STORE LOCATION IN LONDON

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I. INTRODUCTION

A. DESCRIPTION & DISUCSSION OF THE BACKGROUND

London is a megacity, the capital of the United Kingdom and one of the oldest of the world's great cities, with its history spanning nearly two millennia. By far Britain's largest metropolis, it is also the country's economic, transportation, and cultural center. The population of London had already exceeded one million by 1800 and it reached 9 million in 2018. London and the UK's population has one of the most diverse groups of origin countries in the world. Also, London is one of the world's leading tourism destinations with 21 million international visitors in 2018.

In recent years the restaurant industry in the United Kingdom and specifically London has undergone a period of growth. Consumer expenditure on restaurants and cafes reached close to £ 88 billion in 2017. The number of enterprises has been steadily increasing, contributing £ 17.9 billion to the British Economy.

Considering London's diversity and ethnicity it is evident that starting a restaurant business would earn you more money comparatively than most of the other businesses. However this diversity of nations and culinaries possibilities may be an issue for a WW brand with a Fast Food Behavior similarity. Although, with more profitable business there comes the most competition. This article can serve as one of the guides to start a store with different identities Indian, Italian, American, with different food sort variation based on the cultural tendency we have by providing a specific location. The number of restaurants in a specific location categorized based on cuisine and population distribution based on ethnicity and culture are some of the features considered for analysis.

B. PROBLEM DESCRIPTION

A restaurant is a business which prepares and serves food and drink to customers in return for money, either paid before the meal, after the meal or with an open account. London is famous for its excellent cuisine. Its food culture includes an array of international cuisines influenced by the city's immigrant history.

So, it is evident that to survive in such competitive market it is very important to strategically plan. Various factors need to be studied in order to decide on location such as;

1. London Population and demographics
2. Who are the competitors in that location?
3. Cuisine served / Menu of the competitors
4. Are there any venues like Tourist attractions, Entertainment zones, Parks etc., nearby where floating population is high.
5. Segmentation of the Borough
6. Untapped markets
7. Saturated markets etc.

And the list goes on…

Even though well-funded STARBUCKS Company Ltd. needs to choose the correct location to expand its venture. If this is successful, they can replicate the same in other locations. First move is very important, thereby choice of location is very important.

Target Audience:

To recommend the correct location, STARBUCKS Company Ltd has appointed me to lead of the Data Science team. The objective is to locate and recommend to the management which neighborhood of London will be best choice to start a store based in the customized nationality. The management also expects to understand the rationale of the recommendations made.

Success Criteria:

The success criteria of the project will be a good recommendation of neighborhood choice to STARBUCKS Company Ltd based on Lack of such restaurants considering cuisine as a factor in that location.

II. DATA

To build a recommendation model, following datasets and information are considered for analysis;

1. Scrapped Wikipedia using BeautifulSoup, to extract information about 32 London boroughs also known as local authority districts. Also, considered local areas or neighborhoods for each borough for detailed analysis.
2. I used Foursquare API to get information about available restaurants for a given neighborhood and borough in London. The API also provided information about restaurant styles based on cuisine.
3. Employed data provided by the British Government from data.london.gov.uk to get more insights about London boroughs.

The data provided knowledge about the population density, immigrants' country of origin and many more.

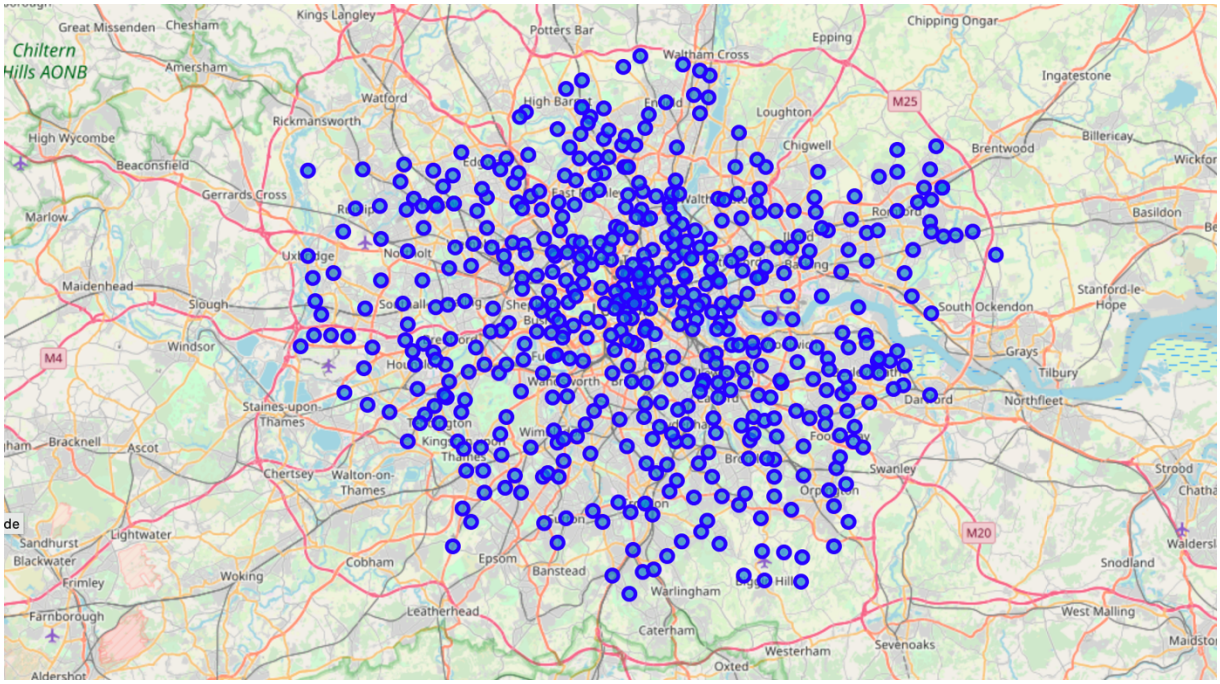
III. METHODOLOGY

Business Understanding:

Our main goal is to get optimum location for new restaurant business in London for STARBUCKS Company based on cuisine.

A. EXPLORATORY DATA ANALYSIS

London is mainly divided into 32 boroughs also known as local authority districts with 526 neighborhoods. Geopy and folium libraries to create a map to visualize neighborhoods of London.

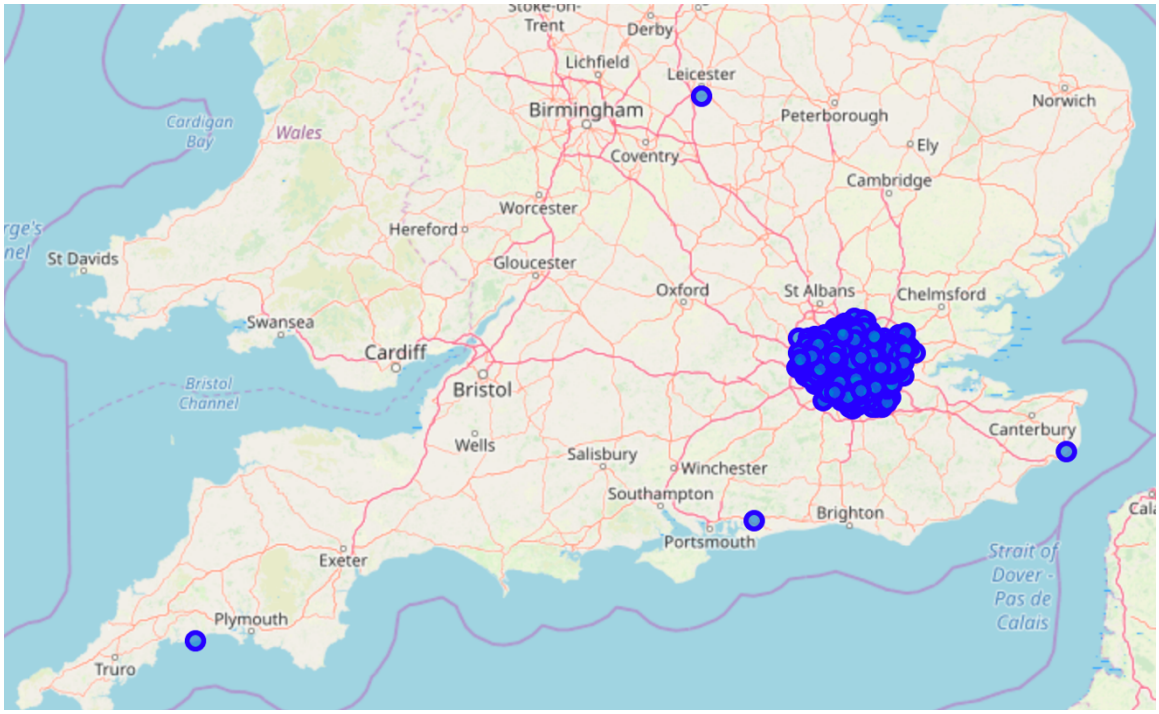


All the blue markers on the map above are for neighborhoods. It is evident that the city is more congested at the center and widespread in the outskirts

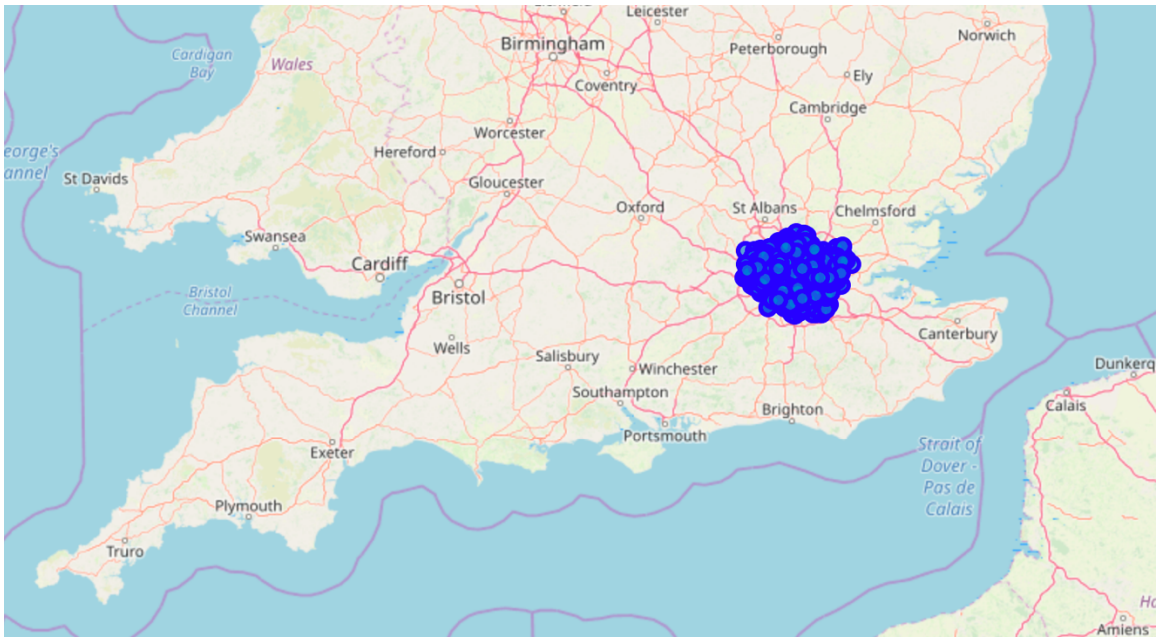
B. PROBLEM APPROACH AND USING K-MEANS CLUSTERING

The process starts with scrapping the Wikipedia web page containing information about London boroughs and neighborhoods present in each borough using library BeautifulSoup. During the process Pandas data frame is constructed with two rows having boroughs and corresponding neighborhood information.

The neighborhoods in the resulting data frame has to be plotted on a map using folium library. In order to do so, latitude and longitude value for each neighborhood is determined using geopy library. After getting latitude and longitude values, it is merged with the original data frame containing neighborhood and borough information appropriately. Finally, each neighborhood is plotted on folium map. Neighborhood with undetermined latitude and longitude values by geopy are excluded from evaluation. Also, the resulting values create four outliers and they are dealt using corresponding longitude values.



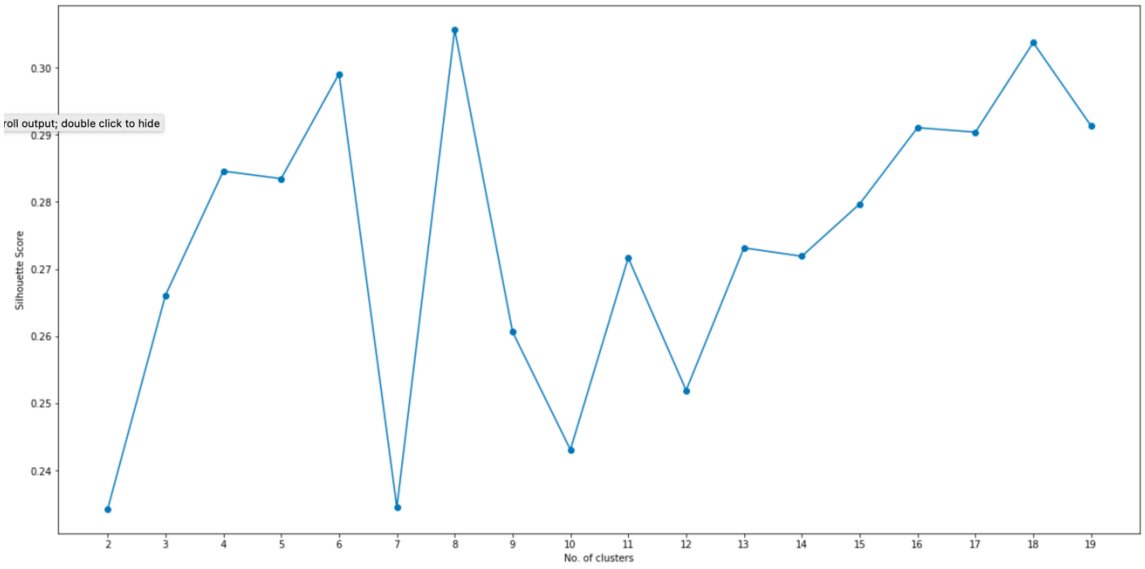
The extreme left location to be considered for study is Longford, Hillington with longitude value of '-0.490805'. Similarly, the extreme right is North Ockendon, Havering with longitude value of '0.293698'. So, any longitude value less then '-0.5' and greater than '0.3' will not be considered for evaluation.



Now Foursquare API is used to explore the neighborhoods and segment them. First, data frame with all the venues information provided by foursquare for the given latitude and longitude values. Foursquare API returns 12237 results with 423 unique categories. Now, only restaurants are extracted from venue category list. The resulting data frame has 87 unique categories or cuisines available in London. Next, one hot encoding is performed on the resulting data frame for each neighborhood. The results have 2657 unique restaurants in London with 87 different style of cuisines.

Rows are grouped by neighborhood to determine the frequency of occurrence of each restaurant. A new data frame is created with each row assigned for neighborhood and its corresponding top ten common restaurants based on cuisine.

Finally, k-means clustering is performed on the data frame to check the pattern for each neighborhood and get the information about the top ten common restaurants for each neighborhood. Before fitting the data frame best value of k for k-means clustering is determined by based on silhouette_score from sklearn.metrics. It is observed from the graph below that, k = 8 would yield more better results for the computation using k-means clustering.



Finally, k-means clustering is performed on the following data frame with k = 8, to determine the pattern of top 10 restaurants based on cuisine in every neighborhood.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
11	Acton	51.508140	-0.273261	Amigo's Peri Peri	51.508396	-0.274561	Fast Food Restaurant	2	Japanese Restaurant	Thai Restaurant	Chinese Restaurant
15	Acton	51.508140	-0.273261	Ting Tong Thai	51.508363	-0.277755	Thai Restaurant	2	Japanese Restaurant	Thai Restaurant	Chinese Restaurant
18	Acton	51.508140	-0.273261	North China Restaurant	51.508251	-0.277435	Chinese Restaurant	2	Japanese Restaurant	Thai Restaurant	Chinese Restaurant
24	Acton	51.508140	-0.273261	Hasu	51.508167	-0.269494	Japanese Restaurant	2	Japanese Restaurant	Thai Restaurant	Chinese Restaurant
30	Addington	51.358637	-0.031635	The Cricketers (Harvester)	51.357833	-0.032844	English Restaurant	1	English Restaurant	Xinjiang Restaurant	Gluten-free Restaurant

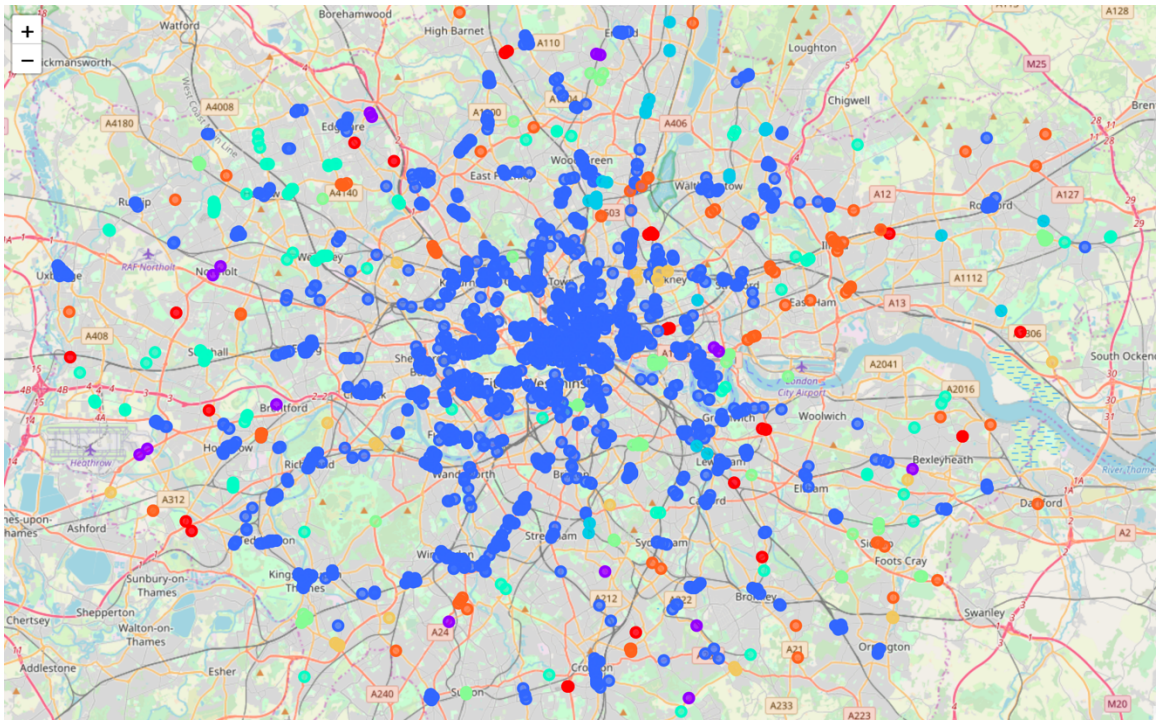
III. RESULTS

Neighborhood K-Means clustering based on mean occurrence of venue category:

All 8 clusters follow unique pattern for top ten common restaurants for a particular neighborhood. The detail shows the number of neighborhoods assigned to each cluster. Cluster 2 has the highest neighborhoods of 2306 and cluster 1 has the least with 16.

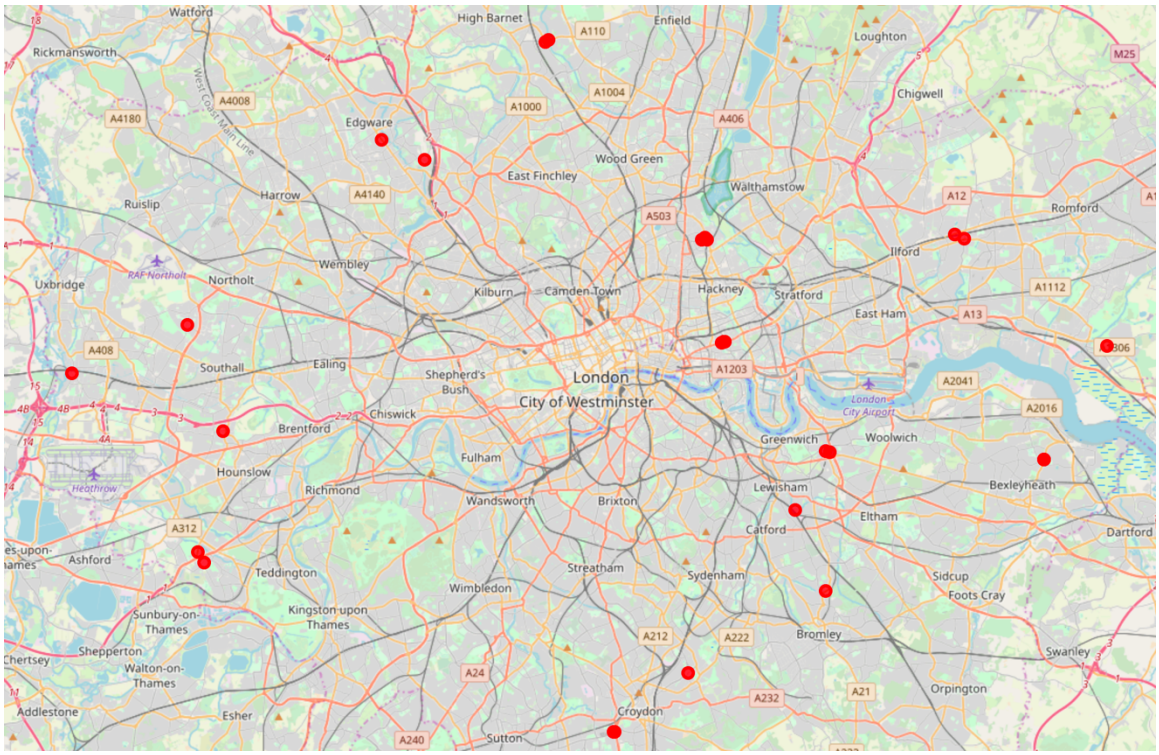
```
2    2306
4      97
7      77
5      64
3      36
6      33
0      28
1      16
Name: Cluster Labels, dtype: int64
```

The clustered map is shown below;



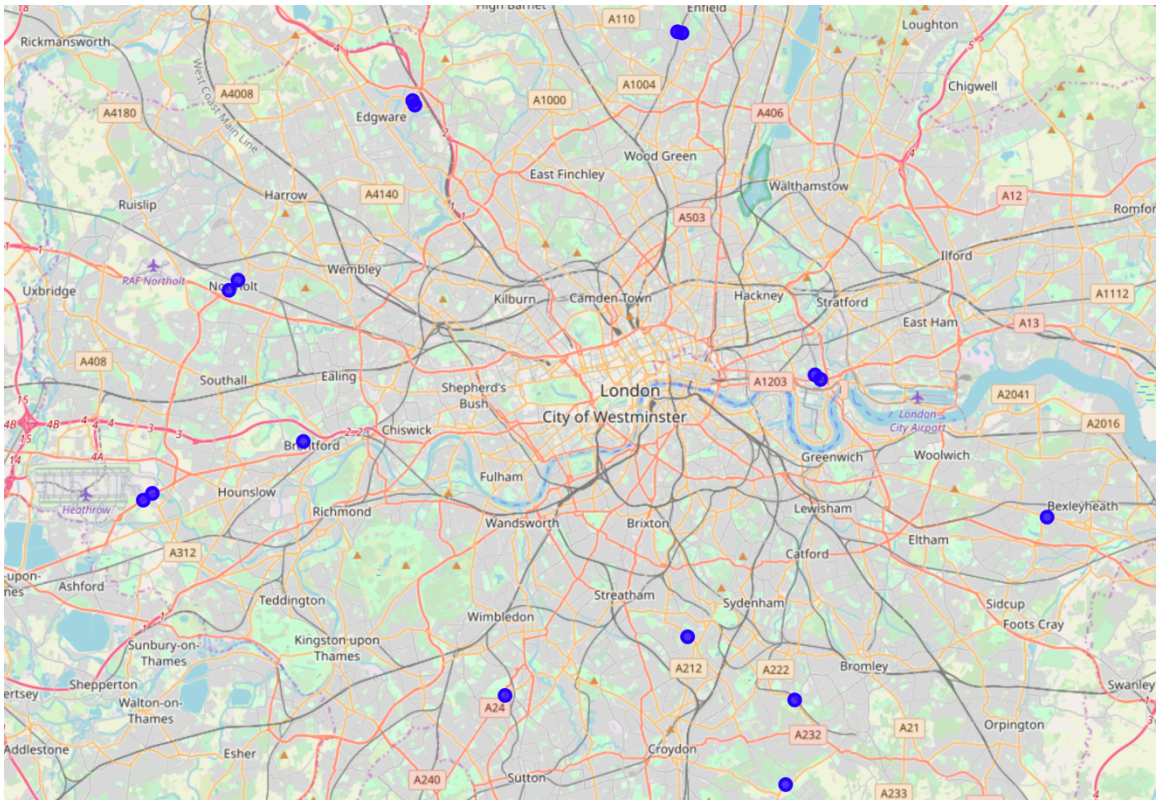
The resulting data frames for each cluster are shown below.

- Cluster 1 (Most Common: Chinese & Xinjiang Restaurant)



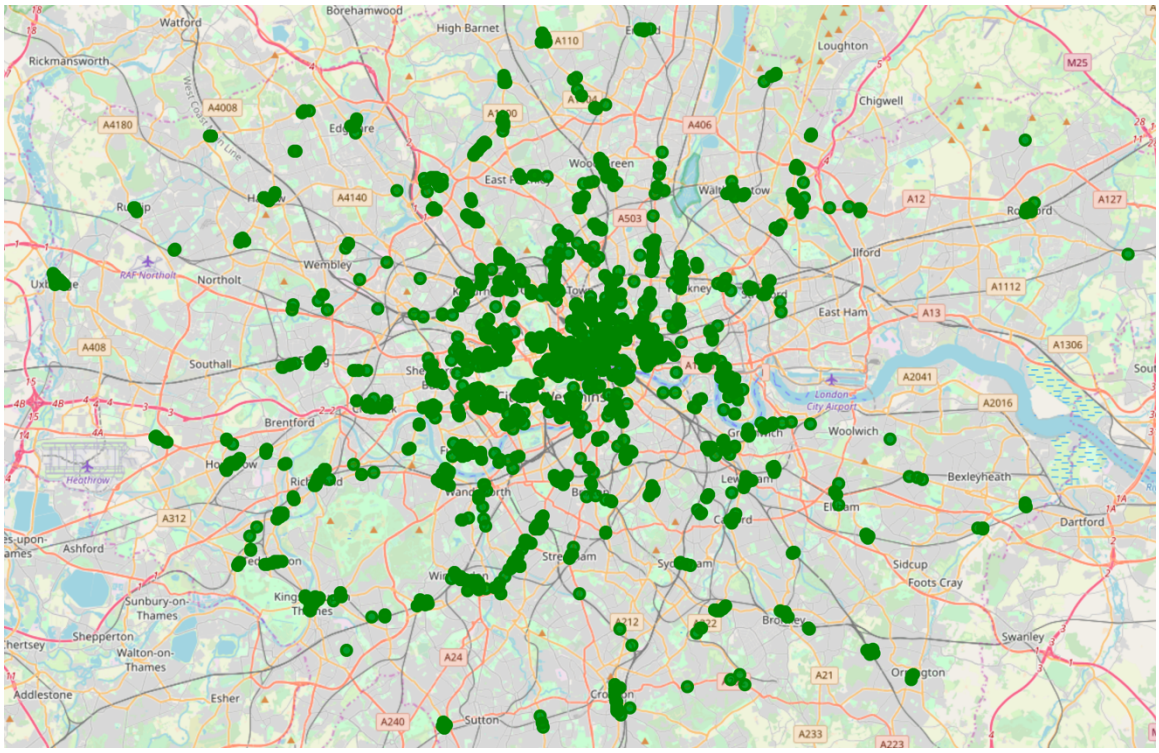
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	Co
1285	Blackheath Royal Standard	Chinese Restaurant	Fast Food Restaurant	Xinjiang Restaurant	Dumpling Restaurant	
1686	Burnt Oak	Chinese Restaurant	Xinjiang Restaurant	Dumpling Restaurant	Empanada Restaurant	
2757	Colindale	Chinese Restaurant	Xinjiang Restaurant	Dumpling Restaurant	Empanada Restaurant	
3525	East Barnet	Chinese Restaurant	Greek Restaurant	Xinjiang Restaurant	German Restaurant	
4471	Goodmayes	Chinese Restaurant	Fast Food Restaurant	Xinjiang Restaurant	Dumpling Restaurant	
5007	Hanworth	Restaurant	Chinese Restaurant	Xinjiang Restaurant	German Restaurant	
5268	Heston	Chinese Restaurant	Xinjiang Restaurant	Dumpling Restaurant	Empanada Restaurant	

- Cluster 2 (Most Common: English Restaurant)



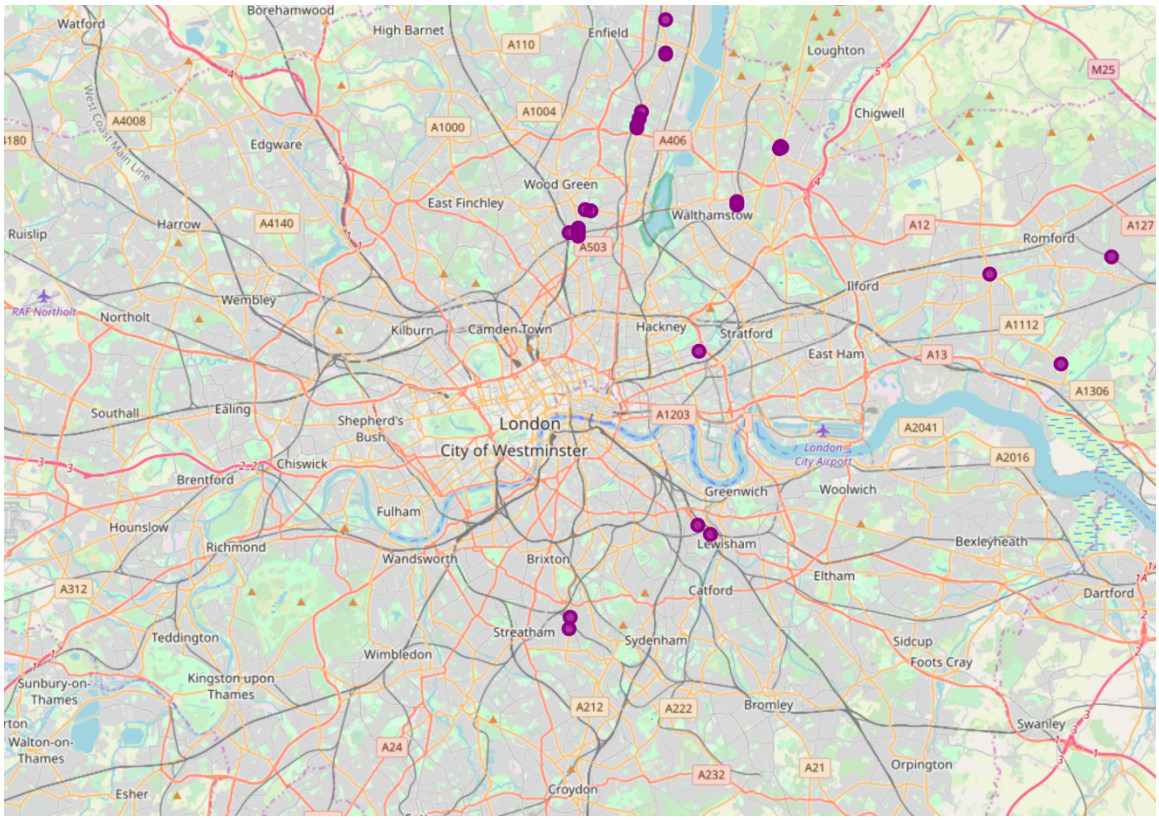
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	Co
30	Addington	English Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
1468	Brentford	English Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
3056	Crook Log	English Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
3659	Eden Park	English Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
4495	Grange Park	English Restaurant	Indian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	
4814	The Hale	English Restaurant	Mediterranean Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	
5183	Hatton	English Restaurant	Fast Food Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	

- Cluster 3 (Most Common: Depends upon neighborhood)



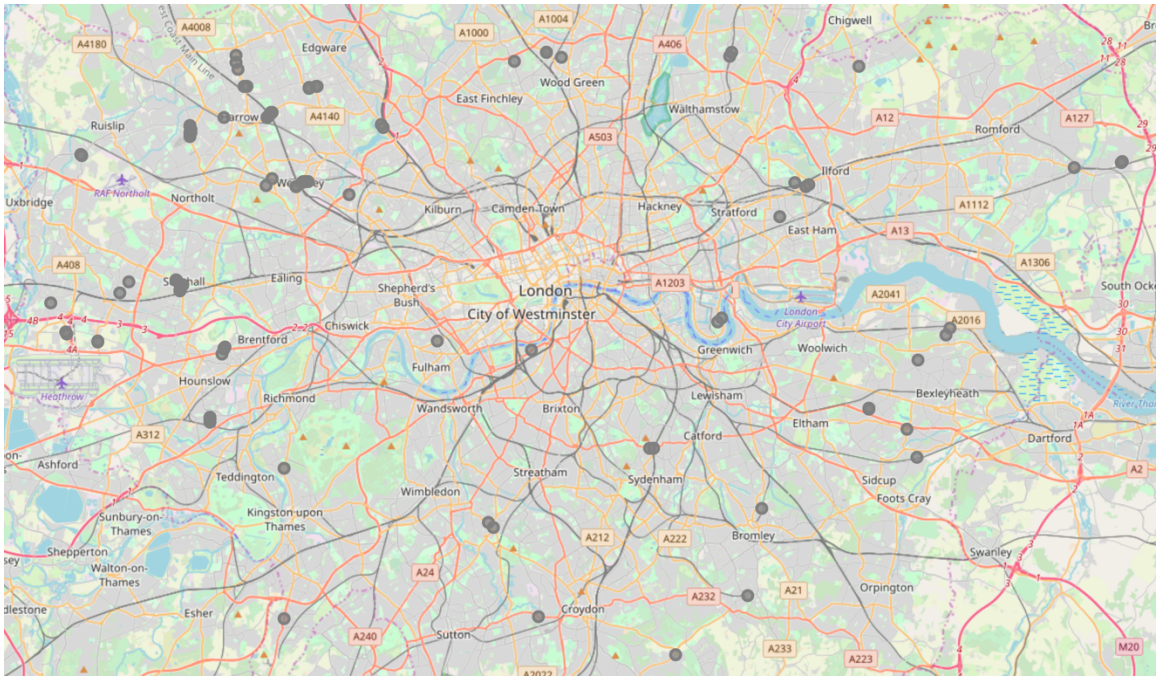
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
11	Acton	Japanese Restaurant	Thai Restaurant	Chinese Restaurant	Fast Food Restaurant
58	Aldgate	Indian Restaurant	Thai Restaurant	Asian Restaurant	Middle Eastern Restaurant
152	Aldwych	Restaurant	Seafood Restaurant	Sushi Restaurant	Italian Restaurant
254	Alperton	Middle Eastern Restaurant	Indian Restaurant	Asian Restaurant	Fast Food Restaurant
282	Angel	Sushi Restaurant	Vietnamese Restaurant	Mediterranean Restaurant	Indian Restaurant
356	Archway	Italian Restaurant	Japanese Restaurant	Vegetarian / Vegan Restaurant	Kebab Restaurant
398	Arnos Grove	French Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant

- Cluster 4 (Most Common: Turkish Restaurant)



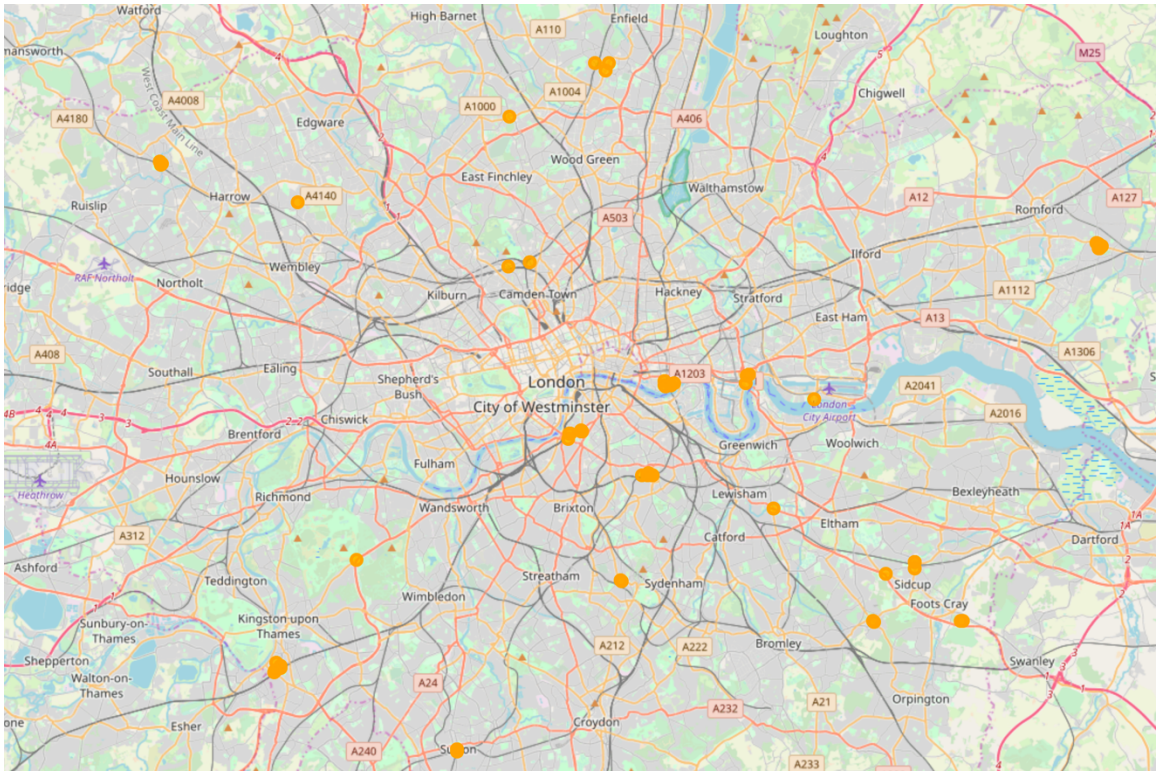
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	C
898	Becontree Heath	Turkish Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
3691	Edmonton	Turkish Restaurant	Kebab Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	
3819	Emerson Park	Turkish Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
3827	Enfield Highway	Turkish Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
4282	Freezywater	Turkish Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	
5050	Harringay	Turkish Restaurant	Mediterranean Restaurant	Tapas Restaurant	Fast Food Restaurant	
7756	Old Ford	Turkish Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant	

- Cluster 5 (Most Common: Indian Restaurant)



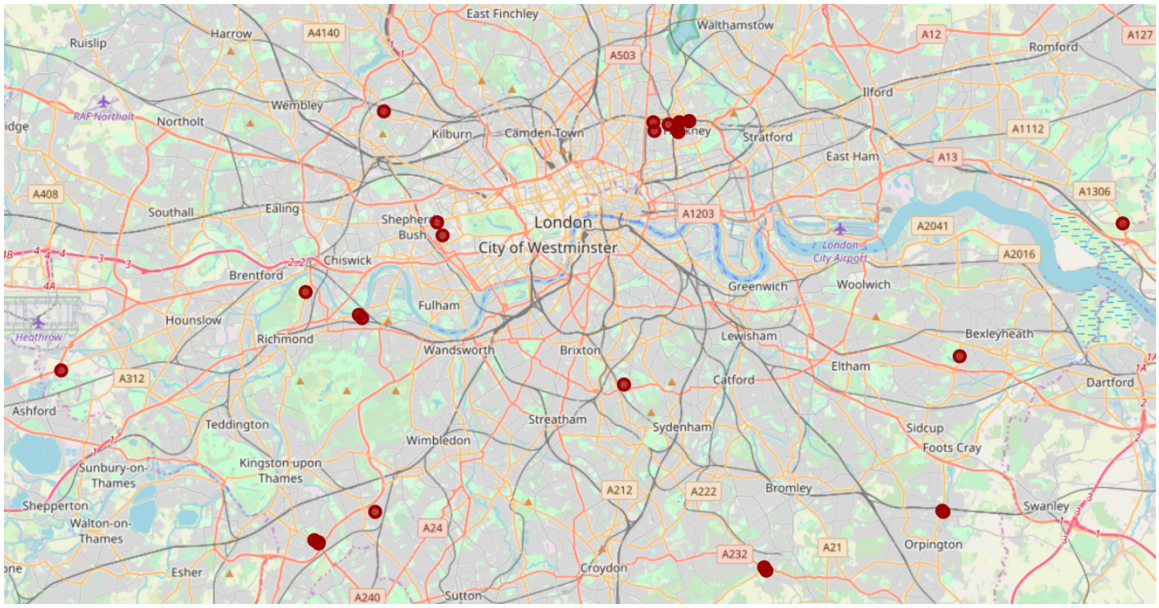
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
47	Albany Park	Indian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
908	Beddington	Indian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
1052	Belvedere	Eastern European Restaurant	Indian Restaurant	Gluten-free Restaurant	Empanada Restaurant
1312	Blendon	Indian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
1426	Bounds Green	Indian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
1449	Bowes Park	Greek Restaurant	Indian Restaurant	Gluten-free Restaurant	Empanada Restaurant
1522	Brent Park	Indian Restaurant	Fast Food Restaurant	Mediterranean Restaurant	Xinjiang Restaurant

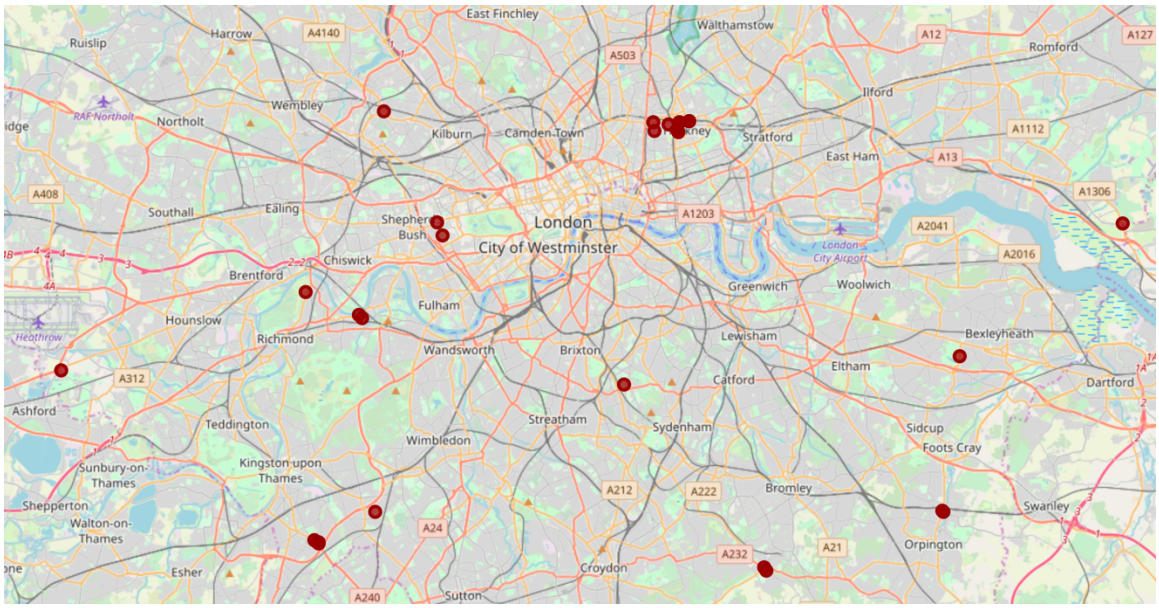
- Cluster 6 (Most Common: Italian Restaurant)



	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
1294	Blackwall	Italian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
2453	Chislehurst	Italian Restaurant	Indian Restaurant	Xinjiang Restaurant	German Restaurant
4285	Friern Barnet	Italian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
4427	Gipsy Hill	Italian Restaurant	Indian Restaurant	Xinjiang Restaurant	German Restaurant
4479	Gospel Oak	Italian Restaurant	French Restaurant	Xinjiang Restaurant	Gluten-free Restaurant
5604	Hornchurch	Italian Restaurant	American Restaurant	Thai Restaurant	Portuguese Restaurant
6240	Kingston Vale	Italian Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant

- Cluster 7 (Most Common: Multi-cuisine Restaurant)

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A12
A127
Ruislip
Romford
Ilford
RAF Northolt
Wembley
Northolt
Kilburn
Camden Town
Stratford
A1112
East Ham
A13
A408
A1306
Southall
Ealing
Shepherd's Bush
London
A1203
A2041
City of Westminster
London City Airport
A2016
Chiswick
Brentford
Greenwich
Woolwich
Fulham
Heathrow
Hounslow
Richmond
Wandsworth
Brixton
Lewisham
Bexleyheath
Eltham
A312
Catford
Dartford
Ashford
Teddington
Streatham
Sydenham
Sidcup
Wimbledon
Foots Cray
Kingston upon Thames
Sunbury-on-Thames
A212
A222
Bromley
Shepperton
Swanley
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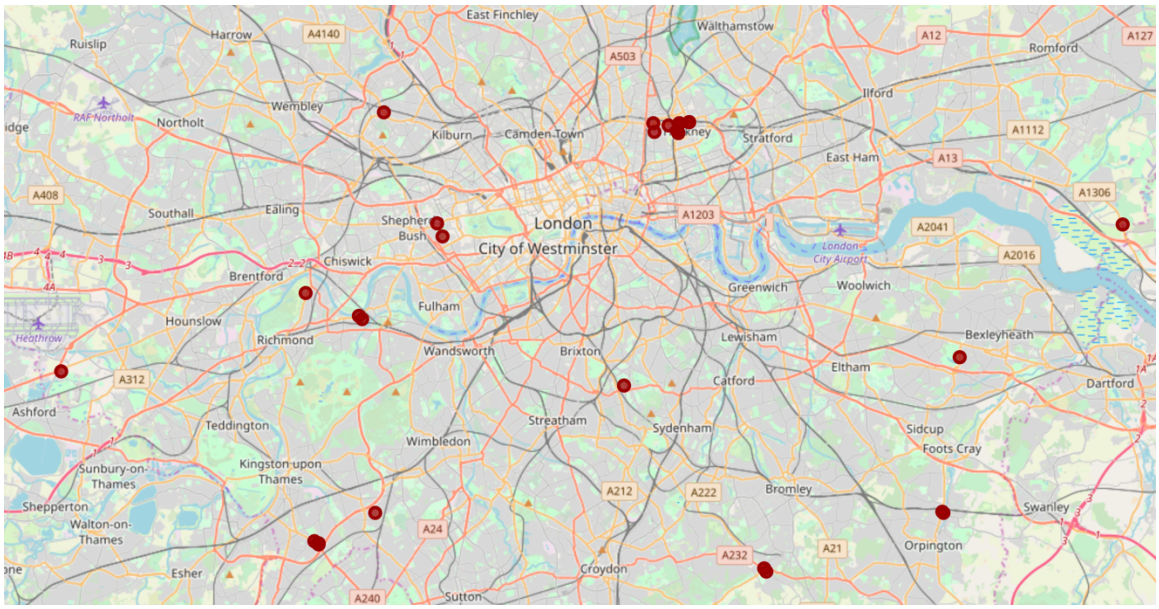
Walton-on-Thames
A232
A21
Orpington
Esher
Croydon
A240
Sutton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Sunbury-on-Thames
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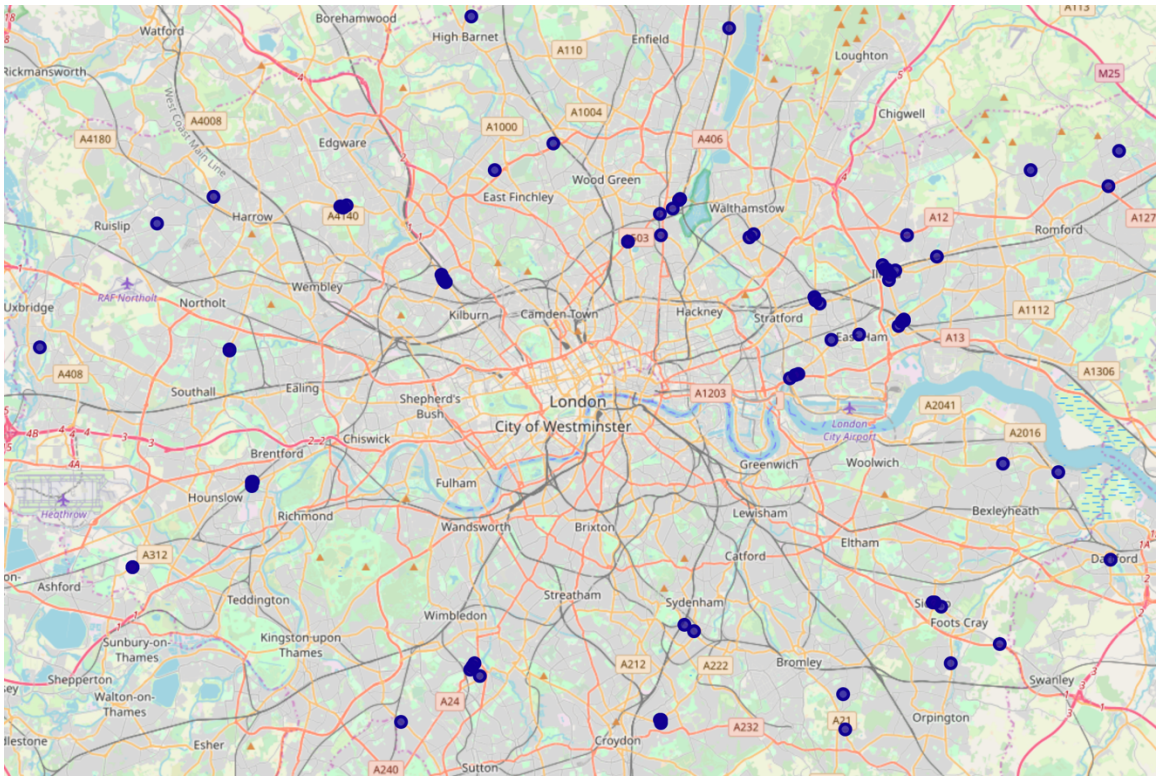
A222
Bromley
Shepperton
Swanley
A24
Walton-on-Thames
A232
A21
Orpington
Esher
Croydon
A240
Sutton

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
2805	Coney Hall	Restaurant	Dumpling Restaurant	Eastern European Restaurant	Empanada Restaurant
3213	Dalston	Restaurant	Modern European Restaurant	Israeli Restaurant	Indonesian Restaurant
3323	Dollis Hill	Restaurant	Dumpling Restaurant	Eastern European Restaurant	Empanada Restaurant
3340	Dulwich	Restaurant	Dumpling Restaurant	Eastern European Restaurant	Empanada Restaurant
3533	East Bedfont	Restaurant	Dumpling Restaurant	Eastern European Restaurant	Empanada Restaurant
4630	Hackney	Vietnamese Restaurant	Restaurant	Italian Restaurant	Israeli Restaurant
5214	Hazelwood	Restaurant	Dumpling Restaurant	Eastern European Restaurant	Empanada Restaurant

- Cluster 8 (Most Common: Fast Food Restaurant)



	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
37	Addiscombe	Fast Food Restaurant	Chinese Restaurant	Xinjiang Restaurant	Dumpling Restaurant
627	Barking	Fast Food Restaurant	Portuguese Restaurant	Chinese Restaurant	Xinjiang Restaurant
1533	Brimsdown	Fast Food Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
1636	Bromley Common	Fast Food Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
1963	Canning Town	Fast Food Restaurant	Turkish Restaurant	Xinjiang Restaurant	Gluten-free Restaurant
2764	Collier Row	Fast Food Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant
2942	Cowley	Fast Food Restaurant	Xinjiang Restaurant	Gluten-free Restaurant	Empanada Restaurant

IV. DISCUSSION

1. *The results can be approached in three ways;*
2. *If STARBUCKS company want to open a store in preferred location and irrespective of cuisine, refer to that neighborhood in specific cluster and chose cuisine with the least common restaurant for better profits*
3. *If STARBUCKS company wants to open a store with a preferred cuisine and customize the store to the most common nationality in the region*
4. *In the fast food predominant area concentrate the main store to do its traditional good performance close to fast food chains*

V. CONCLUSION

London has so many restaurants, yet certain neighborhood or borough doesn't have a specific cuisine restaurant available.

Depending on the culinary and focus different clusters in the city appears. If we want to test stores close to fast food restaurants, Italian, Indian, French, American, English, multifood may be a useful beta testa to replicate the investment in the clusters

As per the neighborhood of fast food restarants concentrate the main units based on the success track close to these stablishments and customized ethnical stores close to nationality concentrated clusters