COURSERA CAPSTONE PROJECT – THE BATTLE OF NEIGHBORHOODS
MOSCOW FLATS

INTRODUCTION

This project will help people who want to buy a one- or two-room flat in Moscow to find the district which will match their personal needs and lifestyle. From this study you can see:

- Which districts have lower flat prices and what is an average price per square meter in each district
- What venues are most popular in each district, which can help you choose the district that matches preferences
- You can see which other districts in Moscow have the same infrastructure as your preferable one, so you can widen your search and find truly the best option

DATA

The data on the flats' sizes, prices, number of rooms and addresses was collected by scrapping one of the most popular local websites with apartment listings - CIAN. Using Yandex API, the coordinates for each flat were found (as the addresses on the local apartments website are in Russian, Yandex gave more accurate results than geopy). Then, the data on the closest venues (parks, cafes, hotels, gyms, supermarkets, etc.) for each district was collected using the Foursquare API.

METHODOLOGY

As a first step, I scraped the data (price, number of rooms, size and address) from local apartment listings website CIAN for the one- and two-room flats in Moscow using the BeautifulSoup package and put the data into the below Pandas data frame:
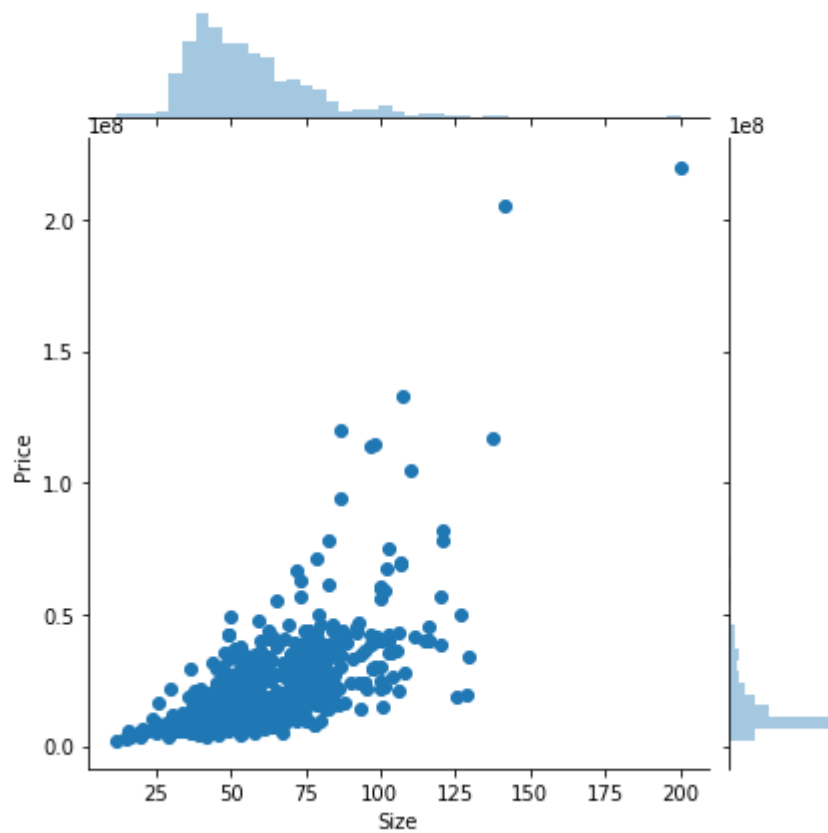
Price	Rooms	Size	Town	Region	District	Street	House
28 000 000 ₽	2	56 м²	Москва	ЦАО	р-н Пресненский	1-й Красногвардейский проезд	22с2
5 392 000 ₽	1	16 м²	Москва	ЦАО	р-н Басманный	Старокирочный пер.	6
7 891 540 ₽	2	63,8 м²	Москва	ЮВАО	р-н Некрасовка	ул. Лавриненко	3
5 406 652 ₽	1	35,6 м²	Москва	ЮВАО	р-н Некрасовка	ул. Вертолетчиков	4
105 000 000 ₽	2	109,9 м²	Москва	ЦАО	р-н Тверской	2-я Брестская ул.	6

I have also added a calculated price per square meter column to compare prices across districts:
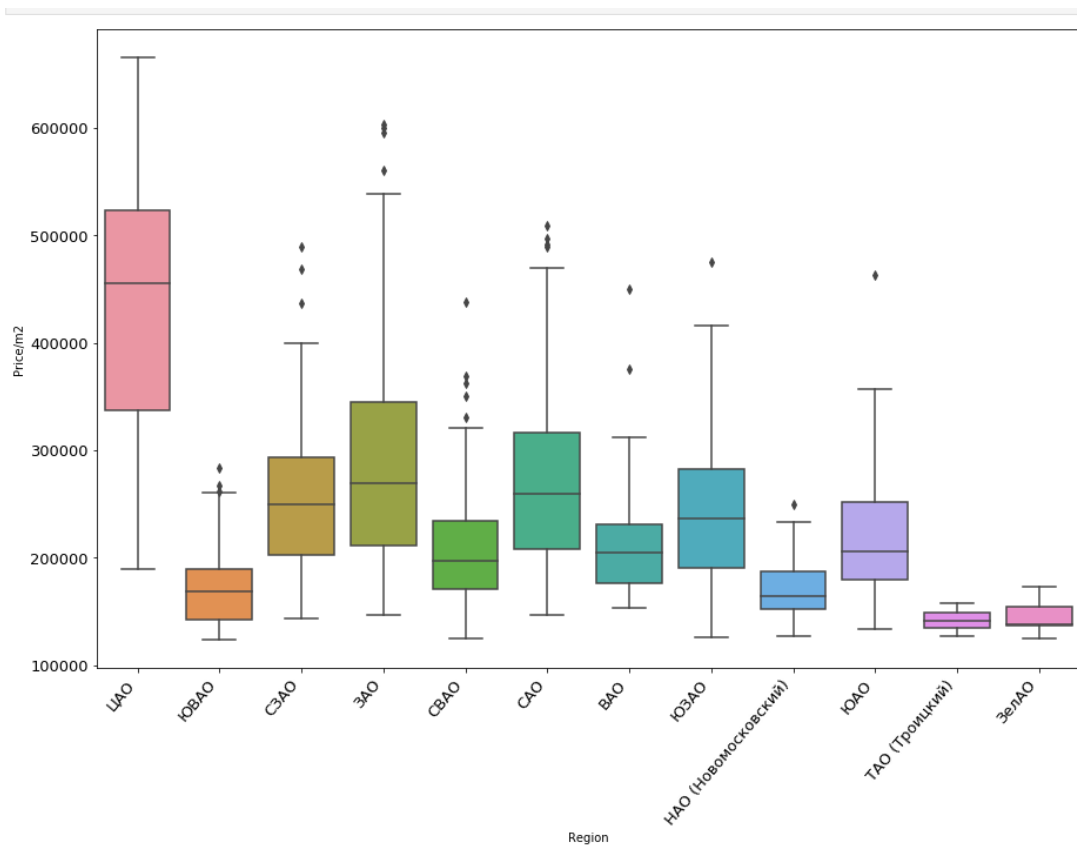
Price	Rooms	Size	Town	Region	District	Street	House	Price/m2
28000000.0	2.0	56.0	Москва	ЦАО	р-н Пресненский	1-й Красногвардейский проезд	22с2	500000.00
5392000.0	1.0	16.0	Москва	ЦАО	р-н Басманный	Старокирочный пер.	6	337000.00
7891540.0	2.0	63.8	Москва	ЮВАО	р-н Некрасовка	ул. Лавриненко	3	123691.85
5406652.0	1.0	35.6	Москва	ЮВАО	р-н Некрасовка	ул. Вертолетчиков	4	151872.25
105000000.0	2.0	109.9	Москва	ЦАО	р-н Тверской	2-я Брестская ул.	6	955414.01

After removing all outliers, which you can see on the plot below, we got a final data set of 1178 flats.

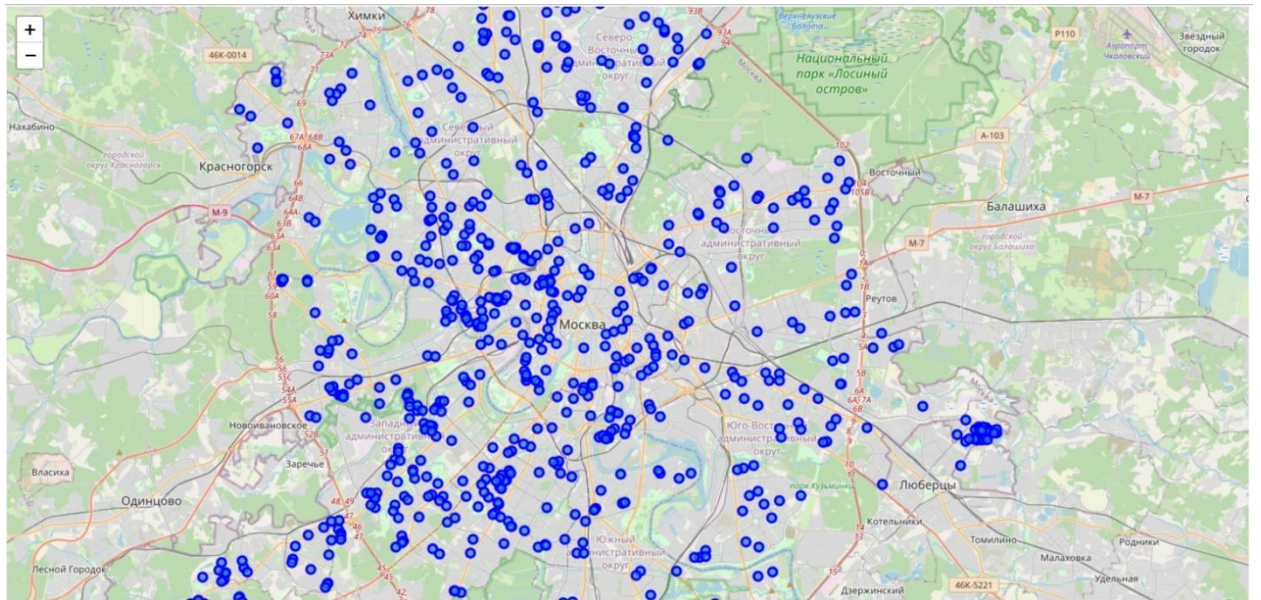[13]: <seaborn.axisgrid.JointGrid at 0x7f671aba01d0>

From the boxplot below you can see how the price per square meter is distributed among Moscow regions. The first one is the central part of Moscow. Troytsky region has the lowest price per square meter - it is a part of 'New Moscow' and was united to Moscow only a couple of years ago.
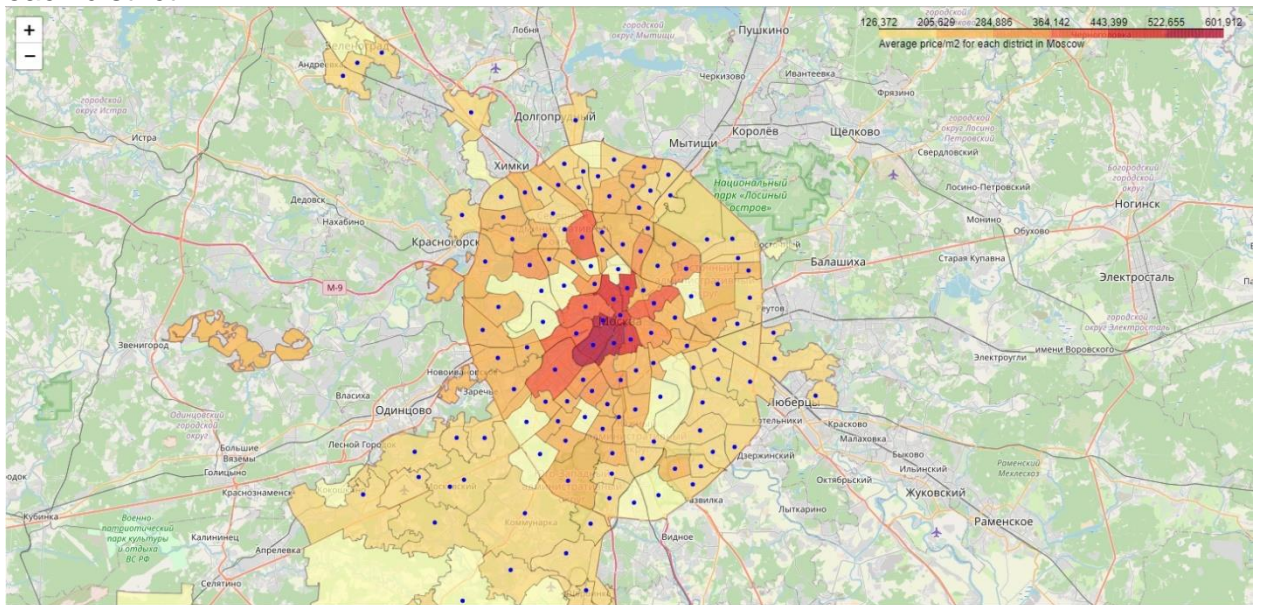
Using the Yandex API I found the coordinates for each flat and each district of the flats from the analyzed dataset:

Price	Rooms	Size	Town	Region	District	Street	House	Price/m2	Address	Latitude	Longitude
28000000.0	2.0	56.0	Москва	ЦАО	р-н Пресненский	1-й Красногвардейский проезд	22c2	500000.00	Москва 1-й Красногвардейский проезд 22c2	55.763432	37.562389
5392000.0	1.0	16.0	Москва	ЦАО	р-н Басманный	Старокирочный пер.	6	337000.00	Москва Старокирочный пер. 6	55.766567	37.671229
5406652.0	1.0	35.6	Москва	ЮВАО	р-н Некрасовка	ул. Вертолетчиков	4	151872.25	Москва ул. Вертолетчиков 4	55.683793	37.928704
5656010.0	1.0	38.5	Москва	ЮВАО	р-н Некрасовка	ул. Лавриненко	5	146909.35	Москва ул. Лавриненко 5	55.683793	37.928704
5743766.0	1.0	39.1	Москва	ЮВАО	р-н Некрасовка	ул. Вертолетчиков	13	146899.39	Москва ул. Вертолетчиков 13	55.683793	37.928704

We can use the Follium Map to see the flats from the final dataset on the Moscow map:

Using the Choropleth Map we can also see the average price per square meter for each district.
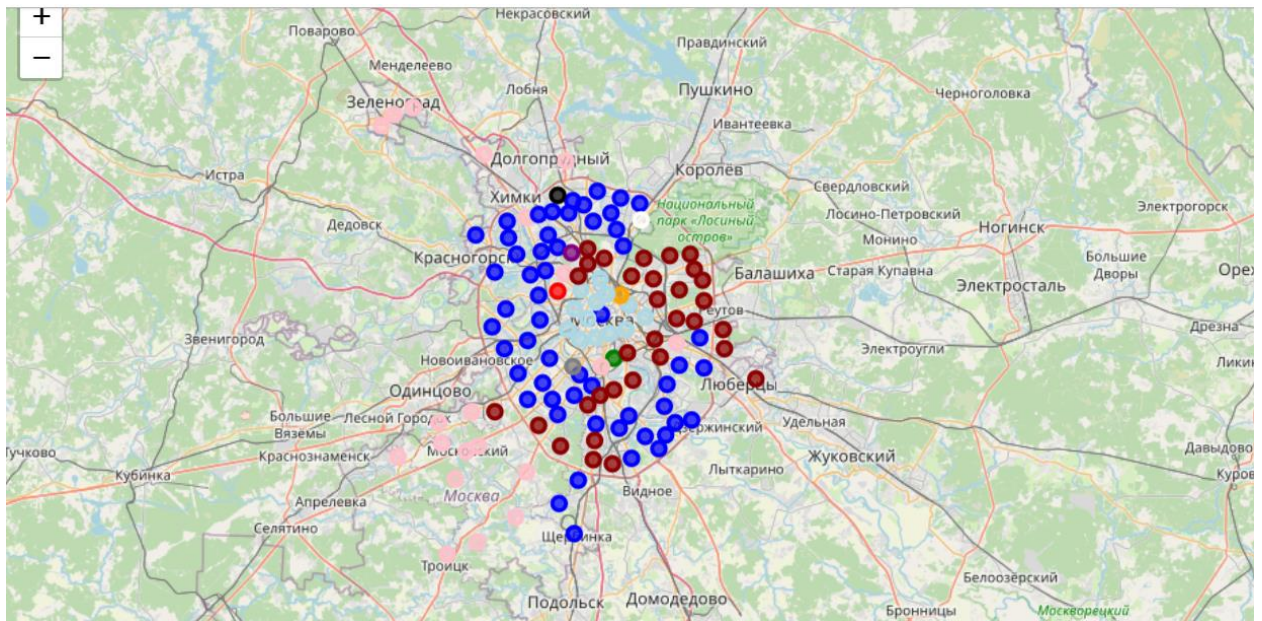

Having the district coordinates, we can find most popular venues for each district using the Foursquare API:

	Neighborhood	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	Академический	Park	Health Food Store	Gym / Fitness Center	Coffee Shop	Scenic Lookout	Wine Shop	Outdoor Gym	Trail	Soccer Field	Arcade
1	Алтуфьевский	Park	Health Food Store	Gym / Fitness Center	Supermarket	Auto Workshop	Restaurant	Clothing Store	Dance Studio	Coffee Shop	Yoga Studio
2	Арбат	Coffee Shop	Hotel	Park	Yoga Studio	Plaza	Concert Hall	Road	Bookstore	Russian Restaurant	Boutique
3	Аэропорт	Café	Grocery Store	Coffee Shop	Restaurant	Gourmet Shop	Shopping Mall	Bakery	Dessert Shop	Supermarket	Modern European Restaurant
4	Басманный	Coffee Shop	Hotel	Yoga Studio	Garden	Bar	Park	Art Gallery	Plaza	Gym / Fitness Center	Pizza Place
...	...	...	...	...	...	...	...	...	...	...	...
121	Южное Тушино	Park	Gym / Fitness Center	Restaurant	Coffee Shop	Surf Spot	Cosmetics Shop	Concert Hall	Pet Store	Health Food Store	Sports Bar
122	Южнопортовый	Coffee Shop	Gym / Fitness Center	Arcade	Martial Arts Dojo	Bar	Convenience Store	Nightclub	Auto Workshop	Health Food Store	Music Venue
123	Якиманка	Park	Hotel	Coffee Shop	Yoga Studio	Theater	Pizza Place	Scenic Lookout	Concert Hall	Bar	Garden
		Food & Drink	Farmers	Fast Food							

Finally, with all the collected data we can run k-means clustering to cluster the districts. There were 11 clusters generated, as it appears to be the best k value in this case. Due to the highly diversified locations, 7 clusters have only one district inside. For example, one district with a Zoo was identified as a separate cluster (red dot on the map below) or another one has one of the most popular food markets inside, so it was also allocated to a separate cluster (green dot). The most interesting for analysis are the 4 clusters that have many districts, so let's analyze each of the clusters.

The first cluster is represented by blue dots on the map above. The most popular venues there are parks. By analyzing the data, we can see that these are the most 'green' districts with plenty of places for playing sports and buying healthy groceries. If you are looking for the most quiet and natural place to live in Moscow, I would choose one of the districts from the 'blue' cluster:

Neighborhood	Size	Price/m2	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	10th Most Common Venue
Коммунарка	44.747059	181391.181176	55.755814	37.617635	0	Park	Clothing Store	Gym / Fitness Center	Restaurant	Café	Cosmetics Shop	Italian Restaurant	Jewelry Store	Gourmet Shop	Supermarket
Щербинка	42.500000	157214.285000	55.509034	37.563377	0	Park	Supermarket	Gym / Fitness Center	Fast Food Restaurant	Pizza Place	Gas Station	Grocery Store	Gym	Restaurant	Salon / Barbershop
Академический	63.238889	302697.381111	55.688005	37.572684	0	Park	Health Food Store	Gym / Fitness Center	Coffee Shop	Scenic Lookout	Wine Shop	Outdoor Gym	Trail	Soccer Field	Arcade
Алтуфьевский	37.625000	187058.515000	55.879849	37.582278	0	Park	Health Food Store	Gym / Fitness Center	Supermarket	Auto Workshop	Restaurant	Clothing Store	Dance Studio	Coffee Shop	Yoga Studio
Бескудниковский	32.000000	196562.500000	55.870056	37.551636	0	Park	Health Food Store	Pet Store	Auto Workshop	Gym / Fitness Center	Supermarket	Stables	Pizza Place	Cosmetics Shop	Salon / Barbershop
Бибирево	39.471429	191089.107143	55.894768	37.607700	0	Park	Health Food Store	Gym / Fitness Center	Supermarket	Coffee Shop	Clothing Store	Shopping Mall	Gym	Big Box Store	Jewelry Store
Бирюлево Восточное	50.441176	153228.715882	55.594585	37.678649	0	Park	Gym / Fitness Center	Clothing Store	Health Food Store	Cosmetics Shop	Pet Store	Supermarket	Caucasian Restaurant	Restaurant	Shopping Mall
Братеево	50.950000	175673.175000	55.633434	37.765058	0	Park	Gym / Fitness Center	Supermarket	Health Food Store	Beer Store	Cosmetics Shop	Caucasian Restaurant	Pet Store	Middle Eastern Restaurant	Irish Pub
Вешняки	48.183333	195433.213333	55.730771	37.815184	0	Park	Gym / Fitness Center	Coffee Shop	Café	Cosmetics Shop	Bakery	Grocery Store	Beer Store	Gym	Theater
Войковский	59.400000	269150.411667	55.827247	37.497342	0	Park	Coffee Shop	Gym / Fitness Center	Health Food Store	Gourmet Shop	Spa	Lingerie Store	Beach	Soccer Stadium	Convenience Store
Восточное Дегунино	46.560000	192467.846000	55.884277	37.558841	0	Park	Health Food Store	Gym / Fitness Center	Restaurant	Auto Workshop	Pet Store	Cosmetics Shop	Supermarket	Big Box Store	Clothing Store
Выхино-Жулебино	41.790000	177876.856000	55.696357	37.824553	0	Park	Gym / Fitness Center	Coffee Shop	Pet Store	Health Food Store	Dance Studio	Restaurant	Gourmet Shop	Grocery Store	Shoe Store

The second cluster, where dots are colored in brown, looks more urban than the previous cluster. It still has a lot of parks, but there are also a lot of other places like a variety of eating and coffee shops. These districts are also perfect for doing sports, but there you will feel a more 'in town' vibe with plenty of facilities.

Neighborhood	Size	Price/m2	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	10th Most Common Venue
Бирюлево Западное	43.400000	174107.412000	55.587860	37.639644	5	Park	Gym / Fitness Center	Clothing Store	Pizza Place	Coffee Shop	Supermarket	Auto Workshop	Big Box Store	Pet Store	Dance Studio
Богородское	60.900000	238147.987500	55.819241	37.703415	5	Park	Dance Studio	Gym / Fitness Center	Coffee Shop	Health Food Store	Soccer Stadium	Pet Store	Photography Studio	Soccer Field	Supermarket
Бутырский	67.750000	280398.877500	55.814123	37.589204	5	Park	Coffee Shop	Health Food Store	Photography Studio	Dance Studio	Gym / Fitness Center	Fountain	Supermarket	Theater	Arcade
Восточное Измайлово	39.666667	219247.693333	55.795818	37.821804	5	Gym / Fitness Center	Park	Gym	Supermarket	Cosmetics Shop	Pizza Place	Coffee Shop	Candy Store	Dance Studio	Flower Shop
Гольяново	42.833333	192487.005556	55.824162	37.796130	5	Gym / Fitness Center	Park	Supermarket	Candy Store	Coffee Shop	Dance Studio	Pizza Place	Pet Store	Flower Shop	Café
Зюзино	42.625000	207554.097500	55.654066	37.589608	5	Gym / Fitness Center	Park	Health Food Store	Coffee Shop	Cosmetics Shop	Fish Market	Sports Bar	Arcade	Gym	Supermarket
Ивановское	33.840000	204431.260000	55.771479	37.824005	5	Park	Gym / Fitness Center	Coffee Shop	Supermarket	Pizza Place	Cosmetics Shop	Gym	Beer Store	Historic Site	Beer Bar
Измайлово	89.500000	241446.363333	55.783681	37.772783	5	Coffee Shop	Park	Gym / Fitness Center	Supermarket	Dance Studio	Health Food Store	Photography Studio	Candy Store	Pizza Place	Pet Store
Косино-Ухтомский	39.000000	175641.030000	55.717061	37.863450	5	Gym / Fitness Center	Park	Pet Store	Coffee Shop	Pizza Place	Beer Store	Cosmetics Shop	Historic Site	Multiplex	Restaurant
Марфино	22.000000	272727.270000	55.830002	37.588745	5	Park	Health Food Store	Coffee Shop	Auto Workshop	Photography Studio	Gym / Fitness Center	Fountain	Supermarket	Science Museum	Beer Store
Метрогородок	33.000000	175757.580000	55.823616	37.755832	5	Gym / Fitness Center	Coffee Shop	Dance Studio	Park	Pizza Place	Candy Store	Supermarket	Auto Workshop	Health Food Store	Convenience Store
Нагатино-Садовники	41.985714	227426.520000	55.671422	37.641710	5	Gym / Fitness Center	Health Food Store	Coffee Shop	Park	Sporting Goods Shop	Arcade	Dance Studio	Wine Shop	Food & Drink Shop	Pharmacy
Нагатинский затон	37.210000	260405.198000	55.682849	37.681568	5	Gym / Fitness Center	Coffee Shop	Park	Health Food Store	Dance Studio	Arcade	Beer Store	Café	Bath House	Nightclub
Нагорный	53.400000	222649.350000	55.664659	37.615470	5	Park	Gym / Fitness Center	Health Food Store	Coffee Shop	Arcade	Pharmacy	Food & Drink Shop	Skate Park	Café	Cosmetics Shop

The next cluster with pink dots mostly consists of districts located quite far from the town center - many of them are close to airports and have 'Trail' as the most common venue, which means that there are quite a lot of forest areas inside the districts. These places are good for those who are not keen on being close to the center of Moscow (for example do not have to commute to the center every day), who have jobs in such remote areas as airports or who just want to live in more 'natural' places, but still near the town.

Neighborhood	Size	Price/m2	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	10th Most Common Venue
Внуковское	47.333333	180645.263750	55.633500	37.290298	6	Café	Gym / Fitness Center	Airport Service	Supermarket	Museum	Clothing Store	Gym Pool	Mobile Phone Shop	Gourmet Shop	Coffee Shop
Воскресенское	52.000000	145546.985000	55.527326	37.443200	6	Supermarket	Health Food Store	Park	Fast Food Restaurant	Fried Chicken Joint	Clothing Store	Japanese Restaurant	Italian Restaurant	Restaurant	Rest Area
Десеновское	46.550000	156829.279000	55.499571	37.366610	6	Park	Restaurant	Supermarket	Rest Area	Convenience Store	Resort	Bakery	Trail	Italian Restaurant	Grocery Store
Марушкинское	44.500000	159806.910000	55.595160	37.208273	6	Airport Lounge	Airport Service	Scenic Lookout	Coffee Shop	Duty-free Shop	Convenience Store	Train Station	Café	Racetrack	Supermarket
Московский	48.442857	163715.341429	55.602144	37.346551	6	Supermarket	Clothing Store	Coffee Shop	Pizza Place	Hotel	Gym / Fitness Center	Convenience Store	Bar	Park	Big Box Store
Московский	60.466667	192210.563333	55.608404	37.368901	6	Supermarket	Clothing Store	Coffee Shop	Pizza Place	Hotel	Gym / Fitness Center	Convenience Store	Bar	Park	Big Box Store
Сосенское	47.488333	163809.746875	55.578330	37.465892	6	Clothing Store	Park	Gym / Fitness Center	Café	Supermarket	Cosmetics Shop	Restaurant	Jewelry Store	Gourmet Shop	Italian Restaurant
Троицк	51.633333	141985.216667	55.484842	37.305561	6	Supermarket	Park	Café	Restaurant	Soccer Field	Farmers Market	Bakery	Grocery Store	Convenience Store	Trail
Филимонковское	29.000000	131034.480000	55.570014	37.322368	6	Airport Service	Supermarket	Clothing Store	Coffee Shop	Shopping Mall	Mobile Phone Shop	Hotel	Airport Lounge	Bar	Housing Development
Аэропорт	71.820000	262446.278000	55.803312	37.542599	6	Café	Grocery Store	Coffee Shop	Restaurant	Gourmet Shop	Shopping Mall	Bakery	Dessert Shop	Supermarket	Modern European Restaurant
Внуково	37.000000	172972.970000	55.610845	37.296685	6	Airport Service	Supermarket	Coffee Shop	Mobile Phone Shop	Pizza Place	Clothing Store	Airport Lounge	Café	Park	Zoo
Донской	52.560000	313983.910000	55.697798	37.618390	6	Movie Theater	Big Box Store	Pizza Place	Shopping Mall	Restaurant	Convenience Store	Electronics Store	Multiplex	Food & Drink Shop	Skating Rink
Крюково	47.275000	139882.672500	55.969330	37.176122	6	Park	Pizza Place	Gym / Fitness Center	Café	Brewery	Restaurant	Pharmacy	Coffee Shop	Pool Hall	Beach
											Italian	Shopping		Bed &	

The last cluster, labeled with light blue dots on the map, represents the central part of Moscow with a great variety of cafes, restaurants, hotels (yoga studio is also quite a popular venue there) and the most vibrant life. If you want to always feel 'in the center', this is most likely the best (but, obviously, it is the most expensive) place to live.
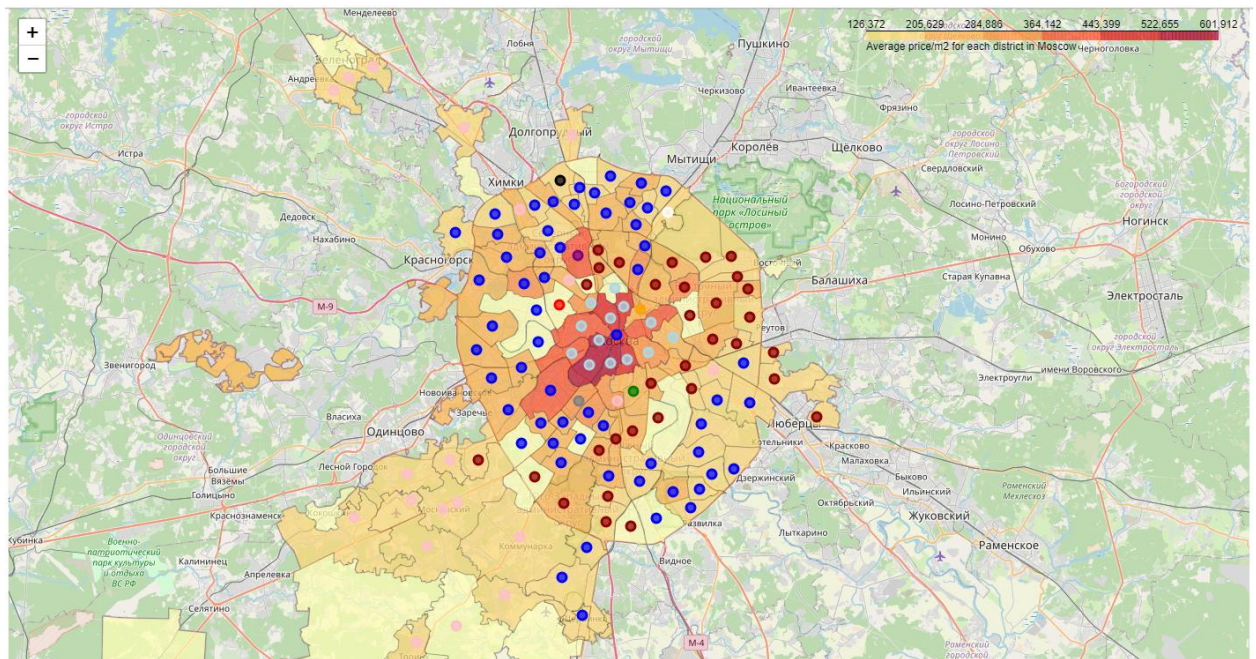
Neighborhood	Size	Price/m2	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
Арбат	64.625000	535307.287500	55.751138	37.590003	7	Coffee Shop	Hotel	Park	Yoga Studio	Plaza	Concert Hall	Road	Bookstore	Russian Restaurant	Boutique
Басманный	63.500000	410910.774545	55.766567	37.671229	7	Coffee Shop	Hotel	Yoga Studio	Garden	Bar	Park	Art Gallery	Plaza	Gym / Fitness Center	Pizza Place
Беговой	58.795937	358908.453438	55.783833	37.576960	7	Coffee Shop	Hotel	Yoga Studio	Park	Beer Bar	Photography Studio	Dance Studio	Plaza	Health Food Store	Concert Hall
Дорогомилово	60.800000	375134.585556	55.739468	37.547656	7	Park	Coffee Shop	Yoga Studio	Scenic Lookout	Road	Restaurant	Fountain	Wine Shop	Hotel	Plaza
Замоскворечье	55.200000	467350.657500	55.734157	37.634290	7	Hotel	Yoga Studio	Concert Hall	Art Gallery	Theater	Pizza Place	Road	Coffee Shop	Plaza	Park
Лефортово	51.725000	225177.850000	55.753635	37.704817	7	Coffee Shop	Yoga Studio	Gym / Fitness Center	Health Food Store	Arts & Crafts Store	Gourmet Shop	Bar	Music Venue	Martial Arts Dojo	Basketball Court
Марьина роща	50.700000	278059.105000	55.796931	37.614374	7	Coffee Shop	Park	Beer Bar	Photography Studio	Concert Hall	Health Food Store	Dance Studio	Gym / Fitness Center	Yoga Studio	Hotel
Мещанский	38.333333	520245.633333	55.780066	37.628801	7	Coffee Shop	Plaza	Hotel	Park	Yoga Studio	Dance Studio	Russian Restaurant	Concert Hall	Basketball Court	Salon / Barbershop
Пресненский	60.033611	437091.013611	55.763432	37.562389	7	Coffee Shop	Hotel	Park	Plaza	Yoga Studio	Beer Bar	Theater	Art Museum	Spa	Gourmet Shop
Таганский	57.026667	343136.710667	55.740010	37.666971	7	Yoga Studio	Gym / Fitness Center	Hotel	Plaza	Bar	Theater	Arcade	Hookah Bar	Martial Arts Dojo	Candy Store
Тверской	58.070000	453421.178000	55.770127	37.606918	7	Coffee Shop	Yoga Studio	Hotel	Plaza	Russian Restaurant	Concert Hall	Theater	Pizza Place	Park	Flower Shop
Хамовники	67.711765	532246.782353	55.729199	37.574525	7	Park	Scenic Lookout	Wine Shop	Road	Coffee Shop	Yoga Studio	Theater	Hotel	Auto Workshop	Salon / Barbershop
Якиманка	68.033333	597249.783333	55.730826	37.607565	7	Park	Hotel	Coffee Shop	Yoga Studio	Theater	Pizza Place	Scenic Lookout	Concert Hall	Bar	Garden

RESULTS

There are four main clusters in Moscow identified during the research, each of them reflects different needs to accompany various lifestyles. The Blue cluster, as discussed above, will be mostly suitable for people who love parks, nature, need a lot of sport facilities, but still want to be closer to the center and don't have a demand for such venues as cafes, restaurants or just more modern infrastructure near their home. Brown cluster is more 'equipped' for the town comparing to the Blue one and also contains a lot of sport facilities, but at the same time you can find a wider range of venues in these districts. The Pink cluster is mostly quite far from the center with more forest areas. You will probably need a car to live there and comfortably reach all the necessary venues in the district. The Light Blue cluster is the town center with its usual pros and cons for such places: high diversity of nearby venues, but high prices and almost no 'green' areas.

You can see all clusters described above on the final visualization together with the average prices per square meter in Moscow. We can see that there are a lot of districts which fall under one cluster but have different prices per square meter. Using this map, you can find the districts with the infrastructure type you want and find the similar ones, but in a different price range.

DISCUSSION AND CONCLUSION

Using the flats data parsed from CIAN website, geodata and Foursquare venues data, we looked at the flat price ranges across different districts in Moscow, their top venues and clustered the data according to the most popular venues. This allowed us to reveal the most suitable areas to live for different lifestyles and needs. Of course, as mentioned earlier, this study does not provide an absolutely full picture to make a decision on buying a flat in the certain location: you must also consider such factors as condition of the house, ecological situation, transportation system, maybe even crime level of a certain district and a lot more. This study, however, helps to get the first overall impression of each district and what you can expect in terms of price and facilities if you decide to buy your flat there.

REFERENCES

1. https://www.cian.ru/ – flats data
2. https://tech.yandex.com/maps/ – flats coordinates
3. https://gis-lab.info/qa/moscow-atd.html – districts geodata
4. https://github.com/FUlyankin/Parsers/blob/master/sems/2_CIAN/2.1%20CIAN_parser.ipynb – CIAN parsing recommendations
5. https://github.com/kosticn/The-Battle-of-Neighborhoods/blob/master/The%20Battle%20of%20Neighborhoods.ipynb – scripting tips and ideas for analysis
6. https://developer.foursquare.com/docs/ – venues data
7. https://github.com/aipastukhova/Coursera_Capstone/blob/master/Moscow%20flats%20Coursera_IBM.ipynb – ipynb