



THE BATTLE OF NEIGHBORHOOD

Salu Jain

Introduction

- **Background:** Safety is the most important factor while moving to a new area. So it is very important to select a home which feels like safe heaven.
- **Problem:** The aim of this project is to select safest Borough in London based on the crime rate, explore the neighbourhoods and find 10 most common venues in each neighbourhood. Finally cluster the neighbourhoods using k-means clustering.
- **Audience:** People who are considering to relocate to London will be interested to identify the safest borough in London and explore it's neighbourhoods.

Data Acquisition and cleaning

- **Data Acquisition:** The has been collected from 3 different data sources.
 - **Data Source 1:** London Crime data which has 13M records of crime in London from 2008-2016. This data set is available on Kaggle.com
 - **Data Source 2:** The data is scraped from a Wikipedia page which contains the list of London Broughs. This page contains additional info about boroughs too.
 - **Data Source 3:** This contains the neighbourhood in the Royal Borough of Kingston upon Thames .

- **Data Cleaning:** Data Cleaning process done separately for all the three data sources.
 - Assuming Year 2016 as most recent year, only data of 2016 are required for our analysis. The major categories of crime are pivoted to get the total crimes per boroughs for each major category.
 - The second dataset scraped from a Wikipedia page using BeautifulSoup library in python. Data can be extracted in tabular format using this library.
 - The two datasets are merged on the borough names to form a new dataset. The purpose of this dataset is to visualize the crimes recorded during the year 2016.
 - After visualizing the crime in each borough we can find the borough with lowest crime rate. The third dataset has been created with the names of neighbourhoods and the name of the borough with latitude and longitude obtained using Google Maps API geocoding.
 - The new dataset is used to generate the 10 most common venues for each neighbourhood using the Foursquare API, finally using k-means clustering algorithm to cluster similar neighbourhoods.

Methodology

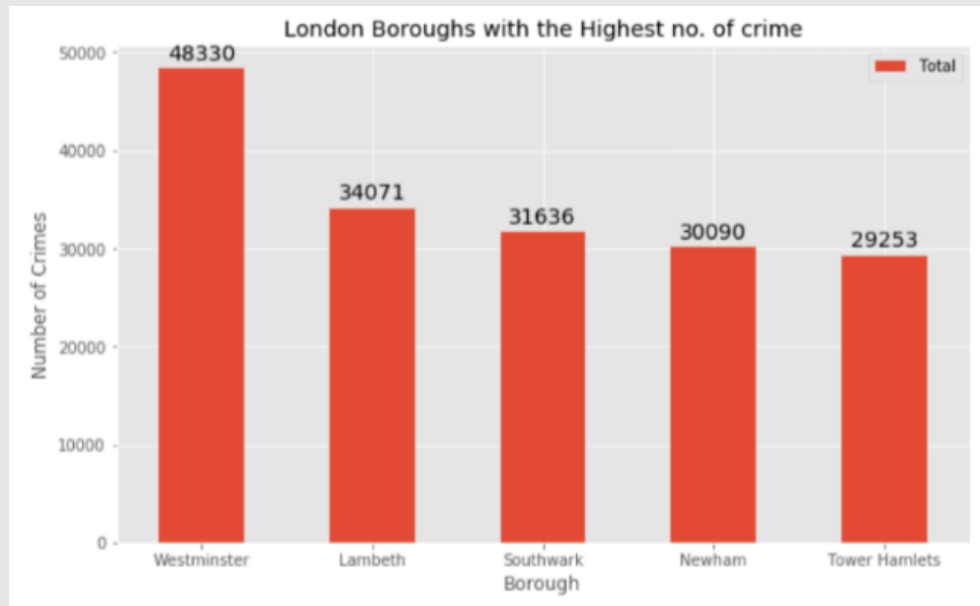
Exploratory data analysis

The count for the each major categories of crime returns the value 33 which is no of boroughs in London. "Theft and Handling" is the highest reported crime during year 2016 followed by "Violence against a person"," Criminal damage". The lowest recorded crimes are "Drugs", "Robbery" and "Other notifiable offences"

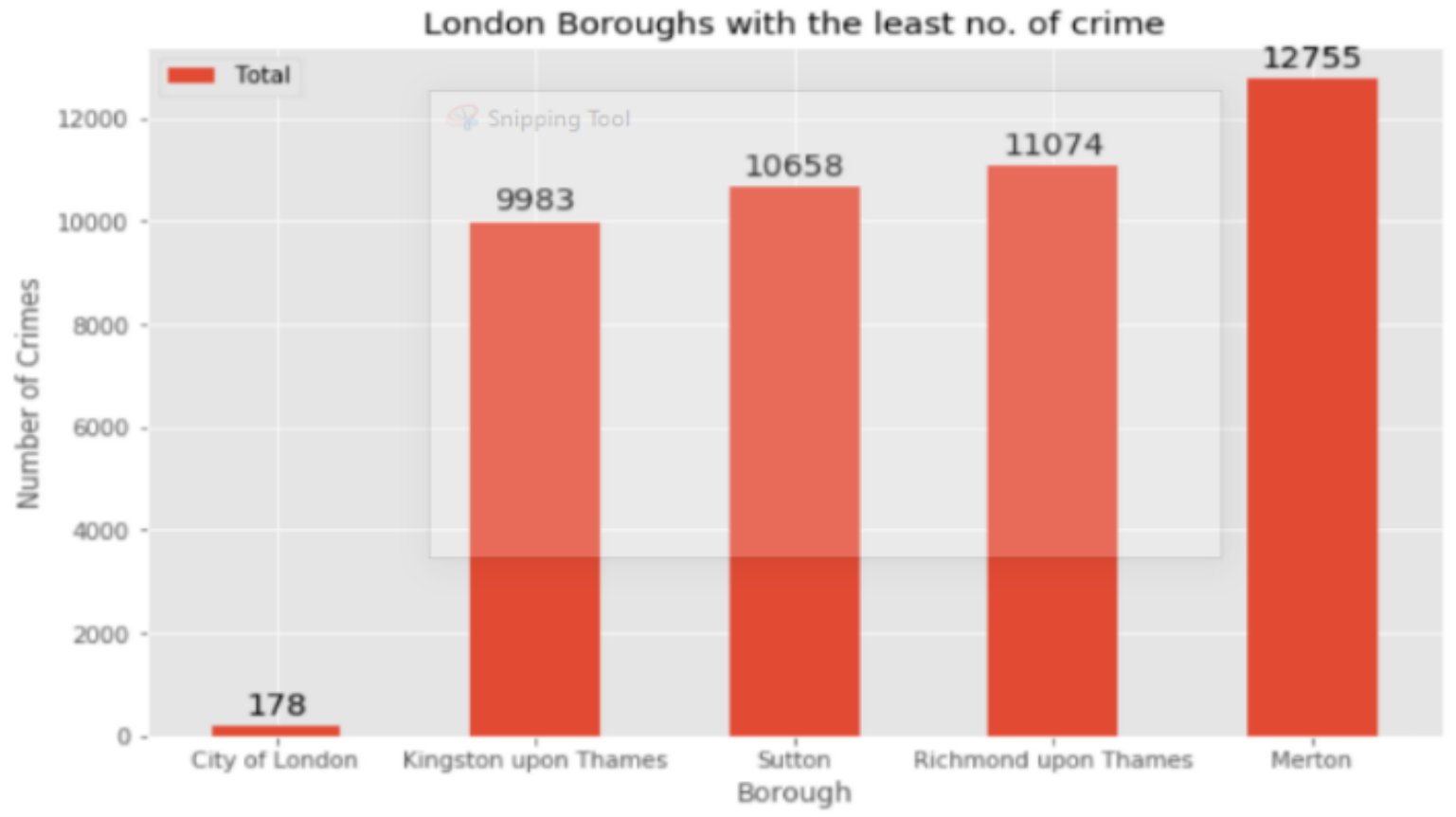
Statistical Summary of crimes

	Burglary	Criminal Damage	Drugs	Other Notifiable Offences	Robbery	Theft and Handling	Violence Against the Person	Total
count	33.000000	33.000000	33.000000	33.000000	33.000000	33.000000	33.000000	33.000000
mean	2069.242424	1941.545455	1179.212121	479.060606	682.666667	8913.121212	7041.848485	22306.696970
std	737.448644	625.207070	586.406416	223.298698	441.425366	4620.565054	2513.601551	8828.228749
min	2.000000	2.000000	10.000000	6.000000	4.000000	129.000000	25.000000	178.000000
25%	1531.000000	1650.000000	743.000000	378.000000	377.000000	5919.000000	5936.000000	16903.000000
50%	2071.000000	1989.000000	1063.000000	490.000000	599.000000	8925.000000	7409.000000	22730.000000
75%	2631.000000	2351.000000	1617.000000	551.000000	936.000000	10789.000000	8832.000000	27174.000000
max	3402.000000	3219.000000	2738.000000	1305.000000	1822.000000	27520.000000	10834.000000	48330.000000

Boroughs with the highest crime rates

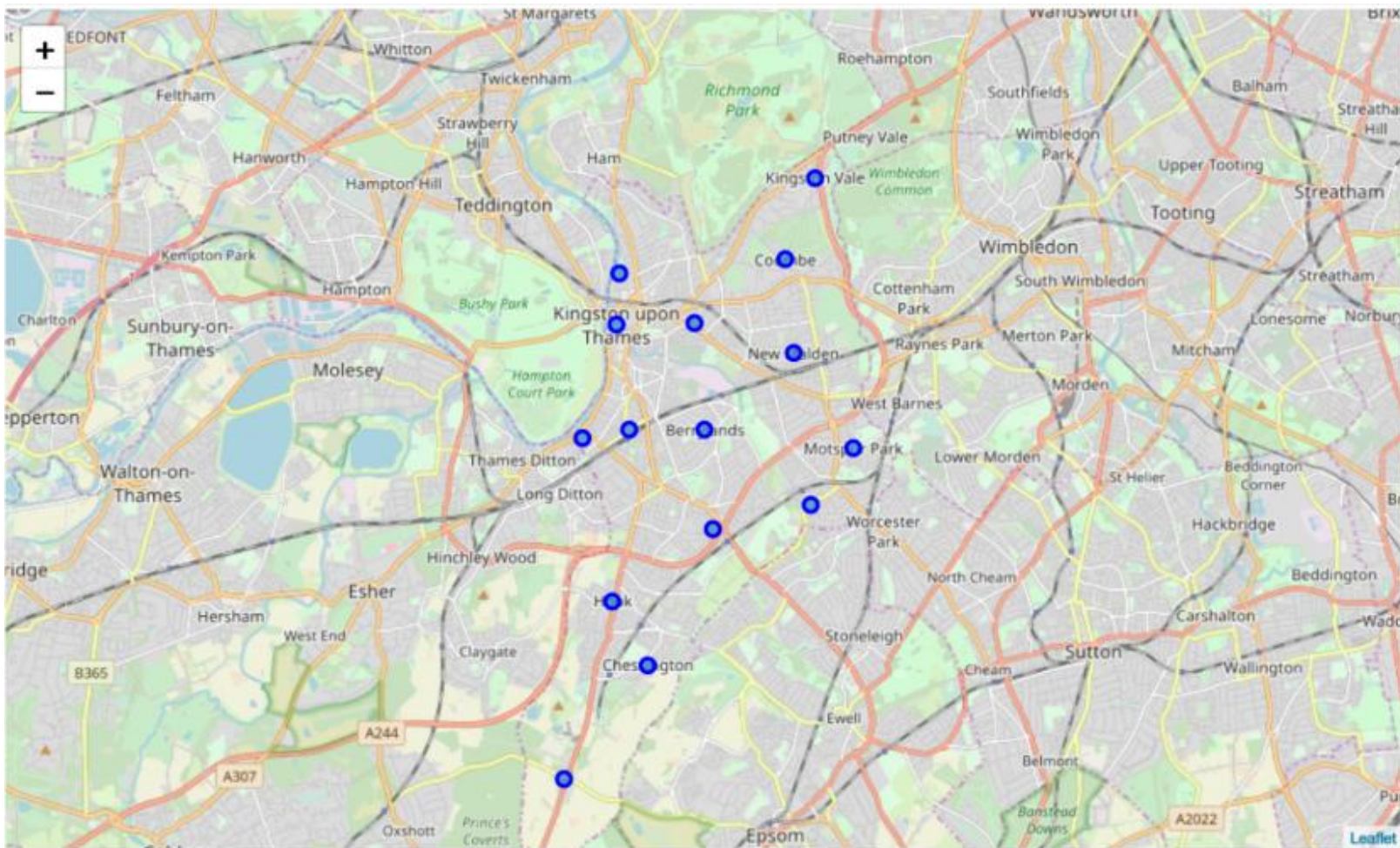


- Comparing five boroughs with the highest crime rate during the year 2016 it is evident that Westminster has the highest crimes recorded followed by Lambeth, Southwark, Newham and Tower Hamlets. Westminster has a significantly higher crime rate than the other boroughs



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 Boroughs with the lowest crime rates.

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. Hence 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 visualized on a map using folium on python

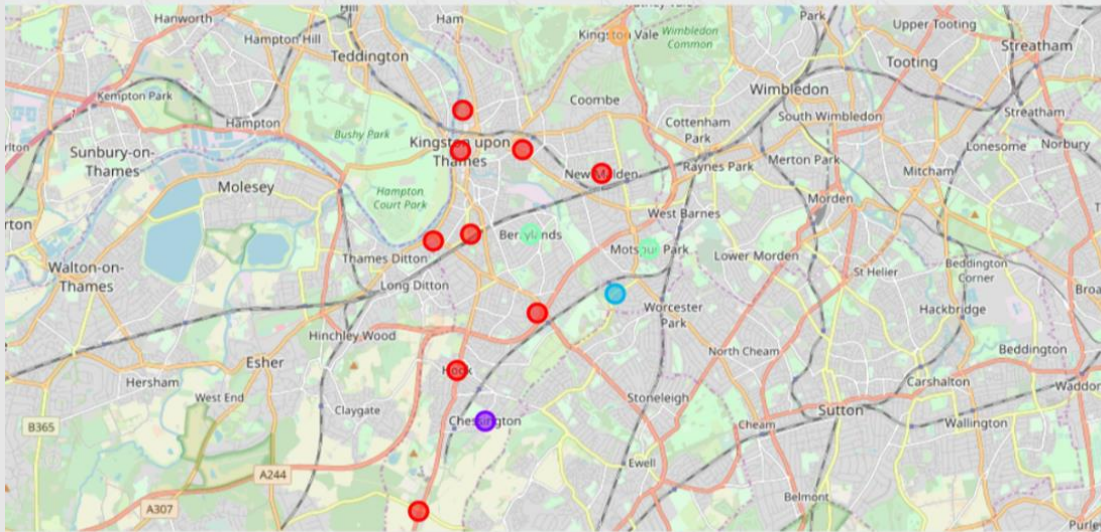
Modelling

- Using the final dataset 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. This returns a json file containing all the venues in each neighborhood which is converted to a pandas dataframe. This dataframe contains all the venues along with their coordinates and category.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Berrylands	51.393781	-0.284802	Surbiton Racket & Fitness Club	51.392676	-0.290224	Gym / Fitness Center
1	Berrylands	51.393781	-0.284802	Alexandra Park	51.394230	-0.281206	Park
2	Berrylands	51.393781	-0.284802	K2 Bus Stop	51.392302	-0.281534	Bus Stop
3	Berrylands	51.393781	-0.284802	Cafe Rosa	51.390175	-0.282490	Café
4	Canbury	51.417499	-0.305553	The Boater's Inn	51.418546	-0.305915	Pub

- One hot encoding is done on the venues data. (One hot encoding is a process by which categorical variables are converted into a form that could be provided to ML algorithms to do a better job in prediction).
- 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.

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 clusters on map using folium.
- Each cluster is color coded for the ease of presentation, we can see that majority of the neighborhood falls in the red cluster which is the first cluster. Three neighborhoods have their own cluster (Blue, Purple and Yellow), these are clusters two three and five. The green cluster consists of two neighborhoods which is the 4th 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	51.417499	-0.305553	0	Pub	Café	Plaza	Fish & Chips Shop	Supermarket	Spa	Shop & Service	Park
4	Hook	Kingston upon Thames	51.367898	-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	51.341052	-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	51.393756	-0.303310	0	Coffee Shop	Pub	Supermarket	Breakfast Spot	Grocery Store	Gastropub	French Restaurant	Train Station
14	Tolworth	Kingston upon Thames	51.378876	-0.282860	0	Grocery Store	Pharmacy	Furniture / Home Store	Train Station	Pizza Place	Discount Store	Coffee Shop	Bus Stop

Cluster 1: Looking into the neighborhoods in the first cluster

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, Super markets, and stores.

Cluster 2: Neighbourhood of second 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
2	Chessington	Kingston upon Thames	51.358336	-0.298622	1	Fast Food Restaurant	Wine Shop	Golf Course	German Restaurant	Gastropub	Garden Center	Furniture / Home Store	Fried Chicken Joint	French Restaurant

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

Cluster 3: Neighbourhood of third 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
11	Old Malden	Kingston upon Thames	51.382484	-0.25909	2	Train Station	Pub	Food	Gastropub	Garden Center	Furniture / Home Store	Fried Chicken Joint	French Restaurant	Deli / Bodega

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

Cluster 4: Neighbourhood of 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: Neighbourhood of fifth 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 fifth cluster has one neighborhood which consists of Venues such as Grocery shops, Bars, Restaurants, Furniture shops, and Department stores. We will look into the neighbourhoods in the fourth cluster

Discussion

- The aim of this project is to help people who want to relocate to the safest borough in London, 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 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.

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.