The Best Place to Open a Restaurant in the City of Kyiv, Ukraine

Recommendation

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Introduction

1.1 Background

Every potential restaurant owner is interested to find a location for his business that satisfy the following criteria:

1. Located in a densely populated area for higher chances of attracting customers
2. Popular with clients
3. Customers should be willing to spend decent amount in the restaurant
4. Convenient logistics
5. Some perks to fend off competition

Introduction

Business Problem

In this project we will try to find an optimal location for opening a restaurant in Kyiv, Ukraine near the center within 6 km radius. Kyiv is the capital and most populous city of Ukraine, located in the north-central part of the country on the Dnipro River. The population of Kyiv is 3 million people, making Kyiv the 7th most populous city in Europe. Kyiv is an important industrial, scientific, educational and cultural center of Eastern Europe.

Introduction

Business Interest

Our first objective is to find zones in the center of Kyiv, which are most densely populated with restaurants and try to identify key factors that contribute to the popularity of those areas.

Our second objective is to detect locations that are not already crowded with restaurants. We would also prefer locations as close to Kyiv Center (Kreschatik Street) as possible.

We will use our data science skills to generate most promising neighborhoods based on this criteria. Advantages of each area will then be clearly expressed so that best possible final location can be chosen by stakeholders.

Data Acquisition, Cleaning, Visualization

Data Sources

To convert an address into latitude and longitude coordinates of Kyiv, Ukraine we used geopy.geocoder library with Nominatim module.

We also used foursquare API to scrape the addresses of all places that are within 12 kilometer radius from Kyiv Center (Kreschatik Street) and also satisfy search query “food”. We found 100 locations that meet our search criteria.

Data Acquisition, Cleaning, Visualization

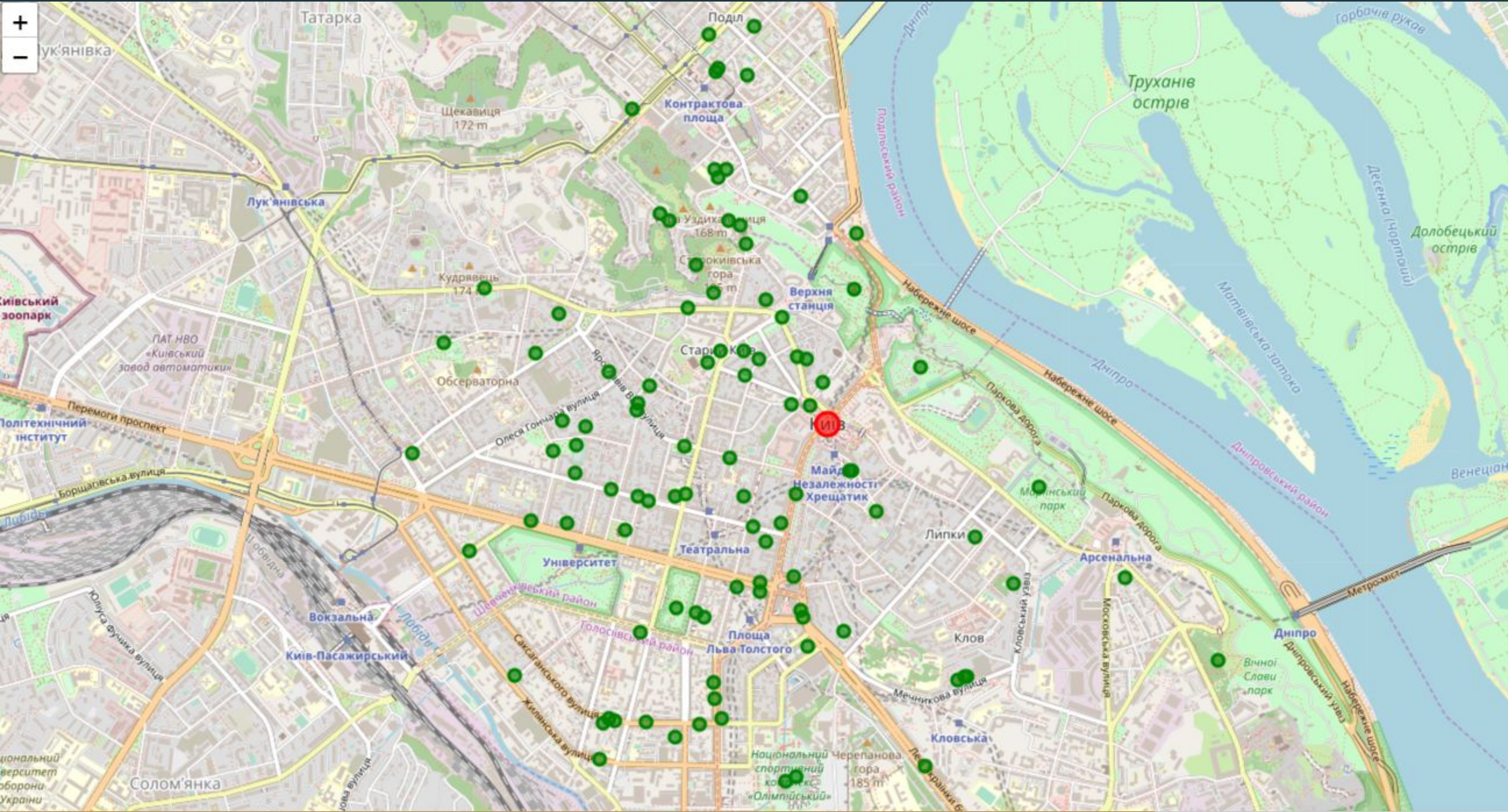
Data Cleaning

I used requests Python module that takes care of both retrieving JSON data and decoding it, due to its built in JSON decoder. Once I had my data in a dataframe format I filtered the columns (only columns containing information relevant to our study were left). Redundant information in rows was also removed.

Data Acquisition, Cleaning, Visualization

Data Visualization

I used Folium Library for visualize obtained data locations on a map. Kyiv Center was marked as a red circle and each location within 12 kilometer radius that meets search criteria “food” was marked on a map as a green circle with a name displayed if you click on a circle.


Татарка
Поділ
Щекавиця
172 m
Контрактова
площа
Труханів
острів
Подільський район
Лук'янівська
Кудрявець
Верхня
станція
ПАТ НВО
«Київський
завод автоматики»
Обсерваторна
Набережне шосе
Десенка (Чортолії)
Долобецький
острів
Матвіївська затока
Дніпро
Паркова дорога
Перемоги проспект
Політехнічний
інститут
Олеся Гончара вулиця
Київ
Незалежності
Хрещатик
Борщагівська вулиця
Маріїнський
парк
Дніпровський район
Липки
Театральна
Університет
Арсенальна
Шевченківський район
Голосіївський район
Вокзальна
Київ-Пасажирський
Площа
Льва Толстого
Клов
Кловський узвіз
Московська вулиця
Дніпро
Дніпровський узвіз
Вічної
Слави
парк
Метро-міст
Мечникова вулиця
Саксаганського вулиця
Жилянська вулиця
Кловська
Юліуса Фучика вулиця
Національний
спортивний
«Олімпійський»
Черепанова
гора
185 m
Солом'янка

Exploratory Data Analysis

Since 6 km in radius around Kreschatik Street there many restaurants, I tried to find most optimal location for it. We would also prefer locations as close to Kreschatik Street as possible. I divided area around Kyiv Center into grids up to 6 km radius and I tried to find areas with least number of restaurants in those grids. I created a grid of cells covering our area of interest which is aproximately 12x12 kilometers centered around Kreschatik Street.

Exploratory Data Analysis

I used pyproj package in order to convert geographic latitude/longitude values of Kyiv center to native map projection (x,y) coordinates and vice versa

```
KyivCenter longitude=30.5234, latitude=50.4501
KyivCenter UTM X=1599401.2120611041, Y=5704805.204621618
KyivCenter longitude=30.523399999999995, latitude=50.450099999999999
```

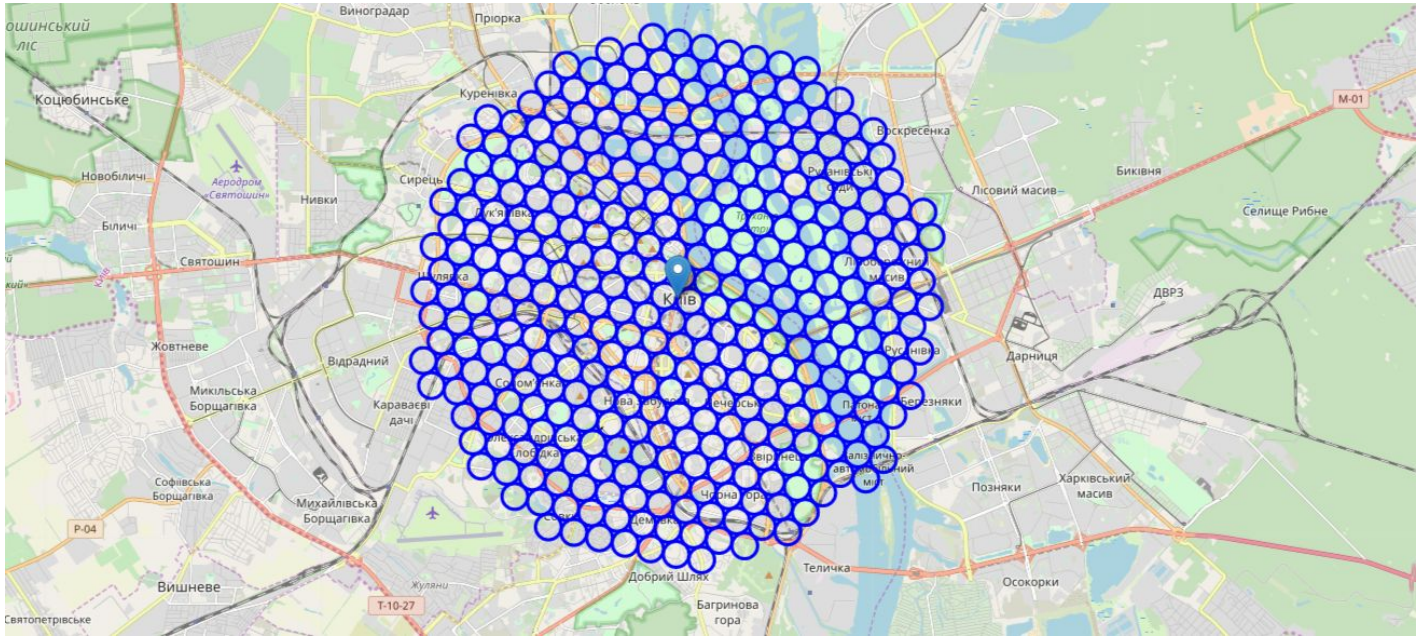
Exploratory Data Analysis

Package shapely.geometry was used to construct a hexagonal grid of cells. I offset every other row, and adjusted vertical row spacing so that every cell center is equally distant from all its neighbors.

Each candidate neighbour center had a radius 300 m.

As a result, 364 candidate neighborhood centers were generated.

Exploratory Data Analysis



364 candidate neighborhood centers were generated

Exploratory Data Analysis

For each cell out of 364 candidate neighborhood centers we obtained a location address along with location latitude, longitude, their native map projection (x,y) coordinates, and finally their distances from Kyiv Center (Kreschatik Street). A head of this table is presented here:

	Address	Latitude	Longitude	X	Y	Distance from center
0	Yabluneva St, 9A, Kyiv, Ukraine, 02000	50.40390348631848	30.482402018977115	1597601.2120611041	5699089.43695664	5992.495306631506
1	Kramatorska St, 10A, Kyiv, Ukraine, 02000	50.40279322769645	30.490538047319937	1598201.2120611041	5699089.43695664	5840.3767001795895
2	Horysta St, 14, Kyiv, Ukraine, 02000	50.40168241763217	30.498673564992913	1598801.2120611041	5699089.43695664	5747.173218200459
3	Avtostoianka, Kyiv, Ukraine, 02000	50.40057105621086	30.506808571784475	1599401.2120611041	5699089.43695664	5715.767664977349
4	Viktora Zabily St, 6, Kyiv, Ukraine, 02000	50.39945914351774	30.514943067483152	1600001.2120611041	5699089.43695664	5747.173218200459
5	Ural's'kyi Ln, 26, Kyiv, Ukraine, 02000	50.39834667963813	30.52307705187758	1600601.2120611041	5699089.43695664	5840.3767001795895
6	Nauky Ave, 25, Kyiv, Ukraine, 02000	50.397233664657335	30.53121052475647	1601201.2120611041	5699089.43695664	5992.495306631506
7	Kadets'kyi Hai St, 13, Kyiv, Ukraine, 02000	50.41007144767082	30.471700208545634	1596701.2120611041	5699609.052198911	5855.7663887829085
8	Park, Przheval's'koho St, 15, Kyiv, Ukraine, 02000	50.408961839950514	30.479837714661734	1597301.2120611041	5699609.052198911	5604.462507680789
9	Volodymyra Brozhka St, 136, Kyiv, Ukraine, 02000	50.4078516805807	30.487974710259515	1597901.2120611041	5699609.052198911	5408.32691319595

Exploratory Data Analysis

The next step, for each out of 364 candidate neighbourhood centers the number of restaurants was calculated. Each location that had in a category description words such as: 'restaurant', 'diner', 'taverna', 'steakhouse' where selected.

As a result of this analysis total number of restaurants identified was 1889. And the average number of restaurants in each neighborhood was 4.7

```
Total number of restaurants: 1889
Average number of restaurants in neighborhood: 4.725274725274725
```

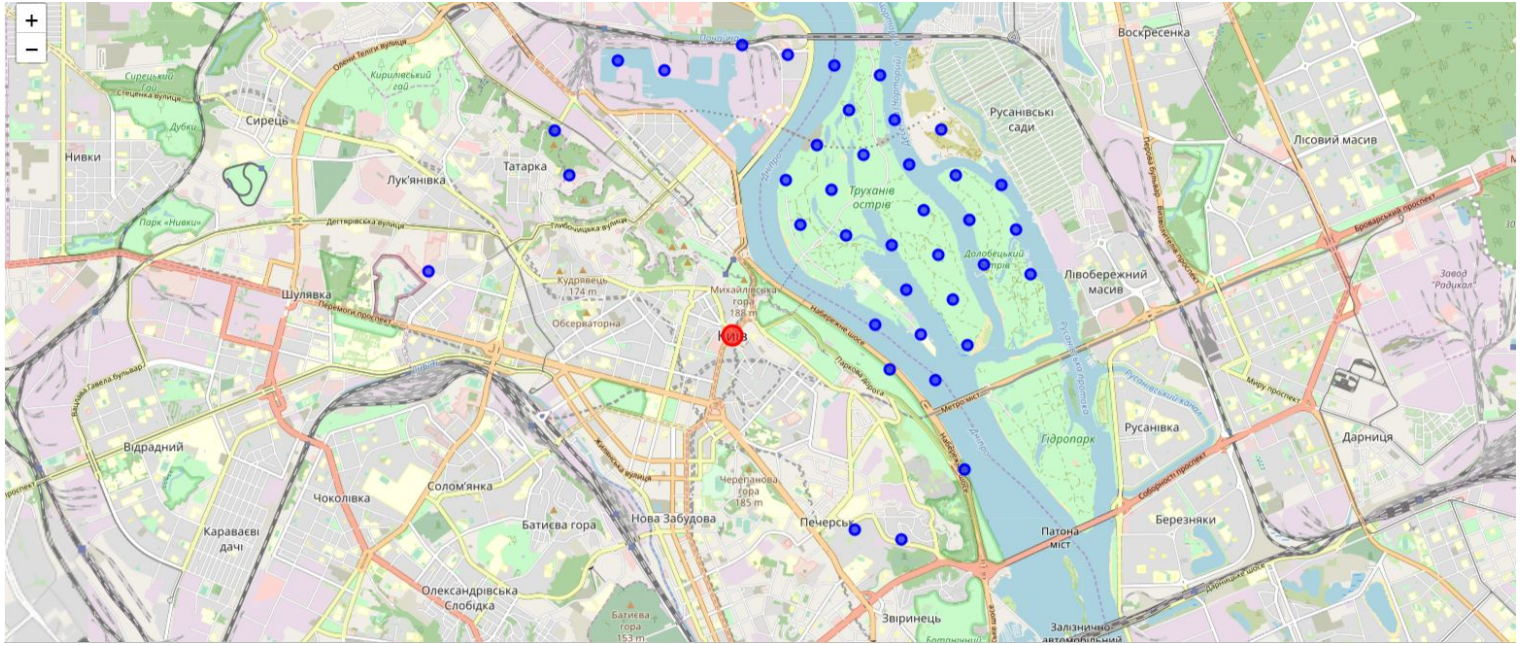
Exploratory Data Analysis

		Address	Latitude	Longitude	X	Y	Distance from center	Restaurants in area
11	10	oad, Kyiv, Ukraine, 02000	50.454086481172624	30.5630644787842	1602101.2120611041	5705844.435106159	2893.095228297951	0
12	11	St, 2, Kyiv, Ukraine, 02000	50.46805916660873	30.495349994414305	1597001.2120611041	5706364.05034843	2861.8176042509835	0
13	12	kova, Kyiv, Ukraine, 02000	50.462492738719014	30.5360774765274	1600001.2120611041	5706364.05034843	1670.3293088492576	0
14	13	/s'ka, Kyiv, Ukraine, 02000	50.46137779590324	30.5442214328843	1600601.2120611041	5706364.05034843	1967.2315572908133	0
15	14	oad, Kyiv, Ukraine, 02000	50.460262300874675	30.552364875391017	1601201.2120611041	5706364.05034843	2381.1761799583073	0
16	15	oad, Kyiv, Ukraine, 02000	50.4591462537 1903	30.560507803835637	1601801.2120611041	5706364.05034843	2861.8176042509835	0
17	16	rom, Kyiv, Ukraine, 02000	50.45802965452203	30.568650218006344	1602401.2120611041	5706364.05034843	3380.8283008755175	0
18	17	oad, Kyiv, Ukraine, 02000	50.45691250336945	30.576792117691394	1603001.2120611041	5706364.05034843	3923.009049186713	0
19	18	ı, 19, Kyiv, Ukraine, 02000	50.473118149606144	30.492785099665888	1596701.2120611041	5706883.6655907	3407.3450074798147	0
20	19	kova, Kyiv, Ukraine, 02000	50.467552217902906	30.53351743471251	1599701.2120611041	5706883.6655907	2099.999999999433	0
21	20	oad, Kyiv, Ukraine, 02000	50.466437373957376	30.541662361472977	1600301.2120611041	5706883.6655907	2264.9503305806993	0
22	21	oad, Kyiv, Ukraine, 02000	50.46420602914666	30.557950673047486	1601501.2120611041	5706883.6655907	2954.657340538429	0
23	22	oad, Kyiv, Ukraine, 02000	50.46308952845293	30.56609405743759	1602101.2120611041	5706883.6655907	3407.3450074798147	0
24	23	oad, Kyiv, Ukraine, 02000	50.461972475681335	30.57423692728046	1602701.2120611041	5706883.6655907	3899.999999999695	0
25	24	idge, Kyiv, Ukraine, 02000	50.47149695472203	30.53910283346351	1600001.2120611041	5707403.2808329705	2666.458325194206	0
26	25	idge, Kyiv, Ukraine, 02000	50.47038165725797	30.547248216928146	1600601.2120611041	5707403.2808329705	2861.8176042503983	0
27	26	/s'ka, Kyiv, Ukraine, 02000	50.469265807422175	30.555393086207914	1601201.2120611041	5707403.2808329705	3160.6961258554243	0
28	27	oad, Kyiv, Ukraine, 02000	50.46814940530037	30.563537441090784	1601801.2120611041	5707403.2808329705	3536.947836765124	0
29	28	va, 1, Kyiv, Ukraine, 02000	50.46703245097836	30.57168128136483	1602401.2120611041	5707403.2808329705	3968.6269665965697	0
30	29	12A, Kyiv, Ukraine, 02000	50.4810118058233	30.503952293012432	1597301.2120611041	5707922.896075241	3758.9892258421737	0
31	30	ı, 19, Kyiv, Ukraine, 02000	50.47989881807806	30.512100702227904	1597901.2120611041	5707922.896075241	3459.768778400884	0
32	31	oad, Kyiv, Ukraine, 02000	50.47544133958508	30.544689202997517	1600301.2120611041	5707922.896075241	3244.996147917212	0
33	32	idge, Kyiv, Ukraine, 02000	50.47432558851222	30.552835043105	1600901.2120611041	5707922.896075241	3459.768778400884	0
34	33	idge, Kyiv, Ukraine, 02000	50.473209285031	30.560980368754098	1601501.2120611041	5707922.896075241	3758.9892258421737	0
35	34	ation, Kyiv, Ukraine, 02000	50.482730671171716	30.525834567189943	1598801.2120611041	5708442.511317512	3686.461718233052	0
36	35	t, 21, Kyiv, Ukraine, 02000	50.481616124249314	30.5339824068016	1599401.2120611041	5708442.511317512	3637.306695894338	0
37	36	iv St, Kyiv, Ukraine, 02000	50.48050102462464	30.542129732317967	1600001.2120611041	5708442.511317512	3686.461718233052	0
38	37	/s'ka, Kyiv, Ukraine, 02000	50.47938537238343	30.5502765435267	1600601.2120611041	5708442.511317512	3830.1436004408224	0

Our interest lies in selection of candidate neighbour centers that had no restaurants.

38 such candidate neighbour centers were identified.

Exploratory Data Analysis



38 candidate neighbour centers with no restaurants

Results and Discussion

Our analysis shows that there are many restaurants near Kreschatik Street and we were mainly concerned about finding best suitable location that is not already crowded with restaurants and is nearest to Kreschatik Street. Total number (100 in our initial area of interest which was within a radius of 6 km around the cental streen in Kyiv, Kreschatik Street), there are large pockets of low restaurant density fairly close to Kreschatik Street. Highest concentration of restaurants was detected near Kyiv Center on the right bank of Dnipro River. The popularity of this area can be explained by a few factors: 1. This area is a business center in Kyiv where most successful businesses and also governmental agencies are located. 2. The second factor is a proximity to majority of expansive hotels make those restaurants convenient for customers.

Results and Discussion

We also found out the neighbourhoods with no restaurants and distance from Kreschatik Street less than 6 km and found out 38 such suitable neighbourhoods. The majority of recommended neighbourhoods for opening a new restaurant are located on the Trukhaniv Island. Perhaps due to complicated logistics business owners are reluctant to open a new business on the Trikhaniv Island. On the other hand, Trukhaniv Island is popular among tourists and it might eventually turn out to be a profitable venture.

Results and Discussion

The purpose of this analysis was to provide information on areas close to Kreschatik Street (the center of Kyiv) and not overcrowded with restaurants. It is entirely possible that there is a very good reason for small number of restaurants in any of those areas, reasons which would make them unsuitable for a new restaurant regardless of lack of competition in the area. Recommended zones should therefore be considered only as a starting point for more detailed analysis, which could eventually result in location which has not only no nearby competition, but also other factors taken into account and all other relevant conditions met.

Conclusion

The purpose of this project was to identify Kyiv Center areas close to Kreschatik Street and with low number of restaurants in order to aid stakeholders in narrowing down the search for optimal location for a new restaurant. By calculating restaurant density distribution from Foursquare data we have first identified co-ordinates and neighbourhoods that justify further analysis and then generated extensive collection of locations which satisfy some basic requirements regarding existing nearby restaurants.Final decision on optimal restaurant location will be made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone, taking into consideration additional factors like attractiveness of each location (proximity to park or local attractions), levels of noise / proximity to major roads, real estate availability, prices, social and economic dynamics of every neighborhood etc.