Features and Crime Data Mapping of the Neighbourhoods in Vancouver

Introduction

Vancouver is the largest city in the west coast of Canada [1]. It is one of the busiest ports, have major business centers, popular tourist spots, ski resorts [1]. This city consistently been ranked one of the top ten livable cities in the world [2]. Every year the city draws large numbers of tourists, visitors and immigrants from almost every corners of the world [3]. For the people who wants to find a place to settle down or rent, open up business opportunities need to know the main features each neighborhood has to offer. It would also be helpful if the most happening crime category of each neighborhood is provided. This information can better help people in deciding their home plan or business opportunities based on the features and crime data of every neighborhoods. Therefore, this project is pushed to provide insights on the main features a neighborhood offers, grouping similar neighborhoods together, listing the most occurring crime and categorizing the neighborhoods to the levels of crime.

Data

The list of Vancouver neighborhoods data was sourced from the [City of Vancouver website](). To map the neighborhoods geo-locations were needed. Geo-location data of the neighborhoods was extracted by a Python library called geopy specifically with Nominatim function. Up to 100 features that includes restaurant, coffee shop, grocery, park, metro and more were extracted from each neighborhoods from the database of Foursquare API [4]. Vancouver neighbourhoods crime data for 2018 was accessed through [Vancouver Police department website]().
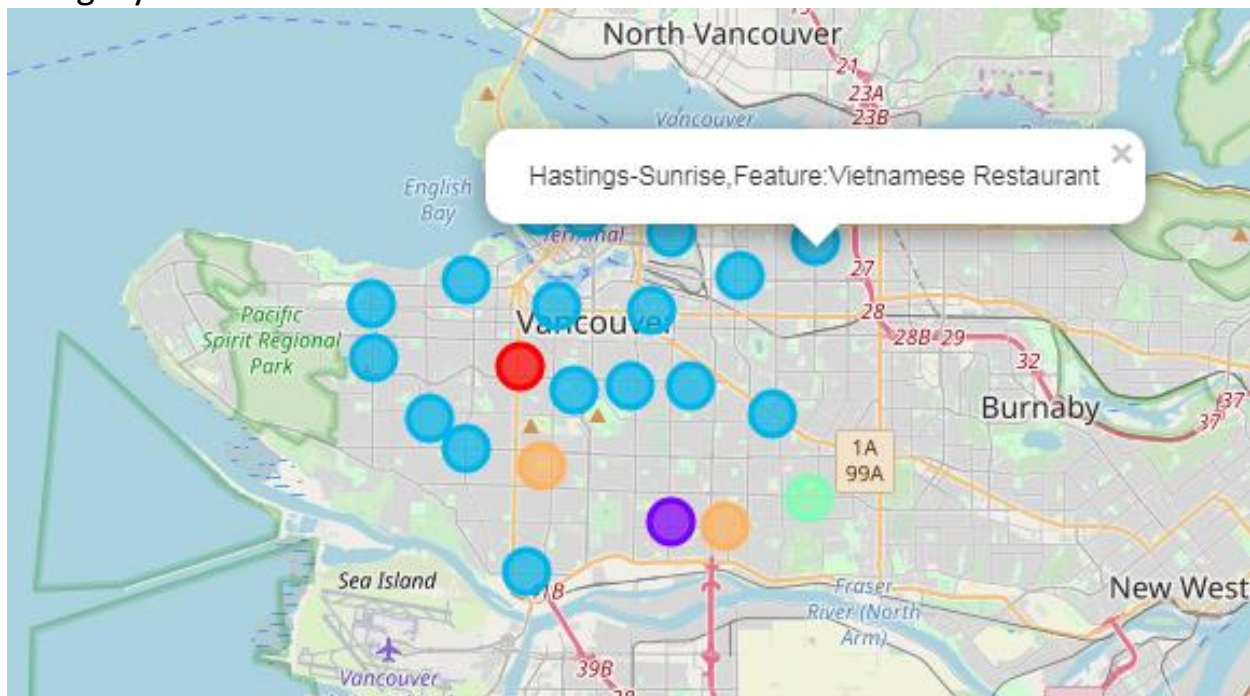
Methodology

In ranking the features of each neighborhoods, as a first step lists of 100 features of every neighborhoods were extracted with the help of Nominatim function through Foursquare API website. From the lists, features have been categorized and ranked up to 10 most common features. One of the objectives of this analysis is to show how the neighborhoods bound together or differ based on the similarities between features. k-means clustering algorithm [5] was run on the 100 features of the neighborhoods to cluster into 5 groups. Finally a data-frame was generated containing the top features and cluster number the neighborhood belong to. To visualize the result, neighborhoods were displayed in Vancouver map, showing the name, most common feature and the circle color shows neighborhoods that belong to the same category. For the crime rate mapping, neighborhood crime data was ranked up-to 3 most happening crime. The crime rates were then categorized into low, medium and high levels. The thresholding was done based on the statistics of the total crime of the neighborhoods. The thresholding levels are: 50% crime for 'low', 75% for 'medium' and above 75% is high. The most happening crime along with the level of crime of the neighborhoods were shown in the Vancouver map.

Results and discussion

The following map shows the feature map of the Vancouver neighborhood. Each group is shown by unique color circle. Shaughnessy neighborhood falls into a single group and shown in red color. Most common feature is the park. Arbutus-Ridge neighborhood falls into another category having
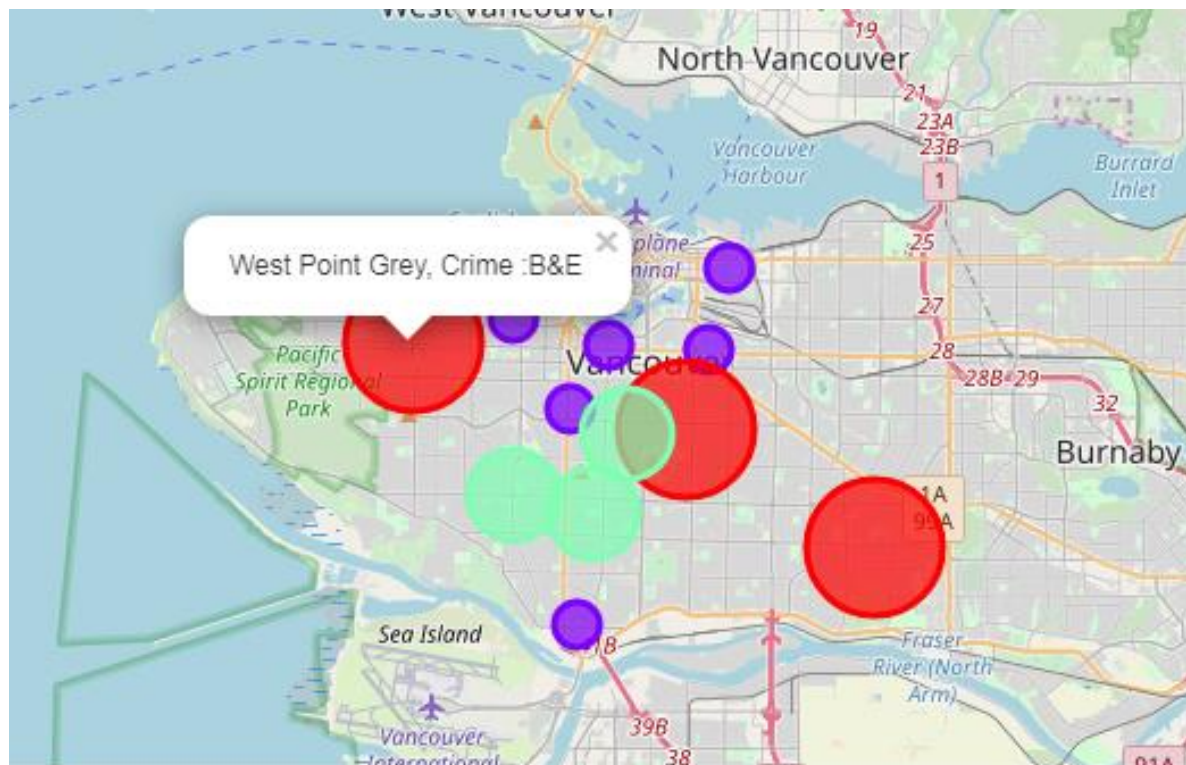
common feature of bakery. This is shown in purple circle. Victoria-Fraserview shown in the green circle have the common feature of convenience store. People living in Vancouver know the high density of convenience stores present in the Fraserview area. Killarney and Sunset neighbourhood grouped as one category and displayed by orange circles. Rest of the neighborhoods were displayed by blue circles and belong to the same
category.

A partial list of the five most common features of the neighborhoods has been shown below:

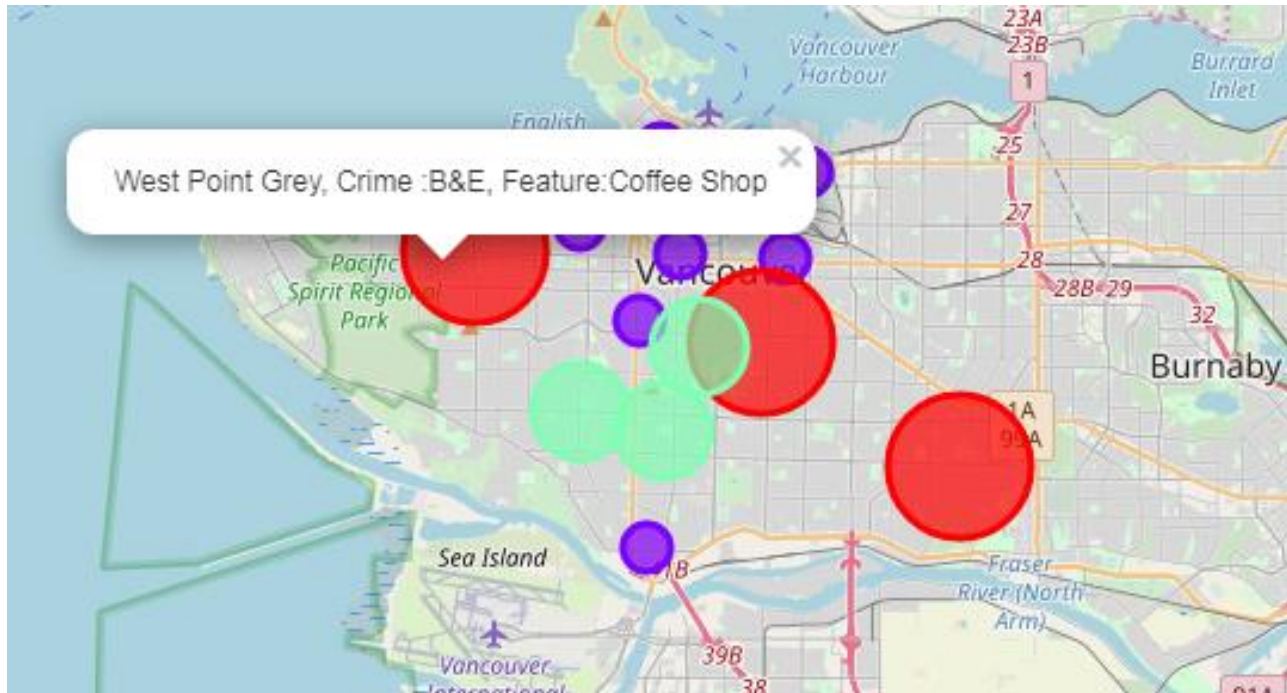|	Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Mount Pleasant	Coffee Shop	Sandwich Place	Diner	Sushi Restaurant	Breakfast Spot
2	Riley Park	Coffee Shop	Japanese Restaurant	Restaurant	Café	Grocery Store
3	Downtown	Hotel	Food Truck	Coffee Shop	Café	Clothing Store
4	Kitsilano	Bakery	Coffee Shop	Sushi Restaurant	Thai Restaurant	Food Truck
5	Dunbar-Southlands	Japanese Restaurant	Liquor Store	Fast Food Restaurant	Coffee Shop	Salon / Barbershop
6	Kerrisdale	Coffee Shop	Chinese Restaurant	Tea Room	Sushi Restaurant	Sandwich Place
7	Arbutus-Ridge	Jewelry Store	Grocery Store	Pet Store	Bakery	Falafel Restaurant
8	West Point Grey	Coffee Shop	Café	Japanese Restaurant	Sushi Restaurant	Bookstore
9	Marpole	Pizza Place	Sushi Restaurant	Chinese Restaurant	Vietnamese Restaurant	Japanese Restaurant

In this part crime rate of Vancouver neighborhood was mapped and shown below. The map categorizes crime into three levels. Low level crimes were marked by purple circles and generally seen in the neighborhoods of northern and southern parts of Vancouver. Most committed crimes are auto and theft below 5k. Medium level crimes are marked by green circles and represented generally by the neighborhoods located in the middle of Vancouver. Mostly committed crime is auto and one theft below 5k. High level of crimes were labeled by red circles and seen in the east, west and middle neighborhood. Highest numbers of crimes committed is auto related.

A partial list of the three most common crimes of the neighborhoods has been shown below:

	Neighbourhood	1st Most Common crimes	2nd Most Common crimes	3rd Most Common crimes
1	Arbutus Ridge	Auto	B&E	Theft<>$5K
2	Central Business District	Auto	Theft<>$5K	Assaults
3	Dunbar - Southlands	Auto	B&E	Mischief
4	Fairview	Theft<>$5K	Auto	B&E
5	Grandview - Woodland	Auto	Theft<>$5K	B&E
6	Hastings - Sunrise	Auto	Theft<>$5K	Mischief
7	Kensington - Cedar Cottage	Auto	Theft<>$5K	Mischief
8	Kerrisdale	Auto	B&E	Theft<>$5K
9	Killarney	Auto	Theft<>$5K	B&E
10	Kitsilano	Auto	Theft<>$5K	Mischief
11	Marpole	Auto	Theft<>$5K	B&E
12	Mount Pleasant	Theft<>$5K	Auto	B&E

The following map couples the neighborhood feature information with the crime map. This gives an idea for a particular neighborhood the most common feature it offers and the crime activity. For example 'West point grey' neighborhood has the most common feature as 'coffee shop' and the most frequent crime happened in 2018 is auto related and this neighborhood has the highest level of crime compare to the other neighborhoods.

This is a simple depiction of what can be mapped about the neighborhoods of Vancouver. for simplicity only the top feature and happening crime is shown in the map. It is possible to display more top features and crimes in the pop-up text in the map. Given the availability of health data, health facility could be attached. House price and office rental price influence heavily in deciding to open a business. Availability of such data can be processed and included in the present map. Finally, a 'suitability index' can be developed by weighting all the contributing factors, that is expected to better help in deciding the house or business settlement decision in Vancouver neighborhoods.

Conclusion

This analysis provided an opportunity to explore and map the common features each neighborhoods in Vancouver can offer. Ten most common features of each neighborhoods were extracted and only the top was displayed. In addition, crime rate was grouped into low, medium and high categories. Crime was also ranked up-to three most happening categories. The feature map was coupled with the crime map data. This map can be used as a firsthand source of visual of the features a neighborhood of interest can offer coupled with the level of crime activity. This can help deciding people to look for suitable places to settle down or open up business based on the information provided.

References

[1]. https://en.wikipedia.org/wiki/Vancouver

[2]. https://www.dw.com/en/the-worlds-10-most-livable-cities-in-2019/g-50267607

[3]. https://vancouversun.com/news/local-news/metro-vancouver-population-sees-record-losses-in-latest-census-report

[4]. https://developer.foursquare.com/

[5]. https://scikit-learn.org/stable/modules/generated/sklearn.cluster.KMeans.html