





THE BATTLE OF NEIGHBORHOODS

Rent a low cost apartment in Dublin which is near
to
Dublin City Center

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INTRODUCTION – BUSINESS PROBLEM

➤ Target Audience:

- Fingal's Housing Community Agency is a community driven agency that helps people in buying and renting Houses/Apartments.

➤ Business Problem:

- Recommend the optimal location to Fingal's Housing Community Agency.
- It was so hard to find a double bed room apartment for rent nearby Dublin City Center and with lower cost.
- Dublin County has more than 27 postal districts of which we are targeting North Dublin and South Dublin with 22 (D01–D18, D6W, D20, D22, D24) postal districts.

➤ Success Criteria:

- Since there are lots of apartments in Dublin South/North Districts we will try to detect locations that are closer to the Dublin City and apartments that are at lower cost.

About Dublin

- Dublin is the capital and largest city of Ireland. Situated on a bay on the east coast, at the mouth of the River Liffey.
- It has an urban area population of 1,173,179 while the population of the Dublin Region (formerly County Dublin) as of 2016 was 1,347,359. The population of the Greater Dublin Area was 1,904,806 per the 2016 census.
- Dublin celebrated its 'official' millennium in 1988, meaning the Irish government recognized 988 as the year in which the city was settled and that this first settlement would later become the city of Dublin.
- Since 1997, the landscape of Dublin has changed. The city was at the forefront of Ireland's economic expansion during the Celtic Tiger period, with private sector and state development of housing, transport and business. Following an economic decline during the Great Recession, Dublin has rebounded and as of 2017 has close to full employment, but a significant problem with housing supply in both city and surrounds.

DATA DESCRIPTION

➤ Data 1:

- D01–D18, D6W, D20, D22, D24 Districts has returned 167Borough's data for 2 Bed Apartment.
- Pre-processed the data of 167 borough's to remove unassigned data and blank values.
- After cleaning and modification finally we have data for 100 Borough's.
- Dataset is available online from the **Residential Tenancies Board (RTB)** hosted by the **Central Statistics Office (CSO)** for download.

Link : [https://www.cso.ie/px/pxeirestat/Statire>SelectOut/PxSort.asp?
file=20199410331813283992RIQ02&PLanguage=0&MainTable=RIQ02&MainTablePrestext=&potsize=2839](https://www.cso.ie/px/pxeirestat/Statire>SelectOut/PxSort.asp?file=20199410331813283992RIQ02&PLanguage=0&MainTable=RIQ02&MainTablePrestext=&potsize=2839)

Property Type	Number of Bedrooms	Borough	Neighbourhood	Latitude	Longitude	2015Q1	2015Q2	2015Q3	2015Q4	...	2017Q1	2017Q2	2017Q3	2017Q4	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1
Apartment	Two bed	Dublin	Dublin	53.349764	-6.260273	1203.10	1224.80	1271.08	1274.81	...	1377.60	1415.03	1454.95	1473.57	1489.44	1517.31	1557.85	1579.17	1605.37
Apartment	Two bed	Balbriggan	Dublin	53.609832	-6.186196	806.56	824.96	840.79	861.38	...	976.34	983.98	999.51	1029.35	1049.56	1065.20	1088.56	1118.25	1126.03
Apartment	Two bed	Blackrock	Dublin	53.301864	-6.178834	1403.09	1431.49	1462.82	1467.62	...	1602.84	1638.30	1643.56	1655.93	1666.64	1687.02	1726.35	1735.95	1779.98
Apartment	Two bed	Booterstown	Dublin	53.308629	-6.196652	1411.06	1452.15	1459.70	1484.88	...	1574.34	1609.10	1620.15	1632.22	1688.19	1720.91	1805.39	1830.86	1871.69
Apartment	Two bed	Donabate	Dublin	53.481800	-6.154880	925.00	957.98	978.41	992.05	...	1156.67	1178.92	1205.77	1179.59	1200.17	1207.49	1239.22	1252.57	1253.95

➤ Data 2:

- Using Geopy library geopy.distance calculated distance from Neighbourhood to Dublin City Center.
- Average apartment rent of all the years for each Neighborhood and yearly rent calculated from all Quarters for each Neighborhood

Borough	Neighbourhood	Latitude	Longitude	2015Q1	2015Q2	2015Q3	2015Q4	...	2018Q3	2018Q4	2019Q1	Distance_from_City_Center_miles	avgAptRent	2015	2016	2017	2018	2019	
Dublin	Dublin	53.349764	-6.260273	1203.10	1224.80	1271.08	1274.81	...	1557.85	1579.17	1605.37		1.0	1395	1243	1319	1430	1535	1605
Balbriggan	Dublin	53.609832	-6.186196	806.56	824.96	840.79	861.38	...	1088.56	1118.25	1126.03		18.2	967	833	920	997	1080	1126
Blackrock	Dublin	53.301864	-6.178834	1403.09	1431.49	1462.82	1467.62	...	1726.35	1735.95	1779.98		4.7	1587	1441	1521	1635	1703	1779
Booterstown	Dublin	53.308629	-6.196652	1411.06	1452.15	1459.70	1484.88	...	1805.39	1830.86	1871.69		3.9	1607	1451	1543	1608	1761	1871
Donabate	Dublin	53.481800	-6.154880	925.00	957.98	978.41	992.05	...	1239.22	1252.57	1253.95		10.1	1117	963	1065	1180	1224	1253

➤ Data 3:

- Extracted Venues from Foursquare.com for each borough.

We will use Foursquare API to find venues for each borough in Dublin City. Below is the Foursquare API data.

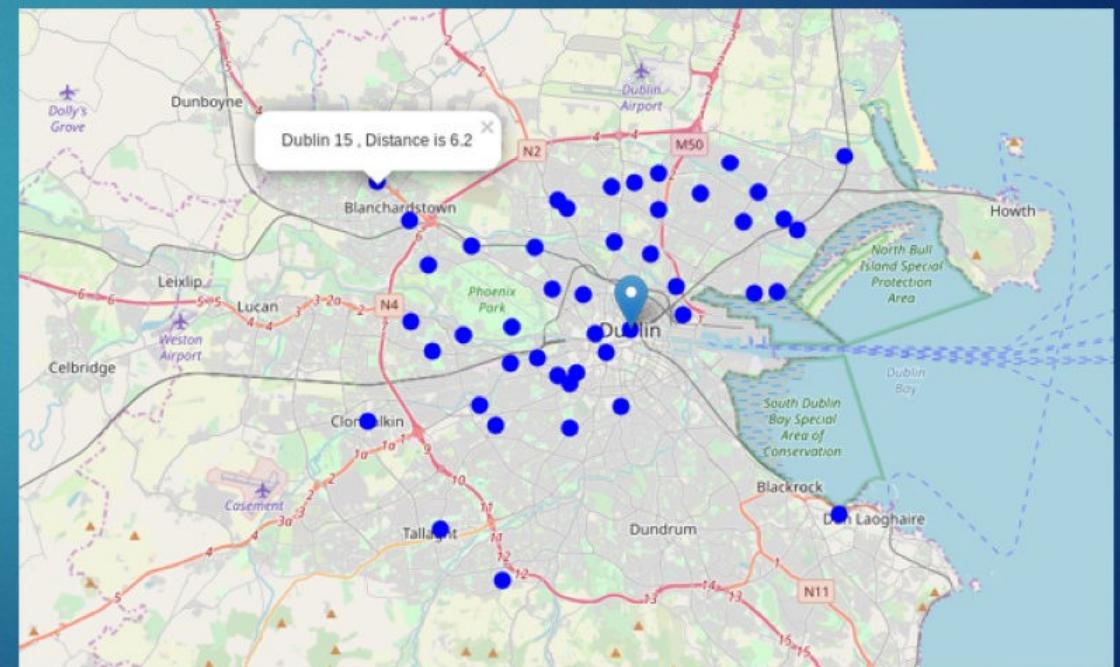
There are 185 unique categories

Borough	Neighborhood Latitude	Neighborhood Longitude	Venue ID	Venue Name	Venue Latitude	Venue Longitude	Venue Category	Venue Address	Venue Distance	
0	Dublin	53.349764	-6.260273	4bb9e25e1261d13ae1efe998	Pull&Bear	53.349533	-6.262053	Clothing Store	22-23 Henry St, Dublin, Dublin City, Ireland	121
1	Dublin	53.349764	-6.260273	51093750e4b0e991dc341337	Vice Coffee Inc.	53.347915	-6.262327	Coffee Shop	54 Middle Abbey St, Dublin, Dublin City, Ireland	247
2	Dublin	53.349764	-6.260273	5092a33be4b0eedd3968e593	Dealz	53.350623	-6.263183	Discount Store	44-45 The Ilac Centre, Moore Street Moore St, ...	215
3	Dublin	53.349764	-6.260273	5187b38b498e68948f3a969d	Gino's Gelato	53.349573	-6.261846	Ice Cream Shop	41 Henry St, Dublin, Dublin City, Ireland	106
4	Dublin	53.349764	-6.260273	4ade0f17f964a520177121e3	Abbey Theatre	53.348542	-6.257492	Theater	26 Lwr Abbey St, Dublin, Dublin City, Ireland	229

METHODOLOGY

- Limit our analysis to **area ~6.2mi around city center** as we can drive easily.
- Limit our analysis to **apartments rent that's less than 1500 euros** in all boroughs.
- 46 Borough's matched the above criteria's

Locations within 6.2mi from Dublin City Center : 76
Apartments with rent less than 1500 euros: 66
Locations with both conditions met: 46



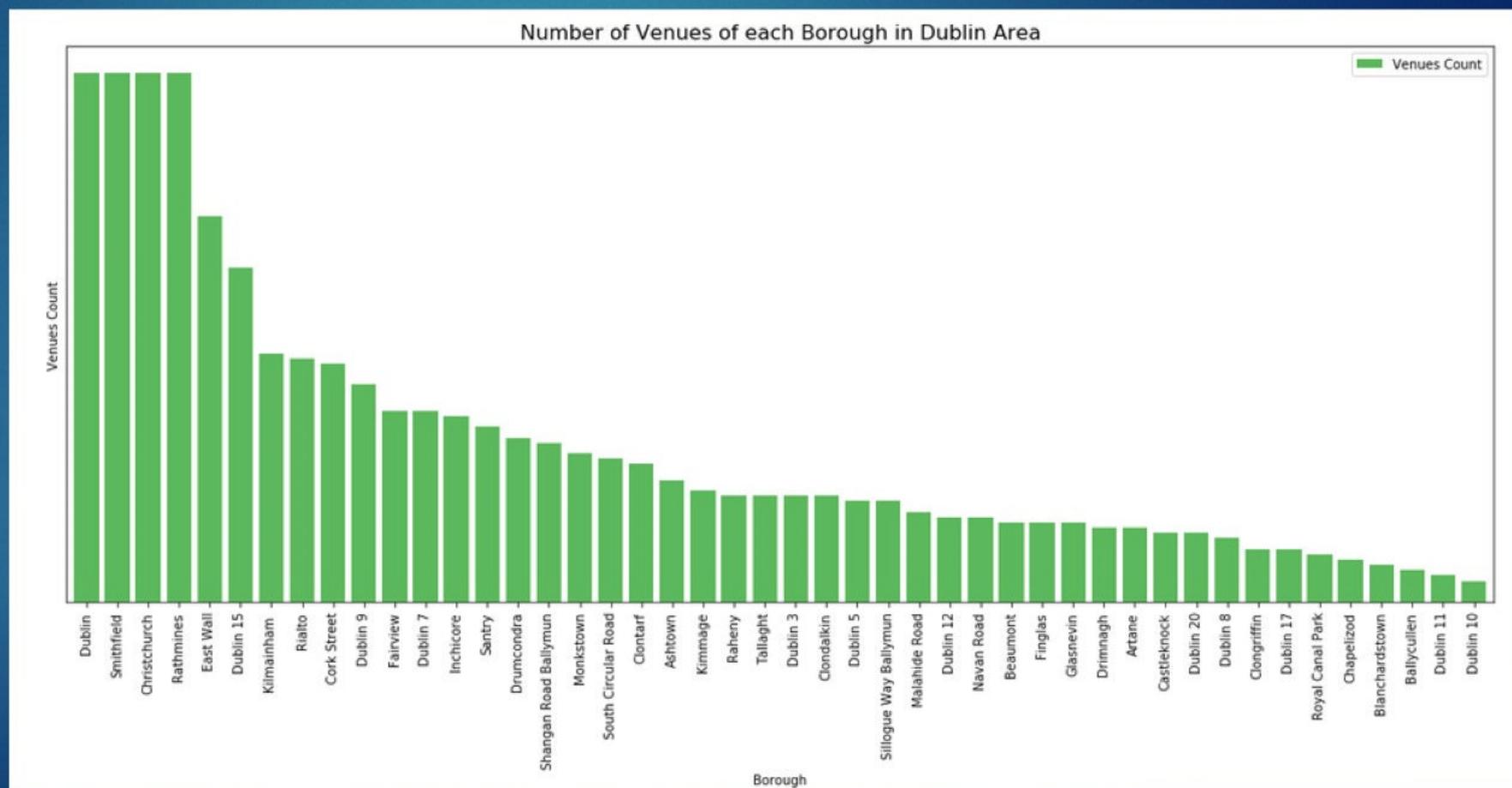
METHODOLOGY

- We used BeautifulSoup python library. BeautifulSoup is a Python package for parsing HTML and XML documents.
- It creates a parse tree for parsed pages that can be used to extract data from HTML, which is useful for web scraping
- We used unsupervised learning K-means algorithm to cluster the boroughs on avgAptrent.
- We used Folium python library. Folium map is used to plot out boroughs using Circle and CircleMarker.

EXPLORATORY DATA ANALYSIS

- Venue counts for each borough and plot out bar graph.
- We can see that few Boroughs reached 100 venues list whereas few are below 10. Below is the venues count for each Borough.

Borough	Venues Count	
0	Artane	14
1	Ashtown	23
2	Ballycullen	6
3	Beaumont	15
4	Blanchardstown	7
5	Castleknock	13
6	Chapelizod	8
7	Christchurch	100
8	Clondalkin	20
9	Clongriffin	10



- Results show that 189 unique categories are returned for all borough's latitude and longitude information using Foursquare API. Out of the returned venues for each borough we will show data of top 10 most common venues for each borough.

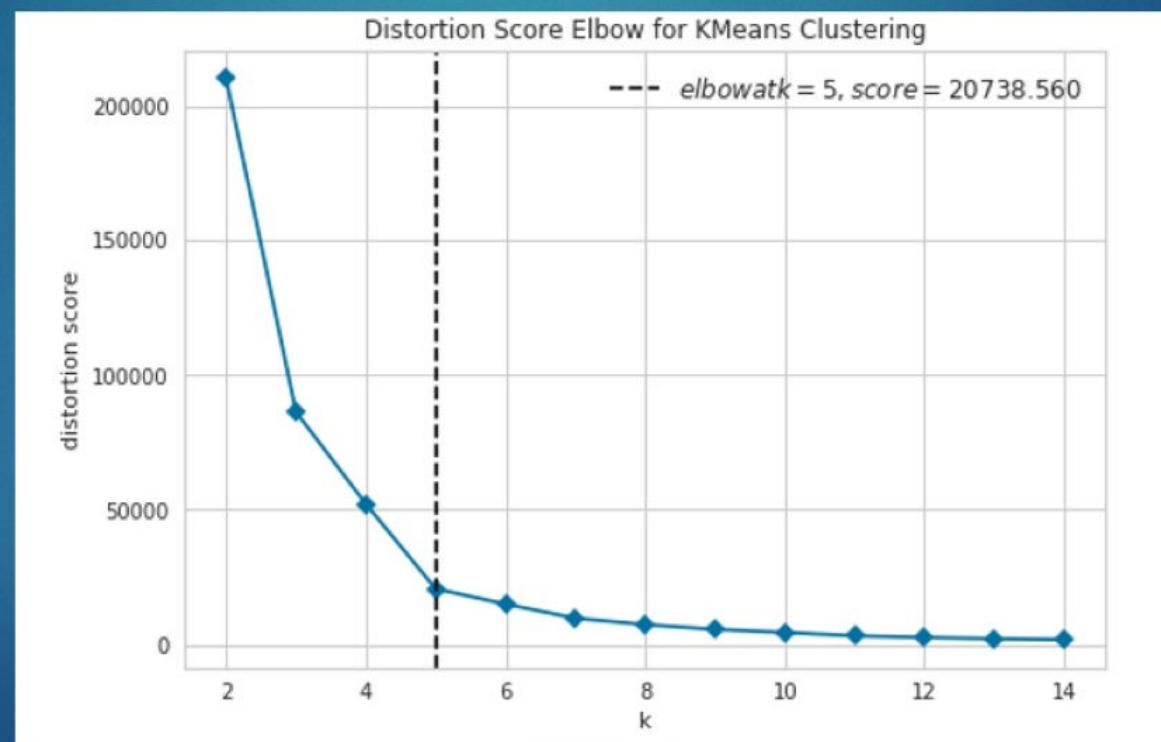
	Borough	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Artane	Grocery Store	Supermarket	Ice Cream Shop	Pharmacy	Sports Club	Fast Food Restaurant	Bus Stop	Shopping Mall	Chinese Restaurant	Pub
1	Ashtown	Train Station	Sports Club	Park	Café	Canal Lock	Sporting Goods Shop	Bar	Coffee Shop	Restaurant	Gym
2	Ballycullen	Convenience Store	Supermarket	Mountain	Pharmacy	Chinese Restaurant	Indian Restaurant	Arts & Crafts Store	Furniture / Home Store	French Restaurant	Food Truck
3	Beaumont	Supermarket	Café	Fast Food Restaurant	Sandwich Place	Other Great Outdoors	Electronics Store	Coffee Shop	Athletics & Sports	Bus Stop	Convenience Store
4	Blanchardstown	Supermarket	Hotel	Bar	Steakhouse	Pub	Thai Restaurant	Food & Drink Shop	Fish & Chips Shop	Film Studio	Fast Food Restaurant
5	Castleknock	Chinese Restaurant	Café	Park	Bakery	Pub	Italian Restaurant	Asian Restaurant	Gastropub	Farm	Supermarket
6	Chapelizod	Convenience Store	Chinese Restaurant	Café	Gastropub	Park	Golf Course	Grocery Store	Pub	Hotel	Dessert Shop
7	Christchurch	Pub	Café	Coffee Shop	Restaurant	Cocktail Bar	Historic Site	Pizza Place	Bar	Bakery	Burrito Place
8	Clondalkin	Restaurant	Bar	Fast Food Restaurant	Convenience Store	Coffee Shop	Chinese Restaurant	Supermarket	Italian Restaurant	Garden Center	Park
9	Clongriffin	Park	Food & Drink Shop	Fish & Chips Shop	Italian Restaurant	Auto Garage	Badminton Court	Chinese Restaurant	Grocery Store	Train Station	Zoo Exhibit

- In order to find optimal location and show useful data we have grouped all common venues and joined top 3 grouped venues for each borough.

	Borough	Top3Venues
0	Artane	3 Grocery Store, 2 Supermarket, 2 Bus Stop
1	Ashtown	4 Train Station, 2 Sports Club, 2 Park
2	Ballycullen	1 Supermarket, 1 Chinese Restaurant, 1 Conveni...
3	Beaumont	2 Café, 2 Supermarket, 2 Fast Food Restaurant
4	Blanchardstown	2 Supermarket, 1 Bar, 1 Hotel
5	Castleknock	2 Park, 2 Chinese Restaurant, 2 Café
6	Chapelizod	1 Pub, 1 Park, 1 Café
7	Christchurch	9 Café, 8 Coffee Shop, 3 Burrito Place
8	Clondalkin	2 Supermarket, 2 Restaurant, 2 Fast Food Resta...
9	Clongriffin	1 Chinese Restaurant, 1 Food & Drink Shop, 1 G...

Borough	Latitude	Longitude	Distance_from_City_Center_miles	Cluster Labels	avgAptRent	Label Name	Top3Venues	
0	53.349764	-6.260273		1.0	4	1395	High-Range Level-2	9 Café, 4 Coffee Shop, 2 Gastropub
1	53.293645	-6.153902		5.9	4	1438	High-Range Level-2	3 Café, 3 Pub, 2 Bar
2	53.361223	-6.185467		3.2	4	1437	High-Range Level-2	2 Modern European Restaurant, 2 Italian Restau...
3	53.360814	-6.196854		2.7	4	1458	High-Range Level-2	3 Hotel, 2 Fish & Chips Shop, 2 Italian Restau...
4	53.354069	-6.233519		1.1	4	1428	High-Range Level-2	7 Coffee Shop, 4 Bar, 3 Grocery Store

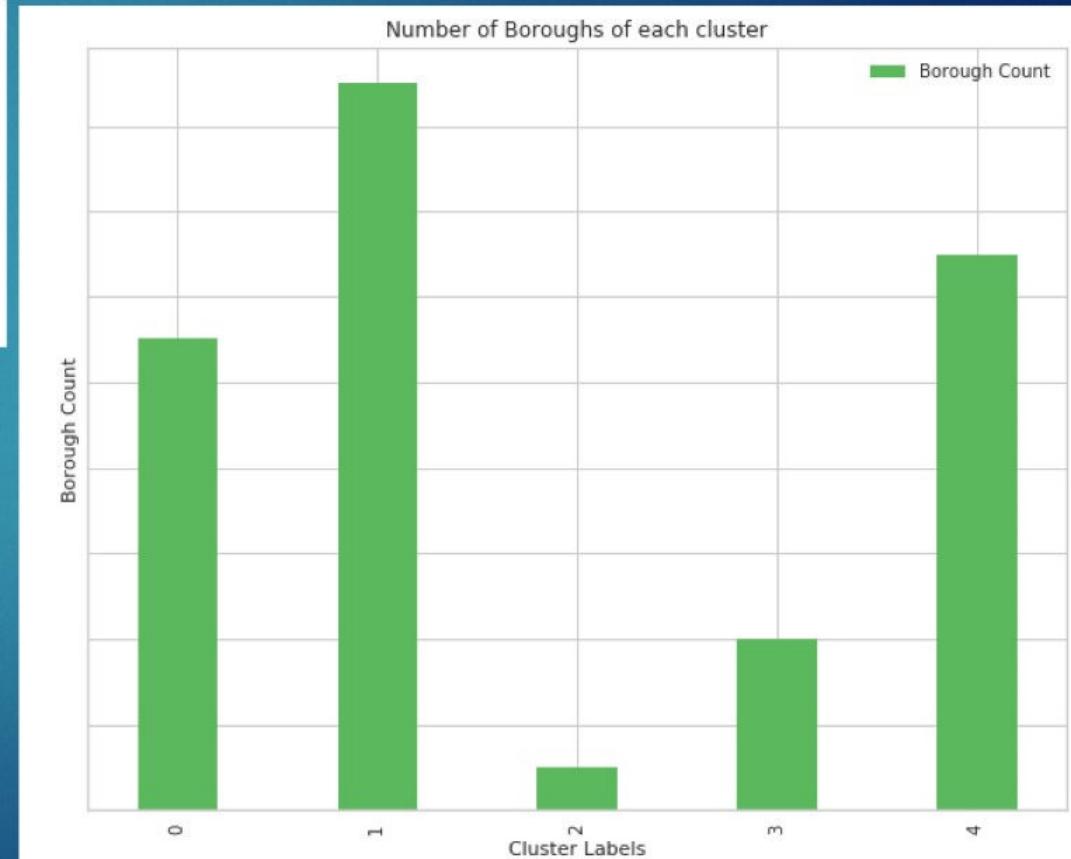
- As our goal is to find low cost apartment which is near to Dublin city center in all boroughs, we will cluster the average Apartment Rent using k-means algorithm (elbow method). K-Means algorithm is one of the most common cluster methods of unsupervised learning. We will visualize the data of k-means algorithm elbow method using KEElbowVisualizer.



- k-means elbow method shows that the optimum value for k is 5.
- Now we will cluster the boroughs data into 5 clusters using K-Means.

Borough	Latitude	Longitude	Distance_from_City_Center_miles	Cluster Labels	avgAptRent	
0	Dublin	53.349764	-6.260273	1.0	4	1395
1	Monkstown	53.293645	-6.153902	5.9	4	1438
2	Dublin 3	53.361223	-6.185467	3.2	4	1437
3	Clontarf	53.360814	-6.196854	2.7	4	1458
4	East Wall	53.354069	-6.233519	1.1	4	1428
5	Fairview	53.362846	-6.236656	1.3	0	1332

Cluster Labels	Borough Count
0	11
1	17
2	1
3	4
4	13



- We will label each cluster for better understanding of average apartment rent.

Cluster 0 : "Low-Range"

Cluster 1 : "Mid-Range Level-1"

Cluster 2 : "Mid-Range Level-2"

Cluster 3 : "High-Range Level-1"

Cluster 4 : "High-Range Level-2"

	Borough	Latitude	Longitude	Distance_from_City_Center_miles	Cluster Labels	avgAptRent	Label Name
0	Dublin	53.349764	-6.260273	1.0	4	1395	High-Range Level-2
1	Monkstown	53.293645	-6.153902	5.9	4	1438	High-Range Level-2
2	Dublin 3	53.361223	-6.185467	3.2	4	1437	High-Range Level-2
3	Clontarf	53.360814	-6.196854	2.7	4	1458	High-Range Level-2
4	East Wall	53.354069	-6.233519	1.1	4	1428	High-Range Level-2
5	Fairview	53.362846	-6.236656	1.3	0	1332	High-Range Level-1
6	Dublin 5	53.383454	-6.181923	4.0	0	1333	High-Range Level-1

- For better understanding we will group the data on 'Distance to City Centre in Miles' in the following manner. We have 46 boroughs and this miles count returned same number. We will use this miles count in our further study in this project.

Grouping Distance to City Center

- Less than 1 Mile = 1 Mile Radius
- Between 1 and 3 Mile Radius = 3 Mile Radius
- Between 3 and 5 Mile Radius = 5 Mile Radius
- Between 5 and 7 Mile Radius = 7 Mile Radius
- More than 7 Mile Radius = 10 Mile Radius

Miles	Count
3	19
7	7
5	17
1	3

RESULTS

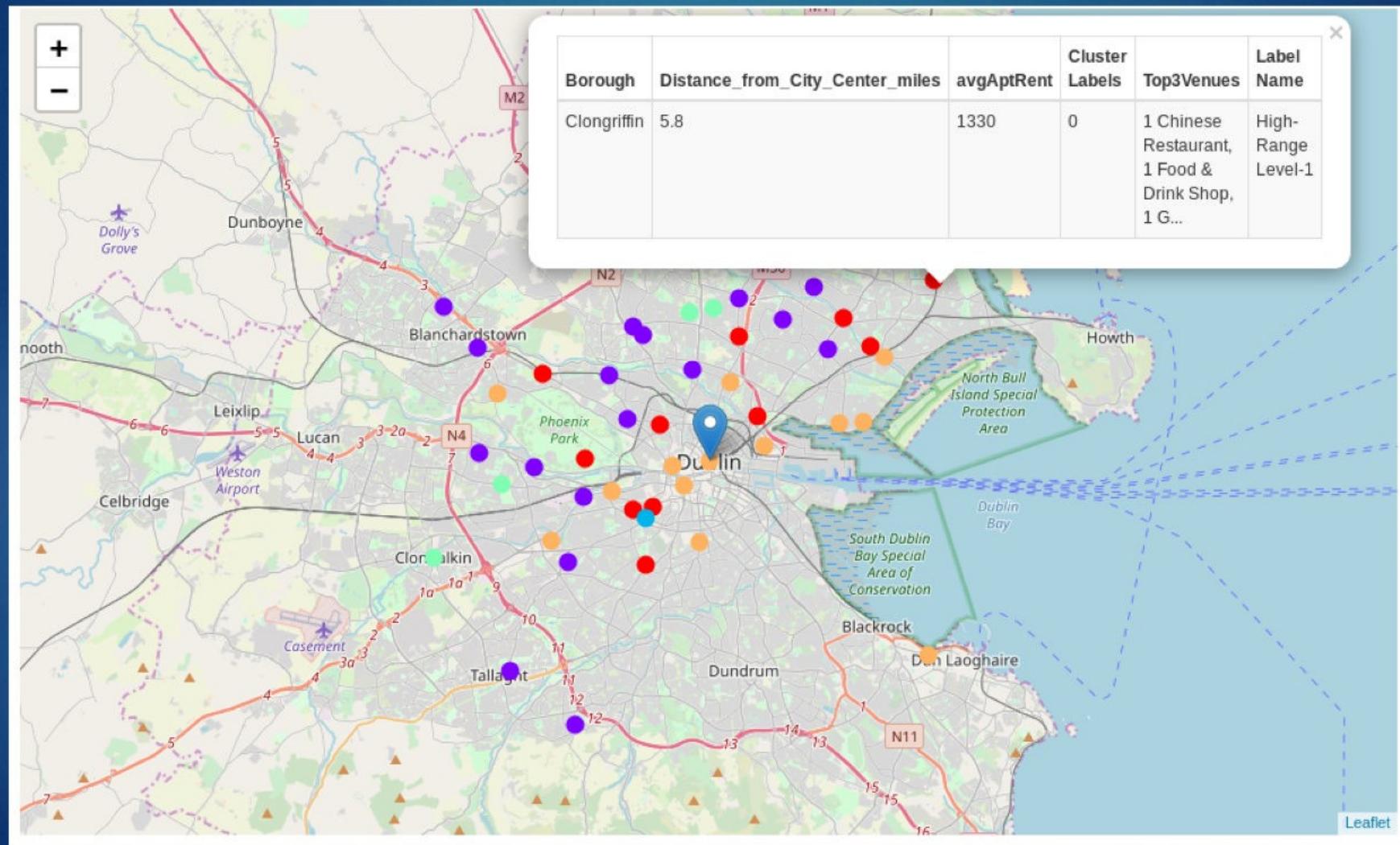
- Results have been presented by merging all new variables and present the final dataframe.

Borough	Latitude	Longitude	Distance_from_City_Center_miles	Cluster Labels	avgAptRent	Label Name	Top3Venues	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
0 South Circular Road	53.333362	-6.291173	1.7	2	929	Low-Range	3 Brewery, 3 Restaurant, 2 Pub	Restaurant	Brewery	Pub	Bar	Café	Grocery Store	Supermarket
1 Sillogue Way Ballymun	53.393092	-6.269997	3.0	3	1093	Mid-Range Level-1	2 Hotel, 2 Pizza Place, 2 Pub	Hotel	Pub	Pizza Place	Supermarket	Theater	Restaurant	Park
2 Dublin 10	53.343217	-6.360964	4.2	3	1120	Mid-Range Level-1	1 Supermarket, 1 Chinese Restaurant, 1 Grocery...	Grocery Store	Hotel	Supermarket	Chinese Restaurant	Zoo Exhibit	Food & Drink Shop	Fish & Chips Shop
3 Shangan Road Ballymun	53.394419	-6.258052	3.1	3	1142	Mid-Range Level-1	5 Supermarket, 3 Coffee Shop, 2 Theater	Supermarket	Coffee Shop	Theater	Hotel	Multiplex	Park	Nature Preserve
4 Clondalkin	53.321962	-6.394269	5.9	3	1152	Mid-Range Level-1	2 Supermarket, 2 Restaurant, 2 Fast Food Resta	Coffee Shop	Supermarket	Convenience Store	Restaurant	Fast Food Restaurant	Chinese Restaurant	Bar

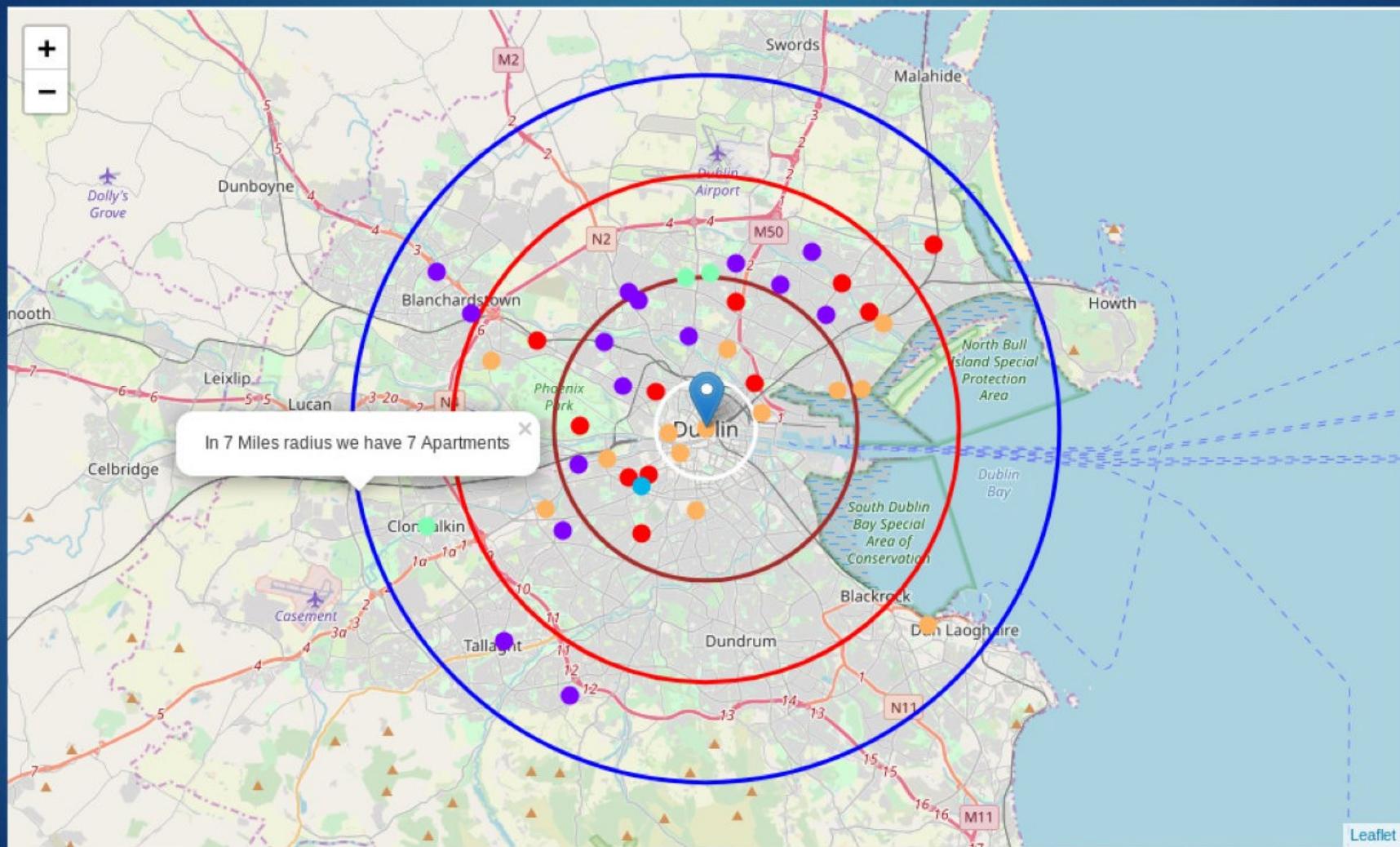
- We will plot this data into map using folium library. In the map we will use **Circle** for the distance to city center miles grouped data, **colormap** for the min and max average apartment rent, **CircleMarker** for each clustered boroughs with different colors for each cluster. We will present the below information for borough as html popup.

- Borough
- Distance to City Centre
- Average Apartment Rent
- Cluster Labels
- Top 3 Venues
- Label Name

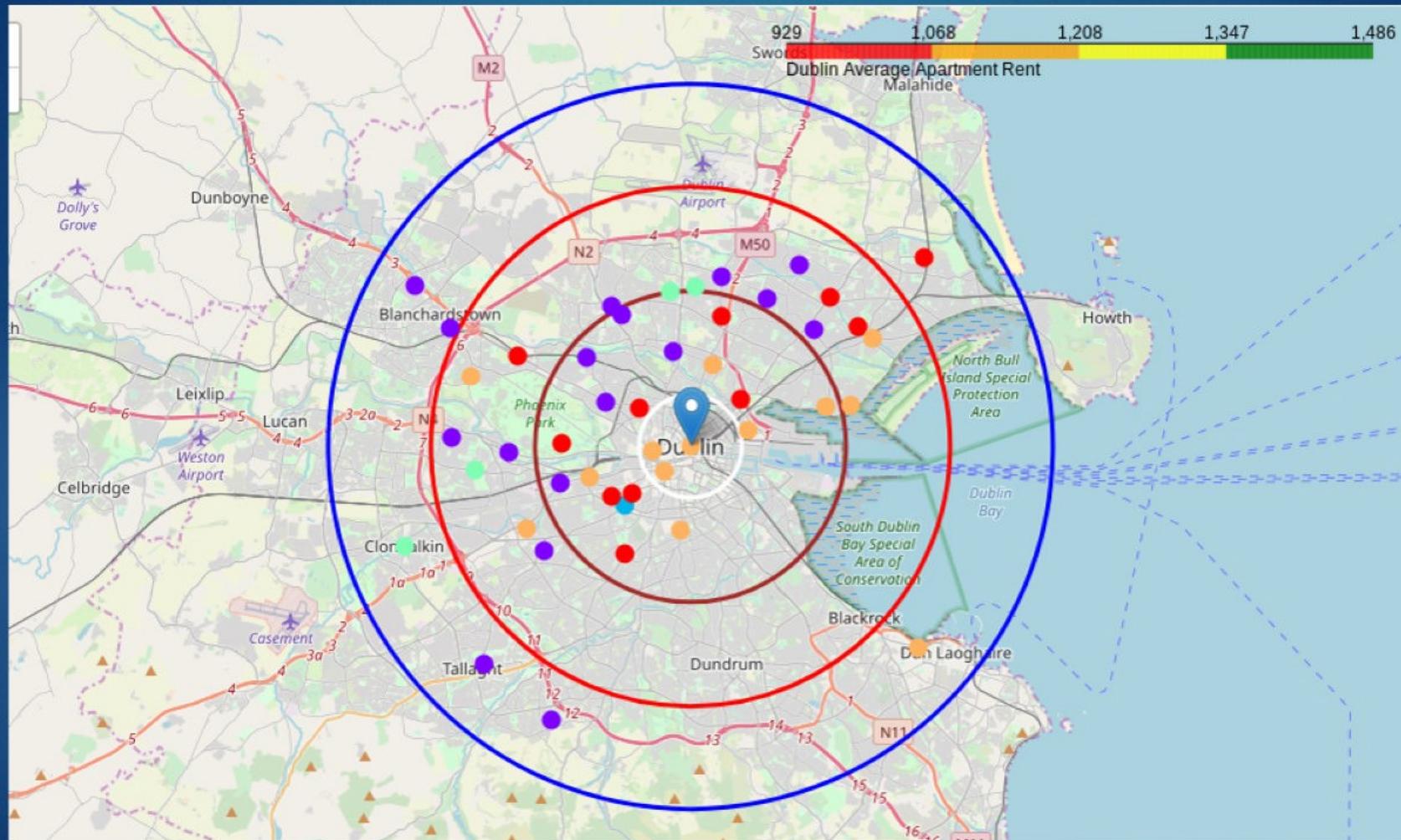
CircleMarker



Circle & CircleMarker



Circle, CircleMarker & Colormap



DISCUSSIONS

- When we compare the apartment rents in different clusters, we see that the lowest and highest rents were observed in Cluster 2 (929 Euros) and Cluster 4 (1395 to 1486 Euros). The apartment rent in Cluster 3 ranged from 1093 to 1152 Euros whereas in Cluster 1 it was between 1221 and 1293 Euros.
- The range of rent in Cluster 0 was 1314 to 1384 Euros.
- **Cluster 0** has good number of boroughs located close to Dublin City Center, approximately within 3 miles. These boroughs also have higher number of venue counts. However, the apartment rent is a bit high (1314 to 1384 Euros) in this cluster. Hence, we can ignore this cluster.
- **Cluster 4** being close to Dublin City Center has more number of boroughs with venue count reaching 100 but the apartment rents are the highest here compared to other clusters.
- **Cluster 2** with the lowest apartment rent has only one borough [South Circular Road](#), though it has a higher number of venue counts. Much information about this borough was not available in Wikipedia.

- **Cluster 3** has four boroughs that with mid-range apartment rent. Out of the 4 boroughs we consider two Boroughs as they are in 3 mile radius to City Center.
 - **Sillogue Way Ballymun:** It has an average apartment rent of 1093 Euros and is located 3 miles from Dublin City Center with a venue count of 18.
 - **Shangan Road Ballymun:** It has an average apartment rent of 1142 Euros and is located 3.1 miles from Dublin City Center with a venue count of 35.
- These two boroughs are located within 100m radius and therefore they might be sharing common venues though Shangan Road Ballymun has more number of venues compared to the Sillogue Way Ballymun. Shangan Road Ballymun, with a population 21,626 persons has Bus Station, Schools and Dublin Central University (DCU) and is also in close proximity to Dublin Airport
- Hence, we can recommend Shangan Road Ballymun location as optimal one from Cluster 3

- **Cluster 1** has apartments with mid-range rent. It has few good locations such as Dublin 15, Santry, Blanchardstown, Artane, Inchicore which has good number of venues when compare to other locations of Cluster 1. Some of them are close and few are pretty far from Dublin City Center.

Borough	2015	2016	2017	2018	2019	2015-2016%	2016-2017%	2017-2018%	2018-2019%	2015-2019%	
0	Artane	1114	1183	1283	1387	1487	6.2	8.5	8.1	7.2	33.5
1	Inchicore	1166	1234	1344	1381	1422	5.8	8.9	2.8	3.0	22.0
2	Santry	1122	1229	1322	1394	1422	9.5	7.6	5.4	2.0	26.7
3	Dublin 15	1140	1226	1317	1415	1461	7.5	7.4	7.4	3.3	28.2
4	Blanchardstown	1106	1191	1269	1358	1389	7.7	6.5	7.0	2.3	25.6

Note: Blanchardstown is part of Dublin 15 Region. Hence the venue count of Dublin 15 can also be attributed to Blanchardstown. Dublin 15 is a district which consists of Blanchardstown and couple of other Neighborhoods.

Inchicore: <https://en.wikipedia.org/wiki/Inchicore>

Inchicore is accessed by multiple roads and served by a range of Dublin Bus services. Modern Inchicore grew from a small village. It has few schools and colleges.

As it retains a village atmosphere we can exclude as we are looking for urban locations.

Santry: <https://en.wikipedia.org/wiki/Santry>

This borough has Boys and Girls National schools, Secondary schools, Colleges, Stadiums, Industrial Estates, Business Park (IT Companies) and Shopping Centers, Dublin Bus routes to major locations in Dublin, Dublin Metro Close to Airport.

Blanchardstown: <https://en.wikipedia.org/wiki/Blanchardstown>

It is one of the largest urban areas in Dublin. One of Ireland's largest shopping and leisure centres, the Blanchardstown Centre, is located in the area. It has bus routes to all places in Dublin operated by Dublin Bus, Go-Ahead Ireland.

Artane: https://en.wikipedia.org/wiki/Artane,_Dublin

It has a population of 36,564 persons, Shopping Centers, Dublin Bus serving more locations and it has two Train Stations.

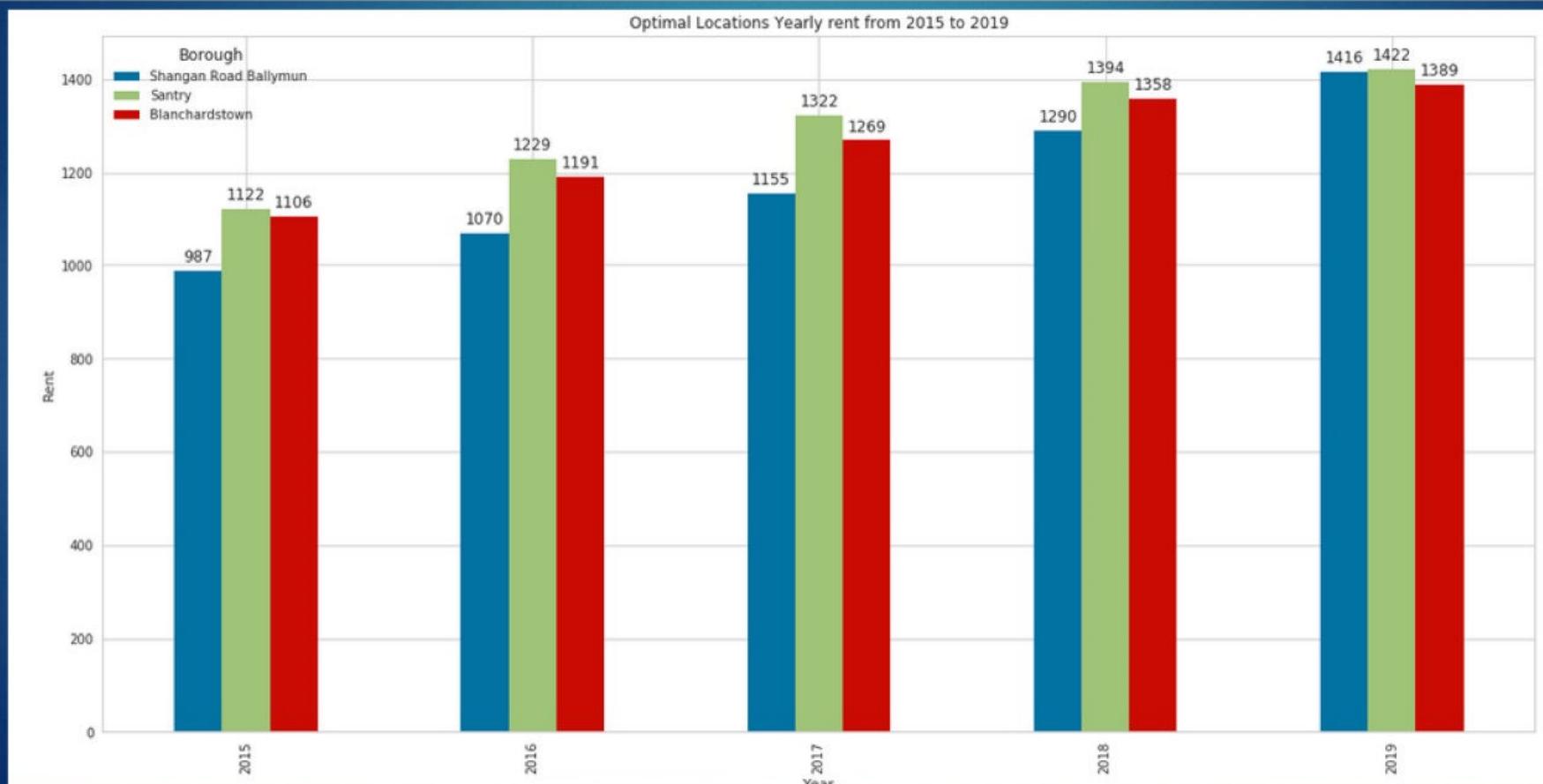
Borough	2015	2016	2017	2018	2019	2015-2016%	2016-2017%	2017-2018%	2018-2019%	2015-2019%
0 Artane	1114	1183	1283	1387	1487	6.2	8.5	8.1	7.2	33.5
1 Santry	1122	1229	1322	1394	1422	9.5	7.6	5.4	2.0	26.7
2 Blanchardstown	1106	1191	1269	1358	1389	7.7	6.5	7.0	2.3	25.6

Artane apartment rent as well as its percentage of apartment rise from 2015-2019 is 33.5 which is higher than Santry and Blanchardstown. And Artane's Venue count is lower than all. So we are excluding Artane.

From Cluster 1 we choose Santry and Blanchardstown as the optimal locations

Compare the optimal locations of Cluster1 and Cluster 3:

Borough	Latitude	Longitude	Cluster Labels	Distance_from_City_Center_miles	avgAptRent	Top3Venues	Label Name	Venues Count	
Shangan Road Ballymun	53.394419	-6.258052		3	3.1	1142	5 Supermarket, 3 Coffee Shop, 2 Theater	Mid-Range Level-1	32
Blanchardstown	53.383081	-6.372418		1	5.2	1240	2 Supermarket, 1 Hotel, 1 Bar	Mid-Range Level-2	7
Santry	53.397158	-6.245472		1	3.3	1276	4 Supermarket, 3 Park, 2 Asian Restaurant	Mid-Range Level-2	35



Taking price as the only criterion:

Out of the determined optimal locations of Shangan Road Ballymun (Cluster3), Santry (Cluster1) and Blanchardstown (Cluster1), the study found **Blanchardstown** (Cluster1) is the ideal locations to rent a low cost apartment near to Dublin City Centre.

Though Shangan Road Ballymum average apartment rent is low but the percentage rise of apartment rent from 2015 to 2019 is 43.5% which is double the growth of Blanchardstown percentage rise.

Though Blanchardstown is 5.2 miles away from the Dublin City Centre, it has direct buses to many locations and has Irish Rail Train station, Hospital, Shopping Center, Leisure centers, National Sports Campus, Large Public Library.

When we think about price and distance:

Shangan Road Ballymun(Cluster3) & Santry (Cluster1) - **Santry** is the ideal location

	Borough	2015	2016	2017	2018	2019	2015-2016%	2016-2017%	2017-2018%	2018-2019%	2015-2019%
0	Shangan Road Ballymun	987	1070	1155	1290	1416	8.4	7.9	11.7	9.8	43.5
1	Santry	1122	1229	1322	1394	1422	9.5	7.6	5.4	2.0	26.7
2	Blanchardstown	1106	1191	1269	1358	1389	7.7	6.5	7.0	2.3	25.6

CONCLUSION

- With the data we have we were able to accurately cluster the locations and identify the best possible location for the client's current requirements (To rent a low cost apartment which is close to Dublin City Center).
- The analysis can be further improved by considering various other factors such as: **Population**, **Average per-capita income**, **Crime** of all locations.
- As a result, people are opting for urban locations which has more number of venues which are close to City center to rent an apartment.