Finding Location For A Restaurant Around The Subway Station

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1. Introduction

1.1 Background

Burnaby is a city in British Columbia, Canada, part of Metro Vancouver and immediately to the east of the City of Vancouver. It is the third-largest city in British Columbia by population, following Vancouver and nearby Surrey. Burnaby was incorporated in 1892 and achieved its City status in 1992, 100 years after incorporation. It is the seat of Metro Vancouver's regional government.

The main campuses of Simon Fraser University and the British Columbia Institute of Technology are located in Burnaby. Metropolis at Metrotown is the largest mall in British Columbia, and second largest in Canada. It is home to high-tech companies such as Ballard Power (fuel cell), Clio (legal software), D-Wave (quantum computing), General Fusion (fusion power), Electronic Arts Vancouver, and Capcom Canada.

The city is served by the Expo Line and the Millennium Line with total 11 stations. Metrotown station in downtown Metrotown is the second-busiest station in regional Vancouver's Skytrain system as of 2018.

1.2 Problem

With more and more people working in Burnaby, there is an increasing demand of an easily accessible restaurant for those young professionals to meet. The new restaurant should be surrounded by other shops and boutiques, particularly coffee shops and cafes, but with fewer restaurant competitors and it must be within the walkable distance to a subway station.

1.3 Interest

Therefore, the restaurant location I am going to find will appeal to the students and employees of high-tech companies, it must be near a subway station, so people can easily catch up during lunch or dinner time. I also want the restaurant in the vicinity of other shops and boutiques. What’s more important, the customers of coffee shops and cafes would be the target market. In a word,

the restaurant would be a creative place for those high-tech company employees and technology students to make friends and exchange ideas. It might be an incubator of startup companies.

2. Data acquisition and cleaning

2.1 Data Acquisition

Based on definition of our problem, There are three kinds of data that need to be find:

- Subway Station data of Burnaby with the locations. I obtained the GIS data of subway stations from City of Burnaby website and convert them into readable CSV file. Data Link:

https://data.burnaby.ca/datasets/b39d6277a1ec4edb8bba956664d30dc1_11/data

- Subway Station Characteristics data demonstrating employment and population status around the Stations. Data Link:

https://www.translink.ca/Plans-and-Projects/Managing-the-Transit-Network/Transit-Service-Performance-Review.aspx

- Venues data nearby Subway Stations. I utilized the Four Square's database to obtain all the venue data within 500 meters radius of subway stations.

2.2 Data Cleaning

Subway station data are in good shape with Latitude and Longitude information in Y and X columns respectively, I only dropped the unnecessary columns. In order to merge subway station data with station characteristics data, I must reformat the station names making them exactly same in both data frames. For the venue data, I extracted the venue categories around the stations and calculate their proportions to the total around a station and displayed them in the table in a descending order.

3. Methodology

3.1 Clustering Nearby Venues

I utilized the Four Square API to analyze the current venues around the station. First, I extract all the venues within 500 meters radius of subway stations in Burnaby and get the feel of the areas. Second, I utilized k-means clustering algorithm to categorize the subway stations according to their surrounding venues. A station area that has fewer characteristics of restaurants but with most other characteristics, such as cafes and coffee shops, boutiques are

considered proper choice for the new restaurant.

3.2 **Visualizing the data**

I mapped the stations according to their clustered labels and utilized the bar charts to demonstrate the employment and population (2019) around each station.

3.3 **Analyzing through Stations Characteristics Data**

Once narrowing down the stations with fewer restaurant characteristics, I utilized the Subway Stations Characteristics data to compare the information of population and employment around the station.

4. Results

4.1 Dataset for subway station locations

	X	Y	NAME
0	-122.938732	49.254594	LAKE CITY WAY STATION
1	-123.003426	49.225616	METROTOWN STATION
2	-123.001326	49.266423	BRENTWOOD TOWN CENTRE STATION
3	-122.917920	49.253390	PRODUCTION WAY - UNIVERSITY STATION
4	-122.988630	49.220112	ROYAL OAK STATION
5	-122.963679	49.259134	SPERLING - BURNABY LAKE STATION
6	-123.012611	49.229753	PATTERSON STATION
7	-123.013687	49.264887	GILMORE STATION
8	-122.896435	49.248231	LOUGHEED TOWN CENTRE STATION
9	-122.982009	49.264734	HOLDOM STATION
10	-122.959163	49.212014	EDMONDS STATION

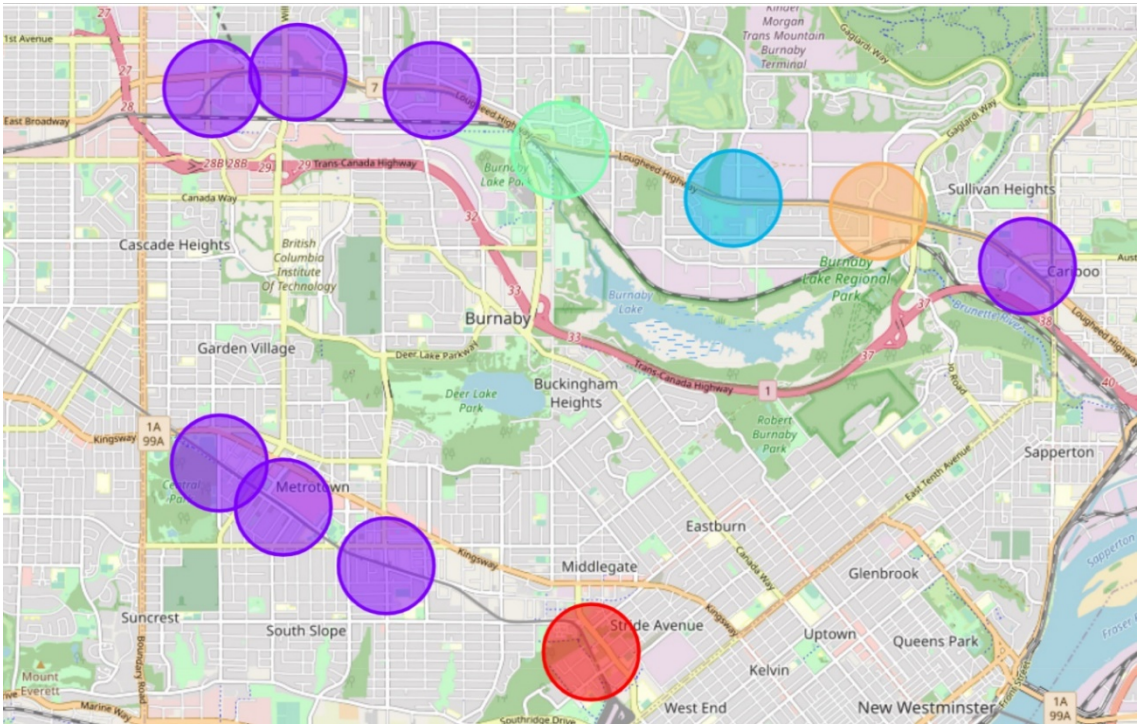
4.2 Dataset for venue categories around the stations

Station Name	Station Latitude	Station Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
BRENTWOOD TOWN CENTRE STATION	35	35	35	35	35	35
EDMONDS STATION	8	8	8	8	8	8
GILMORE STATION	15	15	15	15	15	15
HOLDOM STATION	18	18	18	18	18	18
LAKE CITY WAY STATION	4	4	4	4	4	4
LOUGHEED TOWN CENTRE STATION	38	38	38	38	38	38
METROTOWN STATION	48	48	48	48	48	48
PATTERSON STATION	13	13	13	13	13	13
PRODUCTION WAY - UNIVERSITY STATION	7	7	7	7	7	7
ROYAL OAK STATION	12	12	12	12	12	12
SPERLING - BURNABY LAKE STATION	3	3	3	3	3	3

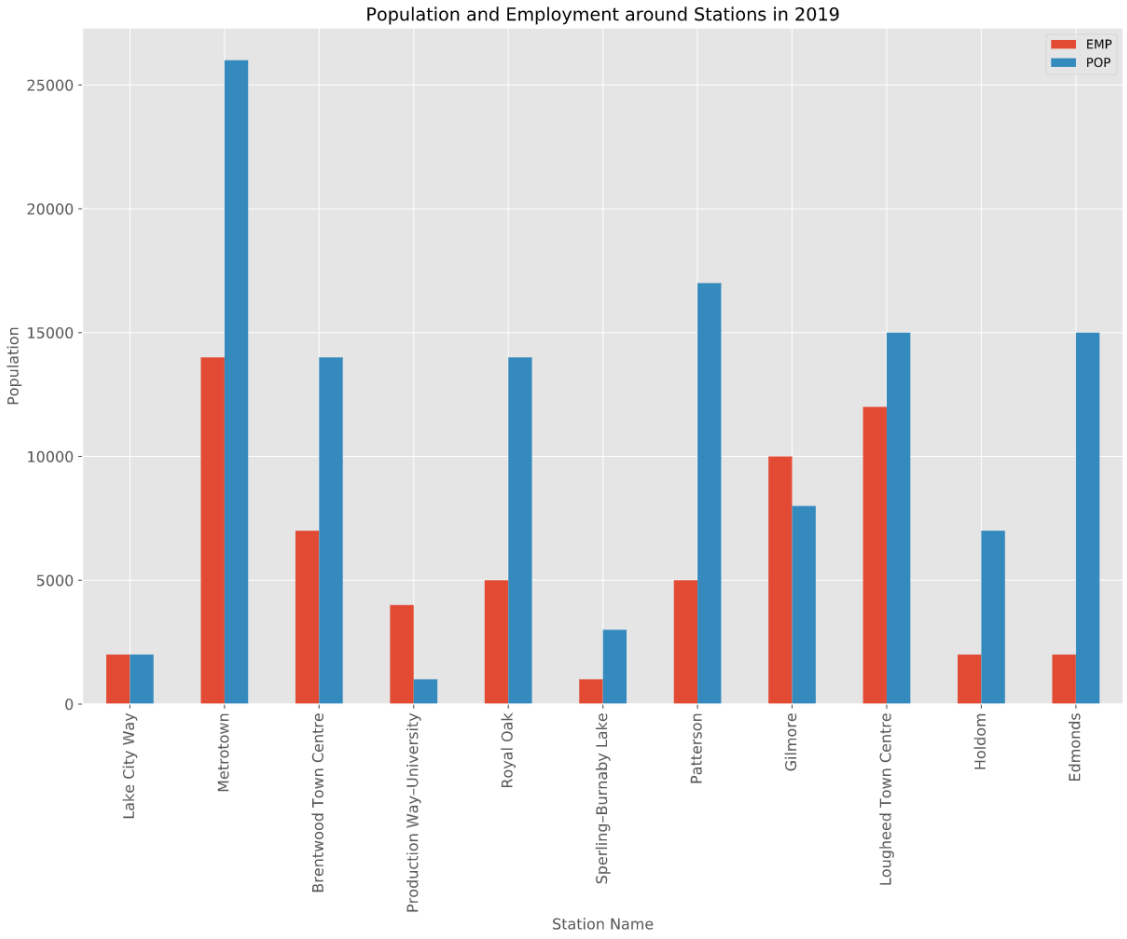
4.3 Dataset for clustered stations with sorted venue categories

Station Name	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
BRENTWOOD TOWN CENTRE STATION	1	Coffee Shop	Sushi Restaurant	Pharmacy	Pizza Place	Restaurant	Grocery Store	Wine Shop	Light Rail Station	Liquor Store	Italian Restaurant
EDMONDS STATION	0	Park	Coffee Shop	Gym / Fitness Center	Garden	Café	Bus Station	Electronics Store	Department Store	Dessert Shop	Dim Sum Restaurant
GILMORE STATION	1	American Restaurant	Coffee Shop	Japanese Restaurant	Sushi Restaurant	Deli / Bodega	Department Store	Burger Joint	Shipping Store	Fried Chicken Joint	Supermarket
HOLDOM STATION	1	Bus Stop	Sushi Restaurant	Grocery Store	Rental Service	Chinese Restaurant	Chiropractor	Diner	Breakfast Spot	Bowling Alley	Hotel
LAKE CITY WAY STATION	2	Light Rail Station	Park	Bus Stop	Sporting Goods Shop	Yoga Studio	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner
LOUGHEED TOWN CENTRE STATION	1	Korean Restaurant	Fast Food Restaurant	Café	Sporting Goods Shop	Coffee Shop	Sushi Restaurant	Burger Joint	Farmers Market	Japanese Restaurant	Hotel
METROTOWN STATION	1	Bakery	Cosmetics Shop	Coffee Shop	Sporting Goods Shop	Electronics Store	Dessert Shop	Furniture / Home Store	Toy / Game Store	Bookstore	Asian Restaurant
PATTERSON STATION	1	Indian Restaurant	Gym / Fitness Center	Park	Pizza Place	Portuguese Restaurant	Chinese Restaurant	Sandwich Place	Japanese Restaurant	Tanning Salon	Coffee Shop
PRODUCTION WAY - UNIVERSITY STATION	4	Pizza Place	Trail	Sandwich Place	Electronics Store	Brewery	Convenience Store	Warehouse Store	Distribution Center	Cosmetics Shop	Deli / Bodega
ROYAL OAK STATION	1	Ramen Restaurant	Asian Restaurant	Vietnamese Restaurant	Wine Shop	Gym	Dessert Shop	Malay Restaurant	Light Rail Station	Noodle House	Bubble Tea Shop
SPERLING - BURNABY LAKE STATION	3	Coffee Shop	Convenience Store	Bus Station	Deli / Bodega	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Distribution Center	Electronics Store

4.4 Map for clustered stations



4.5 Bar chart for station characteristics data



5. Discussion

The stations with less restaurant characteristics will be considered more suitable for a new restaurant. From clustering analysis, we conclude that the proper choices of stations for new restaurant include Lake City Way, Production Way-University, Sperling-Burnaby Lake, and Edmonds Station.

Station areas with more population and employment will be considered better choice for a new restaurant. From above bar chart, we can see that Metrotown, Brentwood Town Center,Royal Oak, Patterson,Gilmore, Lougheed Town Center, Edmonds are among our choices.

6. Conclusion

Purpose of this project was to identify station areas suitable for a restaurant. By clustering venues stations into five categories, we have found that the Cluster1 stations have most characteristics of surrounding by restaurants. Cluster 0,2,3,4 stations would be more suitable to have the new station. Comparing those stations with employment and population data, the final decision on optimal restaurant location will be the **Edmonds Station**.

7. References:

[1] Burnaby— Wikipedia

[3] Forsquare API

[4] City of Burnaby Website

[5] Transit Link Website