

Capstone  
Project

- The Battle of  
Neighborhoods  
Presentation  
AVI PATEL

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# 1. Introduction

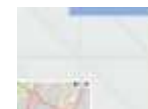
- Background: Safety is a top concern when moving to a new area. If you don't feel safe in your own home, you're not going to be able to enjoy living there.
- Problem: This project aims to select the safest borough in London based on the total crimes, explore the neighborhoods of that borough to find the 10 most common venues in each neighborhood and finally cluster the neighborhoods using k-mean clustering.
- Interest: Expats who are considering to relocate to London will be interested to identify the safest borough in London and explore its neighborhoods and common venues around each neighborhood.

Boroughs with the lowest crime rates



Neighborhoods in Kingston upon Thames

1 2 3 4 5 6 7 8 9 10



## DATA ACQUISITION

Data Acquisition: The data acquired for this project is a combination of data from three sources:

- The first data source of the project uses a London crime data that shows the crime per borough in London.
- The second source of data is scraped from a wikipedia page that contains the list of London boroughs. This page contains additional information about the boroughs.
- The third data source is the list of Neighborhoods in the Royal Borough of Kingston upon Thames as found on the wikipedia page.

Data Cleaning: The data cleaning process for each of the three sources of data are done separately.

- From the London crime data, the crimes during the most recent year (2016) are only selected. The major categories of crime are pivoted to get the total crimes per the boroughs for each major category.
- The second data is scraped from a wikipedia page using the Beautiful Soup library in python. Using this library we can extract the data in the tabular format as shown in the website.
- The two data sets are merged on the Borough names to form a new data set. The purpose of this data set is to visualize the crime rates in each borough and identify the borough with the least crimes recorded during the year 2016.
- After visualizing the crime in each borough we can find the borough with the lowest crime rate. The third data set is created, with the names of the neighborhoods and the name of the borough with the latitude and longitude obtained using Google Maps API geocoding.
- The new data set is used to generate the 10 most common venues for each neighborhood using the Foursquare API, finally using k means clustering algorithm to cluster similar neighborhoods together.

## METHODOLOGY

3.

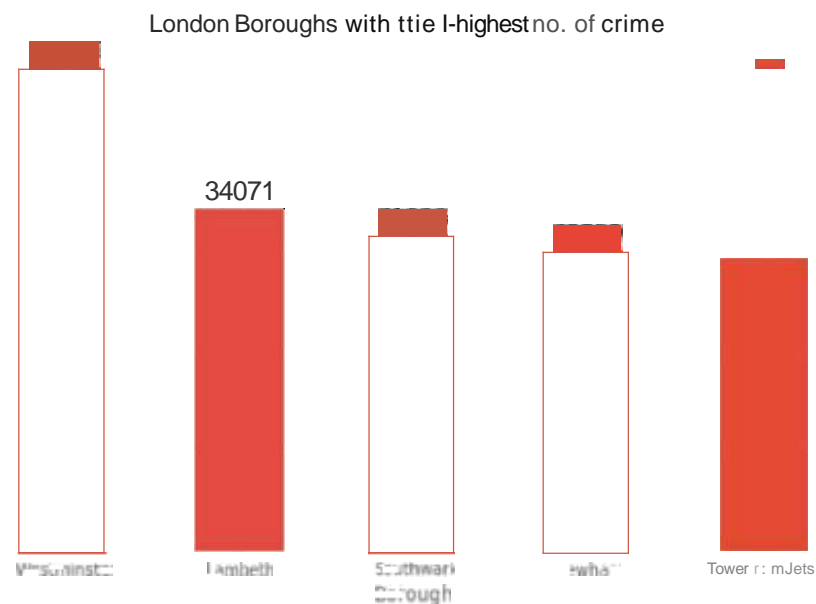
### Exploratory Data Analysis

#### Statistical summary of crimes

Burglary	Criminal Damage	Drugs	Other Notifiable Offences	Robbery	Theft and Handling	Violence Against the Person	Total
mean 208e.242424	194a.S4S45S 117B GUI 21				33.000000		
std 737.448844	625.107070	58 400418	479.060606	682.666657	8010.121212	TO41.848485 12R0KB8B070	
rdn Z.000Qet	2.00t IXI 10.IAI0000		223.2B08B8	441.426300	4420.666054	ZS13.801551 8828 874B	
OSL 1531.0000EO	185ILOAXK 743		6.000000	4.000000	110.0000IKI	2S.000XXI	
60X 1071.000IXAf	1086.IAI0000 1086.IAI0000		978.00XXXI	377.IX000EI	5819.000000	5936.000000 16208.000000	1781
y63« 28s1.000lzz	SZS1.aAzzz 1617.0zz1000		490.000000	599.000000	802IL0000IXI	7408.0000XAI 22730.IXXX00	
max 3402.0000EB	SZ16.0000QI 2738.IAI0000		551.000000	936.000000	10780 ACOIKI	8832.000000 a7174.	
			130S.0000XAI 1822.IAI00IXI	27520.000000		10834.0000XXI 48330AXXIt10	

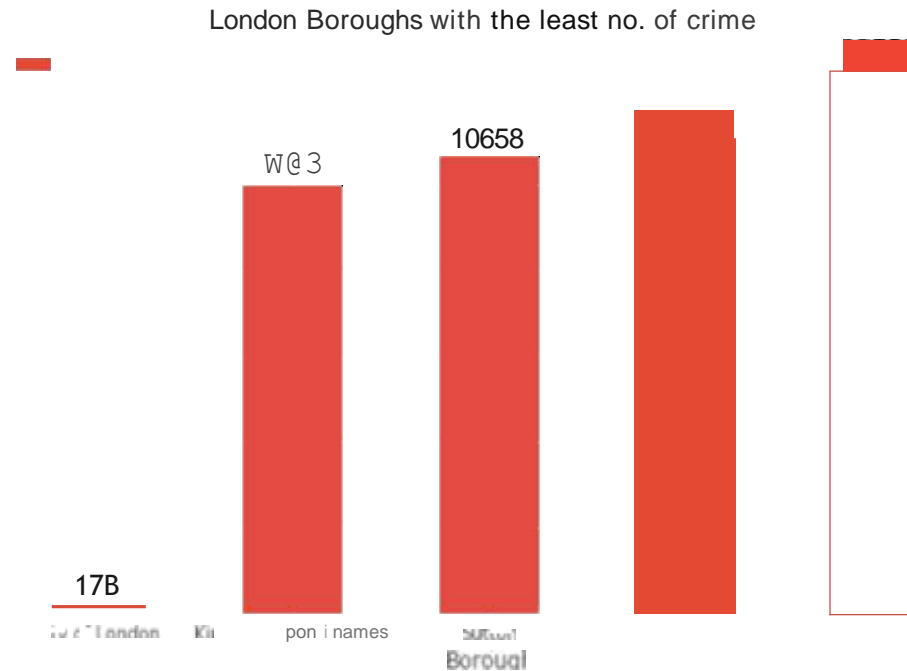
The count for each of the major categories of crime returns the value 33 which is the number of London boroughs. 'Theft and Handling' is the highest reported crime during the year 2016 followed by 'Violence against the person', 'Criminal damage'. The lowest recorded crimes are 'Drugs', 'Robbery' and 'Other Notifiable offenses'

## Boroughs with the highest crime rates



Comparing five boroughs with the highest crime rate during the year 2016 it is evident that Westminster has the highest crimes recorded followed by Lambeth, Southwark, Newham and Tower Hamlets. Westminster has a significantly higher crime rate than the other 4 boroughs.

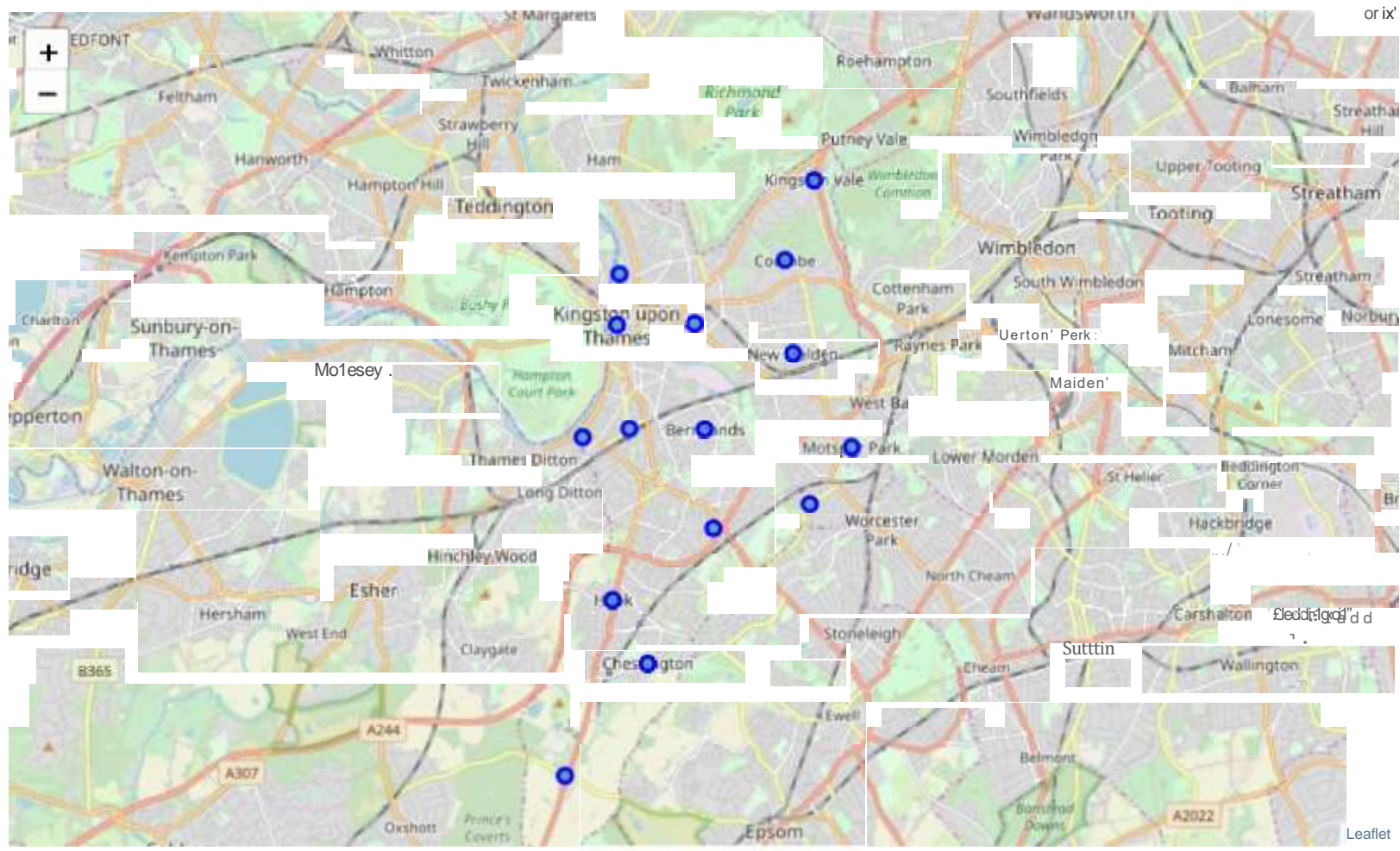
## Boroughs with the lowest crime rates



Comparing five boroughs with the lowest crime rate during the year 2016, City of London has the lowest recorded crimes followed by Kingston upon Thames, Sutton, Richmond upon Thames and Merton.

- City of London has a significantly lower crime rate because it is the 33rd principal division of Greater London but it is not a London borough. It has an area of 1.12 square miles and a population of 7000 as of 2013 which suggests that it is a small area.
- We will consider the next borough with the lowest crime rate as the safest borough in London which is Kingston upon Thames.

# Neighborhoods in Kingston upon Thames



There are 15 neighborhoods in the royal borough of Kingston upon Thames, they are visualised on a map using folium on python.



## Modelling

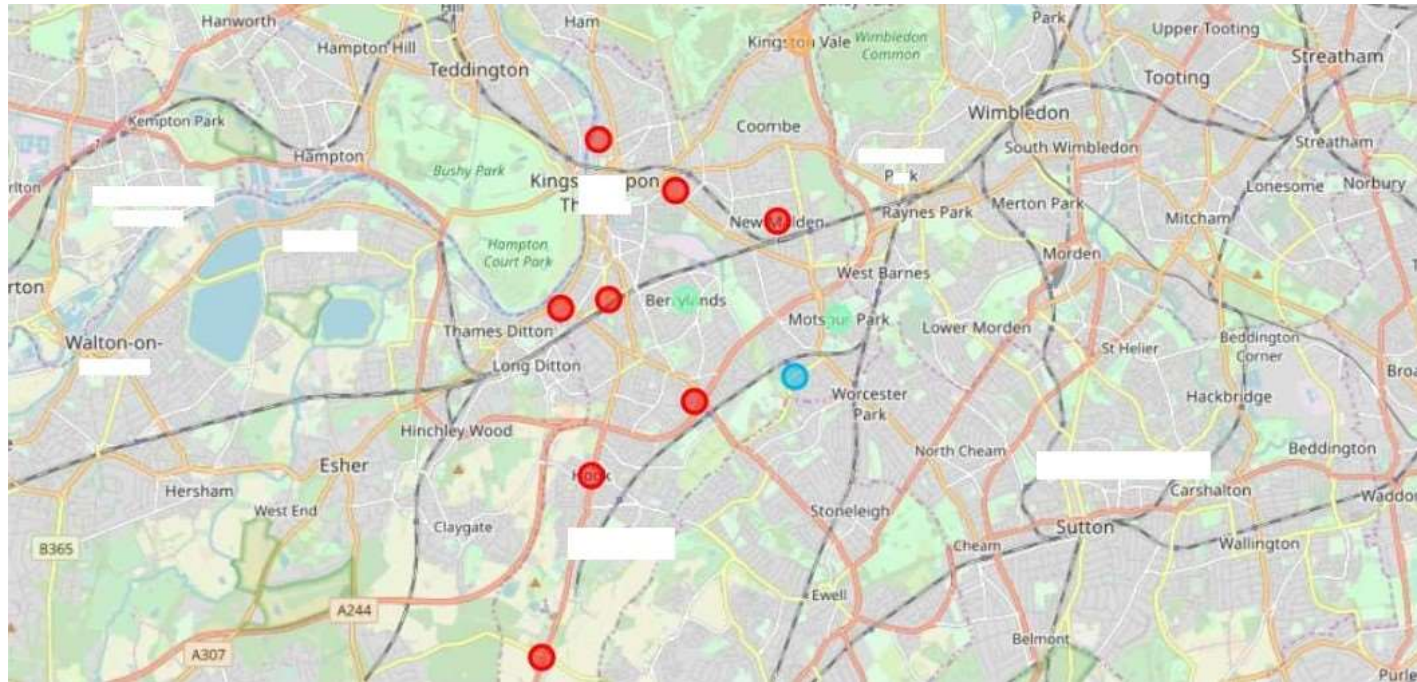
- Using the final data set containing the neighborhoods in Kingston upon Thames along with the latitude and longitude, we can find all the venues within a 500 meter radius of each neighborhood by connecting to the Foursquare API.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Berrylands	51.393781	-0.284802	Suttons Racket & Fitness Club	51.392676	-0.290224	Gym / Fitness Center
1	Berrylands	51.393781	-0.284802	Axarquia Park	51.394230	-0.284108	Park
2	Berrylands	51.393781	-0.284802	K2 Bua Group	51.382302	-0.281534	Bu Group
3	Berrylands	51.393781	-0.284802	Cafe Rasa	51.390175	-0.282480	Cafe
4	Berrylands	51.417499	-0.305553	The Boaters Inn	51.418548	-0.305553	Pub

- One-hot encoding is done on the venues data. The Venues data is then grouped by the Neighborhood and the mean of the venues are calculated, finally the 10 common venues are calculated for each of the neighborhoods.
- To help people find similar neighborhoods in the safest 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 a cluster size of 5 for this project that will cluster the 15 neighborhoods into 5 clusters. The reason to conduct a K- means clustering is to cluster neighborhoods with similar venues together so that people can shortlist the area of their interests based on the venues/amenities around each neighborhood.

## 4. Results

After running the K-means clustering we can access each cluster created to see which neighborhoods were assigned to each of the five clusters. Visualizing the clustered neighborhoods on a map using the folium library.



Each cluster is color coded, for the ease of presentation, we can see that most of the neighborhoods fall into the red cluster. The blue, purple, and yellow clusters have their own clusters. The green cluster consists of two neighborhoods, which is the 4th cluster.

## Cluster 1: Looking in to the neighborhoods in the first cluster

	Neighborhood	Borough	Latitude	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
1	Canbury	Kingston upon Thames	51.417409	-0.305553	0	Pub	Café	Plaza	Fish & Chips Shop	Supermarket	Spa	Shop & Service	Park
4	Hook	Kingston upon Thames	51.387808	-0.307145	0	Bakery	Convenience Store	Indian Restaurant	Fish & Chips Shop	Wine Shop	Food	Electronics Store	Farmers Market
5	Kingston upon Thames	Kingston upon Thames	51.409627	-0.306262	0	Coffee Shop	Café	Burger Joint	Sushi Restaurant	Pub	Record Shop	Cosmetics Shop	Market
7	Malden Rushett	Kingston upon Thames	51.41052	-0.319076	0	Convenience Store	Pub	Garden Center	Restaurant	Fast Food Restaurant	Discount Store	Dry Cleaner	Electronics Store
9	New Malden	Kingston upon Thames	51.405335	-0.263407	0	Gastropub	Gym	Sushi Restaurant	Supermarket	Korean Restaurant	Indian Restaurant	Fish & Chips Shop	Dry Cleaner
10	Norbiton	Kingston upon Thames	51.409999	-0.287396	0	Indian Restaurant	Pub	Food	Italian Restaurant	Platform	Grocery Store	Farmers Market	Dry Cleaner
12	Seething Wells	Kingston upon Thames	51.392642	-0.314366	0	Indian Restaurant	Coffee Shop	Italian Restaurant	Pub	Café	Wine Shop	Fast Food Restaurant	Chinese Restaurant
13	Surbiton	Kingston upon Thames	51.40758	-0.905310	0	Coffee Shop	Pub	Supermarket	Breakfast Spot	Grocery Store	Gastropub	French Restaurant	Train Station
14	Tolworth	Kingston upon Thames	51.408878	-0.282860	0	Grocery Store	Pharmacy	Home Store	Train Station	Pizza Place	Discount Store	Coffee Shop	Bus Stop

The cluster one is the biggest cluster with 9 of the 15 neighborhoods in the borough Kingston upon Thames. Upon closely examining these neighborhoods we can see that the most common venues in these neighborhoods are Restaurants, Pubs, Cafe, Supermarkets, and stores

## Cluster 2: Looking into the neighborhoods in the second cluster.

				1st Most	2nd	3rd Most	4th Most	5th Most	6th Most	7th Most	8th Most	9th Most	
2	Chessington	Kingston upon	51.358336 -0.298622	1	Fast Food Restaurant	Wine Shop	Golf Course	German Restaurant	Gastropub	Garden Center	Furniture / Home	Fried Chicken	French Restaurant

The second cluster has one neighborhood which consists of Venues such as Restaurants, Golf courses, and wine shops.

## Cluster 3: Looking into the neighborhoods in the third cluster.

	Old Malden	Kingston upon	51.382484	-0.25909	2	Train Station	Pub	Food	Gastropub	Garden Center	/ Home	Chicken	French Restaurant	Deli / Bodega

The third cluster has one neighborhood which consists of Venues such as Train stations, Restaurants, and Furniture shops.

## Cluster 4: Looking into the neighborhoods in the fourth cluster.

	Neighborhood	Borough	Latitude	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
0	Berrylands	Kingston upon Thames	51.393781	-0.284802	3	Gym / Fitness Center	Park	Café	Bus Stop	Wine Shop	Fish & Chips Shop	Electronics Store	Farmers Market	Fast Food Restaurant
8	Motspur Park	Kingston upon Thames	51.390985	-0.248898	3	Park	Gym	Restaurant	Soccer Field	Bus Stop	Wine Shop	Fast Food Restaurant	Dry Cleaner	Electronics Store

The fourth cluster has two neighborhoods in it, these neighborhoods have common venues such as Parks, Gym/Fitness centers, Bus Stops, Restaurants, Electronics Stores and Soccer fields etc.

## Cluster 5: Looking into the neighborhoods in the fourth cluster.

	Neighborhood	Borough	Latitude	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
6	Kingston Vale	Kingston upon Thames	51.43185	-0.258138	4	Grocery Store	Bar	Italian Restaurant	Soccer Field	Garden Center	Furniture / Home Store	Fried Chicken Joint	French Restaurant	Department Store

The fi2h cluster has one neighborhood which consists of Venues such as Grocery shops, Bars, Restaurants, Furniture shops, and Department stores.



# 5. Discussion

- The aim of this project is to help people who want to relocate to the safest borough in London, expats can chose the neighborhoods to which they want to relocate based on the most common venues in it.
- For example if a person is looking for a neighborhood with good connectivity and public transportation we can see that Clusters 3 and 4 have Train stations and Bus stops as the most common venues.
- If a person is looking for a neighborhood with stores and restaurants in a close proximity then the neighborhoods in the first cluster is suitable.
- For a family I feel that the neighborhoods in Cluster 4 are more suitable due to the common venues in that cluster, these neighborhoods have common venues such as Parks, Gym/Fitness centers, Bus Stops, Restaurants, Electronics Stores and Soccer fields which is ideal for a family.
- The preference of venues may vary from person to person, they can select a neighborhood based on ones priorities.

# 6.Conclusion

- This project helps a person get a better understanding of the neighborhoods with respect to the most common venues in that neighborhood. It is always helpful to make use of technology to stay one step ahead i.e. finding out more about places before moving into a neighborhood.
- We have just taken safety as a primary concern to shortlist the safest borough of London. The future of this project includes taking other factors such as cost of living in the areas into consideration to shortlist the borough, such as filtering areas based on a predefined budget.