Segmenting and Clustering Neighborhoods in UK

Chris Kan, Feb 4,2021

Introduction

- One of the issues when parents choose whether to settle in a district or area to live is whether a location has good schools or not and what are the surrounding neighbourhoods. Are the surroundings suitable for children? Take for an example, if a family settle in Bristol, most likely this family has made the decision to retire in this near-seashore city. In Bristol, when looking up its neighbourhood venues in Foursquare, many of them are bars, which is very much different from that of Oxford. Therefore, finding out schools and its surrounding could help parents making sensible choices when choosing a place to settle or for their children to study.

Source of Data

- The data came from the open data initiatives of UK government.

- Schools data were downloaded from https://ea-edubase-api-prod.azurewebsites.net/edubase/downloads/public/edubasealldata20210201.csv, provided by Gov.uk. These data contained information about a school: its location, its establishment group, its religion, its Ofsted Rating, etc. There is no latitude and longitude data.

- To get the latitude, longitude and nearby postcodes of a postcode, this API is used : https://api.postcodes.io/.

- Venues data are from Foursquare.

Methodology

- First, a complete list of postcodes with NHS info and a complete list of education establishment were downloaded from gov.uk. Initial exploration was done to understand what data were available for investigation.

- The datasets were merged and postcodes with no schools were removed. For the purpose of this exercise, the NHS info was not used for further investigation.

- Since there is no latitude and longitude info in both data set, the data was obtained from an online API for each postcode.

- Next we drill into one of the cities to explore the rating and number of schools inside the city and create a visual map for further exploration.

- The neighbourhoods were identified using an online API. As the results returned were in postcodes, they were converted to latitude and longitude before exploring further with Foursquare. Afterwards, neighbourhoods were explored.

Analysis (1)
Schools distribution in Oxford vs Bristol

Town	EstablishmentTypeGroup (name)	OfstedRating (name)	County (name)	Postcode	EstablishmentName
Oxford	Academies	Good	10	11	11
		Outstanding	1	1	1
		Requires improvement	3	3	3
		Special Measures	4	4	4
	Colleges	Good	1	1	1
	Free Schools	Good	1	1	1
	Independent schools	Good	3	3	3
	Local authority maintained schools	Good	21	21	21
		Outstanding	4	4	4
		Requires improvement	1	1	1
		Serious Weaknesses	2	2	2
		Special Measures	2	2	2
	Special schools	Good	1	2	2
		Outstanding	2	2	2
		Special Measures	1	1	1
	Universities	Good	1	1	1

Town	EstablishmentTypeGroup (name)	OfstedRating (name)	County (name)	Postcode	EstablishmentName
Bristol	Academies	Good	8	16	16
		Outstanding	0	8	8
		Requires improvement	1	9	9
		Special Measures	1	2	2
	Colleges	Good	0	1	1
		Requires improvement	0	1	1
	Free Schools	Good	1	1	1
		Requires improvement	0	1	1
	Independent schools	Good	1	2	2
		Inadequate	2	3	3
	Local authority maintained schools	Good	5	31	31
		Outstanding	2	14	14
		Requires improvement	1	6	6
		Special Measures	1	4	4
	Special schools	Good	0	2	2
		Requires improvement	1	1	1

Analysis (2)
Name of schools in Oxford vs Bristol sorted by OfstedRating

	EstablishmentTypeGroup (name)	EstablishmentName	OfstedRating (name)	County (name)	Town	Postcode
1315119	Independent schools	Carfax College	Good	Oxfordshire	Oxford	OX1 2EP
1331228	Local authority maintained schools	Church Cowley St James Church of England Prima...	Good	Oxfordshire	Oxford	OX4 3QH
1329481	Academies	Cheney School	Good	Oxfordshire	Oxford	OX3 7QH
1329525	Local authority maintained schools	St Joseph's Catholic Primary School, Oxford	Good	Oxfordshire	Oxford	OX3 7SX
1329598	Academies	Endeavour Academy, Oxford	Good	Oxfordshire	Oxford	OX3 8DD
...	...	...	...	...	...	...
1331714	Academies	The Oxford Academy	NaN	Oxfordshire	Oxford	OX4 6JZ
1331717	Local authority maintained schools	St John Fisher Catholic Primary School, Little...	NaN	Oxfordshire	Oxford	OX4 6LD
1331775	Local authority maintained schools	Pegasus School	NaN	Oxfordshire	Oxford	OX4 6RQ
1331781	Academies	Mabel Prichard School	NaN	NaN	Oxford	OX4 6SB
1332753	Special schools	LVS Oxford	NaN	Oxfordshire	Oxford	OX5 1RX

|	EstablishmentTypeGroup (name)	EstablishmentName	OfstedRating (name)	County (name)	Town	Postcode
484216	Special schools	Claremont School	Good	NaN	Bristol	BS9 4LR
476747	Academies	Oasis Academy Connaught	Good	NaN	Bristol	BS4 1NH
476751	Special schools	Knowle DGE	Good	NaN	Bristol	BS4 1NN
476788	Academies	Greenfield E-Act Primary Academy	Good	Bristol	Bristol	BS4 1QW
477087	Local authority maintained schools	Knowle Park Primary School	Good	NaN	Bristol	BS4 2XG
...	...	...	...	...	...	...
483952	Local authority maintained schools	Westbury-on-Trym CofE Primary School	NaN	NaN	Bristol	BS9 3HZ
484097	Local authority maintained schools	Elmlea Junior School	NaN	NaN	Bristol	BS9 3UF
484107	Academies	Elmlea Infant School	NaN	NaN	Bristol	BS9 3UU
484153	Independent schools	Oasis School Westbury	NaN	NaN	Bristol	BS9 4DT
484207	Local authority maintained schools	Henleaze Junior School	NaN	NaN	Bristol	BS9 4LG

Analysis (3)
Schools with latitude and longitude added

|	EstablishmentTypeGroup (name)	EstablishmentName	OfstedRating (name)	County (name)	Town	Postcode	country	postcode	admin_district	latitude	longitude
6175	Independent schools	Bristol Cathedral School	NaN	NaN	Bristol	BS1 5TS	England	BS1 5TS	Bristol, City of	51.451211	-2.600784
6176	Academies	Bristol Cathedral Choir School	Outstanding	NaN	Bristol	BS1 5TS	England	BS1 5TS	Bristol, City of	51.451211	-2.600784
6177	Free Schools	Cathedral Primary School	Good	Bristol	Bristol	BS1 5TS	England	BS1 5TS	Bristol, City of	51.451211	-2.600784
6178	Colleges	City of Bristol College	Requires improvement	NaN	Bristol	BS1 5UA	England	BS1 5UA	Bristol, City of	51.450934	-2.605730
6179	Local authority maintained schools	St George Church of England Primary School	Good	NaN	Bristol	BS1 5XJ	England	BS1 5XJ	Bristol, City of	51.451609	-2.605552
...	...	...	...	...	...	...	...	...	...	...	...
6376	Academies	St Ursula's E-ACT Academy	Good	NaN	Bristol	BS9 4DT	England	BS9 4DT	Bristol, City of	51.485894	-2.614201
6377	Local authority maintained schools	Henleaze Junior School	NaN	NaN	Bristol	BS9 4LG	England	BS9 4LG	Bristol, City of	51.485310	-2.605538
6378	Local authority maintained schools	Henleaze Infant School	Requires improvement	NaN	Bristol	BS9 4LG	England	BS9 4LG	Bristol, City of	51.485310	-2.605538
6379	Academies	Henleaze Junior School	Outstanding	NaN	Bristol	BS9 4LG	England	BS9 4LG	Bristol, City of	51.485310	-2.605538
6380	Special schools	Claremont School	Good	NaN	Bristol	BS9 4LR	England	BS9 4LR	Bristol, City of	51.485076	-2.603835

Analysis (4)
Schools with different ratings are highlighted for easy reference
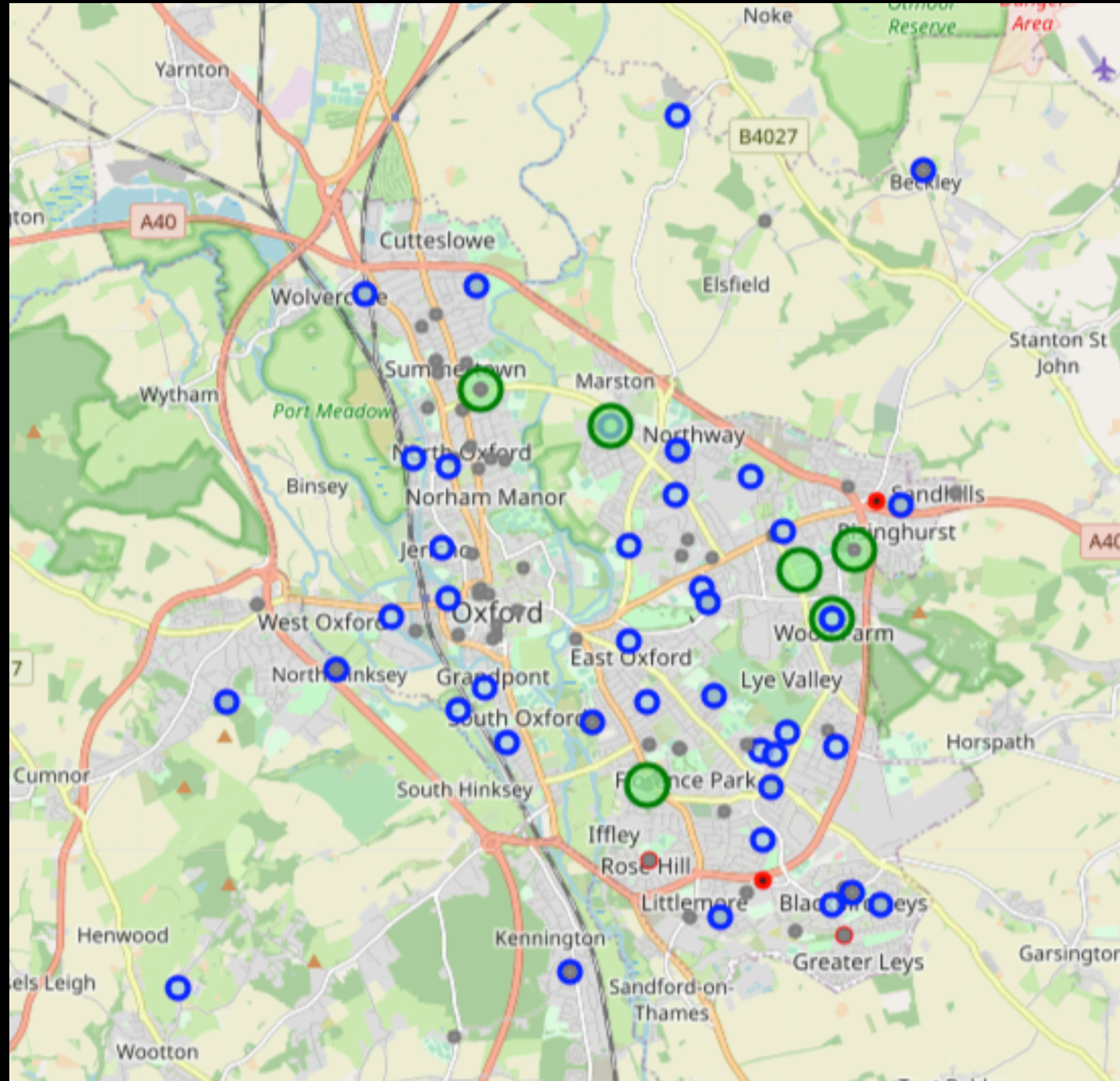
Oxford
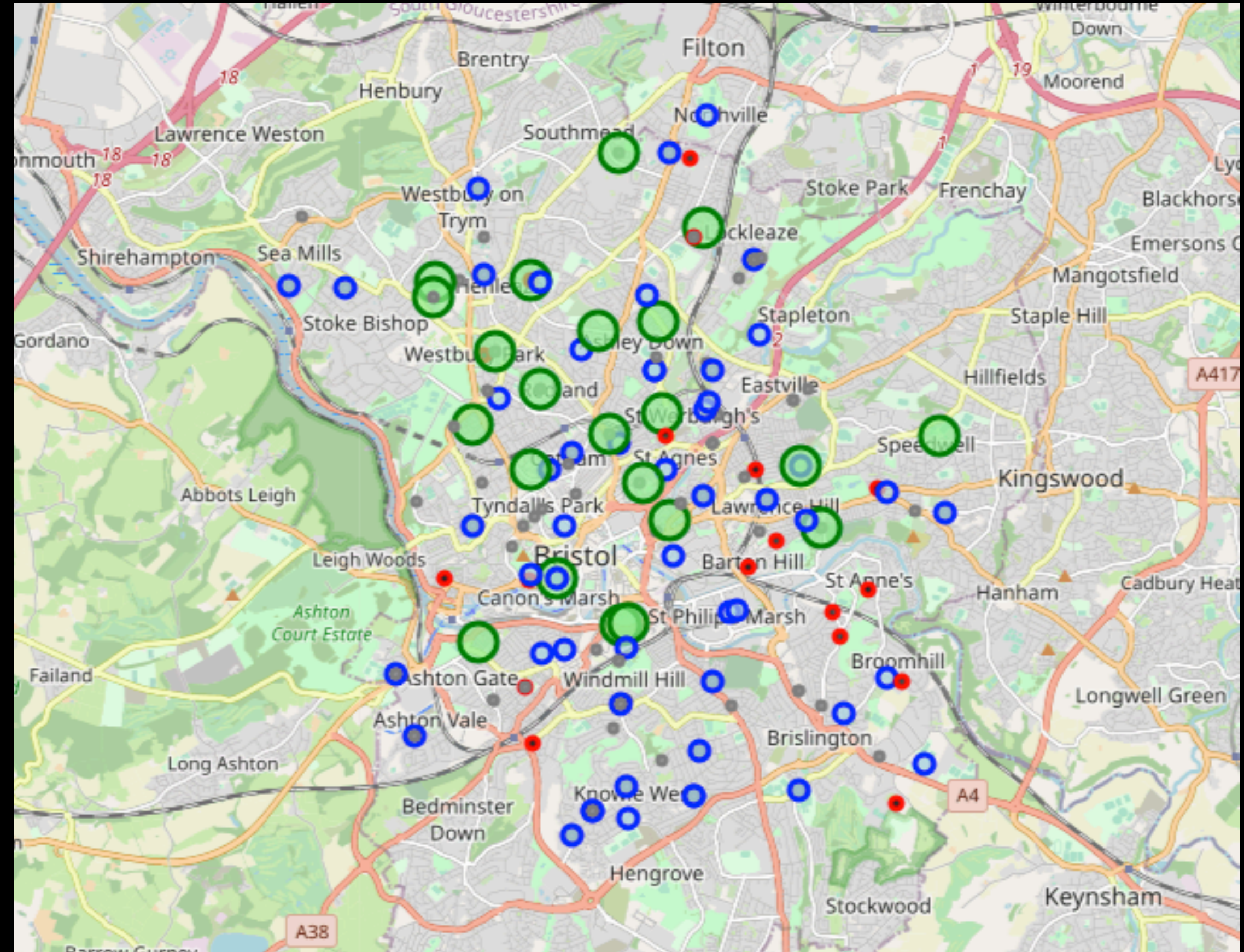
Bristol

Schools are colored according to their
Ofsted Rating
Good: Blue
Outstanding: Green
Requires improvement: Red
Others: Gray

Analysis (5)
Schools neighbourhood

• Suppose we want to explore the neighbourhood of Rosemary Nursery School and Children's Centre which is located in BS2 0DT, we use the API from postcodes.io to get the nearest postcodes

	country	Neighbourhood	Latitude	Longitude
0	England	BS2 0DT	51.457825	-2.580188
1	England	BS2 9DT	51.457653	-2.580344
2	England	BS2 0DB	51.457556	-2.579882
3	England	BS2 0DS	51.457786	-2.580720
4	England	BS2 0DU	51.457621	-2.579638
5	England	BS2 0DQ	51.457494	-2.579766
6	England	BS2 0DR	51.457543	-2.580702
7	England	BS2 0DE	51.457402	-2.579968
8	England	BS2 0DX	51.458232	-2.579588
9	England	BS2 9DY	51.458480	-2.580311

Analysis (6)
Getting neighbourhood detail with Foursquare

- Detail of neighbourhood postcodes of BS2 0DT were retrieved using Foursquare for clustering

```
In [51]: results = requests.get(url).json()
         results

Out[51]: {'meta': {'code': 200, 'requestId': '601d384f9af83733c18ed844'},
          'response': {'suggestedFilters': {'header': 'Tap to show:',
           'filters': [{'name': 'Open now', 'key': 'openNow'}]},
          'headerLocation': 'Bristol',
          'headerFullLocation': 'Bristol',
          'headerLocationGranularity': 'city',
          'totalResults': 114,
          'suggestedBounds': {'ne': {'lat': 51.46682500900001,
            'lng': -2.5657708256466556},
           'sw': {'lat': 51.44882499099999, 'lng': -2.594605174353344}},
          'groups': [{'type': 'Recommended Places',
            'name': 'recommended',
            'items': [{'reasons': {'count': 0,
               'items': [{'summary': 'This spot is popular',
                 'type': 'general',
                 'reasonName': 'globalInteractionReason'}]},
              'venue': {'id': '5658dfd7498ea630649e7086',
               'name': 'The Old Market Assembly',
               'location': {'address': '25 West Street, Old Market',
```

Analysis (7)
Neighborhood clusters

- Neighborhood clusters were created using K-means

- E.g. Cluster 4 contained BS2 0DU, BS2 0DQ and BS2 0DX

	country	Neighbourhood	Latitude	Longitude	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
0	England	BS2 0DT	51.457825	-2.580188	2	Pub	Café	Clothing Store	Music Venue	Gay Bar	Department Store	Gym / Fitness Center	French Restaurant	Burger
1	England	BS2 9D'		.580344	2	Pub	Café	Clothing Store	French Restaurant	Gym / Fitness Center	Sushi Restaurant	Gay Bar	Department Store	Burger
2	England	BS2 0DI		.579882	1	Pub	Café	Clothing Store	Music Venue	Gay Bar	Department Store	Gym / Fitness Center	Sushi Restaurant	Burger
3	England	BS2 0DS	51.457786	-2.580720	0	Pub	Café	Clothing Store	Burger Joint	Sushi Restaurant	Gay Bar	Department Store	Coffee Shop	Fre Resta
4	England	BS2 0DU	51.457621	-2.579638	4	Pub	Café	Clothing Store	Gay Bar	Department Store	Burger Joint	Music Venue	Gym / Fitness Center	Conveni S
5	England	BS2 0DQ	51.457494	-2.579766	4	Pub	Café	Clothing Store	Gay Bar	Department Store	Burger Joint	Music Venue	Gym / Fitness Center	Conveni S
6	England	BS2 0DR	51.457543	-2.580702	0	Pub	Café	Clothing Store	Burger Joint	Sushi Restaurant	Gay Bar	Department Store	Coffee Shop	Fre Resta
7	England	BS2 0DE	51.457402	-2.579968	1	Pub	Café	Clothing Store	Music Venue	Gay Bar	Department Store	Gym / Fitness Center	Sushi Restaurant	Burger
8	England	BS2 0DX	51.458232	-2.579588	4	Pub	Café	Gym / Fitness Center	Clothing Store	Gay Bar	Department Store	Burger Joint	Music Venue	Conveni S
9	England	BS2 9DY	51.458480	-2.580311	3	Pub	Café	Gym / Fitness Center	Clothing Store	Music Venue	Gay Bar	Department Store	French Restaurant	Burger

Analysis (8)

- Clusters of postcodes with common characteristics were represented by different colours
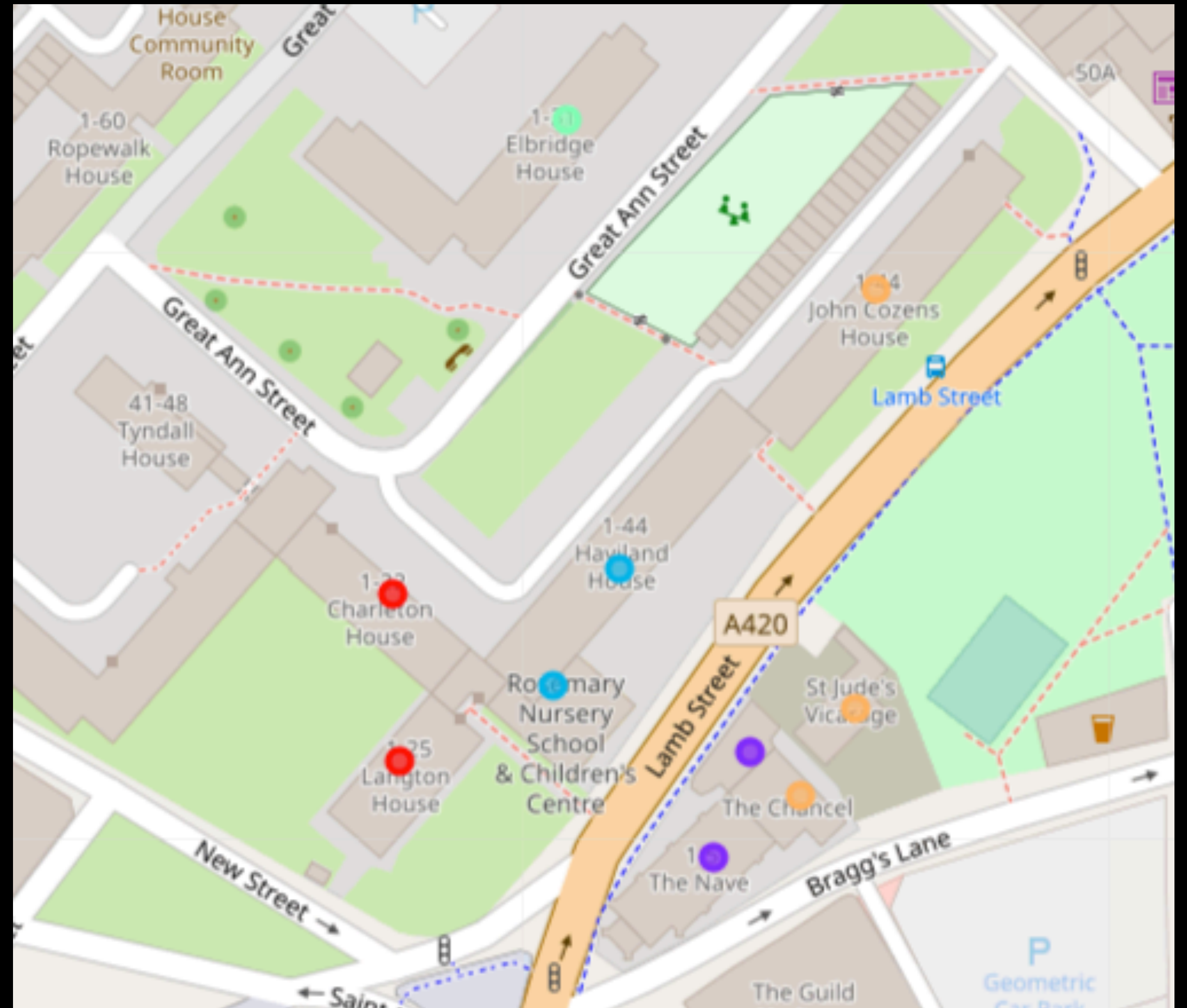
Result Summary

- The concentration of schools is quite different from that of Oxford. The result could serve as an initial supporting evidence for selecting an area to settle or study.

- Using one of the postcodes in City of Bristol as example, the result showed that the most common venue in the neighbourhoods of a school are Pub, clothing stores and Cafe. This reflects the reality that Bristol is a travel city, good for retirement and vacation.

Discussion

- This exercise is a framework for analysis. For further improvement, it would be interesting to see any spending figures or income figures added to the dataframe for analysis. Adding average house prices in postcodes may help choosing a property with specific neighborhood conditions.

- This framework can be extended further to answer other interesting questions. For example,

  - is there any relationship between income, study area and transport availability?

  - What is the best place to study if a person do not want to own a car?