To Find the best place to construct a student hall in London City

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1.Introduction

1.1 Background

London is considered as one of the popular destinations for higher education where students from all around the world travel to pursue their educations. Overseas students are increasingly selecting London as their study destination of choice, with 2018-19 representing a record year for international students in the UK capital in the past decade.

According to new data from the Higher Education Statistics Agency (HESA), the total number of international students grew 5.8%, representing an uplift in overseas students for the 6th consecutive year, reinforcing London's reputation as a top Higher Education destination on the global stage. The total number of international students at London's universities in 2018-19 is 125,035 which is a 5.8% rise from 2017-18 which demonstrates the UK capital's growing appeal for prospective students.

1.2 Business Problem

International students face a major challenge of finding an accommodation when they move into a new city. In the UK, one of the most common and reliable housing for students are 'Student Halls'. However, it is not easy to secure a place in a student hall as they are in very high demand. Most of the student halls are owned by the Universities and some are privately constructed by real-estate developers. This project is to help one such real-estate developer to construct a student hall in the City of London.

1.3 Interest

By exploring the different neighbourhoods and boroughs in London City, options of a suitable and safe areas to build a student hall is given to the real-estate developer. Through this project, I aim to solve two persistent problems which is for an international student who look for a safe place to stay during their course of study and to a real-estate developer who is looking for a profitable opportunity to build a student hall.

2. Data Description

2.1 Data Collection

This project requires three different sets of data to solve the business problem which is London's Crime data, the list of London boroughs and the different venues from Foursquare API on the basis of amenities and essential facilities in the city.

London Recorded Crime

Data on London Recorded Crime were extracted from the Metropolitan Police's Recorded Crime:GeographicBreakdown(https://data.london.gov.uk/dataset/recorded_crime_summary). This data comprises of fields such as Borough Name, Type of Crime, the number of crimes committed in each month from 01/08/2018 to 31/07/2020.

	MajorText	MinorText	BoroughName	201808	201809	201810	201811	201812	201901	201902	...	201910	201911	201912	202001	202002	202003	202004
0	Arson and Criminal Damage	Arson	Barking and Dagenham	5	3	8	5	1	5	2	...	9	8	6	4	5	6	2
1	Arson and Criminal Damage	Criminal Damage	Barking and Dagenham	101	107	132	105	88	97	127	...	109	97	121	97	103	107	80
2	Burglary	Burglary - Business and Community	Barking and Dagenham	18	33	32	39	33	45	24	...	30	30	25	31	17	28	29
3	Burglary	Burglary - Residential	Barking and Dagenham	84	99	94	106	164	114	107	...	97	114	130	116	123	97	57
4	Drug Offences	Drug Trafficking	Barking and Dagenham	7	10	9	7	4	5	2	...	8	12	3	14	5	6	12

5 rows × 27 columns

Figure1: London Recorded Crime from 01/08/2018 to 31/07/2020

The above table displays the London crime records classified by boroughs and the nature of the crime in the time period - 01/08/2018 to 31/07/2020. There are 1568 observations and 27 columns.

List of London Boroughs

The second set of data which is the list of London Boroughs was extracted from Wikipedia.

List of boroughs and local authorities [edit]

Borough	Inner	Status	Local authority	Political control	Headquarters	Area (sq mi)	Population (2013 est)[1]	Co-ordinates	Nr. in map
Barking and Dagenham [note 1]			Barking and Dagenham London Borough Council	Labour	Town Hall, 1 Town Square	13.93	194,352	51.5607°N 0.1557°E	25
Barnet			Barnet London Borough Council	Conservative	Barnet House, 2 Bristol Avenue, Colindale	33.49	369,088	51.6252°N 0.1517°W	31
Bexley			Bexley London Borough Council	Conservative	Civic Offices, 2 Watling Street	23.38	236,687	51.4549°N 0.1505°E	23
Brent			Brent London Borough Council	Labour	Brent Civic Centre, Engineers Way	16.70	317,264	51.5588°N 0.2817°W	12
Bromley			Bromley London Borough Council	Conservative	Civic Centre, Stockwell Close	57.97	317,899	51.4039°N 0.0198°E	20
Camden	✓		Camden London Borough Council	Labour	Camden Town Hall, Judd Street	8.40	229,719	51.5290°N 0.1255°W	11
Croydon			Croydon London Borough Council	Labour	Bernard Weatherill House, Mint Walk	33.41	372,752	51.3714°N 0.0977°W	19
Ealing			Ealing London Borough Council	Labour	Perceval House, 14-16 Uxbridge Road	21.44	342,494	51.5130°N 0.3089°W	13
Enfield			Enfield London Borough Council	Labour	Civic Centre, Silver Street	31.74	320,524	51.6538°N 0.0799°W	30

Figure 2: List of London Boroughs

Foursquare API

To explore and target recommended locations across different venues according to the presence of amenities and essential facilities, we will access data through FourSquare API interface (https://api.foursquare.com) and arrange them as a dataframe for visualization.

	BoroughName	Borough Latitude	Borough Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Barking and Dagenham	51.5607	0.1557	Central Park	51.559560	0.161981	Park
1	Barking and Dagenham	51.5607	0.1557	Crowlands Heath Golf Course	51.562457	0.155818	Golf Course
2	Barking and Dagenham	51.5607	0.1557	Robert Clack Leisure Centre	51.560808	0.152704	Martial Arts School
3	Barking and Dagenham	51.5607	0.1557	Beacontree Heath Leisure Centre	51.560997	0.148932	Gym / Fitness Center
4	Barking and Dagenham	51.5607	0.1557	Becontree Heath Bus Station	51.561065	0.150998	Bus Station

Figure 3: Foursquare API data

2.2 How the data helps to solve the problem

By merging data from the London Recorded crime, list of boroughs and data on amenities and essential facilities surrounding such properties from FourSquare API interface, we will be able to recommend profitable options for real-estate developers and safe housing situations for prospective students.

3. Methodology section

The Methodology section will describe the main components of our analysis and predication system. The Methodology section comprises four stages:

- Inspection of Data
- Exploration of Data
- Data preparation and preprocessing
- Modeling

3.1 Inspection of Data

a) London Recorded Crime data

The first set of data to be extracted in the London Recorded Crime data for the time period 01/08/2018 to 31/07/2020. The data set(figure1) was then cleaned and only the fields which are relevant to our project is taken. Additionally, information such as sum of crime incidents in the 24 months, monthly average, the borough with the most and least incidents are calculated from the data because it will be helpful in recommending solutions to our problem statement.

	BoroughName	Sum
0	Barking and Dagenham	38847
1	Barnet	59213
2	Bexley	33772
3	Brent	59732
4	Bromley	47529
5	Camden	72064
6	Croydon	66466
7	Ealing	60576
8	Enfield	58738
9	Greenwich	54906

Figure 4: Sum of incidents in London

	BoroughName	MonthlyAverage
0	Barking and Dagenham	1618.625000
1	Barnet	2467.208333
2	Bexley	1407.166667
3	Brent	2488.833333
4	Bromley	1980.375000
5	Camden	3002.666667
6	Croydon	2769.416667
7	Ealing	2524.000000
8	Enfield	2447.416667
9	Greenwich	2287.750000

Figure 5: Monthly Average of incidents in London

b) List of London Boroughs

The second set of data(figure2), which is the list of London bouroughs is extracted from Wikipedia. Columns like Population and Coordinates will be useful to calculate the ratio of reported crime to population and get neighborhood data from FourSquare respectively. After cleaning, the dataframe looks like as follows:

	BoroughName	Population	Coordinates
0	Barking and Dagenham	194,352	51°33′39″N 0°09′21″E / 51.5607°N 0.1557°E /...
1	Barnet	369,088	51°37′31″N 0°09′06″W / 51.6252°N 0.1517°W /...
2	Bexley	236,687	51°27′18″N 0°09′02″E / 51.4549°N 0.1505°E /...
3	Brent	317,264	51°33′32″N 0°16′54″W / 51.5588°N 0.2817°W /...
4	Bromley	317,899	51°24′14″N 0°01′11″E / 51.4039°N 0.0198°E /...

Figure 6: List of Boroughs with Coordinates

The final dataframe comprises of the population, Latitude and Longitude coordinates of each borough.

	BoroughName	Population	Latitude	Longitude
0	Barking and Dagenham	194352	51.5607	0.1557
1	Barnet	369088	51.6252	-0.1517
2	Bexley	236687	51.4549	0.1505
3	Brent	317264	51.5588	-0.2817
4	Bromley	317899	51.4039	0.0198

Figure 7: List of Boroughs after simplification

c) Foursquare API

The list of top 50 popular places in the neighborhood is accessed through FourSquare API interface and it will be arranged as a dataframe for visualization. This will be helpful in exploring and recommending locations across different venues according to the presence of amenities and essential facilities.

	BoroughName	Borough Latitude	Borough Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Barking and Dagenham	51.5607	0.1557	Central Park	51.559560	0.161981	Park
1	Barking and Dagenham	51.5607	0.1557	Crowlands Heath Golf Course	51.562457	0.155818	Golf Course
2	Barking and Dagenham	51.5607	0.1557	Robert Clack Leisure Centre	51.560808	0.152704	Martial Arts School
3	Barking and Dagenham	51.5607	0.1557	Beacontree Heath Leisure Centre	51.560997	0.148932	Gym / Fitness Center
4	Barking and Dagenham	51.5607	0.1557	Becontree Heath Bus Station	51.561065	0.150998	Bus Station

Figure 8: Foursquare API data

3.2 Exploration of Data

Now that the dataset is cleansed, visualizations were created to gain insights

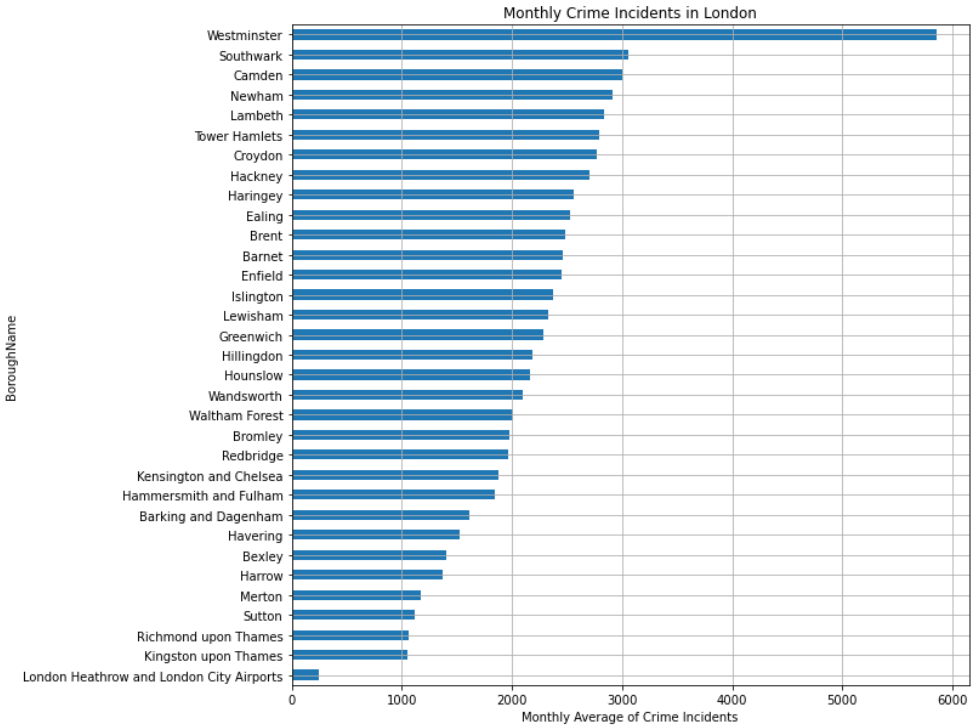

Figure 9: Exploratory Analysis

The above bar chart represents the different boroughs in descending order of monthly crime incidents. Westminster has the highest number of reported crime incidents followed by Southwark and Camden. This initial information gained was helpful in the following processing stages.

3.3) Data preparation and preprocessing

At this stage, we prepare our dataset for the modeling process, opting for the most suitable machine learning algorithm for our scope. Accordingly, we perform the following steps:

- Dropping columns which are not required for the modelling process.
- Combining and Merging data.
- Visualizing the Crime data.
- Join the data to find the coordinates of locations to make further recommendations.
- Plot recommended locations on London map.

From the previous stage (Figure 9), We observed that Westminster has the highest number of reported crimes. However, the different boroughs have different sizes of population and it is not wise to directly compare the absolute number of incidents. So, the ration of crime incidents to population were compared. Hence, the number of recorded crimes per 1000 people were calculated and are displayed below.

	BoroughName	MonthlyAverage	Population	Latitude	Longitude
0	Barking and Dagenham	1618.625000	194352	51.5607	0.1557
1	Barnet	2467.208333	369088	51.6252	-0.1517
2	Bexley	1407.166667	236687	51.4549	0.1505
3	Brent	2488.833333	317264	51.5588	-0.2817
4	Bromley	1980.375000	317899	51.4039	0.0198

Figure 10: Preprocessing- Stage1

	BoroughName	MonthlyAverage	Population	Latitude	Longitude	CrimeToPop
0	Barking and Dagenham	1618.625000	194352	51.5607	0.1557	8.328317
1	Barnet	2467.208333	369088	51.6252	-0.1517	6.684607
2	Bexley	1407.166667	236687	51.4549	0.1505	5.945264
3	Brent	2488.833333	317264	51.5588	-0.2817	7.844676
4	Bromley	1980.375000	317899	51.4039	0.0198	6.229573

Figure 11: Preprocessing- Stage2

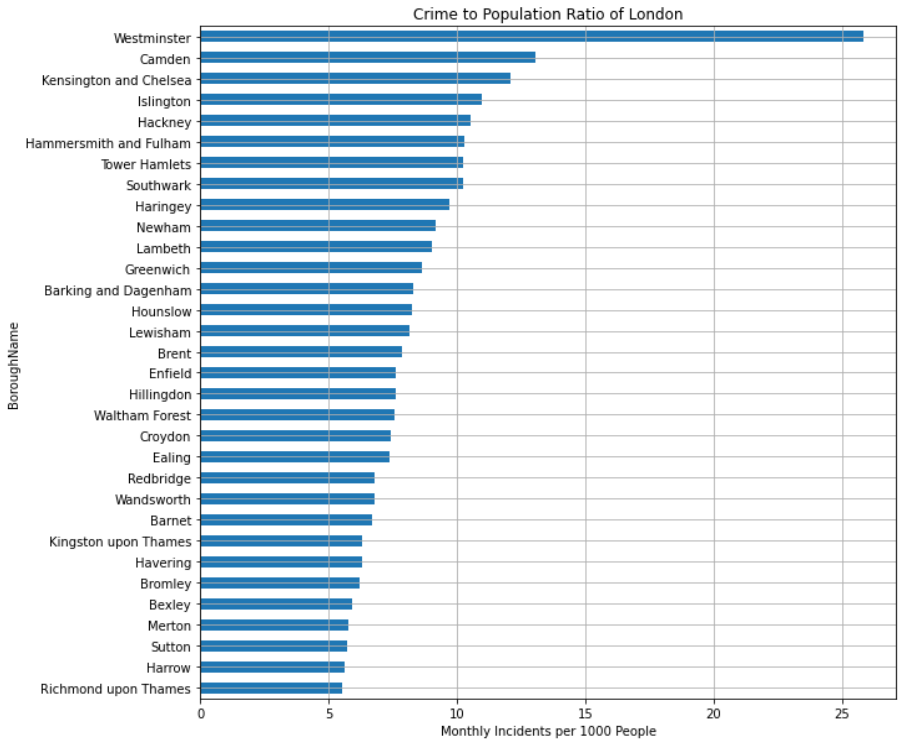

Figure 13: Crime to population ratio per 1000 people

Now, we can now see that Westminster and Camden are the top 2 dangerous areas whereas Southwark and Newham go further down the list.

The locations of each borough were plotted in the map to get an idea about the Greater London area.

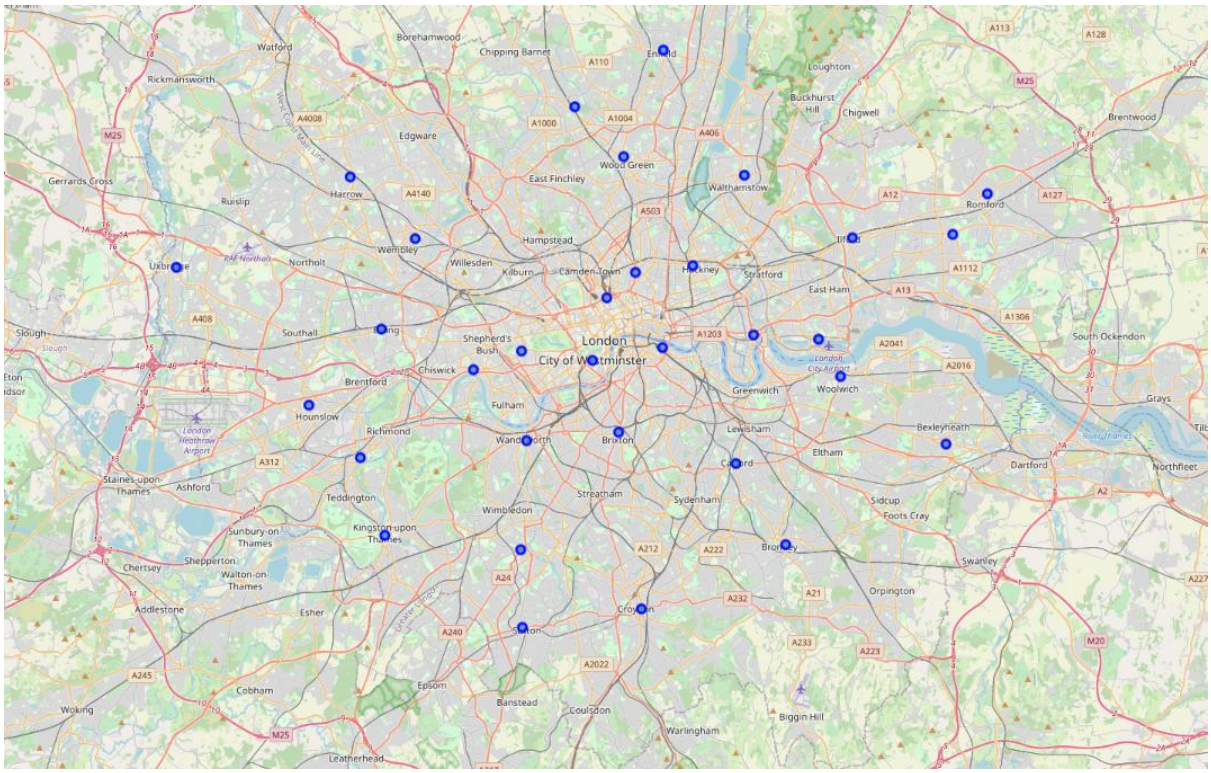

Figure 14: Map of Greater London area with location of boroughs

3.4) Modeling

Cluster Analysis

After exploring the dataset and gaining insights into it, we are ready to use the clustering methodology to analyse real estates. We will use the k-means clustering technique to group the boroughs according to what convenience facilities they have using Foursquare data.

First, one hot encoding was conducted to give binary values to each venue category

	BoroughName	African Restaurant	Airport	Airport Lounge	Airport Service	American Restaurant	Argentinian Restaurant	Art Gallery	Art Museum	Arts & Crafts Store	...	Used Bookstore	Vegetarian / Vegan Restaurant	Video Game Store	Vietnamese Restaurant	Warehouse Store	Wine Bar	Wine Shop	Winery	Women's Store	Yoga Studio
0	Barking and Dagenham	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
1	Barking and Dagenham	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
2	Barking and Dagenham	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	Barking and Dagenham	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	Barking and Dagenham	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

5 rows × 190 columns

Figure 15: One hot encoding

Second, the data was then grouped by borough names to find out how many venues of each category exists in the boroughs within the top 50 venues. Some boroughs displayed less than 50 venues due to the lack of Foursquare data hence the category counts were altered to a frequency of how often the category appears among others. Based in the frequency, a list of the most common venue categories in each borough were displayed as follows:

	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	Gym / Fitness Center	Martial Arts School	Park	Golf Course	Dumpling Restaurant	Fast Food Restaurant	Farmers Market
1	Barnet	Café	Bus Stop	Yoga Studio	Creperie	Fish Market	Fish & Chips Shop	Film Studio	Fast Food Restaurant	Farmers Market	Event Space
2	Bexley	Pub	Coffee Shop	Clothing Store	Pharmacy	Fast Food Restaurant	Supermarket	Bakery	Plaza	Department Store	Portuguese Restaurant
3	Brent	Coffee Shop	Hotel	Grocery Store	Clothing Store	Bar	Sandwich Place	Sporting Goods Shop	American Restaurant	Indian Restaurant	Italian Restaurant
4	Bromley	Coffee Shop	Clothing Store	Pizza Place	Burger Joint	Gym / Fitness Center	Bar	Portuguese Restaurant	Chocolate Shop	Supermarket	Bookstore

Figure 16: Clustering Stage1

Third, the monthly average, population, coordinates, crime to population and the common venues were all merged into one single data frame and is displayed below:

	BoroughName	MonthlyAverage	Population	Latitude	Longitude	CrimeToPop	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	Barking and Dagenham	1618.625000	194352	51.5607	0.1557	8.328317	3	Pool	Bus Station	Supermarket	Gym / Fitness Center	Martial Arts School	Park	Golf Course	Dumpling Restaurant	Fast Food Restaurant	Farmers Market
1	Barnet	2467.208333	369088	51.6252	-0.1517	6.684607	2	Café	Bus Stop	Yoga Studio	Creperie	Fish Market	Fish & Chips Shop	Film Studio	Fast Food Restaurant	Farmers Market	Event Space
2	Bexley	1407.166667	236687	51.4549	0.1505	5.945264	3	Pub	Coffee Shop	Clothing Store	Pharmacy	Fast Food Restaurant	Supermarket	Bakery	Plaza	Department Store	Portuguese Restaurant
3	Brent	2488.833333	317264	51.5588	-0.2817	7.844676	1	Coffee Shop	Hotel	Grocery Store	Clothing Store	Bar	Sandwich Place	Sporting Goods Shop	American Restaurant	Indian Restaurant	Italian Restaurant
4	Bromley	1980.375000	317899	51.4039	0.0198	6.229573	3	Coffee Shop	Clothing Store	Pizza Place	Burger Joint	Gym / Fitness Center	Bar	Portuguese Restaurant	Chocolate Shop	Supermarket	Bookstore

Figure 17: Clustering Stage 2

Based on the venue categories, K-means clustering was conducted to categorize and group the boroughs based on their similarity. The coloured dots represent the different clusters.

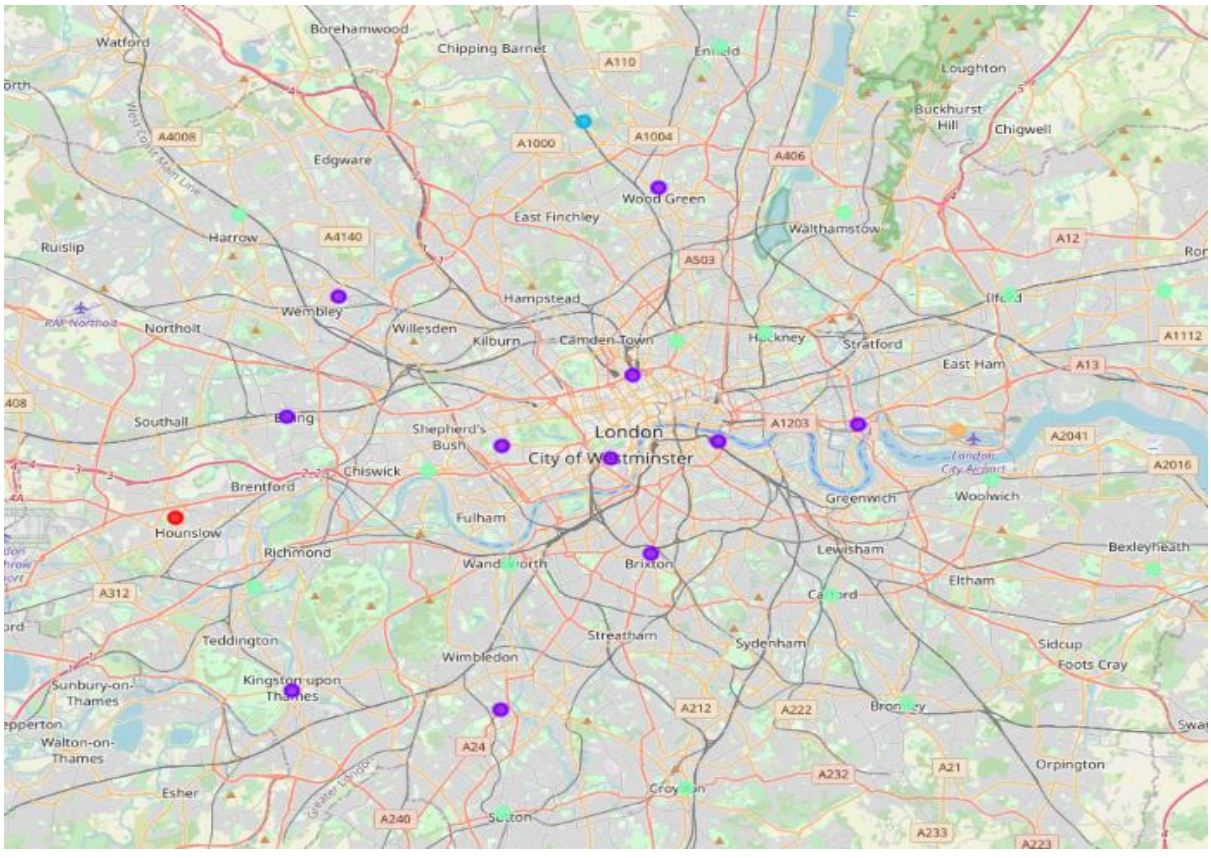

Figure 18: Mapping of Clusters

Now that the clusters are grouped, name tags are given based on their characteristics

Cluster 0: Lively Area (Restaurants, Markets)

	BoroughName	CrimeToPop	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
16	Hounslow	8.23768	0	Pizza Place	Café	Park	Bed & Breakfast	Yoga Studio	Electronics Store	Fish & Chips Shop	Film Studio	Fast Food Restaurant	Farmers Market

Figure 19: Cluster 0

Cluster 1: Hangout Area (Pubs, cafes)

	BoroughName	CrimeToPop	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	Brent	7.844676	1	Coffee Shop	Hotel	Grocery Store	Clothing Store	Bar	Sandwich Place	Sporting Goods Shop	American Restaurant	Indian Restaurant	Italian Restaurant
5	Camden	13.071042	1	Café	Hotel	Coffee Shop	Burger Joint	Breakfast Spot	Deli / Bodega	Pizza Place	Sandwich Place	Train Station	Event Space
7	Ealing	7.369472	1	Coffee Shop	Italian Restaurant	Clothing Store	Park	Vietnamese Restaurant	Burger Joint	Pizza Place	Hotel	Pub	Gym / Fitness Center
12	Haringey	9.736344	1	Bus Stop	Park	Turkish Restaurant	Supermarket	Light Rail Station	Mediterranean Restaurant	Café	Bar	Bakery	Pub
18	Kensington and Chelsea	12.076569	1	Juice Bar	Café	Bakery	Restaurant	Gym / Fitness Center	French Restaurant	Italian Restaurant	Burger Joint	Clothing Store	Gym
19	Kingston upon Thames	6.313714	1	Coffee Shop	Café	Burger Joint	Pub	Italian Restaurant	Sushi Restaurant	Department Store	Furniture / Home Store	French Restaurant	Burrito Place
20	Lambeth	9.044648	1	Market	Caribbean Restaurant	Pub	Restaurant	Indian Restaurant	Cocktail Bar	Nightclub	Pizza Place	Beer Bar	BBQ Joint
22	Merton	5.787772	1	Café	Italian Restaurant	Supermarket	Park	Pizza Place	Bakery	Burger Joint	Fast Food Restaurant	Garden Center	Sandwich Place
26	Southwark	10.239928	1	Coffee Shop	Hotel	Pub	English Restaurant	Hotel Bar	Art Gallery	Pizza Place	Theater	Deli / Bodega	Café
28	Tower Hamlets	10.244512	1	Hotel	Italian Restaurant	Coffee Shop	Sandwich Place	Café	Gym / Fitness Center	Grocery Store	Light Rail Station	Outdoor Sculpture	Pizza Place
31	Westminster	25.818562	1	Coffee Shop	Hotel	Theater	Sandwich Place	Sporting Goods Shop	Hotel Bar	Sushi Restaurant	Juice Bar	Breakfast Spot	Café

Figure 20: Cluster 1

Cluster 2: Quiet Area (Yoga studios)

	BoroughName	CrimeToPop	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	Barnet	6.684607	2	Café	Bus Stop	Yoga Studio	Creperie	Fish Market	Fish & Chips Shop	Film Studio	Fast Food Restaurant	Farmers Market	Event Space

Figure 21: Cluster 2

Cluster 3: Busy Area (Coffee Shops, Clothing Stores)

	BoroughName	CrimeToPop	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	Barking and Dagenham	8.328317	3	Pool	Bus Station	Supermarket	Gym / Fitness Center	Martial Arts School	Park	Golf Course	Dumpling Restaurant	Fast Food Restaurant	Farmers Market
2	Bexley	5.945264	3	Pub	Coffee Shop	Clothing Store	Pharmacy	Fast Food Restaurant	Supermarket	Bakery	Plaza	Department Store	Portuguese Restaurant
4	Bromley	6.229573	3	Coffee Shop	Clothing Store	Pizza Place	Burger Joint	Gym / Fitness Center	Bar	Portuguese Restaurant	Chocolate Shop	Supermarket	Bookstore
6	Croydon	7.429649	3	Pub	Coffee Shop	Portuguese Restaurant	Asian Restaurant	Nightclub	Bus Stop	Bookstore	Breakfast Spot	Food Court	Spanish Restaurant
8	Enfield	7.635674	3	Coffee Shop	Clothing Store	Supermarket	Pub	Bookstore	Pharmacy	Department Store	Shopping Mall	Optical Shop	Fast Food Restaurant
9	Greenwich	8.665457	3	Clothing Store	Pub	Fast Food Restaurant	Coffee Shop	Hotel	Supermarket	Sandwich Place	Plaza	Pharmacy	Grocery Store
10	Hackney	10.516268	3	Pub	Brewery	Coffee Shop	Bakery	Grocery Store	Clothing Store	Modern European Restaurant	Café	Cocktail Bar	Vegetarian / Vegan Restaurant
11	Hammersmith and Fulham	10.313307	3	Pub	Indian Restaurant	Italian Restaurant	Café	Gastropub	Clothing Store	Vietnamese Restaurant	Japanese Restaurant	Park	Chinese Restaurant
13	Harrow	5.621538	3	Indian Restaurant	Platform	Thai Restaurant	Grocery Store	Fast Food Restaurant	Coffee Shop	Supermarket	Indie Movie Theater	Art Museum	Arts & Crafts Store
14	Havering	6.295440	3	Clothing Store	Coffee Shop	Shopping Mall	Hotel	Pub	Fast Food Restaurant	Department Store	Bookstore	Bakery	Café
15	Hillingdon	7.618971	3	Coffee Shop	Clothing Store	Italian Restaurant	Fast Food Restaurant	Pharmacy	Pizza Place	Toy / Game Store	Burger Joint	Electronics Store	Supermarket
17	Islington	10.989164	3	Pub	Park	Mediterranean Restaurant	Boutique	French Restaurant	Theater	Bakery	Burger Joint	Ice Cream Shop	Cocktail Bar
21	Lewisham	8.159637	3	Supermarket	Grocery Store	Platform	Italian Restaurant	Train Station	Coffee Shop	Cocktail Bar	Theater	Shopping Mall	Fast Food Restaurant
24	Redbridge	6.816623	3	Fast Food Restaurant	Supermarket	Clothing Store	Bakery	Coffee Shop	Grocery Store	Sandwich Place	Department Store	Portuguese Restaurant	Buffet
25	Richmond upon Thames	5.525000	3	Coffee Shop	Pub	Italian Restaurant	Indian Restaurant	Japanese Restaurant	Grocery Store	Pharmacy	Bus Stop	Fish Market	Gastropub
27	Sutton	5.711264	3	Pub	Clothing Store	Coffee Shop	Pizza Place	Department Store	Italian Restaurant	Sandwich Place	Café	Bar	Bookstore
29	Waltham Forest	7.560751	3	Pub	Gym / Fitness Center	Pool	Construction & Landscaping	Concert Hall	Coffee Shop	Deli / Bodega	Beer Store	Tea Room	Grocery Store
30	Wandsworth	6.774611	3	Clothing Store	Pub	Coffee Shop	Burger Joint	Gym / Fitness Center	Breakfast Spot	Asian Restaurant	Supermarket	Sandwich Place	Thai Restaurant

Figure 22: Cluster 3

Cluster 4: Traveller Area (Airports, Lounges, Hotels)

	BoroughName	CrimeToPop	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
23	Newham	9.169424	4	Hotel	Currency Exchange	Rafting	Sandwich Place	Pharmacy	Airport Service	Airport Lounge	Airport	Chinese Restaurant	Film Studio

Figure 23: Cluster 4

4 Results

Now we will review all the analysis made in this project before we make a conclusion on which area to live as an international student or invest as a real-estate developer.

Like mentioned in the beginning, our key criteria of location decision will be based on safety and atmosphere.

4.1 Safety

Safety can be determined by the criminal rate we have calculated. We can use the 'CrimeToPop' (Recorded crime per 1000 people) as our safety score.

	BoroughName	CrimeToPop	Cluster Labels	Safety
0	Barking and Dagenham	8.328317	3	0.861862
1	Barnet	6.684607	2	0.942858
2	Bexley	5.945264	3	0.979291
3	Brent	7.844676	1	0.885694
4	Bromley	6.229573	3	0.965281

Figure 24: Determination of Safety score

4.2 Atmosphere

And from the cluster analysis made above, we will give each clusters a name according to the characteristics inferable from the popular venues.

	BoroughName	CrimeToPop	Cluster Labels	Safety	Atmosphere
0	Barking and Dagenham	8.328317	3	0.861862	0
1	Barnet	6.684607	2	0.942858	0
2	Bexley	5.945264	3	0.979291	0
3	Brent	7.844676	1	0.885694	0
4	Bromley	6.229573	3	0.965281	0

Figure 25: Determination of Atmosphere score

5 Discussions and Recommendations

Preference of Atmosphere defers with each person. As a student, who has lived in London for couple of years I would prefer to score the clusters based on my opinion for the sake of this project. The order I decide to weigh the clusters are: Busy Area, Lively Area, Hangout Area, Quiet Area, and Traveller Area.

Weighted score table

Finally, the scores of each borough is calculated by adding the two scores (safety and atmosphere)

	BoroughName	Safety	Atmosphere	Score
1	Barnet	0.942858	1.0	1.942858
22	Merton	0.987051	0.9	1.887051
19	Kingston upon Thames	0.961135	0.9	1.861135
7	Ealing	0.909110	0.9	1.809110
3	Brent	0.885694	0.9	1.785694
20	Lambeth	0.826563	0.9	1.726563
25	Richmond upon Thames	1.000000	0.7	1.700000
13	Harrow	0.995243	0.7	1.695243
12	Haringey	0.792479	0.9	1.692479
27	Sutton	0.990822	0.7	1.690822
2	Bexley	0.979291	0.7	1.679291
26	Southwark	0.767664	0.9	1.667664
28	Tower Hamlets	0.767438	0.9	1.667438
4	Bromley	0.965281	0.7	1.665281
14	Havering	0.962035	0.7	1.662035
30	Wandsworth	0.938423	0.7	1.638423
24	Redbridge	0.936353	0.7	1.636353
6	Croydon	0.906145	0.7	1.606145
29	Waltham Forest	0.899685	0.7	1.599685
15	Hillingdon	0.896816	0.7	1.596816
8	Enfield	0.895993	0.7	1.595993
18	Kensington and Chelsea	0.677160	0.9	1.577160
21	Lewisham	0.870174	0.7	1.570174
0	Barking and Dagenham	0.861862	0.7	1.561862
9	Greenwich	0.845249	0.7	1.545249
5	Camden	0.628156	0.9	1.528156
11	Hammersmith and Fulham	0.764048	0.7	1.464048
10	Hackney	0.754047	0.7	1.454047
17	Islington	0.730744	0.7	1.430744
31	Westminster	-0.000000	0.9	0.900000
16	Hounslow	0.866328	0.0	0.866328
23	Newham	0.820415	0.0	0.820415

Figure 26: Weighted Score Table

The above table displays the boroughs which are suitable to construct a student hall based on the weighted score. Barnet, Merton, Kingston upon Thames, Ealing and Brent are among the top places recommended by the safety and atmosphere scores to the students and real-estate developers.

6 Conclusions

Based on our analysis, the five boroughs below are the best places to build a student hall with regards to safety and atmosphere of the neighborhood. The top five boroughs all belong to the Busy Area cluster and Hangout Area Clusters with many Pubs, coffee shops and clothing stores. Therefore, what differentiates them is the safety score, which was calculated from monthly recorded crimes per 1000 people.

	BoroughName	MonthlyAverage	Population	Latitude	Longitude	CrimeToPop
1	Barnet	2467.208333	369088	51.6252	-0.1517	6.684607
22	Merton	1176.208333	203223	51.4014	-0.1958	5.787772
19	Kingston upon Thames	1053.083333	166793	51.4085	-0.3064	6.313714
7	Ealing	2524.000000	342494	51.5130	-0.3089	7.369472
3	Brent	2488.833333	317264	51.5588	-0.2817	7.844676

Figure 28: Top five suitable places to construct a Student Hall

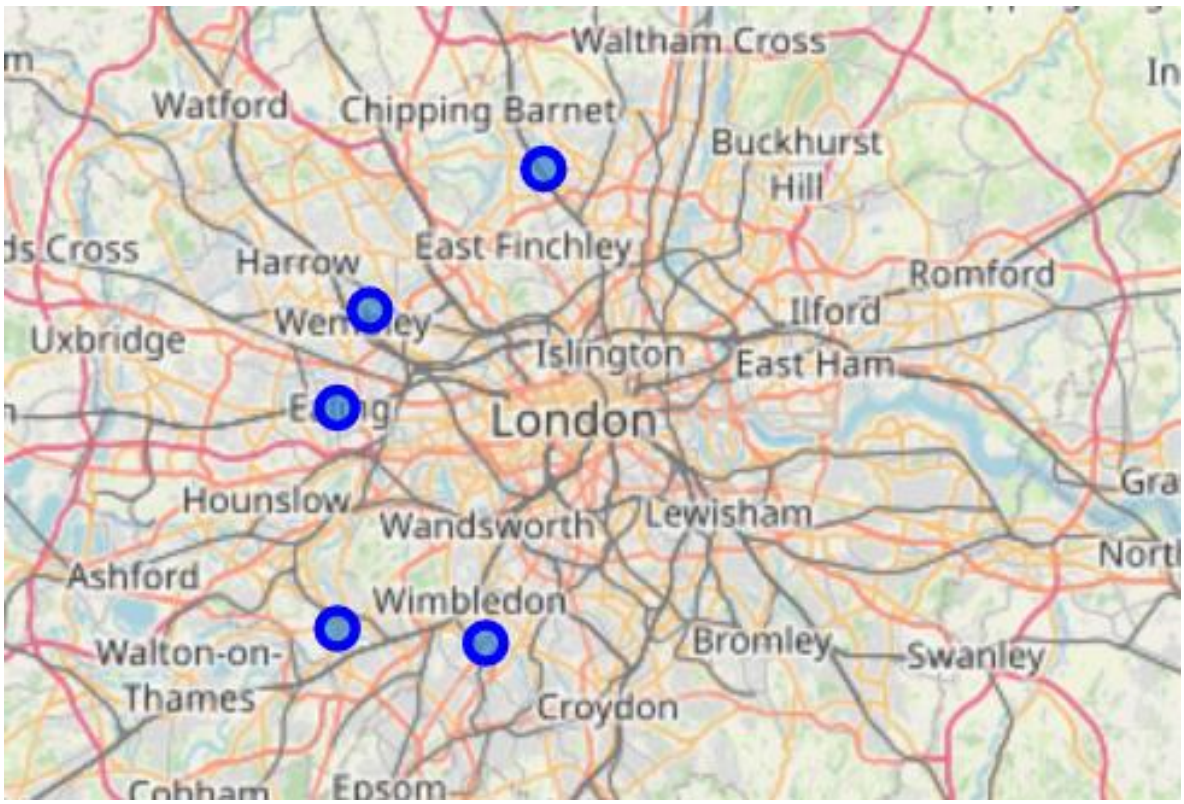

Figure 28: Mapping of the top five suitable places to construct a Student Hall

7 Limitations

One of the limitations in this research is that the best places recommended are far away from the city center and in the suburbs. This is because, only popular venues and the number crime incidents were taken into account to recommend a safe and profitable location to build a student hall. Therefore, a crime which is as serious as homicides were treated as same as petty burglaries. Also, venues with popular stores were only taken into account but we have not considered its importance to a student.

Further research needs to be done on the basis of distance from the city centre, level of seriousness of each crime, current housing prices to overcome this limitation. However, this research still holds good because of the in-depth exploration of each neighborhood and recommendations of suitable places to construct a student hall based on the limited categories taken in to account for the purpose of this project.