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Capstone Project - The Battle of Neighborhoods Report

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1. Introduction

Background

The average American moves about eleven times in their lifetime. This brings us to the question: Do people move until they find a place to settle down where they truly feel happy, or do our wants and needs change over time, prompting us to eventually leave a town we once called home for a new area that will bring us satisfaction? Or, do we too often move to a new area without knowing exactly what we're getting into, forcing us to turn tail and run at the first sign of discomfort? To minimize the chances of this happening, we should always do proper research when planning our next move in life. Consider the following factors when picking a new place to live so you don't end up wasting your valuable time and money making a move you'll end up regretting. 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

The crime statistics dataset of London found on Kaggle has crimes in each Boroughs of London from 2008 to 2016. The year 2016 being the latest we will be considering the data of that year which is actually old information as of now. The crime rates in each borough may have changed over time. 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.

2. Data Acquisition and Cleaning

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 dataset contains the following columns:

- **Isaa_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

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 following are the columns:

- **Borough:** The names of the 33 London boroughs.
- **Inner:** Categorizing the borough as an Inner London borough or an Outer London Borough.
- **Status:** Categorizing the borough as Royal, City or other borough.
- **Local authority:** The local authority assigned to the borough.
- **Political control:** The political party that control the borough.
- **Headquarters:** Headquarters of the Boroughs.
- **Area (sq mi):** Area of the borough in square miles.
- **Population (2013 est)[1]:** The population in the borough recorded during the year 2013.
- **Co-ordinates:** The latitude and longitude of the boroughs.
- **Nr. in map:** The number assigned to each borough to represent visually on a map

The third data source is the list of Neighborhoods in the Royal Borough of Kingston upon Thames as found on a wikipedia page. This dataset is created from scratch using the list of neighborhood available on the site, the following are columns:

- **Neighborhood:** Name of the neighborhood in the Borough.
- **Borough:** Name of the Borough.
- **Latitude:** Latitude of the Borough.
- **Longitude:** Longitude of the Borough.

Data Cleaning

The data preparation for each of the three sources of data is 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. After the web scraping, string manipulation is required to get the names of the boroughs in the correct form. This is important because we will be merging the two datasets together using the Borough names

The two datasets are merged on the Borough names to form a new dataset that combines the necessary information in one dataset (see fig 2.3). The purpose of this dataset is to visualize the crime rates in each borough and identify the borough with the least crimes recorded during the year 2016.

	Borough	Local authority	Political control	Headquarters	Area (sq mi)	Population (2013 est)[1]	Co-ordinates	Burglary	Criminal Damage	Drugs	Other Notifiable Offences	Robbery	Theft and Handling	Violence Against the Person	Total
0	Barking and Dagenham	Barking and Dagenham London Borough Council	Labour	Town Hall, 1 Town Square	13.93	194352	51°33'39"N 0°09'21"E / 51.5607°N 0.1557°E /...	1287	1949	919	378	534	5607	6067	16741
1	Barnet	Barnet London Borough Council	Conservative	North London Business Park, Oakleigh Road South	33.49	369088	51°37'31"N 0°09'06"W / 51.6252°N 0.1517°W /...	3402	2183	906	499	464	9731	7499	24684
2	Bexley	Bexley London Borough Council	Conservative	Civic Offices, 2 Watling Street	23.38	236687	51°27'18"N 0°09'02"E / 51.4549°N 0.1505°E /...	1123	1673	646	294	209	4392	4503	12840
3	Brent	Brent London Borough Council	Labour	Brent Civic Centre, Engineers Way	16.70	317264	51°33'32"N 0°16'54"W / 51.5588°N 0.2817°W /...	2631	2280	2096	536	919	9026	9205	26693
4	Bromley	Bromley London Borough Council	Conservative	Civic Centre, Stockwell Close	57.97	317899	51°24'14"N 0°01'11"E / 51.4039°N 0.0198°E /...	2214	2202	728	417	369	7584	6650	20164

After visualizing the crime in each borough we can find the borough with the lowest crime rate and hence tag that borough as the safest borough. The third source of data is acquired from the list of neighborhoods in the safest borough on wikipedia. This dataset is created from scratch, the pandas data frame is created with the names of the neighborhoods and the name of the borough with the latitude and longitude left blank.

The coordinates of the neighborhoods is be obtained using Google Maps API geocoding to get the final dataset.

	Neighborhood	Borough	Latitude	Longitude
0	Berrylands	Kingston upon Thames	51.393781	-0.284802
1	Canbury	Kingston upon Thames	51.417499	-0.305553
2	Chessington	Kingston upon Thames	51.358336	-0.298622
3	Coombe	Kingston upon Thames	51.419450	-0.265398
4	Hook	Kingston upon Thames	51.367898	-0.307145

3. Methodology

Exploratory Data Analysis

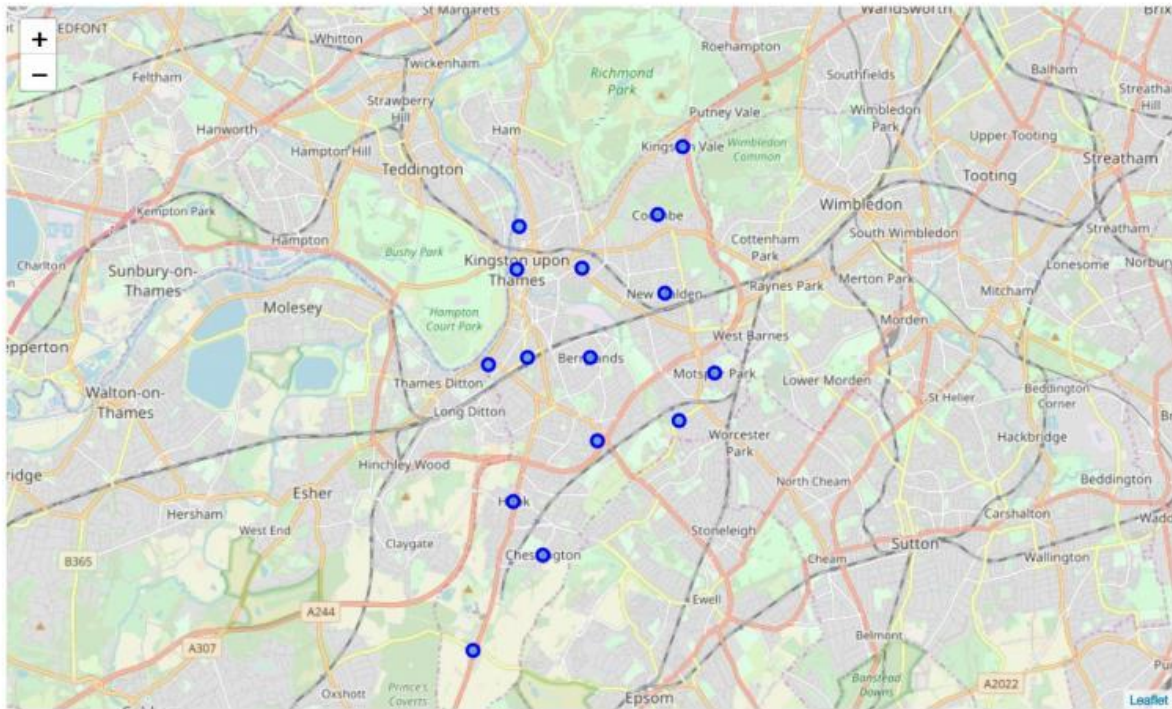
Statistical summary of crimes

The describe function in python is used to get statistics of the London crime data, this returns the mean, standard deviation, minimum, maximum, 1st quartile (25%), 2nd quartile (50%), and the 3rd quartile (75%) for each of the major categories of crime.

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'.

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 (see fig 3.1.3.1). 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



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.

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). 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. 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, Supermarkets, and stores. Looking into the neighborhoods in the second, third and fifth clusters, we can see these clusters have only one neighborhood in each. This is because of the unique venues in each of the neighborhoods, hence they couldn't be clustered into similar neighborhoods.

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 dues 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 choices of neighborhoods may vary from person to person.