# Analysis of the optimal location of a Grocery Store in Rostov-on-Don

**IBM Data Science Capstone Project**

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# Introduction

## Business problem

The task is to find the optimal place to open a grocery store in the city of Rostov-on-Don, Russia. We are interested in places in areas of the city with a high population density, a small number of available chain grocery stores, close to the historical center.

## Data used in the project

The project used data on the districts of the city of Rostov-on-Don, their area, population.

Administrative and territorial borders of Russia in GeoJSON format.

Data with the streets of Rostov on don with reference to the districts. The data obtained using the Foursquare API was used.

# Introduction: Methodology

The goal is to choose the optimal location of a grocery store in Rostov-on-Don based on data on population density depending on the area of the city, data on the number of shops nearby, the distance to the historical center of the city.

The centers of the circle grid, which covers the entire city, were chosen as centroids.
Then, using the DaData API, the addresses of the buildings closest to the centers of the circles were obtained.

Based on the data with the streets of Rostov-on-Don, were removed circles that were NOT related to Rostov-on-Don.

Then, using the Foursquare API, all grocery stores were selected and plotted on the map (radius = 470m).

Also, based on cluster analysis using the K-means algorithm, optimal areas for store placement were selected. The districts meet the following criteria. They are located close to the city center, there are few grocery stores around, the population density of the area is high (34 centroides).

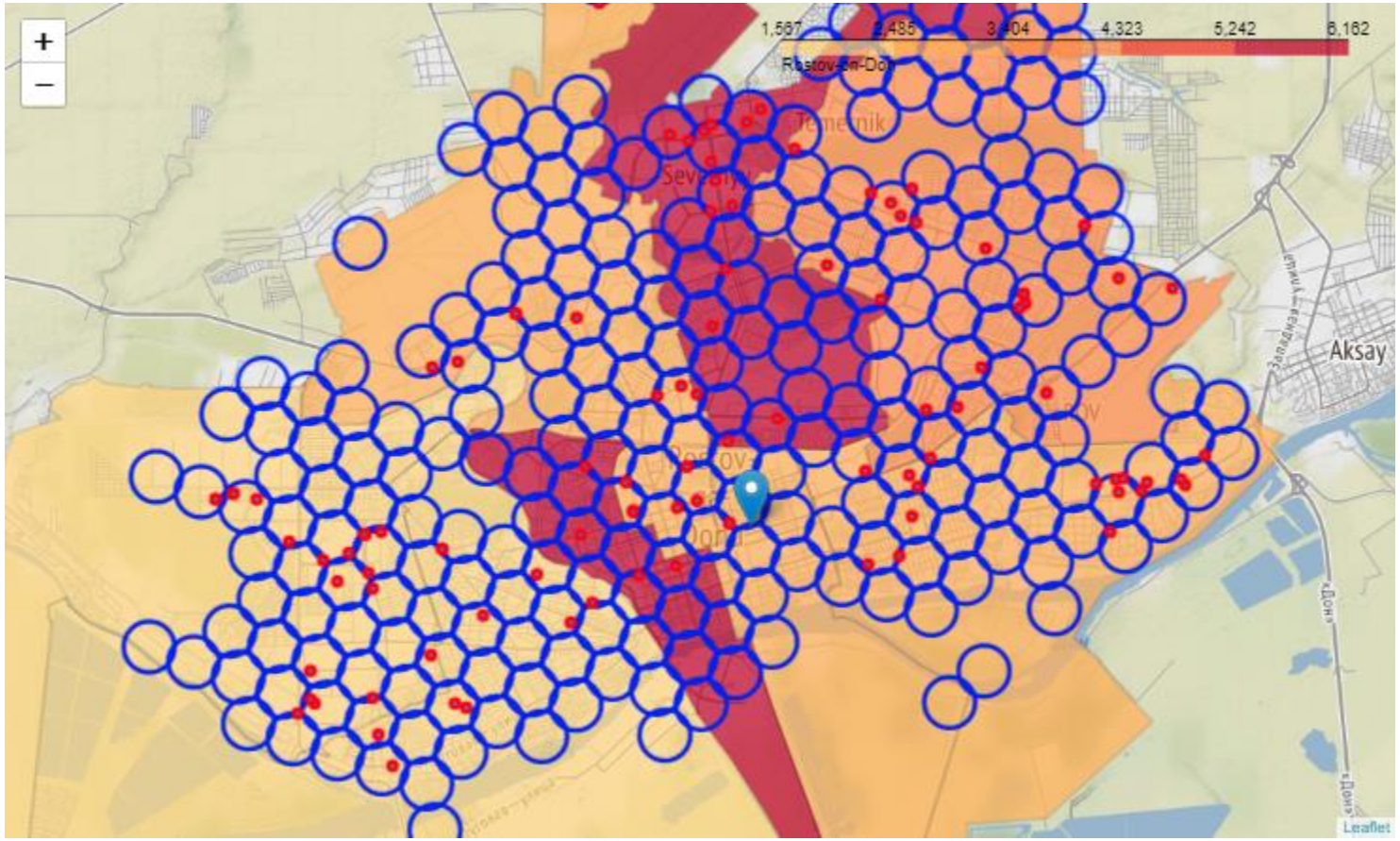
# Preparation of Data

Based on the data sources specified in the "Introduction", a dataset was obtained for subsequent analysis.

| Address | Centroid Latitude | Centroid Longitude | Xs centroid | Ys centroid | Distances from center | Venue | Venue Latitude | Venue Longitude | Venue Category | City | Street |
|---|---|---|---|---|---|---|---|---|---|---|---|
| г Ростов-на-Дону, ул 30-летия Октября, д 58 | 47.198985 | 39.601340 | 2.357344e+06 | 5.528788e+06 | 10333.284812 | Остановка "Станция Первомайская" | 47.200028 | 39.606936 | Bus Station | г Ростов-на-Дону | 30-летияОктября |
| г Ростов-на-Дону, ул Пескова, д 20/33 | 47.196511 | 39.612141 | 2.358244e+06 | 5.528788e+06 | 9659.853777 | Ростов,ж/д станция Первомайска | 47.197858 | 39.611291 | Bus Station | г Ростов-на-Дону | Пескова |
| г Ростов-на-Дону, ул Пескова, д 20/33 | 47.196511 | 39.612141 | 2.358244e+06 | 5.528788e+06 | 9659.853777 | Первомайская | 47.197857 | 39.611282 | Train Station | г Ростов-на-Дону | Пескова |
| г Ростов-на-Дону, ул Пескова, д 20/33 | 47.196511 | 39.612141 | 2.358244e+06 | 5.528788e+06 | 9659.853777 | Рыболов | 47.198462 | 39.613531 | Hobby Shop | г Ростов-на-Дону | Пескова |
| г Ростов-на-Дону, ул Магнитогорская, д 2В | 47.194035 | 39.622941 | 2.359144e+06 | 5.528788e+06 | 9026.005484 | Кумженская роща | 47.190166 | 39.621347 | Park | г Ростов-на-Дону | Магнитогорская |

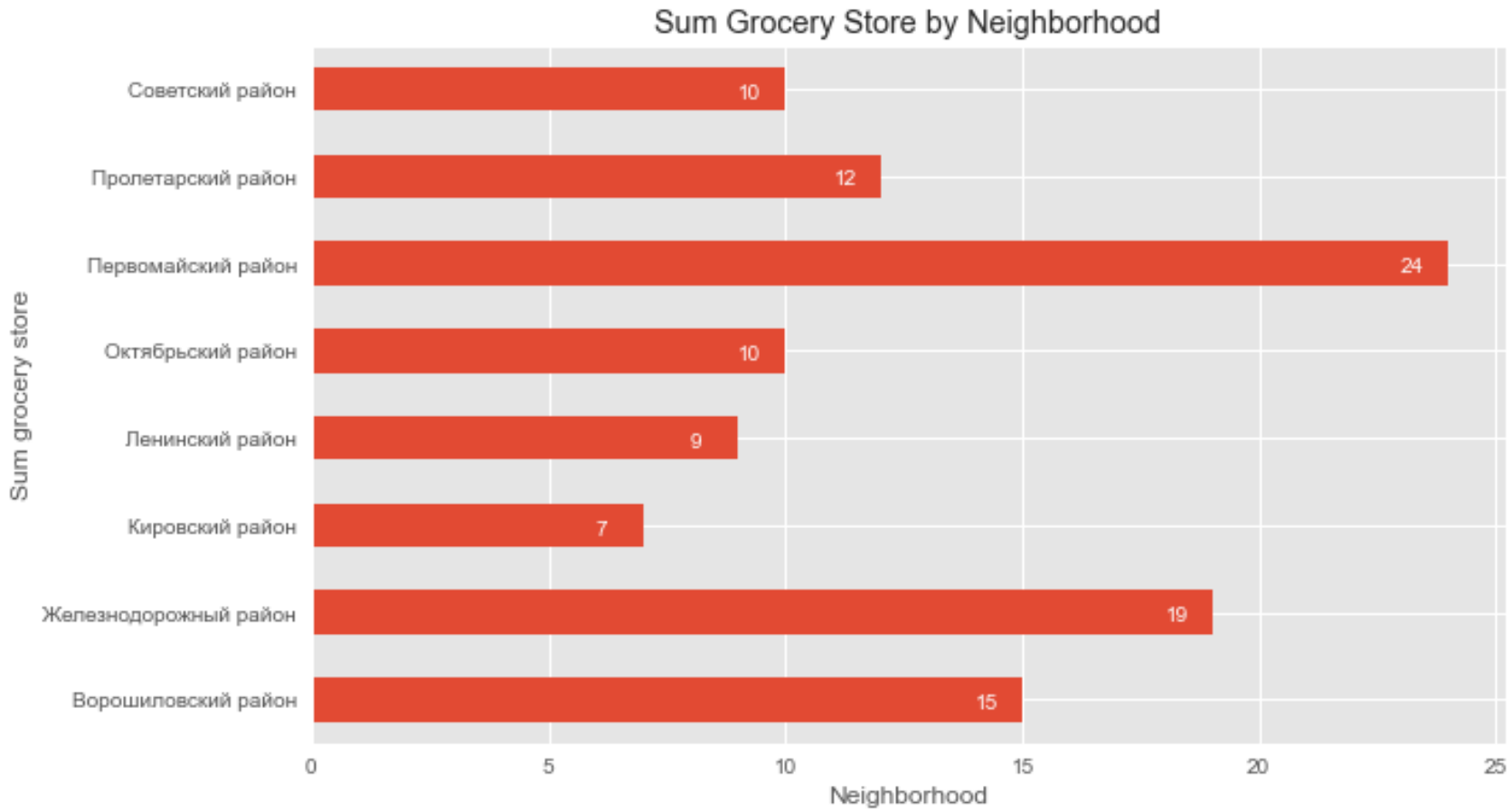
# Preparation of Data: All Stores

A grid of circles with a radius of 470 meters was built on the map. Then those circles that do NOT belong to Rostov-on-Don were removed. All Grocery Stores were also marked on the final map.



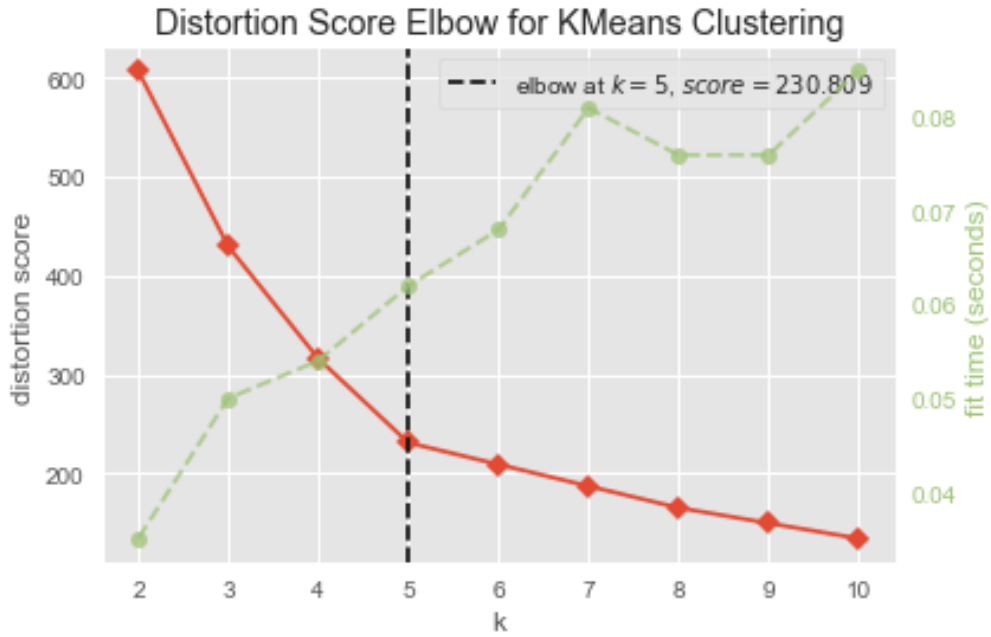
# Data analysis and clustering

The largest number of Grocery stores is located in the Pervomaisky district – 24 stores. The smallest number is in Kirovsky (7 stores)



# Data analysis and clustering

The K-means algorithm was applied. The dataset was divided into 5 clusters

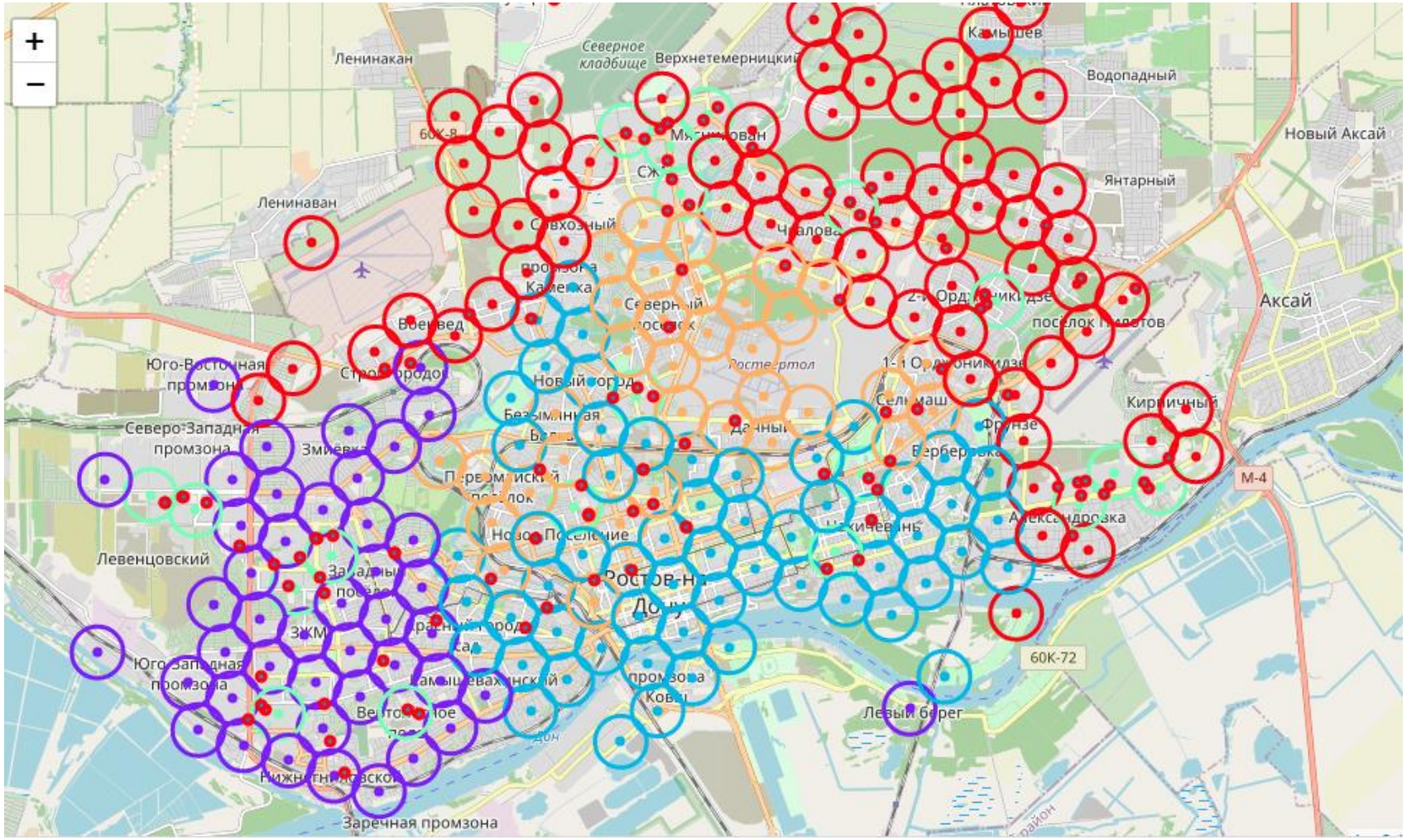



Cluster 4 was selected, as it best fits the parameters we need. Thus, the districts in it have a high population density, they are located close to the historical center of the city, there are few grocery stores in them

| Cluster | Mean_Distances_from_center | Mean_Density_of_Neighborhood | Sum_grocery_store |
|---|---|---|---|
| 0 | 7846.288168 | 4184.231582 | 17 |
| 1 | 7757.947459 | 1791.540692 | 14 |
| 2 | 3267.633992 | 2897.138728 | 11 |
| 3 | 6930.655800 | 3633.571674 | 49 |
| 4 | 3864.848140 | 5617.908233 | 15 |

# Results and Discussion

Thus, based on the results of the study, 34 centroids (cluster 4) were identified, from which it is possible to choose the optimal location for the location of a Grocery store. On the map, these centroids are highlighted in orange. These centroids belong mainly to the Voroshilovsky and Leninsky districts. The analysis shows that there are areas close to the city center with a high population density. At the same time, the number of Grocery stores there is small, which is optimal for us



# Conclusion

The task is to find the optimal place to open a grocery store in the city of Rostov-on-Don, Russia. We are interested in places in areas of the city with a high population density, a small number of available chain grocery stores, close to the historical center.

The task was completed. The optimal areas for the location of the Grocery Store were found. The final decision on its location will be made by Stakeholders based on additional parameters.

Thanks for your attention!