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City environment and quality of living analysis

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1. Introduction and problem description

Quality of Life (QoL) is a very complex term and concept described in different approaches and methodologies. Quality of life is the general well-being of individuals and societies, outlining negative and positive features of life. It observes life satisfaction, including everything from physical health, family, education, employment, wealth, safety, security to freedom, religious beliefs and the environment[1].

City environment and infrastructure are the most important domains influencing citizens' quality of life. For example, in Merser[2] report defining quality of living ranking of 231 cities of the world there are several infrastructural and environmental factors for QoL evaluation:

- Recreation
- Housing
- Consumer goods availability
- Public services and transport
- Natural environment
- Socio-cultural environment
- School and education
- Medical and health consideration.

On the other hand, continuous improvements of living standards through city infrastructure and environment development is one of the important goals of local city governments or city councils.

To determine the successful city development strategy or long-term city development program you need to have answers to several questions:

- What is the current level of city infrastructure and environment development?
- What is the best practice in other cities or what are the main environmental and infrastructural characteristics of cities with high QoL rank?
- What is the difference between my city and the city chosen as standard?
- What are the priorities for my city development to increase citizens quality of life?

In my research I will try to find out an approach that could help to answer these questions.

First of all, I will examine the key characteristics of cities environment of cities from Mercer's research. For example, we could cluster cities from 231 Mercer's list using Foursquare API and K-Means methodology.

Then I would try to examine characteristics of a city environment for cities in different clusters and ranks and will try to understand what is the difference between environment characteristics of these cities.

I assume that my analysis could be interesting for local city government representatives or consulting firms providing services for city development program formation.

2. Data description

To perform analysis described in previous section the following data will be used.

1. As I mentioned before, I will explore cities from the Mercer's report with cities ranking by quality of living. I will build corresponding data frame using published on their site. It would be a table containing Country or region name, City name and QoL Rank.

2. For cities infrastructure and environment exploration I will use the Foursquare data and API and pay special attention to different venue types density and their distribution in the city.

3. Also I need to define geographical coordinates of cities. I found very good free World Cities Database[3] on simplemaps site containing geographical coordinates and other useful data (for example, population) of about 13 thousand cities in the world.

4. Also I may use some other sources to refine the collected data or prepare it manually.

3. Methodology

For my research I used several sources and libraries listed below.

1. GitHub repository the world's largest community of developers to discover, share, and build better software for my study representing and further discussions[4]. I placed here final data frames of my study.

(231, 16)

	Cluster	City	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	Rank	Country/Region	lat	lng	population
216	3	Vienna	College & University	Food	Professional & Other Places	Shop & Service	Arts & Entertainment	Travel & Transport	Outdoors & Recreation	Nightlife Spot	Residence	1	Austria	48.2000	16.3666	2400000.0
230	3	Zürich	Food	Professional & Other Places	College & University	Shop & Service	Nightlife Spot	Travel & Transport	Outdoors & Recreation	Arts & Entertainment	Residence	2	Switzerland	47.3800	8.5500	1108000.0
16	3	Auckland	Food	Professional & Other Places	Shop & Service	Travel & Transport	Nightlife Spot	Arts & Entertainment	Outdoors & Recreation	College & University	Residence	3	New Zealand	-36.8481	174.7630	1377200.0
214	2	Vancouver	Shop & Service	Professional & Other Places	Food	Arts & Entertainment	Residence	Travel & Transport	Outdoors & Recreation	Nightlife Spot	College & University	3	Canada	49.2734	-123.1216	2313328.0
143	2	Munich	Shop & Service	Nightlife Spot	Food	Professional & Other Places	Travel & Transport	Arts & Entertainment	Residence	Outdoors & Recreation	College & University	3	Germany	48.1299	11.5750	1275000.0

(231, 16)

	Cluster	City	Arts & Entertainment	College & University	Food	Nightlife Spot	Outdoors & Recreation	Professional & Other Places	Residence	Shop & Service	Travel & Transport	Rank	Country/Region	lat	lng	population
216	3	Vienna	0.086331	0.273381	0.215827	0.021583	0.043165	0.165468	0.000000	0.129496	0.064748	1	Austria	48.2000	16.3666	2400000.0
230	3	Zürich	0.021277	0.191489	0.276596	0.063830	0.042553	0.212766	0.000000	0.148936	0.042553	2	Switzerland	47.3800	8.5500	1108000.0
16	3	Auckland	0.070588	0.041176	0.247059	0.076471	0.041176	0.229412	0.023529	0.170588	0.100000	3	New Zealand	-36.8481	174.7630	1377200.0
214	2	Vancouver	0.088608	0.000000	0.164557	0.000000	0.012658	0.291139	0.037975	0.379747	0.025316	3	Canada	49.2734	-123.1216	2313328.0
143	2	Munich	0.041322	0.000000	0.115702	0.140496	0.016529	0.107438	0.016529	0.495868	0.066116	3	Germany	48.1299	11.5750	1275000.0

2. python folium library for study results visualization[5]. I used it for final results visualization.

3. pandas library as an open source, BSD-licensed library providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language[6]

4. numpy library to handle data in a vectorized manner[7]

5. Very cool library with beautiful soup as a library for pulling data out of HTML and XML files[8]

6. Fantastic Matplotlib library and associated plotting modules which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms[9]

7. I used Foursquare API[10] the most trusted, independent location data and technology platform to explore more than 30 000 venues of 231 cities with radius 3000 meters. Here is venues count by venue types I studied.

```
Venue Type
Professional & Other Places    7987
Shop & Service                 6637
Food                           5937
Travel & Transport             2619
Outdoors & Recreation          1720
Nightlife Spot                 1588
Arts & Entertainment           1510
College & University           1096
Residence                      1044
Event                            33
```
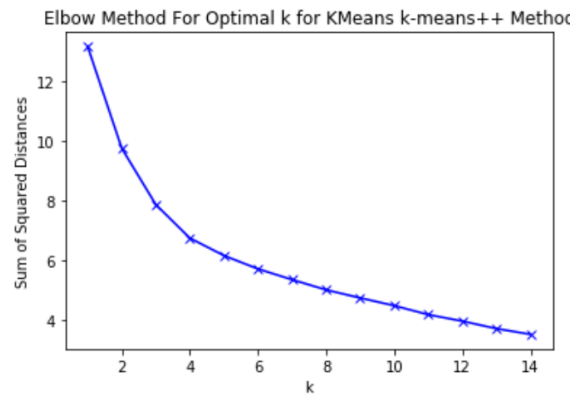
I decided to make an analysis of 231 cities ranked by Mercer using these venue types from Foursquare methodology excepting Event type as not representative. As the final result I formed a table with most common venues for explored cities (as shown below).

(231, 16)

	Cluster	City	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
0	3	Aberdeen	College & University	Shop & Service	Professional & Other Places	Outdoors & Recreation	Travel & Transport	Food	Residence	Nightlife Spot	Arts & Entertainment
1	1	Abidjan	Professional & Other Places	Shop & Service	College & University	Food	Travel & Transport	Arts & Entertainment	Nightlife Spot	Residence	Outdoors & Recreation
2	1	Abu Dhabi	Professional & Other Places	Shop & Service	Food	Outdoors & Recreation	Travel & Transport	Residence	Arts & Entertainment	Nightlife Spot	College & University
3	1	Abuja	Professional & Other Places	Food	Nightlife Spot	Shop & Service	Outdoors & Recreation	Travel & Transport	Residence	Arts & Entertainment	College & University
4	1	Accra	Professional & Other Places	Shop & Service	Nightlife Spot	Food	Travel & Transport	College & University	Arts & Entertainment	Residence	Outdoors & Recreation

8. I also tried to use two Foursquare method of data gathering about locations: explore and search. The search method is more appropriate as it gives more venues for analysis, 30 000+ instead of 18 000+ when I used search method.

4

9. I used sklearn.cluster simple and efficient tools for data mining and data analysis[11] for clustering 231 cities using KMeans method after selecting appropriate number of clusters 4 as shown below (see resulting plot with elbow method).

Elbow Method For Optimal k for KMeans k-means++ Method

10. After 4 clusters examination I defined 4 explicitly different clusters:

Cluster 0. FOR FOOD&SHOPPING
Cluster 1. ONLY FOR WORKING (but you can eat here and make some sopping)
Cluster 2. FIRST SHOPPING (than working)
Cluster 3. MIXED (you can do here what you want)

4. Results

4.1 Resulting dataframes

As I mentioned before as a main result of my study, I have data frames containing detailed information about venues for 231 cities from quality of life ranking research provided by Mercer. These tables contain information about more than 30 000 of venues gathered and consolidated using Foursquare API. First table has information about the most common venues, venues frequency, quality of life rank, country, geographical coordinates and population.

(231, 16)

	Cluster	City	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	Rank	Country/Region	lat	lng	population
216	3	Vienna	College & University	Food	Professional & Other Places	Shop & Service	Arts & Entertainment	Travel & Transport	Outdoors & Recreation	Nightlife Spot	Residence	1	Austria	48.2000	16.3666	2400000.0
230	3	Zürich	Food	Professional & Other Places	College & University	Shop & Service	Nightlife Spot	Travel & Transport	Outdoors & Recreation	Arts & Entertainment	Residence	2	Switzerland	47.3800	8.5500	1108000.0
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214	2	Vancouver	Shop & Service	Professional & Other Places	Food	Arts & Entertainment	Residence	Travel & Transport	Outdoors & Recreation	Nightlife Spot	College & University	3	Canada	49.2734	-123.1216	2313328.0
143	2	Munich	Shop & Service	Nightlife Spot	Food	Professional & Other Places	Travel & Transport	Arts & Entertainment	Residence	Outdoors & Recreation	College & University	3	Germany	48.1299	11.5750	1275000.0

(231, 16)

	Cluster	City	Arts & Entertainment	College & University	Food	Nightlife Spot	Outdoors & Recreation	Professional & Other Places	Residence	Shop & Service	Travel & Transport	Rank	Country/Region	lat	lng	population
216	3	Vienna	0.086331	0.273381	0.215827	0.021583	0.043165	0.165468	0.000000	0.129496	0.064748	1	Austria	48.2000	16.3666	2400000.0
230	3	Zürich	0.021277	0.191489	0.276596	0.063830	0.042553	0.212766	0.000000	0.148936	0.042553	2	Switzerland	47.3800	8.5500	1108000.0
16	3	Auckland	0.070588	0.041176	0.247059	0.076471	0.041176	0.229412	0.023529	0.170588	0.100000	3	New Zealand	-36.8481	174.7630	1377200.0
214	2	Vancouver	0.088608	0.000000	0.164557	0.000000	0.012658	0.291139	0.037975	0.379747	0.025316	3	Canada	49.2734	-123.1216	2313328.0
143	2	Munich	0.041322	0.000000	0.115702	0.140496	0.016529	0.107438	0.016529	0.495868	0.066116	3	Germany	48.1299	11.5750	1275000.0

These cities were clustered using K-Means method into 4 different clusters as shown below.

4.2 World map with clustered 231 cities

4.3 Cluster 0. FOR FOOD&SHOPPING

	Cluster	Cluster	City	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
7	0	0	Algiers	Food	Professional & Other Places	Shop & Service
9	0	0	Amman	Food	Shop & Service	Travel & Transport
24	0	0	Barcelona	Food	Shop & Service	Travel & Transport
26	0	0	Beijing	Food	Shop & Service	Professional & Other Places
38	0	0	Brasilia	Food	Shop & Service	Professional & Other Places
44	0	0	Budapest	Travel & Transport	Shop & Service	Food
46	0	0	Busan	Food	Shop & Service	Arts & Entertainment
52	0	0	Casablanca	Food	Professional & Other Places	Travel & Transport
53	0	0	Chengdu	Food	Travel & Transport	Shop & Service
56	0	0	Chongqing	Food	Travel & Transport	Shop & Service
67	0	0	Djibouti	Food	Professional & Other Places	Travel & Transport
68	0	0	Doha	Food	Shop & Service	Arts & Entertainment
70	0	0	Dubai	Food	Shop & Service	Residence
78	0	0	Geneva	Food	Shop & Service	Professional & Other Places
80	0	0	Guangzhou	Food	Shop & Service	Professional & Other Places
83	0	0	Hanoi	Food	Shop & Service	Travel & Transport
85	0	0	Havana	Food	Travel & Transport	Arts & Entertainment
88	0	0	Hong Kong	Food	Shop & Service	Professional & Other Places
95	0	0	Jeddah	Food	Shop & Service	Professional & Other Places
96	0	0	Jilin	Food	Travel & Transport	Shop & Service
105	0	0	Kobe	Food	Nightlife Spot	Shop & Service
107	0	0	Kuala Lumpur	Food	Shop & Service	Professional & Other Places
113	0	0	Leipzig	Shop & Service	Food	Professional & Other Places
117	0	0	Lisbon	Food	Professional & Other Places	Shop & Service
125	0	0	Lyon	Food	Nightlife Spot	Shop & Service
130	0	0	Manila	Food	Travel & Transport	Shop & Service
146	0	0	Nagoya	Food	Shop & Service	Nightlife Spot
148	0	0	Nanjing	Food	Travel & Transport	Shop & Service
164	0	0	Phnom Penh	Food	Shop & Service	Travel & Transport
172	0	0	Qingdao	Food	Travel & Transport	Shop & Service
174	0	0	Rabat	Food	Travel & Transport	Professional & Other Places
189	0	0	Shanghai	Shop & Service	Food	Professional & Other Places
190	0	0	Shenyang	Food	Shop & Service	Travel & Transport
191	0	0	Shenzhen	Food	Professional & Other Places	Shop & Service
192	0	0	Singapore	Food	Shop & Service	Professional & Other Places
201	0	0	Taichung	Food	Shop & Service	Professional & Other Places
202	0	0	Taipei	Food	Shop & Service	Professional & Other Places
212	0	0	Tripoli	Food	Shop & Service	Travel & Transport
217	0	0	Vientiane	Food	Professional & Other Places	Travel & Transport
224	0	0	Xian	Food	Travel & Transport	Shop & Service
227	0	0	Yerevan	Shop & Service	Food	Professional & Other Places

4.4 Cluster 1. ONLY FOR WORKING

	Cluster	Cluster	City	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4
1	1	1	Abidjan	Professional & Other Places	Shop & Service	College & University	
2	1	1	Abu Dhabi	Professional & Other Places	Shop & Service	Food	
3	1	1	Abuja	Professional & Other Places	Food	Nightlife Spot	
4	1	1	Accra	Professional & Other Places	Shop & Service	Nightlife Spot	
6	1	1	Adelaide	Professional & Other Places	Shop & Service	Food	
10	1	1	Amsterdam	Professional & Other Places	Food	Travel & Transport	
31	1	1	Berlin	Professional & Other Places	Shop & Service	Food	
49	1	1	Canberra	Professional & Other Places	Outdoors & Recreation	Arts & Entertainment	
50	1	1	Cape Town	Professional & Other Places	Shop & Service	Arts & Entertainment	
55	1	1	Chicago	Professional & Other Places	Shop & Service	Travel & Transport	
57	1	1	Colombo	Professional & Other Places	Travel & Transport	Food	
58	1	1	Conakry	Professional & Other Places	Travel & Transport	Food	
59	1	1	Copenhagen	Professional & Other Places	Travel & Transport	Food	
61	1	1	Dakar	Professional & Other Places	Food	Shop & Service	
65	1	1	Detroit	Professional & Other Places	Shop & Service	Travel & Transport	
66	1	1	Dhaka	Professional & Other Places	Food	Shop & Service	
71	1	1	Dublin	Professional & Other Places	Outdoors & Recreation	Shop & Service	
75	1	1	Edinburgh	Professional & Other Places	Travel & Transport	Nightlife Spot	
76	1	1	Frankfurt	Professional & Other Places	Shop & Service	Outdoors & Recreation	
77	1	1	Gaborone	Professional & Other Places	Shop & Service	Food	
82	1	1	Hamburg	Professional & Other Places	Shop & Service	Food	
84	1	1	Harare	Professional & Other Places	Shop & Service	Food	
89	1	1	Honolulu	Professional & Other Places	Outdoors & Recreation	Travel & Transport	
93	1	1	Istanbul	Professional & Other Places	College & University	Food	
94	1	1	Jakarta	Professional & Other Places	Food	Outdoors & Recreation	
100	1	1	Karachi	Professional & Other Places	Shop & Service	Food	
102	1	1	Kigali	Professional & Other Places	Shop & Service	Food	
103	1	1	Kingston	Professional & Other Places	Shop & Service	Travel & Transport	
111	1	1	Lagos	Professional & Other Places	Shop & Service	Travel & Transport	
131	1	1	Maputo	Professional & Other Places	Shop & Service	Food	
135	1	1	Milan	Professional & Other Places	Shop & Service	Food	
137	1	1	Minsk	Professional & Other Places	Arts & Entertainment	College & University	
138	1	1	Monterrey	Professional & Other Places	Shop & Service	Food	
144	1	1	Muscat	Professional & Other Places	Food	Shop & Service	
152	1	1	Niamey	Professional & Other Places	Food	Shop & Service	
160	1	1	Panama City	Professional & Other Places	Shop & Service	Food	
162	1	1	Perth	Professional & Other Places	Travel & Transport	Outdoors & Recreation	
168	1	1	Port au Prince	Professional & Other Places	Shop & Service	Food	
169	1	1	Port of Spain	Professional & Other Places	Travel & Transport	Shop & Service	
170	1	1	Prague	Professional & Other Places	Shop & Service	College & University	
173	1	1	Quito	Professional & Other Places	Food	Shop & Service	
176	1	1	Rio de Janeiro	Professional & Other Places	Shop & Service	Food	
182	1	1	San Salvador	Professional & Other Places	Shop & Service	Food	
183	1	1	Sana'a	Professional & Other Places	Food	Shop & Service	
185	1	1	Santo Domingo	Professional & Other Places	Shop & Service	Food	
194	1	1	Sofia	Professional & Other Places	Arts & Entertainment	Food	
197	1	1	Stockholm	Professional & Other Places	Food	Shop & Service	
200	1	1	São Paulo	Professional & Other Places	Shop & Service	Residence	

4.5   Cluster 2. FIRST SHOPPING (than working)

	Cluster	Cluster	City	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	
8	2	2	Almaty	Shop & Service	Professional & Other Places	Food	
13	2	2	Asunción	Professional & Other Places	Shop & Service	Food	
14	2	2	Athens	Shop & Service	Professional & Other Places	Food	
15	2	2	Atlanta	Shop & Service	Professional & Other Places	Food	
20	2	2	Bandar Seri Begawan	Food	Shop & Service	Professional & Other Places	
21	2	2	Bangkok	Shop & Service	Professional & Other Places	Food	
25	2	2	Basel	Shop & Service	Food	Professional & Other Places	
29	2	2	Belgrade	Shop & Service	Food	Professional & Other Places	
30	2	2	Bengaluru	Shop & Service	Professional & Other Places	Food	
34	2	2	Bishkek	Shop & Service	Professional & Other Places	Residence	
36	2	2	Bogotá	Professional & Other Places	Shop & Service	Food	
37	2	2	Boston	Shop & Service	Professional & Other Places	Outdoors & Recreation	
45	2	2	Buenos Aires	Shop & Service	Professional & Other Places	Food	
47	2	2	Cairo	Shop & Service	Professional & Other Places	Food	
48	2	2	Calgary	Shop & Service	Food	Professional & Other Places	
54	2	2	Chennai	Shop & Service	Food	Professional & Other Places	
62	2	2	Dallas	Shop & Service	Professional & Other Places	Food	
74	2	2	Düsseldorf	Shop & Service	Professional & Other Places	Nightlife Spot	
81	2	2	Guatemala City	Shop & Service	Professional & Other Places	Food	
90	2	2	Houston	Shop & Service	Food	Professional & Other Places	
91	2	2	Hyderabad	Shop & Service	Food	Professional & Other Places	
101	2	2	Khartoum	Professional & Other Places	Shop & Service	Food	
106	2	2	Kolkata	Shop & Service	Food	Professional & Other Places	
108	2	2	Kuwait City	Shop & Service	Professional & Other Places	Food	
109	2	2	Kyiv	Shop & Service	Professional & Other Places	Food	
122	2	2	Luanda	Shop & Service	Professional & Other Places	Food	
123	2	2	Lusaka	Shop & Service	Professional & Other Places	Food	
124	2	2	Luxembourg	Shop & Service	Food	Professional & Other Places	
128	2	2	Manama	Professional & Other Places	Shop & Service	Food	
133	2	2	Mexico City	Shop & Service	Food	Professional & Other Places	
139	2	2	Montevideo	Shop & Service	Professional & Other Places	Food	
142	2	2	Mumbai	Shop & Service	Professional & Other Places	Food	
143	2	2	Munich	Shop & Service	Nightlife Spot	Food	P
154	2	2	Noumea	Shop & Service	Professional & Other Places	Food	
155	2	2	Nuremburg	Shop & Service	Food	Professional & Other Places	
158	2	2	Ottawa	Shop & Service	Professional & Other Places	Food	
163	2	2	Philadelphia	Shop & Service	Professional & Other Places	Food	
166	2	2	Pointe-à-Pitre	Shop & Service	Professional & Other Places	Food	
167	2	2	Port Louis	Shop & Service	Professional & Other Places	Food	
177	2	2	Riyadh	Shop & Service	Professional & Other Places	Arts & Entertainment	
180	2	2	San José	Shop & Service	Travel & Transport	Professional & Other Places	
186	2	2	Sarajevo	Shop & Service	Professional & Other Places	Food	
188	2	2	Seoul	Shop & Service	Food	Professional & Other Places	
199	2	2	Sydney	Professional & Other Places	Shop & Service	Food	
204	2	2	Tashkent	Shop & Service	Professional & Other Places	Food	
205	2	2	Tbilisi	Professional & Other Places	Shop & Service	Travel & Transport	
206	2	2	Tegucigalpa	Shop & Service	Professional & Other Places	Food	
207	2	2	Tehran	Shop & Service	Professional & Other Places	Food	
208	2	2	Tel Aviv	Shop & Service	Food	Residence	P
213	2	2	Tunis	Professional & Other Places	Shop & Service	Food	
214	2	2	Vancouver	Shop & Service	Professional & Other Places	Food	
219	2	2	Warsaw	Shop & Service	Professional & Other Places	Travel & Transport	
221	2	2	Wellington	Shop & Service	Professional & Other Places	Travel & Transport	
222	2	2	Windhoek	Shop & Service	Food	Professional & Other Places	
226	2	2	Yaounde	Shop & Service	Professional & Other Places	Food	

4.6   Cluster 3. MIXED (you can do here what you want)

	Cluster	Cluster	City	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
0	3	3	Aberdeen	College & University	Shop & Service	Professional & Other Places
5	3	3	Addis Ababa	Professional & Other Places	Food	Shop & Service
11	3	3	Antananarivo	Food	Professional & Other Places	Shop & Service
12	3	3	Ashgabat	Professional & Other Places	Shop & Service	Food
16	3	3	Auckland	Food	Professional & Other Places	Shop & Service
17	3	3	Baghdad	Professional & Other Places	Shop & Service	Food
18	3	3	Baku	Professional & Other Places	Shop & Service	Food
19	3	3	Bamako	Food	Professional & Other Places	Travel & Transport
22	3	3	Bangui	Professional & Other Places	Food	Travel & Transport
23	3	3	Banjul	Professional & Other Places	Food	Shop & Service
27	3	3	Beirut	Professional & Other Places	Shop & Service	Outdoors & Recreation
28	3	3	Belfast	Professional & Other Places	Shop & Service	Food
32	3	3	Bern	Shop & Service	Food	Professional & Other Places
33	3	3	Birmingham	Professional & Other Places	Food	Shop & Service
35	3	3	Blantyre	Professional & Other Places	Shop & Service	Food
39	3	3	Bratislava	Professional & Other Places	Shop & Service	Food
40	3	3	Brazzaville	Professional & Other Places	Food	Nightlife Spot
41	3	3	Brisbane	Professional & Other Places	Shop & Service	Nightlife Spot
42	3	3	Brussels	Travel & Transport	Professional & Other Places	Shop & Service
43	3	3	Bucharest	Professional & Other Places	Food	Nightlife Spot
51	3	3	Caracas	Professional & Other Places	Food	Shop & Service
60	3	3	Cotonou	Professional & Other Places	Shop & Service	Nightlife Spot
63	3	3	Damascus	Food	Shop & Service	Professional & Other Places
64	3	3	Dar es Salaam	Professional & Other Places	Shop & Service	Travel & Transport
69	3	3	Douala	Professional & Other Places	Shop & Service	Nightlife Spot
72	3	3	Durban	Professional & Other Places	College & University	Food
73	3	3	Dushanbe	Professional & Other Places	Food	Shop & Service
79	3	3	Glasgow	Professional & Other Places	College & University	Shop & Service
86	3	3	Helsinki	Professional & Other Places	Outdoors & Recreation	Shop & Service
87	3	3	Ho Chi Minh City	Food	Professional & Other Places	Shop & Service
...	...	...	...	...	...	...
153	3	3	Nouakchott	Professional & Other Places	Food	Shop & Service
156	3	3	Osaka	Shop & Service	Travel & Transport	Professional & Other Places
157	3	3	Oslo	Food	Professional & Other Places	Nightlife Spot
159	3	3	Ouagadougou	Professional & Other Places	Travel & Transport	Food
161	3	3	Paris	Professional & Other Places	Shop & Service	Food
165	3	3	Pittsburgh	Professional & Other Places	Travel & Transport	Shop & Service
171	3	3	Pune	Professional & Other Places	Shop & Service	Food
175	3	3	Riga	Professional & Other Places	Shop & Service	Food
178	3	3	Rome	Professional & Other Places	Travel & Transport	Shop & Service
179	3	3	San Francisco	Outdoors & Recreation	Residence	Travel & Transport
181	3	3	San Juan	Professional & Other Places	Food	Outdoors & Recreation
184	3	3	Santiago	College & University	Food	Professional & Other Places
187	3	3	Seattle	Residence	Professional & Other Places	Nightlife Spot
193	3	3	Skopje	Shop & Service	Professional & Other Places	Nightlife Spot
195	3	3	St. Louis	Professional & Other Places	Shop & Service	Food
196	3	3	St. Petersburg	Professional & Other Places	Arts & Entertainment	Shop & Service
198	3	3	Stuttgart	Shop & Service	Professional & Other Places	Food
203	3	3	Tallinn	Professional & Other Places	Shop & Service	College & University
209	3	3	Tirana	Professional & Other Places	Food	Arts & Entertainment
210	3	3	Tokyo	Arts & Entertainment	Outdoors & Recreation	Professional & Other Places
211	3	3	Toronto	Professional & Other Places	Shop & Service	Outdoors & Recreation
215	3	3	Victoria	Professional & Other Places	Shop & Service	Food
216	3	3	Vienna	College & University	Food	Professional & Other Places
218	3	3	Vilnius	Professional & Other Places	Shop & Service	Outdoors & Recreation
220	3	3	Washington	Professional & Other Places	Residence	Outdoors & Recreation
223	3	3	Wroclaw	Food	Nightlife Spot	Professional & Other Places
225	3	3	Yangon	Food	Professional & Other Places	Shop & Service
228	3	3	Yokohama	Food	Professional & Other Places	Outdoors & Recreation
229	3	3	Zagreb	Professional & Other Places	Shop & Service	Food
230	3	3	Zürich	Food	Professional & Other Places	College & University

5. Discussion

My initial expectation was that I could find any direct correlation between quality of living ranking and cities infrastructure development. But it is evident that for such a correlation finding more data about cities should be used. For example, when I used Foursquare API, my observation was that I have very small numbers of venues for certain cities e.g. for Dubai there are only 17 venues instead of Nassau city – 195. That means that a city should be covered by all territory not only by one location in city center with radius equals 3 km.

Also, I suppose that for such analysis another data should be used as additional leverage for correlation e.g. city population, city square and other data, for example city annual budget or GDP.

6. Conclusion

Developed approach for city infrastructure and environment analysis shows interesting results describing different city clusters around the world. It could be useful for the successful city development strategy or long-term city development program formulation when you need to have answers to several questions:

- What is the current level of city infrastructure and environment development?
- What is the best practice in other cities or what are the main environmental and infrastructural characteristics of cities with high quality of living rank?
- What is the difference between my city and the city chosen as standard?
- What are the priorities for my city development to increase citizens quality of life?

I assume that this approach could be interesting for local city government representatives or consulting firms providing services for city development program formation.

7. References

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