

CAPSTONE PROJECT

BATTLE OF THE NEIGHBOURHOODS

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REPORT CONTENT

- 1) Introduction Section
 - a) The business problem to be solved by this project and who can benefit from it
- 2) Data Section
 - a) Describe the data requirements and the sources needed to solve the problem
- 3) Methodology Section
 - a) Main section of the report:- Data Processing, Describe/discuss any Extrapolatory Data Analysis and/or inferential statistical testing performed and/or Machine Learning Algorithm used.
- 4) Result and Discussion Section
 - a) Discussion of the results and observations and if any recommendations
- 5) Conclusion Section

INTRODUCTION

a) Current Scenario

I want to help realtors/buyers to make good investments as it would be a worthy investment if their needs such as aminities and facilities are closeby and within their price range and within walking distance during this pandemic.

b) Problems that are being tackled

Finding apartments in London based on the following conditions:-

- 1) Price range of the property should be within the price range
- 2) Located within walking distance(<=500m)
- 3) Venues and aminities that are desirable by the buyer

c) Target Audience

I believe that the methodology,tools and strategy used in this project is relevant for an entity considering to buy a property in London,UK and can be extended to other areas in US ,Asia etc.The use of FourSquare API's data and mapping techniques combined with data analysis will help resolve the key questions.

DATA SECTION

- Data Requirements
 - Geodata for the streets in London with venues established using Foursquare's API
 - List of the streets and the corresponding cost of properties in those streets using the data from HM Land Registry.
- Data Sources, Processing and Tools used
 - London data and map is created with the use of Nominatim, FourSquare API and folium for mapping.
 - The geolocation of the streets in London is retrieved using Nominatim.
 - Folium map was the basis of mapping with various features to consolidate all data in one map where one can visualize all the details needed to cluster the streets with respect to the common venues closeby.

METHODOLOGY

- Strategy to find the Answer

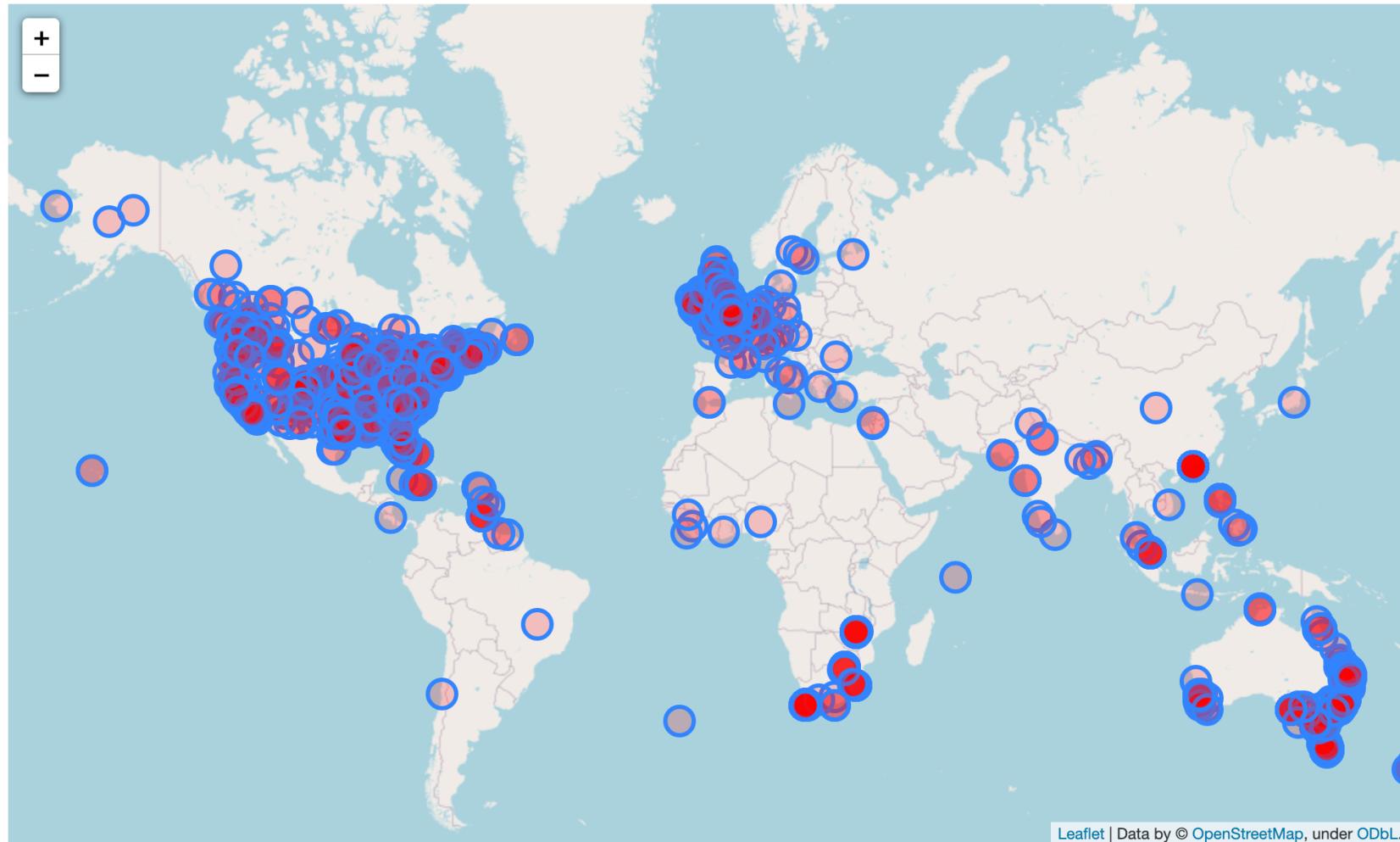
The strategy is based on mapping the described the data in order to facilitate the choice the relevant streets for buying a property. The information will be consolidate in one map where we can see the the name of the street and the cluster it belongs to. The popups on the map will display the location and the cluster of the venues applicable.

- Tools used

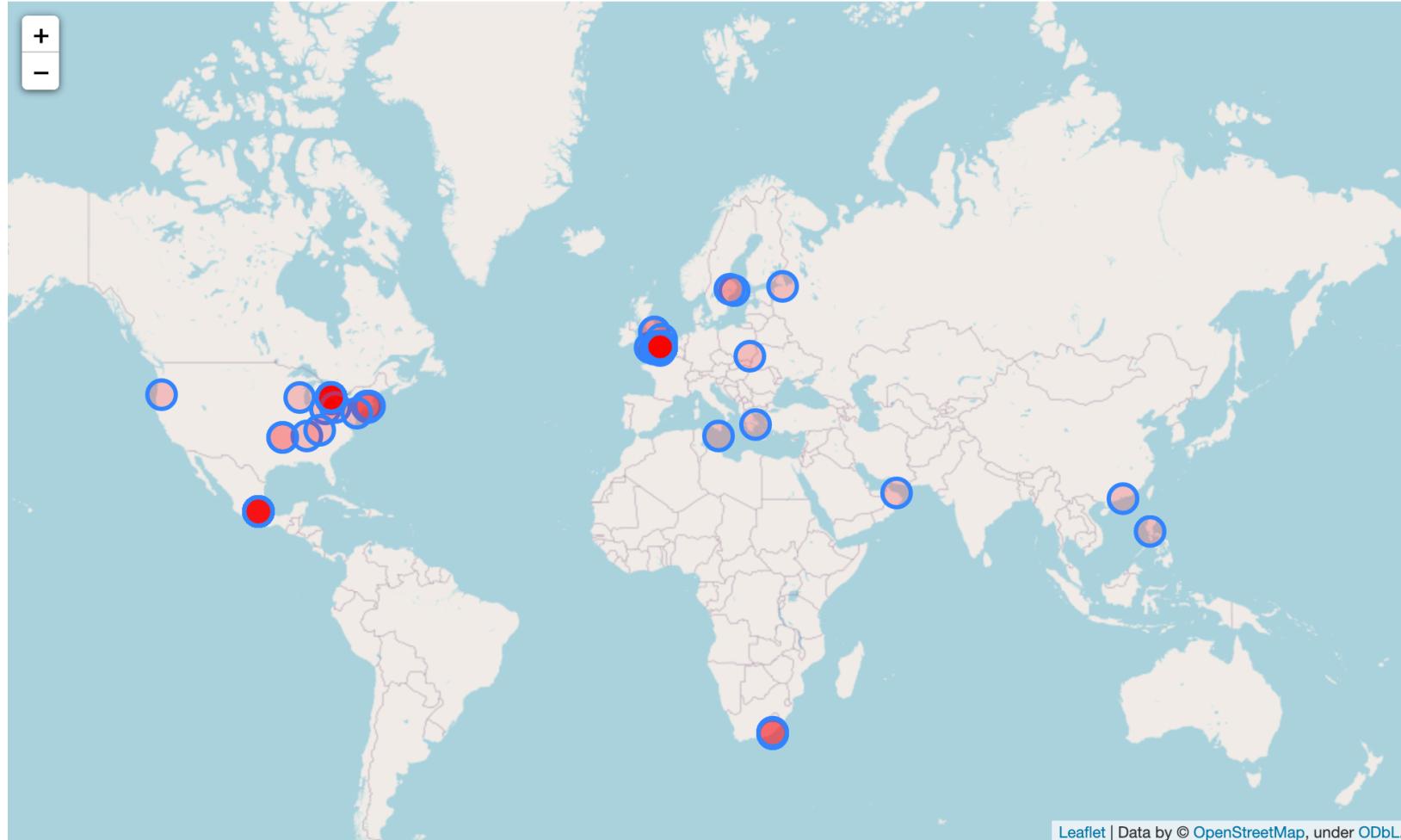
- The data was downloaded from the available dataset in csv format using pandas.
- Geodata was obtained by using Nominatim and rectified the error caused by the package by giving one more level of detail in the information provided to Nominatim.
- YellowBrick's KElbowVisualizer was used to find the elbow point for the dataframe created.
- Maps with popups labels allow quick identification of the location and feature thus making the selection very easy.

EXECUTION AND RESULTS

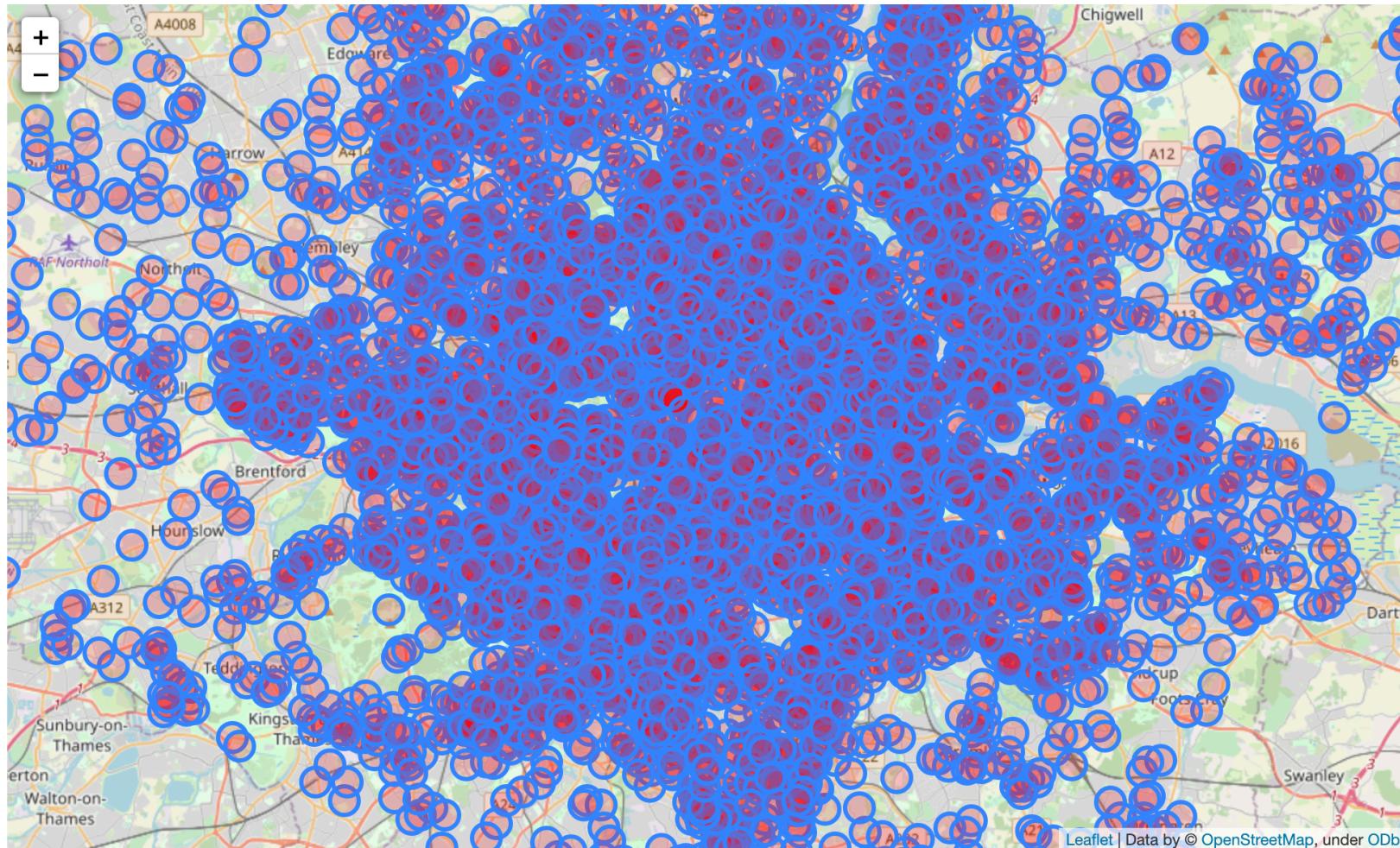
UNOPTIMIZED NOMINATIM GEOLOCATION



AFTER OPTIMIZING THE NOMINATIM AND DATASET



CURRENT PROPERTIES IN LONDON



That's a lot of properties

VENUES AROUND STREETS

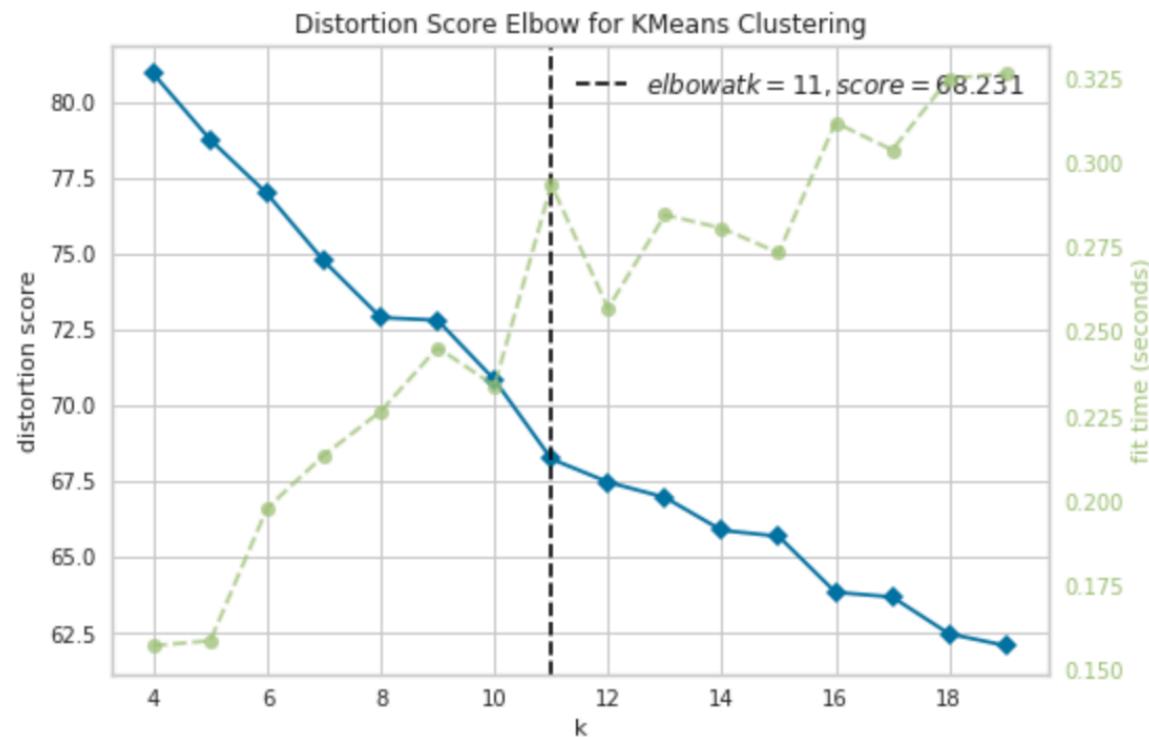
In [195]: `location_venues_london.head()`

Out[195]:

	Street	Street Latitude	Street Longitude	Venue	Venue Latitude	Venue Longitude
0	ABBEY PARADE,London	51.531393	-0.292546	Ristorante Belvedere	51.530216	-0.292395
1	ABBEY PARADE,London	51.531393	-0.292546	Fawanees	51.533734	-0.295594
2	ABBEY PARADE,London	51.531393	-0.292546	Tiger Bay	51.529426	-0.293440
3	ABBEY PARADE,London	51.531393	-0.292546	The Fox & Goose Hotel	51.533215	-0.295605
4	ABBEY PARADE,London	51.531393	-0.292546	Crowne Plaza London - Ealing	51.529613	-0.294060

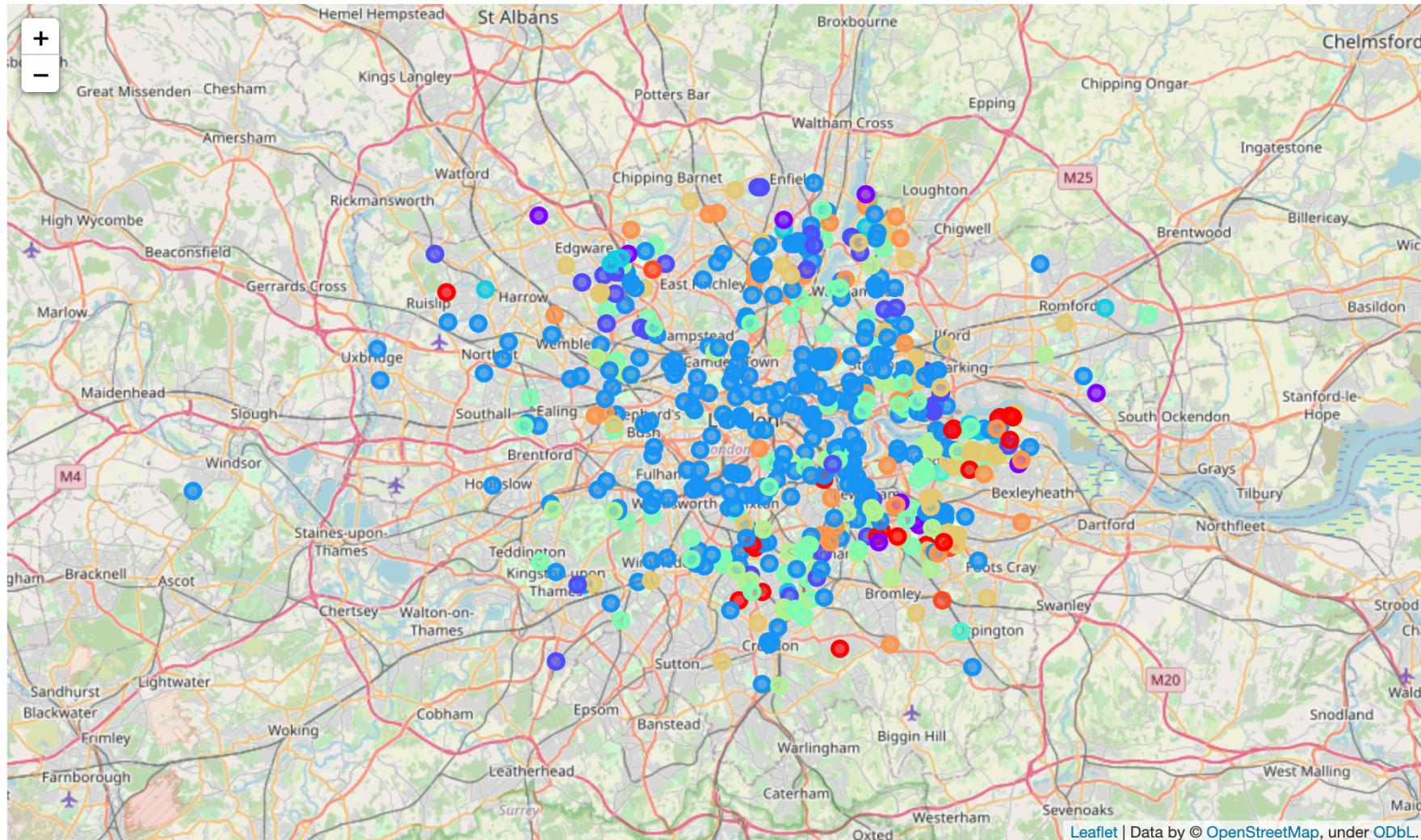
FINDING THE APPROPRIATE K-VALUE

```
In [233]: from sklearn.cluster import KMeans
model = KMeans()
visualizer = KElbowVisualizer(model, k=(4,20))
visualizer.fit(london_clustering)
visualizer.show()
```



```
Out[233]: <matplotlib.axes._subplots.AxesSubplot at 0x7f9b4694d208>
```

LONDON MAP WITH CLUSTERS



GEODATA OF LONDON PROPERTIES

In [19]: `london_sp_corr.head()`

Out[19]:

	Street	Price	location	point	Lat	Long	Alt
0	ABBEVILLE ROAD	6.392308e+05	(Abbeville Road, Wylie, Collin County, Texas, ...	(33.0364242, -96.5679899, 0.0)	33.036424	-96.567990	0.0
1	ABBEY DRIVE	4.400000e+05	(Abbey Drive, Abbots Langley, Three Rivers, He...	(51.6976203, -0.4081993, 0.0)	51.697620	-0.408199	0.0
2	ABBEY GROVE	3.665000e+05	(Abbey Grove, Minster, Thanet, Kent, South Eas...	(51.3305637, 1.3176161, 0.0)	51.330564	1.317616	0.0
3	ABBEY PARADE	2.515000e+05	(Abbey Parade, London Borough of Ealing, Londo...	(51.5313928, -0.2925463, 0.0)	51.531393	-0.292546	0.0
4	ABBEY ROAD	1.120500e+06	(Abbey Road, Martha Lake, Snohomish County, Wa...	(47.84846975, -122.22978951430886, 0.0)	47.848470	-122.229790	0.0

VENUES IN CLUSTER 0

```
In [312]: final.loc[final['Cluster Labels'] == 0, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[312]:

	Street	Price	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
44	BELVEDERE STRAND,London	250000.000000	Convenience Store	Zoo Exhibit	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	Falafel Restau
45	BELVOIR CLOSE,London	228500.000000	Park	Bar	Convenience Store	Pet Store	Farmers Market	English Restaurant	Ethiopian Restaurant	Event Service	Event Space
48	BERTRAND WAY,London	273500.000000	Convenience Store	Sports Club	Zoo Exhibit	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory
65	BRAEMAR AVENUE,London	256000.000000	Convenience Store	Recreation Center	River	Park	Zoo Exhibit	Farm	Electronics Store	English Restaurant	Ethiopi Restau
100	CARISBROOKE ROAD,London	293000.000000	Convenience Store	Park	Construction & Landscaping	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit
142	COURTLAND GROVE,London	280000.000000	Grocery Store	Convenience Store	Soccer Field	Farmers Market	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit

VENUES IN CLUSTER 1

```
In [313]: final.loc[final['Cluster Labels'] == 1, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[313]:

	Street	Price	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
15	ALLEN ROAD, London	255000.0	Construction & Landscaping	Convenience Store	Pharmacy	Café	Zoo Exhibit	Fast Food Restaurant	Ethiopian Restaurant	Event Service	Event Space
122	CHURCHBURY ROAD, London	300000.0	Construction & Landscaping	Soccer Field	Zoo Exhibit	Fast Food Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory
194	FIRS LANE, London	258397.0	Soccer Field	Zoo Exhibit	Cosmetics Shop	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory
230	GREGORY CRESCENT, London	280000.0	Construction & Landscaping	Scenic Lookout	Zoo Exhibit	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit
259	HEXAL ROAD, London	250000.0	Construction & Landscaping	Whisky Bar	History Museum	Zoo Exhibit	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space
326	LYME FARM ROAD, London	230000.0	Rugby Pitch	Recreation Center	Gym / Fitness Center	Soccer Field	Farm	Electronics Store	English Restaurant	Ethiopian Restaurant	Event Service

VENUES IN CLUSTER 2

```
In [314]: final.loc[final['Cluster Labels'] == 2, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[314]:

	Street	Price	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 Ven
8	AERODROME ROAD, London	282500.0	Bus Stop	Supermarket	Gym / Fitness Center	Chinese Restaurant	Café	Metro Station	Coffee Shop	Grocery Store	Boarding House
9	AEROVILLE, London	212000.0	Supermarket	Coffee Shop	Grocery Store	Gym / Fitness Center	Metro Station	Pizza Place	Park	Fish & Chips Shop	Financial or Legal Service
18	AMBASSADOR GARDENS, London	244500.0	Supermarket	Fast Food Restaurant	Pub	Hotel	Bus Station	Gym / Fitness Center	Soccer Field	Farm	English Restaurant
58	BOLTON ROAD, London	287250.0	Breakfast Spot	Train Station	Supermarket	Platform	Fast Food Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit
86	BUCHANAN CLOSE, London	300000.0	Indian Restaurant	Supermarket	Lake	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit
89	BUTTERFIELD SQUARE, London	215000.0	Supermarket	Light Rail Station	Bus Station	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory

VENUES IN CLUSTER 3

```
In [315]: final.loc[final['Cluster Labels'] == 3, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[315]:

	Street	Price	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
0	ABBEY PARADE,London	251500.000000	Indian Restaurant	Italian Restaurant	English Restaurant	Fast Food Restaurant	Fish & Chips Shop	Metro Station	Mediterranean Restaurant	Hardware Store
1	ABBEYFIELDS CLOSE,London	240000.000000	Grocery Store	Food	Laundry Service	Furniture / Home Store	Middle Eastern Restaurant	Health & Beauty Service	Bar	Farmers Market
5	ADDINGTON STREET,London	279881.000000	Coffee Shop	Hotel	Bar	Sandwich Place	Café	Japanese Restaurant	Bakery	Movie Theater
10	AGATE CLOSE,London	220000.000000	Hotel	Rafting	Restaurant	Farm	Light Rail Station	Chinese Restaurant	Coffee Shop	Pub
12	ALBYN ROAD,London	285000.000000	Food Truck	Library	Café	Grocery Store	Gym	Gym / Fitness Center	Pet Store	Coffee Shop
13	ALDEBURGH STREET,London	295000.000000	Clothing Store	Sporting Goods Shop	Pub	Scandinavian Restaurant	Supermarket	Furniture / Home Store	Fast Food Restaurant	Doner Restaurant

VENUES IN CLUSTER 4

```
In [316]: final.loc[final['Cluster Labels'] == 4, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[316]:

	Street	Price	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
4	ACKLINGTON DRIVE,London	274000.0	Park	Gym	Business Service	Pizza Place	Zoo Exhibit	Farmers Market	English Restaurant	Ethiopian Restaurant	Event Service	Event Space
19	AMPLEFORTH ROAD,London	275000.0	Park	Pub	Lake	Supermarket	Farm	Electronics Store	English Restaurant	Ethiopian Restaurant	Event Service	Event Space
28	ARDENT CLOSE,London	210000.0	Park	Construction & Landscaping	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	Falafel Restau
34	BAILEY CLOSE,London	251275.0	Park	Pizza Place	Grocery Store	Flower Shop	Farm	Electronics Store	English Restaurant	Ethiopian Restaurant	Event Service	Event Space
120	CHINGFORD AVENUE,London	276000.0	Park	Pub	Pizza Place	Zoo Exhibit	Farmers Market	Electronics Store	English Restaurant	Ethiopian Restaurant	Event Service	Event Space

VENUES IN CLUSTER 5

```
In [317]: final.loc[final['Cluster Labels'] == 5, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[317]:

	Street	Price	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	Cluster Labels
31	ASHMORE ROAD,London	225654.5	Bus Stop	Zoo Exhibit	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	Falafel Restaurant	Farm	5
53	BIRKDALE CLOSE,London	262500.0	Bus Stop	Zoo Exhibit	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	Falafel Restaurant	Farm	5

VENUES IN CLUSTER 6

```
In [318]: final.loc[final['Cluster Labels'] == 6, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[318]:

	Street	Price	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
23	ANERLEY STATION ROAD, London	297000.0	Pub	Train Station	Gas Station	Park	Farm	Electronics Store	English Restaurant	Ethiopian Restaurant	Event Service
32	AVON ROAD, London	232500.0	Rugby Pitch	Bus Stop	History Museum	Park	Zoo Exhibit	English Restaurant	Ethiopian Restaurant	Event Service	Event Space
43	BELL DRIVE, London	275000.0	Gym	Bus Stop	Scenic Lookout	Park	Zoo Exhibit	Farm	English Restaurant	Ethiopian Restaurant	Event Service
59	BORLAND ROAD, London	204000.0	Park	Pub	Theater	Bus Stop	Thai Restaurant	Farmers Market	Ethiopian Restaurant	Event Service	Event Space
68	BRANDON ESTATE, London	253000.0	Café	Park	Pub	Bakery	Grocery Store	Performing Arts Venue	Bike Rental / Bike Share	Tailor Shop	Fast Food Restaurant
69	BRAY ROAD, London	260000.0	Metro Station	Gym / Fitness Center	Bus Stop	Park	Fast Food Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit

VENUES IN CLUSTER 7

```
In [319]: final.loc[final['Cluster Labels'] == 7, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[319]:

	Street	Price	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
6	ADINE ROAD, London	230000.000000	Café	Gym	Gym / Fitness Center	Bus Station	Grocery Store	Farmers Market	English Restaurant	Ethiopian Restaurant
11	ALAN HOCKEN WAY, London	260000.000000	Platform	Rugby Pitch	Café	Fish & Chips Shop	Trail	English Restaurant	Ethiopian Restaurant	Event Service
20	ANCONA ROAD, London	239000.000000	Platform	Coffee Shop	Grocery Store	Romanian Restaurant	Pub	Hostel	Plaza	Thai Restaurant
38	BARROWFIELD CLOSE, London	270000.000000	Hotel	Turkish Restaurant	Café	Mediterranean Restaurant	Zoo Exhibit	Fast Food Restaurant	Ethiopian Restaurant	Event Service
77	BROADHEAD STRAND, London	291666.666667	History Museum	Café	Park	Pub	Supermarket	Gift Shop	Gym / Fitness Center	Museum
81	BROOKHOWSE ROAD, London	225000.000000	Shipping Store	Train Station	Dance Studio	Hardware Store	Farm	Electronics Store	English Restaurant	Ethiopian Restaurant

VENUES IN CLUSTER 8

```
In [320]: final.loc[final['Cluster Labels'] == 8, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[320]:

	Street	Price	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	
2	ABBOTTS CRESCENT,London	297000.000000	Grocery Store	Coffee Shop	Zoo Exhibit	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Fa
7	ADMIRAL SEYMOUR ROAD,London	275000.000000	Grocery Store	Indian Restaurant	Bus Stop	Restaurant	Pizza Place	Garden	Rugby Pitch	Farm	En Re
56	BLITHDALE ROAD,London	240000.000000	Grocery Store	Playground	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Fa
60	BOSTALL LANE,London	294000.000000	Grocery Store	Playground	Campground	Farmers Market	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Ex
61	BOTELEY CLOSE,London	287500.000000	Grocery Store	Nature Preserve	Pharmacy	Furniture / Home Store	Farmers Market	English Restaurant	Ethiopian Restaurant	Event Service	Ev
66	BRAIDWOOD ROAD,London	248000.000000	Grocery Store	Coffee Shop	Recreation Center	Fried Chicken Joint	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Ev

VENUES IN CLUSTER 9

```
In [321]: final.loc[final['Cluster Labels'] ==9, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[321]:

	Street	Price	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
3	ABINGER GROVE,London	263000.000000	Pub	Vietnamese Restaurant	Fish & Chips Shop	Fast Food Restaurant	Restaurant	Platform	Art Gallery	Park	Fish & Chip Shop
21	ANDERSON ROAD,London	285000.000000	Pub	Café	Coffee Shop	Supermarket	Beer Store	Fish & Chips Shop	Park	Butcher	Record Studio
37	BARRATT AVENUE,London	270000.000000	Pub	Fast Food Restaurant	Indian Restaurant	Hotel Bar	Café	Train Station	Performing Arts Venue	Gastropub	Bar
52	BIRD IN HAND PASSAGE,London	268250.000000	Pub	Coffee Shop	Gym / Fitness Center	Café	Grocery Store	Gastropub	Bar	Bus Stop	Fish & Chip Shop
62	BOULTWOOD ROAD,London	200000.000000	Pub	Airport Terminal	Donut Shop	Light Rail Station	Food	Farmers Market	Ethiopian Restaurant	Event Service	Event Space
85	BRUCE GROVE,London	240000.000000	Pub	Café	Italian Restaurant	Gym / Fitness Center	Train Station	Supermarket	Middle Eastern Restaurant	Social Club	Fast Food Restaurant

VENUES IN CLUSTER 10

```
In [322]: final.loc[final['Cluster Labels'] == 10, final.columns[[0]+ [1]+ list(range(4, final.shape[1]))]]
```

Out[322]:

	Street	Price	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	Cluster Labels
261	HIGH POINT,London	299995.0	Hotel	Zoo Exhibit	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	Falafel Restaurant	Farm	10
315	LINKSWAY,London	295000.0	Hotel	Zoo Exhibit	Filipino Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	Falafel Restaurant	Farm	10
484	STONELEIGH ROAD,London	205000.0	Hotel	Tunnel	Zoo Exhibit	Fast Food Restaurant	English Restaurant	Ethiopian Restaurant	Event Service	Event Space	Exhibit	Factory	10

RESULTS AND DISCUSSION

- First, even though the London Housing Market may get dull, but it is still an "ever-green" for business affairs.
- But by using the above approach we have found the following observation and can recommend the customers based on these:-
 - 1) Cluster 0 is mainly focused for customers who want convenient store and love parks as observed in the 1st and 2nd most common venue.
 - 2) Cluster 1 is for people who are in the business of home renovations.
 - 3) Cluster 2 is surrounded by different kinds of restaurants ,stores and close by Gyms.
 - 4) Cluster 3 has a good combination of pubs, restaurants and good for people who are into Gym and have recreations place like Go Kart etc.
 - 5) Cluster 4 is good for people who like park and variety of other venues like pubs, cafe etc.
 - 6) Cluster 5 is good for people who like to visit zoos and have convenient public transport.
 - 7) Cluster 6 is good for people who like to have a walk in the park and for people who like yoga or going to Gym.
 - 8) Cluster 7 is good for people who commute a lot using public transport.
 - 9) Cluster 8 is good for people who like Grocery store to easily buy home supplies and have close by train stations and bus stops.
 - 10) Cluster 9 is good for people who like to go to Pubs and enjoy various varieties of foods.
 - 11) Cluster 10 is convenient for people who are foodies and like to enjoy various varieties of foods.
- By using these observations one can make a good investment and have a wide range of amenities which are convenient to him/her.

CONCLUSION

- We drew conclusions based on our approach and were able to split them into separate clusters and provided a good distribution for various needs of the buyer based on the surrounding amenities and facilities.
- The mapping with Folium us a very powerful technique to consolidate information and make the analysis and decision thoroughly and with confidence.
- We can use other geocoders like GoogleV3,Pelias etc. to help get more accurate coordinates and have lesser errors compared to Nominatim.
- We can also use new tools to help in shortening the time and and algorithms to help improve the accuracy continuously