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| London neighborhoods |
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| Introduction Overview  * In this project, I look at the boroughs in London and see if they can be clustered based on the geolocation data on venues from Foursquare. I leverage the Foursquare location data to explore and compare neighbourhoods in London. * London boroughs are very diverse, yet, one can tell from experience that they serve different functions. For instance, Westminster and surrounding boroughs should be more inclined towards visitors (either for business, political, or cultural purposes) with a prevalence of hotels and dining outlets. The east of London should be more included towards parks, coffee shops, restaurants and other facilities for families and residential life style in general. * The project is aimed to give recommendation for people looking to relocate to London and make decisions based on the availability of venues that are of primary importance to them. For instance, for politicians, an availability of hotels and restaurants and theatres. * Central London have been a centre for economic activity. The functions vary, however, such as theatres (musicals, opera, ballet, dramas) for Covent Garden and government offices for Westminster. Camden, for instance, is characterised by cultural venues and residential neighbourhoods (with shops and gyms). |
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| Data  * I have collected data on 32 boroughs in London using the Wikipedia page ('https://en.wikipedia.org/wiki/List\_of\_London\_boroughs‘), which included their names their geographical coordinates. Given that the target tables were online, I used a python scraping library, namely Beautiful Soup. After cleaning and organizing the data, it was saved into a Python data frame.   I also used Foursquare API venues data, collecting data on more than 3000 venues around London. I use this information to cluster boroughs based on the prevalence of the types of venues, such as boroughs where the most popular venue are hotels are likely to belong to the same cluster. Descriptive Statistics  * I have obtained data on 32 boroughs after scrapping a table from a webpage. After cleaning and organising, the data looks as follows:  |  |  |  |  | | --- | --- | --- | --- | |  | * Neighborhood | * Latitude | * Longitude | | * 0 | * Barking and Dagenham | * 51.5607 | * 0.1557 | | * 1 | * Barnet | * 51.6252 | * -0.1517 | | * 2 | * Bexley | * 51.4549 | * 0.1505 | | * 3 | * Brent | * 51.5588 | * -0.2817 | | * 4 | * Bromley | * 51.4039 | * 0.0198 | | * 5 | * Camden | * 51.5290 | * -0.1255 | | * 6 | * Croydon | * 51.3714 | * -0.0977 | | * 7 | * Ealing | * 51.5130 | * -0.3089 | | * 8 | * Enfield | * 51.6538 | * -0.0799 | | * 9 | * Greenwich | * 51.4892 | * 0.0648 | | * 10 | * Hackney | * 51.5450 | * -0.0553 | | * 11 | * Hammersmith and Fulham | * 51.4927 | * -0.2339 | | * 12 | * Haringey | * 51.6000 | * -0.1119 | | * 13 | * Harrow | * 51.5898 | * -0.3346 | | * 14 | * Havering | * 51.5812 | * 0.1837 | | * 15 | * Hillingdon | * 51.5441 | * -0.4760 | | * 16 | * Hounslow | * 51.4746 | * -0.3680 | | * 17 | * Islington | * 51.5416 | * -0.1022 | | * 18 | * Kensington and Chelsea | * 51.5020 | * -0.1947 | | * 19 | * Kingston upon Thames | * 51.4085 | * -0.3064 | | * 20 | * Lambeth | * 51.4607 | * -0.1163 | | * 21 | * Lewisham | * 51.4452 | * -0.0209 | | * 22 | * Merton | * 51.4014 | * -0.1958 | | * 23 | * Newham | * 51.5077 | * 0.0469 | | * 24 | * Redbridge | * 51.5590 | * 0.0741 | | * 25 | * Richmond upon Thames | * 51.4479 | * -0.3260 | | * 26 | * Southwark | * 51.5035 | * -0.0804 | | * 27 | * Sutton | * 51.3618 | * -0.1945 | | * 28 | * Tower Hamlets | * 51.5099 | * -0.0059 | | * 29 | * Waltham Forest | * 51.5908 | * -0.0134 | | * 30 | * Wandsworth | * 51.4567 | * -0.1910 | | * 31 | * Westminster | * 51.4973 | * -0.1372 |  MapI have created a map of London boroughs using folium to visualise boroughs using their latitude and longitude.Foursquare API venuesFoursquare API returned 3200 venues, which could be used for exploring the differences and similarities between London boroughs.Merged data with boroughs and venues  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | Neighborhood | Neighborhood Latitude | Neighborhood Longitude | Venue | Venue Latitude | Venue Longitude | Venue Category | | 0 | Barking and Dagenham | 51.5607 | 0.1557 | Better London Aquatics Centre | 51.540252 | -0.010536 | Pool | | 1 | Barking and Dagenham | 51.5607 | 0.1557 | Lee Valley VeloPark | 51.550345 | -0.016796 | Athletics & Sports | | 2 | Barking and Dagenham | 51.5607 | 0.1557 | Secret Cinema | 51.515953 | 0.007427 | Movie Theater | | 3 | Barking and Dagenham | 51.5607 | 0.1557 | Sodo Pizza Cafe - Walthamstow | 51.586197 | -0.020491 | Pizza Place | | 4 | Barking and Dagenham | 51.5607 | 0.1557 | Crate Brewery | 51.542973 | -0.022063 | Brewery |  List of top 10 venue category for each borough  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | Neighborhood | 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 | Hotel | Theater | Cocktail Bar | Coffee Shop | Park | Pub | Indian Restaurant | Nature Preserve | Canal | Performing Arts Venue | | 1 | Barnet | Park | Hotel | Coffee Shop | Cocktail Bar | Pub | Indian Restaurant | Pizza Place | Garden | Lounge | Grocery Store | | 2 | Bexley | Hotel | Park | Theater | Cocktail Bar | Coffee Shop | Pub | Garden | Art Museum | Canal | Beer Store | | 3 | Brent | Park | Hotel | Cocktail Bar | Grocery Store | Bookstore | Botanical Garden | Garden | Department Store | Pizza Place | Indian Restaurant | | 4 | Bromley | Hotel | Park | Cocktail Bar | Theater | Coffee Shop | Art Museum | Beer Store | Scenic Lookout | Liquor Store | Brewery | | 5 | Camden | Hotel | Park | Cocktail Bar | Theater | Indian Restaurant | Bookstore | Grocery Store | Coffee Shop | Department Store | Garden | | 6 | Croydon | Hotel | Park | Art Museum | Theater | Cocktail Bar | Café | Boutique | Pizza Place | Plaza | Bookstore | | 7 | Ealing | Park | Hotel | Cocktail Bar | Garden | Art Museum | Bookstore | Botanical Garden | Department Store | Café | Pizza Place | | 8 | Enfield | Park | Cocktail Bar | Coffee Shop | Hotel | Pub | Garden | Indian Restaurant | Grocery Store | Nature Preserve | Climbing Gym | | 9 | Greenwich | Hotel | Park | Cocktail Bar | Theater | Coffee Shop | Pub | Garden | Canal | Market | Brewery | | 10 | Hackney | Hotel | Cocktail Bar | Coffee Shop | Theater | Pub | Grocery Store | Canal | Ice Cream Shop | Nature Preserve | Garden | | 11 | Hammersmith and Fulham | Hotel | Park | Cocktail Bar | Art Museum | Café | Bookstore | Botanical Garden | Department Store | Garden | Pizza Place | | 12 | Haringey | Park | Coffee Shop | Cocktail Bar | Hotel | Pub | Indian Restaurant | Garden | Nature Preserve | Grocery Store | Climbing Gym | | 13 | Harrow | Park | Hotel | Cocktail Bar | Coffee Shop | Café | Grocery Store | Garden | Pizza Place | Botanical Garden | Boutique | | 14 | Havering | Hotel | Cocktail Bar | Theater | Coffee Shop | Park | Pub | Nature Preserve | Indian Restaurant | Brewery | Canal | | 15 | Hillingdon | Park | Hotel | Garden | Cocktail Bar | Pizza Place | Botanical Garden | Café | Coffee Shop | Pub | Department Store | | 16 | Hounslow | Park | Hotel | Cocktail Bar | Garden | Café | Art Museum | Pizza Place | Botanical Garden | Department Store | Hotel Bar | | 17 | Islington | Hotel | Coffee Shop | Cocktail Bar | Park | Pub | Theater | Indian Restaurant | Grocery Store | Garden | Steakhouse | | 18 | Kensington and Chelsea | Hotel | Park | Cocktail Bar | Art Museum | Department Store | Garden | Bookstore | Plaza | Clothing Store | Pizza Place | | 19 | Kingston upon Thames | Park | Hotel | Cocktail Bar | Art Museum | Café | Garden | Bookstore | Botanical Garden | Department Store | Clothing Store | | 20 | Lambeth | Hotel | Park | Art Museum | Theater | Cocktail Bar | Café | Coffee Shop | Boutique | Bookstore | Beer Store | | 21 | Lewisham | Hotel | Park | Cocktail Bar | Art Museum | Theater | Coffee Shop | Market | Art Gallery | Garden | Scenic Lookout | | 22 | Merton | Park | Hotel | Art Museum | Theater | Café | Botanical Garden | Garden | Beer Store | Plaza | Clothing Store | | 23 | Newham | Hotel | Park | Theater | Cocktail Bar | Coffee Shop | Pub | Garden | Canal | Nature Preserve | Brewery | | 24 | Redbridge | Hotel | Theater | Cocktail Bar | Coffee Shop | Park | Pub | Indian Restaurant | Canal | Nature Preserve | Climbing Gym | | 25 | Richmond upon Thames | Park | Hotel | Art Museum | Café | Cocktail Bar | Garden | Bookstore | Botanical Garden | Department Store | Clothing Store | | 26 | Southwark | Hotel | Cocktail Bar | Art Museum | Coffee Shop | Theater | Indian Restaurant | Pub | Liquor Store | Clothing Store | Park | | 27 | Sutton | Park | Hotel | Café | Theater | Art Museum | Botanical Garden | Garden | Clothing Store | Bar | Hotel Bar | | 28 | Tower Hamlets | Hotel | Cocktail Bar | Theater | Coffee Shop | Park | Pub | Garden | Indian Restaurant | Canal | Nature Preserve | | 29 | Waltham Forest | Hotel | Park | Coffee Shop | Cocktail Bar | Pub | Theater | Grocery Store | Indian Restaurant | Garden | Scenic Lookout | | 30 | Wandsworth | Hotel | Park | Cocktail Bar | Art Museum | Theater | Café | Bookstore | Department Store | Botanical Garden | Art Gallery | | 31 | Westminster | Hotel | Park | Cocktail Bar | Art Museum | Theater | Bookstore | Hotel Bar | Department Store | Art Gallery | Plaza |  Methodology I have used an unsupervised machine learning algorithm, K-means to cluster London boroughs. It is one of the most common methods and does a good job given the data on venues and boroughs. I checked for the optimal number of clusters, and the graph suggests that 4 would be a good number.  Elbow graph showing that 4 clusters are optimal.   Results Below is the table with 32 boroughs, their most common venues, and cluster assignment for each of them.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | Neighborhood | 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 | Hotel | Theater | Cocktail Bar | Coffee Shop | Park | Pub | Indian Restaurant | Nature Preserve | Canal | Performing Arts Venue | | 1 | Barnet | Park | Hotel | Coffee Shop | Cocktail Bar | Pub | Indian Restaurant | Pizza Place | Garden | Lounge | Grocery Store | | 2 | Bexley | Hotel | Park | Theater | Cocktail Bar | Coffee Shop | Pub | Garden | Art Museum | Canal | Beer Store | | 3 | Brent | Park | Hotel | Cocktail Bar | Grocery Store | Bookstore | Botanical Garden | Garden | Department Store | Pizza Place | Indian Restaurant | | 4 | Bromley | Hotel | Park | Cocktail Bar | Theater | Coffee Shop | Art Museum | Beer Store | Scenic Lookout | Liquor Store | BreIry | | 5 | Camden | Hotel | Park | Cocktail Bar | Theater | Indian Restaurant | Bookstore | Grocery Store | Coffee Shop | Department Store | Garden | | 6 | Croydon | Hotel | Park | Art Museum | Theater | Cocktail Bar | Café | Boutique | Pizza Place | Plaza | Bookstore | | 7 | Ealing | Park | Hotel | Cocktail Bar | Garden | Art Museum | Bookstore | Botanical Garden | Department Store | Café | Pizza Place | | 8 | Enfield | Park | Cocktail Bar | Coffee Shop | Hotel | Pub | Garden | Indian Restaurant | Grocery Store | Nature Preserve | Climbing Gym | | 9 | Greenwich | Hotel | Park | Cocktail Bar | Theater | Coffee Shop | Pub | Garden | Canal | Market | BreIry | | 10 | Hackney | Hotel | Cocktail Bar | Coffee Shop | Theater | Pub | Grocery Store | Canal | Ice Cream Shop | Nature Preserve | Garden | | 11 | Hammersmith and Fulham | Hotel | Park | Cocktail Bar | Art Museum | Café | Bookstore | Botanical Garden | Department Store | Garden | Pizza Place | | 12 | Haringey | Park | Coffee Shop | Cocktail Bar | Hotel | Pub | Indian Restaurant | Garden | Nature Preserve | Grocery Store | Climbing Gym | | 13 | Harrow | Park | Hotel | Cocktail Bar | Coffee Shop | Café | Grocery Store | Garden | Pizza Place | Botanical Garden | Boutique | | 14 | Havering | Hotel | Cocktail Bar | Theater | Coffee Shop | Park | Pub | Nature Preserve | Indian Restaurant | BreIry | Canal | | 15 | Hillingdon | Park | Hotel | Garden | Cocktail Bar | Pizza Place | Botanical Garden | Café | Coffee Shop | Pub | Department Store | | 16 | Hounslow | Park | Hotel | Cocktail Bar | Garden | Café | Art Museum | Pizza Place | Botanical Garden | Department Store | Hotel Bar | | 17 | Islington | Hotel | Coffee Shop | Cocktail Bar | Park | Pub | Theater | Indian Restaurant | Grocery Store | Garden | Steakhouse | | 18 | Kensington and Chelsea | Hotel | Park | Cocktail Bar | Art Museum | Department Store | Garden | Bookstore | Plaza | Clothing Store | Pizza Place | | 19 | Kingston upon Thames | Park | Hotel | Cocktail Bar | Art Museum | Café | Garden | Bookstore | Botanical Garden | Department Store | Clothing Store | | 20 | Lambeth | Hotel | Park | Art Museum | Theater | Cocktail Bar | Café | Coffee Shop | Boutique | Bookstore | Beer Store | | 21 | Lewisham | Hotel | Park | Cocktail Bar | Art Museum | Theater | Coffee Shop | Market | Art Gallery | Garden | Scenic Lookout | | 22 | Merton | Park | Hotel | Art Museum | Theater | Café | Botanical Garden | Garden | Beer Store | Plaza | Clothing Store | | 23 | Newham | Hotel | Park | Theater | Cocktail Bar | Coffee Shop | Pub | Garden | Canal | Nature Preserve | BreIry | | 24 | Redbridge | Hotel | Theater | Cocktail Bar | Coffee Shop | Park | Pub | Indian Restaurant | Canal | Nature Preserve | Climbing Gym | | 25 | Richmond upon Thames | Park | Hotel | Art Museum | Café | Cocktail Bar | Garden | Bookstore | Botanical Garden | Department Store | Clothing Store | | 26 | Southwark | Hotel | Cocktail Bar | Art Museum | Coffee Shop | Theater | Indian Restaurant | Pub | Liquor Store | Clothing Store | Park | | 27 | Sutton | Park | Hotel | Café | Theater | Art Museum | Botanical Garden | Garden | Clothing Store | Bar | Hotel Bar | | 28 | ToIr Hamlets | Hotel | Cocktail Bar | Theater | Coffee Shop | Park | Pub | Garden | Indian Restaurant | Canal | Nature Preserve | | 29 | Waltham Forest | Hotel | Park | Coffee Shop | Cocktail Bar | Pub | Theater | Grocery Store | Indian Restaurant | Garden | Scenic Lookout | | 30 | Wandsworth | Hotel | Park | Cocktail Bar | Art Museum | Theater | Café | Bookstore | Department Store | Botanical Garden | Art Gallery | | 31 | Istminster | Hotel | Park | Cocktail Bar | Art Museum | Theater | Bookstore | Hotel Bar | Department Store | Art Gallery | Plaza |   Here is a map of clustered boroughs of London.    London boroughs fall into four clusters rather neatly, with no obvious outliers. The east and the west boroughs have fewer hotels, more parks and other residential facilities for everyday life. More centric borrows lean towards hotels and overall infrastructure that aims at short-term visitors (such as theatres and restaurants). Discussion London boroughs fall into four clusters rather neatly, with no obvious outliers. The east and the west boroughs have fewer hotels, more parks and other residential facilities for everyday life. More centric borrows lean towards hotels and overall infrastructure that aims at short-term visitors (such as theatres and restaurants). ConclusionClustering algorithms proved very useful for creating a map of London, where boroughs are combined based on their prevalence of venues of a certain type. Data analysis can be useful for obtaining various type of results, such as giving more nuanced information on the best places to live, for example. |
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