Capstone Project - The Battle of the Neighborhoods

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Introduction: Business Problem

The objective of this project is to identify the best area to stay where any person who is relocating from any corner of the world to London for business purpose or Job change. Criteria for a place to be safe is not only amenities like Hospital,park,gym,pool etc but a safe place where crime rate is minimal.

The main question aims to select the safest place in London is based on the **total crimes**, need to explore the **neighborhoods** of that borough to find the **10 most common venues** in each neighborhood and finally cluster the neighborhoods using **k-mean clustering**.

This report will be targeted to people who are looking to **relocate to London**. Inorder to finalise a neighborhood to hunt for an apartment, **safety** is considered as a top concern when moving to a new place. If you don't feel safe in your own home, you're not going to be able to enjoy living there. The **crime statistics** will provide an insight into this issue.

We will focus on the 10 most common venues in each neighborhood so that the best neighborhood suited to an individual's needs can be selected.

Data

As per the problem, factors that will influence our decision are:

- The total number of crimes committed in each of the borough during the last year.
- The most common venues in each of the neighborhood in the safest borough selected.

Below is the data sources which will be needed to populate the required information:

- Part 1: Preprocessing a real world data set from Kaggle showing the London Crimes from 2008 to 2016: A dataset consisting of the crime statistics of each borough in London obtained from Kaggle
- Part 2: Scraping additional information of the different Boroughs in London from a Wikipedia
 page.: More information regarding the boroughs of London is scraped using the Beautifulsoup
 library
- Part 3: Creating a new dataset of the Neighborhoods of the safest borough in London and generating their co-ordinates.: Co-ordinate of neighborhood will be obtained using Google Maps API geocoding

Part 1: Preprocessing a real world data set from Kaggle showing the London Crimes from 2008 to 2016

London Crime Data

About this file

- Isoa_code: code for Lower Super Output Area in Greater London.
- borough: Common name for London borough.
- major_category: High level categorization of crime
- minor_category: Low level categorization of crime within major category.
- value: monthly reported count of categorical crime in given borough
- year: Year of reported counts, 2008-2016
- month: Month of reported counts, 1-12

Data set URL: https://www.kaggle.com/jboysen/london-crime

▼ Import necessary libraries

```
import requests # library to handle requests
import pandas as pd # library for data analsysis
import numpy as np # library to handle data in a vectorized manner
import random # library for random number generation
from bs4 import BeautifulSoup # library for web scrapping

#!conda install -c conda-forge geocoder --yes
import geocoder

#!conda install -c conda-forge geopy --yes
from geopy.geocoders import Nominatim # module to convert an address into latitude and longit

# libraries for displaying images
```

```
from IPython.core.display import HTML
# tranforming json file into a pandas dataframe library
from pandas.io.json import json normalize
#!conda install -c conda-forge folium=0.5.0 --yes
import folium # plotting library
print('Folium installed')
print('Libraries imported.')
```



Folium installed Libraries imported.

Define Foursquare Credentials and Version

Make sure that you have created a Foursquare developer account and have your credentials handy

```
CLIENT ID = 'R01LINGO2WC45KLRLKT3ZHU2QENAO2IPRK2N2ELOHRNK4P3K' # your Foursquare ID
CLIENT SECRET = '4JT1TWRMXMPLX5IOKNBAFU3L3ARXK4D5JJDPFK1CLRZM2ZVW' # your Foursquare Secret
VERSION = '20180604'
LIMIT = 30
print('Your credentails:')
print('CLIENT ID: ' + CLIENT ID)
print('CLIENT_SECRET:' + CLIENT_SECRET)
    Your credentails:
```



CLIENT ID: R01LINGO2WC45KLRLKT3ZHU2QENAO2IPRK2N2ELOHRNK4P3K CLIENT SECRET:4JT1TWRMXMPLX5IOKNBAFU3L3ARXK4D5JJDPFK1CLRZM2ZVW

Read in the dataset

```
# Read in the data
df = pd.read_csv("london_crime_by_lsoa.csv")
# View the top rows of the dataset
df.head()
```



	lsoa_code	borough	major_category	minor_category	value	year	month
0	E01001116	Croydon	Burglary	Burglary in Other	0	2016	11

▼ Accessing the most recent crime rates (2016)

```
# Taking only the most recent year (2016) and dropping the rest df.drop(df.index[df['year'] != 2016], inplace = True)
```

```
# Removing all the entires where crime values are null
df = df[df.value != 0]
```

Reset the index and dropping the previous index
df = df.reset_index(drop=True)

Shape of the data frame df.shape



(392042, 7)

View the top of the dataset
df.head()

8		lsoa_code	borough	major_category	minor_category	value	year	month	
	0	E01004177	Sutton	Theft and Handling	Theft/Taking of Pedal Cycle	1	2016	8	
	1	E01000733	Bromley	Criminal Damage	Criminal Damage To Motor Vehicle	1	2016	4	
	2	E01003989	Southwark	Theft and Handling	Theft From Shops	4	2016	8	
	2	E01000076	Hayarina	Duralany	Puralant in a Dutallina	1	2016	0	

▼ Change the column names

df.columns = ['LSOA_Code', 'Borough', 'Major_Category', 'Minor_Category', 'No_of_Crimes', 'Year',
df.head()



LSOA_Code Borough Major_Category Minor_Category No_of_Crimes Year Month

View the information of the dataset
df.info()



<class 'pandas.core.frame.DataFrame'>
RangeIndex: 392042 entries, 0 to 392041
Data columns (total 7 columns):

LSOA_Code 392042 non-null object
Borough 392042 non-null object
Major_Category 392042 non-null object
Minor_Category 392042 non-null object
No_of_Crimes 392042 non-null int64
Year 392042 non-null int64
Month 392042 non-null int64

dtypes: int64(3), object(4)
memory usage: 20.9+ MB

▼ Total number of crimes in each Borough

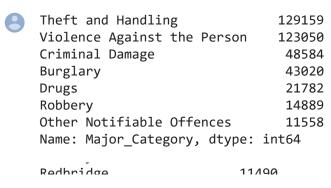
```
df['Borough'].value_counts()
```



Lambeth	17605
Southwark	16560
Croydon	16254
Newham	15622
Ealing	15284
Tower Hamlets	15719

▼ The total crimes per major category

```
df['Major_Category'].value_counts()
```



▼ Pivoting the table to view the no. of crimes for each major category in each Borough



No_of_Crimes

Major_Category	Burglary	Criminal Damage		Other Drugs Notifiable Offences		Theft and Handling	Violence Against the Person	
Borough								
Barking and Dagenham	1287	1949	919	378	534	5607	6067	
Barnet	3402	2183	906	499	464	9731	7499	
Bexley	1123	1673	646	294	209	4392	4503	
5 (0004	0000	0000	500	040	0000	2225	

```
# Reset the index
London_crime.reset_index(inplace = True)
```

```
# Total crimes per Borough
London_crime['Total'] = London_crime.sum(axis=1)
London_crime.head(33)
```



Borough No_of_Crimes

Major_Category		Burglary	Criminal Damage	Drugs	Other Notifiable Offences	Robbery	Theft and Handling
0	Barking and Dagenham	1287	1949	919	378	534	5607
1	Barnet	3402	2183	906	499	464	9731
2	Bexley	1123	1673	646	294	209	4392
3	Brent	2631	2280	2096	536	919	9026
4	Bromley	2214	2202	728	417	369	7584
5	Camden	2652	1935	1493	490	899	14088
6	City of London	2	2	10	6	4	129
7	Croydon	2738	3219	1367	718	1139	9229
8	Ealing	2492	2562	1355	613	669	10040
9	Enfield	2541	2136	1063	492	807	8037
10	Greenwich	1780	2476	867	521	486	8010
11	Hackney	2719	1981	1353	499	1030	11851
12	Hammersmith and Fulham	1531	1408	1321	474	397	8925
13	Haringey	2474	2233	1540	551	1248	10554
14	Harrow	1994	1212	473	267	377	4537
15	Havering	1826	1804	718	389	311	5919
16	Hillingdon	2229	2470	1042	1305	420	9045
17	Hounslow	1808	2213	1086	665	392	8682
18	Islington	2051	1903	1777	508	936	12077
19	Kensington and Chelsea	1449	1051	1680	326	523	9855
20	Kingston upon Thames	879	1054	743	189	121	3803
21	Lambeth	3087	2764	2738	635	1196	13155
22	Lewisham	2071	2351	1617	485	869	7702
23	Merton	1419	1418	466	249	283	4894
24	Newham	2115	2496	1684	713	1472	11964

25	Redbridge	1997	1650	1017	381	599	7447
26	Richmond upon Thames	1359	1148	320	217	106	4769

Removing the multi index so that it will be easier to merge

London_crime.columns = London_crime.columns.map(''.join)
London_crime.head()

8		Borough	No_of_CrimesBurglary	No_of_CrimesCriminal Damage	No_of_CrimesDrugs	No_of_Crima Not: O
	0	Barking and Dagenham	1287	1949	919	
	1	Barnet	3402	2183	906	
	2	Bexley	1123	1673	646	
	3	Brent	2631	2280	2096	

▼ Renaming the columns



	Borough	Burglary	Criminal Damage	Drugs	Other Notifiable Offences	Robbery	Theft and Handling	Violence Against the Person	Total
0	Barking and Dagenham	1287	1949	919	378	534	5607	6067	16741
1	Barnet	3402	2183	906	499	464	9731	7499	24684
_				~			1000		

Shape of the data set London_crime.shape



(33, 9)

[#] View the Columns in the data frame

[#] London_crime.columns.tolist()

Part 2: Scraping additional information of the different Boroughs in London from a Wikipedia page

Using Beautiful soup to scrap the latitude and longitiude of the boroughs in London

URL: https://en.wikipedia.org/wiki/List_of_London_boroughs

```
# getting data from internet
wikipedia_link='https://en.wikipedia.org/wiki/List_of_London_boroughs'
raw_wikipedia_page= requests.get(wikipedia_link).text

# using beautiful soup to parse the HTML/XML codes.
soup = BeautifulSoup(raw_wikipedia_page,'xml')
print(soup.prettify())
```



```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE html>
<html class="client-nojs" dir="ltr" lang="en">
 <head>
  <meta charset="UTF-8"/>
  <title>
   List of London boroughs - Wikipedia
  </title>
  <script>
   document.documentElement.className = document.documentElement.className.replace( /(^
  </script>
  <script>
   (window.RLQ=window.RLQ||[]).push(function(){mw.config.set({"wgCanonicalNamespace":"",
});RLPAGEMODULES=["ext.cite.ux-enhancements", "site", "mediawiki.page.startup", "mediawiki
  </script>
  <link href="/w/load.php?lang=en&amp;modules=ext.3d.styles%7Cext.cite.styles%7Cext.uls</pre>
  <script async="" src="/w/load.php?lang=en&amp;modules=startup&amp;only=scripts&amp;ski</pre>
  <meta content="" name="ResourceLoaderDynamicStyles"/>
  <link href="/w/load.php?lang=en&amp;modules=ext.gadget.charinsert-styles&amp;only=sty]</pre>
  <link href="/w/load.php?lang=en&amp;modules=site.styles&amp;only=styles&amp;skin=vector</pre>
  <meta content="MediaWiki 1.34.0-wmf.1" name="generator"/>
  <meta content="origin" name="referrer"/>
  <meta content="origin-when-crossorigin" name="referrer"/>
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  <link href="android-app://org.wikipedia/http/en.m.wikipedia.org/wiki/List of London bo</pre>
  <link href="/w/index.php?title=List_of_London_boroughs&amp;action=edit" rel="alternate")</pre>
  <link href="/w/index.php?title=List of London boroughs&amp;action=edit" rel="edit" tit</pre>
  <link href="/static/apple-touch/wikipedia.png" rel="apple-touch-icon"/>
  <link href="/static/favicon/wikipedia.ico" rel="shortcut icon"/>
  <link href="/w/opensearch desc.php" rel="search" title="Wikipedia (en)" type="applicat</pre>
  <link href="//en.wikipedia.org/w/api.php?action=rsd" rel="EditURI" type="application/r</pre>
  <link href="//creativecommons.org/licenses/by-sa/3.0/" rel="license"/>
  <link href="https://en.wikipedia.org/wiki/List of London boroughs" rel="canonical"/>
  <link href="//login.wikimedia.org" rel="dns-prefetch"/>
  <link href="//meta.wikimedia.org" rel="dns-prefetch"/>
  <!--[if lt IE 9]><script src="/w/load.php?lang=qqx&amp;modules=html5shiv&amp;only=scri
 </head>
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  <div class="noprint" id="mw-head-base"/>
  <div class="mw-body" id="content" role="main">
   <a id="top"/>
   <div class="mw-body-content" id="siteNotice">
    <!-- CentralNotice -->
   </div>
   <div class="mw-indicators mw-body-content">
   <h1 class="firstHeading" id="firstHeading" lang="en">
    List of London boroughs
   <div class="mw-body-content" id="bodyContent">
    <div class="noprint" id="siteSub">
     From Wikipedia, the free encyclopedia
    </div>
    <div id="contentSub"/>
    <div id="jump-to-nav"/>
    <a class="mw-jump-link" href="#mw-head">
```

```
Jump to navigation
</a>
<a class="mw-jump-link" href="#p-search">
Jump to search
</a>
<div class="mw-content-ltr" dir="ltr" id="mw-content-text" lang="en">
 <div class="mw-parser-output">
 <div class="thumb tright">
  <div class="thumbinner" style="width:302px;">
    <a class="image" href="/wiki/File:London-boroughs.svg">
     <img alt="" class="thumbimage" data-file-height="386" data-file-width="489" de</pre>
    </a>
    <div class="thumbcaption">
     <div class="magnify">
     <a class="internal" href="/wiki/File:London-boroughs.svg" title="Enlarge"/>
    Map of the 32 London boroughs and the City of London.
   </div>
  </div>
 </div>
 >
  This is a list of
  <a href="/wiki/Districts of England" title="Districts of England">
   local authority districts
  </a>
  within
  <a href="/wiki/Greater London" title="Greater London">
   Greater London
  </a>
   , including 32
  <a href="/wiki/London_boroughs" title="London boroughs">
   London boroughs
  </a>
   <a href="/wiki/City_of_London" title="City of London">
   City of London
   </a>
   . The London boroughs were all created on 1 April 1965. Upon creation, twelve wer
  <a href="/wiki/Inner London" title="Inner London">
   Inner London
  </a>
  boroughs and the remaining twenty were designated
  <a href="/wiki/Outer London" title="Outer London">
   Outer London
   </a>
  boroughs. The
  <a href="/wiki/Office_for_National_Statistics" title="Office for National Statist</pre>
   Office for National Statistics
  </a>
  has amended the designations of three boroughs for statistics purposes only. Thre
  <a class="mw-redirect" href="/wiki/Royal_borough" title="Royal borough">
   royal borough
  </a>
  and one has
```

```
<a href="/wiki/City status in the United Kingdom" title="City status in 
    city status
  </a>
  . For planning purposes, in addition to the boroughs and City there are also two
  <a href="/wiki/London_Legacy_Development_Corporation" title="London Legacy Development">Legacy_Development_Corporation
    London Legacy Development Corporation
  </a>
  and
  <a href="/wiki/Old Oak and Park Royal Development Corporation" title="Old Oak and
    Old Oak and Park Royal Development Corporation
  </a>
<div class="toc" id="toc">
  <input class="toctogglecheckbox" id="toctogglecheckbox" role="button" style="disp</pre>
  <div class="toctitle" dir="ltr" lang="en">
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       Contents
     </h2>
     <span class="toctogglespan">
       <label class="toctogglelabel" for="toctogglecheckbox"/>
    </span>
  </div>
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          <span class="tocnumber">
            1
         </span>
         <span class="toctext">
           List of boroughs and local authorities
         </span>
       </a>
     <a href="#City of London">
          <span class="tocnumber">
            2
         </span>
          <span class="toctext">
           City of London
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       </a>
     <a href="#See_also">
         <span class="tocnumber">
            3
          </span>
         <span class="toctext">
           See also
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       </a>
     <a href="#Notes">
         <span class="tocnumber">
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   5
   </span>
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   References
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  </a>
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   External links
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  </a>
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 <span class="mw-editsection-bracket">
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Borough
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Local authority
Political control
Headquarters
Area (sq mi)
Population (2013 est)
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  <a href="#cite_note-1">
   [1]
  </a>
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  Nr. in map
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  Barking and Dagenham
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  <a href="#cite note-2">
   [note 1]
  </a>
 </sup>
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     <span class="latitude">
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   </span>
   <span class="geo-multi-punct">
   </span>
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    <span class="vcard">
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 25
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  Barnet
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              </span>
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                   Barnet
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     <span class="longitude">
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   <span class="geo-multi-punct">
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       51.4549; 0.1505
      </span>
     </span>
     <span style="display:none">
      <span class="fn org">
       Bexley
      </span>
     </span>
    </span>
   </span>
  </a>
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23
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  Brent
 </a>
<a href="/wiki/Brent_London_Borough_Council" title="Brent London Borough Council"</pre>
  Brent London Borough Council
 </a>
<a href="/wiki/Labour_Party_(UK)" title="Labour Party (UK)">
 </a>
<a href="/wiki/Brent_Civic_Centre" title="Brent Civic Centre">
  Brent Civic Centre
 </a>
 , Engineers Way
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    <span class="geo-nondefault">
    <span class="geo-dms" title="Maps, aerial photos, and other data for this ]</pre>
     <span class="latitude">
      51°33′32"N
     </span>
     <span class="longitude">
      0°16′54″W
     </span>
    </span>
    </span>
    <span class="geo-multi-punct">
    </span>
    <span class="geo-default">
    <span class="vcard">
     <span class="geo-dec" title="Maps, aerial photos, and other data for this</pre>
      51.5588°N 0.2817°W
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29
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  Labour
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