Investigation into opening German-themed restaurant(s) in Central London

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Introduction

Having recently worked in Germany, I have been engaged by a consortium of German investors in the restaurant business. They are investigating whether to open one, and perhaps even several, ***German-themed restaurants*** in ***Central London***. They have commissioned me to find (an) optimal location(s) for (a) restaurant(s) in Central London.

London is one of the world's oldest, most popular and most visited cities. London has become very metropolitan and there are many restaurants with different nationality's cuisine. There is a high density of restaurants and food stands in Central London. I will try to map the restaurants in the vicinity of what I consider to be the tube stops making up Central London. I will investigate how many German-themed restaurants are in a radius of 500 metres from the selected tube stops. I will use data science techniques to collate this information. Ideally I would like to find the tube-stops with few or no German-themed restaurants. I will use data science techniques to collate this information. I will also present the data graphically, and use machine-learning techniques like Clustering to determine good street addresses to set up German-themed restaurants.

As a caveat, this analysis is provided as a guide. It will still be incumbent on the consortium of investors to do further due diligence in the locations provided. They would need to perform further market research in the suggested locations to have a high confidence of success.

Data

Based on the definition of our business problem, factors that will influence our decision are:

- The number of existing restaurants in the tube-stop radius, i.e. any type of restaurant
- The number of German-themed restaurants in the tube-stop radius, if any

I have discussed this with the consortium of investors and we selected 14 tube stops that we consider to make up Central London. (Obviously this is subjective, but this is **a starting point that has been agreed with the investors**). I have also decided that Waterloo is the centre point for Central London. This is obviously another subjective decision. Each tube stop will be analysed to see the number of restaurants, and number of German-themed restaurants. The 350 metre radius around each tube-stop can overlap. To prevent duplicate restaurants appearing, I store the restaurants in a dictionary with their Foursquare Id.

We will need the following data sources to extract and generate the required information:

- List of London tube-stops and coordinates: **https://wiki.openstreetmap.org/wiki/List_of_London_Underground_stations**. I have scraped the Web page and created a csv file with tube-stop name, latitiude, and longitude. From this I curated the list of 14 tube-stops we are interested in analysing, and saved them in a csv file, **SubSelected.csv**.
- The number of restaurants and their type and location in every tube-stop radius will be obtained using the **Foursquare API**.

Figure 1 shows the selected tube-stop DataFrame:

	Name	Latitude	Longitude
0	Waterloo	51.503220	-0.113280
1	Westminster	51.501210	-0.124890
2	Embankment	51.507170	-0.121950
3	Charing Cross	51.507108	-0.122963
4	St.James's Park	51.499710	-0.133940
5	Victoria	51.496629	-0.144009
6	Piccadilly Circus	51.510220	-0.133920
7	Green Park	51.506740	-0.142760
8	Oxford Circus	51.515170	-0.141190
9	Tottenham Court Road	51.516721	-0.130939
10	Baker Street	51.522236	-0.157080
11	Leicester Square	51.511480	-0.128490
12	Regent's Park	51.523440	-0.147130
13	Covent Garden	51.513080	-0.124270

Figure 1 *- Tube-Stop Data*

Figure 2 shows visualisation of the tube-stops we have selected:

Figure 2 *- Map of Tube-Stops selected for Analysis*

Methodology

Exploratory data analysis

When using Foursquare to look up restaurants in the vicinity of each of the 14 tube-stops, 439 restaurants were found. The search was limited to food establishments that are restaurants, i.e. we excluded food establishments that might be coffee shops, pizza places, bakeries, etc. **Foursquare food categories** were also used to look up restaurants that are German-themed. I found an average of about 36 restaurants in a 350 metre radius of the tube-stops being analysed.

Surprisingly, only 1 German-themed restaurant was returned in the 350 metre radius of our selected tube-stops. This was “Herman ze German”, 148 metres fro the Charing Cross tube-stop. I did some further analysis here. There are only a handful of German-themed restaurants in and around London, mainly outside of the central London area we have selected to analyse. I am also aware of a Viennese-themed (Austrian) restaurant in the vicinity of Charing Cross. When I investigated the categorisation of this restaurant, it was not labelled as German-themed. I decided that this restaurant would not be competition for our German-themed restaurant anyway, as there are quite a few differences with the Viennese theme. Given that there is only 1 German-themed restaurant in Charing Cross, I decided that, due to the low density of restaurants in Charing Cross, we should retain this tube-stop for further analysis. Figure 3 shows a map of the number and location of each restaurant we found in the 350 metre radius around each selected tube-stop:

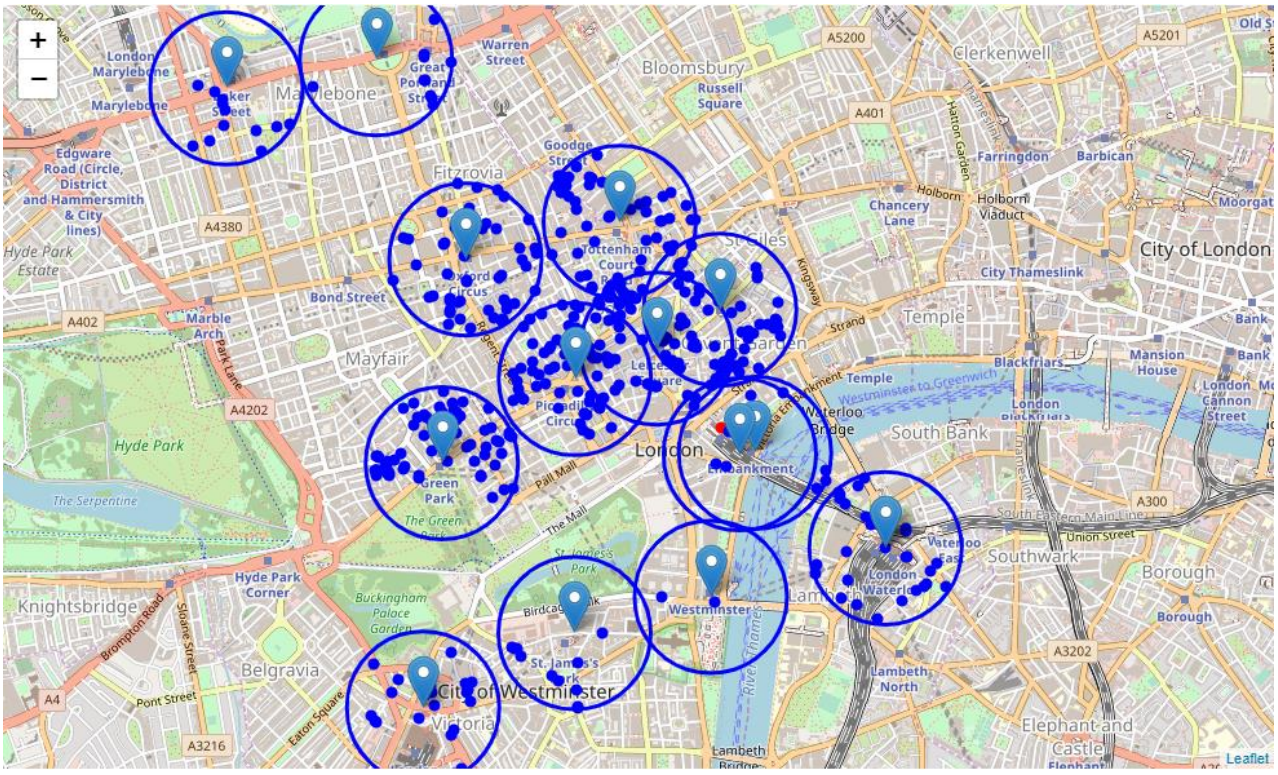

Figure 3 *- Map of Restaurants in 350 metre radius of selected tube-stops*

The next step is to analyse the data that we have collected using our tube-stops and Foursquare restaurant details. We will look at the 'restaurant density' across the different central London tube-stops. We will use heat maps to identify the promising areas, with a low number of restaurants in general (and no German-themed restaurants in the vicinity). We will focus on those areas.

The final step will involve **creating clusters** of locations that meet some basic requirements established in our discussion with the investor’s consortium: We will consider locations with **no more**

than thirty restaurants in a radius of 250 meters. (I have decided to ignore German-themed restaurants in the area due to only having 1. This will have a negligible effect on the analysis). We will map all such locations and also create clusters (using k-Means clustering) of those locations to identify areas which should be a **starting point** for final analysis for a suitable street location. This final analysis will be performed by the investor's consortium.

Figure 4 shows a list of the selected tube-stops and the number of restaurants in each 350 metre radius:

	Name	Latitude	Longitude	Restaurants in area
0	Waterloo	51.503220	-0.113280	27
1	Westminster	51.501210	-0.124890	2
2	Embankment	51.507170	-0.121950	10
3	Charing Cross	51.507108	-0.122963	10
4	St.James's Park	51.499710	-0.133940	11
5	Victoria	51.496629	-0.144009	23
6	Piccadilly Circus	51.510220	-0.133920	73
7	Green Park	51.506740	-0.142760	65
8	Oxford Circus	51.515170	-0.141190	55
9	Tottenham Court Road	51.516721	-0.130939	69
10	Baker Street	51.522236	-0.157080	12
11	Leicester Square	51.511480	-0.128490	73
12	Regent's Park	51.523440	-0.147130	10
13	Covent Garden	51.513080	-0.124270	63

Figure 4 *– Number of restaurants in 350 metre radius of selected tube-stops*

Figure 5 shows a heat map of the selected tube-stops and the number of restaurants in each 350 metre radius:

Figure 5 *– Heat map of restaurants in 350 metre radius of selected tube-stops*

One can see that the Central London area is quite densely populated with restaurants. There are some less densely populated areas around the fringes. The main point of interest is the general sparsity of German-themed restaurants. We could postulate that placing a German-themed restaurant anywhere in the Central London tube-stop area where there are currently no German-themed restaurants within 350 metres would be acceptable. (Only Charing Cross has a German-themed restaurant within 350 metres; **we could exclude this tube-stop from further analysis**). However, if we look at the list of tube-stops and number of restaurants, there are some tube-stops where there are less restaurants, i.e. a lower density. Figure 6 shows the tube-stops with number of restaurants in a 350 metre radius, in descending order:

	Name	Latitude	Longitude	Restaurants in area
6	Piccadilly Circus	51.510220	-0.133920	73
11	Leicester Square	51.511480	-0.128490	73
9	Tottenham Court Road	51.516721	-0.130939	69
7	Green Park	51.506740	-0.142760	65
13	Covent Garden	51.513080	-0.124270	63
8	Oxford Circus	51.515170	-0.141190	55
0	Waterloo	51.503220	-0.113280	27
5	Victoria	51.496629	-0.144009	23
10	Baker Street	51.522236	-0.157080	12
4	St.James's Park	51.499710	-0.133940	11
2	Embankment	51.507170	-0.121950	10
3	Charing Cross	51.507108	-0.122963	10
12	Regent's Park	51.523440	-0.147130	10
1	Westminster	51.501210	-0.124890	2

Figure 6 *– Number of restaurants in 350 metre radius of selected tube-stops, in descending order*

We can see that Charing Cross, where the German-themed restaurant is, is a tube-stop with a lower density of restaurants. This would mean it could be a desirable location. Given that the 1 German-themed restaurant is 148 metres from Charing Cross tube-stop, we can include the tube-stop on the assumption that the competition will not be crowding us out in this location.

The next step is to analyse the selected tube-stops to find all tube-stops where there are 30 or less restaurants within 250 metres of the tube-stop. Figure 7 shows the result of our analysis:

Tube Stop	Total
Piccadilly Circus	50
Leicester Square	37
Covent Garden	35
Green Park	34
Oxford Circus	26
Tottenham Court Road	26
Victoria	18
Waterloo	13
Baker Street	7
Charing Cross	5
Embankment	5
Regent's Park	4
St.James's Park	4
Westminster	2

Figure 7 *– Number of restaurants in 250 metre radius of selected tube-stops, in descending order*

From this, we select the 10 tube-stops with the least density of restaurants in the immediate (i.e. 250 metre) vicinity. Our analysis shows these are the best locations when considering a general lack of German-themed restaurants and restaurant density.

The investor's consortium has asked for 5 locations to begin planning opening a restaurant. We will use k-Means clustering to determine the 5 best locations by clustering the coordinates of these 10 tube-stops. We then take these 5 coordinates and map them back to street addresses. Figure 8 shows the 5 locations we are going to recommend:

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Addresses of centers of areas recommended for further analysis
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Heron House, 19 Marylebone Rd, Marylebone, London NW1 5LT
Waterloo Underground Station, York Rd, South Bank, London SE1 7ND
129 Oxford St, Soho, London W1D 2HU
1-2 Castle Ln, Westminster, London SW1E 6DR
A3211, Westminster, London SW1A 2EF
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Figure 8 *– Address locations of the 5 coordinates recommended by k-Means unsupervised machine learning algorithm*

Figure 9 shows a map of the 5 locations selected by the k-Means algorithm with a 350 metre radius drawn around them. Note that there is no overlap in these 5 locations:

Figure 9 *– Map of the 5 coordinates recommended by k-Means unsupervised machine learning algorithm*

Note the white radius line, drawn 3.5 kilometres from Waterloo. This shows that our recommended coordinates are within 3.5 kilometres of each other, in the central London area we analysed.

What is also interesting is that 2 of the locations recommended, i.e. Heron House at 19 Marylebone Road, and A3211 in Westminster, are sparsely populated with restaurants and may be the first locations that should be investigated.

Results and Discussion

The analysis shows that there are surprisingly few German-themed restaurants in Central London. When I performed a search for German-themed restaurants, there are relatively few and only one in the Central London area we have investigated. By further analysing the Central London tube-stops, we found the best 10 tube-stops where there are a lower density of restaurants in the vicinity. By using k-Means clustering analysis, we found 5 potential locations to act as starting points for a marketing research initiative.

Conclusion

German culture like that exhibited at Oktoberfest, i.e. Durndls and Lederhosen, Wurst and big mugs of beer are gaining popularity in England, and especially London. **The analysis seems to clearly point to a market opportunity to establish more German-themed restaurants in Central London**. The caveat is that the investor's consortium will need to do more due diligence on the starting addresses I provide. There would be a need to conduct at least basic through to thorough market research in these areas to establish a reasonable confidence of success with the venture.