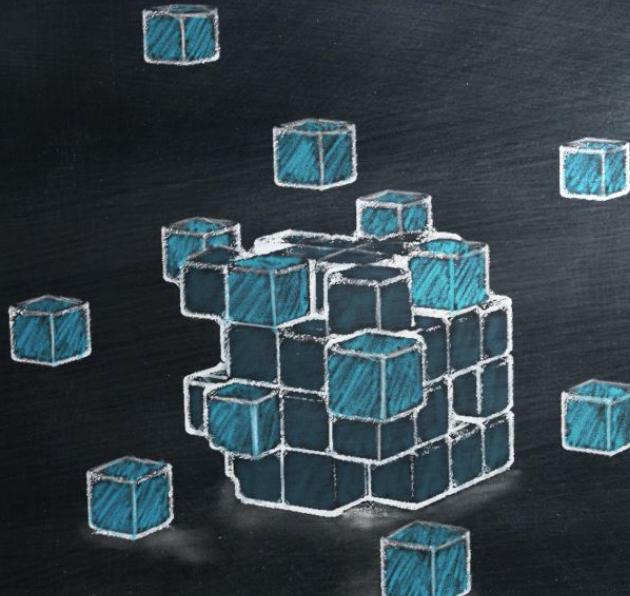


IBM DATA SCIENCE CAPSTONE PROJECT

RENT PRICES AND SOCIAL ENVIRONMENT ANALYSIS OF VANCOUVER NEIGHBOURHOODS



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BACKGROUND AND PROBLEM

- Vancouver is the largest city in the province of British Columbia, and the eighth largest municipality in Canada. With its scenic views, mild climate, and friendly people, Vancouver is known around the world as both a popular tourist attraction and one of the best places to live. Vancouver has now also become one of the fastest growing cities in the world by attracting large populations of internal and international migrants. According to the World Population Review, population of Greater Vancouver metropolitan area has risen from 1.96 million in 1990 to 2.58 million in 2020. According to the 15th Annual Demographia International Housing Affordability Survey, Vancouver has been listed as 2nd least affordable city in the world as of 2019.
- Above stated issue has now become a major concern for those who seek affordable rental living. This analytical work aims to identify what factors, specifically what types of venues and their presence in a neighbourhood affect rental prices.

DATA

- Vancouver Rental Market Statistics Summary provided by Zones from Canada Mortgage and Housing Corporation. This source provided both list of neighbourhoods of Vancouver as well as average rental price for 1-bedroom residences within those neighbourhoods.
- Geocoder Python package was used to obtain geographical coordinates of the neighbourhoods. This information would allow us to pass coordinates as parameters when creating neighbourhood maps and collecting information on venues within those neighbourhoods
- Foursquare Application Programming Interface (API) was used to gather information on venues, categories of venues, their location, quantity and quality (based on user reviews) within each of the neighbourhoods of Vancouver.

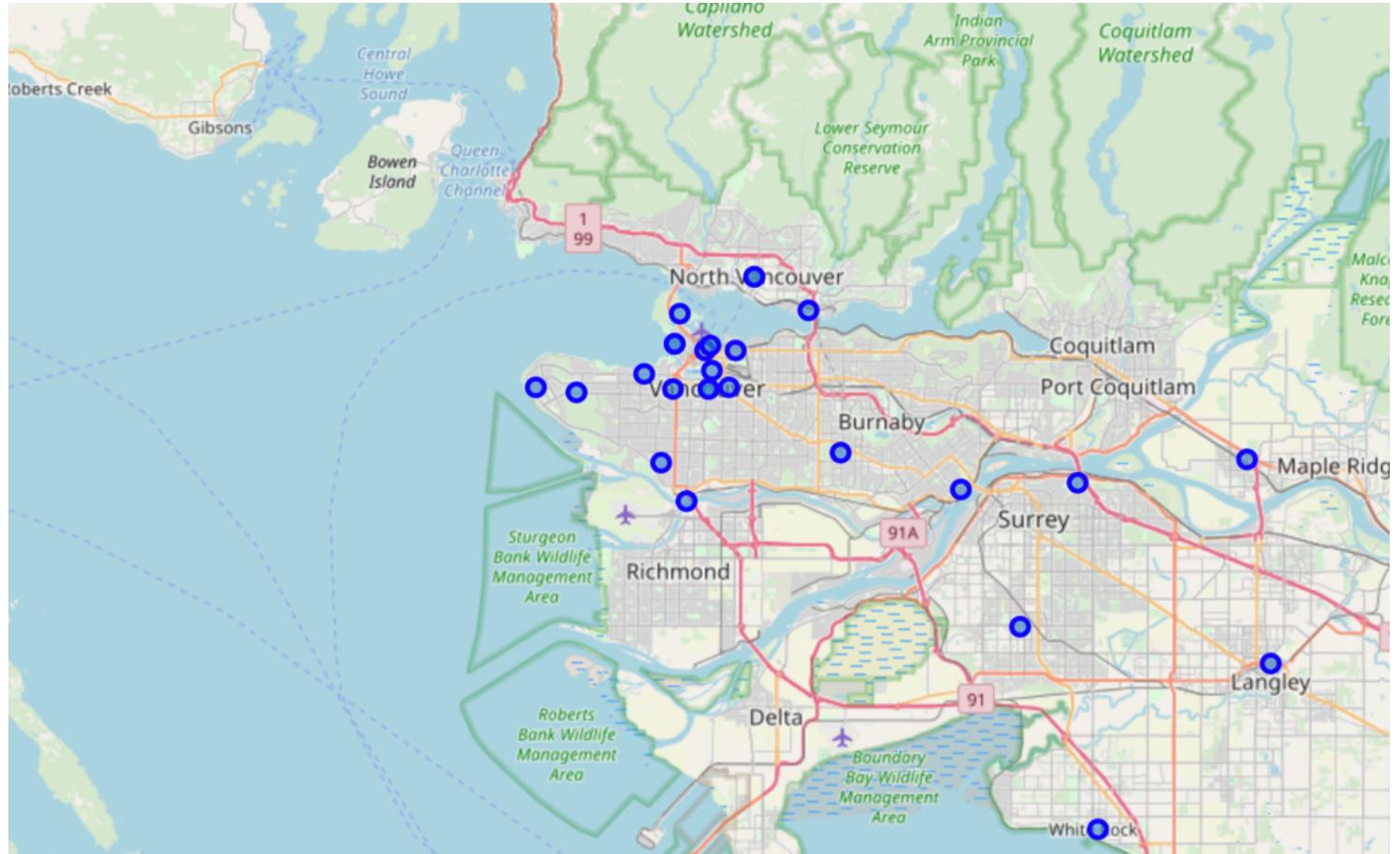
METHODOLOGY

- Identify list of Vancouver neighbourhoods and obtain average rent prices for these neighbourhoods
- Get neighbourhood coordinates and map neighbourhoods to have visual understanding of the region
- Cluster neighbourhoods based on average rent prices and conduct preliminary analysis
- Gather information on venues for each of the neighbourhoods
- Analyze venues in the neighbourhoods by identifying the most common venue categories in each of the neighbourhoods to understand how they differentiate between each other
- Cluster neighbourhoods based on new venues dataset and visualize clusters on the map
- Analyze if social environment (venues) of the neighbourhoods impact on rent prices, and if yes, then which venue categories specifically have most effect

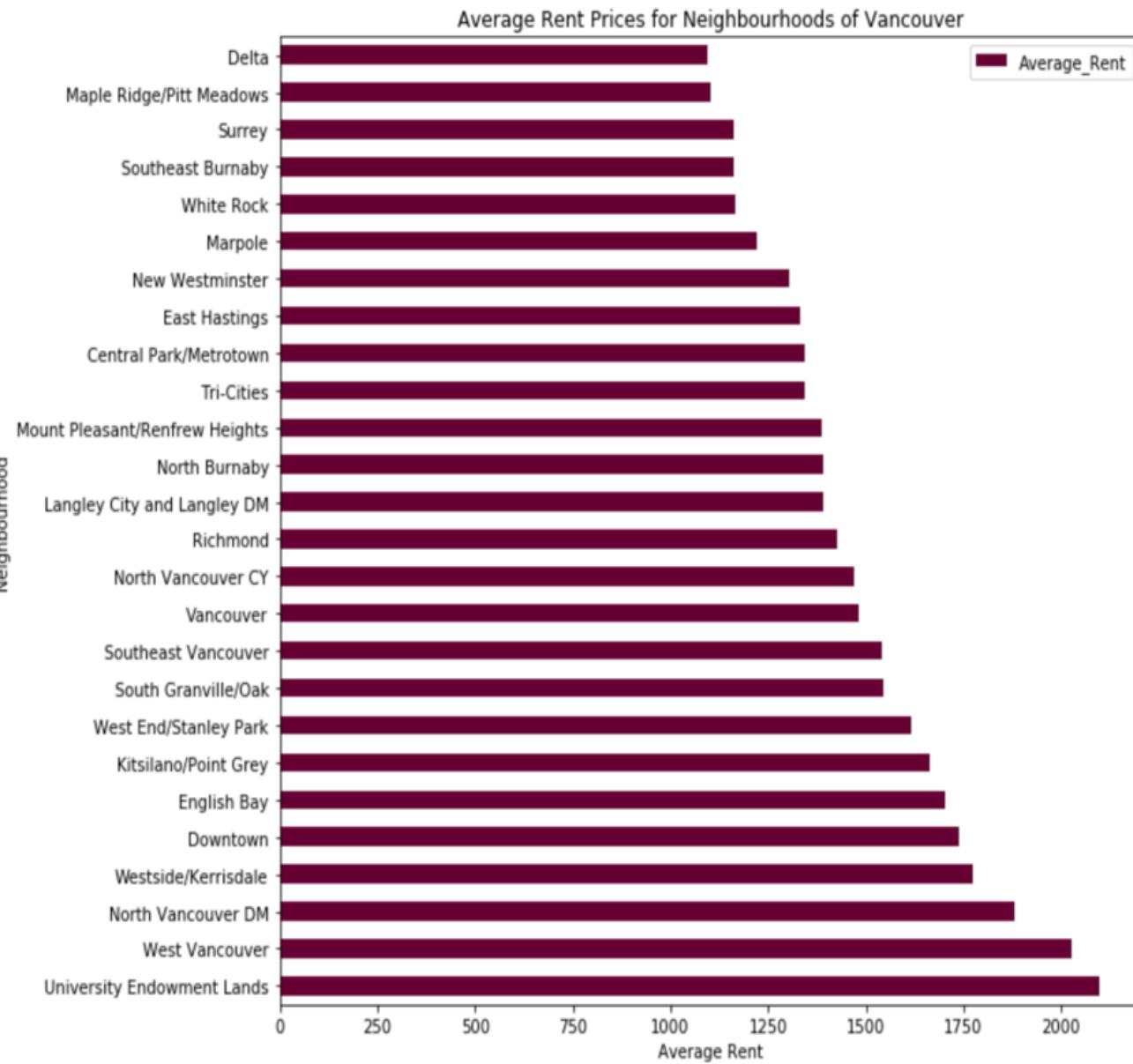
VANCOUVER NEIGHBORHOODS AND AVERAGE RENT PRICES

	Neighbourhood	Average_Rent	Latitude	Longitude
0	University Endowment Lands	2097	49.258570	-123.220150
1	West Vancouver	2024	49.261149	-123.253041
2	North Vancouver DM	1881	49.321080	-123.075210
3	Westside/Kerrisdale	1773	49.220970	-123.150730
4	Downtown	1738	49.281080	-123.115900
5	English Bay	1701	49.132838	-122.859585
6	Kitsilano/Point Grey	1662	49.268330	-123.165420
7	West End/Stanley Park	1615	49.301060	-123.135730
8	South Granville/Oak	1545	49.260830	-123.141000
9	Southeast Vancouver	1539	49.270110	-123.110100
10	Vancouver	1480	49.260380	-123.113360
11	North Vancouver CY	1471	49.321080	-123.075210
12	Richmond	1427	49.303077	-123.031500
13	Langley City and Langley DM	1392	49.113252	-122.657324
14	North Burnaby	1392	49.284611	-123.139880
15	Mount Pleasant/Renfrew Heights	1385	49.261780	-123.096080
16	Tri-Cities	1344	49.260380	-123.113360
17	Central Park/Metrotown	1343	49.226660	-123.005270
18	East Hastings	1332	49.281163	-123.090760
19	New Westminster	1305	49.207060	-122.908410
20	Marpole	1221	49.200670	-123.130530
21	White Rock	1164	49.023920	-122.796790
22	Southeast Burnaby	1161	49.284611	-123.139880
23	Surrey	1161	49.210498	-122.813874
24	Maple Ridge/Pitt Meadows	1102	49.222531	-122.676635
25	Delta	1095	49.284150	-123.112080

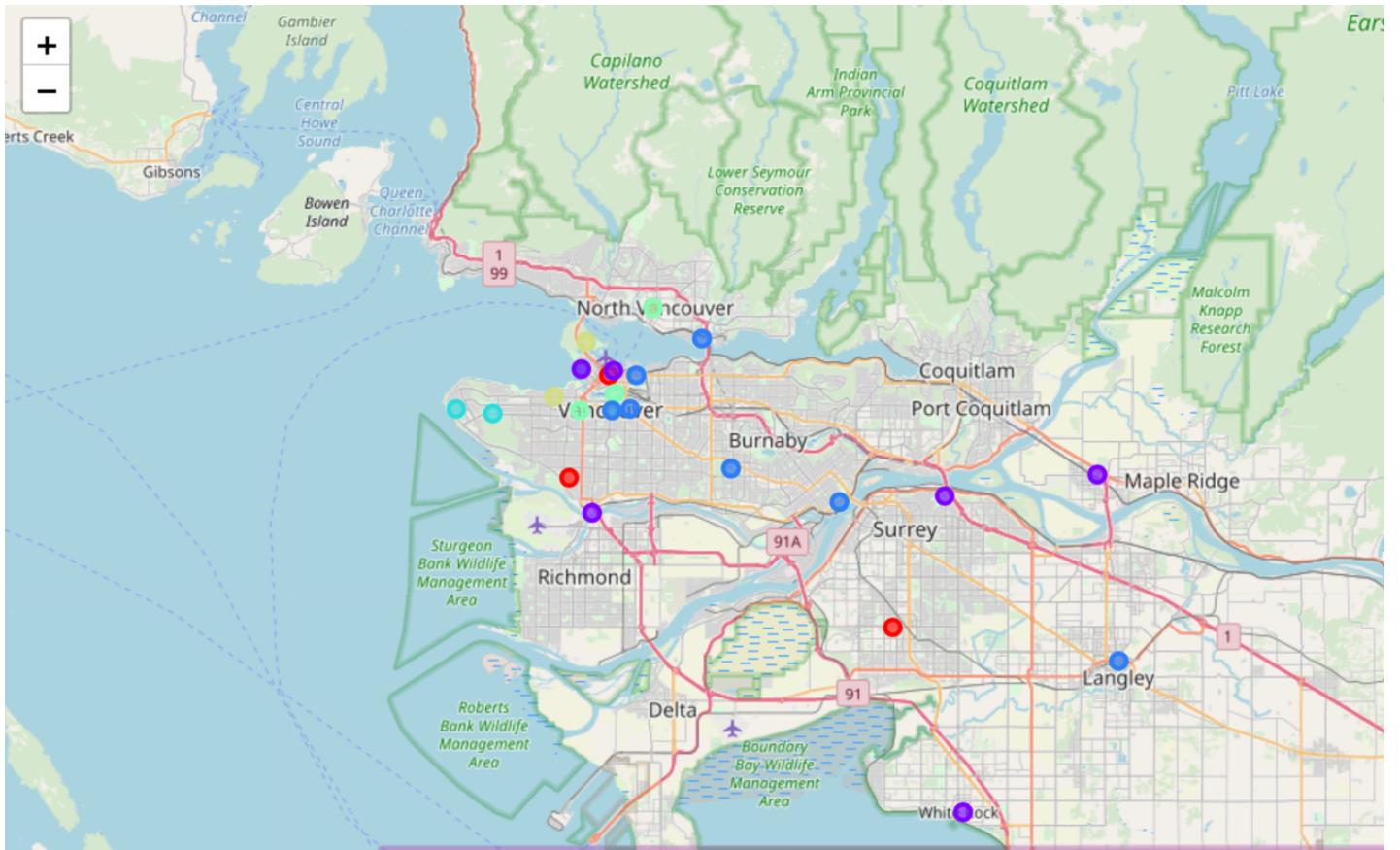
VANCOUVER NEIGHBORHOODS ON A MAP



AVERAGE RENT PRICES BAR CHART



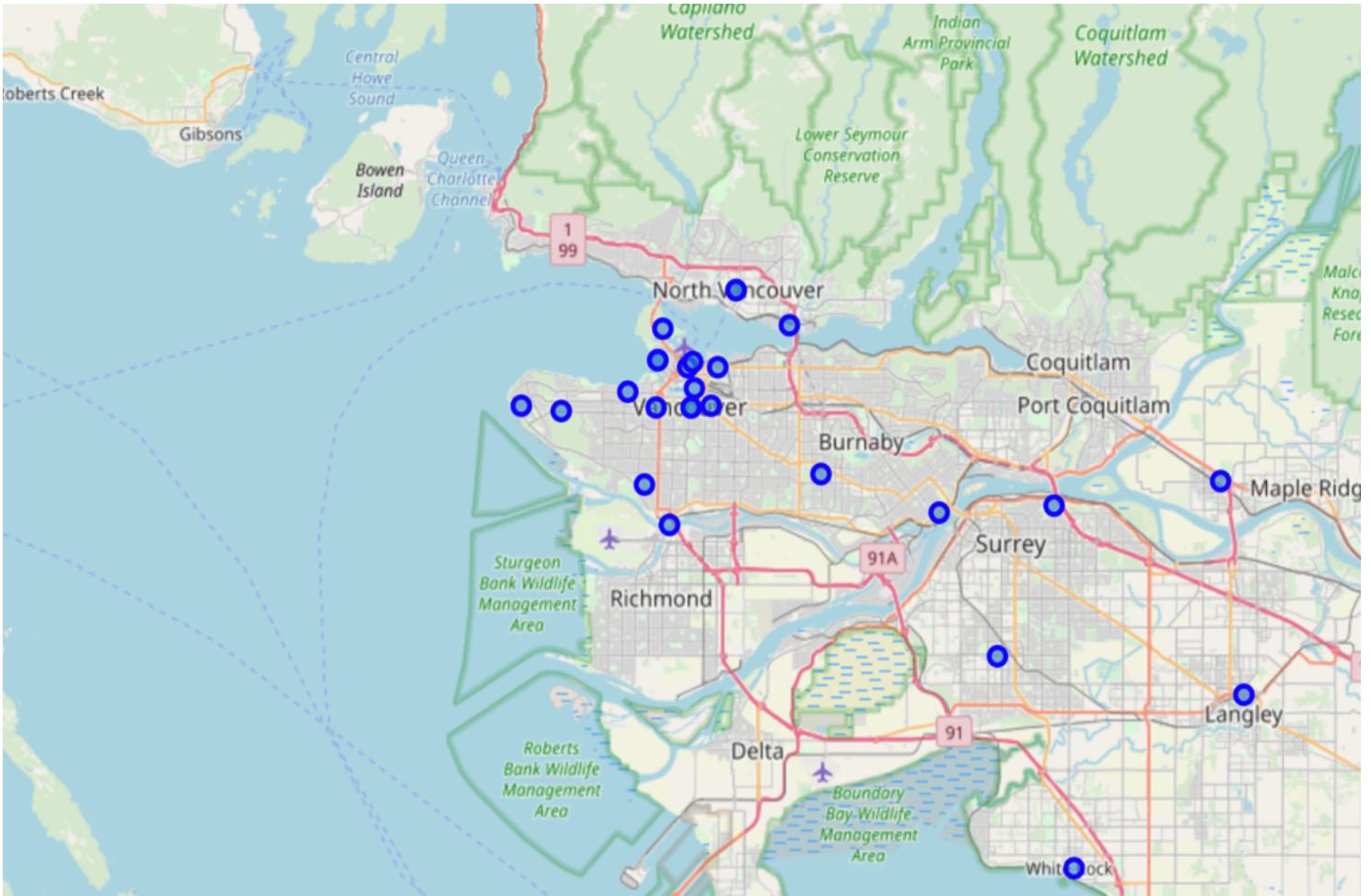
VANCOUVER NEIGHBORHOODS CLUSTERING BASED ON AVERAGE RENT PRICES



	Neighbourhood	Latitude	Longitude	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	University Endowment Lands	49.258570	-123.220150	3	Trail	Zoo Exhibit	Ethiopian Restaurant	French Restaurant	Food Truck	Food Court	Food	Financial or Legal Service	Fast Food Restaurant	Falafel Restaurant
1	West Vancouver	49.261149	-123.253041	5	Coffee Shop	Park	Italian Restaurant	Plaza	Fast Food Restaurant	Sandwich Place	Museum	Science Museum	Ethiopian Restaurant	Food
2	North Vancouver DM	49.321080	-123.075210	4	Coffee Shop	Sushi Restaurant	Grocery Store	Middle Eastern Restaurant	Italian Restaurant	Gym / Fitness Center	Sandwich Place	Mediterranean Restaurant	Café	Portuguese Restaurant
3	Westside/Kerrisdale	49.220970	-123.150730	0	Supermarket	Spanish Restaurant	Café	Park	Event Space	Food Truck	Food Court	Food	Financial or Legal Service	Fast Food Restaurant
4	Downtown	49.281080	-123.115900	4	Hotel	Coffee Shop	Café	Restaurant	Steakhouse	Concert Hall	Electronics Store	Italian Restaurant	Ramen Restaurant	Bookstore

TOP 10 VENUE CATEGORIES FOR EACH OF THE NEIGHBORHOODS (FIRST 5 ROWS)

VANCOUVER NEIGHBORHOODS CLUSTERING BASED ON MOST FREQUENT VENUE CATEGORIES



	Neighbourhood	Average_Rent	Latitude	Longitude	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
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5	English Bay	1701	49.132838	-122.859585	2	Sandwich Place	Zoo Exhibit	Ethiopian Restaurant	Food Truck	Food Court	Food	Financial or Legal Service	Fast Food Restaurant	Falafel Restaurant	Exhibit

COMPARISON OF AVERAGE RENT PRICES AND MOST FREQUENT VENUE CATEGORIES FOR EACH NEIGHBORHOOD

RESULTS

- Looking at the results of the clustering, it is hard to derive any direct relationships between the frequency of specific venue category in a neighbourhood and the average rent price in that neighbourhood. However, there are some hints showing that there can be relationships between these factors, for example:
 - neighbourhoods with parks, trails and other natural venues tend to have higher average rent prices.
 - neighbourhoods which have cultural venues such as museums, concert halls, plazas and event spaces tend to rank among high average rent priced neighbourhoods
- Although results of the clustering algorithm in a tabular format did not explicitly state any associations, visualization of the clusters on a map did provide some understanding on how geographical location and proximity to specific natural landmarks and center of the City play bigger role on defining the average rent prices.
- Other factors that highly affect average rent prices can include social and economical aspects of the neighbourhoods, such as crime rates, household income and others as well as presence of key infrastructure, such as public transportation and schools.

CONCLUSION

- There is no a defined and direct relationship between frequent presence of any of the venue categories in a neighbourhood and average rent prices in that neighbourhood
- Neighbourhoods with parks, trails and other natural venues tend to have higher average rent prices
- Neighbourhoods which have cultural venues such as museums, concert halls, plazas and event spaces tend to rank among high average rent priced neighbourhoods
- Further analysis of the matter by taking other factors, such as geographical location, infrastructure, social aspects, population density and household income of the residents might deliver higher-quality and more encompassing results.

REFERENCES

- City of Vancouver. Information about Vancouver - <https://vancouver.ca/about-vancouver.aspx>
- Vancouver population - <http://worldpopulationreview.com/world-cities/vancouver-population/>
- 15th Annual Demographia International Housing Affordability Survey - http://demographia.com/media_rls_2019.pdf
- CMHC Rental Market Report Data Tables - <https://www.cmhc-schl.gc.ca/en/data-and-research/data-tables>
- Foursquare API - <https://developer.foursquare.com/>
- Geocoder Python Library - <https://geocoder.readthedocs.io/index.html>