbourhood | Cluster Labels | 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 | Church and Wellesley | 0 | Japanese Restaurant | Coffee Shop | Sushi Restaurant | Restaurant | Gay Bar | Gastropub | Men's Store | Mediterranean Restaurant | Hotel | Gym |
| 1 | Ryerson, Garden District | 0 | Coffee Shop | Clothing Store | Cosmetics Shop | Café | Middle Eastern Restaurant | Ramen Restaurant | Sporting Goods Shop | Bubble Tea Shop | Pizza Place | Italian Restaurant |
| 2 | St. James Town | 0 | Coffee Shop | Café | Hotel | Restaurant | Cosmetics Shop | Bakery | Breakfast Spot | Gastropub | Clothing Store | Cocktail Bar |
| 3 | Central Bay Street | 0 | Coffee Shop | Café | Italian Restaurant | Burger Joint | Middle Eastern Restaurant | Bar | Sushi Restaurant | Bakery | Chinese Restaurant | Japanese Restaurant |
| 4 | Adelaide, King, Richmond | 0 | Coffee Shop | Café | Thai Restaurant | Bar | Steakhouse | American Restaurant | Burger Joint | Cosmetics Shop | Bakery | Hotel |
| 5 | Harbourfront East, Toronto Islands, Union Station | 0 | Coffee Shop | Hotel | Aquarium | Italian Restaurant | Café | Fried Chicken Joint | Scenic Lookout | Pizza Place | Bakery | Restaurant |
| 6 | Design Exchange, Toronto Dominion Centre | 0 | Coffee Shop | Hotel | Café | Restaurant | Deli / Bodega | Steakhouse | Bakery | Seafood Restaurant | Gastropub | Italian Restaurant |
| 7 | Commerce Court, Victoria Hotel | 0 | Coffee Shop | Café | Hotel | Restaurant | American Restaurant | Bakery | Italian Restaurant | Deli / Bodega | Seafood Restaurant | Steakhouse |
| 9 | Stn A PO Boxes 25 The Esplanade | 0 | Coffee Shop | Restaurant | Café | Italian Restaurant | Cocktail Bar | Hotel | Seafood Restaurant | Beer Bar | Fast Food Restaurant | Bakery |
| 10 | First Canadian Place, Underground city | 0 | Coffee Shop | Café | Hotel | Bakery | Deli / Bodega | Burger Joint | Restaurant | Seafood Restaurant | Bar | Steakhouse |

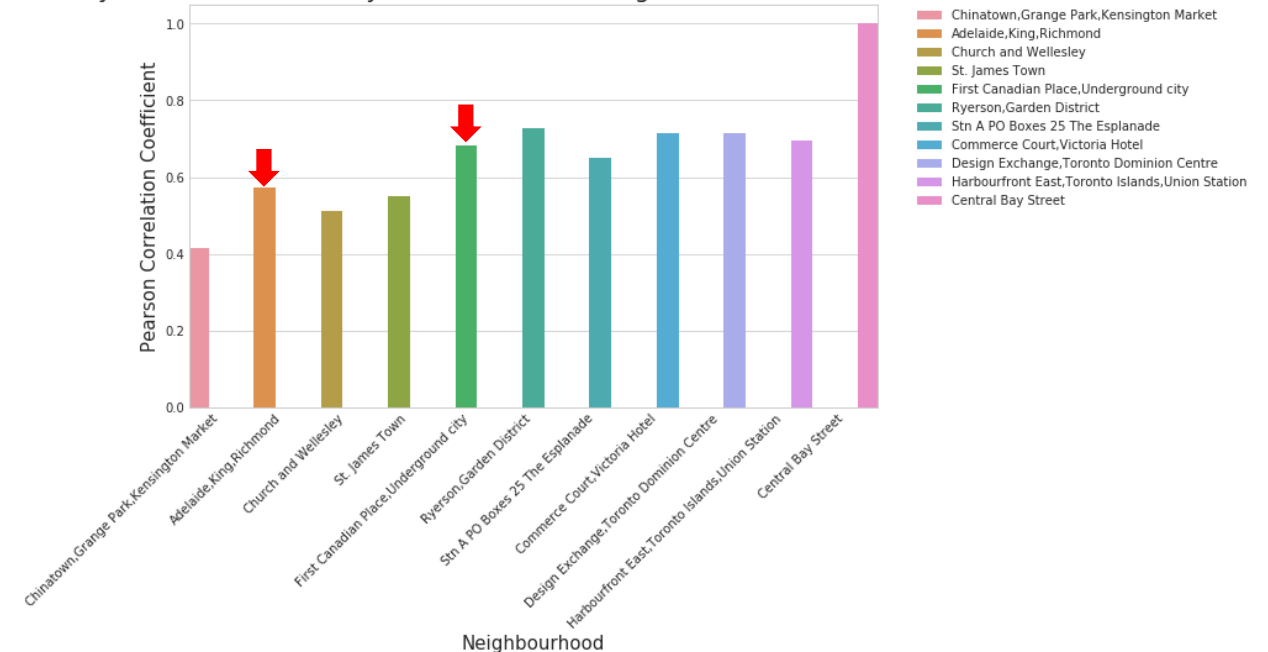
Statistical testing for correlation

Evaluate similarities via Pearson correlation coefficient and p-values

- We have tested the correlation between each neighbourhood vs. Central Bay Street by calculating Pearson correlation coefficients and p-values
- From the 5 neighbourhoods with the lowest frequencies of coffee shops, we select the 2 with the highest Pearson correlation coefficients (and lowest p-values)
 - Adelaide/King/Richmond
 - First Canadian Place/Underground City

| | Neighbourhood | Coffee Shop | Pearson Correlation Coefficient | P-value |
|----|---|-------------|---------------------------------|--------------|
| 0 | Chinatown,Grange Park,Kensington Market | 0.040000 | 0.414713 | 7.124575e-09 |
| 1 | Adelaide,King,Richmond | 0.060000 | 0.571578 | 5.304815e-17 |
| 2 | Church and Wellesley | 0.068182 | 0.512197 | 1.990909e-13 |
| 3 | St. James Town | 0.070000 | 0.549027 | 1.464666e-15 |
| 4 | First Canadian Place,Underground city | 0.090000 | 0.682063 | 5.596237e-26 |
| 5 | Ryerson,Garden District | 0.100000 | 0.726425 | 8.293996e-31 |
| 6 | Stn A PO Boxes 25 The Esplanade | 0.106383 | 0.649456 | 6.105092e-23 |
| 7 | Commerce Court,Victoria Hotel | 0.110000 | 0.715710 | 1.477158e-29 |
| 8 | Design Exchange,Toronto Dominion Centre | 0.120000 | 0.714348 | 2.110117e-29 |
| 9 | Harbourfront East,Toronto Islands,Union Station | 0.120000 | 0.696131 | 2.050364e-27 |
| 10 | Central Bay Street | 0.160920 | 1.000000 | 0.000000e+00 |

Similarity between Central Bay Street vs. Other Neighbourhoods in Downtown Toronto



Conclusions and future directions

- After conducting a detailed data analysis of the neighbourhoods in Downtown Toronto, we have found the most suitable locations for opening up a new coffee shop based on the business owner's criteria
- We recommend the business owner to open new coffee shops in these two particular neighbourhoods in Downtown Toronto: Adelaide/King/Richmond and First Canadian Place/Underground City
- Other neighbourhoods can also be considered if the business owner decides to change the scale of expansion or modify the criteria for expansion