Investigation of Housing Price to District Amenities in Central London

Coursera Capstone Project Final Report

1. Introduction

Central London has seen its real estate prices constantly rise since 1995 with only minor correction during this timeframe. It is therefore increasingly more difficult for young professionals to afford mortgages to buy properties to get onto the property ladder. This situation thus increases the amount of time these people will be renting in properties that are farther away from their workspace hence increasing daily commute time and stress. The following report aims to investigate the rise in housing prices in central London against the spur of local amenities by district. The objective is to provide a quantitative analysis of districts wherein housing price are undervalued compared to other similar districts with a similar amenities density. The typical target audience for this report are:

- Young professional buyers working in central London
- Investors looking for a good investment in central London
- Businesses looking for opportunities to open new shops in London
- Advertisement agencies looking for promotion opportunities

2. Business Problem

The rising price of real estate in central London is straining potential young first time buyers to look for properties farther away from their typical workplace in central London increasing their commute time and stress. Also the rising prices are making increasingly more difficult for investors to find properties with a good ROI making the decision of whether to buy or hold onto the capital more blurred than in the past. Small businesses are also finding increasingly more difficult renting and opening shops in high street venues, thus pushing these farther away from ideal hotspots where their customers might be. The following report aims to narrow the problem of property search by identifying districts housing prices which are undervalued compared to the average housing price in other parts of the city using different metrics such as: local amenity density, local restaurant density, multi-ethnical restaurant density and office amenity density.

The main objective of this report is to provide an analysis to the correlation of prices with respect to the above metrics to make a more informed investment decision.

Disclaimer: All suggestions and results shown in this report are purely informative and is by no means an actionable investment opportunity more detailed analysis is required. The author takes no

responsibility in any loss from investment decision from the following paper. Have a good read.

3. Data Description

- Location data of local amenities in London is obtained from the [Foursquare API sandbox](). This will be used to retrieve data regarding the most frequent and popular amenities by type for each neighbourhood and use this data to train the machine learning algorithm.
- Housing Data index will be scraped from the [London Datastore]() and other sources affiliated regarding housing price data and district boundaries coordinates.
- Price data is web-scraped from Foxton public available data in London and used to assign market value price data to each of the neighbourhoods in London.
- London postcodes and neighbourhood data has been web-scraped from the [wikipedia page](), this will be used to identify and categorise each neighbourhood in London.

4. Methodology

4.1 Data Engineering and Understanding

The project will make use of the data described in section 3. Firstly the district data has been imported from the wikipedia page and went through a subsequent process of data cleaning and engineering to put in a pandas dataframe such that information is correctly labelled and ready to use.

The Foxton median price data has then been added to the original postcodes and neighbourhoods dataframe which enabled early visualization analysis of the current housing market situation in London. Figure 1 below shows the price distribution of all neighbourhoods in London from the most expensive to the least, the neighbourhood name is not as important as identifying a clear trend. From figure 1 we can assume that each neighbourhood is part of a price category which we can arbitrary define by identify where there is a step change in housing median price.
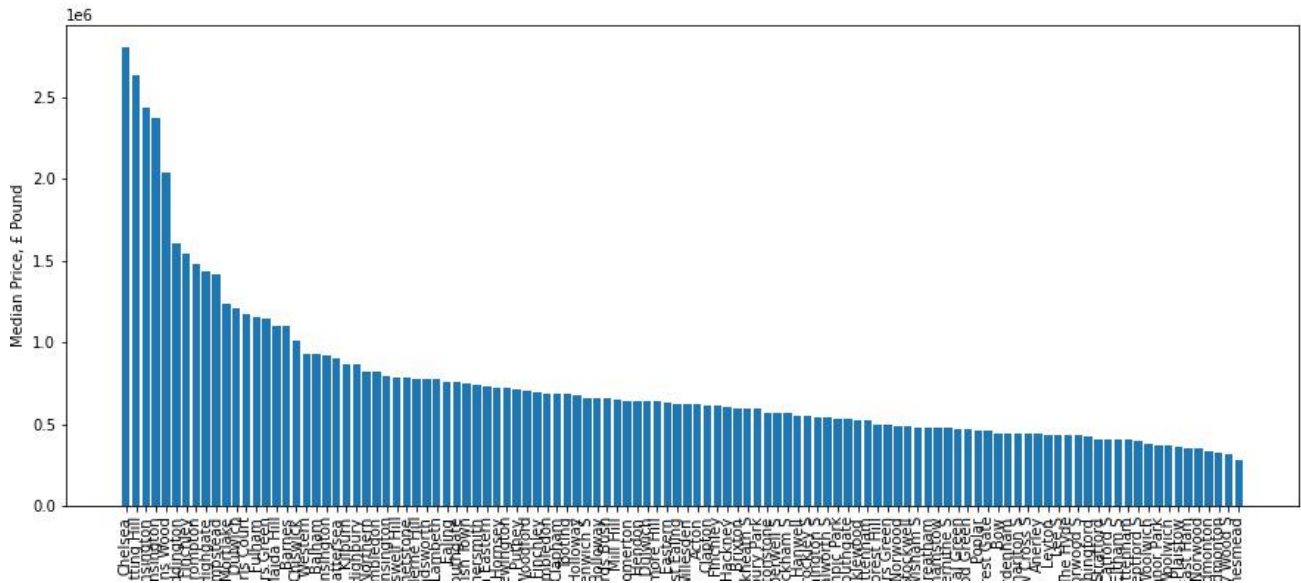
Figure 1 Median housing price distribution across all neighbourhoods in London

As an initial iteration the market price categories have been identified to be the following:

- Very High Valued Neighbourhoods > £1,600,000
- High Valued Neighbourhoods > £1,000,000
- Medium Valued Neighbourhoods > £600,000
- Low Valued Neighbourhood < £600,000

To better visualise this we can plot this price ranges onto the median price distribution to obtain Figure 2 below.
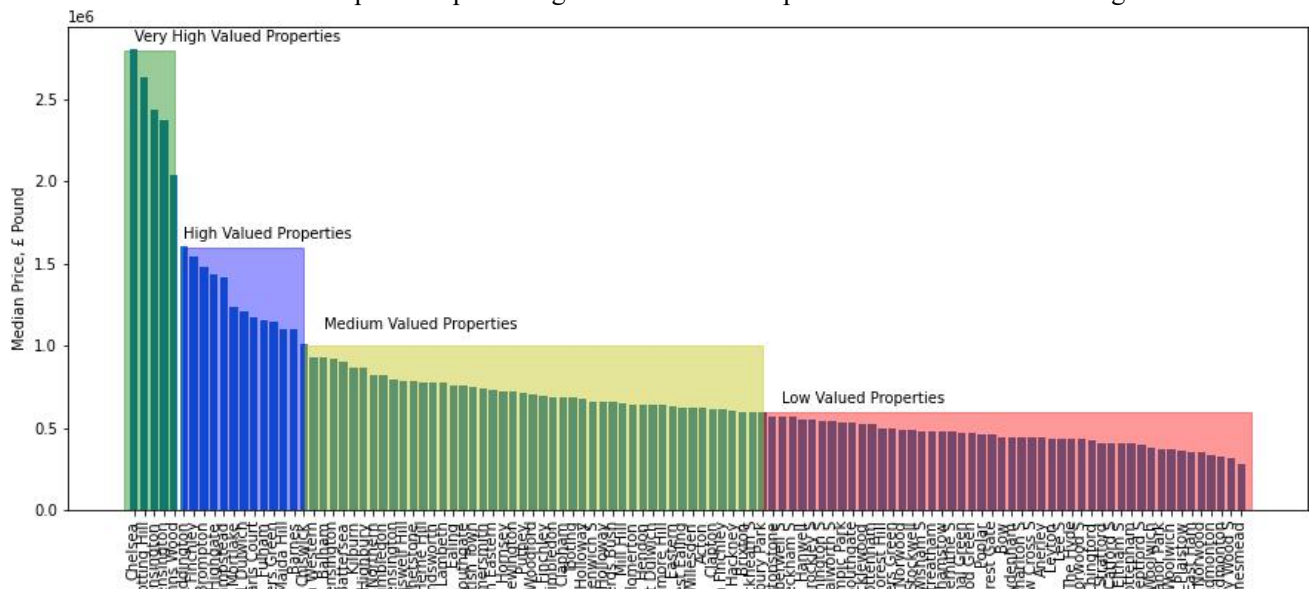

Figure 2 Market price category plotted on top of the neighbourhood price distribution

The above market price categorization is arbitrary and based by inspection on price step change in the distribution. Future work can improve on this categorization by taking into account neighbourhood location data and to improve on the estimation.

4.2 Foursquare API Amenities location retrieval

The foursquare api have been used to return 100 amenities for each neighbourhood given its coordinates in latitude and longitude. The api then return the amenities and the notebook will then categorize them and return the 10 most frequent amenities for each neighbourhood as shown in Figure 3 below.

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	Cluster Labels	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
E1	Eastern	Eastern	51.517388	-0.059488	633477	M	3	Hotel	Sandwich Place	Park	Pub	Indian Restaurant	Burger Joint	Grocery Store	Coffee Shop	Bakery	Ice Cream Shop
E2	Eastern	Bethnal Green	51.529604	-0.062598	472717	L	1	Pub	Coffee Shop	Cocktail Bar	Café	Italian Restaurant	Wine Bar	Flower Shop	Bar	Pizza Place	Yoga Studio
E3	Eastern	Bow	51.527949	-0.025267	446893	L	3	Pub	Hotel	Convenience Store	Bus Stop	Locksmith	Bar	Grocery Store	Park	Burger Joint	Exhibit
E4	Eastern	Chingford	51.621723	-0.005750	423602	L	10	English Restaurant	Gym	American Restaurant	Film Studio	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market	Fast Food Restaurant
E5	Eastern	Clapton	51.558879	-0.053755	614403	M	0	Grocery Store	Pub	Park	Coffee Shop	Gym / Fitness Center	Bus Stop	Burger Joint	Fried Chicken Joint	Martial Arts School	Garden

Figure 3 Pandas Dataframe showing cleaned data with top 10 most frequent amenities per neighbourhood

4.3 Clustering and K-Mean Algorithm

The goal here is to predict the price category of each neighbourhood based on the local amenity density and type and compare it against the market price category and see whether our prediction confirm the market or whether it detects any change.
We will be using the K-means supervised learning algorithm to cluster the different neighbourhood based on the top 10 local amenity type alone. The K parameter has been set to 20 as this seems to provide the best differentiation between the four category type. The K-means algorithm has been used due to its flexibility in providing clustering capabilities on structured data such as the amenity density per neighbourhood.

The model essentially is trained to recognize patterns between amenities and cluster them accordingly. Ideally the model would capture that similar neighbourhoods would acquire a similar cluster whereas very different will have different labels. Any discrepancy in this is what the scope for this project is. To identify overpriced and undervalued neighbourhoods based on amenities alone.

After training the model and clustering each of the neighbourhood the following approach has been employed to predict price category based on amenity:

- Divide our original dataframe now containing information of market price category and amenity based price category into 4 subsets defined by the market based price category.
- For each subset dataframe I would extract the 75% percentile amenity based cluster label for each neighbourhood.
- A comparison between the extracted labels and the market based price category would then be carried out.
- The code would then plot to identify any discrepancy between the predicted amenity based value and the current market based price value.

5. Results

As shown in Figure 2 the distribution of the property prices per neighbourhood is not linear but almost follow an exponential trend. Figure 4 below shows the difference between the top most expensive and most affordable neighbourhoods in London.
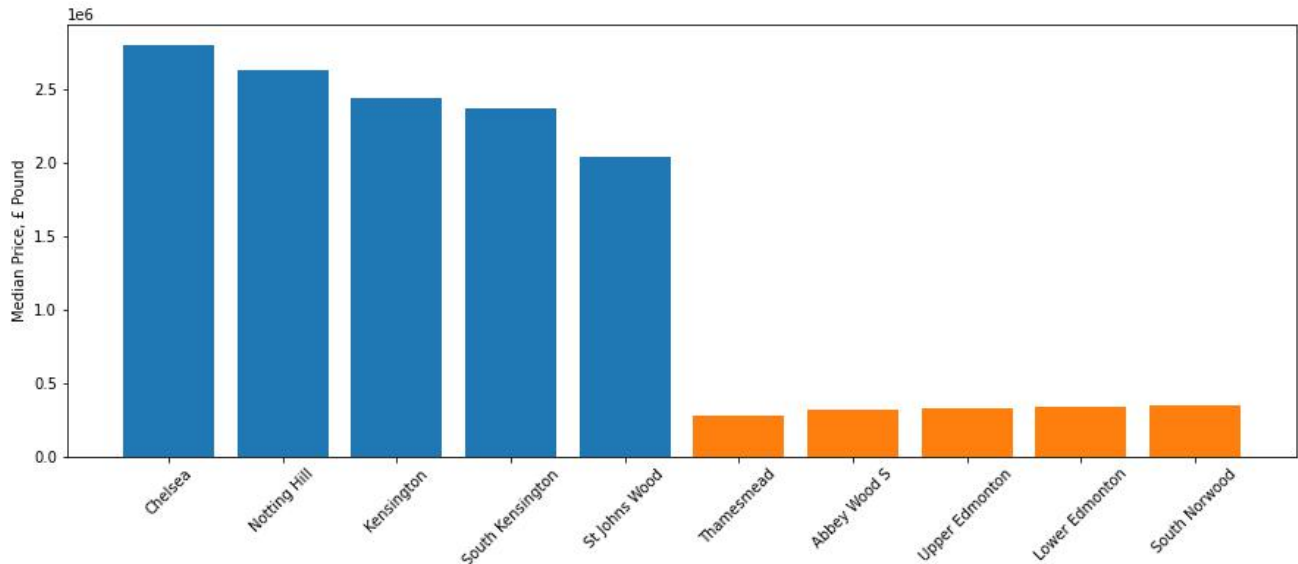

Figure 4 Top 5 most expensive and most affordable neighbourhoods in London

Using the approach outlined in the above section all neighbourhoods have been assigned a category price based on current market price data, as shown in table 2 to 5 in appendix A.

The 75% percentile of the label for each price category, shown in table 1, has then been obtained to use as a benchmark to classify what each market price based category should be identified through the cluster label.

Table 1 75% percentile cluster label for each market price based category

	Very High Valued	**High Valued**	**Medium Valued**	**Low Valued**
75% Cluster Label	18	9.75	7	14

With the valued of the 75% for each category we can then compare individual neighbourhoods cluster label against the values in table 1 and identify whether the particular neighbourhood falls within the category based on the market price data or whether its amenities density and type resemble more the ones of other price categories. Full details of the cluster label can be found in table 2-5 in Appendix A.

5.1 Very High Valued Neighbourhood Predictions

Figure 5 below shows the prediction of our model against the current market price for the Very High Valued neighbourhoods. It can be seen that the model predictions are in agreement with the current market price data across all the most valuable neighbourhoods in London.
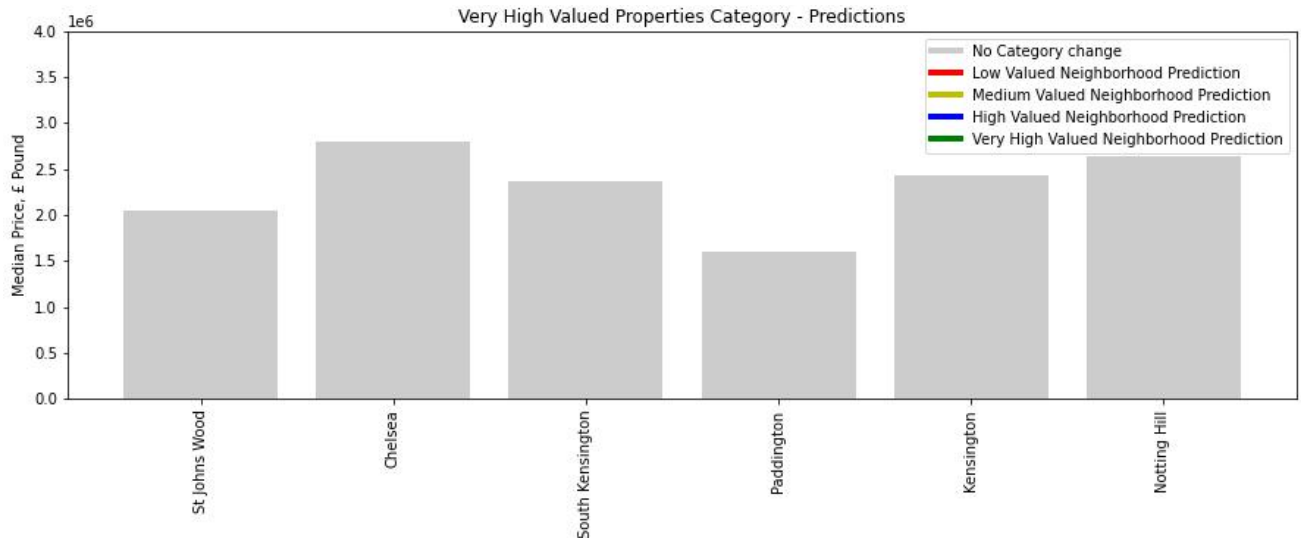
Figure 5 Very High Valued neighbourhood predictions, predictions in agreement with current market price data

5.2 High Valued Neighbourhoods Predictions

Figure 6 below show the predictions for the high valued properties. All predictions are in disagreement with the current market valuation.
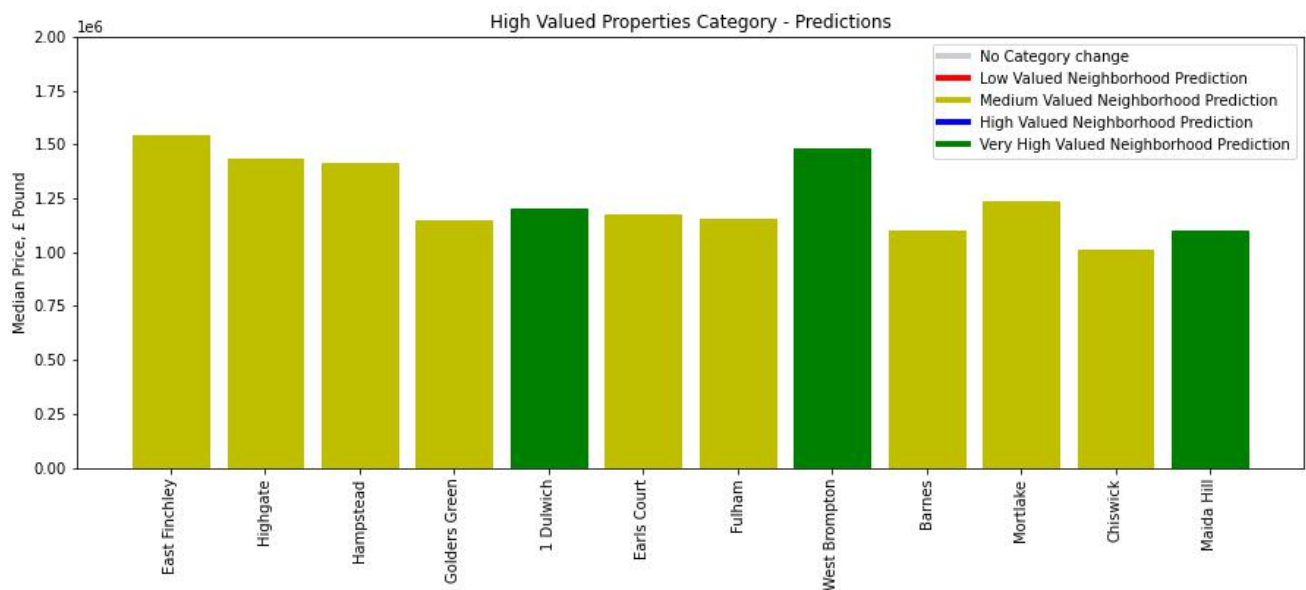
Figure 6 High Valued neighbour predictions

5.3 Medium Valued Neighbourhoods Predictions

For the medium valued neighbourhoods the predictions are for the most part in agreement with the market with few postcodes being predicted to be very similar to very high valued postcodes. Only Willesden has been predicted to be overpriced.
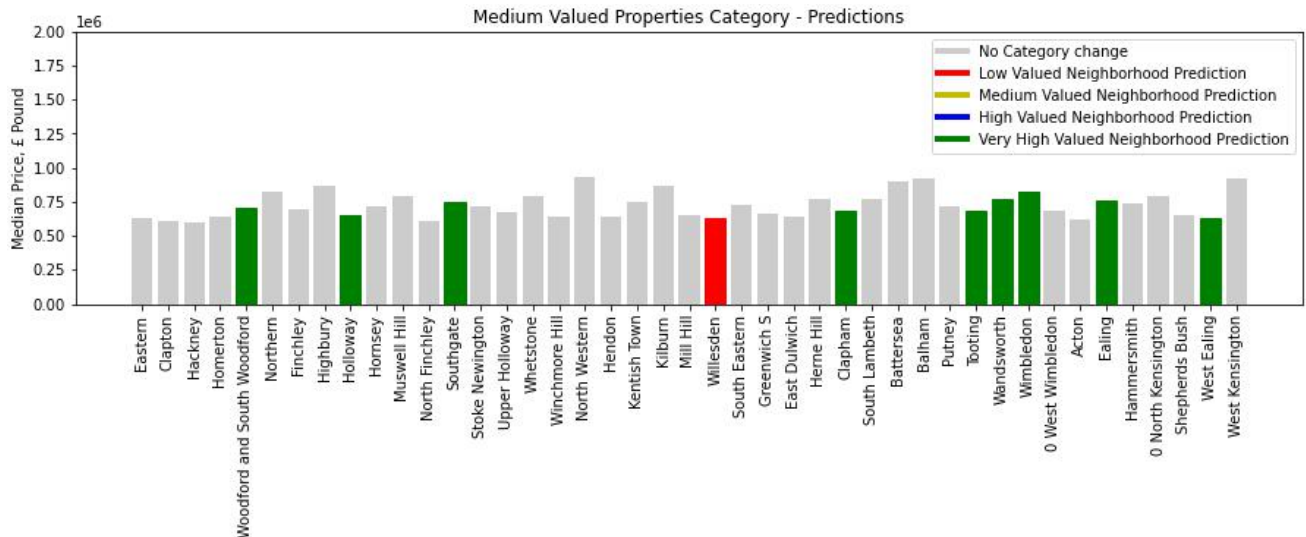
Figure 7 Medium Valued neighbourhoods predictions

5.4 Low Valued Neighbourhoods Predictions

The plot in Figure 8 shows that the majority of the neighbourhoods are undervalued by the market and present amenity characteristics more similar to a medium valued neighbourhood with some exception where this predicted to very high and high valued neighbourhoods.
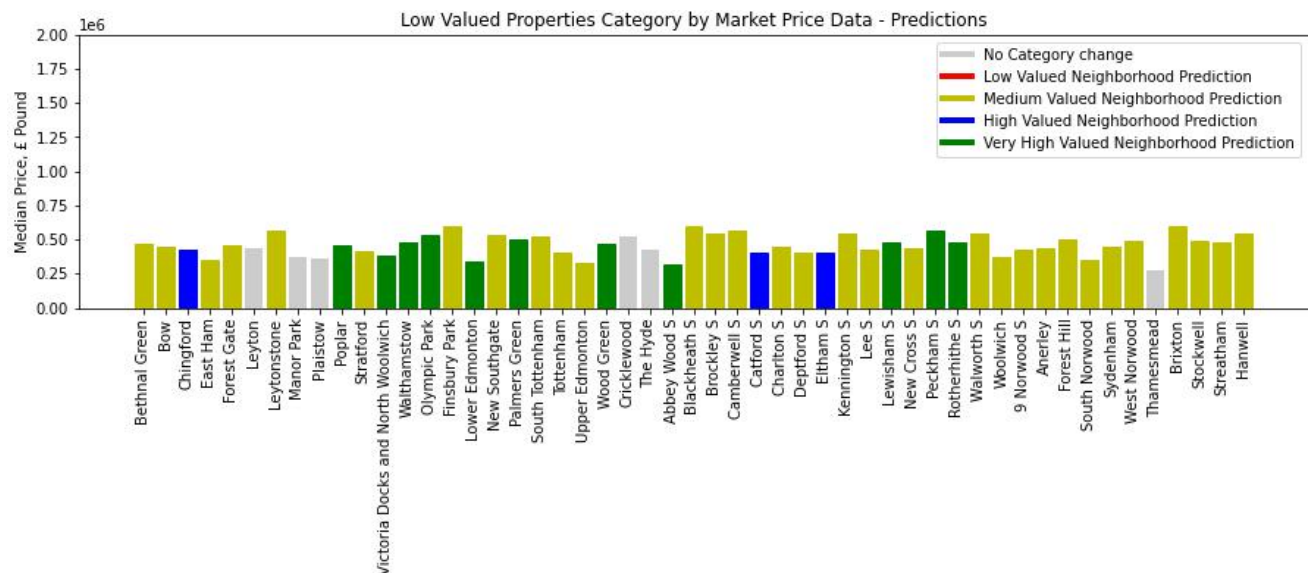
Figure 8 Low Valued neighbourhoods Predictions

6. Discussion

From the results section we can clearly deduct some conclusions regarding the current valuation of the properties in the area of London. Firstly we can notice that concerning the very high valued properties the model is in perfect agreement with the market valuation with none of the neighbourhoods being downgraded to a lower tier. This

results reflect the highly specific type of amenities density for these neighbourhoods with amenities such as museum, vicinity to large parks such as Hyde Park and high end restaurants which push the value of these areas well above the average housing price in London.

In stark contrast to our very high value properties prediction the High valued neighbourhoods predictions are in complete disagreement with the market valuation. As shown in figure 6 most properties are actually being downgraded to medium valued neighbourhoods. This signifies that there is a large proportion of housing in London which is overvalued compared to the offered amenities which do not match the ask price for many of the properties residing in these areas. Exception to this rule are: Dulwhich, West Brompton and Maida Hill which are predicted to be undervalued and to be more similar to the very high neighbourhoods in terms of amenities. Indeed, all of these areas do presents characteristics such as closeness to greenery, attractions and rare all relatively well connected to the city centre.

Medium valued properties are well in agreement with the models with just Willesden being downgraded. Other few exceptions have insted being predicted to be on a very high value range.

Lastly, the low valued properties are the one which shows the most variation across all neighbourhoods, with the majority be predicted to be in the medium range and some of them high and very high range. This might suggest that maybe the original arbitrary distribution might not be representative of the real market conditions especially towards the most affordable neighbourhoods.

7. Conclusion

The work presented in this report aims to identify neighbourhoods that are overpriced and undervalued using metrics such as amenity density and type against the current market valuation.

This has been performed using the K-Means clustering algorithm to cluster neighbourhoods's amenities and find patters and similarities between sets of amenities.

It has been shown that amenities such as closeness to parks/greenery, museum, tourist attractions and high-end restaurant all contribute to the increase the neighbourhood value and this seems to be a good predictor of its value with all the model predictions being in agreement with the market valuation. However, towards the lower end of the spectrum the vast variety of amenities type makes predicting and differentiating high, medium and low valued properties harder to do.

In order to improve the accuracy at this price range spectrum it is intended for the model to include other parameters such as access to TFL (Transport for London) and national railway services, distance to high street venues and proximity to recreational locations. This would make the model even more general and able to better predict the real value of the High, Medium and Low valued neighbourhoods.

Appendix A - Tables containing amenities per neighbourhood divided by market price category

Very High Valued Neighbourhoods

Table 2 Very High Valued Neighbourhoods

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	ClusterLabels	Predictions	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
NW8	North Western	St Johns Wood	51.53227236	-0.174576944	2042682	VH	18	VH	Cricket Ground	Deli / Bodega	Pub	Coffee Shop	Café	Yoga Studio	Fast Food Restaurant	Gastropub	Lebanese Restaurant	Garden
SW3	South Western	Chelsea	51.4891305	-0.165711226	2804697	VH	18	VH	Café	Bakery	Restaurant	Bookstore	Ice Cream Shop	Hotel	Coffee Shop	Pub	English Restaurant	Burger Joint
SW7	South Western	South Kensington	51.49628504	-0.177008489	2371696	VH	18	VH	Exhibit	Science Museum	Hotel	Café	Bakery	Burger Joint	Sandwich Place	Pizza Place	Italian Restaurant	Gift Shop
W2	Paddington	Paddington	51.51495981	-0.186585418	1608012	VH	18	VH	Hotel	Pub	Coffee Shop	Garden	Chinese Restaurant	Café	Gym / Fitness Center	Persian Restaurant	Indian Restaurant	Pizza Place
W8	Paddington	Kensington	51.50112505	-0.194330145	2437705	VH	18	VH	Café	Juice Bar	Italian Restaurant	Bakery	Restaurant	Burger Joint	French Restaurant	Clothing Store	Indian Restaurant	Spa
W11	Paddington	Notting Hill	51.51229824	-0.216151032	2633748	VH	16	VH	Gym / Fitness Center	Theme Park Ride / Attraction	Park	Wine Bar	Department Store	Cosmetics Shop	Indoor Play Area	Massage Studio	Latin American Restaurant	Bakery

High Valued Neighbourhoods

Table 3 High Valued Neighbourhoods

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	ClusterLabels	Predictions	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
N2	Northern	East Finchley	51.59007719	-0.169284532	1541812	H	7	M	Café	Coffee Shop	Pub	Platform	Grocery Store	Italian Restaurant	Japanese Restaurant	Movie Theater	Middle Eastern Restaurant	Shoe Store
N6	Northern	Highgate	51.57319105	-0.146024433	1432396	H	5	M	Pub	Café	Italian Restaurant	Indian Restaurant	Bakery	Tea Room	Coffee Shop	Theater	Park	French Restaurant
NW3	North Western	Hampstead	51.55234997	-0.172517828	1415477	H	5	M	Pub	Bagel Shop	Italian Restaurant	Bakery	Hotel	Coffee Shop	Clothing Store	Chinese Restaurant	Museum	Movie Theater
NW11	North Western	Golders Green	51.57842827	-0.197467481	1148698	H	1	M	Bakery	Turkish Restaurant	Grocery Store	Coffee Shop	Italian Restaurant	Restaurant	Yoga Studio	Event Service	Event Space	Exhibit
SE21	South Eastern	1 Dulwich	51.43900012	-0.08764721	1205694	H	19	VH	Flower Shop	Restaurant	Park	Bakery	Coffee Shop	Gym / Fitness Center	Garden Center	Wine Shop	Gift Shop	Fast Food Restaurant
SW5	South Western	Earls Court	51.49162191	-0.191974039	1173065	H	3	M	Hotel	Garden	Café	Coffee Shop	Italian Restaurant	Thai Restaurant	Lebanese Restaurant	Pizza Place	Pub	Hotel Bar

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	ClusterLabels	Predictions	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
SW6	South Western	Fulham	51.47663358	-0.201205103	1157224	H	1	M	Coffee Shop	Café	Pub	Italian Restaurant	French Restaurant	Bakery	Grocery Store	Thai Restaurant	Yoga Studio	Juice Bar
SW10	South Western	West Brompton	51.48378494	-0.18280067	1478159	H	18	VH	Italian Restaurant	Grocery Store	Pub	Nightclub	Restaurant	Juice Bar	French Restaurant	Bakery	Coffee Shop	Sandwich Place
SW13	Battersea	Barnes	51.47617202	-0.243661189	1100733	H	1	M	Pizza Place	Farmers Market	Coffee Shop	Pub	Grocery Store	Movie Theater	Food & Drink Shop	French Restaurant	Breakfast Spot	Gastropub
SW14	Battersea	Mortlake	51.46539662	-0.266983167	1235414	H	1	M	Coffee Shop	Pub	Pizza Place	Grocery Store	Italian Restaurant	Beer Store	Gelato Shop	Supermarket	Pharmacy	Chinese Restaurant
W4	Paddington	Chiswick	51.4912038	-0.264028271	1011246	H	5	M	Pub	Bookstore	Bakery	Italian Restaurant	Café	Supermarket	Sushi Restaurant	Coffee Shop	Playground	Vietnamese Restaurant
W9	Paddington	Maida Hill	51.52489396	-0.192637574	1103532	H	18	VH	Deli / Bodega	Pizza Place	Coffee Shop	Indian Restaurant	Grocery Store	Fast Food Restaurant	Food & Drink Shop	Dance Studio	Middle Eastern Restaurant	Bus Stop

Medium Valued Neighbourhoods

Table 4 Medium Valued Neighbourhoods

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	ClusterLabels	Predictions	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
E1	Eastern	Eastern	51.5	-0.05	633	M	3	M	Hotel	Sandwich	Park	Pub	Indian	Burger	Grocery	Coffee	Bakery	Ice Cream

	rn		173 8819	9488 273	477						Place			Restaurant	Joint	Store	Shop	Shop
E5	Eastern	Clapton	51.5588 7905	-0.0537 55096	614403	M	0	M	Grocery Store	Pub	Park	Coffee Shop	Gym / Fitness Center	Bus Stop	Burger Joint	Fried Chicken Joint	Martial Arts School	Garden
E8	Eastern	Hackney	51.5437 2465	-0.0661 77023	601868	M	7	M	Coffee Shop	Wine Shop	Restaurant	Café	Pub	Modern European Restaurant	Convenience Store	Gym / Fitness Center	Music Venue	Gastropub
E9	Eastern	Homerton	51.5441 5318	-0.0428 44989	645092	M	5	M	Pub	Café	Supermarket	Coffee Shop	Yoga Studio	Train Station	Bus Stop	Pizza Place	Butcher	Beer Store
E18	Eastern	Woodford and South Woodford	51.5927 5775	0.0249 51511	703027	M	18	VH	Italian Restaurant	Grocery Store	Supermarket	Café	Fast Food Restaurant	Coffee Shop	Chinese Restaurant	Furniture / Home Store	Multiplex	Yoga Studio
N1	Northern	Northern	51.5377 4667	-0.0970 50804	824273	M	5	M	Pub	Bakery	French Restaurant	Burger Joint	Park	Mediterranean Restaurant	Theater	Gastropub	Boutique	Café
N3	Northern	Finchley	51.6002 41	-0.1938 92859	696893	M	1	M	Coffee Shop	Supermarket	Turkish Restaurant	Pizza Place	Japanese Restaurant	Pub	Park	Restaurant	Chinese Restaurant	Café
N5	Northern	Highbury	51.5538 6741	-0.0986 05089	864120	M	7	M	Café	Pub	Thai Restaurant	Fish & Chips Shop	Seafood Restaurant	Bookstore	Cheese Shop	Tapas Restaurant	Restaurant	Tennis Court

ID	Region	Name	Latitude	Longitude		Sex	Num	Rank	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
N7	Northern	Holloway	51.5534 6009	-0.118347097	657539	M	18	VH	Pub	Supermarket	Café	Ramen Restaurant	School	Clothing Store	Restaurant	Coffee Shop	Yoga Studio	Bed & Breakfast
N8	Northern	Hornsey	51.5827 5284	-0.120155774	722079	M	7	M	Café	Pub	French Restaurant	Grocery Store	Coffee Shop	Bar	Japanese Restaurant	Thai Restaurant	Convenience Store	Tapas Restaurant
N10	Northern	Muswell Hill	51.5947 7278	-0.144997996	789727	M	7	M	Pizza Place	Café	Coffee Shop	Japanese Restaurant	Diner	Tapas Restaurant	English Restaurant	Stationery Store	Restaurant	Greek Restaurant
N12	Northern	North Finchley	51.6149 065	-0.177626614	614343	M	1	M	Coffee Shop	Supermarket	Fast Food Restaurant	Grocery Store	Pharmacy	Breakfast Spot	Bookstore	Sandwich Place	Bar	Sushi Restaurant
N14	Northern	Southgate	51.6343 1777	-0.130840799	753964	M	18	VH	Gym / Fitness Center	Café	Coffee Shop	Ice Cream Shop	Sandwich Place	Spanish Restaurant	Food & Drink Shop	Bus Stop	Fast Food Restaurant	Chinese Restaurant
N16	Northern	Stoke Newington	51.5625 1025	-0.076646293	717834	M	7	M	Pub	Café	Pizza Place	Cocktail Bar	Coffee Shop	Italian Restaurant	Beer Store	Japanese Restaurant	Thai Restaurant	Gift Shop
N19	Northern	Upper Holloway	51.5652 5904	-0.129951364	673721	M	0	M	Grocery Store	Coffee Shop	Pizza Place	Indian Restaurant	Café	Italian Restaurant	Pub	Bus Stop	Fast Food Restaurant	Farmers Market
N20	Northern	Whetstone	51.6292 552	-0.174356015	789223	M	1	M	Coffee Shop	Café	Italian Restaurant	Pub	Turkish Restaurant	Metro Station	Mediterranean Restaurant	Brazilian Restaurant	Sandwich Place	Supermarket

			8														nt		
N21	Northern	Winchmore Hill	51.6367 2767	-0.099693 179	637069	M	5	M	Bar	Italian Restaurant	Train Station	Middle Eastern Restaurant	Bus Stop	Bistro	Pub	Coffee Shop	Supermarket	Yoga Studio
NW1	North Western	North Western	51.5332 4963	-0.143852 827	927202	M	1	M	Coffee Shop	Pizza Place	Japanese Restaurant	Pub	Greek Restaurant	Tea Room	Music Venue	Sandwich Place	Park	Hotel
NW4	North Western	Hendon	51.5873 4792	-0.224318 383	639635	M	0	M	Grocery Store	Chinese Restaurant	Bagel Shop	Café	Middle Eastern Restaurant	Metro Station	Plaza	Pub	Coffee Shop	Noodle House
NW5	North Western	Kentish Town	51.5518 1344	-0.144925 739	750442	M	1	M	Pub	Coffee Shop	Grocery Store	Gastropub	Cocktail Bar	Café	Sandwich Place	Italian Restaurant	Indian Restaurant	Bakery
NW6	North Western	Kilburn	51.5422 2582	-0.196298 879	870595	M	7	M	Café	Indian Restaurant	Brazilian Restaurant	Supermarket	Pub	Thai Restaurant	Discount Store	Fast Food Restaurant	Czech Restaurant	Sandwich Place
NW7	North Western	Mill Hill	51.6148 558	-0.235174 541	647837	M	6	M	Park	Yoga Studio	Fast Food Restaurant	Event Service	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market	Film Studio
NW10	North Western	Willesden	51.5412 6467	-0.248085 856	626244	M	15	L	Park	Warehouse Store	Fast Food Restaurant	Chinese Restaurant	Flower Shop	Flea Market	Food & Drink Shop	Fish Market	Fish & Chips Shop	Escape Room
SE1	Sout	South	51.4	-0.09	727	M	5	M	Pub	Café	Park	Italian	Sandwich	Garden	Ice	Morocca	Fast Food	Movie

									V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
	h Eastern	Eastern	99183	1531182	875							Restaurant	Place		Cream Shop	n Restaurant	Restaurant	Theater
SE10	South Eastern	Greenwich S	51.48446818	0.000178235	662483	M	5	M	Pub	Grocery Store	Pier	Indian Restaurant	Turkish Restaurant	English Restaurant	Historic Site	Café	Museum	Japanese Restaurant
SE22	South Eastern	East Dulwich	51.45445892	-0.072426041	637255	M	7	M	Café	Gastropub	Ice Cream Shop	Grocery Store	Convenience Store	Pub	Restaurant	Coffee Shop	Cocktail Bar	Chinese Restaurant
SE24	South Eastern	Herne Hill	51.45629412	-0.100249853	776182	M	7	M	Pub	Café	Pizza Place	Bookstore	Coffee Shop	Restaurant	Middle Eastern Restaurant	Platform	Deli / Bodega	Cocktail Bar
SW4	South Western	Clapham	51.46111161	-0.136480999	684309	M	18	VH	Pub	Restaurant	Burger Joint	Café	Cocktail Bar	Bar	Grocery Store	Coffee Shop	Italian Restaurant	Tapas Restaurant
SW8	South Western	South Lambeth	51.47653832	-0.132007959	772247	M	5	M	Bus Stop	Portuguese Restaurant	Fish & Chips Shop	Pub	Gym / Fitness Center	Park	Pizza Place	Coffee Shop	Supermarket	Bakery
SW11	Battersea	Battersea	51.46811017	-0.16383825 22	898709	M	5	M	Pub	Café	Thai Restaurant	Theater	Bar	Italian Restaurant	Gym / Fitness Center	Supermarket	Coffee Shop	Breakfast Spot
SW12	Battersea	Balham	51.4462986	-0.149127963	926724	M	1	M	Coffee Shop	Pub	Pizza Place	Bakery	Indian Restaurant	Sandwich Place	Bar	Café	Supermarket	Steakhouse

Postcode	Area	District	Lat	Long	Num	G	Age	Rating	1	2	3	4	5	6	7	8	9	10
SW15	Battersea	Putney	51.45703289	-0.228502539	712352	M	4	M	Photography Studio	Yoga Studio	Escape Room	Event Service	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market	Fast Food Restaurant
SW17	Battersea	Tooting	51.43079473	-0.164678271	682780	M	18	VH	Pub	Coffee Shop	Burger Joint	Indian Restaurant	Supermarket	Pharmacy	South Indian Restaurant	Convenience Store	Fish & Chips Shop	Bar
SW18	Battersea	Wandsworth	51.4512825	-0.191483098	772571	M	18	VH	Clothing Store	Coffee Shop	Burger Joint	Gym	Supermarket	Bookstore	Asian Restaurant	Pharmacy	Pub	Fountain
SW19	Battersea	Wimbledon	51.42416024	-0.203041058	823783	M	18	VH	Clothing Store	Coffee Shop	Sushi Restaurant	Pub	Bar	Pharmacy	Supermarket	Grocery Store	Sandwich Place	Shoe Store
SW20	Battersea	0 West Wimbledon	51.41091436	-0.227736715	687295	M	7	M	Bus Stop	Platform	Indian Restaurant	Pub	Café	Coffee Shop	Fast Food Restaurant	Grocery Store	Trail	Hotel
W3	Paddington	Acton	51.51065486	-0.267983473	623048	M	3	M	Pub	Grocery Store	Coffee Shop	Gym / Fitness Center	Park	Hotel	Supermarket	Wine Shop	Creperie	Sandwich Place
W5	Paddington	Ealing	51.51321291	-0.302338374	758890	M	18	VH	Coffee Shop	Pub	Platform	Burger Joint	Italian Restaurant	Clothing Store	Park	Bus Stop	Café	Thai Restaurant
W6	Paddington	Hammersmith	51.4926	-0.228568192	743192	M	5	M	Pub	Coffee Shop	Café	Sandwich Place	Hotel	Gym / Fitness	Platform	Italian Restaurant	Vegetarian / Vegan	Gastropub

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	ClusterLabels	Predictions	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
		n	1206	505								Center				nt	Restaurant	
W10	Paddington	0 North Kensington	51.52316552721 9	-0.21794587		M	7	M	Café	Gym / Fitness Center	Furniture / Home Store	Middle Eastern Restaurant	Pizza Place	Pub	Park	Bar	Bakery	Supermarket
W12	Paddington	Shepherds Bush	51.50828427	-0.2406490 1	656182	M	0	M	Café	Grocery Store	Gastropub	Hotel	Pizza Place	Fast Food Restaurant	Park	African Restaurant	Pub	Department Store
W13	Paddington	West Ealing	51.5130 0753	-0.32117 5607	627489	M	18	VH	Coffee Shop	Grocery Store	Hotel	Supermarket	Indian Restaurant	Persian Restaurant	Bagel Shop	Bistro	Sandwich Place	Furniture / Home Store
W14	Paddington	West Kensington	51.4946 8437	-0.21025 5941	920117	M	3	M	Pub	Hotel	Sandwich Place	Indian Restaurant	Grocery Store	Persian Restaurant	Café	Bus Stop	Convention Center	Convenience Store

Low Valued Neighbourhoods

Table 5 Low Valued Neighbourhoods

PostalCode	District	Neighborhood	Latitude	Longitude	MedianPrice	PriceCat	ClusterLabels	Predictions	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
E2	Easte	Bethnal	51.5	-0.06	472	L	1	M	Pub	Coffee	Cocktail	Café	Italian	Wine Bar	Flower	Bar	Pizza Place	Yoga

	rn	Green	2960366	2597572	717					Shop	Bar		Restaurant		Shop			Studio
E3	Eastern	Bow	51.5279491 3	-0.025266637	446893	L	3	M	Pub	Hotel	Convenience Store	Bus Stop	Locksmith	Bar	Grocery Store	Park	Burger Joint	Exhibit
E4	Eastern	Chingford	51.6217228 8	-0.005749971	423602	L	10	H	English Restaurant	Gym	American Restaurant	Film Studio	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market	Fast Food Restaurant
E6	Eastern	East Ham	51.5265604 5	0.053931972	356263	L	3	M	Sandwich Place	Pub	Grocery Store	Park	Falafel Restaurant	English Restaurant	Escape Room	Ethiopian Restaurant	Event Service	Event Space
E7	Eastern	Forest Gate	51.5471303 2	0.027600408	458009	L	0	M	Grocery Store	Bus Stop	Pub	Fast Food Restaurant	Train Station	Indian Restaurant	Chinese Restaurant	Fish & Chips Shop	Bakery	Comfort Food Restaurant
E10	Eastern	Leyton	51.5679704 2	-0.014401682	437812	L	15	L	Park	Farm	Hotel	Cricket Ground	Convenience Store	Coffee Shop	Chinese Restaurant	Ethiopian Restaurant	Event Service	Event Space
E11	Eastern	Leytonstone	51.5687553 9	0.013606637	571463	L	5	M	Pub	Café	Pizza Place	Bus Stop	Coffee Shop	Fast Food Restaurant	Grocery Store	Burger Joint	Italian Restaurant	Supermarket
E12	Eastern	Manor Park	51.5507379	0.052999742	370138	L	12	L	Gas Station	Restaurant	Indian Restaurant	Gym / Fitness Center	Event Service	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market

Code	Region	Name	Lat	Lon						V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
			7																
E13	Eastern	Plaistow	51.5278145 3	0.026579545	362300	L	13	L	Pub	Bus Station	Café	Gym	Yoga Studio	Fast Food Restaurant	Event Space	Exhibit	Falafel Restaurant	Farm
E14	Eastern	Poplar	51.5061973 1	-0.018549308	461299	L	18	VH	Coffee Shop	Italian Restaurant	Plaza	Sushi Restaurant	Burger Joint	Park	Sandwich Place	Pizza Place	Stationery Store	Street Food Gathering
E15	Eastern	Stratford	51.5404115 9	0.003519 93	410347	L	5	M	Pub	Sandwich Place	Fast Food Restaurant	Supermarket	Coffee Shop	Shopping Mall	Bar	Bus Stop	Platform	General Entertainment
E16	Eastern	Victoria Docks and North Woolwich	51.5106709 7	0.028975913	382309	L	18	VH	Chinese Restaurant	Hotel	Italian Restaurant	Bridge	Fast Food Restaurant	Sandwich Place	Light Rail Station	Tapas Restaurant	English Restaurant	Restaurant
E17	Eastern	Walthamstow	51.5869223 4	-0.020732971	479394	L	18	VH	Grocery Store	Coffee Shop	Sandwich Place	Pizza Place	Clothing Store	Café	Bookstore	Bakery	Pub	Pharmacy
E20	Eastern	Olympic Park	51.5464795 1	-0.010048731	536667	L	18	VH	Clothing Store	Café	Italian Restaurant	Coffee Shop	Ice Cream Shop	Burger Joint	Pizza Place	Hotel	Gym / Fitness Center	Toy / Game Store
N4	Northern	Finsbury Park	51.5700886 4	-0.104145355	594613	L	7	M	Café	Coffee Shop	Hotel	Pub	Tapas Restaurant	Clothing Store	Tennis Court	Restaurant	Park	Athletics & Sports
N9	Northern	Lower	51.6	-0.05	335	L	18	VH	Coffee	Sporting	Gym /	Supermar	Bus	Clothing	Furniture	Grocery	Train	Noodle

	hern	Edmonton	2850915	8026114	369				Shop	Goods Shop	Fitness Center	ket	Station	Store	/ Home Store	Store	Station	House
N11	Northern	New Southgate	51.61376457	-0.138994755	534361	L	0	M	Grocery Store	Pet Store	Sporting Goods Shop	Train Station	Coffee Shop	Hardware Store	Furniture / Home Store	Toy / Game Store	Shopping Plaza	Fast Food Restaurant
N13	Northern	Palmers Green	51.61809998	-0.104231204	498635	L	18	VH	Pub	Grocery Store	Sandwich Place	Coffee Shop	Ice Cream Shop	Supermarket	Bookstore	Breakfast Spot	Café	Pizza Place
N15	Northern	South Tottenham	51.58280679	-0.080745122	519177	L	5	M	Pub	Hardware Store	Hostel	Deli / Bodega	Coffee Shop	Café	Grocery Store	Farmers Market	Event Service	Event Space
N17	Northern	Tottenham	51.59809565	-0.071699437	404286	L	5	M	Pub	Supermarket	Park	Gym / Fitness Center	Gas Station	Sandwich Place	Greek Restaurant	Bar	Grocery Store	Discount Store
N18	Northern	Upper Edmonton	51.61389149	-0.06662715	328007	L	1	M	Turkish Restaurant	Coffee Shop	Fast Food Restaurant	Asian Restaurant	Sandwich Place	Supermarket	Bookstore	Bakery	Grocery Store	Park
N22	Northern	Wood Green	51.59988773	-0.110238173	469949	L	18	VH	Fast Food Restaurant	Café	Turkish Restaurant	Pub	Supermarket	Restaurant	Park	Bar	Bakery	Convenience Store
NW2	North West	Cricklewood	51.5581309	-0.22028118	526348	L	14	L	Fast Food Restaurant	Grocery Store	Hotel	Bagel Shop	Clothing Store	Sandwich Place	Café	Supermarket	Warehouse Store	Coffee Shop

Postcode	Region	Station	Latitude	Longitude														
	ern		4															
NW9	North Western	The Hyde	51.5880 8427	-0.255298 496	430114	L	14	L	Ice Cream Shop	Asian Restaurant	Clothing Store	Event Service	Park	Sushi Restaurant	Grocery Store	Gym / Fitness Center	Hardware Store	Furniture / Home Store
SE2	South Eastern	Abbey Wood S	51.4897 0142	0.115893 822	315939	L	17	VH	Supermarket	Platform	Grocery Store	Convenience Store	Coffee Shop	Yoga Studio	Event Space	Exhibit	Falafel Restaurant	Farm
SE3	South Eastern	Blackheath S	51.4695 5365	0.019670 623	596804	L	2	M	Café	Yoga Studio	Film Studio	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market	Fast Food Restaurant	Fish & Chips Shop
SE4	South Eastern	Brockley S	51.4610 0172	-0.035209 397	548412	L	7	M	Café	Convenience Store	Grocery Store	Coffee Shop	Fish & Chips Shop	Pizza Place	Gastropub	Beer Store	Train Station	Brewery
SE5	South Eastern	Camberwell S	51.4738 2072	-0.091455 886	568848	L	7	M	Café	Coffee Shop	Bus Stop	Pub	Grocery Store	Vietnamese Restaurant	Gym / Fitness Center	Bakery	Park	Gastropub
SE6	South Eastern	Catford S	51.4385 4702	-0.016583 802	407619	L	11	H	Shopping Plaza	Discount Store	Grocery Store	Furniture / Home Store	Turkish Restaurant	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market
SE7	South Eastern	Charlton S	51.4841 087	0.034310 607	444886	L	0	M	Bus Stop	Grocery Store	Food Truck	Platform	Fast Food Restaurant	Sporting Goods Shop	Café	Supermarket	Chinese Restaurant	Thai Restaurant
SE8	Sout	Deptford S	51.4	-0.02	400	L	1	M	Coffee	Pub	Cocktail	Bar	Vietname	Plaza	Park	Grocery	Performing	Italian

	h Eastern			8191812	9464787	492				Shop		Bar		se Restaurant			Store	Arts Venue	Restaurant
SE9	South Eastern	Eltham S	51.4514241 424 1	0.054826 263	407166	L	9	H	Golf Course	Hardware Store	Historic Site	Fast Food Restaurant	Event Service	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market
SE11	South Eastern	Kennington S	51.4898 3614	-0.111633 851	543337	L	5	M	Pub	Café	Coffee Shop	Fish & Chips Shop	Indian Restaurant	Gastropub	Italian Restaurant	Pizza Place	Park	Motorcycle Shop
SE12	South Eastern	Lee S	51.4446388 1	0.019838 025	430360	L	3	M	Hotel	Veterinarian	Pub	Fast Food Restaurant	Bus Stop	Polish Restaurant	Historic Site	Falafel Restaurant	English Restaurant	Escape Room
SE13	South Eastern	Lewisham S	51.4594 397 4	-0.009609 356	481274	L	18	VH	Clothing Store	Pub	Fast Food Restaurant	Coffee Shop	Restaurant	Grocery Store	Video Game Store	Café	Pharmacy	Supermarket
SE14	South Eastern	New Cross S	51.4758 907 4	-0.042474 433	440925	L	7	M	Café	Pub	Chinese Restaurant	Coffee Shop	Thai Restaurant	Grocery Store	Gastropub	Lebanese Restaurant	Clothing Store	Bus Stop
SE15	South Eastern	Peckham S	51.4727 341 5	-0.065648 807	564763	L	18	VH	Pub	Grocery Store	Supermarket	Pharmacy	Italian Restaurant	Fast Food Restaurant	Restaurant	Gym / Fitness Center	Cocktail Bar	Bar
SE16	South Eastern	Rotherhithe S	51.4966 028	-0.052928 296	478043	L	18	VH	Clothing Store	Café	Pharmacy	Sporting Goods Shop	Coffee Shop	Bar	Grocery Store	Metro Station	Food Truck	Breakfast Spot

	Region	Name	Latitude	Longitude														
	rn		9															
SE17	South Eastern	Walworth S	51.4882 2933	-0.0933 1843	541 613	L	7	M	Café	Pub	Coffee Shop	Hostel	Sandwich Place	Brewery	Thai Restaurant	Caribbean Restaurant	Grocery Store	Bakery
SE18	South Eastern	Woolwich	51.4843 3928	0.0725 65626	368 158	L	0	M	Indian Restaurant	Bus Stop	Chinese Restaurant	Child Care Service	Pub	Grocery Store	Fish & Chips Shop	Convenience Store	Health & Beauty Service	Yoga Studio
SE19	South Eastern	9 Norwood S	51.4179 8038	-0.0861 09746	429 458	L	1	M	Coffee Shop	Italian Restaurant	Pizza Place	Café	Gastropub	Pub	Thai Restaurant	Flea Market	Garden Center	Latin American Restaurant
SE20	South Eastern	Anerley	51.4123 0182	-0.0594 52762	438 354	L	3	M	Hotel	Hardware Store	Furniture / Home Store	Fast Food Restaurant	Supermarket	Trail	Train Station	Park	Dessert Shop	Event Service
SE23	South Eastern	Forest Hill	51.4414 675	-0.0491 53782	499 709	L	5	M	Pub	Café	Coffee Shop	Fish & Chips Shop	Bookstore	Garden Center	Train Station	Gym / Fitness Center	Bar	Farmers Market
SE25	South Eastern	South Norwood	51.3977 841	-0.0767 81304	349 226	L	8	M	Platform	Café	Supermarket	Indian Restaurant	Bus Stop	Pub	Fish & Chips Shop	Park	Gas Station	Coffee Shop
SE26	South Eastern	Sydenham	51.4279 5202	-0.0548 1565	445 166	L	5	M	Gastropub	Sandwich Place	Café	Supermarket	Indian Restaurant	Portuguese Restaurant	Pharmacy	Pub	Coffee Shop	Italian Restaurant
SE2	Sout	West	51.4	-0.10	491	L	7	M	Café	Grocery	Bakery	Pub	Coffee	Train	Farmers	Movie	Breakfast	Sporting

7	h Eastern	Norwood	3056204	2368291	183					Store			Shop	Station	Market	Theater	Spot	Goods Shop
SE28	South Eastern	Thamesmead	51.50234594	0.104426943	278195	L	14	L	Fast Food Restaurant	Clothing Store	Grocery Store	Warehouse Store	Furniture / Home Store	Pet Store	Supermarket	Yoga Studio	Farm	Event Service
SW2	South Western	Brixton	51.44928805	-0.119834055	598472	L	0	M	Grocery Store	Hardware Store	Auto Garage	Bus Stop	Spa	Portuguese Restaurant	Pub	Coffee Shop	Vegetarian / Vegan Restaurant	Caribbean Restaurant
SW9	South Western	Stockwell	51.46936044	-0.113860548	490704	L	5	M	Pub	Ice Cream Shop	Spanish Restaurant	Skate Park	Caribbean Restaurant	Music Venue	Bike Shop	Restaurant	Bakery	Bus Stop
SW16	Battersea	Streatham	51.42125279	-0.129235431	479709	L	5	M	Pub	Supermarket	Gastropub	Playground	Park	Burger Joint	Pizza Place	Skating Rink	Fast Food Restaurant	Fried Chicken Joint
W7	Paddington	Hanwell	51.51188247	-0.335952125	548776	L	7	M	Café	Flower Shop	Pizza Place	Convenience Store	Gym	Coffee Shop	Supermarket	Yoga Studio	Farmers Market	Event Space