Identification of East London Suburbs with Parks for Recreation

A report for Estate Agents and Realtors

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1. Executive Summary

Executives of Lions Denergy, a data science consultancy recognised a growing trend amongst the population of major cities to relocate to more suburban areas with parks and open spaces. This trend has been accelerated by Covid-related lockdowns during 20020-21. The executives have commissioned this study by one of their data scientists to identify which suburbs of East London would appeal to those seeking to relocate for the reasons stated above. We see a market for this report amongst estate agents/realtors, and more informed members of the public who are looking to move from the centre of London to similar suburbs further from the city centre.

The study has gathered data and analysed it using data science tools and machine learning algorithms to identify the suburbs of East London which share similar characteristics of having many parks. Of the 93 suburbs examined, 12 (Chase Cross, Chingford, Cranham, Gidea Park, Hackney Marshes, Hainault, Highams Park, Loxford, North Ockendon, Rainham, South Hornchurch and Upminster) are the most attractive, and fall mainly in the London boroughs of Havering (7), Redbridge (2), Waltham Forest (2), and Hackney.

Further work is recommended on the sensitivity of the results to the search criteria/distance used, and whether there is any correlation between property/real estate prices and areas with better access to parks and open spaces.

2. Introduction

The Covid crisis has highlighted the need for easy access to open spaces for citizens, especially those who live in apartments and may not have a private garden. As a result, many are looking to move to neighbourhoods and suburbs with parks and leisure facilities, especially those that can be reached by walking. In London, historically there has always been a migration from the city centre towards the suburbs. Young couples or recent immigrants start off in apartments near the city centre, where night life and pubs/bars are abundant, and as they mature, they seek areas where houses with gardens are more abundant and affordable, and the quality of schooling is often better, if they go on to start families and to have children. Covid-19 has accelerated this trend.

This project aims to identify which boroughs and suburbs in East London are the most attractive in terms of parks and open spaces. I have chosen East London because the migration from the centre of London is often towards the east because housing there is relatively cheap (the 'East End' was heavily bombed during the Second World War) compared to the wealthier north, west and south of London. I also live in East London so it is of personal interest to me.

The above increase in demand for housing close to open spaces is so recent that it is unlikely to have been studied before, although it has been written about (***Housing market after Covid-19 lockdown: buyer demand surges for homes with office space, gardens, balconies and near local parks***; London Evening Standard, 11th June 2020; https://www.standard.co.uk/homesandproperty/property-news/buy-house-demand-office-garden-balcony-a138776.html .)

3. Methodology

The analysis was conducted in a Jupyter Notebook using Python language for coding and standard Python-compatible libraries and APIs for the analysis, which comprised of the following steps:

a. A listing of the suburbs of London (approximately 500) and the borough they occur within was scraped from a Wikipedia page (https://en.wikipedia.org/wiki/List_of_areas_of_London) and transferred to a pandas dataframe, as illustrated below

	Location	London borough	Post town	Postcode district	Dial code	OS grid ref
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020	TQ465785
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020	TQ205805
2	Addington	Croydon[8]	CROYDON	CR0	020	TQ375645
3	Addiscombe	Croydon[8]	CROYDON	CR0	020	TQ345665
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020	TQ478728

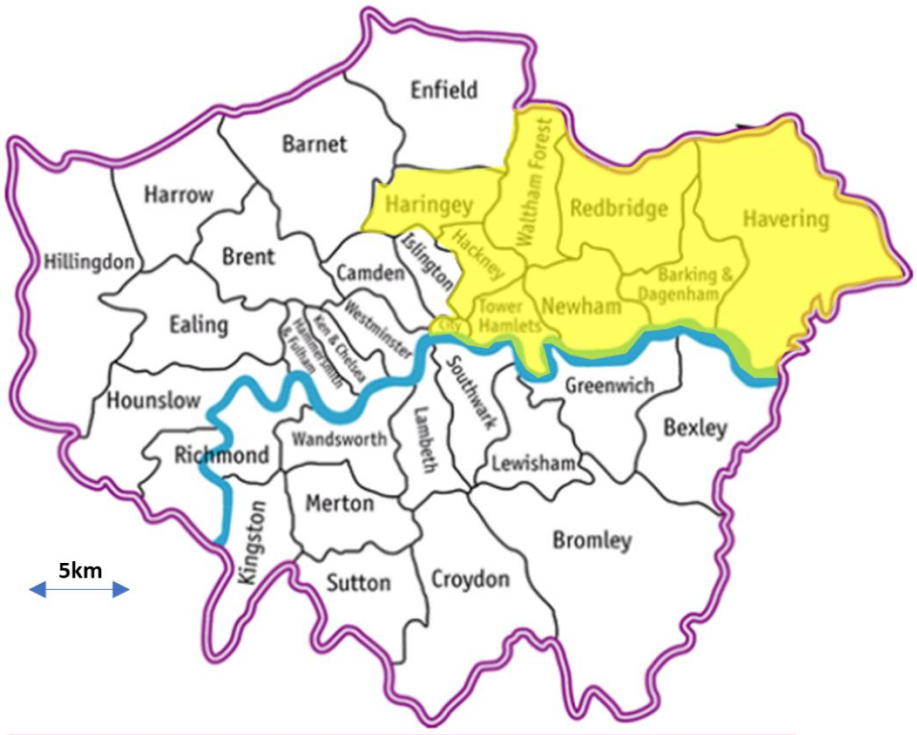
b. Search criteria for each suburb were defined and Nominatim was used to extract latitude and longitude values for each, as shown below:

	Location	London borough	Post town	Postcode district	Dial code	OS grid ref	SearchLocation	Geodata
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020	TQ465785	LONDON, Abbey Wood	(51.487621, 0.1140504)
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020	TQ205805	LONDON, Acton	(51.5081402, -0.2732607)
2	Addington	Croydon[8]	CROYDON	CR0	020	TQ375645	CROYDON, Addington	(44.4206405, -76.978248)
3	Addiscombe	Croydon[8]	CROYDON	CR0	020	TQ345665	CROYDON, Addiscombe	(51.3796916, -0.0742821)
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020	TQ478728	BEXLEY, SIDCUP, Albany Park	(51.4353837, 0.1259653)

c. The data was cleaned, including the removal of unnecessary columns and rows with null (NaN values,) and filtering down to the 94 suburbs within the

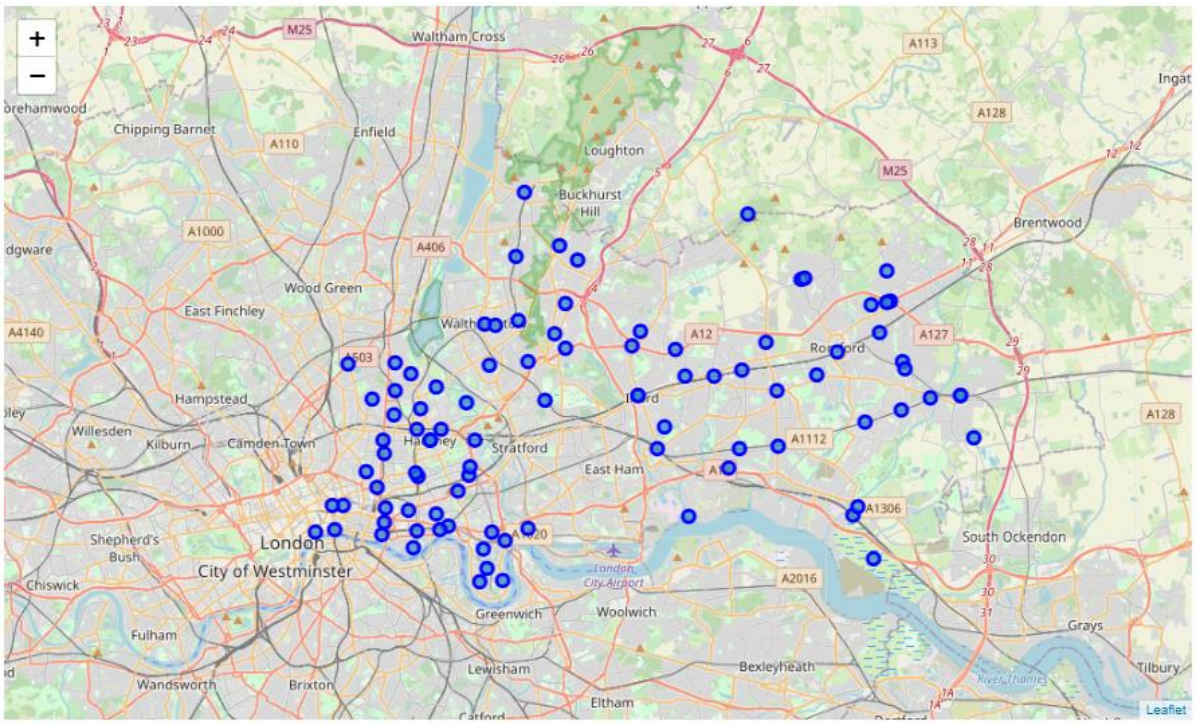
eight boroughs that lie north of the River Thames and east/northeast of the city centre. The suburbs are illustrated below and the relevant boroughs are shown in the following map:

	Location	borough	latitude	longitude
0	Aldgate	City[10]	51.5142477	-0.0757186
1	Ardleigh Green	Havering[12]	51.5712468	0.2190799
2	Barbican	City[14]	51.5201501	-0.0986832
3	Barking	Barking and Dagenham[14]	51.5402677	0.0793235
4	Barkingside	Redbridge[15]	51.581935349999995	0.07005708323668366
5	Becontree	Barking and Dagenham[20]	51.5403111	0.1265241
6	Becontree Heath	Barking and Dagenham[21]	51.5610299	0.1478793
7	Bethnal Green	Tower Hamlets[25]	51.5303456	-0.0561633
8	Blackfriars	City[27]	51.5115854	-0.1037671
9	Blackwall	Tower Hamlets[28]	51.5079378	-0.0071843
10	Bow	Tower Hamlets[31]	51.5309383	-0.0274853
11	Cambridge Heath	Tower Hamlets[40]	51.5319544	-0.0574215
12	Canary Wharf	Tower Hamlets[40]	51.5048954	-0.0190006
13	Cann Hall	Waltham Forest[41]	51.55743685	0.015681373492808938
14	Castle Green	Barking and Dagenham	51.5334036	0.12005152247941958
15	Chadwell Heath	Redbridge, Barking and Dagenham	51.5679857	0.127994



Study Area and London Borough Highlighted in Yellow

d. Exploratory data analysis was carried out by visualizing the suburbs data for East London on a Folium map:



Suburbs Within the Eight East London Boroughs Chosen for Cluster Analysis

e. The Foursquare API was used to obtain locations data for venues within the 1000m of the suburb locations. Further data exploration was carried out by grouping the venues, counting them, checking the number of unique categories and finding the mean number of each category vis one hot coding, as illustrated below:

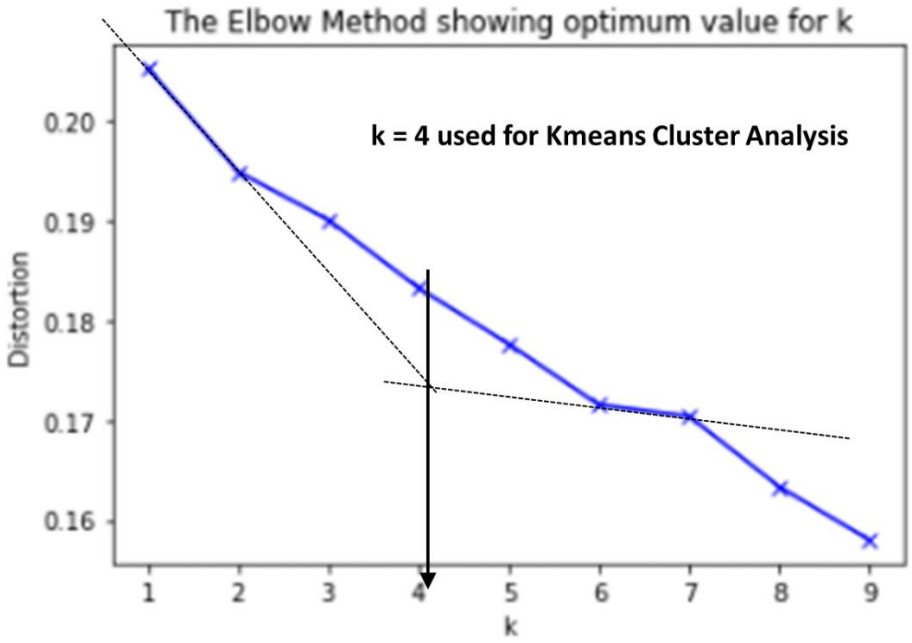
	Suburb	Adult Boutique	American Restaurant	Antique Shop	Arcade	Arepa Restaurant	Argentinian Restaurant	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Auto Garage	BBQ Joint
0	Aldgate	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.020000	0.00	0.010000	0.010000	0.000000	0.000000	0.000000
1	Ardleigh Green	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
2	Barbican	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.010000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
3	Barking	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
4	Barkingside	0.00	0.034483	0.000000	0.000000	0.00	0.00	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
5	Becontree	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
6	Becontree Heath	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
7	Bethnal Green	0.00	0.000000	0.000000	0.000000	0.01	0.00	0.010000	0.00	0.000000	0.000000	0.000000	0.000000	0.000000
8	Blackfriars	0.00	0.000000	0.000000	0.000000	0.00	0.01	0.020000	0.03	0.000000	0.000000	0.000000	0.000000	0.000000
9	Blackwall	0.00	0.000000	0.000000	0.000000	0.00	0.00	0.000000	0.00	0.000000	0.010000	0.010000	0.000000	0.000000
10	Bow	0.00	0.000000	0.012821	0.000000	0.00	0.00	0.038462	0.00	0.000000	0.000000	0.000000	0.000000	0.000000

The top five most common venues for each suburb were investigated, with parks being the joint second most common venue in my own suburb of Wanstead, as shown below:

```
----Wanstead----
                venue  freq
0                 Pub  0.10
1               Café  0.08
2          Restaurant  0.08
3                Park  0.08
4  Gym / Fitness Center  0.05
```

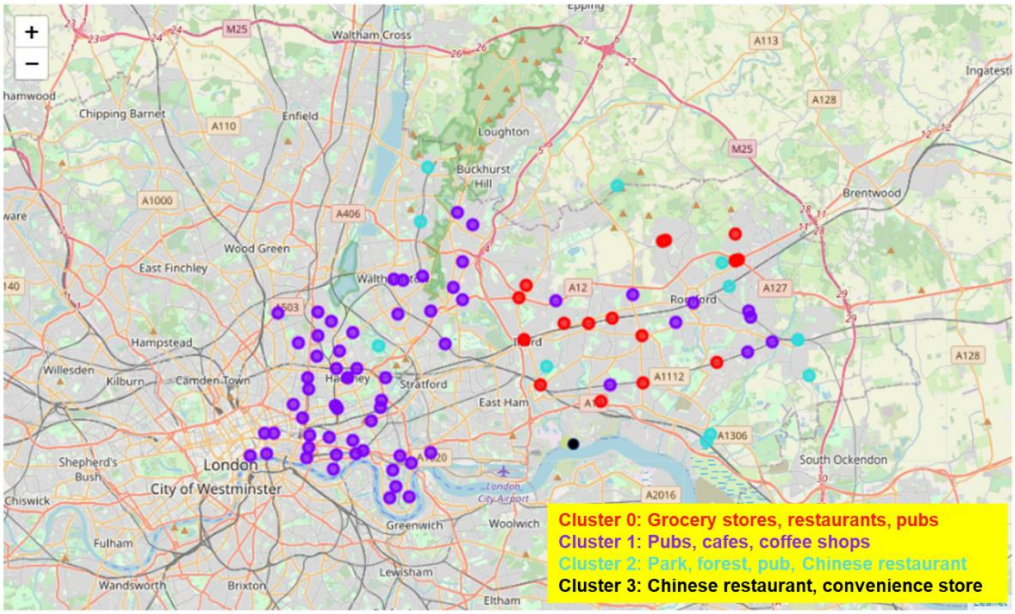
f. The suburb data was clustered using a KMeans machine learning algorithm with a k value of 4. An elbow analysis was attempted to find the best value for k and this was not definitive, but further graphical analysis suggested 4 as the best k, as shown below:

g.



h. The resulting clusters were visualised on a Folium map, as shown below in section 4

4. Results



The result of the cluster analysis is shown in the map above and is summarised in the table below.

Cluster	No. of Suburbs	Example Suburbs	No. of Boroughs	Typical Most Common Venues	Remarks
0	18	Barking, Gants Hill	3	Grocery stores, restaurants, pubs	Eight (44%) have park as 3/4/5th most common
1	62	Mile End, Wanstead	8	Pubs, cafes, coffee shops	Parks are in the four most common category in nine suburbs (15%)
2	12	Gidea Park, Highams Park	4	Park, forest, pub, Chinese restaurant	Parks are 1st, 2nd or 3rd most common in 10 suburbs (83%)
3	1	Creekmouth	1	Chinese restaurant, convenience store	23 suburbs (38%) have parks within the 7 most common categories

5. Discussion

The analysis shows that in the 12 suburbs in Cluster 2, parks are the most common venue in four of them and rank no lower than third in 83% of them. Two suburbs have the word ‘park’ in their names, which is reassuring. Seven of the Cluster 2 suburbs are in the London Borough of Havering, which is the most rural and the East London borough furthest from the city centre. The other Cluster 2 suburbs are in Redbridge, Waltham Forest and Hackney. The first two of those boroughs contain large forests (Epping) or country parks (Hainault), whereas Hackney includes land along the floodplain of the River Lee (Hackney Marshes,) which was unsuitable for housing and was retained as parkland and playing fields. Hackney therefore offers parks relatively close to the city centre but house prices there may be high as a result, relative to the outer boroughs.

Cluster 2: Park, forest, pub, Chinese restaurant

```
]: ondon_merged3.loc[London_merged3['Cluster_Labels'] == 2, London_merged3.columns[[0, 1] + list(range(5, London_merged3.shape[1]))]
```

]:

	Location	borough	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	Chase Cross	Havering	Coffee Shop	Pizza Place	Park	Department Store	English Restaurant	Warehouse Store	Furniture / Home Store	Bus Stop	Fast Food Restaurant	Yoga Studio
17	Chingford	Waltham Forest	Pub	Italian Restaurant	Coffee Shop	Grocery Store	History Museum	Café	Park	Golf Course	Athletics & Sports	Nature Preserve
19	Cranham	Havering	Coffee Shop	Park	Pub	Platform	Grocery Store	Soccer Stadium	Stationery Store	Metro Station	Supermarket	Sandwich Place
29	Gidea Park	Havering	Park	Grocery Store	Bus Stop	English Restaurant	Gym / Fitness Center	Electronics Store	Coffee Shop	Wine Shop	Shoe Store	Fish Market
33	Hackney Marshes	Hackney	Park	Nature Preserve	Market	Bus Stop	Café	Hockey Field	Plaza	Bistro	Filipino Restaurant	Farmers Market
36	Hainault	Redbridge	Park	Pub	Steakhouse	Bakery	Coffee Shop	Yoga Studio	Filipino Restaurant	Falafel Restaurant	Farm	Farmers Market
41	Highams Park	Waltham Forest	Pub	Hotel	Park	Coffee Shop	Gym	Clothing Store	Yoga Studio	Falafel Restaurant	Farm	Farmers Market
53	Loxford	Redbridge	Ice Cream Shop	Pub	Park	Portuguese Restaurant	Grocery Store	Convenience Store	Betting Shop	Coffee Shop	Pizza Place	Yoga Studio
59	North Ockendon	Havering	Coffee Shop	Pub	Campground	Motorcycle Shop	Yoga Studio	Farm	Farmers Market	Fast Food Restaurant	Field	Filipino Restaurant
62	Rainham	Havering	Bus Stop	Park	Pizza Place	Gas Station	Pub	Chinese Restaurant	Museum	Fish & Chips Shop	Historic Site	Pet Store
73	South Hornchurch	Havering	Park	Bus Stop	Pharmacy	Pub	Chinese Restaurant	Museum	Fish & Chips Shop	Historic Site	Gas Station	Café
81	Upminster	Havering	Coffee Shop	Park	Pub	Platform	Grocery Store	Soccer Stadium	Stationery Store	Metro Station	Supermarket	Sandwich Place

Cluster 2 Suburbs, All Showing Parks as the 1st, 2nd or 3rd Most Common Venue

Cluster 0 suburbs are in the outer boroughs of Havering, Redbridge and Barking/Dagenham.

44% of the Cluster 0 suburbs have parks as the 3rd/4th/5th most popular venue and 15% of Cluster 1 suburbs have parks within the three most popular venues. This shows that London has many green spaces (parks) compared to many other major cities in the world.

Cluster 1 suburbs are scattered within all eight London boroughs studied but are more urban than those of Cluster 2 and are concentrated closer to the city centre, with the venues dominated by pubs, cafes, coffee shops and restaurants.

Cluster 3 has the solitary suburb of Creekmouth, where the lack of parks or supermarkets suggests that it is not a residential area but caters to a more transient population, with markets and convenience stores etc.

It is unclear exactly how stable the result of the KMeans algorithm is, since two separate runs with the same parameters produced results that were surprisingly different for some suburbs. It is also unclear whether a very large country park is rated the same as a small suburban green space, or the effect on the search results where suburbs are smaller than the search radius used to retrieve the venues data.

6. Recommendations

1. Sensitivity analysis should be carried out on the search radius used for the Foursquare API, especially where the suburbs are small and the search areas of adjoining suburbs may overlap
2. Prices for similar residential properties in the Cluster 2 suburbs could be compared to further refine the analysis of desirable East London suburbs with parks and open spaces.

London, April 2021