

MEMPHIS, TN

POPULATION
650,632
0.245% DECLINE

POVERTY RATE
26.9%

MEDIAN AGE
34.3

MEDIAN HOUSEHOLD INCOME
\$37,199
5.43% DECLINE

NUMBER OF EMPLOYEES
290,457
0.945% GROWTH

MEDIAN PROPERTY VALUE
\$103,700
5.07% GROWTH

Coursera - IBM Professional Certificate - Applied Data Science Capstone Project

Title of the project : Aerial view - venues mapping support system

By Geetha Narayanan

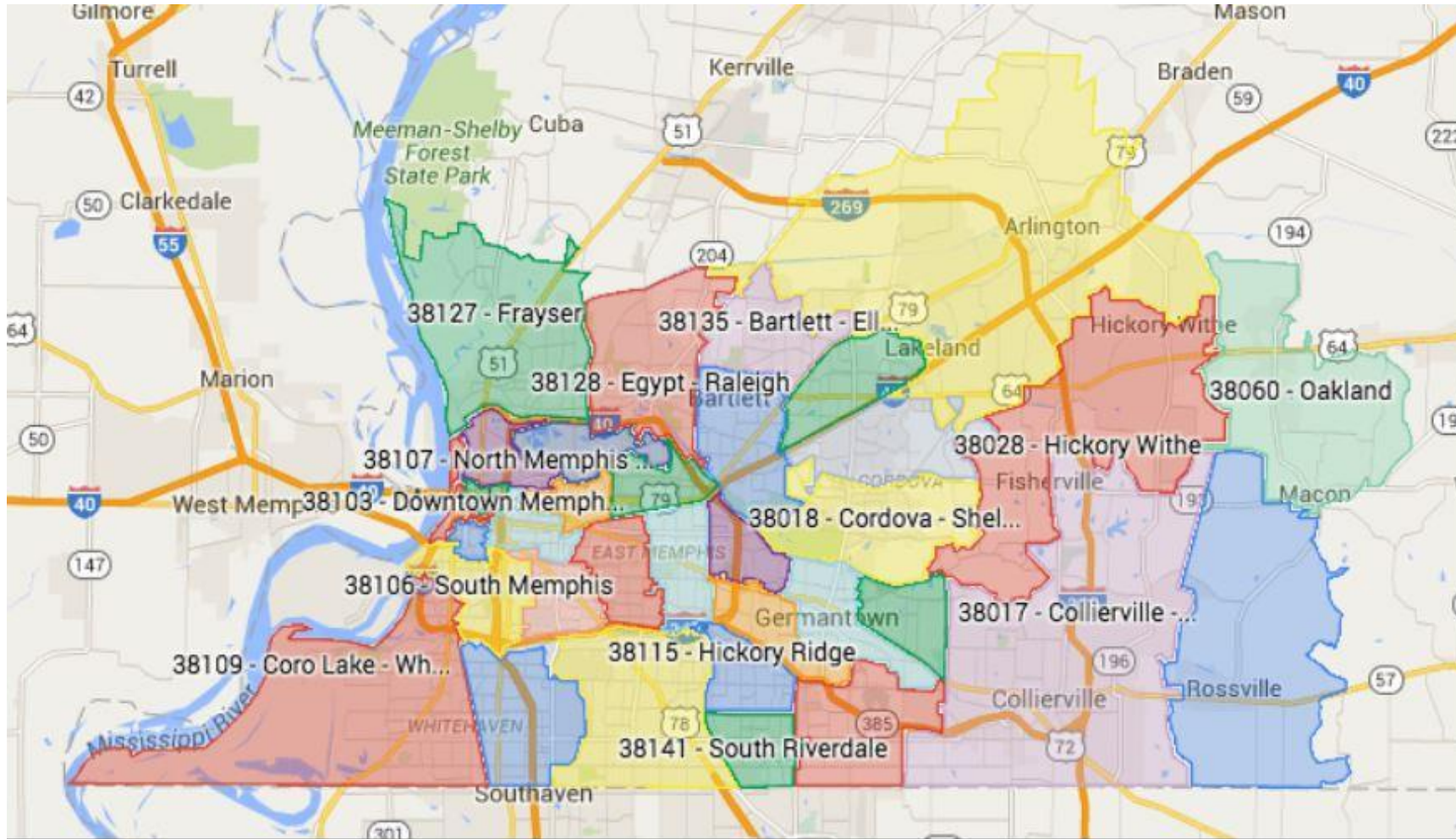
Introduction

- **Introduction / Background** :Catalyst LLC is a new start-up company in Memphis, Tennessee, USA which provides support services to tourists and visitors as well as aiding to conduct personal/professional events and functions.
- Catalyst LLC has a plan to have a support system for selected option by the customer who likes to explore the city.
- As a quick-win proto project, residential City of Memphis taken as a geo-location and through the coding in Python with the help of Coursera-IBM Skill lab and GitHub working out a proposal.

About Memphis city

- MEMPHIS is a city located in Tennessee, United States of America. The city population was 650,618 in 2018. Memphis is the 26th largest city out of 314 US cities.
- Memphis is one of the leading commercial centers in transportation and logistics. Memphis international airport is the second busiest cargo airport in the world and the international port of Memphis is the fifth busiest inland water port in America.
- As on date, Memphis is a regional center for commerce, education, media, art, music and entertainment.
- (Note: Two memorable places in Memphis are : 1. King of rock and roll – singer and actor Elvis Presley's and 2. The Noble Peace Prize 1964 winner for non-violence and Leader - Martin Luther King Jr.'s.)
- (P.S) Interesting to also note that each and every FedEx air package in US goes through Memphis, though there are direct routes.

Memphis map – with Postal Codes



Objective, Scope & Target:

- **Objective**: The objective of this project is to provide management and users to view list of combined venues like food centers, cafeteria, fun place, Nightlife & Top pick of our choice in the selected city together with their geo-spatial data or through an aerial map to save their decision support and saving their time by avoiding one by one search.
- **Scope**: Starting with one city – Memphis but can be deployed with multiple cities optional selection by clustering in next phase, after quick-win of the project. Other Tennessee cities (e,g) like Nashville (First largest) and Knoxville(Third largest) may also be included by including their address 2 and 3 as shown in Python Jupyter note book – row #
- **Target** : Users includes not only of our company management person but also mainly our customers and public on need (i.e) exploring different places or similar places.

Data Description

1. The data used in the project is obtained from FOURSQUARE API. By using Explorer, data collected for café, restaurant, fun, nightlife , etc., for multiple searches.

Link: <https://foursquare.com/>

2. For the city data: Latitude: **35.122864**, Longitude: **89.951860**, Population: **729,307**, Area: **391.55** sq. miles, Land: **386.69** sq. miles, Water: **4.86** sq. miles, Population Density: **1,886.02** people per sq. mile,- Elevation: **273.0** feet above sea level . Time Zone: Central (GMT -6)

Link: [https://en.wikipedia.org/wiki/Memphis, Tennessee](https://en.wikipedia.org/wiki/Memphis,_Tennessee)

[https://en.wikipedia.org/wiki/List of neighborhoods in Memphis, Tennessee](https://en.wikipedia.org/wiki/List_of_neighborhoods_in_Memphis,_Tennessee)

[https://en.wikipedia.org/wiki/Category:Neighborhoods in Memphis, Tennessee](https://en.wikipedia.org/wiki/Category:Neighborhoods_in_Memphis,_Tennessee)

[https://en.wikipedia.org/wiki/List of United States cities by population](https://en.wikipedia.org/wiki/List_of_United_States_cities_by_population)

<https://open311.memphistn.gov/#!/view-data>

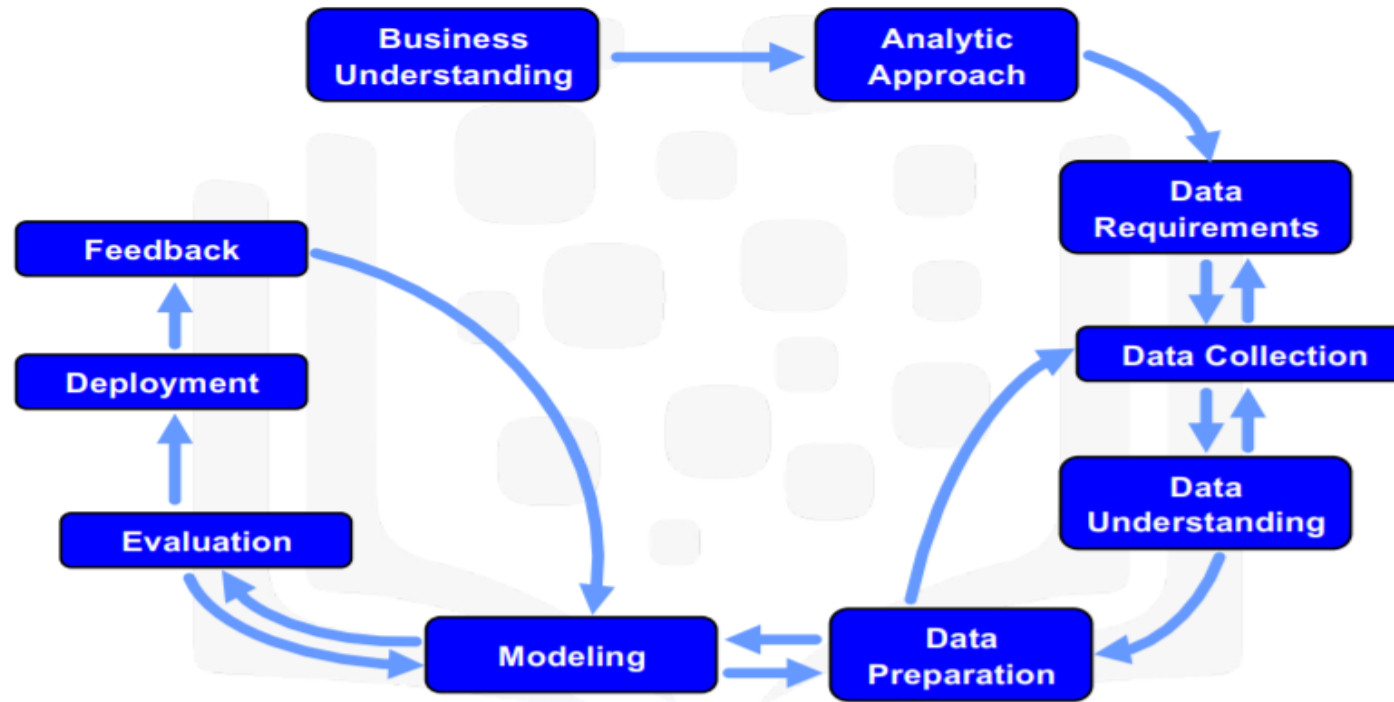
<https://www.fedex.com/en-us/about/policy/aviation/why-memphis.html>

3. For Choropleth maps , geojson file of Memphis used.

4. Python Folium library will be used to visualize the venues & allied clusters.

Methodology : Learning IBM Model-CRISP

CRISP (Cross Industries Standard Process) through Coursera :



Remember: Above 10 steps are need not to be followed strictly in a sequence (i.e) a flexible and iterative approach- (seq optional).

Coverage :

- Venues geo mapping :
 - Food, Cafeteria, Breakfast, Restaurants, Fun-Gym, Park, Nightlife & Top pick-Museum
- The following questions are to be attempted:
 - 1.How many places or venues under each category?
 2. How many similar venues exist and its' specialty ?
 3. How to get 'Birds eye view' of their locations ?

Importing Libraries

1. Importing / installing Libraries:

```
: import pandas as pd # for data analysis
import numpy as np # to handle data in a vectorized manner
import random # library for random number generation
import requests # to handle requests
import json
!pip install geopy
!pip install Nominatim
!conda install -c conda-forge geopy --yes
from geopy.geocoders import Nominatim # module to convert an address into latitude and longitude values
# Libraries for displaying images
from IPython.display import Image
from IPython.core.display import HTML
#transforming json file into a pandas dataframe library
from pandas.io.json import json_normalize
!pip install folium
import folium # plotting library
from urllib.request import urlopen
!pip install bs4
from bs4 import BeautifulSoup
import matplotlib.pyplot as plt
import pylab as pl
from sklearn import linear_model
from sklearn.metrics import jaccard_similarity_score
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix
from sklearn.metrics import classification_report, confusion_matrix
from sklearn.metrics import log_loss
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error, r2_score
import itertools
import time

print('all Libraries imported.')
```

Data Wrangling – URL tried for multi-cities

2.1 Data Scraping and Cleaning :

For the selected city (My choice: Memphis,TN) ,obtaining its latitude & longitude :

In order to define an instance of the geocoder, we need to define a user_agent. We will name our agent foursquare_agent, as shown below.

```
city1 = 'Memphis, Tennessee'
geolocator = Nominatim(user_agent="foursquare_agent")
location1 = geolocator.geocode(city1)
latitude1 = location1.latitude
longitude1 = location1.longitude
print('The geograpical coordinate of {} are {}, {}'.format(city1, latitude1, longitude1))
```

The geograpical coordinate of Memphis, Tennessee are 35.1490215, -90.0516285.

To extend to another city (for an example -my choice: Nashville,TN),obtaining its latitude & longitude :

```
city2 = 'Nashville, Tennessee'
geolocator = Nominatim()
location2 = geolocator.geocode(city2)
latitude2 = location2.latitude
longitude2 = location2.longitude
print('The geograpical coordinate of {} are {}, {}'.format(city2, latitude2, longitude2))

#city3 = 'Knoxville, Tennessee'
#geolocator = Nominatim()
#location3 = geolocator.geocode(city3)
#latitude3 = location3.latitude
#longitude3 = location3.longitude
#print('The geograpical coordinate of {} are {}, {}'.format(city3, latitude3, longitude3))
```

/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages/ipykernel_launcher.py:2: DeprecationWarning: Using Nominatim with the default "geopy/1.21.0" `user_agent` is strongly discouraged, as it violates Nominatim's ToS <https://operations.osmfoundation.org/policies/nominatim/> and may possibly cause 403 and 429 HTTP errors. Please specify a custom `user_agent` with `Nominatim(user_agent="my-application")` or by overriding the default `user_agent`: `geopy.geocoders.options.default_user_agent = "my-application"`. In geopy 2.0 this will become an exception.

The geograpical coordinate of Nashville, Tennessee are 36.1622296, -86.7743531.

Feasibility-2 cities data merge

	name	categories	lat	lng	id	city	likes	categories_classified
1	Qahwa	Coffee Shop	35.148373	-90.051681	4f9880f6e4b05f758cb5077c	Memphis	17	casual
3	Rachel's Salon & Day Spa	Salon / Barbershop	35.145709	-90.052597	4b78671bf964a5209ecb2ee3	Memphis	7	None
4	Maciel's Tortas & Tacos	Mexican Restaurant	35.144000	-90.053038	5612b256498e2a8fc88814fd	Memphis	39	latino
5	Flight Restaurant and Wine Bar	Tapas Restaurant	35.144260	-90.053297	4c76a4d73adda14383a70aaf	Memphis	134	None
6	Bardog Tavern	Bar	35.144412	-90.053921	4b075448f964a5201afc22e3	Memphis	153	bar

```
nearby_venues.tail()
```

	name	categories	lat	lng	id	city	likes	categories_classified
94	Wild Eggs	Breakfast Spot	36.164955	-86.779510	571f6c75498e62aa9dbf14d0	Nashville	30	casual
95	The Anchor Fellowship	Church	36.154068	-86.771582	4bafdb84f964a52092263ce3	Nashville	8	None
96	Hermitage Cafe	Diner	36.156002	-86.767434	4b058669f964a520f66022e3	Nashville	69	None
97	Dandgure's Cafeteria	American Restaurant	36.153401	-86.775551	4b8568e2f964a520f65b31e3	Nashville	7	american
98	North Endzone	Stadium	36.167020	-86.771635	5a246106f193c026baa3b463	Nashville	9	None

Data Extraction – Various search inputs-after cleaning

	name	categories	lat	lng	postalCode	city	state	address
3	Easy Way Food Stores	Food	35.147379	-90.051552	38103	Memphis	TN	80 N Main St
11	Healthy Life Styles Food Bstr	Food	35.143946	-90.053421	38103	Memphis	TN	45 S Main St
12	Gli Food Service	Food	35.142295	-90.050066	38103	Memphis	TN	203 Union Ave

	name	categories	address	lat	lng	postalCode	city	state
0	Premier Cafeteria	Café	109 N Main St	35.147857	-90.052471	38103	Memphis	TN
2	The MED Cafeteria	Food Court	Jefferson Ave, Memphis, TN	35.142368	-90.031839	38105	Memphis	TN
5	Peabody Cafeteria	Cafeteria	Young	35.120480	-89.992474	38104	Memphis	TN

	name	categories	address	lat	lng	postalCode	city	state
0	Memphis Park	Park	51 Front St	35.146732	-90.054067	38103	Memphis	TN
1	Tom Lee Park	Park	357 South Riverside Dr.	35.136636	-90.062896	38103	Memphis	TN
3	Mississippi River Greenbelt Park	Park	Mud Island	35.173387	-90.055146	38103	Memphis	TN
5	Robert Church Park	Park	Beale Street	35.138468	-90.048910	38126	Memphis	TN
6	Mud Island River Park	Park	125 N Front St	35.149415	-90.058117	38103	Memphis	TN
10	Overton Park	Park	2080 Poplar Ave	35.146540	-89.991928	38104	Memphis	TN
16	Mississippi River Park	Park	51 N. Riverside Drive	35.147167	-90.055145	38103	Memphis	TN
27	Handy Park	Park	200 Beale St	35.139737	-90.051340	38103	Memphis	TN
28	AutoZone Headquarters Park	Park	Wagner Place	35.142112	-90.056010	38103	Memphis	TN
31	Colonial Park	Park	AW Willis & Main St	35.157355	-90.048398	38105	Memphis	TN
41	Martyrs Park	Park	Channel 3 Dr	35.128397	-90.070222	38103	Memphis	TN
43	Founders Park	Park	South Main	35.135182	-90.058673	38103	Memphis	TN

	name	categories	address	lat	lng	postalCode	city	state
0	Fire Museum of Memphis	History Museum	118 Adams Ave	35.148367	-90.050699	38103	Memphis	TN
1	Cotton Museum of Memphis	History Museum	65 Union Ave	35.143515	-90.054718	38103	Memphis	TN
2	Belz Museum of Asian & Judaic Art	Museum	119 S Main St	35.141874	-90.054437	38103	Memphis	TN
3	Rock'n'Soul Museum	History Museum	191 Beale St	35.138997	-90.052141	38103	Memphis	TN
4	Mississippi River Museum	Museum	125 N Front St	35.149115	-90.054715	38103	Memphis	TN
6	Withers Collection Museum & Gallery	Art Museum	333 Beale St	35.139158	-90.050266	38103	Memphis	TN
7	W.C. Handy's Memphis Home & Museum	Museum - Monument / Landmark	352 Beale St	35.139744	-90.049557	38103	Memphis	TN

	name	categories	address	lat	lng	postalCode	city	state
0	Comfort In Downtown Breakfast Area	Breakfast Spot	100 N Front St, Memphis, TN 38103, USA	35.147797	-90.05155	38103	Memphis	TN

	name	categories	lat	lng	city	state	address	postalCode
1	Sheraton Memphis Downtown	Hotel	35.151554	-90.049635	Memphis	TN	250 N Main St	38103
4	SpringHill Suites Fitness Center	Hotel	35.146005	-90.052795	Memphis	TN	85 Court Ave	38103
7	Fitness Center at the Doubletree Hotel	Gym / Fitness Center	35.142023	-90.050803	Memphis	TN	185 Union Ave	38103
8	Hampton Inn & Suites Fitness Center	Gym / Fitness Center	35.140010	-90.051651	Memphis	TN	175 Peabody Pl	38103
9	Hotel Indigo Memphis Downtown	Hotel	35.145326	-90.049544	Memphis	TN	22 N B B King Blvd	38103

	name	categories	address	lat	lng	postalCode	city	state
0	Flight Restaurant and Wine Bar	Tapas Restaurant	39 S Main St	35.144260	-90.053297	38103	Memphis	TN
1	Bleu Restaurant and Lounge	American Restaurant	221 S 3rd St	35.138975	-90.052381	38103	Memphis	TN

	name	categories	lat	lng	city	state	address	postalCode
1	Alfred's on Beale	Bar	35.139356	-90.051506	Memphis	TN	197 Beale St	38103
2	Purple Haze	Nightclub	35.138941	-90.053773	Memphis	TN	140 Lt. George W. Lee Ave.	38103

1. Food cluster & 2. Park cluster

```
# creating dataframe of food, Cafeteria and Restaurant
food_neighbourhood_df = pd.concat([df_food, df_Cafeteria, df_Restaurant], ignore_index=True)
food_neighbourhood_df
```

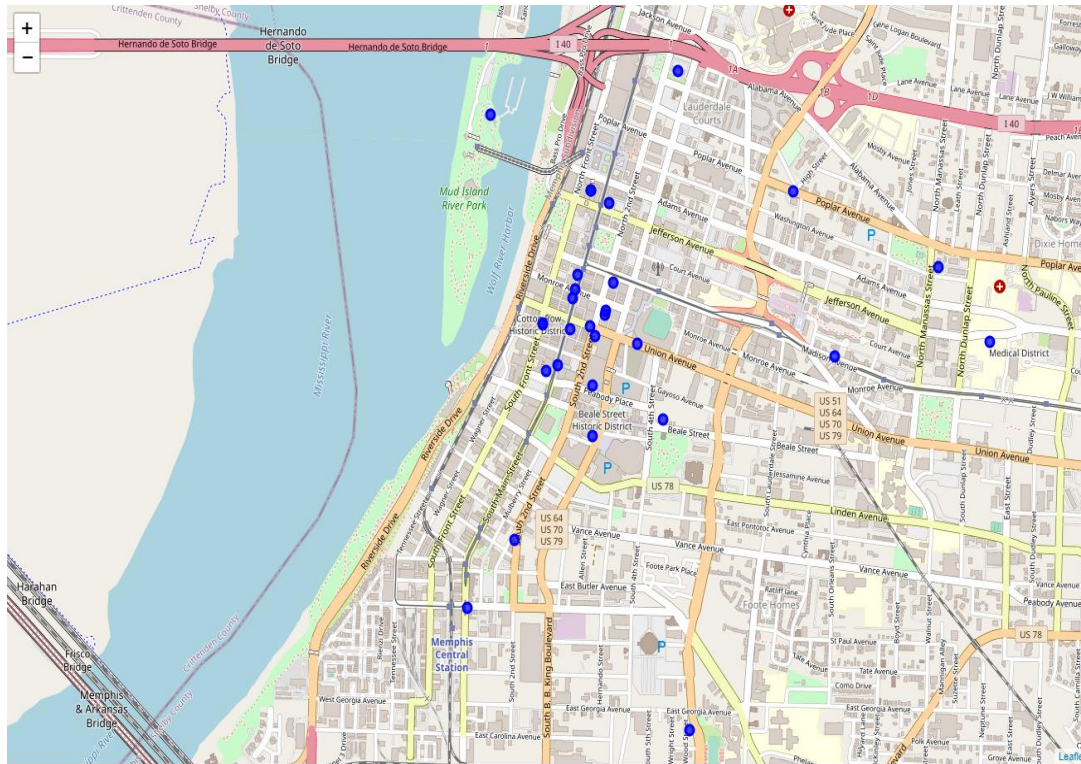
	name	categories	lat	lng	postalCode	city	state	address
0	Easy Way Food Stores	Food	35.147379	-90.051552	38103	Memphis	TN	80 N Main St
1	Healthy Life Styles Food Bstr	Food	35.143946	-90.053421	38103	Memphis	TN	45 S Main St
2	Gli Food Service	Food	35.142295	-90.050066	38103	Memphis	TN	203 Union Ave
3	Premier Cafeteria	Café	35.147857	-90.052471	38103	Memphis	TN	109 N Main St
4	The MED Cafeteria	Food Court	35.142368	-90.031839	38105	Memphis	TN	Jefferson Ave, Memphis, TN
5	Peabody Cafeteria	Cafeteria	35.120480	-89.992474	38104	Memphis	TN	Young

```
# creating dataframe of Park, Restaurant and Cafeteria
park_neighbourhood_df = pd.concat([df_park, df_Restaurant, df_Cafeteria, df_Top_picks], ignore_index=True)
park_neighbourhood_df
```

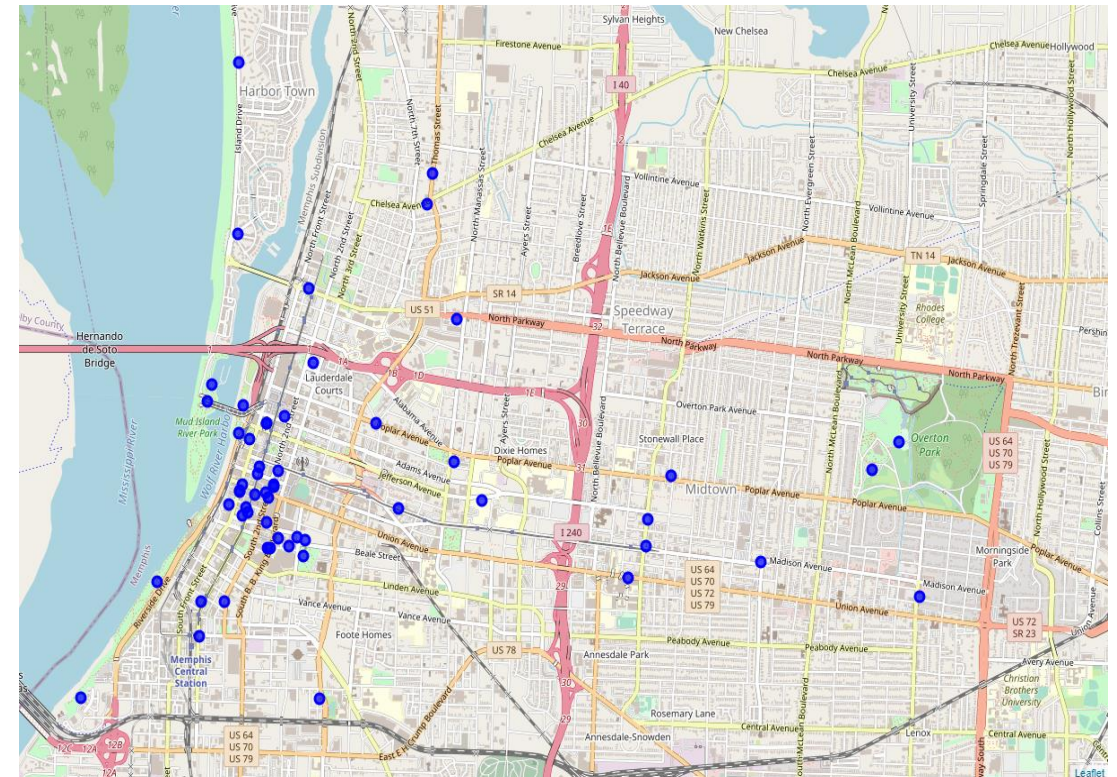
	name	categories	address	lat	lng	postalCode	city	state
0	Memphis Park	Park	51 Front St	35.146732	-90.054067	38103	Memphis	TN
1	Tom Lee Park	Park	357 South Riverside Dr.	35.136636	-90.062896	38103	Memphis	TN
2	Mississippi River Greenbelt Park	Park	Mud Island	35.173387	-90.055146	38103	Memphis	TN
3	Robert Church Park	Park	Beale Street	35.138468	-90.048910	38126	Memphis	TN
4	Mud Island River Park	Park	125 N Front St	35.149415	-90.058117	38103	Memphis	TN
...

3.Clustering: Creating aerial / geographical location map view- for multi clusters combination

3.1 Cluster 1: Food-Combining Food, Cafeteria and Restaurant venues



3.2 Cluster 2: Park- Combining Park, Restaurant, Cafeteria and Top Pick venues



3. Hotel cluster & 4. Visit cluster

```
# creating dataframe of food, Restaurant, Cafeteria and Breakfast categories
Hotel_neighbourhood_df = pd.concat([df_food, df_Restaurant, df_Cafeteria, df_Breakfast], ignore_index=True)
Hotel_neighbourhood_df
```

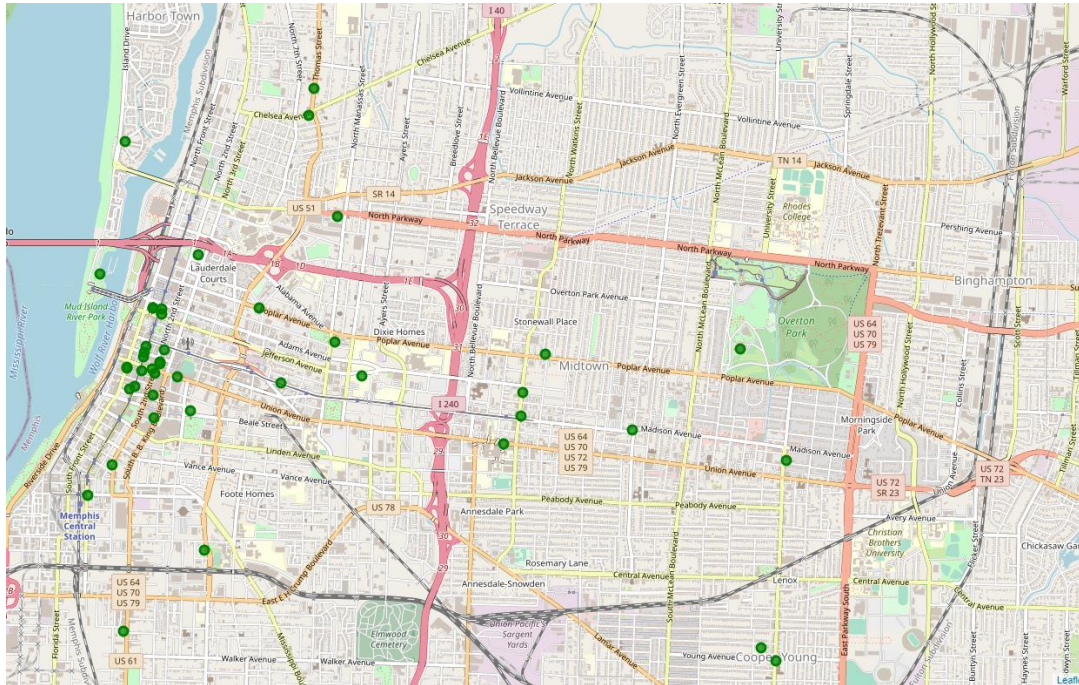
	name	categories	lat	lng	postalCode	city	state	address
0	Easy Way Food Stores	Food	35.147379	-90.051552	38103	Memphis	TN	80 N Main St
1	Healthy Life Styles Food Bstr	Food	35.143946	-90.053421	38103	Memphis	TN	45 S Main St
2	Gli Food Service	Food	35.142295	-90.050066	38103	Memphis	TN	203 Union Ave
3	Flight Restaurant and Wine Bar	Tapas Restaurant	35.144260	-90.053297	38103	Memphis	TN	39 S Main St
4	Bleu Restaurant and Lounge	American Restaurant	35.138975	-90.052381	38103	Memphis	TN	221 S 3rd St
5	Arcade Restaurant	Breakfast Spot	35.132748	-90.058863	38103	Memphis	TN	540 S Main St

```
# creating dataframe of Park, Restaurant and Cafeteria
Visit_neighbourhood_df = pd.concat([df_Fun, df_Top_picks, df_Nightlife], ignore_index=True)
Visit_neighbourhood_df
```

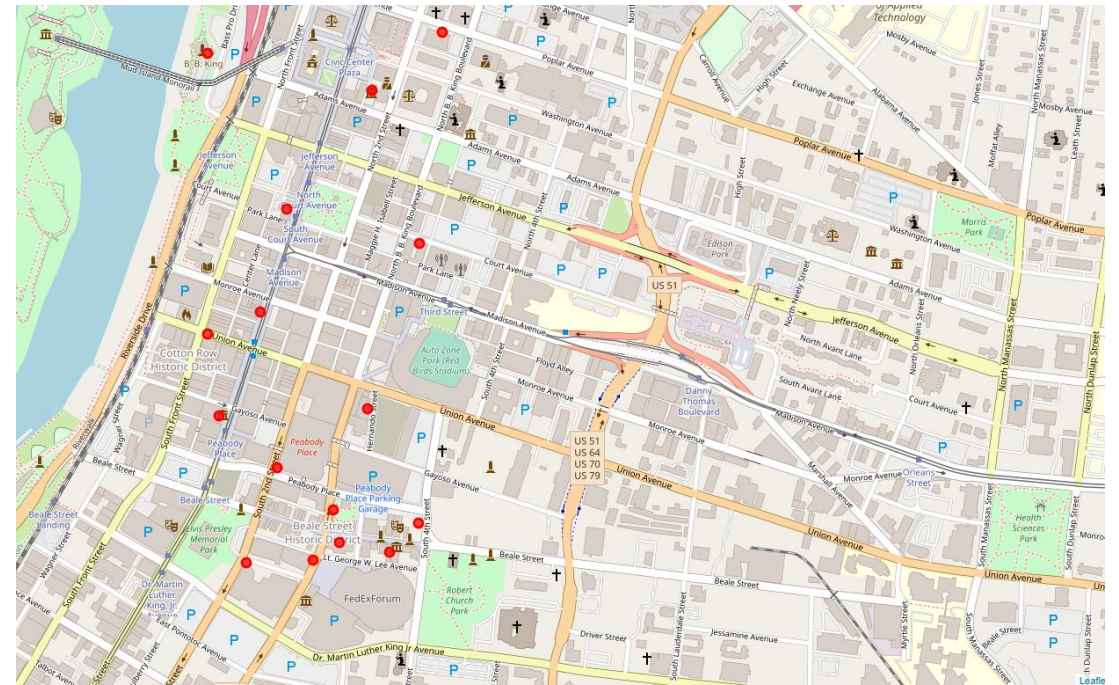
	name	categories	lat	lng	city	state	address	postalCode
0	Sheraton Memphis Downtown	Hotel	35.151554	-90.049635	Memphis	TN	250 N Main St	38103
1	SpringHill Suites Fitness Center	Hotel	35.146005	-90.052795	Memphis	TN	85 Court Ave	38103
2	Fitness Center at the Doubletree Hotel	Gym / Fitness Center	35.142023	-90.050803	Memphis	TN	185 Union Ave	38103
3	Hampton Inn & Suites Fitness Center	Gym / Fitness Center	35.140010	-90.051651	Memphis	TN	175 Peabody Pl	38103
4	Hotel Indigo Memphis Downtown	Hotel	35.145326	-90.049544	Memphis	TN	22 N B B King Blvd	38103
5	Fire Museum of Memphis	History Museum	35.148367	-90.050699	Memphis	TN	118 Adams Ave	38103

3. Clustering: Creating aerial / geographical location map view- for multi clusters combination

3.3 Cluster 3: Hotel- Combining Food,
Restaurant, Cafeteria and Breakfast venues:



3.4 Cluster 4: Visit-Combining Fun-Gym/Fitness
center, Top Pick-Museum and Nightlife venues :



4.Conclusion:

- Above exercise carried out as a pilot clustering and view with combined option for one city, keeping in mind that to be extended with multi cities combination or for comparison for user need for quicker overall view and decision. (In 2.1 - we had created for 2 cities as an example with url1 & url2 , but 2.2 onwards for easier working , url1 used as url only but with same latitude & longitude)

4.1 Assumption :

Though the exercise limited with clustering concept with four square API and we will be noticing that initially all libraries are imported viz., k-means, Linear model, Logistic Regression, iteration tool, time etc.,

Thanks to all peers and Instructors !

- Geetha Narayanan

