The Battle of Neighborhoods

Best Borough to move as an Expat in London

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1. Introduction

1.1 Background

London is the **capital** and **largest city** of **England** and the **United Kingdom**. London has been a major settlement for two millennia. London is one of the world's most important **global** cities and has been called the world's most powerful, most desirable, most influential, most visited, most expensive, sustainable, most investment-friendly, and most-popular-for-work city. London also has largest **financial** institutions and is also home to **top-ranked** universities in the world. ([Wiki](#))

1.2 Problem Description

London has always been a dream city for me personally to move and live there. To move to such a vibrant city, one of the main concerns is to find good affordable accommodation in a safe neighborhood. Therefore, in this project, I intend to explore London neighborhoods and find the best the neighborhood to move in. This project could potentially help other people who have similar interests to move to London and live there.

Through this project, I would like to get to know the safest borough (less crime rate as one of main factor) and its neighborhoods venues.

2. Data Description

To get the desired results, following data sources will be used.

1. London Recorded Crime (Crime Data)(Last 24 months data is considered for evaluation)
2. List of London Boroughs (List)
3. Foursquare APIs are used too explore neighborhoods and target different venues according to the presence of needed facilities. The data is stored in the data frame and used for visualization.

2.1 London Crime Data

Crime data recorded from past 24 months is used for analysis in this project. The data consists of 1566 records(rows) and 27 Columns.

	MajorText	MinorText	LookUp_BoroughName	201806	201807	201808	201809	201810	201811	201812	201901	201902	201903	201904	201905	201906	201907	201908
0	Arson and Criminal Damage	Arson	Barking and Dagenham	12	6	5	3	8	5	1	5	2	5	5	11	3	5	3
1	Arson and Criminal Damage	Criminal Damage	Barking and Dagenham	123	127	101	107	132	105	88	97	127	138	130	140	113	134	118
2	Burglary	Burglary - Business and Community	Barking and Dagenham	33	30	18	33	32	39	33	45	24	29	27	21	27	31	35
3	Burglary	Burglary - Residential	Barking and Dagenham	77	94	84	99	94	106	164	114	107	99	96	114	96	71	67
4	Drug Offences	Drug Trafficking	Barking and Dagenham	6	8	7	10	7	7	4	5	2	6	5	9	6	11	7
5	Drug Offences	Possession of Drugs	Barking and Dagenham	69	77	70	72	64	75	69	79	74	117	104	86	100	92	74
6	Miscellaneous Crimes Against Society	Bail Offences	Barking and Dagenham	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Miscellaneous Crimes Against Society	Bigamy	Barking and Dagenham	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Figure 1: London Crime Data for past 24 Months

2.2 List of London Boroughs

The list of Boroughs from London is obtained from Wikipedia page. Size of the data as obtained from data source is 32 rows and 10 columns.

	Borough	Inner	Status	Local authority	Political control	Headquarters	Area (sq mi)	Population	Co-ordinates	Nr. in map
0	Barking and Dagenham [note 1]			Barking and Dagenham London Borough Council	Labour	Town Hall, 1 Town Square	13.93	194,352	51°33'39"N 0°09'21"E / 51.5607°N 0.1557°E /...	25
1	Barnet			Barnet London Borough Council	Conservative	Barnet House, 2 Bristol Avenue, Colindale	33.49	369,088	51°37'31"N 0°09'06"W / 51.6252°N 0.1517°W /...	31
2	Bexley			Bexley London Borough Council	Conservative	Civic Offices, 2 Watling Street	23.38	236,687	51°27'18"N 0°09'02"E / 51.4549°N 0.1505°E /...	23
3	Brent			Brent London Borough Council	Labour	Brent Civic Centre, Engineers Way	16.70	317,264	51°33'32"N 0°16'54"W / 51.5588°N 0.2817°W /...	12
4	Bromley			Bromley London Borough Council	Conservative	Civic Centre, Stockwell Close	57.97	317,899	51°24'14"N 0°01'11"E / 51.4039°N 0.0198°E /...	20
5	Camden	Y		Camden London Borough Council	Labour	Camden Town Hall, Judd Street	8.40	229,719	51°31'44"N 0°07'32"W / 51.5290°N 0.1255°W /...	11
6	Croydon			Croydon London Borough Council	Labour	Bernard Weatherill House, Mint Walk	33.41	372,752	51°22'17"N 0°05'52"W / 51.3714°N 0.0977°W /...	19
7	Ealing			Ealing London Borough Council	Labour	Perceval House, 14-16 Uxbridge Road	21.44	342,494	51°30'47"N 0°18'32"W / 51.5130°N 0.3089°W /...	13
8	Enfield			Enfield London Borough Council	Labour	Civic Centre, Silver Street	31.74	320,524	51°39'14"N 0°04'48"W / 51.6538°N 0.0799°W /...	30
9	Greenwich [note 2]	Y [note 3]	Royal	Greenwich London Borough Council	Labour	Woolwich Town Hall, Wellington Street	18.28	264,008	51°29'21"N 0°03'53"E / 51.4892°N 0.0648°E /...	22

Figure 2: List of Boroughs in London

The data source contains for each Borough in London, data on Population, its coordinates. Population can used to calculate the Crime ratio and co-ordinates can be used to compute the latitude and longitude for each borough. These values are need for Foursquare APIs to analyze the neighborhood data.

BoroughName	Population	Latitude	Longitude
Barking and Dagenham	194352	51.5607	0.1557
Barnet	369088	51.6252	-0.1517
Bexley	236687	51.4549	0.1505
Brent	317264	51.5588	-0.2817
Bromley	317899	51.4039	0.0198
Camden	229719	51.5290	-0.1255
Croydon	372752	51.3714	-0.0977
Ealing	342494	51.5130	-0.3089
Enfield	320524	51.6538	-0.0799
Greenwich	264008	51.4892	0.0648

Figure 3: Customized London Boroughs Data

2.3 Foursquare APIs

Foursquare APIs are used to explore the venues in each of the neighborhoods of London. Data is obtained using the GET Request command from a URL source. The data obtained using these APIs looks as shown in below figure 4.

BoroughName	Borough Latitude	Borough Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Barking and Dagenham	51.5607	0.1557	Central Park	51.559560	0.161981	Park
Barking and Dagenham	51.5607	0.1557	Crowlands Heath Golf Course	51.562457	0.155818	Golf Course
Barking and Dagenham	51.5607	0.1557	Robert Clack Leisure Centre	51.560808	0.152704	Martial Arts Dojo
Barking and Dagenham	51.5607	0.1557	Beacontree Heath Leisure Centre	51.560997	0.148932	Gym / Fitness Center
Barking and Dagenham	51.5607	0.1557	Morrisons	51.559774	0.148752	Supermarket
Barking and Dagenham	51.5607	0.1557	Becontree Heath Bus Station	51.561065	0.150998	Bus Station
Barking and Dagenham	51.5607	0.1557	Dagenham Swimming Pool	51.560946	0.150054	Pool
Barnet	51.6252	-0.1517	The Atrium	51.624726	-0.151933	Café
Barnet	51.6252	-0.1517	Beaconsfield Road (BF)	51.622827	-0.151466	Bus Stop
Barnet	51.6252	-0.1517	Oakleigh Cafe	51.623412	-0.154899	Café

Figure 4: London Venues obtained using Foursqaure APIs

3. Analysis and Modeling

3.1 Exploring Crime Data

Crime data obtained from data source is post processed to remove anomalies. From the crime data, top five and bottom five boroughs with crime incidents are identified. These data are shown below in the two graphs.
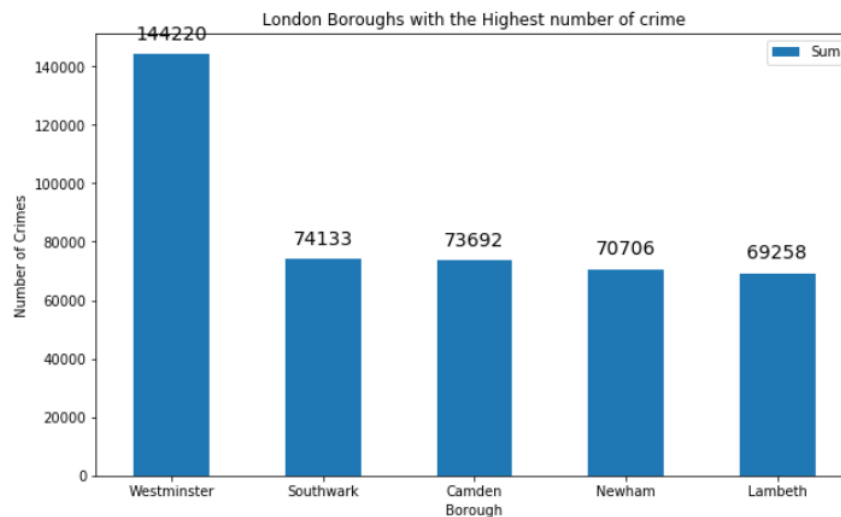

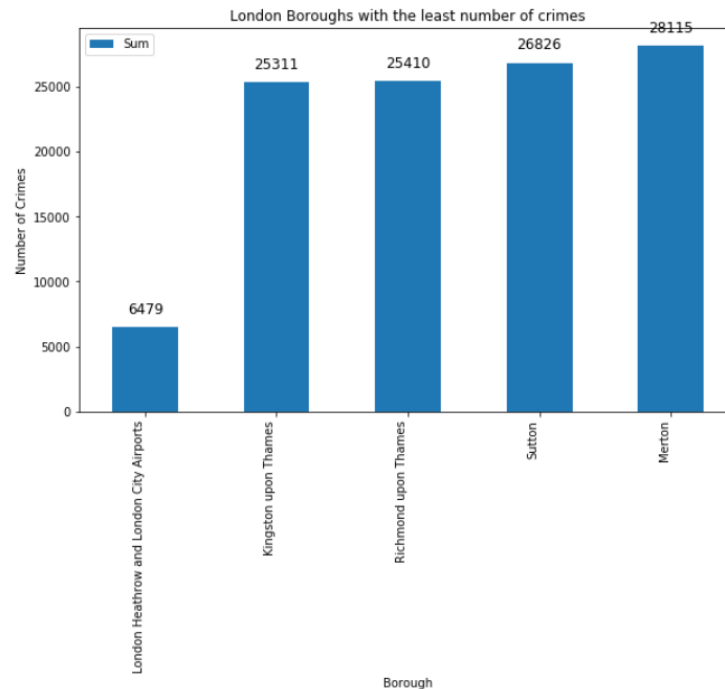*Figure 5: Top 5 Boroughs with highest crime rates*

Figure 6: Bottom 5 Borough with lowest crime rates

Westminster has highest crime rate (probably due to more touristic attractions in the Borough) followed by Southwark, Camden, Newham and Lambeth.

Kingston upon Thames is the Borough with lowest crime incident, by neglecting the airport areas as they are not usually considered for residential locations.

Number of crime incidents doesn't directly indicate the severity and impact of crimes in each borough as each has different area and population. We need to consider ratio of crime incidents to people. As seen from the population per each London borough, it is good assumption to calculate crime ration per 1000 people.
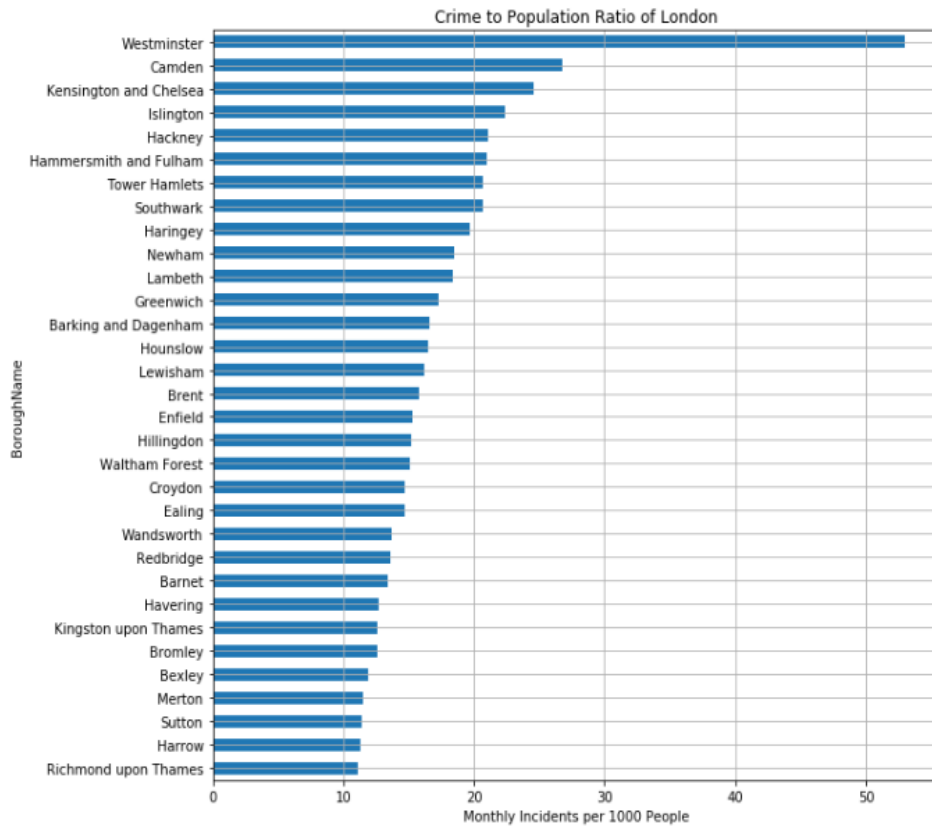
Figure 7: Monthly Average Crime ration per 1000 people

As seen from the above plot, **Westminster** has highest crime rate for every 1000 people (probably due to more touristic attractions in the Borough). **Richmond upon Thames** has lowest crime rate Ratio.

3.2 List of Borough in London

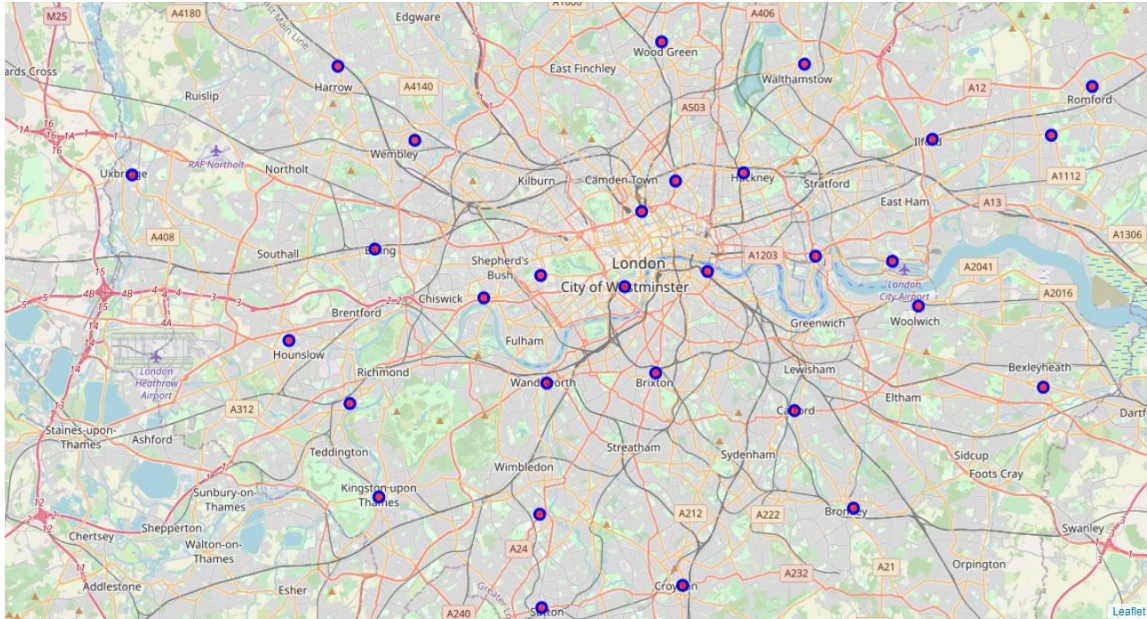Different borough in London are shown in the plot below to get an overview of how big the city of London is.

Figure 8: Borough in London

3.3 Cluster Analysis

Using k-means clustering, boroughs are grouped based on venues present. This data is obtained using Foursquare APIs.
One hot encoding was performed to given binary values to each venue identified.

Figure 9: One hot Encoding

Based on the Frequency of each venue, common venues for each borough is obtained.

	BoroughName	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	Barking and Dagenham	Pool	Bus Station	Supermarket	Park	Golf Course	Gym / Fitness Center	Martial Arts Dojo	Electronics Store	Fish Market	Film Studio
1	Barnet	Café	Bus Stop	Yoga Studio	Gaming Cafe	French Restaurant	Food Court	Flea Market	Fish Market	Film Studio	Fast Food Restaurant
2	Bexley	Coffee Shop	Clothing Store	Pub	Fast Food Restaurant	Italian Restaurant	Supermarket	Pharmacy	Bakery	Sandwich Place	Furniture / Home Store
3	Brent	Coffee Shop	Hotel	Clothing Store	Grocery Store	American Restaurant	Sandwich Place	Sporting Goods Shop	Bar	Hotel Bar	Bubble Tea Shop
4	Bromley	Clothing Store	Coffee Shop	Gym / Fitness Center	Bar	Burger Joint	Pizza Place	Electronics Store	Cosmetics Shop	Portuguese Restaurant	Pub
5	Camden	Hotel	Coffee Shop	Café	Burger Joint	Train Station	Pizza Place	Garden	Breakfast Spot	Deli / Bodega	Used Bookstore
6	Croydon	Pub	Coffee Shop	Portuguese Restaurant	Hotel Bar	Sandwich Place	Malay Restaurant	Gaming Cafe	Burger Joint	Burrito Place	Mediterranean Restaurant
7	Ealing	Coffee Shop	Italian Restaurant	Pizza Place	Hotel	Burger Joint	Vietnamese Restaurant	Park	Pub	Polish Restaurant	Sandwich Place
8	Enfield	Coffee Shop	Clothing Store	Optical Shop	Pub	Pharmacy	Sandwich Place	Shopping Mall	Bookstore	Supermarket	Café
9	Greenwich	Pub	Coffee Shop	Fast Food Restaurant	Clothing Store	Sandwich Place	Hotel	Grocery Store	Pharmacy	Supermarket	Platform

Figure 10: Common Venues for each Borough

Based on the venue categories, k-means clustering was conducted to group(5 clusters) the boroughs. In the plot below, each cluster is represented by a colored dot.
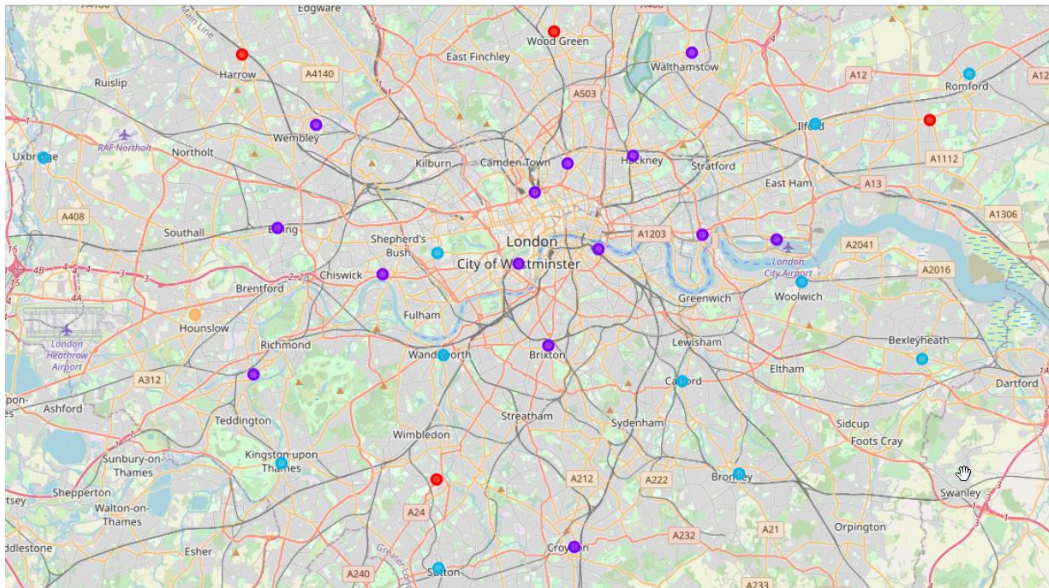

Figure 11: k-means clustering

Common Venues for each Borough are as shown below. Each of cluster is given a name based on the venues present in the area.

Cluster 1: Pools, Gyms, Cafes, Restaurants, Parks and Super Markets→ Fitness Area

	BoroughName	CrimeToPopulation	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
3	Merton	5.764398	0	Italian Restaurant	Café	Supermarket	Bus Stop	Park	Garden Center	Grocery Store	Bar	Bakery	Coffee Shop
4	Harrow	5.652526	0	Indie Movie Theater	Indian Restaurant	Coffee Shop	Supermarket	Fast Food Restaurant	Grocery Store	Yoga Studio	English Restaurant	Food Court	Flea Market
7	Barking and Dagenham	8.299589	0	Pool	Bus Station	Supermarket	Park	Golf Course	Gym / Fitness Center	Martial Arts Dojo	Electronics Store	Fish Market	Film Studio
23	Haringey	9.860528	0	Park	Café	Fast Food Restaurant	Grocery Store	Mediterranean Restaurant	Movie Theater	Bar	Bakery	Gym / Fitness Center	Turkish Restaurant

Cluster 2: Cafes, Pubs, Restaurants, Hotels → **Lively Area**

	BoroughName	CrimeToPopulation	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
1	Richmond upon Thames	5.532621	1	Pub	Coffee Shop	Italian Restaurant	Indian Restaurant	Grocery Store	Steakhouse	Pharmacy	Mediterranean Restaurant	Gastropub	Portuguese Restaurant
8	Hammersmith and Fulham	10.477470	1	Pub	Indian Restaurant	Italian Restaurant	Café	Clothing Store	Japanese Restaurant	Vietnamese Restaurant	Gastropub	Jazz Club	Pharmacy
12	Waltham Forest	7.535042	1	Pub	Pool	Vegetarian / Vegan Restaurant	Pizza Place	Tea Room	Beer Store	Coffee Shop	Gym / Fitness Center	Art Gallery	Deli / Bodega
18	Islington	11.201876	1	Pub	Bakery	Mediterranean Restaurant	Boutique	Theater	Burger Joint	Music Venue	Ice Cream Shop	Liquor Store	Gift Shop
21	Brent	7.905220	1	Coffee Shop	Hotel	Clothing Store	Grocery Store	American Restaurant	Sandwich Place	Sporting Goods Shop	Bar	Hotel Bar	Bubble Tea Shop
				Coffee	Italian				Vietnamese			Polish	Sandwich

Cluster 3: Cafes, Stores, Shopping malls, fast foods → **Busy Area**

	BoroughName	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	Kingston upon Thames	-0.3064	2	Café	Coffee Shop	Italian Restaurant	Pub	Burger Joint	Department Store	Thai Restaurant	Sushi Restaurant	Clothing Store	Portuguese Restaurant
2	Sutton	-0.1945	2	Clothing Store	Pub	Coffee Shop	Department Store	Bar	Italian Restaurant	Pizza Place	Sandwich Place	Café	Fast Food Restaurant
5	Bexley	0.1505	2	Coffee Shop	Clothing Store	Pub	Fast Food Restaurant	Italian Restaurant	Supermarket	Pharmacy	Bakery	Sandwich Place	Furniture / Home Store
6	Havering	0.1837	2	Coffee Shop	Shopping Mall	Clothing Store	Bakery	Fast Food Restaurant	Bookstore	Supermarket	Pub	Café	Department Store
9	Kensington and Chelsea	-0.1947	2	Juice Bar	Café	Clothing Store	Bakery	Restaurant	Burger Joint	Breakfast Spot	Gym / Fitness Center	Pub	Modern European Restaurant

Cluster 4: Cafes, Bus stop, Yoga studio, Gaming Cafe → **Quite Area**

	BoroughName	CrimeToPopulation	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
20	Barnet	26.416013	3	Café	Bus Stop	Yoga Studio	Gaming Cafe	French Restaurant	Food Court	Flea Market	Fish Market	Film Studio	Fast Food Restaurant

Cluster 5: Pizza Place, Cafe, parks, Metro Station → **Noisy Area**

	BoroughName	CrimeToPopulation	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
14	Hounslow	32.46293	4	Pizza Place	Café	Park	Metro Station	Yoga Studio	Event Space	Food Court	Flea Market	Fish Market	Film Studio

4. Results

In Section 3, we collected and analyzed the data for each borough to determine the safety and top venues for each borough. We need to combine both the analysis of crime rate and venues to make a final conclusion for best borough to move in as a expat.

4.1 Safety

For safety, normalizing the Crime to Population values. A borough with score of 1 is assumed the safest place or less crime ration for 1000 people

	BoroughName	CrimeToPopulation	Cluster Labels	Safety
0	Kingston upon Thames	24.885637	2	0.961917
1	Richmond upon Thames	21.708515	1	1.000000
2	Sutton	22.391628	2	0.991812
3	Merton	22.656966	0	0.988631
4	Harrow	22.205376	0	0.994044
5	Bexley	23.397638	2	0.979753
6	Havering	25.013081	2	0.960390
7	Barking and Dagenham	32.583920	0	0.869642
8	Hammersmith and Fulham	41.270952	1	0.765515
9	Kensington and Chelsea	48.614771	2	0.677488

Figure 12: Safety Score of Borough in London

As we see from the above table, **Richmond upon Thames** is safest place followed by **Sutton**.

4.2 Amenities

For best facilities, score based on personal preference are set in the data. For Ex: Highest score for Cluster 2 and lowest for Cluster 5.

	BoroughName	CrimeToPopulation	Cluster Labels	Safety	Amenities
0	Kingston upon Thames	24.885637	2.0	0.961917	1.0
1	Richmond upon Thames	21.708515	1.0	1.000000	0.9
2	Sutton	22.391628	2.0	0.991812	1.0
3	Merton	22.656966	0.8	0.988631	0.0
4	Harrow	22.205376	0.8	0.994044	0.0
5	Bexley	23.397638	2.0	0.979753	1.0
6	Havering	25.013081	2.0	0.960390	1.0
7	Barking and Dagenham	32.583920	0.8	0.869642	0.0
8	Hammersmith and Fulham	41.270952	1.0	0.765515	0.9
9	Kensington and Chelsea	48.614771	2.0	0.677488	1.0

Figure 13: Borough with top venues

4.3 Final selection of borough based on scores

Sutton is good borough to move considering the safety and amenities together followed by **Baxley as** seen in the table below.

	BoroughName	Safety	Amenities	Score
2	Sutton	0.991812	1.0	1.991812
5	Bexley	0.979753	1.0	1.979753
11	Bromley	0.964143	1.0	1.964143
0	Kingston upon Thames	0.961917	1.0	1.961917
6	Havering	0.960390	1.0	1.960390
10	Redbridge	0.939072	1.0	1.939072
13	Wandsworth	0.938054	1.0	1.938054
15	Hillingdon	0.902262	1.0	1.902262
19	Enfield	0.901386	1.0	1.901386
1	Richmond upon Thames	1.000000	0.9	1.900000
17	Lewisham	0.878935	1.0	1.878935
16	Greenwich	0.852783	1.0	1.852783
25	Croydon	0.914100	0.9	1.814100
22	Ealing	0.914006	0.9	1.814006
12	Waltham Forest	0.906097	0.9	1.806097
21	Brent	0.888156	0.9	1.788156

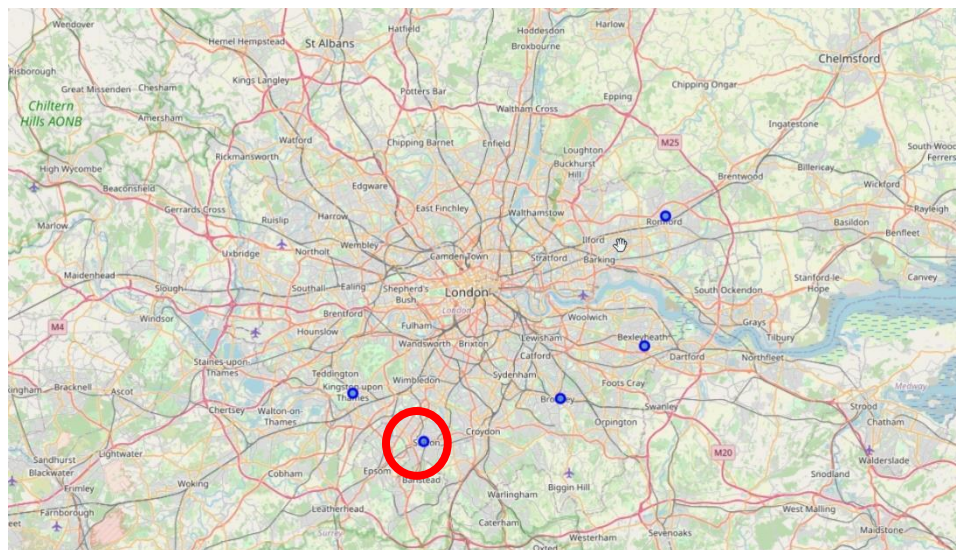*Figure 14: Borough with good venues and less crime rate*

Figure 15: Borough Sutton - Best to Move-in

5. Conclusion

From the analysis done in the course of this project, best five boroughs in London are identified based on the safety and best venues in the neighborhood. These boroughs contain Pubs, Cafes, Restaurants and stores needed for good living and also mixing with local and international people in London.

However, as seen in the map, the above boroughs are a bit far from Central London. It would take considerable amount of time to commute towards central London (assuming the work place location). Moreover, we only considered venues which are popular and have reviews.

We could as well consider each borough individually and all the neighborhoods in each of borough to determine good location.