

The Battle of Neighborhoods (Week 2)

A description of the problem and a discussion of the background

Bengaluru (old name Bangalore) is IT hub of India. College grads migrate from different states to start their IT career in Bengaluru. 50% population of this city is migrant. Bengaluru comes in top 10 Indian cities for multilingual people. Because of massive development of IT industry in this city, there are other industries and businesses growing here like real state, hotel/hospitality industry, restaurants, e-Commerce and retail industry. Because of the diversity, different type of people like to spend their weekends and holidays differently, some people like visit restaurants and bars, some people like to spend time with family and kids in shopping malls and some people like to go for trips. If someone is looking to open a new business, a restaurant or superstore, s/he would need to understand population density of different neighborhoods of Bengaluru and already existing restaurants, bars and superstores.

A description of the data and how it will be used to solve the problem

I would collect population density of different neighborhood of Bengaluru. Using latitude and longitude for the neighborhood, I would explore them for restaurants/bars/superstore/malls with the help of Foursquare APIs. Higher population density with less number of restaurants/bars/superstore/malls would be the best places to start a new business.

Data Source

Bruhat Bengaluru Mahanagara Palike (BBMP) official website

http://bbmp.gov.in/documents/10180/460906/BBMPR_ward_master_BBMP+Restructuring+03-08-2015.pdf
(http://bbmp.gov.in/documents/10180/460906/BBMPR_ward_master_BBMP+Restructuring+03-08-2015.pdf)

Importing libraries to use in my analysis

```
In [174]: import pandas as pd
import requests
import folium # map rendering library
from geopy.geocoders import Nominatim # convert an address into latitude and longitude values
```

Importing data from local excel file

```
In [4]: df_data=pd.read_excel(r'C:\Users\sanjay_godiya\Desktop\MyDocs\DataScience\Lab_data\BBMP_Ward_Master_2011.xlsx',
                             sheet_name='Sheet1')
```

```
In [5]: df_data.head(10)
```

Out[5]:

	Ward_Name	Population_density_(persons_per_sq_km)
0	Kempegowda Ward	3182
1	Chowdeswari Ward	5635
2	Atturu	6606
3	Yelahanka Satellite Town	9224
4	Jakkuru	2215
5	Thanisandra	7161
6	Byatarayanapura	7198
7	Kodigehalli	12369
8	Vidyaranyapura	5753
9	Dodda Bommasandra	8673

```
In [6]: df_data.shape
```

Out[6]: (198, 2)

Defining a function to find latitude and longitude values of different neighbourhoods of Bangalore

```
In [8]: def getBlrData(ward_name,population_density):
        data=[]
        for name,density in zip (ward_name,population_density):
            row=[]
            address = name + ', Bangalore, India'
            geolocator = Nominatim(user_agent="ny_explorer")
            location = geolocator.geocode(address)
            if location is not None:
                lat = location.latitude
                long = location.longitude
                row.append(name)
                row.append(density)
                row.append(lat)
                row.append(long)
            data.append(row)
        return(data)
```

```
In [9]: df_data['Ward_Name']=df_data['Ward_Name'].str.replace('Ward','')
df_data.columns=df_data.columns.str.strip()
blr_data=getBlrData(ward_name=df_data['Ward_Name'],
                    population_density=df_data['Population_density_(persons_per_sq_km)'])
```

```
In [10]: Bangalore_df=pd.DataFrame(blr_data,columns=['Neighbourhood','Population_density_(persons_per_sq_km)','Latitude','Longitude'])
Bangalore_df.dropna(how='any',inplace=True)
Bangalore_df['Population_density_(persons_per_sq_km)']=Bangalore_df['Population_density_(persons_per_sq_km)'].astype(int)
Bangalore_df.head()
```

Out[10]:

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude
0	Kempegowda	3182	13.109018	77.601900
1	Chowdeswari	5635	13.120459	77.579618
2	Atturu	6606	13.100409	77.858725
3	Yelahanka Satellite Town	9224	13.089139	77.582717
4	Jakkuru	2215	13.098320	77.625146

```
In [11]: Bangalore_df.shape
```

Out[11]: (168, 4)

```
In [12]: address = 'Bangalore, India'
geolocator = Nominatim(user_agent="ny_explorer")
location = geolocator.geocode(address)
blr_lat = location.latitude
blr_long = location.longitude
print('The geograpical coordinates of Bangalore are {}, {}'.format(blr_lat, blr_long))
```

The geograpical coordinates of Bangalore are 12.9791198, 77.5912997.

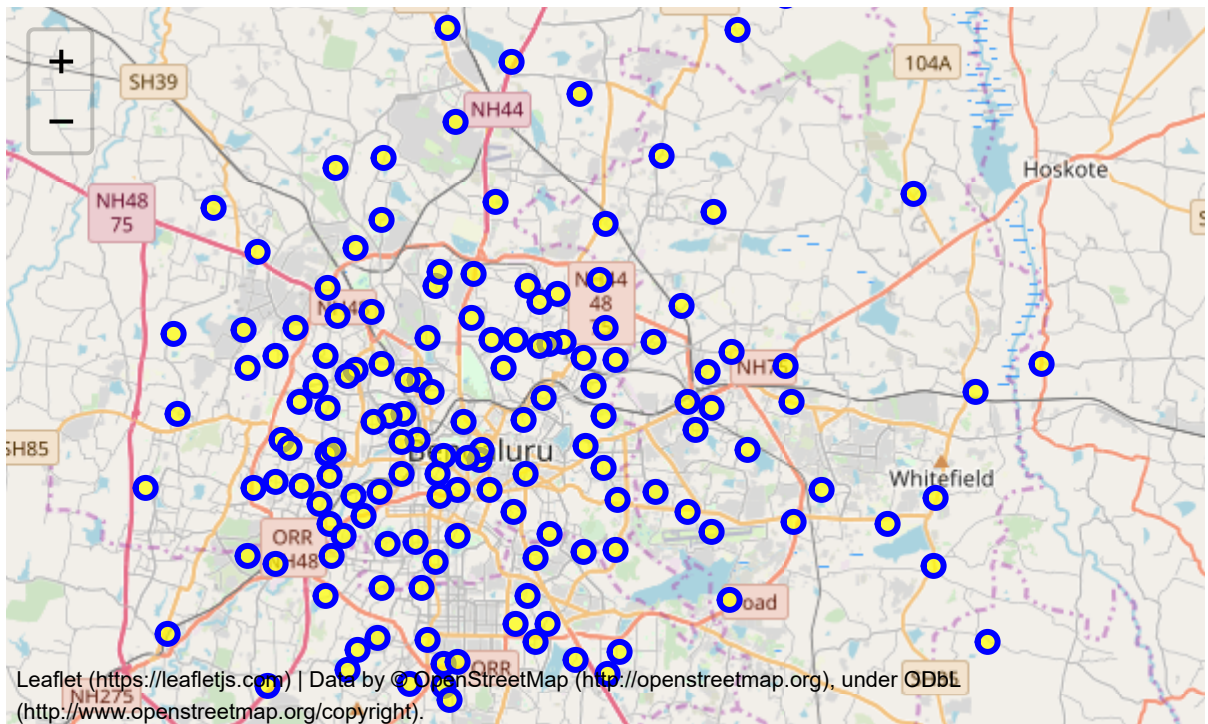
Plotting different neighbourhoods of Bangalore using Folium

```

In [13]: map_blr = folium.Map(location=[blr_lat, blr_long], zoom_start=10)
# add markers to map
for lat, lng, label, density in zip(Bangalore_df['Latitude'], Bangalore_df['Longitude'], Bangalore_df['Neighbourhood'], Bangalore_df['Population_density_(persons_per_sq_km)']):
    label = folium.Popup(label+', '+ str(density), parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='yellow',
        fill_opacity=0.7,
        parse_html=False).add_to(map_blr)
map_blr

```

Out[13]:



Defining Foursquare Credentials and Version

I will utilize the Foursquare API to explore the neighborhoods and segment them.

```

In [148]: CLIENT_ID = 'EWJ54CJ55IE1TC0SLXR10STUZX3NY0MCIHU3HU0ABVIIDYA' #Foursquare ID
CLIENT_SECRET = 'XDMSRVNYZJNRT15V2XSWCAG5FKFNJSP5UPNEDXDV33U2X23' #Foursquare Secret
VERSION = '20200101' # Foursquare API version

```

Creating a function to explore 500 venues at each neighbourhood

```

In [149]: LIMIT=500
def getNearbyVenues(names,densities,latitudes,longitudes):
    venues_list=[]
    for name,dens,lat,lng in zip(names,densities,latitudes,longitudes):

        # API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll={},{}&limit={}'.format(
            CLIENT_ID,CLIENT_SECRET,VERSION,lat,lng,LIMIT)

        # GET request
        results = requests.get(url).json()['response']['groups'][0]['items']
        #print(results)

        # append only relevant information for each nearby venue
        venues_list.append([(name,dens,lat,lng,v['venue']['name'],v['venue']['location']['lat'],v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

    nearby_venues = pd.DataFrame([item for venue_list in venues_list for item
in venue_list])
    nearby_venues.columns = ['Neighbourhood','Population_density_(persons_per_sq_km)','Latitude','Longitude',
        'Venue','Venue_Latitude','Venue_Longitude', 'Venue_Category']

    return(nearby_venues)

```

```
In [150]: blr_venues = getNearbyVenues(names=Bangalore_df['Neighbourhood'],densities=Ban  
galore_df['Population_density_(persons_per_sq_km)'],  
latitudes=Bangalore_df['Latitude'],longitudes=Ban  
galore_df['Longitude'])  
blr_venues
```

Out[150]:

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude	Venu
0	Kempegowda	3182	13.109018	77.601900	Kan Sweet
1	Kempegowda	3182	13.109018	77.601900	The Drui Garde
2	Kempegowda	3182	13.109018	77.601900	Big Strav
3	Kempegowda	3182	13.109018	77.601900	Jus'Truf Chocolat Shop an Caf
4	Kempegowda	3182	13.109018	77.601900	Decathlo
5	Kempegowda	3182	13.109018	77.601900	Caf Coffee Da
6	Kempegowda	3182	13.109018	77.601900	Hill Statio Caf
7	Kempegowda	3182	13.109018	77.601900	Caf Coffee Da
8	Kempegowda	3182	13.109018	77.601900	Swensen'
9	Kempegowda	3182	13.109018	77.601900	Godre Woodsma Estat
10	Kempegowda	3182	13.109018	77.601900	Sanja Dhab
11	Kempegowda	3182	13.109018	77.601900	By Brewsl
12	Kempegowda	3182	13.109018	77.601900	More Meg Stor
13	Kempegowda	3182	13.109018	77.601900	Bhartiy Cit
14	Kempegowda	3182	13.109018	77.601900	Lifestyl
15	Kempegowda	3182	13.109018	77.601900	Freskk
16	Kempegowda	3182	13.109018	77.601900	Caf Coffee Da
17	Kempegowda	3182	13.109018	77.601900	Caf Potenz
18	Kempegowda	3182	13.109018	77.601900	Shiva Kaba Corne
19	Kempegowda	3182	13.109018	77.601900	cafe coffe da
20	Kempegowda	3182	13.109018	77.601900	Jakku Airfiel
21	Kempegowda	3182	13.109018	77.601900	Sunda Soul Sant
22	Kempegowda	3182	13.109018	77.601900	Aah Andhr

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude	Venu
23	Kempegowda	3182	13.109018	77.601900	Domino' Pizz
24	Kempegowda	3182	13.109018	77.601900	McDonald'
25	Kempegowda	3182	13.109018	77.601900	XLR Indoc Sport Aren
26	Kempegowda	3182	13.109018	77.601900	Subwa
27	Kempegowda	3182	13.109018	77.601900	Just Bak
28	Kempegowda	3182	13.109018	77.601900	Caf Coffee Da
29	Kempegowda	3182	13.109018	77.601900	Subwa
...
12367	Hemmigepura	1652	12.881929	77.485497	Dining Ha
12368	Hemmigepura	1652	12.881929	77.485497	Tree Shad
12369	Hemmigepura	1652	12.881929	77.485497	Adya Anand Bhava (A2E
12370	Hemmigepura	1652	12.881929	77.485497	My Te Hous
12371	Hemmigepura	1652	12.881929	77.485497	SI suprem fastfoo
12372	Hemmigepura	1652	12.881929	77.485497	Kava
12373	Hemmigepura	1652	12.881929	77.485497	Domino' Pizz
12374	Hemmigepura	1652	12.881929	77.485497	Caf Coffee Da
12375	Hemmigepura	1652	12.881929	77.485497	Caf Coffee Da
12376	Hemmigepura	1652	12.881929	77.485497	Caf Coffee Da
12377	Hemmigepura	1652	12.881929	77.485497	Polar Bee
12378	Hemmigepura	1652	12.881929	77.485497	Subwa
12379	Hemmigepura	1652	12.881929	77.485497	Vasude Adigas'
12380	Hemmigepura	1652	12.881929	77.485497	Caf Coffee Da
12381	Hemmigepura	1652	12.881929	77.485497	MTR 192
12382	Hemmigepura	1652	12.881929	77.485497	Pizza Hl
12383	Hemmigepura	1652	12.881929	77.485497	194

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude	Venu
12384	Hemmigepura	1652	12.881929	77.485497	Domino' Pizz
12385	Hemmigepura	1652	12.881929	77.485497	Grip
12386	Hemmigepura	1652	12.881929	77.485497	McDonald'
12387	Hemmigepura	1652	12.881929	77.485497	Holida Villag
12388	Hemmigepura	1652	12.881929	77.485497	Guhantar Reso Bangalor
12389	Hemmigepura	1652	12.881929	77.485497	Caf Coffee Da
12390	Hemmigepura	1652	12.881929	77.485497	Kadamb Ve
12391	Hemmigepura	1652	12.881929	77.485497	Urba Valle Reso
12392	Hemmigepura	1652	12.881929	77.485497	Fireflie
12393	Hemmigepura	1652	12.881929	77.485497	Polar Bea
12394	Hemmigepura	1652	12.881929	77.485497	Stop Ove
12395	Hemmigepura	1652	12.881929	77.485497	Tirumal Gre Palac
12396	Hemmigepura	1652	12.881929	77.485497	Thirumal Gree Palac

12397 rows × 8 columns

Category wise venue count

```
In [152]: blr_venues['Venue_Category'].value_counts()
```

Out[152]:	Indian Restaurant	1995
	Café	877
	Fast Food Restaurant	615
	Ice Cream Shop	601
	Pizza Place	510
	Coffee Shop	449
	Hotel	290
	Bakery	286
	Chinese Restaurant	277
	Italian Restaurant	234
	Vegetarian / Vegan Restaurant	210
	Restaurant	203
	Lounge	199
	Breakfast Spot	198
	Sandwich Place	193
	Department Store	189
	Multiplex	175
	Clothing Store	159
	Snack Place	157
	Shopping Mall	147
	Brewery	144
	Donut Shop	131
	Asian Restaurant	131
	Seafood Restaurant	127
	Park	125
	Gym	123
	BBQ Joint	114
	Pub	110
	Dessert Shop	101
	Bar	97
	...	
	Airport Service	2
	Other Great Outdoors	2
	Kebab Restaurant	2
	Farm	2
	Travel & Transport	2
	Tech Startup	2
	Zoo	1
	Moving Target	1
	Business Service	1
	Paella Restaurant	1
	Buffet	1
	Southern / Soul Food Restaurant	1
	Hotel Pool	1
	Frozen Yogurt Shop	1
	Scenic Lookout	1
	Roof Deck	1
	Noodle House	1
	Print Shop	1
	Tex-Mex Restaurant	1
	Theme Park Ride / Attraction	1
	Photography Studio	1
	Hospital	1
	Music Store	1
	Garden Center	1
	Outdoors & Recreation	1
	Tourist Information Center	1

Castle	1
Road	1
Tennis Stadium	1
Fish & Chips Shop	1

Name: Venue_Category, Length: 239, dtype: int64

Filtering dataset for all types of restaurants

```
In [178]: blr_restaurants=blr_venues[blr_venues['Venue_Category'].str.contains('Restaurant')]  
blr_restaurants_grouped=blr_restaurants.groupby(['Neighbourhood', 'Venue_Category', 'Population_density(persons_per_sq_km)'])[['Venue_Category']].count()
```

```
In [179]: blr_restaurants_grouped=blr_restaurants_grouped.add_suffix('_Count').reset_index()
```

```
In [180]: blr_restaurants_grouped.sort_values(by=['Population_density_(persons_per_sq_k  
m)'],ascending=False)
```

Out[180]:

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Category.
1154	Padarayanapura	Fast Food Restaurant	118059	
1155	Padarayanapura	Indian Restaurant	118059	
1156	Padarayanapura	Restaurant	118059	
1157	Padarayanapura	Seafood Restaurant	118059	
1153	Padarayanapura	Asian Restaurant	118059	
856	Kempapura Agrahara	Vegetarian / Vegan Restaurant	113291	
855	Kempapura Agrahara	Karnataka Restaurant	113291	
854	Kempapura Agrahara	Indian Restaurant	113291	
853	Kempapura Agrahara	Himalayan Restaurant	113291	
1141	Nilasandra	Middle Eastern Restaurant	94287	
1142	Nilasandra	Southern / Soul Food Restaurant	94287	
1131	Nilasandra	Andhra Restaurant	94287	
1140	Nilasandra	Mediterranean Restaurant	94287	
1132	Nilasandra	Asian Restaurant	94287	
1133	Nilasandra	Chinese Restaurant	94287	
1134	Nilasandra	Fast Food Restaurant	94287	
1135	Nilasandra	Indian Restaurant	94287	
1136	Nilasandra	Italian Restaurant	94287	
1137	Nilasandra	Karnataka Restaurant	94287	
1138	Nilasandra	Kerala Restaurant	94287	
1139	Nilasandra	Korean Restaurant	94287	
1369	Shivaji Nagar	Indian Restaurant	87856	
1366	Shivaji Nagar	Eastern European Restaurant	87856	
1367	Shivaji Nagar	Fast Food Restaurant	87856	
1368	Shivaji Nagar	Hyderabadi Restaurant	87856	

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Category.
1373	Shivaji Nagar	South Indian Restaurant	87856	
1370	Shivaji Nagar	Italian Restaurant	87856	
1371	Shivaji Nagar	Middle Eastern Restaurant	87856	
1372	Shivaji Nagar	Seafood Restaurant	87856	
1363	Shivaji Nagar	American Restaurant	87856	
...	
184	Bellanduru	Italian Restaurant	3041	
183	Bellanduru	Indian Restaurant	3041	
178	Bellanduru	Andhra Restaurant	3041	
182	Bellanduru	Fast Food Restaurant	3041	
641	Jakkuru	Vegetarian / Vegan Restaurant	2215	
639	Jakkuru	Mexican Restaurant	2215	
638	Jakkuru	Italian Restaurant	2215	
637	Jakkuru	Indian Restaurant	2215	
636	Jakkuru	Fast Food Restaurant	2215	
635	Jakkuru	American Restaurant	2215	
640	Jakkuru	South Indian Restaurant	2215	
1499	Varthur	Restaurant	1929	
1491	Varthur	Chinese Restaurant	1929	
1500	Varthur	Vegetarian / Vegan Restaurant	1929	
1497	Varthur	Maharashtrian Restaurant	1929	
1498	Varthur	Rajasthani Restaurant	1929	
1492	Varthur	Eastern European Restaurant	1929	
1496	Varthur	Kerala Restaurant	1929	
1495	Varthur	Italian Restaurant	1929	

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Category.
1494	Varthur	Indian Restaurant	1929	
1493	Varthur	Fast Food Restaurant	1929	
1489	Varthur	American Restaurant	1929	
1490	Varthur	Andhra Restaurant	1929	
536	Hemmigepura	Chinese Restaurant	1652	
537	Hemmigepura	Fast Food Restaurant	1652	
538	Hemmigepura	Indian Chinese Restaurant	1652	
539	Hemmigepura	Indian Restaurant	1652	
540	Hemmigepura	Restaurant	1652	
541	Hemmigepura	South Indian Restaurant	1652	
542	Hemmigepura	Vegetarian / Vegan Restaurant	1652	

1610 rows × 4 columns

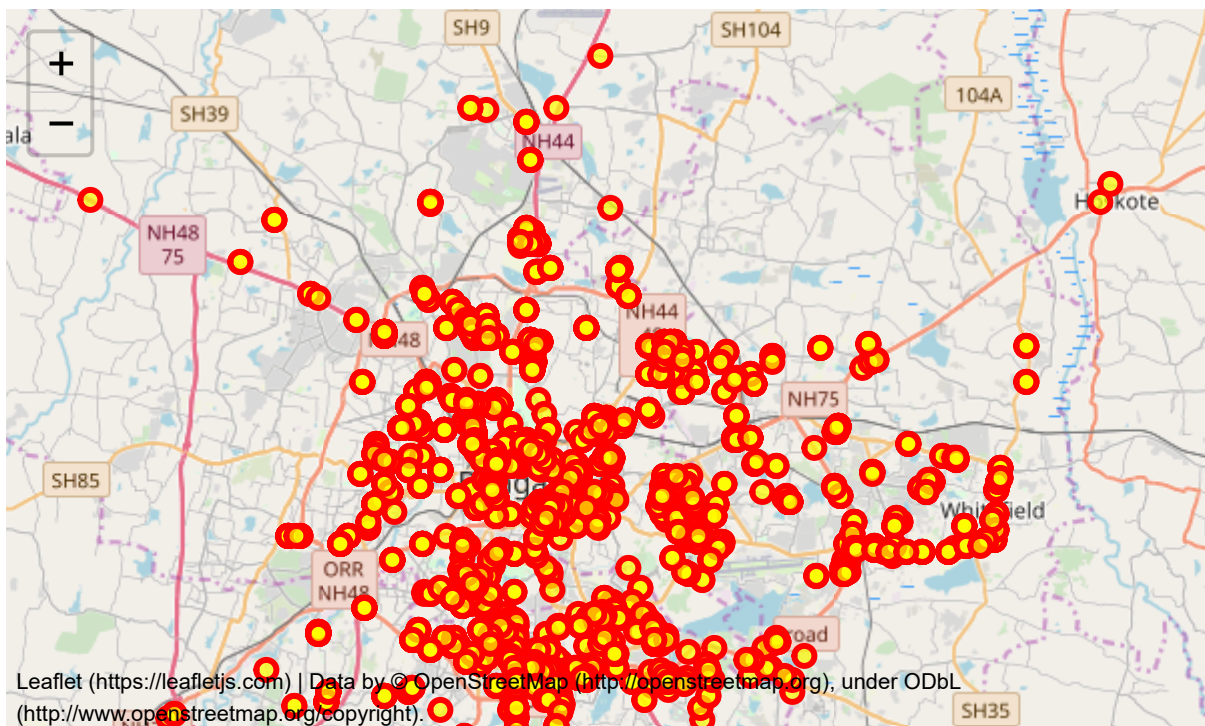
Plotting all restaurants of Bangalore


```

In [156]: map_blr_venues = folium.Map(location=[blr_lat, blr_long], zoom_start=10)
# add markers to map
for lat, lng, label, neigh in zip(blr_restaurants['Venue_Latitude'], blr_restau
rants['Venue_Longitude'],
                                blr_restaurants['Venue_Category'],
                                blr_restaurants['Neighbourhood']):
    label = folium.Popup(label+', '+neigh, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='red',
        fill=True,
        fill_color='yellow',
        fill_opacity=0.7,
        parse_html=False).add_to(map_blr_venues)
map_blr_venues

```

Out[156]:



Results

Finding top 10 most dens areas of Bangalore

```
In [157]: top10_dens=Bangalore_df.sort_values(by='Population_density_(persons_per_sq_k  
m)',ascending=False).head(10)  
top10_dens
```

Out[157]:

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude
134	Padarayanapura	118059	12.963801	77.547523
121	Kempapura Agrahara	113291	13.154848	77.289579
115	Nilasandra	94287	12.951245	77.614791
91	Shivaji Nagar	87856	12.989158	77.606089
136	Rayapuram	81770	12.964870	77.556562
96	Dayananda Nagar	80035	12.991025	77.564519
47	Muneshwara Nagar	74511	13.014081	77.611474
133	Bapuji Nagar	72549	12.954321	77.539697
170	Gurappana Palya	72068	12.920758	77.603333
29	Kadugondanahalli	65514	13.015587	77.620031

Finding restaurants for top 10 most dens areas of Bangalore

```
In [159]: blr_restaurants_grouped[blr_restaurants_grouped.Neighbourhood.isin(top10_dens[
'Neighbourhood'].tolist())].sort_values(by='Population_density_(persons_per_sq
_km)',ascending=False)
```

Out[159]:

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Categor
1153	Padarayanapura	Asian Restaurant	118059	
1154	Padarayanapura	Fast Food Restaurant	118059	
1155	Padarayanapura	Indian Restaurant	118059	
1156	Padarayanapura	Restaurant	118059	
1157	Padarayanapura	Seafood Restaurant	118059	
854	Kempapura Agrahara	Indian Restaurant	113291	
853	Kempapura Agrahara	Himalayan Restaurant	113291	
856	Kempapura Agrahara	Vegetarian / Vegan Restaurant	113291	
855	Kempapura Agrahara	Karnataka Restaurant	113291	
1138	Nilasandra	Kerala Restaurant	94287	
1139	Nilasandra	Korean Restaurant	94287	
1140	Nilasandra	Mediterranean Restaurant	94287	
1142	Nilasandra	Southern / Soul Food Restaurant	94287	
1141	Nilasandra	Middle Eastern Restaurant	94287	
1136	Nilasandra	Italian Restaurant	94287	
1135	Nilasandra	Indian Restaurant	94287	
1134	Nilasandra	Fast Food Restaurant	94287	
1133	Nilasandra	Chinese Restaurant	94287	
1132	Nilasandra	Asian Restaurant	94287	
1131	Nilasandra	Andhra Restaurant	94287	
1137	Nilasandra	Karnataka Restaurant	94287	
1362	Shivaji Nagar	Afghan Restaurant	87856	
1374	Shivaji Nagar	Vegetarian / Vegan Restaurant	87856	
1363	Shivaji Nagar	American Restaurant	87856	
1364	Shivaji Nagar	Asian Restaurant	87856	

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Categor
1365	Shivaji Nagar	Chinese Restaurant	87856	
1366	Shivaji Nagar	Eastern European Restaurant	87856	
1367	Shivaji Nagar	Fast Food Restaurant	87856	
1369	Shivaji Nagar	Indian Restaurant	87856	
1370	Shivaji Nagar	Italian Restaurant	87856	
...	
135	Bapuji Nagar	Fast Food Restaurant	72549	
136	Bapuji Nagar	Indian Restaurant	72549	
137	Bapuji Nagar	Seafood Restaurant	72549	
138	Bapuji Nagar	Szechuan Restaurant	72549	
133	Bapuji Nagar	Andhra Restaurant	72549	
134	Bapuji Nagar	Asian Restaurant	72549	
450	Gurappana Palya	Rajasthani Restaurant	72068	
448	Gurappana Palya	Italian Restaurant	72068	
443	Gurappana Palya	Asian Restaurant	72068	
444	Gurappana Palya	Chinese Restaurant	72068	
445	Gurappana Palya	Dim Sum Restaurant	72068	
446	Gurappana Palya	Fast Food Restaurant	72068	
452	Gurappana Palya	Vegetarian / Vegan Restaurant	72068	
451	Gurappana Palya	Restaurant	72068	
447	Gurappana Palya	Indian Restaurant	72068	
449	Gurappana Palya	Middle Eastern Restaurant	72068	
799	Kadugondanahalli	Seafood Restaurant	65514	
798	Kadugondanahalli	Restaurant	65514	
797	Kadugondanahalli	Pakistani Restaurant	65514	
795	Kadugondanahalli	Mediterranean Restaurant	65514	

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Categor
794	Kadugondanahalli	Korean Restaurant	65514	
786	Kadugondanahalli	Chinese Restaurant	65514	
787	Kadugondanahalli	Falafel Restaurant	65514	
788	Kadugondanahalli	Fast Food Restaurant	65514	
796	Kadugondanahalli	Middle Eastern Restaurant	65514	
790	Kadugondanahalli	Indian Chinese Restaurant	65514	
791	Kadugondanahalli	Indian Restaurant	65514	
792	Kadugondanahalli	Italian Restaurant	65514	
793	Kadugondanahalli	Kerala Restaurant	65514	
789	Kadugondanahalli	Hyderabadi Restaurant	65514	

90 rows × 4 columns

Finding top 10 least dens areas of Bangalore

```
In [158]: least10_dens=Bangalore_df.sort_values(by='Population_density_(persons_per_sq_k
m)',ascending=True).head(10)
least10_dens
```

Out[158]:

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude
197	Hemmigepura	1652	12.881929	77.485497
148	Varthur	1929	12.940615	77.746994
4	Jakkuru	2215	13.098320	77.625146
149	Bellanduru	3041	12.929211	77.677042
0	Kempegowda	3182	13.109018	77.601900
113	Agaram	3345	12.945704	77.637886
53	Hudi	3349	13.058506	77.671339
82	Kadugodi	3934	12.998577	77.760972
195	Anjanapura	3997	12.858081	77.558071
83	Hagadur	4003	12.963344	77.747285

Finding restaurants for top 10 least dens areas of Bangalore

```
In [160]: blr_restaurants_grouped[blr_restaurants_grouped.Neighbourhood.isin(least10_den  
s['Neighbourhood'].tolist())].sort_values(by='Population_density_(persons_per_  
sq_km)',ascending=True)
```

Out[160]:

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Category.
539	Hemmigepura	Indian Restaurant	1652	
538	Hemmigepura	Indian Chinese Restaurant	1652	
540	Hemmigepura	Restaurant	1652	
541	Hemmigepura	South Indian Restaurant	1652	
542	Hemmigepura	Vegetarian / Vegan Restaurant	1652	
537	Hemmigepura	Fast Food Restaurant	1652	
536	Hemmigepura	Chinese Restaurant	1652	
1492	Varthur	Eastern European Restaurant	1929	
1494	Varthur	Indian Restaurant	1929	
1490	Varthur	Andhra Restaurant	1929	
1489	Varthur	American Restaurant	1929	
1495	Varthur	Italian Restaurant	1929	
1496	Varthur	Kerala Restaurant	1929	
1497	Varthur	Maharashtrian Restaurant	1929	
1499	Varthur	Restaurant	1929	
1498	Varthur	Rajasthani Restaurant	1929	
1493	Varthur	Fast Food Restaurant	1929	
1491	Varthur	Chinese Restaurant	1929	
1500	Varthur	Vegetarian / Vegan Restaurant	1929	
641	Jakkuru	Vegetarian / Vegan Restaurant	2215	
635	Jakkuru	American Restaurant	2215	
636	Jakkuru	Fast Food Restaurant	2215	
639	Jakkuru	Mexican Restaurant	2215	
638	Jakkuru	Italian Restaurant	2215	

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Category.
637	Jakkuru	Indian Restaurant	2215	
640	Jakkuru	South Indian Restaurant	2215	
189	Bellanduru	Vegetarian / Vegan Restaurant	3041	
188	Bellanduru	Seafood Restaurant	3041	
186	Bellanduru	North Indian Restaurant	3041	
185	Bellanduru	Kerala Restaurant	3041	
...	
775	Kadugodi	Chinese Restaurant	3934	
782	Kadugodi	Mexican Restaurant	3934	
773	Kadugodi	American Restaurant	3934	
781	Kadugodi	Maharashtrian Restaurant	3934	
784	Kadugodi	Restaurant	3934	
785	Kadugodi	Vegetarian / Vegan Restaurant	3934	
774	Kadugodi	Asian Restaurant	3934	
783	Kadugodi	Rajasthani Restaurant	3934	
50	Anjanapura	Vegetarian / Vegan Restaurant	3997	
49	Anjanapura	South Indian Restaurant	3997	
47	Anjanapura	Rajasthani Restaurant	3997	
45	Anjanapura	Indian Restaurant	3997	
42	Anjanapura	American Restaurant	3997	
43	Anjanapura	Chinese Restaurant	3997	
46	Anjanapura	Italian Restaurant	3997	
48	Anjanapura	Restaurant	3997	
44	Anjanapura	Fast Food Restaurant	3997	
512	Hagadur	Mexican Restaurant	4003	

	Neighbourhood	Venue_Category	Population_density_(persons_per_sq_km)	Venue_Category.
511	Hagadur	Maharashtrian Restaurant	4003	
510	Hagadur	Kerala Restaurant	4003	
509	Hagadur	Italian Restaurant	4003	
514	Hagadur	Restaurant	4003	
507	Hagadur	Fast Food Restaurant	4003	
506	Hagadur	Falafel Restaurant	4003	
505	Hagadur	Eastern European Restaurant	4003	
504	Hagadur	Chinese Restaurant	4003	
503	Hagadur	American Restaurant	4003	
515	Hagadur	Vegetarian / Vegan Restaurant	4003	
513	Hagadur	Rajasthani Restaurant	4003	
508	Hagadur	Indian Restaurant	4003	

105 rows × 4 columns

Plotting Restaurants for top 10 most dens areas of Bangalore

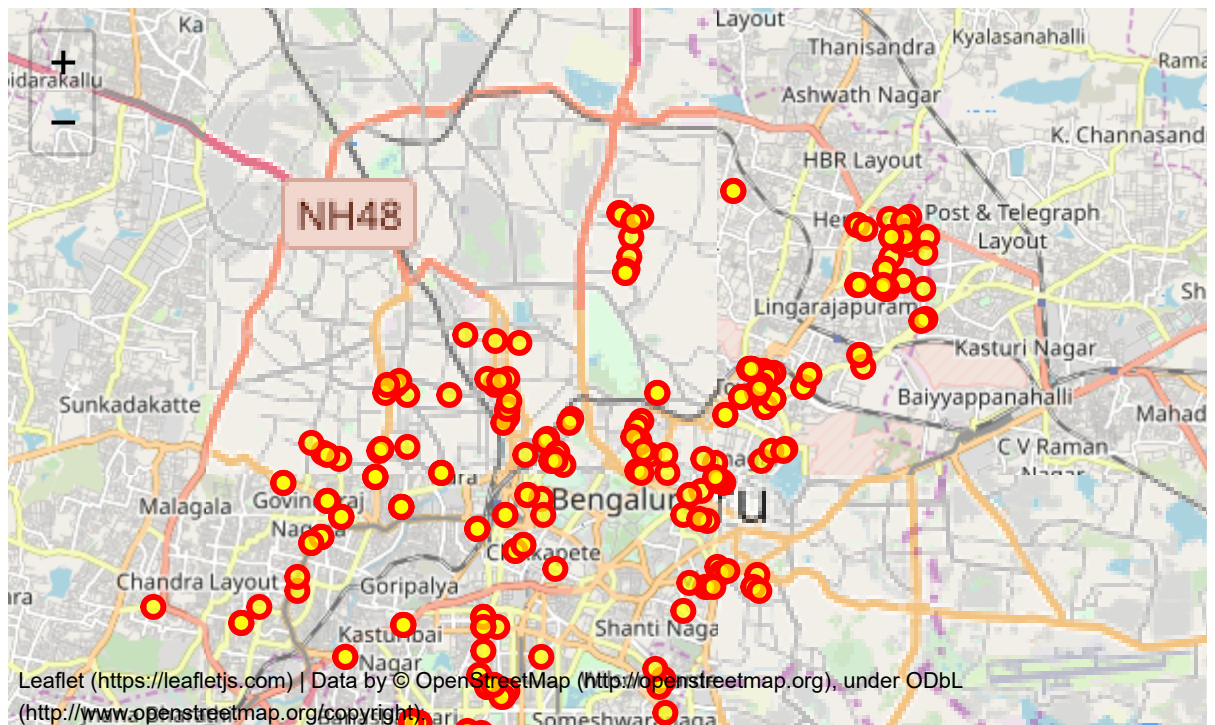
```
In [162]: blr_restaurants_top10=blr_restaurants[blr_restaurants.Neighbourhood.isin(top10_
_dens[ 'Neighbourhood' ].tolist())]
```

```

In [167]: map_blr_restaurants_top10 = folium.Map(location=[blr_lat, blr_long], zoom_start=10)
# add markers to map
for lat, lng, label, neigh in zip(blr_restaurants_top10['Venue_Latitude'], blr_restaurants_top10['Venue_Longitude'],
                                blr_restaurants_top10['Venue_Category'],
                                blr_restaurants_top10['Neighbourhood']):
    label = folium.Popup(label+' '+neigh, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='red',
        fill=True,
        fill_color='yellow',
        fill_opacity=0.7,
        parse_html=False).add_to(map_blr_restaurants_top10)
map_blr_restaurants_top10

```

Out[167]:



Plotting Restaurants for top 10 least dens areas of Bangalore

```

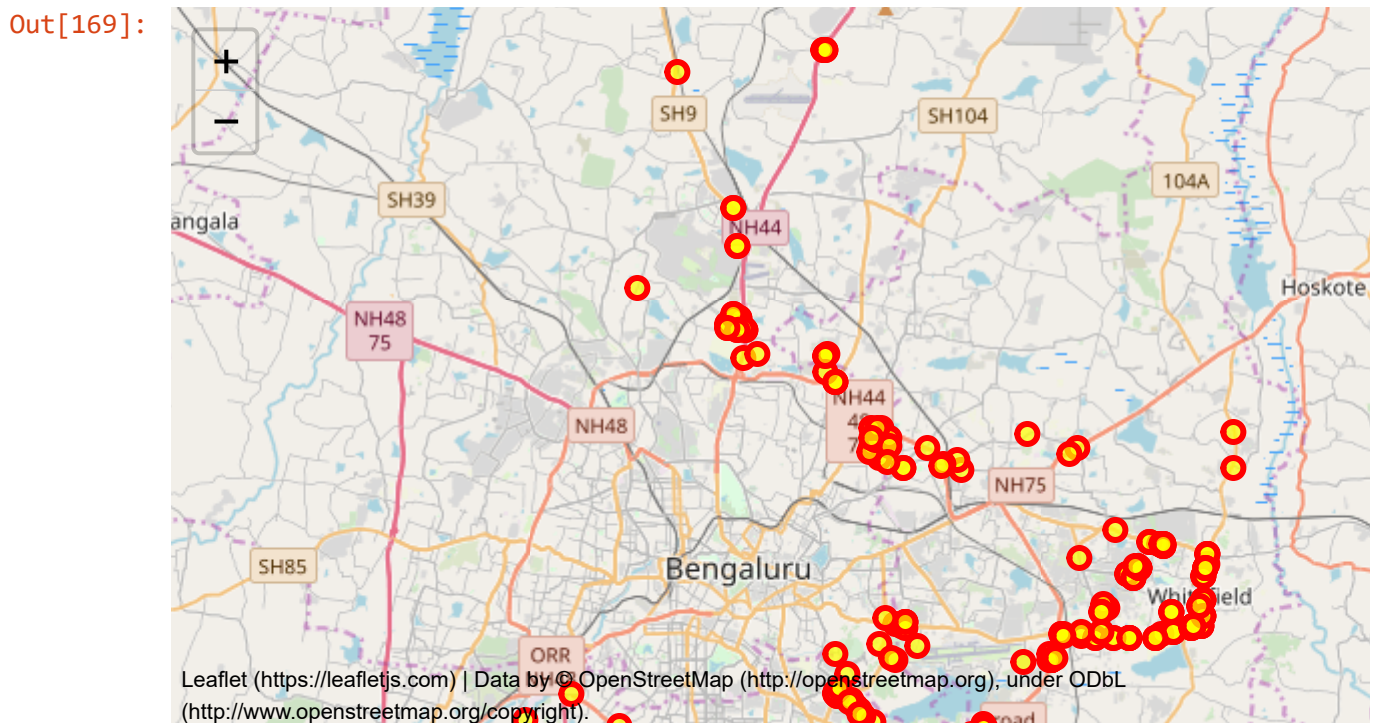
In [168]: blr_restaurants_least10=blr_restaurants[blr_restaurants.Neighbourhood.isin(least10_dens['Neighbourhood'].tolist())]

```

```

In [169]: map_blr_restaurants_least10= folium.Map(location=[blr_lat, blr_long], zoom_start=10)
# add markers to map
for lat, lng, label, neigh in zip(blr_restaurants_least10['Venue_Latitude'], blr_restaurants_least10['Venue_Longitude'],
                                blr_restaurants_least10['Venue_Category'],
                                blr_restaurants_least10['Neighbourhood']):
    label = folium.Popup(label+', '+neigh, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='red',
        fill=True,
        fill_color='yellow',
        fill_opacity=0.7,
        parse_html=False).add_to(map_blr_restaurants_least10)
map_blr_restaurants_least10

```



Finding neighbourhoods having no venues of any category.
 These neighbourhoods could be potential locations to start a new business.

```

In [161]: Bangalore_df[~Bangalore_df.Neighbourhood.isin(blr_restaurants_grouped['Neighbourhood'].tolist())].sort_values(by='Population_density_(persons_per_sq_km)', ascending=True)

```

Out[161]:

	Neighbourhood	Population_density_(persons_per_sq_km)	Latitude	Longitude
38	Chokkasandra	15752	13.187971	77.901090
33	Gangenahalli	22226	12.983417	77.391874

Total restaurants count for top 10 least dens neighbourhoods of Bangalore

```
In [189]: blr_restaurants_grouped[blr_restaurants_grouped.Neighbourhood.isin(least10_dens[
'Neighbourhood'].tolist())].groupby(['Neighbourhood', 'Population_density_(persons_per_sq_km)'])['Venue_Category_Count'].sum()
```

```
Out[189]: Neighbourhood  Population_density_(persons_per_sq_km)
Agaram              3345                                         31
Anjanapura          3997                                         16
Bellanduru          3041                                         25
Hagadur             4003                                         32
Hemmigepura         1652                                         14
Hudi                3349                                         26
Jakkuru             2215                                         19
Kadugodi            3934                                         35
Kempegowda          3182                                         15
Varthur             1929                                         41
Name: Venue_Category_Count, dtype: int64
```

Total restaurants count for top 10 most dens neighbourhoods of Bangalore

```
In [190]: blr_restaurants_grouped[blr_restaurants_grouped.Neighbourhood.isin(top10_dens[
'Neighbourhood'].tolist())].groupby(['Neighbourhood', 'Population_density_(persons_per_sq_km)'])['Venue_Category_Count'].sum()
```

```
Out[190]: Neighbourhood  Population_density_(persons_per_sq_km)
Bapuji Nagar          72549                                         23
Dayananda Nagar       80035                                         39
Gurappana Palya       72068                                         48
Kadugondanahalli      65514                                         47
Kempapura Agrahara    113291                                         5
Muneshwara Nagar      74511                                         43
Nilasandra            94287                                         25
Padarayanapura        118059                                         27
Rayapuram             81770                                         29
Shivaji Nagar         87856                                         38
Name: Venue_Category_Count, dtype: int64
```

Observation

The number of restaurants in top 10 least dens areas are very high compare to number of restaurants in top 10 most dens areas. It means there are opportunities to open new restaurants in dens areas.

Kempapura Agrahara having population desity of 113291 person/sq-km has only 5 restaurants which is very less compare to its nearby neighbourhood Padarayanapura (population density 118059 person/sq-km) which has 27 restaurants. Kempapura Agrahara can also be a good location to start a new restaurant business.

Chokkasandra and Gangenahalli neighbourhoods has no single venue of any category so these locations are good to start restaurants, fast-food centers or super stores.