

Capstone Project

The Battle of the Neighborhoods

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Applied Data Science Capstone
by IBM / Coursera

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Introduction

The restaurant chain of Eastern European cuisine "EEC", St. Petersburg, Russia plans to expand to foreign countries. It was decided to open the first foreign restaurant in Tallinn, Estonia - the nearest capital of a foreign state to St. Petersburg.

Preliminary analysis has shown that the most popular area of Tallinn for both tourists and locals is Old Town or Vanalinn (<https://www.visitallinn.ee/eng/visitor/ideas-tips/tips-and-guides/top-must-see-sights>).

It is the oldest part of Tallinn, Estonia. Old Town of Tallinn has managed to wholly preserve its structure of medieval and Hanseatic origin. Old town has exceptionally intact 13th century city plan. Since 1997, the area has been registered in the UNESCO World Heritage List. The old town is bordered by the Walls of Tallinn. Its area is 113 ha. The majority of the old town's structures were built during the 13th–16th centuries (https://en.wikipedia.org/wiki/Tallinn_Old_Town).

Thus, the location of the restaurant was determined by the old town and the adjacent territories within walking distance (up to 1.5 km) from Town Hall Square - the cultural and historical center of the old town.

The aim of the project is to determine the most promising locations for placing the restaurant, taking into account the presence of restaurants in general and with Eastern European cuisine in particular in the area under consideration.

Determining a specific location for a restaurant is beyond the scope of this project, requiring additional analysis, including conducted directly on the spot.

Data

Based on the formulation of a business problem, the main factors influencing its solution will be:

- coverage area for analysis (1.5 km from Town Hall Square);
- total number of restaurants of all types in the area under consideration (density);
- number of Eastern European restaurants in the area under consideration (density);
- distance between neighboring restaurants of Eastern European cuisine;
- distance from the center of the considered area (Town Hall Square) to each restaurant of Eastern European cuisine found in it.

We will use a uniformly distributed grid of locations centered around Town Hall Square to break the area into separate locations.

The sources of the necessary data will be:

- coordinates of the center of the considered area (Town Hall Square) will be obtained using the Nominatim geocoding API;
- centers of individual locations of the considered area will be generated algorithmically, and their coordinates will be obtained using reverse geocoding;
- number of restaurants, their type and location will be obtained using the Foursquare API.

Neighborhood Candidates

At first, we determine the latitude and longitude of the center of the area under consideration using a specific, well-known place (Town Hall Square) and the Nominatim geocoding API:

Coordinate of Town Hall Square, Tallinn, Estonia:
(59.43735425, 24.74521104002489)

Then, we create a grid of potential locations at an equal distance from each other, centered in Town Hall Square and with a radius of 1.5 km.

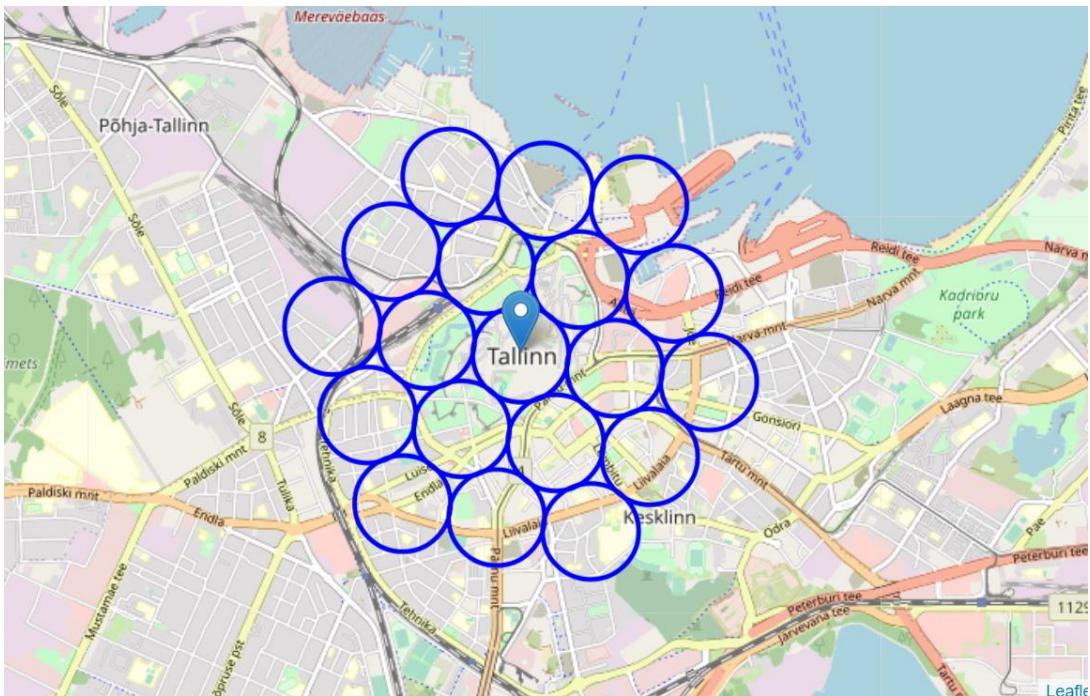
Our locations will be defined as circles with a radius of 300 meters, so their centers will be located at a distance of 600 meters from each other.

To calculate distances, we will create a grid of locations in a Cartesian 2D coordinate system, which allows us to calculate distances in meters (and not in degrees of latitude/ longitude). Then we will project these coordinates back to the degrees of latitude/ longitude that will be shown on the Folium map.

We take the functions for converting between the spherical coordinate system WGS 84 (degrees of latitude/longitude) and the Cartesian coordinate system UTM (X/Y coordinates in meters).

And create a grid of cells by shifting every second row and adjusting the distance between the vertical rows so that the center of each cell is equally distant from all its neighbors.

We visualize the data we have - the location of the center of the area under consideration (Town Hall Square) and the boundaries of potential locations within it.



Now we have the coordinates of the locations to be further evaluated, with the centers at an equal distance from each other and within 1.5 km of Town Hall Square.

Foursquare

That we have potentially interesting locations, we use the Foursquare API to get information about restaurants located in them in general and Eastern European cuisine in particular.

Category IDs corresponding to restaurants were taken from Foursquare web site <https://developer.foursquare.com/docs/resources/categories>.

Restaurants of Russian and Ukrainian cuisine belonging to Eastern European cuisine, are allocated in Foursquare in separate categories ("Russian Restaurant" and "Ukrainian Restaurant"), so we will add them to the category "Eastern European Restaurant".

We are interested in catering establishments, but only those that are real restaurants.

Coffee shops, pizzerias, bakeries, etc. are not our direct competitors, so we will include in our list only those establishments in the name of the category of which there are words indicating their attitude to "serious" establishments such as a restaurant.

Now we go through our locations and find nearby restaurants.

We will also keep a dictionary of all the restaurants found in general and Eastern European cuisine in particular.

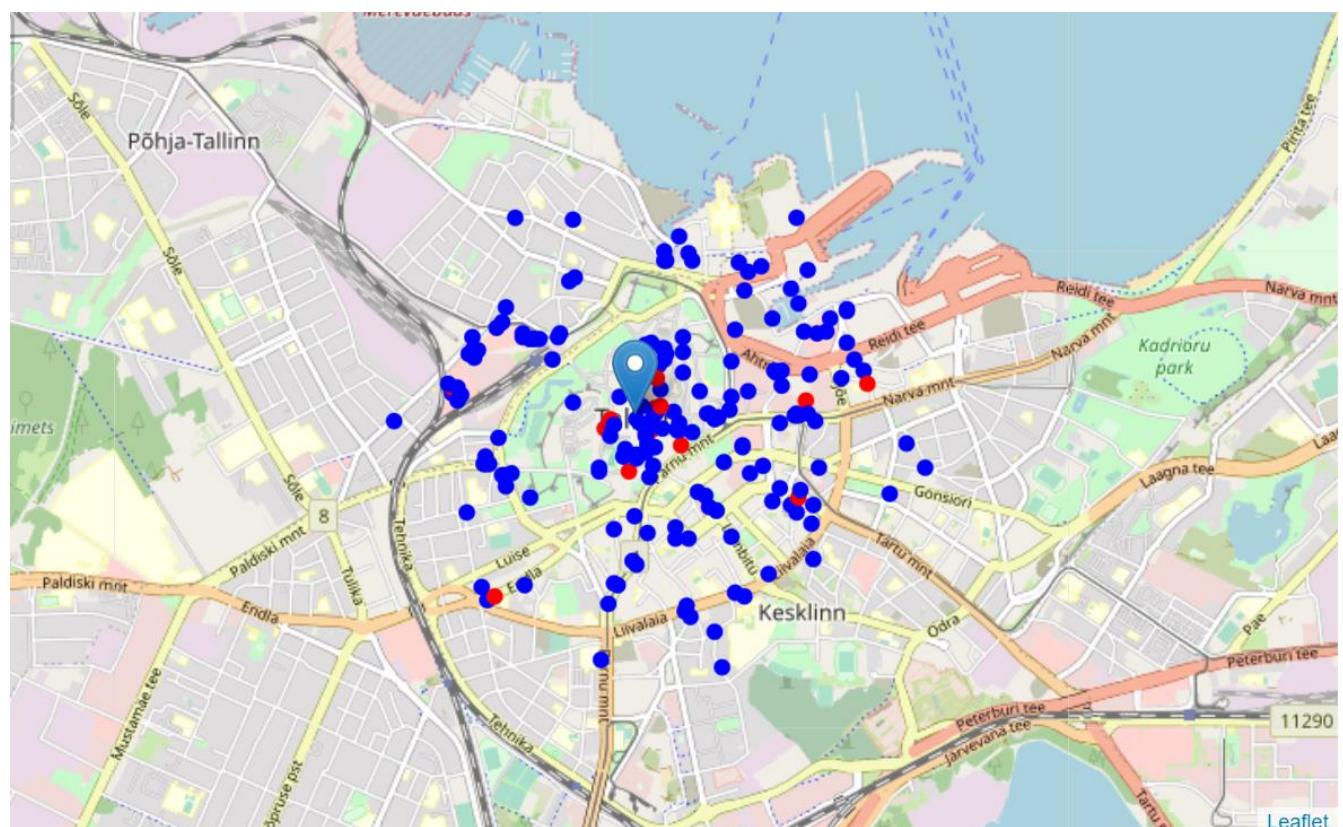
In a generalized form, we have obtained the following results:

Total number of restaurants: 199

Total number of Eastern European restaurants: 15

Percentage of Eastern European: 7.54%

Let's look at the map (in the area under consideration) all the restaurants found in general and Eastern European cuisine in particular, marking them in different colors (blue and red, respectively).



So, now we have all the restaurants in the area within 1.5 km from Town Hall Square; we also know which of them are restaurants of Eastern European cuisine.

The data collection stage is completed.

Now we will use this data for analysis to choose the optimal locations for our restaurant.

Methodology

In this project, we will determine the locations of the historical part of Tallinn and the surrounding areas with a low density of restaurants in general and restaurants of Eastern European cuisine in particular.

We will limit our search (analysis) to an area with a radius of 1.5 km from the "heart" of old Tallinn - Town Hall Square.

At the first stage, we collected the necessary data - the location of all restaurants within 1.5 km from Town Hall Square, as well as restaurants of Eastern European cuisine (in accordance with the Foursquare categorization).

The second stage of our analysis is the calculation and study of the "density" of restaurants in different locations of the considered area in order to identify several promising locations near Town Hall Square with a small number of restaurants in general and the absence of restaurants of Eastern European cuisine nearby. To do this, we will use heat maps.

Thus, the results of our project will become the starting point for a detailed study at the "street level" and, taking into account the analysis of additional factors

beyond the scope of this study, determining the optimal location of the first foreign restaurant of the company "EEC.

Analysis

We will conduct a basic analysis of our data and get additional information for the purposes of our research.

First, we calculate the average number of restaurants in each location of the area under consideration:

Average number of restaurants in every area with radius=300m : 9.4

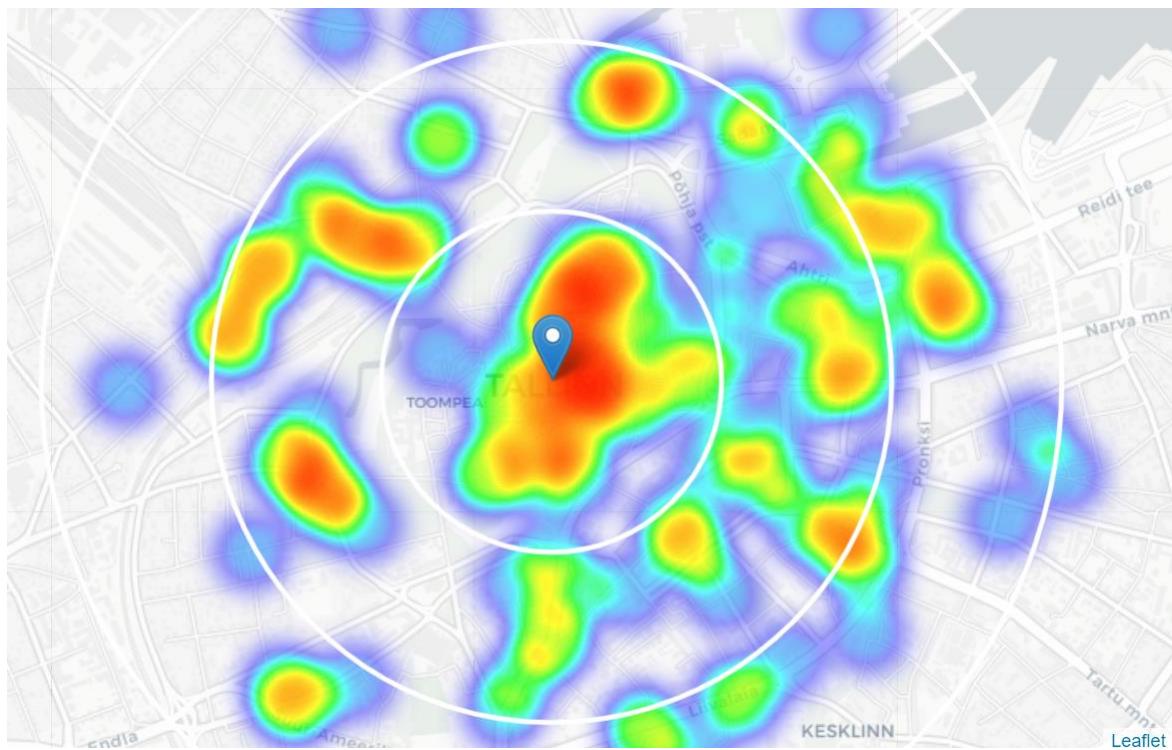
Now we will calculate the distance to the nearest restaurant of Eastern European cuisine from each location of the area under consideration (not only within 300 meters from the center of the location) and we will output the average value:

Average distance to closest Eastern European restaurant from each area center: 461.6

Thus, on average, a restaurant of Eastern European cuisine can be found within 500 meters from each location of the area under consideration. This is quite close, so you need to carefully explore promising locations.

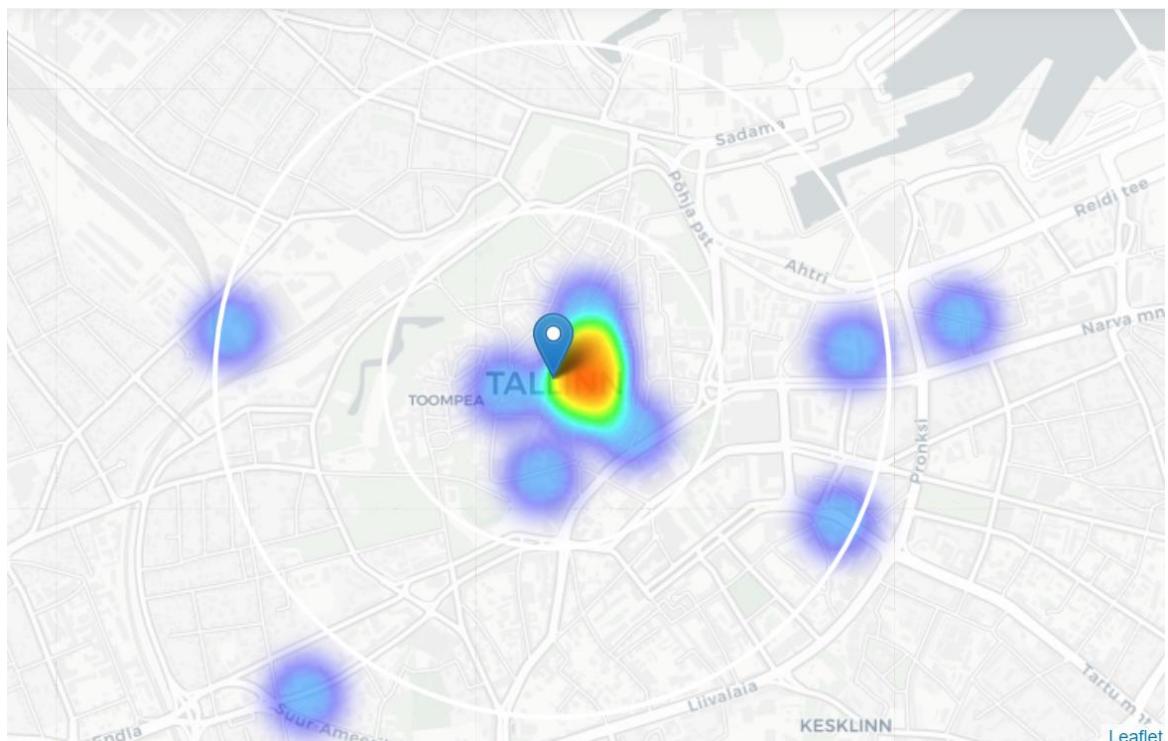
To do this, we will create a heat map showing the density of restaurant locations, and try to extract information from it that is significant for the purposes of this project.

For the convenience of visual perception, we will show circles on the map indicating the distance of 0.5 km, 1 km and 2 km from Town Hall Square.



We see that in the western and northern parts of the area under consideration there are locations with a relatively low density of restaurants.

Let's create a heat map showing the density of placement of only Eastern European restaurants.



This map shows a sufficient number of locations where there are no restaurants of Eastern European cuisine.

Taking into account the map of the density of placement of restaurants of all categories, we can determine the locations that are the most priority for the placement of our restaurant.

Results

Our research shows that there are a relatively large number of restaurants of different types / categories in the historical part of Tallinn and in the surrounding area (~200 in our area of interest, with a radius of 1.5 km around Town Hall Square).

The largest concentration of restaurants was found in the center and to the east of Town Hall Square, while there are locations with a relatively low density of restaurants in the west and north.

The density of restaurants of Eastern European cuisine, as the analysis shows, is quite low in the entire area under consideration.

Discussion

On the one hand, the locations to the west and north of Town Hall Square can be considered as a priority for further more detailed research, including in the "field" conditions.

However, this does not mean that these locations are the optimal places for our restaurant. Perhaps there are good reasons for the low density of restaurants in these locations, which can become stop factors for opening our restaurant there.

The recommended locations should be considered only as a starting point for further, more detailed analysis.

Conclusion

The purpose of this project was to determine the most promising locations for placing an Eastern European cuisine restaurant in the historical part of Tallinn, taking into account the presence of restaurants in general and with Eastern European cuisine in particular in the area under consideration.

Having calculated the distribution of the density of restaurants according to Foursquare data, we have identified the locations (to the west and north of Town Hall Square) that will be used as starting points for a detailed study.

The final decision on the location of the restaurant will be made by the interested parties on the basis of additional information about the locations and the competitive environment obtained during their study directly on the spot.