Battle of the Neighborhoods: Accessible Moscow

Clustering Moscow Hotels Accessible to Visitors with Disabilities and Impairments

1. Introduction

The capital of Russia, Moscow is an extremely important financial, travelling and medical hub for the Russians as well as for the visitors from all over the world. The largest city in Russia boasts numerous sights to explore and offers quite a number of services to use.

As such, it is highly important for Moscow to be as accessible and inclusive as possible. A lot of tourists coming here are seniors, or have health problems. Besides, a lot of patients have to arrive in the city to undergo treatment, which is not possible in their home towns, and often have to spend a considerable amount of time in the capital.

The visitors tend to stay in hotels, and it is vital for them to have access to the facilities near their hotel of choice.

2. Business Problem

The aim of this project is to help the target group, i.e. visitors with disabilities and impairments, choose their destination hotel suited to their needs, taking into the account the facilities nearby.

3. Data Description

Regarding the problem, the following factors will influence our decision:

1) if the hotel provides amenities for people with disabilities and/or impairments;

2) distance of the venues from the given hotels.

To solve the problems, we require:

1) geolocational data for Moscow to find out the locations of the hotels;

2) data on different venues in the vicinity of the specific hotel.

3.1. Geolocational Data for Moscow

We shall leverage the data available on the Open Data portal of the Government of Moscow. The dataset has the information about hotels which have amenities for the elderly and the impaired. The information about the dataset is also available in English.

The original dataset contains detailed information; however, we are particularly interested in the following rows:

- geometry.coordinates: Coordinates for each hotel.
- properties.Attributes.FullName: Name of the hotel.
- properties.Attributes.Address: Address of the hotel.
- properties.Attributes.FullAvailable: Shows if the hotel is fully accessible for people with impairments, disabilities or the elderly.
- properties.Attributes.Available_o: Shows if the hotel is accessible for people with Muscular Skeletal Disorders.
- properties.Attributes.Available_z: Shows if the hotel is accessible for people with visual impairments.
- properties.Attributes.Available_s: Shows if the hotel is accessible for people with hearing impairments.
- properties.Attributes.Available_k: Shows if the hotel is accessible for wheelchair users.
- properties.Attributes.PresenceRoom: Shows if there are rooms designed for people with disabilities.

3.2. Data on Venues

For this purpose, we will use Foursquare to gain the information.

Foursquare is a location platform which provides data about venues within an area of interest, including their names, menus, photos and tips from other users. The Foursquare location platform will be used as the sole data source regarding the venues, since all the required information can be obtained through the API.

After creating the list of hotels, we will connect to the Foursquare API to gather information about venues neighbouring the hotels. For each hotel, we have chosen the radius to be 500 meters, which will solve the distance issue.

3.3. Objectives

Thus, the approach taken here is to do the following:

1) explore each of the hotels individually;

2) plot the map to show the hotels under consideration;

3) use Foursquare to display venues nearby the hotels;

4) build the model by clustering the areas with similar features;

5) plot the new map with the clustered areas.

4. Methodology

We will create our model with the help of Python. The packages used in this project are:

- Pandas: to collect and manipulate data, to perform data analysis;
- geojson: to import the initial dataset;
- requests: to make http requests;
- googletrans: to translate names of the hotels from Russian into English;
- folium: to generate a map of Moscow;
- matplotlib: to make the generated map more detailed;
- sklearn: to import Kmeans, which is the machine learning model that will be used.

4.1. Collecting Data on Hotels

To collect the data on Moscow hotels adjusted to the needs of people with disabilities and impairments, we have sent an API request to the Open Data portal.

	type	geometry.type	geometry.coordinates	properties.DatasetId	properties.VersionNumber	properties.ReleaseNumber	properties.RowId	properties.Attributes.FullName	properties.Attributes.AdmArea	properties.Attributes.District	properties.Attributes.Address	properties.Attributes.FullAvailable	properties.Attributes.Available_o	properties.Attributes.Available_s
0	Feature	Point	[37.645491, 55.662813]	61221	1	16	None	Гостиница «Иван Чай»	Южный административный округ	район Нагатино-Садовники	город Москва, Нагатинская набережная, дом 10, ...	нет	да	да
1	Feature	Point	[37.585951, 55.852088]	61221	1	16	None	Гостиница «Владыкино»	Северо-Восточный административный округ	район Отрадное	город Москва, Алтуфьевское шоссе, дом 6	нет	нет	нет
2	Feature	Point	[37.736122, 55.70506]	61221	1	16	None	Гостиница «Москвич»	Юго-Восточный административный округ	район Текстильщики	город Москва, 11-я улица Текстильщиков, дом 1	нет	нет	нет

4.2. Preprocessing Data

During this step, we have dropped the columns not necessary for further analysis. Moreover, we have chosen hotels with features suited

to the needs of our target group by making sure it has at least one feature shown in Columns 5-8 and 11 (i.e., adapted to people with a specific impairment and the availability of a specifically designed room).

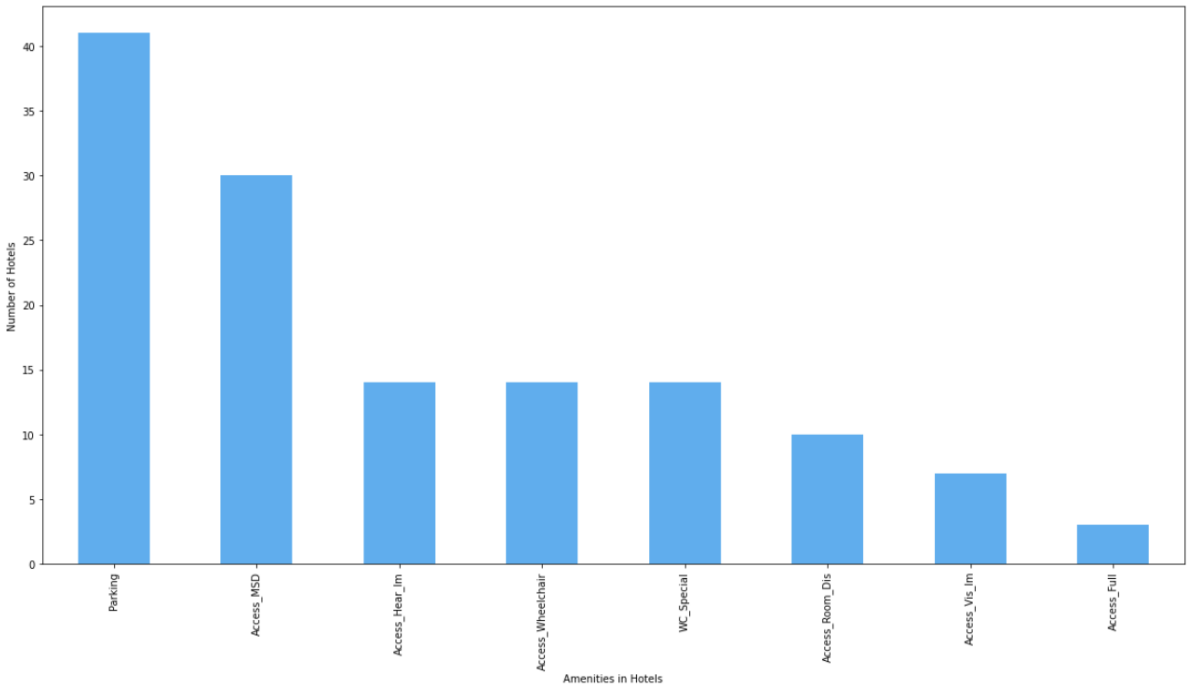
The names of the chosen hotels then have been translated into English to make the data accessible to the international audience.

The Coordinates column of the dataframe has been split into Latitude and Longitude.

Out[22]:

	Hotel_Name	Access_Full	Access_MSD	Access_Vis_Im	Access_Hear_Im	Access_Wheelchair	Parking	WC_Special	Access_Room_Dis	Latitude	Longitude
0	Hotel "Ivan Chai"	0	1	1	0	0	1	0	0	55.682813	37.645491
1	Hotel "Vladykino"	0	0	0	0	1	1	0	0	55.852088	37.585951
2	Hotel "Moskvich"	0	0	0	0	1	1	0	0	55.705060	37.736122
3	Hotel "Brighton"	0	1	0	0	0	1	0	0	55.804493	37.561412
4	Hotel "MosUztsentr"	0	1	0	0	1	1	1	0	55.715760	37.791304

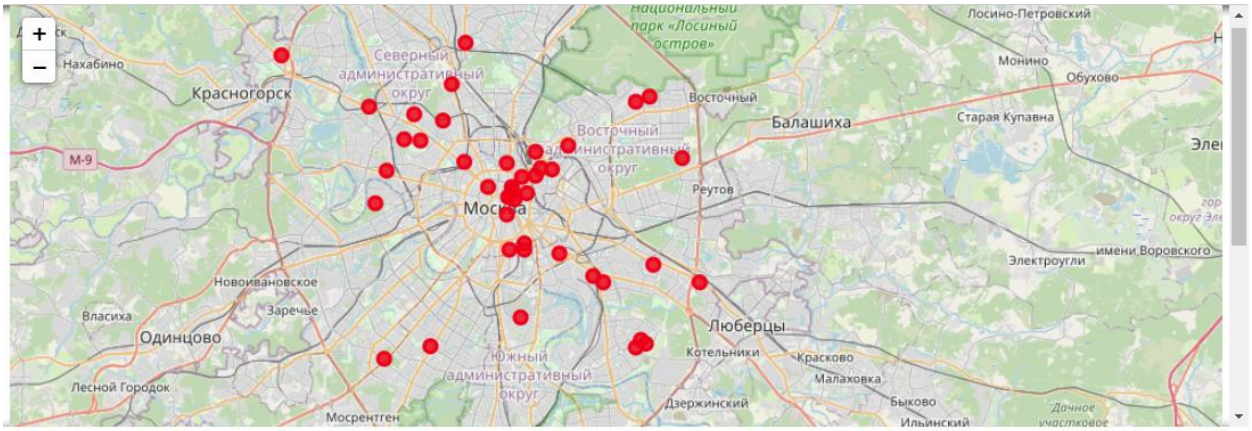
To gain deeper understanding of the data, we have created a bar chart to see how many hotels have amenities belonging to the selected categories.



As we can see, most of the hotels have parking facilities available for people with disabilities, which is quite useful if the person in question uses their car to get around a city. Approximately 71% of the hotels are made accessible for visitors with muscular skeletal disorders, followed by those suited for the hearing impaired and wheelchair users. The smallest number of hotels are fully accessible and can accomodate visitors with various health conditions.

4.3. Visualizing Hotels

Using the Folium package and GeoPy for finding out the coordinates of Moscow, we have created a map of Moscow with the hotels shown on it.



4.4. Getting the Venues

In order to display the venues and their categories, we have initialized the Foursquare API credentials, defined a function which will get the venues in the desired radius, i.e., 500 metres, and stored the data in a new dataframe. According to the data, there are 212 unique categories of the venues near the hotels.

	Hotel	Hotel Latitude	Hotel Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Hotel "Ivan Chai"	55.682813	37.645491	Красное & Белое	55.678923	37.645132	Convenience Store
1	Hotel "Ivan Chai"	55.682813	37.645491	Детский клуб "Дирижабль"	55.679395	37.642836	Arcade
2	Hotel "Ivan Chai"	55.682813	37.645491	Бородачи	55.678991	37.643691	Hookah Bar
3	Hotel "Ivan Chai"	55.682813	37.645491	Мясновъ	55.679520	37.641816	Butcher
4	Hotel "Ivan Chai"	55.682813	37.645491	Иверия	55.683131	37.640460	Caucasian Restaurant

4.5. Grouping the Venues

We have performed one hot encoding on the venue categories, merged the dataframes and grouped the rows by the mean of the frequency of occurence of each category.

	Yoga Studio	Accessories Store	Adult Boutique	African Restaurant	American Restaurant	Amphitheater	Aquarium	Arcade	Art Gallery	Arts & Crafts Store	...	Tunnel	Turkish Restaurant	Udon Restaurant	Ukrainian Restaurant
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0
1	0	0	0	0	0	0	0	1	0	0	...	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0

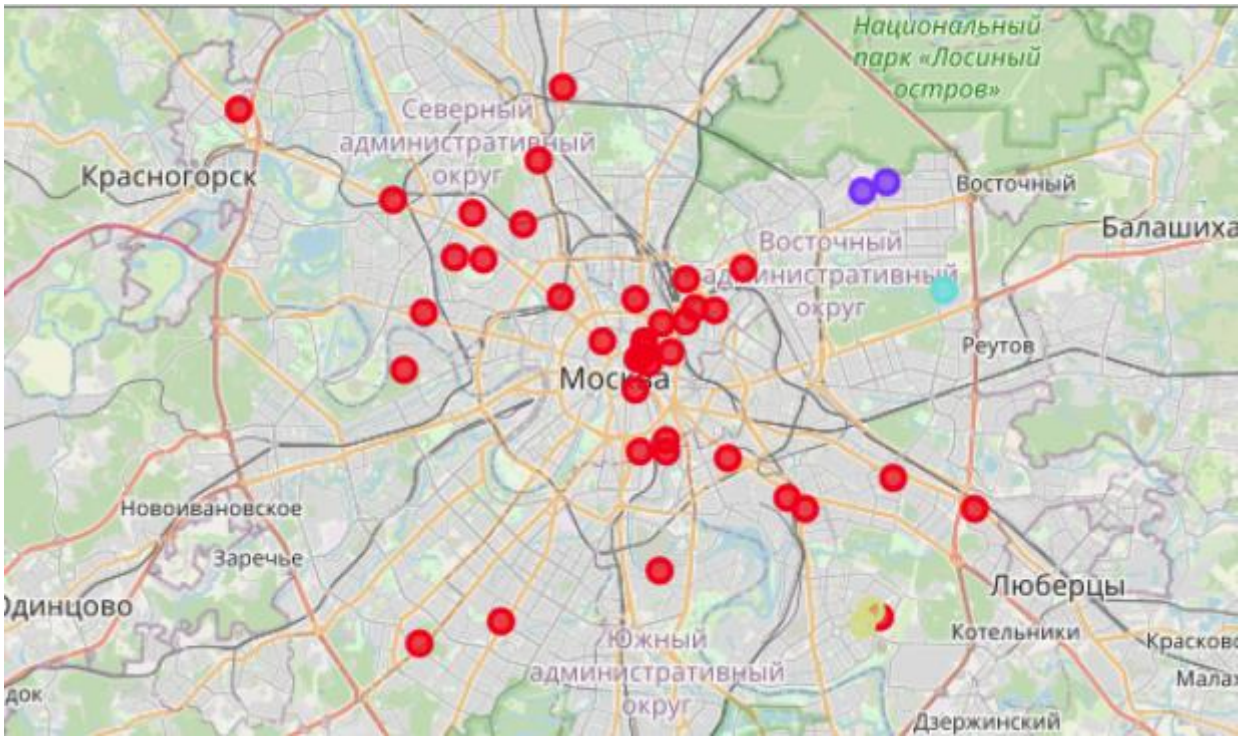
5 rows × 212 columns

As the number of the categories is too big, we have chosen 10 most common ones for further analysis.

	Hotel	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	"Art Hotel"	Restaurant	Tennis Court	Gym / Fitness Center	Sporting Goods Shop	Spa	Bus Stop	Gym	Soccer Stadium	Café	Gourmet Shop
1	"Citadel Comfort Hotel"	Yoga Studio	Bar	Clothing Store	Café	Bookstore	Plaza	Vegetarian / Vegan Restaurant	Theater	Russian Restaurant	Flower Shop
2	"Grand Hotel Belorusskaya"	Coffee Shop	Steakhouse	Seafood Restaurant	Cocktail Bar	Tea Room	Health Food Store	Other Repair Shop	Clothing Store	Gym / Fitness Center	Bar
3	Avita Krasnye Vorota Hotel	Coffee Shop	Dance Studio	Caucasian Restaurant	Accessories Store	Yoga Studio	Plaza	Modern European Restaurant	Belgian Restaurant	Mobile Phone Shop	Cosmetics Shop
4	Boutique Hotel "De Marie"	Middle Eastern Restaurant	Gym / Fitness Center	Steakhouse	Gourmet Shop	Café	Athletics & Sports	Pet Store	Supermarket	Donut Shop	Italian Restaurant

4.6. K-Means Clustering

Using K-Means Clustering, we have clustered the hotels into 4 clusters with distinct features. We have visualized the clusters on the map and then verified them.



```
In [48]: mos_merged.loc[mos_merged['Cluster Labels'] == 0, mos_merged.columns[[1] + list(range(5, mos_merged.shape[1]))]]
```

Out[48]:

	Access_Full	Access_Wheelchair	Parking	WC_Special	Access_Room_Dis	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Co
0	0	0	1	0	0	55.682813	37.645491	0	Burger Joint	Liquor Store	Butcher	
1	0	1	1	0	0	55.852088	37.585951	0	Sandwich Place	Hookah Bar	Gastropub	
2	0	1	1	0	0	55.705060	37.736122	0	Bus Stop	Gym / Fitness Center	Track	Health
3	0	0	1	0	0	55.804493	37.561412	0	Supermarket	Cafeteria	Playground	Po
4	0	1	1	1	0	55.715760	37.791304	0	Fast Food Restaurant	Mobile Phone Shop	Cafeteria	Coffee
5	0	0	1	0	0	55.844242	37.383477	0	Electronics Store	Yoga Studio	Sushi Restaurant	Phone

```
In [49]: mos_merged.loc[mos_merged['Cluster Labels'] == 1, mos_merged.columns[[1] + list(range(5, mos_merged.shape[1]))]]
```

Out[49]:

	Access_Full	Access_Wheelchair	Parking	WC_Special	Access_Room_Dis	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Cor
24	0	0	1	0	0	55.815726	37.772969	1	Auto Workshop	Bus Station	Gym / Fitness Center	Bed & Breakfast	Ca
27	0	0	1	0	0	55.819203	37.787804	1	Car Wash	Candy Store	Supermarket	Auto Workshop	

```
In [50]: mos_merged.loc[mos_merged['Cluster Labels'] == 2, mos_merged.columns[[1] + list(range(5, mos_merged.shape[1]))]]
```

Out[50]:

	Access_Full	Access_Wheelchair	Parking	WC_Special	Access_Room_Dis	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Comm Ve
38	0	0	1	0	0	55.78126	37.82334	2	Gym	Cosmetics Shop	Basketball Court	Yoga Studio	Pedestr Pl

```
In [51]: mos_merged.loc[mos_merged['Cluster Labels'] == 3, mos_merged.columns[[1] + list(range(5, mos_merged.shape[1]))]]
```

Out[51]:

	Access_Full	Access_Wheelchair	Parking	WC_Special	Access_Room_Dis	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
18	0	0	1	0	0	55.664251	37.771861	3	Bus Stop	Park	Food & Drink Shop	Playground
20	0	0	1	0	0	55.669069	37.777401	3	Food & Drink Shop	Playground	Supermarket	Vietnamese Restaurant

5. Results and Discussion

Although the number of hotels suited for people with disabilities and impairments is small for a city as large as Moscow, there are various facilities in the vicinity, including places to eat in different price ranges, supermarkets, parks, transportation options and sports facilities, should one choose to take a look at rehabilitation courses they might provide.

The biggest, red, cluster contains all the hotels in the center and the majority of the hotels in the more prestigious districts, with a wide variety of restaurants, cafes and shops available nearby.

The next, purple, cluster is located near the northern transportation hub in Moscow, which allows for easy access to the Moscow Central Bus Terminal. There are also car facilities nearby, so it might be preferred by those travelling by car.

The following, turquoise, cluster consists of one hotel and is located in the vicinity of a large park in Moscow with lots of walking trails and a small Kremlin to explore (the Izmailovo Kremlin). It also has a lot of sports facilities, including a gym with a swimming pool. As the hotel is adapted to people with MSD, they might opt to choose rehabilitation programs in the sports facilities, provided they suit their needs and individual conditions.

The final, yellow, cluster is located in a quiet neighborhood near a medium-sized park, with supermarkets and convenience stores nearby.

Although not shown in the top-10 venues, some of the hotels have hospitals nearby.

6. Conclusion

The purpose of this project was to explore the hotels of Moscow, which contain facilities suited for visitors with disabilities and impairments, choose their destination hotel suited to their needs, considering the type of venues relatively close to the hotels.

We could see that despite the initial large number, few hotels are actually making the experience of visiting Moscow accessible to anyone. Although the authorities claim they are working on improving the city's facilities, and, indeed, more wheelchair ramps, elevators and improved transportation have appeared over the past 5 years, there is a lot of room for improvement. In our case, the majority of the hotels with only parking listed as the available feature could be made more accessible by introducing more amenities for visitors with disabilities and impairments.

Regarding the hotels analysed, we can see that there are useful venues nearby, belonging to different categories, such as food, health, shops, etc. The hotels seem to be located near major roads and metro stations, which allows for easier transportation around the city.

All in all, there are a number of facilities to choose from based on the visitors' expectations. Hopefully, with the future development of the city, Moscow would be more accessible to everyone, and there will be plenty more hotels to choose from.

7. References

1.Dataset on Hotels: Russian Version: https://data.mos.ru/opendata/7703465612-obekty-turisticheskogo-pokaza-i-obekty-gostinichnogo-hozyaystva-goroda-moskvy-prisposoblennye-dlya-lits-s-ogranichennymi-vozmojnostyami-zdorovya-i-lyudey-pojilogo-vozrasta/data/table?versionNumber=1&releaseNumber=16

2.Dataset on Hotels: English Version (dataset passport): https://data.mos.ru/opendata/7703465612-objects-of-the-tourist-display-and-objects-of-the-hotel-industry-in-moscow-adapted-for-persons-with-the-removal-of-health-and-the-elderly?pageNumber=1&countPerPage=10

3.Moscow Open Data Portal API: https://apidata.mos.ru/help/index!/Features/Features_GetListByDatasetId_0

4.Foursquare: https://foursquare.com