

# **WHAT COUNTRIES TO TRAVEL IN A LIMITED TIME**

Athar Kamal

4<sup>th</sup> November, 2019

# PROBLEM STATEMENT

## Optimal Travel to Europe

- People who work have limited time and cannot leave their work for extended period.
- These travelers want to maximize the number of cities they can travel.
- This project aims to cluster the most populous and famous European cities for people who Work

# DATA ACQUISITION

## Data Sources

- Major European cities were collected through (using beautifulsoup4):

[https://en.wikipedia.org/wiki/List\\_of\\_urban\\_areas\\_in\\_the\\_European\\_Union](https://en.wikipedia.org/wiki/List_of_urban_areas_in_the_European_Union)

- Latitude and Longitude of each city were added through GeoPy.

- There were 83 Rows and 6 columns for the initial dataset.

- Airport distance were collected through the FourSquare API

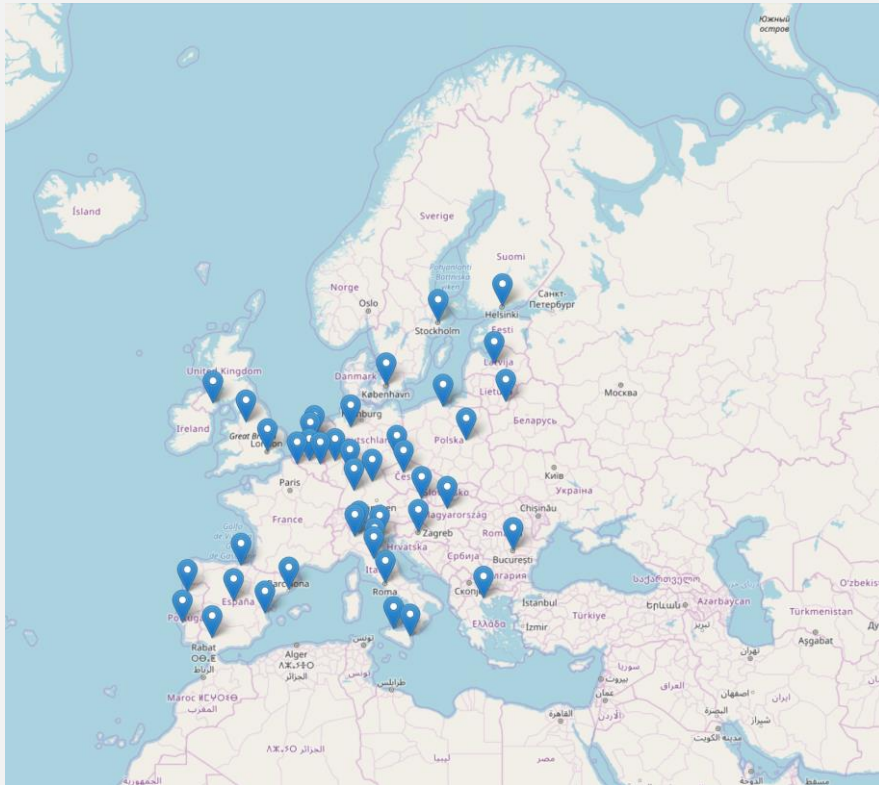
- Cleaned Data looked like the table:

	City	Rank	Country	Population	Density per km^2	Latitude	Longitude	url	Distance
0	London	2	United Kingdom	10470000	5900	51.507322	-0.127647	https://api.foursquare.com/v2/venues/explore?&...	608
1	Madrid	4	Spain	6610000	4600	40.416705	-3.703582	https://api.foursquare.com/v2/venues/explore?&...	2148
2	Milan	5	Italy	5280000	2800	45.466800	9.190500	https://api.foursquare.com/v2/venues/explore?&...	2845
3	Barcelona	6	Spain	5260000	4300	41.382894	2.177432	https://api.foursquare.com/v2/venues/explore?&...	841
4	Rome	8	Italy	3950000	3400	41.894802	12.485338	https://api.foursquare.com/v2/venues/explore?&...	1602
5	Lisbon	11	Portugal	2700000	2800	38.707751	-9.136592	https://api.foursquare.com/v2/venues/explore?&...	1292
6	Greater Manchester Urban Area	13	United Kingdom	2685000	4200	53.385561	-2.340603	https://api.foursquare.com/v2/venues/explore?&...	4371
7	Rotterdam	14	Netherlands	2670000	2700	51.922893	4.463179	https://api.foursquare.com/v2/venues/explore?&...	1659
8	Budapest	16	Hungary	2500000	1900	47.498382	19.040471	https://api.foursquare.com/v2/venues/explore?&...	987
9	Prague	17	Czech Republic	2300000	4600	50.087465	14.421254	https://api.foursquare.com/v2/venues/explore?&...	1327
10	Warsaw	18	Poland	2200000	3200	52.233717	21.071411	https://api.foursquare.com/v2/venues/explore?&...	4363
11	Cologne/Bonn Region	19	Germany	2165000	2300	50.867793	7.138906	https://api.foursquare.com/v2/venues/explore?&...	1807
12	Brussels	20	Belgium	2120000	2600	50.846557	4.351697	https://api.foursquare.com/v2/venues/explore?&...	4173
13	Bucharest	21	Romania	2115000	6500	44.436141	26.102720	https://api.foursquare.com/v2/venues/explore?&...	3151
14	Frankfurt	25	Germany	1950000	3000	50.110644	8.682092	https://api.foursquare.com/v2/venues/explore?&...	630
15	Vienna	26	Austria	1785000	3900	48.208354	16.372504	https://api.foursquare.com/v2/venues/explore?&...	3699
16	Amsterdam	28	Netherlands	1650000	3200	52.374540	4.897976	https://api.foursquare.com/v2/venues/explore?&...	758
17	Valencia	31	Spain	1585000	5700	39.469901	-0.375951	https://api.foursquare.com/v2/venues/explore?&...	223
18	Stockholm	32	Sweden	1565000	4300	59.325117	18.071093	https://api.foursquare.com/v2/venues/explore?&...	3347
19	Porto	34	Portugal	1485000	1900	41.149451	-8.610788	https://api.foursquare.com/v2/venues/explore?&...	963
20	Stuttgart	36	Germany	1395000	2900	48.778449	9.180013	https://api.foursquare.com/v2/venues/explore?&...	716
21	Copenhagen	38	Denmark	1290000	2700	55.686724	12.570072	https://api.foursquare.com/v2/venues/explore?&...	1843
22	Helsinki	39	Finland	1280000	2400	60.167409	24.942568	https://api.foursquare.com/v2/venues/explore?&...	542
23	Sevilla	44	Spain	1110000	5600	37.388630	-5.995340	https://api.foursquare.com/v2/venues/explore?&...	1846

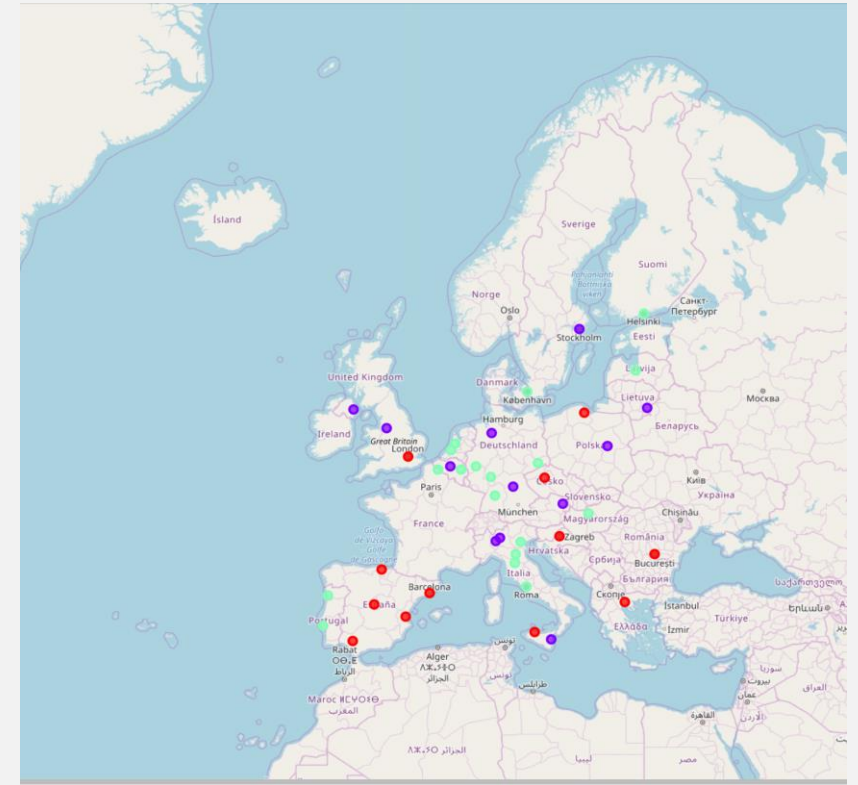
# DATA ANALYSIS

## K-means Clustering

- K-Means clustering was performed on the cleaned data and were plotted as follows:



**K-means  
Clustering**



# DISCUSSION & CONCLUSION

## Optimal Travel to Europe

- Red and Purple clusters are optimized for travel.
- Travelers can consider either short distance between airport and city or lower population density.
- The recommended city tours are as in the following tables:

Figure 1: Red Cluster

[24]:	City	Density per km^2	Latitude	Longitude	url	Distance
0	London	5900	51.507322	-0.127647	https://api.foursquare.com/v2/venues/explore?&...	608
1	Madrid	4600	40.416705	-3.703582	https://api.foursquare.com/v2/venues/explore?&...	2148
3	Barcelona	4300	41.382894	2.177432	https://api.foursquare.com/v2/venues/explore?&...	841
9	Prague	4600	50.087465	14.421254	https://api.foursquare.com/v2/venues/explore?&...	1327
13	Bucharest	6500	44.436141	26.102720	https://api.foursquare.com/v2/venues/explore?&...	3151
17	Valencia	5700	39.469901	-0.375951	https://api.foursquare.com/v2/venues/explore?&...	223
23	Sevilla	5600	37.388630	-5.995340	https://api.foursquare.com/v2/venues/explore?&...	1846
24	Gdańsk	5000	54.347629	18.645232	https://api.foursquare.com/v2/venues/explore?&...	1140
28	Thessaloniki	4300	40.640317	22.935272	https://api.foursquare.com/v2/venues/explore?&...	2243
29	Bilbao	5800	43.263005	-2.934992	https://api.foursquare.com/v2/venues/explore?&...	4166
32	Palermo	6000	38.111227	13.352443	https://api.foursquare.com/v2/venues/explore?&...	3631
33	Zagreb	4400	45.813177	15.977048	https://api.foursquare.com/v2/venues/explore?&...	1576

Figure 2: Purple Cluster

[27]:	City	Density per km^2	Latitude	Longitude	url	Distance
2	Milan	2800	45.466800	9.190500	https://api.foursquare.com/v2/venues/explore?&...	2845
6	Greater Manchester Urban Area	4200	53.385561	-2.340603	https://api.foursquare.com/v2/venues/explore?&...	4371
10	Warsaw	3200	52.233717	21.071411	https://api.foursquare.com/v2/venues/explore?&...	4363
12	Brussels	2600	50.846557	4.351697	https://api.foursquare.com/v2/venues/explore?&...	4173
15	Vienna	3900	48.208354	16.372504	https://api.foursquare.com/v2/venues/explore?&...	3699
18	Stockholm	4300	59.325117	18.071093	https://api.foursquare.com/v2/venues/explore?&...	3347
26	Bergamo	3300	45.694495	9.669873	https://api.foursquare.com/v2/venues/explore?&...	3894
31	Catania	2900	37.502235	15.087380	https://api.foursquare.com/v2/venues/explore?&...	3785
34	Nuremberg	3000	49.453872	11.077298	https://api.foursquare.com/v2/venues/explore?&...	4513
35	Bremen	2400	53.075820	8.807165	https://api.foursquare.com/v2/venues/explore?&...	2988
36	Belfast	3500	54.596441	-5.930276	https://api.foursquare.com/v2/venues/explore?&...	3804
40	Vilnius	2500	54.687046	25.282911	https://api.foursquare.com/v2/venues/explore?&...	4903