Capstone Project

The Battle of Neighborhoods

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1. Introduction/Business Problem

If you are a first-time visitor to London, it can seem like an overwhelming place because there are so many popular places to visit, such as the iconic clock tower called 'Big Ben', London Bridge, London Eye, Westminster Abbey, Buckingham Palace, Windsor Castle, museums, and the list goes on. Although 11.3 million visitors are expected in 2021, which is nowhere near the 21 million visitors in 2019, it is still a very large number for a city with a population of approximately 9 million. Besides so many tourist attractions, what kinds of restaurants are available in London? This project will help answer this question using Foursquare API, which is an independent location data platform that provides diverse detailed information about venues and their locations.

2. Data Description

For this project, geographical data, such as boroughs (neighborhoods), coordinates (latitude and longitude) will be needed to display these locations on maps. Wikipedia is a good source to retrieve London's list of boroughs and geopy library will be used to get coordinates for those boroughs. Additionally, information regarding venues in each borough will be obtained from Foursquare API, which is an independent location data platform that provides diverse detailed information about venues and their locations.

Data Source for London's boroughs:

https://en.wikipedia.org/wiki/List_of_London_boroughs

3. Methodology
- Exploration Data Analysis
  - Find the names of London's boroughs, area and population by web-scraping
  - Clean the data so that irrelevant, incomplete or null values are eliminated
  - Get the geographical coordinates (latitude and longitude) of all the boroughs
- Data Visualization
  - Use Foursquare API to retrieve information about the different types of venues, categories and their count
  - Obtain information about different types of restaurants

o   Visualize the types of restaurants by their count using Seaborn library
- Cluster Boroughs of London
   o   Cluster boroughs by calculating the frequency of restaurant types using K-means algorithm from sklearn clustering library
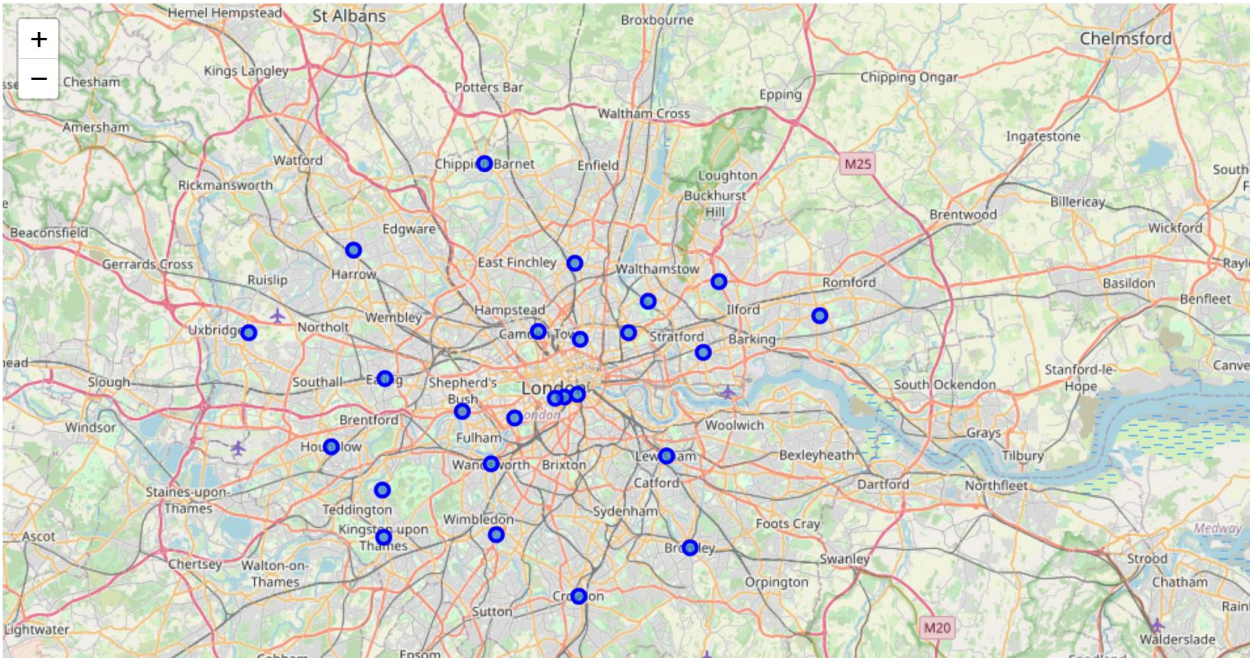   o   Visualize these clusters using Folium, a map rendering library

4. Results

London has 32 boroughs and Barnet has the highest population of 395,896 within an area of 33.49 square miles and Bromley has the highest area of 57.97 square miles with 332,336 people in 2019. Barnet is more densely populated.

	Borough	Area (sq mi)	Population (2019 est)[1]
0	Barking and Dagenham[note 1]	13.93	212906
1	Barnet	33.49	395896
2	Bexley	23.38	248287
3	Brent	16.70	329771
4	Bromley	57.97	332336
5	Camden	8.40	270029
6	Croydon	33.41	386710
7	Ealing	21.44	341806
8	Enfield	31.74	333794
9	Greenwich [note 2]	18.28	287942
10	Hackney	7.36	281120
11	Hammersmith and Fulham[note 4]	6.33	185143
12	Haringey	11.42	268647
13	Harrow	19.49	251160
14	Havering	43.35	259552
15	Hillingdon	44.67	306870
16	Hounslow	21.61	271523
17	Islington	5.74	242467

18	Kensington and Chelsea	4.68	156129
19	Kingston upon Thames	14.38	177507
20	Lambeth	10.36	326034
21	Lewisham	13.57	305842
22	Merton	14.52	206548
23	Newham	13.98	353134
24	Redbridge	21.78	305222
25	Richmond upon Thames	22.17	198019
26	Southwark	11.14	318830
27	Sutton	16.93	206349
28	Tower Hamlets	7.63	324745
29	Waltham Forest	14.99	276983
30	Wandsworth	13.23	329677
31	Westminster	8.29	261317

The Folium library plots a map where we can see the all the boroughs in London.
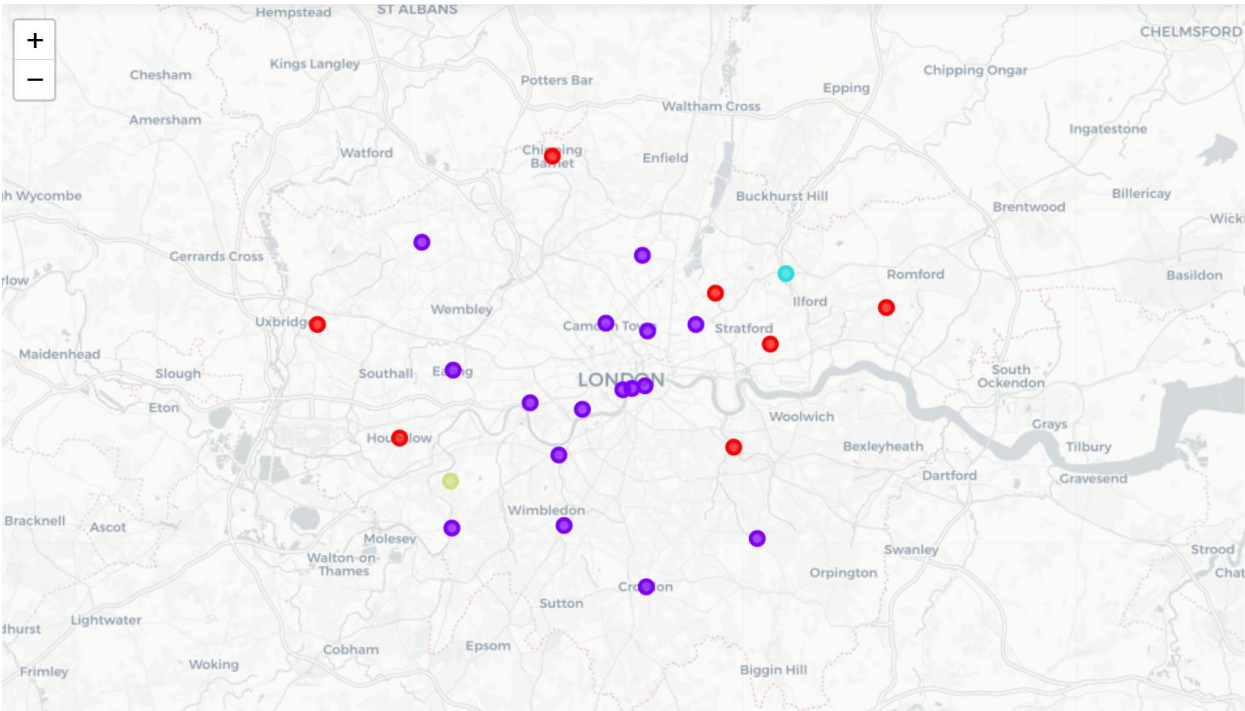

Fast Food and Italian Restaurants have the highest number of restaurants compared to other restaurants followed by Restaurant category, which is not very descriptive in the food it offers. Indian Restaurant has the fourth highest frequency of restaurants in London.

When I checked for the Top 10 Most Common Venues for each Borough, there was a variety of restaurants depending on the borough. For instance, if you were in Barnet, the most common restaurant would be Fast Food, whereas, if you were in Croydon, you would find more Indian restaurants listed there. These are the first five boroughs:

	Borough	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
0	Barnet	Fast Food Restaurant	Restaurant	Italian Restaurant	Chinese Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant
1	Bromley	Portuguese Restaurant	Turkish Restaurant	Sushi Restaurant	Fast Food Restaurant	Asian Restaurant	Mexican Restaurant	Vietnamese Restaurant	Chinese Restaurant	German Restaurant	French Restaurant
2	Camden	Restaurant	Chinese Restaurant	American Restaurant	Fast Food Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant
3	Croydon	Indian Restaurant	Italian Restaurant	Asian Restaurant	Spanish Restaurant	Korean Restaurant	Portuguese Restaurant	Malay Restaurant	Caribbean Restaurant	Mediterranean Restaurant	Eastern European Restaurant
4	Ealing	Italian Restaurant	Vietnamese Restaurant	Thai Restaurant	Fast Food Restaurant	Asian Restaurant	Greek Restaurant	Indian Restaurant	English Restaurant	Caribbean Restaurant	Middle Eastern Restaurant

In order to find clusters of similar restaurants, we used kmeans algorithm, and the Elbow Method showed the best k-value, which is the number of clusters. For this project, the best number of clusters was 4. Once again, the folium map showed the 4 clusters of 10 most common restaurant types in London.

Cluster 1:

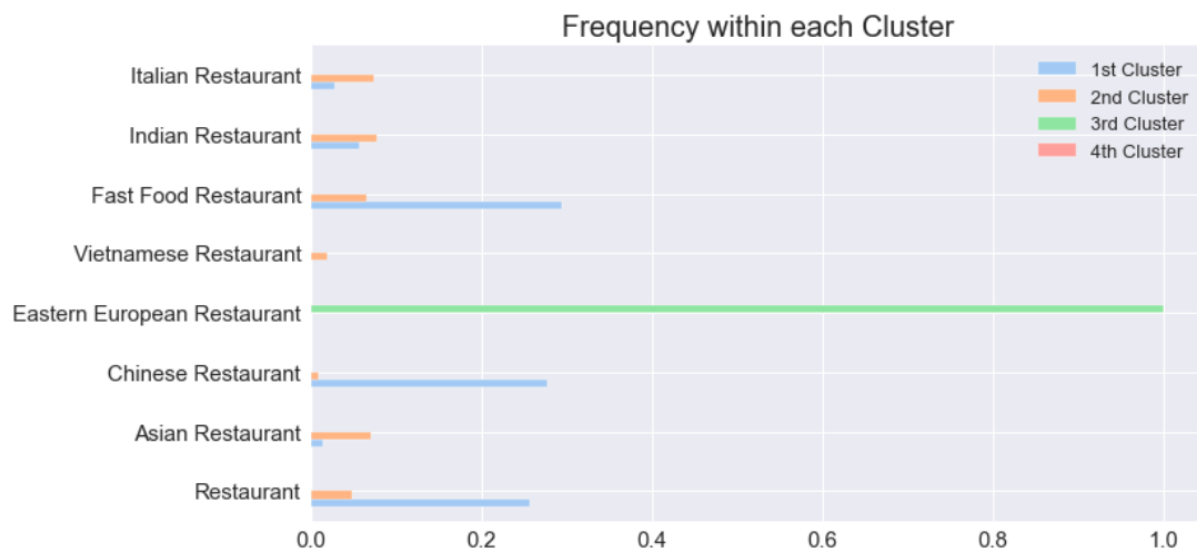|	Borough	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
0	Barking and Dagenham	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	Barnet	0	Fast Food Restaurant	Restaurant	Italian Restaurant	Chinese Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant
2	Bexley	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	Brent	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
5	Camden	0	Restaurant	Chinese Restaurant	American Restaurant	Fast Food Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant
8	Enfield	0	Chinese Restaurant	Restaurant	Vietnamese Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Fast Food Restaurant	Falafel Restaurant	English Restaurant
9	Greenwich	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
15	Hillingdon	0	Chinese Restaurant	Fast Food Restaurant	Italian Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Falafel Restaurant	English Restaurant	Eastern European Restaurant
16	Hounslow	0	Indian Restaurant	Fast Food Restaurant	Chinese Restaurant	Asian Restaurant	Restaurant	Vietnamese Restaurant	Dim Sum Restaurant	Greek Restaurant	German Restaurant	French Restaurant
21	Lewisham	0	Fast Food Restaurant	Restaurant	Turkish Restaurant	Portuguese Restaurant	Vietnamese Restaurant	Chinese Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Falafel Restaurant
23	Newham	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
27	Sutton	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
28	Tower Hamlets	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
29	Waltham Forest	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

Cluster 2:

	Borough	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
4	Bromley	1	Portuguese Restaurant	Turkish Restaurant	Sushi Restaurant	Fast Food Restaurant	Asian Restaurant	Mexican Restaurant	Vietnamese Restaurant	Chinese Restaurant	German Restaurant	French Restaurant
6	Croydon	1	Indian Restaurant	Italian Restaurant	Asian Restaurant	Spanish Restaurant	Korean Restaurant	Portuguese Restaurant	Malay Restaurant	Caribbean Restaurant	Mediterranean Restaurant	Eastern European Restaurant
7	Ealing	1	Italian Restaurant	Vietnamese Restaurant	Thai Restaurant	Fast Food Restaurant	Asian Restaurant	Greek Restaurant	Indian Restaurant	English Restaurant	Caribbean Restaurant	Middle Eastern Restaurant
10	Hackney	1	Vegetarian / Vegan Restaurant	English Restaurant	Modern European Restaurant	Dim Sum Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Fast Food Restaurant	Falafel Restaurant
11	Hammersmith and Fulham	1	Portuguese Restaurant	Japanese Restaurant	Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant	English Restaurant	Asian Restaurant	Indian Restaurant	Sushi Restaurant	Turkish Restaurant
12	Haringey	1	Indian Restaurant	Middle Eastern Restaurant	Turkish Restaurant	African Restaurant	Italian Restaurant	Fast Food Restaurant	Bulgarian Restaurant	Polish Restaurant	Malay Restaurant	Mediterranean Restaurant
13	Harrow	1	Afghan Restaurant	Indian Restaurant	Fast Food Restaurant	Italian Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Falafel Restaurant	English Restaurant	Eastern European Restaurant
14	Havering	1	Caribbean Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	French Restaurant	Falafel Restaurant	Portuguese Restaurant	Italian Restaurant	Turkish Restaurant	Austrian Restaurant	English Restaurant
17	Islington	1	Mediterranean Restaurant	French Restaurant	Japanese Restaurant	Sushi Restaurant	Italian Restaurant	Restaurant	Mexican Restaurant	Peruvian Restaurant	Austrian Restaurant	Indian Restaurant
18	Kensington and Chelsea	1	Japanese Restaurant	English Restaurant	Seafood Restaurant	American Restaurant	French Restaurant	Italian Restaurant	Middle Eastern Restaurant	Vietnamese Restaurant	Tapas Restaurant	German Restaurant
19	Kingston upon Thames	1	Italian Restaurant	Sushi Restaurant	Thai Restaurant	Indian Restaurant	Vietnamese Restaurant	Mexican Restaurant	Asian Restaurant	Cajun / Creole Restaurant	English Restaurant	Falafel Restaurant
20	Lambeth	1	Korean Restaurant	Japanese Restaurant	Dim Sum Restaurant	Italian Restaurant	Thai Restaurant	French Restaurant	Latin American Restaurant	Restaurant	Indian Restaurant	German Restaurant
22	Merton	1	Thai Restaurant	Sushi Restaurant	Fast Food Restaurant	Brazilian Restaurant	Vietnamese Restaurant	Chinese Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Falafel Restaurant
26	Southwark	1	Chinese Restaurant	English Restaurant	Italian Restaurant	Restaurant	Ramen Restaurant	Vietnamese Restaurant	Asian Restaurant	Israeli Restaurant	Kebab Restaurant	Korean Restaurant
30	Wandsworth	1	Asian Restaurant	Indian Restaurant	Thai Restaurant	Restaurant	Portuguese Restaurant	Chinese Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Fast Food Restaurant
31	Westminster	1	Italian Restaurant	Indian Restaurant	Sushi Restaurant	Asian Restaurant	Restaurant	Dim Sum Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Fast Food Restaurant

Cluster 3:

	Borough	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
24	Redbridge	2	Eastern European Restaurant	Vietnamese Restaurant	Italian Restaurant	Indian Restaurant	Greek Restaurant	German Restaurant	French Restaurant	Fast Food Restaurant	Falafel Restaurant	English Restaurant

Cluster 4:

	Borough	Cluster Labels	1st Most Common Restaurant	2nd Most Common Restaurant	3rd Most Common Restaurant	4th Most Common Restaurant	5th Most Common Restaurant	6th Most Common Restaurant	7th Most Common Restaurant	8th Most Common Restaurant	9th Most Common Restaurant	10th Most Common Restaurant
25	Richmond upon Thames	3	German Restaurant	Vietnamese Restaurant	Italian Restaurant	Indian Restaurant	Greek Restaurant	French Restaurant	Fast Food Restaurant	Falafel Restaurant	English Restaurant	Eastern European Restaurant

Frequency within each Cluster

5. Conclusion

According to the results, Cluster 2 has the highest number of boroughs with the most variety of cuisine types. Kingston upon Thames has the most variety in the restaurants (27) followed by Islington (26), whereas, Redbridge and Richmond upon Thames has the least number of venue categories in restaurants. The cluster map shows a concentration of purple dots that are in the heart of London, which is Cluster 2.

Cluster 1 had missing values for restaurants for boroughs: Barking and Dagenham, Bexley, Brent, Greenwich, Newham, Sutton, Tower Hamlets, and Waltham Forest which is an anomaly. Further research would be needed to figure out why there were no listings of restaurants in these boroughs, however, it is out of the scope of this project.