Introduction: Business Problem

The aim of this project is to find a safe and secure location for opening of commercial establishments in Vancouver, Canada. Specifically, this report will be targeted to stakeholders interested in opening any business place like **Grocery Store** in **Vancouver City**, Canada.

The first task would be to **choose the safest borough** by analysing crime data for opening a grocery store and **short listing a neighbourhood**, where grocery stores are not amongst the most commom venues, and yet **as close to the city as possible**.

We will make use of our data science tools to analyse data and focus on the safest borough and explore its neighborhoods and the 10 most common venues in each neighborhood so that the best neighborhood where grocery store is not amongst the most common venue can be selected.

Data

Based on definition of our problem, factors that will influence our decission are:

- finding the safest borough based on crime statistics
- finding the most common venues
- choosing the right neighbourhood within the borough

We will be using the geographical coordinates of Vancouver to plot neighbourhoods in a borough that is safe and in the city's vicinity, and finally cluster our neighborhoods and present our findings.

Following data sources will be needed to extract/generate the required information:

- **Part 1**: Using a real world data set from Kaggle containing the Vancouver Crimes from 2003 to 2019: A dataset consisting of the crime statistics of each Neighbourhoof in Vancouver along with type of crime, recorded year, month and hour.
- **Part 2**: Gathering additional information of the list of officially categorized boroughs in Vancouver from Wikipedia.: Borough information will be used to map the existing data where each neighbourhood can be assigned with the right borough.
- **Part 3**: Creating a new consolidated dataset of the Neighborhoods, along with their boroughs, crime data and the respective Neighbourhood's co-ordinates.: This data will be fetched using OpenCage Geocoder to find the safest borough and explore the neighbourhood by plotting it on maps using Folium and perform exploratory data analysis.
- **Part 4**: Creating a new consolidated dataset of the Neighborhoods, boroughs, and the most common venues and the respective Neighbourhood along with co-ordinates.: This data will be fetched using Four Square API to explore the neighbourhood venues and to apply machine learning algorithm to cluster the neighbourhoods and present the findings by plotting it on maps using Folium.

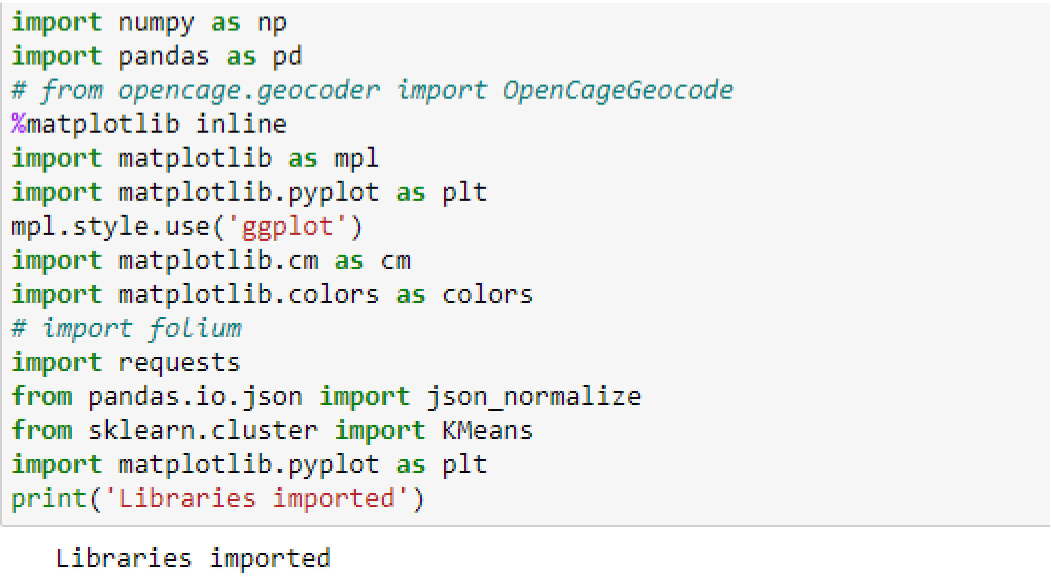
Part 1: Using a real world data set from Kaggle containing the Vancouver Crimes from 2003 to 2019

Vancouver Crime Report

Properties of the Crime Report

- TYPE - Crime type
- YEAR - Recorded year
- MONTH - Recorded month
- DAY - Recorded day
- HOUR - Recorded hour
- MINUTE - Recorded minute
- HUNDRED_BLOCK - Recorded block
- NEIGHBOURHOOD - Recorded neighborhood
- X - GPS longtitude
- Y - GPS latitude

Data set URL: https://www.kaggle.com/agilesifaka/vancouver-crime-report/version/2

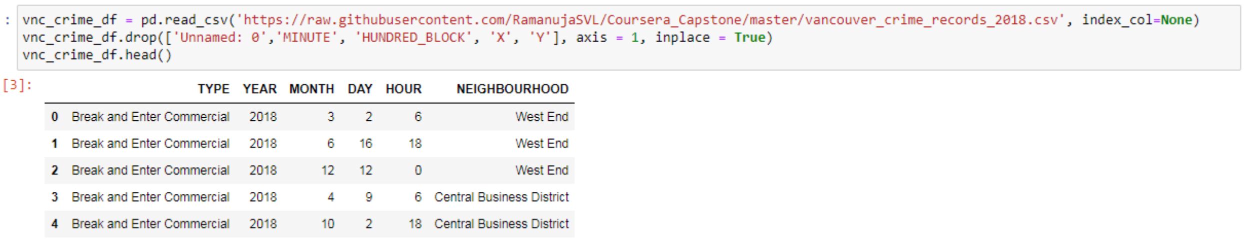


```
import numpy as np
import pandas as pd
# from opencage.geocoder import OpenCageGeocode
%matplotlib inline
import matplotlib as mpl
import matplotlib.pyplot as plt
mpl.style.use('ggplot')
import matplotlib.cm as cm
import matplotlib.colors as colors
# import folium
import requests
from pandas.io.json import json_normalize
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
print('Libraries imported')
```

```
Libraries imported
```

Reading from the Dataset

Due to sheer amount of data(~ 600,000 rows), it was not possible to process all of them and instead for this project we will be considering the recent crime report of the 2018.



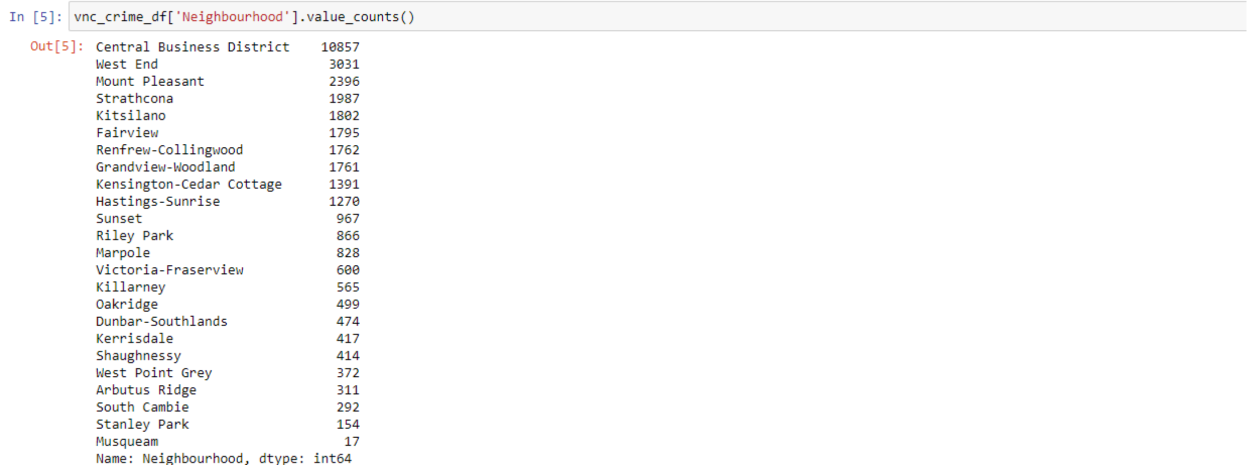
```
: vnc_crime_df = pd.read_csv('https://raw.githubusercontent.com/RamanujaSVL/Coursera_Capstone/master/vancouver_crime_records_2018.csv', index_col=None)
  vnc_crime_df.drop(['Unnamed: 0','MINUTE', 'HUNDRED_BLOCK', 'X', 'Y'], axis = 1, inplace = True)
  vnc_crime_df.head()
```

[3]:

	TYPE	YEAR	MONTH	DAY	HOUR	NEIGHBOURHOOD
0	Break and Enter Commercial	2018	3	2	6	West End
1	Break and Enter Commercial	2018	6	16	18	West End
2	Break and Enter Commercial	2018	12	12	0	West End
3	Break and Enter Commercial	2018	4	9	6	Central Business District
4	Break and Enter Commercial	2018	10	2	18	Central Business District

Part 2: Gathering additional information about the Neighborhood from Wikipedia

As part of data set Borough which the neighborhood was part of was not categorized, so we will create a dictionary of Neighborhood and based on data in the following Wikipedia page.



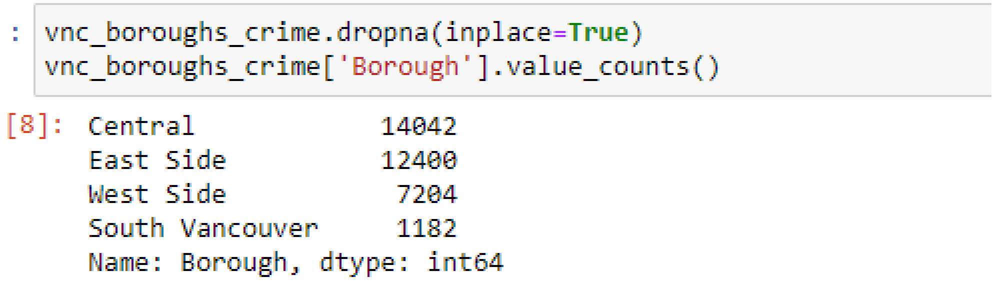
```
In [5]: vnc_crime_df['Neighbourhood'].value_counts()

Out[5]: Central Business District    10857
        West End                      3031
        Mount Pleasant                2396
        Strathcona                    1987
        Kitsilano                     1802
        Fairview                      1795
        Renfrew-Collingwood           1762
        Grandview-Woodland            1761
        Kensington-Cedar Cottage      1391
        Hastings-Sunrise              1270
        Sunset                         967
        Riley Park                     866
        Marpole                        828
        Victoria-Fraserview            600
        Killarney                      565
        Oakridge                       499
        Dunbar-Southlands              474
        Kerrisdale                     417
        Shaughnessy                    414
        West Point Grey                372
        Arbutus Ridge                  311
        South Cambie                   292
        Stanley Park                   154
        Musqueam                        17
        Name: Neighbourhood, dtype: int64
```

Methodology

Categorized the methodologysection into two parts:

- **Exploratory Data Analysis:** Visualise the crime repots in different Vancouver boroughs to idenity the safest borough and normalise the neighborhoods of that borough. We will Use the resulting data and find 10 most common venues in each neighborhood.

- **Modelling:** To help stakeholders choose the right neighborhood within a borough we will be clustering similar neighborhoods using K - means clustering which is a form of unsupervised machine learning algorithm that clusters data based on predefined cluster size. We will use K-Means clustering to address this problem so as to group data based on existing venues which will help in the decision making process.

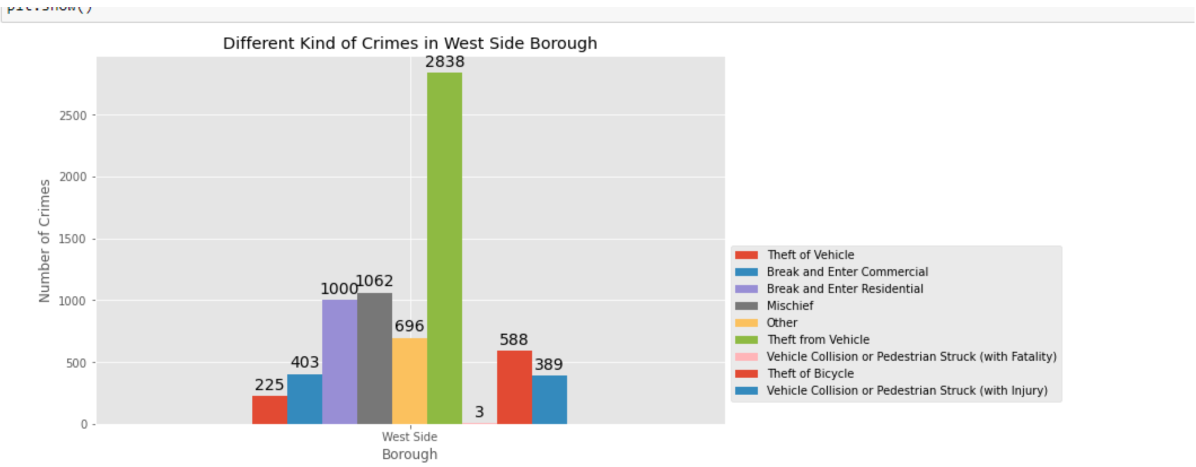


```
:  vnc_boroughs_crime.dropna(inplace=True)
   vnc_boroughs_crime['Borough'].value_counts()
```

```
[8]:  Central              14042
      East Side            12400
      West Side             7204
      South Vancouver       1182
      Name: Borough, dtype: int64
```

Based on exploratory data analysis it is clear that South Vancouver has the lowest crimes

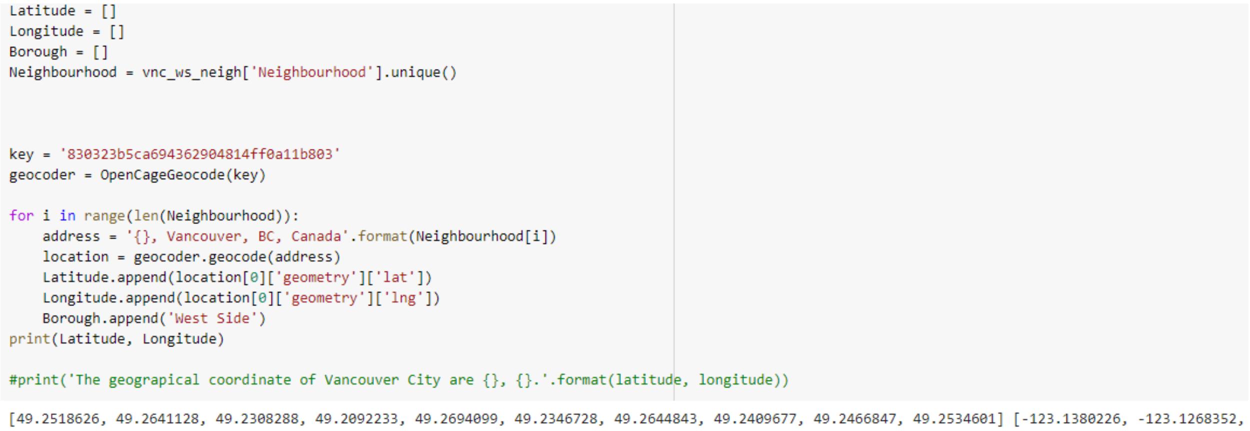
Since South Vancouver has very little number of neighborhoods and opening a commercial establishment would not be viable, we can choose the next borough with lowest crime which is West Side**.**



```
plt.show()
```

Part 3: Creating a new consolidated dataset of the Neighborhoods, along with their boroughs, crime data and the respective Neighbourhood's co-ordinates.:

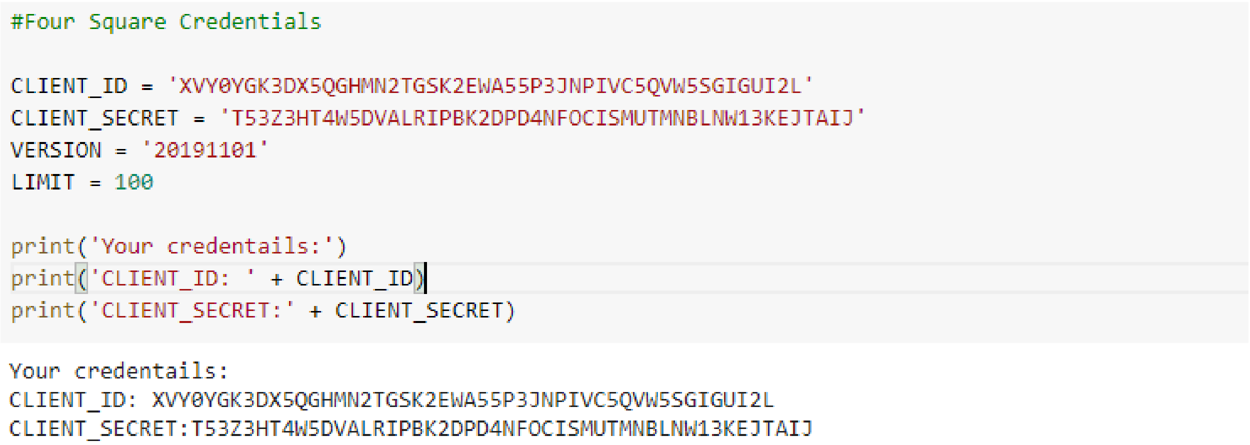
This data will be fetched using OpenCage Geocoder to find the safest borough and explore the neighbourhood by plotting it on maps using Folium and perform exploratory data analysis.



```
Latitude = []
Longitude = []
Borough = []
Neighbourhood = vnc_ws_neigh['Neighbourhood'].unique()



key = '830323b5ca694362904814ff0a11b803'
geocoder = OpenCageGeocode(key)

for i in range(len(Neighbourhood)):
    address = '{}, Vancouver, BC, Canada'.format(Neighbourhood[i])
    location = geocoder.geocode(address)
    Latitude.append(location[0]['geometry']['lat'])
    Longitude.append(location[0]['geometry']['lng'])
    Borough.append('West Side')
print(Latitude, Longitude)

#print('The geograpical coordinate of Vancouver City are {}, {}.'.format(latitude, longitude))
```

```
[49.2518626, 49.2641128, 49.2308288, 49.2092233, 49.2694099, 49.2346728, 49.2644843, 49.2409677, 49.2466847, 49.2534601] [-123.1380226, -123.1268352,
```

Part 4: Creating a new consolidated dataset of the Neighborhoods, boroughs, and the most common venues and the respective Neighbourhood along with co-ordinates.:



```
#Four Square Credentials

CLIENT_ID = 'XVY0YGK3DX5QGHMN2TGSK2EWA55P3JNPIVC5QVW5SGIGUI2L'
CLIENT_SECRET = 'T53Z3HT4W5DVALRIPBK2DPD4NFOCISMUTMNBLNW13KEJTAIJ'
VERSION = '20191101'
LIMIT = 100

print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET:' + CLIENT_SECRET)
```

```
Your credentails:
CLIENT_ID: XVY0YGK3DX5QGHMN2TGSK2EWA55P3JNPIVC5QVW5SGIGUI2L
CLIENT_SECRET:T53Z3HT4W5DVALRIPBK2DPD4NFOCISMUTMNBLNW13KEJTAIJ
```

Results and Discussion

The objective of the business problem was to help stakeholders identify one of the safest borough in Vancouver, and an appropriate neighborhood within the borough to set up a commercial establishment especially a Grocery store. This has been achieved by first making use of Vancouver crime data to identify a safe borugh with considerable number of neighborhood for any business to be viable. After selecting the borough it was imperative to choose the right neighborhood where grocery shops were not among venues in a close proximity to each other. We achieved this by grouping the neighborhoods into clusters to assist the stakeholders by providing them with relavent data about venues and safety of a given neighborhood.

Conclusion

We have explored the crime data to understand different types of crimes in all neighborhoods of Vancouver and later categorized them into different boroughs, this helped us group the neighborhoods into boroughs and choose the safest borough first. Once we confirmed the borough the number of neighborhoods for consideration also comes down, we further shortlist the neighborhoods based on the common venues, to choose a neighborhood which best suits the business problem.