IBM “Applied Data Science Capstone” Project Report
Setting up a Pub in the Bristol and Bath Area

1. Problem Description

In 2020, an area of Bristol has been named one of the best places to live in the UK. Having studied in a university in Bristol myself, I come to realize that the city has more than a picturesque harborside and Clifton suspension bridge, it is also number of activities that one can do to relax with friends that make the city one of the best.

The Bristol and Bath area houses over 550,000 people according to data in 2019, with at least 4 universities in the area, the demand for nightlife is high. Nevertheless, Bristol has been named the city with the third-highest pubs' density in the UK following Portsmouth and Liverpool, with 10 pubs per square mile, which means the competition is also very strong in the area. Therefore, in this report, we will be investigating on where the best location would be to set up our pub, by utilizing the machine learning method of K-means clustering.

2. Data Resources and Preprocessing

There are three different types of data we need to obtain to conduct our analysis. First, we collected the data on neighbourhoods in the Bristol and Bath area, as well as their postcode. Both sets of information collected from their respective Wikipedia page:

1. Bristol: https://en.wikipedia.org/wiki/BS_postcode_area
2. Bath: https://en.wikipedia.org/wiki/BA_postcode_area

Secondly, we need the information of each neighbourhood’s latitude and longitude position to plot the location on the map, we will utilize the geocoder Python library to collect these data. Then finally, we would need to collect the data regarding the venue types of each neighbourhood areas, these data will be collected from the foursquare API.

Once we have collected the data from Wikipedia, we will first need to identify if there are any missing data. In fact, upon investigation, some postal areas have not been assign a neighbourhood or local authority areas, these postal codes do not relate to a specific geographical area and are therefore used for postal purposes only. Thus, we will be dropping these codes and from our list of neighbourhoods.

2.1 Initial data inspection

To ensure the data we collected was valid, we have plotted the locations on a map using the folium library with the latitude and latitude we collected. Errors can occur at this stage due to the fact that even in the same country, some towns might have similar names, or the mapping library might give out the wrong data. Fortunately, the areas are in fact located in around areas where we expected, and none of them are out of the scope of the Bristol and Bath area.

Secondly, we looked at the aggregate number of each venues for the area we are interested. As anticipated, pubs are by far the most frequent venue in the area, followed by coffee shops and hotels. While some of the venue data seems misleading, such as where there are only one mobile phone shop in all these area in combine, we will make the assumption that the data is a good approximation of what we need. In fact, there are no other ways for us to obtain better data than what is already in the foursquare API that are publicly available.

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Figure 1 – Neighborhoods in the Bristol and Bath Area

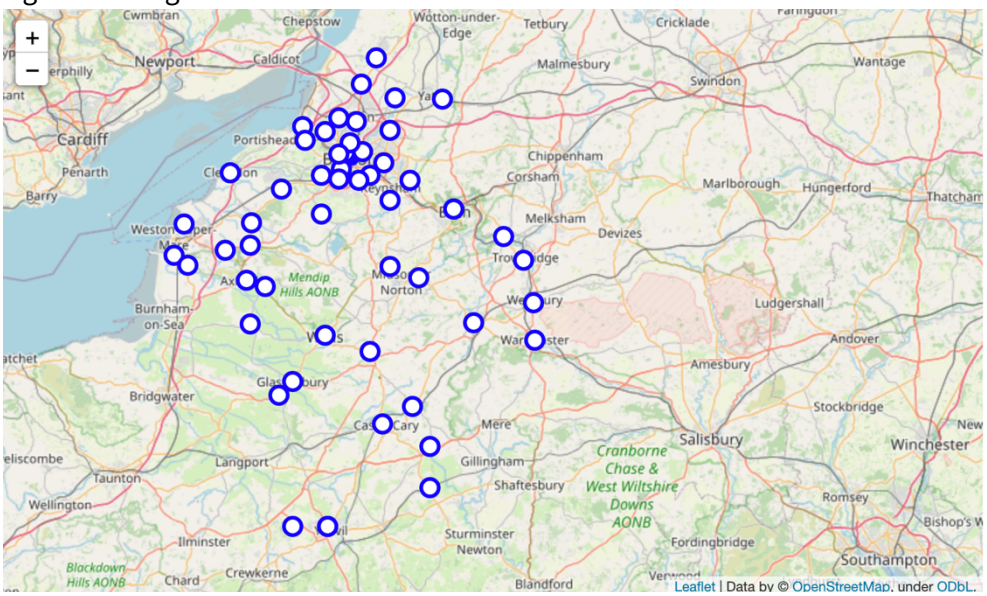
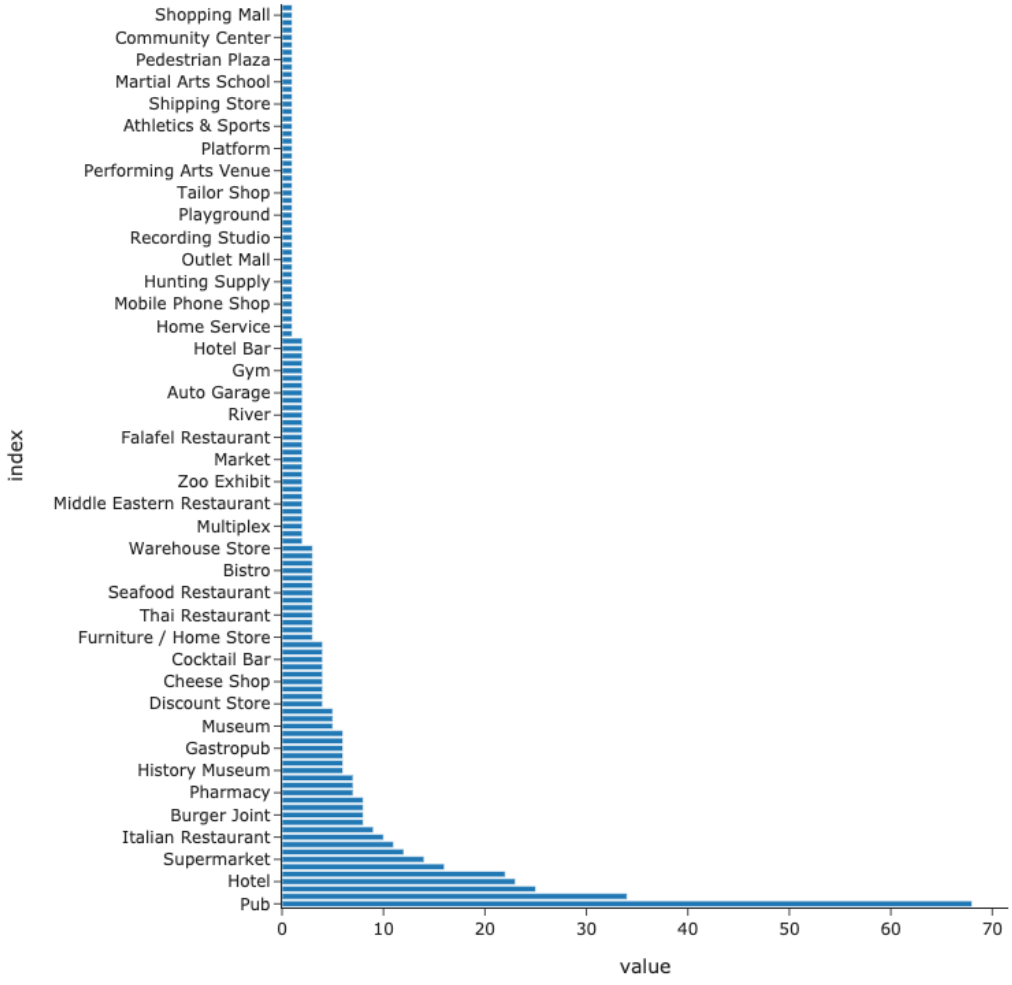


Figure 2 – Total Numbers of Venue in the Area



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3. Methodology

3.1 Unsupervised Learning - K-means Clustering

In this project, we apply the K-means clustering unsupervised learning algorithm to cluster the venues based on their latitude and longitude locations. This allow us to identify neighborhoods with similar traits in terms of venues type and gain an insight to decide which neighborhood(s) are the best for setting up a pub.

To determine the value of K in out k-means clustering algorithm, we will be using the Silhouette Analysis method. After running the analysis, we have found that the optimal number of clusters is five, given that it has the largest silhouette score.

Figure 3 – Optimal number of clusters is five

number of clusters	Silhouette Score
2	0.04879454250792859
3	0.053283264380034105
4	0.06967888896597921
5	0.11393809035062452
6	0.08079810289116551
7	0.10593779146905426

4. Results

Upon dividing the neighborhoods into five different clusters, we plotted it onto a folium map. As shown in figure 4 below, most of the areas are labelled in purple, and the rest are mostly in green, followed by one to two areas labeled red and blue.

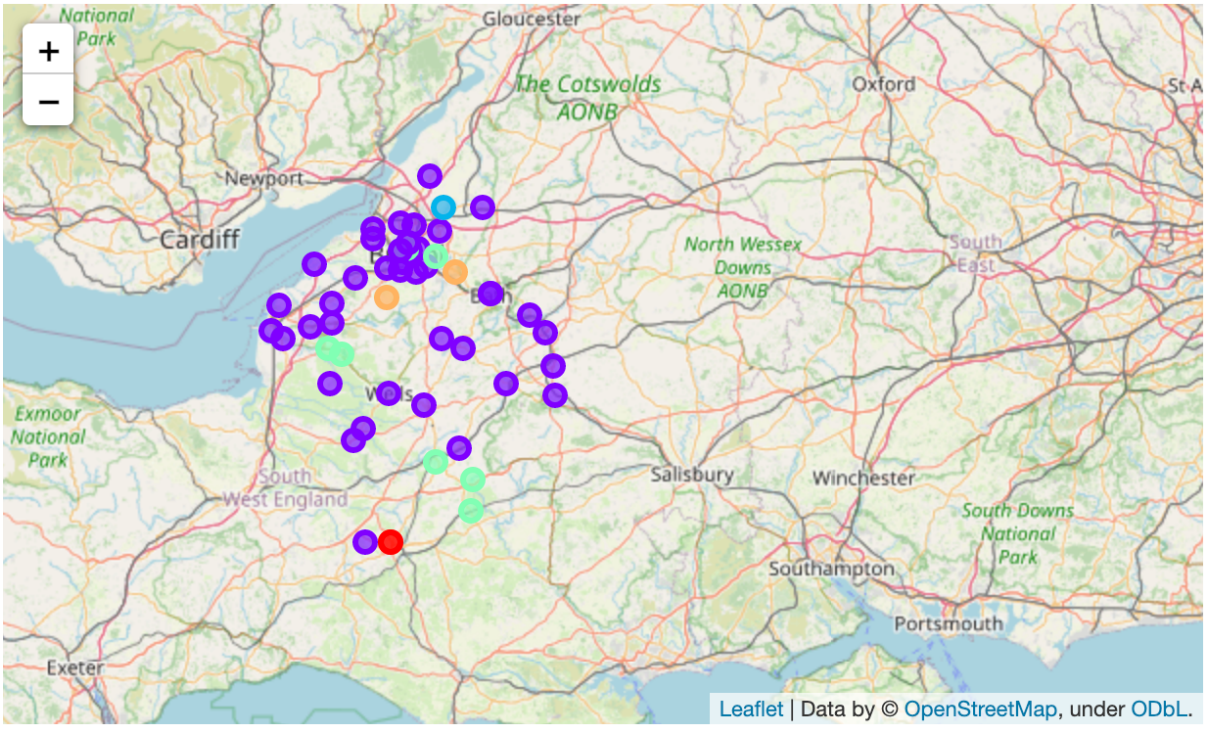

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Figure 5 to 10 – Clustering results

Cluster 0

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	Postcode	#1 Most Common Venue	#2 Most Common Venue	#3 Most Common Venue	#4 Most Common Venue	#5 Most Common Venue
54	BA21	Dog Run	Track	Zoo Exhibit	Golf Course	Electronics Store
55	BA22	Dog Run	Track	Zoo Exhibit	Golf Course	Electronics Store

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Cluster 1

	Postcode	#1 Most Common Venue	#2 Most Common Venue	#3 Most Common Venue	#4 Most Common Venue	#5 Most Common Venue
0	BS1	Pub	Coffee Shop	French Restaurant	Café	Burger Joint
2	BS3	Coffee Shop	Pub	Indian Restaurant	Bar	Mediterranean Restaurant
3	BS4	Clothing Store	Sandwich Place	Discount Store	Auto Garage	Hobby Shop
4	BS5	Indian Restaurant	Pub	Pizza Place	Sandwich Place	Café
6	BS7	Grocery Store	Pub	Gastropub	Bar	Café
7	BS8	Zoo Exhibit	Theater	Student Center	Italian Restaurant	Music Venue
9	BS10	Pub	Restaurant	Chinese Restaurant	Construction & Landscaping	Tailor Shop
10	BS11	Harbor / Marina	Warehouse Store	Train Station	Pub	Hotel
11	BS13	Bar	Grocery Store	Construction & Landscaping	Performing Arts Venue	Food Service
12	BS14	Business Service	Martial Arts School	Auto Garage	Cosmetics Shop	French Restaurant

(* only showing the top ten rows)

Cluster 2

	Postcode	#1 Most Common Venue	#2 Most Common Venue	#3 Most Common Venue	#4 Most Common Venue	#5 Most Common Venue	
30	BS36	Sporting Goods Shop	Zoo Exhibit	Department Store	Dog Run	Electronics Store	R

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Cluster 3

	Postcode	#1 Most Common Venue	#2 Most Common Venue	#3 Most Common Venue	#4 Most Common Venue	#5 Most Common Venue
1	BS2	Pub	Indie Movie Theater	Bar	River	Sandwich Place
5	BS6	Pub	Bar	Plaza	River	Pizza Place
13	BS15	Pub	Grocery Store	Supermarket	Food & Drink Shop	Furniture / Home Store
21	BS26	Pub	Hotel Bar	Plaza	Grocery Store	Gastropub
22	BS27	Pub	Fish & Chips Shop	Cheese Shop	Grocery Store	Clothing Store
43	BA7	Pub	Hotel	Grocery Store	Gift Shop	Dog Run
44	BA8	Pub	Train Station	Shipping Store	Fish & Chips Shop	Furniture / Home Store
45	BA9	Pub	Hobby Shop	Grocery Store	Gift Shop	Dog Run

Cluster 4

	Postcode	#1 Most Common Venue	#2 Most Common Venue	#3 Most Common Venue	#4 Most Common Venue	#5 Most Common Venue
25	BS30	Convenience Store	Construction & Landscaping	Zoo Exhibit	Discount Store	Electronics Store
33	BS40	Construction & Landscaping	Café	Zoo Exhibit	Discount Store	Electronics Store

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5. Discussion

From the clusters above, we can see that cluster 0 consist of two locations that has a high number Dog Runs and Tracks, while cluster 1, the cluster with the largest number of neighborhoods has a mix of areas and top venues. Cluster 2 consist of one area and that is the location BS36, where in the location there is the only sport shops in the Bristol and Bath area. For Cluster 3, this is a cluster with locations that are populated with pubs and other hospitality venues such as bars and hotel. And finally, cluster 4, are areas where that hosts construction and landscaping venues and Zoo exhibit.

While the clustering algorithm provided us with a classification of the areas, it does not implicitly answer our question that which area(s) are best for setting up our Pub. Nevertheless, the strong characteristic of cluster 3, with all the areas consist of high numbers of pubs, it would be a reasonable strategy to start our new pub venue in the area. However, the high number of pubs also suggest that the area will be high level of competition, and better alternative might be to set up a pub in the areas in cluster 1. While in some areas in cluster 1 there are high numbers of pubs, and hospitality venues similar to cluster 3, there are areas where pubs are amongst the lesser common area, and given the similar trait within the cluster, it could be a good idea to set up a pub in areas in cluster 1 where pubs are amongst the less popular venues, such as BS11 shown in the figure above, where pub is only the fourth most popular venue.