

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, b
lr_long))
```

The geograpical coordinates of Bangalore are 12.9791198, 77.5912997.

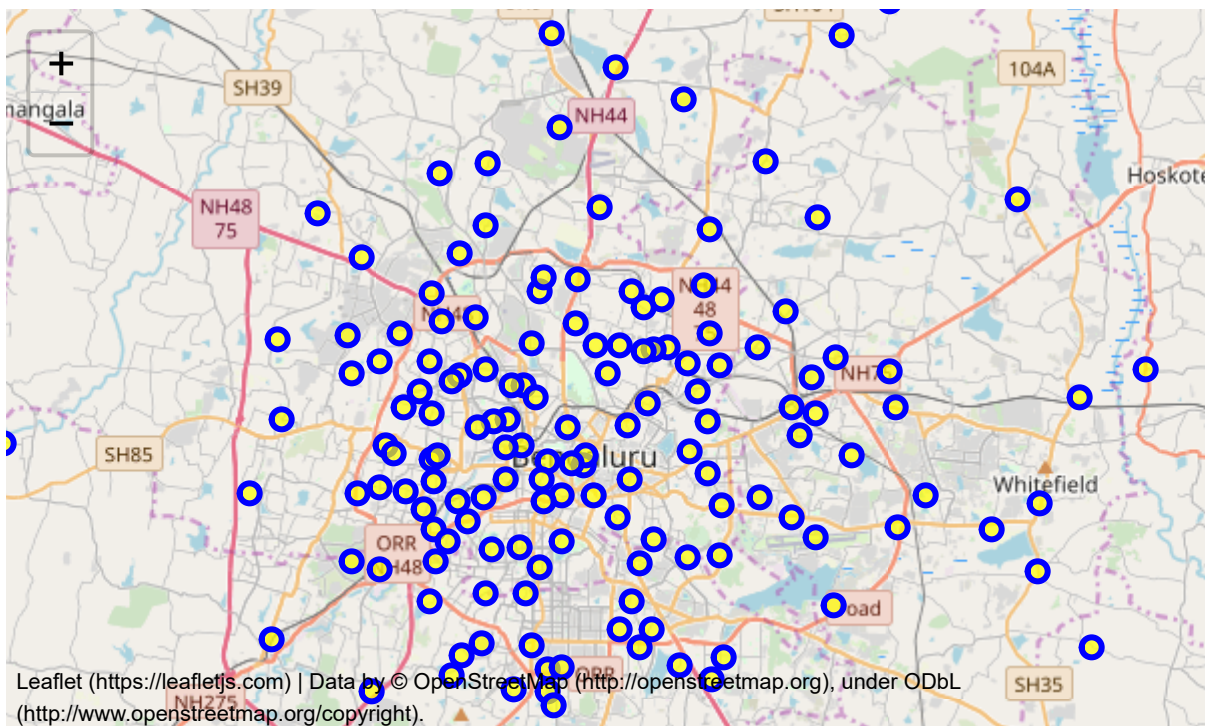
Plotting different neighbourhoods of Bangalore using Folium

```

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 = 'EWWJ54CJ55IE1TC0SLXR10STUZK3NY0MCIHU3HU0ABVIIDYA' #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 Beæ |
| 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

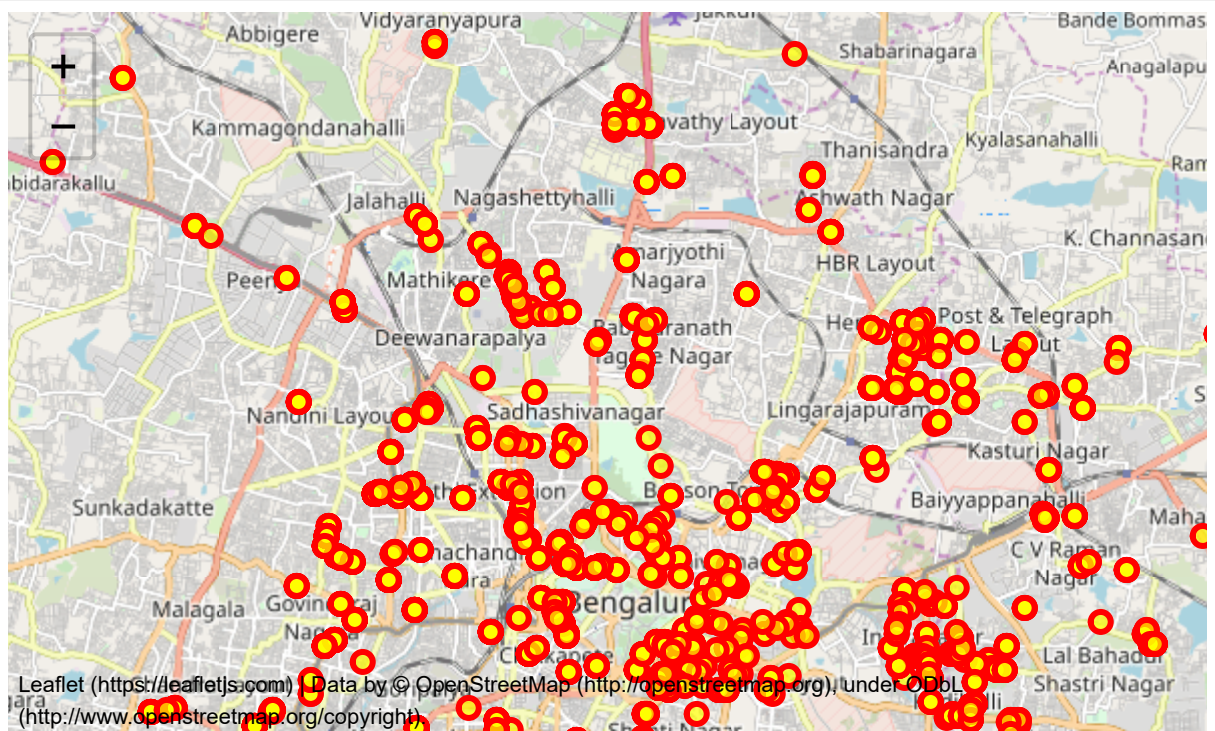
Plotting all restaurants of Bangalore


```

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

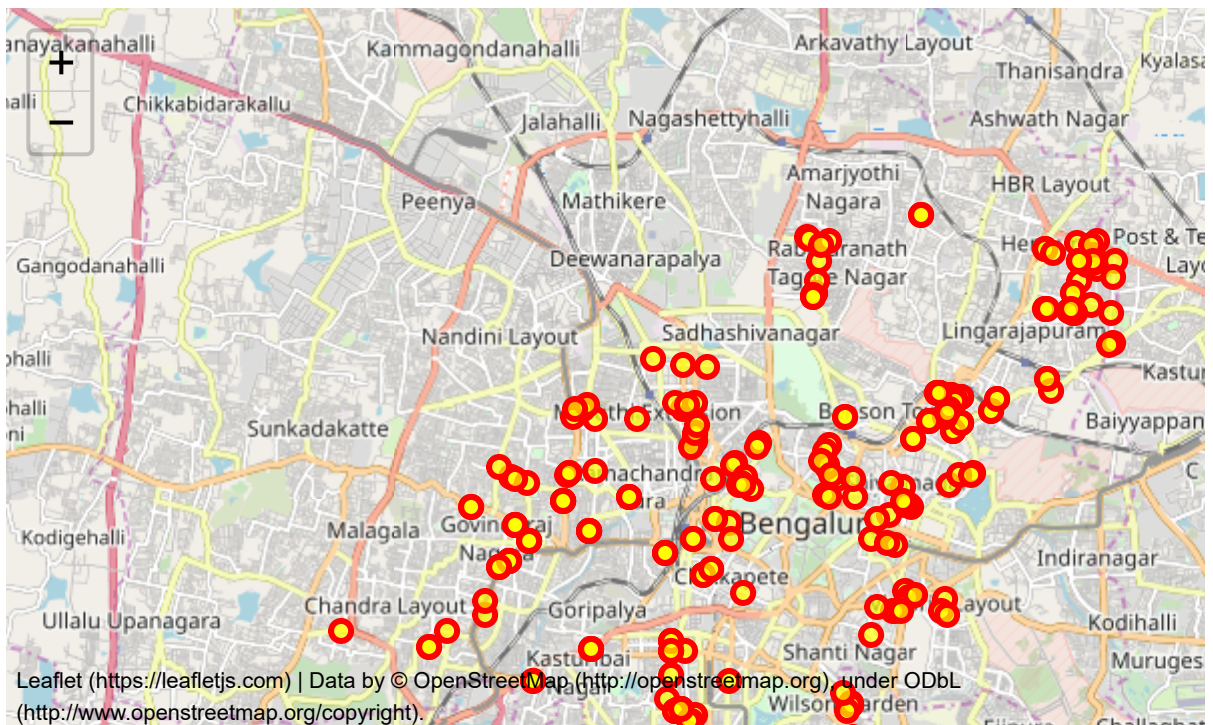
```
In [162]: blr_restaurants_top10=blr_restaurants[blr_restaurants.Neighbourhood.isin(top10_
_dens['Neighbourhood']).tolist()]
```

```

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())]

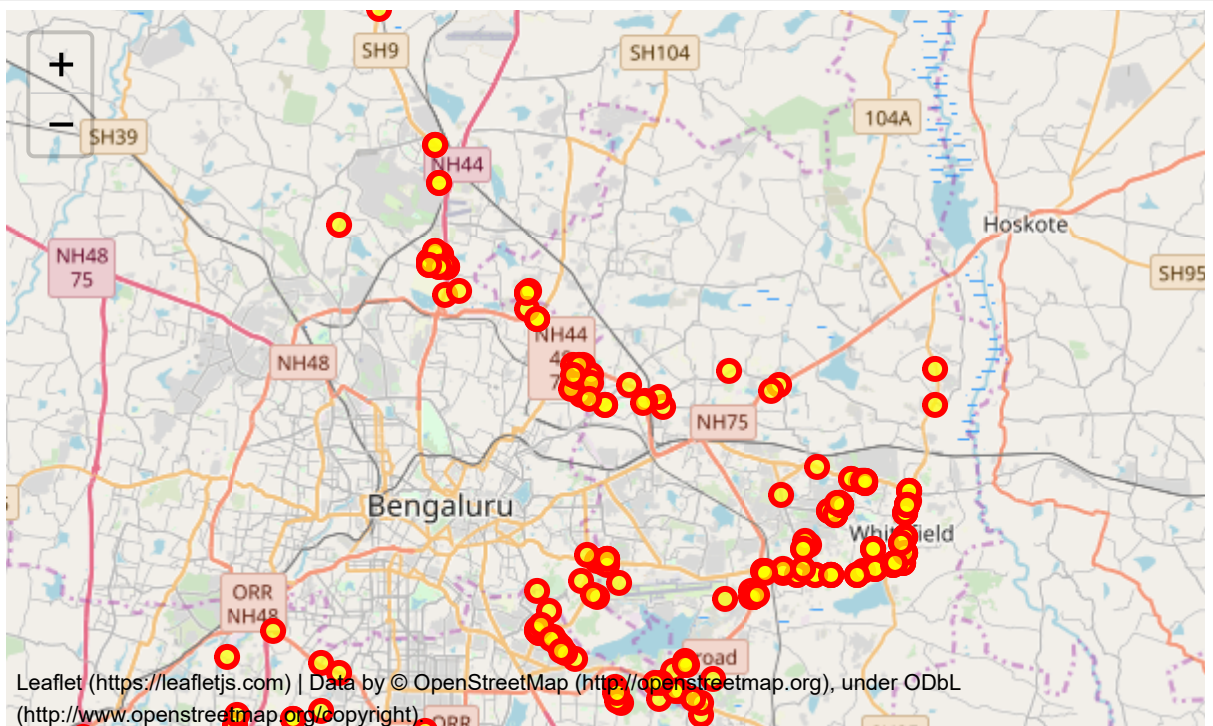
```

```

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

```

Out[169]:



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 desity 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.