

# Bangalore-02-Capstone\_The-Battle-of-the-Neighborhoods

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## 1 Coursera Capstone Project

### 1.0.1 Anand Konji

Now that you have been equipped with the skills and the tools to use location data to explore a geographical location, over the course of two weeks, you will have the opportunity to be as creative as you want and come up with an idea to leverage the Foursquare location data to explore or compare neighborhoods or cities of your choice or to come up with a problem that you can use the Foursquare location data to solve. If you cannot think of an idea or a problem, here are some ideas to get you started:

In Module 3, we explored New York City and the city of Toronto and segmented and clustered their neighborhoods. Both cities are very diverse and are the financial capitals of their respective countries. One interesting idea would be to compare the neighborhoods of the two cities and determine how similar or dissimilar they are. Is New York City more like Toronto or Paris or some other multicultural city? I will leave it to you to refine this idea. In a city of your choice, if someone is looking to open a restaurant, where would you recommend that they open it? Similarly, if a contractor is trying to start their own business, where would you recommend that they setup their office? These are just a couple of many ideas and problems that can be solved using location data in addition to other datasets. No matter what you decide to do, make sure to provide sufficient justification of why you think what you want to do or solve is important and why would a client or a group of people be interested in your project.

**Review criteria**less This capstone project will be graded by your peers. This capstone project is worth 70% of your total grade. The project will be completed over the course of 2 weeks. Week 1 submissions will be worth 30% whereas week 2 submissions will be worth 40% of your total grade.

For this week, you will required to submit the following:

A description of the problem and a discussion of the background. (15 marks) A description of the data and how it will be used to solve the problem. (15 marks) For the second week, the final deliverables of the project will be:

A link to your Notebook on your Github repository, showing your code. (15 marks) A full report consisting of all of the following components (15 marks): Introduction where you discuss the business problem and who would be interested in this project. Data where you describe the data that will be used to solve the problem and the source of the data. Methodology section which represents the main component of the report where you discuss and describe any exploratory data analysis that you did, any inferential statistical testing that you performed, if any, and what machine learnings were used and why. Results section where you discuss the results. Discussion section where you discuss any observations you noted and any recommendations you can make based on the results.

Conclusion section where you conclude the report. 3. Your choice of a presentation or blogpost. (10 marks)

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## 1.1 Table of contents

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## 1.2 1. Introduction: Business Problem

In this project we will try to find an optimal location for a restaurant. Specifically, this report will be targeted to stakeholders interested in opening an **Italian restaurant** in **Bangalore**, India.

Since there are lots of restaurants in Bangalore we will try to detect **locations that are not already crowded with restaurants**. We are also particularly interested in **areas with no Italian restaurants in vicinity**. We would also prefer locations **as close to city center as possible**, assuming that first two conditions are met.

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

## 1.3 2. Data

Based on definition of our problem, factors that will influence our decision are: \* number of existing restaurants in the neighborhood (any type of restaurant) \* number of and distance to Italian restaurants in the neighborhood, if any \* distance of neighborhood from city center

We decided to use regularly spaced grid of locations, centered around city center, to define our neighborhoods.

Following data sources will be needed to extract/generate the required information: \* centers of candidate areas will be generated algorithmically and approximate addresses of centers of those areas will be obtained using **reverse geocoding** \* number of restaurants and their type and location in every neighborhood will be obtained using **Foursquare API** \* coordinate of Bangalore center will be obtained using **geocoding** of well known Bangalore location (Koramangala)

### 1.3.1 Neighborhood Candidates

Let's create latitude & longitude coordinates for centroids of our candidate neighborhoods. We will create a grid of cells covering our area of interest which is approx. 10x10 kilometers centered around Bangalore city center.

Let's first find the latitude & longitude of Bangalore city center.

**install the packages required, if not done already**

```
[1]: # install the packages required, if not done already
```

```
!pip install beautifulsoup4
!pip install lxml
!pip install geocoder
!pip install geopy
!pip install folium
print("Installed required packages !!!")
```

```
Requirement already satisfied: beautifulsoup4 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (4.9.0)
Requirement already satisfied: soupsieve>1.2 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
beautifulsoup4) (2.0)
Requirement already satisfied: lxml in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (4.5.0)
Requirement already satisfied: geocoder in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (1.38.1)
Requirement already satisfied: click in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
(7.1.2)
Requirement already satisfied: requests in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
(2.23.0)
Requirement already satisfied: ratelim in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
(0.1.6)
Requirement already satisfied: future in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
(0.18.2)
Requirement already satisfied: six in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
(1.14.0)
Requirement already satisfied: certifi>=2017.4.17 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->geocoder) (2020.4.5.1)
Requirement already satisfied: chardet<4,>=3.0.2 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->geocoder) (3.0.4)
Requirement already satisfied: urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->geocoder) (1.25.9)
Requirement already satisfied: idna<3,>=2.5 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->geocoder) (2.9)
Requirement already satisfied: decorator in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
ratelim->geocoder) (4.4.2)
```

```

Requirement already satisfied: geopy in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (1.21.0)
Requirement already satisfied: geographiclib<2,>=1.49 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geopy)
(1.50)
Requirement already satisfied: folium in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (0.5.0)
Requirement already satisfied: requests in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from folium)
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/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from folium)
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Requirement already satisfied: branca in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from folium)
(0.4.1)
Requirement already satisfied: jinja2 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from folium)
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Requirement already satisfied: certifi>=2017.4.17 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->folium) (2020.4.5.1)
Requirement already satisfied: chardet<4,>=3.0.2 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->folium) (3.0.4)
Requirement already satisfied: urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->folium) (1.25.9)
Requirement already satisfied: idna<3,>=2.5 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
requests->folium) (2.9)
Requirement already satisfied: MarkupSafe>=0.23 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
jinja2->folium) (1.1.1)
Installed required packages !!!

```

### import the required libraries

```

[2]: # import the libraries
import pandas as pd
import requests as rqt
from bs4 import BeautifulSoup as bs
import numpy as np
import geocoder as gc

import folium
import requests
import json

```

```

import matplotlib.cm as cm
import matplotlib.colors as colors
import pandas as pd

from pandas.io.json import json_normalize
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_samples, silhouette_score
from geopy.geocoders import Nominatim

import matplotlib.pyplot as plt
%matplotlib inline

import matplotlib.cm as cm
import matplotlib.colors as colors

pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

print("Imported required stuffs!")

```

Imported required stuffs!

**Scraping Wikipedia page and creating a Dataframe and Transforming the data on Wiki page into pandas dataframe.** Using BeautifulSoup Scraping List of Postal Codes of Given Wikipedia/other source Page

```

[3]: url = "http://pincode.india-server.com/cities/bengaluru/"
    extractData = rqt.get(url).text
    wikiData = bs(extractData, 'lxml')

```

```

[4]: #wikiData

```

Converting content of PostalCode HTML table as dataframe

```

[4]: columnNames = ['Postalcode', 'Town', 'Neighborhood']
    bangalore = pd.DataFrame(columns = columnNames)

    table = wikiData.find('table', class_='pincode-tbl')

```

```

[6]: #table

```

```

[5]: # parsing data and pushing to table rows
    SrNo = 0
    Neighborhood = 0
    town='Bangalore'
    OffType = 0

```

```

PinCode = 0

for tr in table.find_all('tr'):
    i = 0
    for td in tr.find_all('td'):
        if i == 0:
            SrNo = td.text.strip('\n')
            i = i + 1
        elif i == 1:
            Neighborhood = td.text.strip('\n')
            i = i + 1
        elif i == 2:
            OffType = td.text.strip('\n')
            i = i + 1
        elif i == 3:
            PinCode = td.text.strip('\n').replace(']', '')
            #bangalore = bangalore.append({'S.No.': SrNo, 'Post office': PoOff, 'Office_
            ↳type': OffType, 'Pincode': PinCode}, ignore_index=True)
            bangalore = bangalore.append({'Postalcode': PinCode, 'Town':_
            ↳town, 'Neighborhood': Neighborhood}, ignore_index=True)

```

```
[6]: bangalore.head()
```

```

[6]:   Postalcode      Town      Neighborhood
0         0  Bangalore              0
1   Pincode  Bangalore      Post office
2   560063  Bangalore  A F Station Yelahanka
3   560107  Bangalore      Achitnagar
4   561101  Bangalore      Adarangi

```

Data cleansing

```

[6]: # clean dataframe
bangalore = bangalore[bangalore.Neighborhood!='Not assigned']
bangalore = bangalore[bangalore.Neighborhood!= 0]
bangalore = bangalore[bangalore.Neighborhood!='Post office']
bangalore.reset_index(drop = True, inplace = True)
i = 0
for i in range(0, bangalore.shape[0]):
    if bangalore.iloc[i][2] == 'Not assigned':
        bangalore.iloc[i][2] = bangalore.iloc[i][1]
        i = i+1

```

```

[7]: df = bangalore.groupby(['Postalcode', 'Town'])['Neighborhood'].apply(', '.join).
      ↳reset_index()

```

```
[8]: df.head()
```

```
[8]:
```

	Postalcode	Town	Neighborhood
0	560001	Bangalore	Bangalore Bazaar , Bangalore G.P.O., CMM Court...
1	560002	Bangalore	Bangalore City , Bangalore Corporation Building
2	560003	Bangalore	Malleswaram , Palace Guttahalli , Swimming Poo...
3	560004	Bangalore	Basavanagudi , Mavalli , Pampamahakavi Road , ...
4	560005	Bangalore	Fraser Town

```
[9]: df.describe()
```

```
[9]:
```

	Postalcode	Town	Neighborhood
count	131	131	131
unique	131	1	131
top	560049	Bangalore	Gayathrinagar , Srirampuram
freq	1	131	1

Data Cleaning | Drop None rows of df and row which contains 'Not assigned' value | All "Not assigned" will be replace to 'NaN'

```
[10]: df = df.dropna()
empty = 'Not assigned'
df = df[(df.Postalcode != empty) & (df.Town != empty) & (df.Neighborhood !=
↳ empty)]
```

```
[11]: df.head()
```

```
[11]:
```

	Postalcode	Town	Neighborhood
0	560001	Bangalore	Bangalore Bazaar , Bangalore G.P.O., CMM Court...
1	560002	Bangalore	Bangalore City , Bangalore Corporation Building
2	560003	Bangalore	Malleswaram , Palace Guttahalli , Swimming Poo...
3	560004	Bangalore	Basavanagudi , Mavalli , Pampamahakavi Road , ...
4	560005	Bangalore	Fraser Town

```
[12]: def neighborhood_list(grouped):
        return ', '.join(sorted(grouped['Neighborhood'].tolist()))

grp = df.groupby(['Postalcode', 'Town'])
df_2 = grp.apply(neighborhood_list).reset_index(name='Neighborhood')
```

```
[13]: df_2.describe()
```

```
[13]:
```

	Postalcode	Town	Neighborhood
count	131	131	131
unique	131	1	131
top	560049	Bangalore	Gayathrinagar , Srirampuram
freq	1	131	1

```
[14]: print(df_2.shape)
df_2.head()
```

(131, 3)

```
[14]:   Postalcode      Town      Neighborhood
0      560001  Bangalore  Bangalore Bazaar , Bangalore G.P.O., CMM Court...
1      560002  Bangalore  Bangalore City , Bangalore Corporation Building
2      560003  Bangalore  Malleswaram , Palace Guttahalli , Swimming Poo...
3      560004  Bangalore  Basavanagudi , Mavalli , Pampamahakavi Road , ...
4      560005  Bangalore                        Fraser Town
```

```
[17]: #df_2.to_csv('bangalore.csv', index=False)
```

**Adding Latitude and Longitude Co-ordinates to the DataFrame** Reading the bangalore.csv which created on Part 1 Notebook

```
[18]: #df = pd.read_csv('bangalore.csv')
df.head()
```

```
[18]:   Postalcode      Town      Neighborhood
0      560001  Bangalore  Bangalore Bazaar , Bangalore G.P.O., CMM Court...
1      560002  Bangalore  Bangalore City , Bangalore Corporation Building
2      560003  Bangalore  Malleswaram , Palace Guttahalli , Swimming Poo...
3      560004  Bangalore  Basavanagudi , Mavalli , Pampamahakavi Road , ...
4      560005  Bangalore                        Fraser Town
```

```
[15]: print(df.shape)
#df.describe()
```

(131, 3)

```
[16]: def get_latilong(postal_code):
    lati_long_coords = None
    while(lati_long_coords is None):
        g = gc.arcgis('{}, Bangalore, Karnataka'.format(postal_code))
        lati_long_coords = g.latlng
    return lati_long_coords

get_latilong(560034)
```

```
[16]: [12.931355000000053, 77.63397875900006]
```

```
[17]: # Retrieving Postal Code Co-ordinates
postal_codes = df['Postalcode']
coords = [ get_latilong(postal_code) for postal_code in postal_codes.tolist() ]
```



```
[18]: # Adding Columns Latitude & Longitude
df_coords = pd.DataFrame(coords, columns=['Latitude', 'Longitude'])
df['Latitude'] = df_coords['Latitude']
df['Longitude'] = df_coords['Longitude']
```

```
[24]: #df[df.Postalcode == 560034]
```

```
[19]: df.head()
```

```
[19]:  Postalcode      Town      Neighborhood \
0      560001  Bangalore  Bangalore Bazaar , Bangalore G.P.O., CMM Court...
1      560002  Bangalore  Bangalore City , Bangalore Corporation Building
2      560003  Bangalore  Malleswaram , Palace Guttahalli , Swimming Poo...
3      560004  Bangalore  Basavanagudi , Mavalli , Pampamahakavi Road , ...
4      560005  Bangalore  Fraser Town

      Latitude  Longitude
0  12.979185   77.606623
1  12.964070   77.577647
2  13.003656   77.569745
3  12.945664   77.575075
4  12.998115   77.620842
```

```
[26]: #df.to_csv('bangalore_lalo.csv',index=False)
```

```
[27]: #df.head()
```

## 1.4 3. Methodology

```
[20]: #df = pd.read_csv('bangalore_lalo.csv')
print(df.shape)
df.head()
```

(131, 5)

```
[20]:  Postalcode      Town      Neighborhood \
0      560001  Bangalore  Bangalore Bazaar , Bangalore G.P.O., CMM Court...
1      560002  Bangalore  Bangalore City , Bangalore Corporation Building
2      560003  Bangalore  Malleswaram , Palace Guttahalli , Swimming Poo...
3      560004  Bangalore  Basavanagudi , Mavalli , Pampamahakavi Road , ...
4      560005  Bangalore  Fraser Town

      Latitude  Longitude
0  12.979185   77.606623
1  12.964070   77.577647
2  13.003656   77.569745
3  12.945664   77.575075
```

4 12.998115 77.620842

### Getting the coordinates of Bangalore City

```
[21]: address = 'Bangalore, India'
geolocator = Nominatim(user_agent="bangalore_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Bangalore India are {}, {}'.format(
    latitude, longitude))
```

The geograpical coordinate of Bangalore India are 12.9791198, 77.5912997.

### Creating a map of Bangalore City with neighborhoods superimposed on top

```
[22]: # create map of Bangalore using latitude and longitude values
map_bangalore = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, town, neighborhood in zip(df['Latitude'], df['Longitude'],
    df['Town'], df['Neighborhood']):
    label = '{} {}'.format(neighborhood, town)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_bangalore)

map_bangalore
```

[22]: <folium.folium.Map at 0x7ff6e2d05978>

##### Utilizing the Foursquare API to explore the neighborhoods and segment them

Defining Foursquare Credentials and Version

```
[23]: # Foursquare API
CLIENT_ID = '2A51C3ZVYHCBBJ3G1JTWNBUPP3UOQHPU015V3D04LY2PIPLB' # Put Your
    Client Id
CLIENT_SECRET = '1NBYJR1HFLDNDNJACE0C4EPYURV4ACOFXB2IHSCROAHN41KW' # Put Your
    Client Secret
VERSION = '20200508'
```

```

CATEGORYID='4d4b7105d754a06374d81259' # for food category from doc https://
→developer.foursquare.com/docs/build-with-foursquare/categories/
#CATEGORYID='4bf58dd8d48988d110941735' # for Italian category
LIMIT = 100
print('Your credentails:')
print('CLIENT_ID: Hidden')
print('CLIENT_SECRET: Hidden')

```

Your credentails:

CLIENT\_ID: Hidden

CLIENT\_SECRET: Hidden

Creating a dataframe with all the venues information provided by foursquare for the given latitude and longitude values

```

[24]: def getNearbyVenues(names, latitudes, longitudes, radius=500):

    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

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

        # make the GET request
        results = requests.get(url).json()["response"]["groups"][0]["items"]

        # return only relevant information for each nearby venue
        venues_list.append([( name, 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 = ['Neighborhood', 'Neighborhood Latitude',
→'Neighborhood Longitude', 'Venue', 'Venue Latitude', 'Venue Longitude',
→'Venue Category']
    print('Done !!!')
    return(nearby_venues)

```

Using the above function on each neighborhood and create a new dataframe called bangalore\_venues

```
[25]: #df = bangalore_data
bangalore_venues = getNearbyVenues(names=df['Neighborhood'],
↳latitudes=df['Latitude'],longitudes=df['Longitude'])
```

Bangalore Bazaar , Bangalore G.P.O. , CMM Court Complex , Dr. Ambedkar Veedhi , HighCourt , Legislators Home , Mahatma Gandhi Road , Rajbhavan , Vasanthanagar , Vidhana Soudha  
Bangalore City , Bangalore Corporation Building  
Malleswaram , Palace Guttahalli , Swimming Pool Extn , Vyalikaval Extn  
Basavanagudi , Mavalli , Pampamahakavi Road , Thyagarajnagar  
Fraser Town  
J.C.Nagar , Training Command IAF  
Agram , Air Force Hospital  
H.A.L II Stage , Hulsur Bazaar  
Bangalore Dist Offices Bldg , K. G. Road  
Industrial Estate , Rajajinagar , Rajajinagar IVth Block  
Jayangar III Block , Madhavan Park  
Science Institute  
Jalahalli  
Jalahalli East  
Jalahalli West  
Doorvaninagar , Krishnarajapuram R S , Ramamurthy Nagar  
NAL , Vimanapura  
Chamrajpet  
Gaviopuram Extension  
Seshadripuram  
Gayathrinagar , Srirampuram  
Yeshwanthpur Bazar , Yeswanthpura  
Magadi Road  
Anandnagar , H.A. Farm , Hebbal Kempapura  
Bangalore Sub Foreign Post , CMP Centre And School , Museum Road , Richmond Town  
Deepanjalinagar , Governmemnt Electric Factory  
Sampangiramnagar , Shanthinagar , Wilson Garden  
Dharmaram College , Tavarekere  
Adugodi  
P&T Col. Kavalbyrasandra , R T Nagar  
Maruthi Sevanagar  
Agara , Koramangala I Block , Koramangala , St. John Medical College  
Carmelram  
Devasandra , Krishnarajapuram  
Doddanekkundi , Kundalahalli , Marathahalli Colony , Rameshnagar  
Indiranagar  
Nayandahalli  
Chandra Lay Out , Vijayanagar East , Vijayanagar  
Jayanagar , Tilaknagar  
Sivan Chetty Gardens  
Banaswadi , Horamavu , Jalavayuvihar , Kalyananagar

Arabic College , Venkateshapura  
 Benson Town , Jayamahall Road  
 Austin Town , Viveknagar  
 Hoodi , Mahadevapura  
 Bhattarahalli , Bidrahalli , Mundur , Virgonagar  
 Ashoknagar , Banashankari , Dasarahalli(Srinagar) , State Bank Of Mysore Colony  
 H.K.P. Road  
 Chickpet  
 Mathikere , Msrit , Sri Chowdeshwari  
 Malleswaram West  
 Bnagalore Viswavidalaya , Mallathahalli  
 Peenya Dasarahalli  
 Laggere , Peenya I Stage , Peenya Small Industries  
 Rv Niketan  
 Chudenapura , Kengeri , Sulikere  
 Chikkalasandra , Subramanyapura  
 Doddakallasandra , Konanakunte  
 A F Station Yelahanka , BSF Campus Yelahanka  
 Attur , CRPF Campus Yelahanka , Jakkur , Rajanakunte , Singanayakanahalli ,  
 Yelahanka , Yelahanka Satellite Town  
 G.K.V.K.  
 EPIP , Whitefield  
 Devanagundi , Kadugodi Extention SO, Kadugodi , Kalkunte , Kannamangala ,  
 Medimallasandra , Naduvathi , Samethanahalli  
 Begur , Bommanahalli , Madivala , Singasandra  
 B Sk II Stage , Jayanagar West , Padmanabhnagar , Tyagrajnagar  
 Domlur  
 Nagarbhavi  
 Bagalgunte , Chikkabidarkal , Nagasandra , Nelakadiranahalli  
 Kumbalagodu , Kumbalagodu Gollahalli , Ramohalli  
 Jeevanbhimannagar , New Thippasandra  
 Bannerghatta Road , Hulimavu , Hulimavu , JP Nagar VIII phase , Mico Layout ,  
 Mount St Joseph  
 Doddagubbi , Dr. Shivarama Karanth Nagar , Kothanur  
 J P Nagar , JP Nagar III Phase , Kumaraswamy Layout , Yelachenahalli  
 Basaveshwaranagar , K H B Colony , Kamakshipalya  
 Sadashivanagar  
 Chandapura  
 Bolare , Kagalipura , Somanhalli , Taralu , Thataguni , Thattekuppe , Udayapura  
 Bannerghatta , Gottigere , Kalkere , Ragihalli , Sakalavara  
 Lingarajapuram , St. Thomas Town  
 Banashankari III Stage , Girinagar , Kathriguppe  
 Mahalakshmipuram Layout , West of Chord Road II stage  
 Gunjur , Muthusandra , Vartur  
 Hessarghatta  
 Byatha , Hessarghatta Lake , Kakolu , Shivakote  
 Chikkabanavara , Silvepura , Tarabanahalli  
 Bapagrama , Herohalli , Kodigehalli , Viswaneedam

Amruthahalli , Byatarayanapura , Kodigehalli , Sahakaranagar P.O  
 C.V.Raman Nagar  
 ISRO Anthariksha Bhavan , R.M.V. Extension II Stage  
 Koramangala VI Bk  
 Nandinilayout  
 Vidyaranyapura  
 Rajarajeshwarinagar  
 Bommasandra Industrial Estate , Chandapura , Huskur , Muthanallur  
 Electronics City , Wipro Limited  
 HSR Layout  
 Bellandur , Panathur  
 Hampinagar  
 Haragadde , Hennagara , Hulimangala , Jigani , Kallubalu  
 Achitnagar  
 Anjanapura  
 Thalaghattapura  
 Ullalu Upanagar  
 Kodigehalli  
 Bangalore International Airport  
 Adarangi , Hulikal , Kudur , Marasandra , Mayasandra , Sirigiripura ,  
 Sugganahalli  
 Ajjanahalli  
 Antharahalli , Arallumallige , Dodballapura Bazar , Dodballapura , Gundamgere ,  
 Hanabe , Hosahalli , Kanasavadi , Kannamangala , Kodigehalli , Kongadiyappa Road  
 , Mallathahalli , Rajaghatta , Sri Subramanyaghati , Tippur  
 Arudi , Baktharahalli , Doddabelavangala , Doddajejjaji , Hulikunte ,  
 Kadalappanahalli , Kadanur , Koligere , Purushanahalli , Rameshwara ,  
 Sakkaaregollahalli , Sasalu , Syakaladevanapura  
 Gantiganahalli , Hadonahalli , Heggadahalli , Melekote , Tubugere  
 Anekal , Bestamaranahalli , Byagadadenahalli , Guddanahalli , Indalavadi ,  
 Marsur , Samandur , Sidi Hoskote , Thammanayakanahalli , Vanakanahalli  
 Attibele , Bidaraguppe , Mayasandra , Neralur , Yadavanahalli  
 Alurduddanahalli , Anneshwara , Aradeshanahalli , Devanahalli , Doddasanne ,  
 Hegganahalli , Jalige , Kannamangala , Kundana , Sadahalli , Uganavadi ,  
 Vishwanathapura , Yeliyur  
 Arebommanahalli , Baragenahalli , Billanakote , Devarahosahalli , Dobbespeth ,  
 Heggunda , Kambalu , Kuluvanahalli , Lakkur , Maralakunte , Narasipura ,  
 Shivagange , Yelekyathanahalli  
 Doddagattiganabbe , Doddanallala , Hasigala , Hoskote Indl. Area , Hoskote ,  
 Jadigenahalli , Jodidasarahalli , Kattigenahalli , Kembliganahalli , Kollathur ,  
 Kumbalahalli , Lakkondanahalli , Mugabala , Vagata Agrahara  
 Mullahalli  
 Chamarajasagara  
 Begur , Bylanarasapura , Hindaganala , K.Satyavara , Korati , Nandagudi ,  
 Nelavagilu , Shivanapura , Tavarekere  
 Arasinakunte , Budihal , Gollahalli , Honnasandra , Jakkanahalli , Madalakote ,  
 Mahadevapura , Mallarabanavadi , Mandigere , Mylanahalli , Nelamangala ,  
 Teppadabeguru , Yentiganahalli

Dommasandra , Handenahalli , Kugur , Neriga , Sarjapura  
 Banavadi , Bylakere , Gudemaranahalli , Lakkenahalli , Madigondanahalli ,  
 Manniganahalli , Marikuppe , Motagondanahalli , Narasandra , Solur , Udukunte ,  
 Yennegere  
 Bendiganahalli , Bettakote , Budigere , Ibasapura , Reddihalli , Sulebele  
 Chikkanahalli , Chunchanakuppe , Kadabagere , Kithanahalli , Soladevanahalli ,  
 Sondekoppa , Tavarekere  
 Baginigere , Biskur , Doddamudigere , Doddasomanahalli , Gangonahalli ,  
 Hullenahalli , Sankighatta , Thippasandra  
 Doddabele , Kollalagatta , Manne , Niduvanda , Obalapura , Tyamagondlu  
 Channarayapatna , Harohalli , Mandibele , Narayanapura , Vijayapura  
 Bagalur , Bandikodigehalli , Kannur  
 Bettahalsur , Chikkajala , Doddajala , Hunasamaranahalli , Tarahunise ,  
 Vidyanagara  
 Aluru , Dasanapura , Hullegowdanahalli , Huskur , Lakshmipura ,  
 Madanayakanahalli , Madavara , Makali , Mathahalli , Shivanapura  
 Arakere , Basettihalli , Doddatumkur , Konnagatta , NAGADENAHALLI, Shivapura ,  
 Veerapura  
 Avathi, Bidalur , Bijjawara , Karahalli , Koira , Venkatagirikote  
 Done !!!

```
[26]: print(bangalore_venues.shape)
      bangalore_venues.head()
```

(718, 7)

```
[26]:
```

	Neighborhood	Neighborhood	Latitude	\
0	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
1	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
2	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
3	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
4	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	

	Neighborhood	Longitude	Venue	Venue Latitude	Venue Longitude	\
0		77.606623	Peppa Zzing	12.979700	77.605907	
1		77.606623	Samarkand	12.980616	77.604668	
2		77.606623	Coast 2 Coast	12.975305	77.605625	
3		77.606623	Krispy Kreme	12.982630	77.607027	
4		77.606623	Shiv Sagar	12.981879	77.608322	

	Venue Category
0	Burger Joint
1	Afghan Restaurant
2	Indian Restaurant
3	Donut Shop
4	Indian Restaurant

```
[36]: #bangalore_venues.to_csv('bangalore_venues1.csv')
```

```
[27]: # Number of venues for each neighborhood
bangalore_venues.groupby('Neighborhood')
print('There are {} unique categories.'.format(len(bangalore_venues['Venue_
↳Category'].unique())))
```

There are 58 unique categories.

#### 1.4.1 Extracting only restaurants from venue category list and creating a dataframe “bangalore\_restaurants”

```
[28]: bangalore_restaurants = bangalore_venues[bangalore_venues['Venue Category'].str.
↳contains("Restaurant")]
```

```
[39]: print('There are {} unique categories or cuisines available in Bangalore.'.
↳format(len(bangalore_restaurants['Venue Category'].unique())))
```

There are 31 unique categories or cuisines available in Bangalore.

#### 1.5 4. Analysis of each neighborhood

```
[29]: # one hot encoding
bangalore_onehot = pd.get_dummies(bangalore_restaurants[['Venue Category']],
↳prefix="", prefix_sep="")

# add neighborhood column back to dataframe
bangalore_onehot['Neighborhood'] = bangalore_restaurants['Neighborhood']

# move neighborhood column to the first column
fixed_columns = [bangalore_onehot.columns[-1]] + list(bangalore_onehot.columns[:
↳-1])
bangalore_onehot = bangalore_onehot[fixed_columns]

bangalore_onehot.head()
```

```
[29]:
```

	Neighborhood	Afghan Restaurant	\
1	Bangalore Bazaar , Bangalore G.P.O., CMM Court...	1	
2	Bangalore Bazaar , Bangalore G.P.O., CMM Court...	0	
4	Bangalore Bazaar , Bangalore G.P.O., CMM Court...	0	
5	Bangalore Bazaar , Bangalore G.P.O., CMM Court...	0	
7	Bangalore Bazaar , Bangalore G.P.O., CMM Court...	0	

	American Restaurant	Andhra Restaurant	Asian Restaurant	\
1	0	0	0	
2	0	0	0	
4	0	0	0	
5	0	0	0	
7	0	0	0	



	Chinese Restaurant	Dumpling Restaurant	Falafel Restaurant	\
1	0	0	0	
2	0	0	0	
4	0	0	0	
5	0	0	0	
7	0	0	0	

	Fast Food Restaurant	Hyderabadi Restaurant	Indian Chinese Restaurant	\
1	0	0	0	
2	0	0	0	
4	0	0	0	
5	0	0	0	
7	0	0	0	

	Indian Restaurant	Italian Restaurant	Karnataka Restaurant	\
1	0	0	0	
2	1	0	0	
4	1	0	0	
5	0	0	0	
7	0	0	0	

	Kerala Restaurant	Korean Restaurant	Mediterranean Restaurant	\
1	0	0	0	
2	0	0	0	
4	0	0	0	
5	0	0	0	
7	0	0	0	

	Mexican Restaurant	Middle Eastern Restaurant	Modern European Restaurant	\
1	0	0	0	
2	0	0	0	
4	0	0	0	
5	0	0	0	
7	0	0	1	

	Multicuisine Indian Restaurant	North Indian Restaurant	\
1	0	0	
2	0	0	
4	0	0	
5	0	0	
7	0	0	

	Punjabi Restaurant	Rajasthani Restaurant	Restaurant	Seafood Restaurant	\
1	0	0	0	0	
2	0	0	0	0	
4	0	0	0	0	

5	0	0	0	0
7	0	0	0	0

	South Indian Restaurant	Thai Restaurant	Tibetan Restaurant	\
1	0	0	0	
2	0	0	0	
4	0	0	0	
5	1	0	0	
7	0	0	0	

	Udupi Restaurant	Vegetarian / Vegan Restaurant	Vietnamese Restaurant
1	0	0	0
2	0	0	0
4	0	0	0
5	0	0	0
7	0	0	0

```
[30]: print('There are {} restaurants in Bangalore with {} different style of_
↪cuisines.'.format(bangalore_onehot.shape[0],(bangalore_onehot.shape[1]-1)))
```

There are 455 restaurants in Bangalore with 31 different style of cuisines.

Grouping rows by neighborhood and taking the mean of the frequency of occurrence of each category/restaurants

```
[31]: bangalore_grouped = bangalore_onehot.groupby('Neighborhood').mean().
↪reset_index()
bangalore_grouped
```

```
[31]:
```

	Neighborhood	Afghan Restaurant	\
0	Achitnagar	0.000000	
1	Adarangi , Hulikal , Kudur , Marasandra , Maya...	0.000000	
2	Adugodi	0.000000	
3	Agara , Koramangala I Block , Koramangala , St...	0.000000	
4	Ajjanahalli	0.000000	
5	Amruthahalli , Byatarayanapura , Kodigehalli , ...	0.000000	
6	Anandnagar , H.A. Farm , Hebbal Kempapura	0.000000	
7	Arabic College , Venkateshapura	0.000000	
8	Arebomnahalli , Baragenahalli , Billanakote , ...	0.000000	
9	Ashoknagar , Banashankari , Dasarahalli(Srina...	0.000000	
10	Austin Town , Viveknagar	0.000000	
11	B Sk II Stage , Jayanagar West , Padmanabhnaga...	0.000000	
12	Bagalgunte , Chikkabidarkal , Nagasandra , Ne...	0.000000	
13	Baginigere , Biskur , Doddamudigere , Doddasom...	0.000000	
14	Banashankari III Stage , Girinagar , Kathrigu...	0.000000	
15	Banaswadi , Horamavu , Jalavayuvihar , Kalyana...	0.000000	
16	Banavadi , Bylakere , Gudemaranahalli , Lakken...	0.000000	
17	Bangalore Bazaar , Bangalore G.P.O. , CMM Court...	0.034483	

18	Bangalore City , Bangalore Corporation Building	0.000000
19	Bangalore Dist Offices Bldg , K. G. Road	0.000000
20	Bangalore Sub Foreign Post , CMP Centre And Sc...	0.000000
21	Bannerghatta Road , Hulimavu , Hulimavu , JP N...	0.000000
22	Bapagrama , Herohalli , Kodigehalli , Viswanee...	0.000000
23	Basavanagudi , Mavalli , Pampamahakavi Road , ...	0.000000
24	Basaveshwaranagar , K H B Colony , Kamakshipalya	0.000000
25	Begur , Bommanahalli , Madivala , Singasandra	0.000000
26	Bellandur , Panathur	0.000000
27	Benson Town , Jayamahar Road	0.000000
28	Bettahalsur , Chikkajala , Doddajala , Hunasam...	0.000000
29	C.V.Raman Nagar	0.000000
30	Chamarajasagara	0.000000
31	Chamrajpet	0.000000
32	Chandra Lay Out , Vijayanagar East , Vijayanag...	0.000000
33	Chickpet	0.000000
34	Deepanjalinagar , Governmemnt Electric Factory	0.000000
35	Devasandra , Krishnarajapuram	0.000000
36	Dharmaram College , Tavarekere	0.000000
37	Doddagubbi , Dr. Shivarama Karanth Nagar , Kot...	0.000000
38	Doddanekkundi , Kundalahalli , Marathahalli Co...	0.000000
39	Domlur	0.000000
40	Doorvaninagar , Krishnarajapuram R S , Ramamur...	0.000000
41	Electronics City , Wipro Limited	0.000000
42	Fraser Town	0.000000
43	Gaviopuram Extension	0.000000
44	Gayathrinagar , Srirampuram	0.000000
45	Gunjur , Muthusandra , Vartur	0.000000
46	H.A.L II Stage , Hulsur Bazaar	0.000000
47	H.K.P. Road	0.000000
48	HSR Layout	0.000000
49	Hampinagar	0.000000
50	Hoodi , Mahadevapura	0.000000
51	ISRO Anthariksha Bhavan , R.M.V. Extension II ...	0.000000
52	Industrial Estate , Rajajinagar , Rajajinagar...	0.000000
53	J P Nagar , JP Nagar III Phase , Kumaraswamy L...	0.000000
54	J.C.Nagar , Training Command IAF	0.000000
55	Jalahalli	0.000000
56	Jalahalli East	0.000000
57	Jayanagar , Tilaknagar	0.000000
58	Jayangar III Block , Madhavan Park	0.000000
59	Jeevanbhimanagar , New Thippasandra	0.000000
60	Koramangala VI Bk	0.000000
61	Laggere , Peenya I Stage , Peenya Small Indust...	0.000000
62	Lingarajapuram , St. Thomas Town	0.000000
63	Mahalakshimpuram Layout , West of Chord Road I...	0.000000
64	Malleswaram , Palace Guttahalli , Swimming Poo...	0.000000

65	Malleswaram West	0.000000
66	Maruthi Sevanagar	0.000000
67	Mathikere , Msrit , Sri Chowdeshwari	0.000000
68	Mullahalli	0.000000
69	NAL , Vimanapura	0.000000
70	Nagarbhavi	0.000000
71	Nandinilayout	0.000000
72	P&T Col. Kavalbyrasandra , R T Nagar	0.000000
73	Peenya Dasarahalli	0.000000
74	Rajarajeshwarinagar	0.000000
75	Rv Niketan	0.000000
76	Sampangiramnagar , Shanthinagar , Wilson Garden	0.000000
77	Science Institute	0.000000
78	Seshadripuram	0.000000
79	Thalaghattapura	0.000000
80	Yeshwanthpur Bazar , Yeswanthpura	0.000000

	American Restaurant	Andhra Restaurant	Asian Restaurant \
0	0.000000	0.000000	0.500000
1	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.100000
12	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000
15	0.000000	0.066667	0.000000
16	0.000000	0.000000	0.000000
17	0.068966	0.000000	0.000000
18	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.047619
20	0.034483	0.034483	0.034483
21	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.062500
24	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.250000
26	0.000000	0.000000	0.166667
27	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000

29	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000
31	0.000000	0.000000	0.000000
32	0.000000	0.000000	0.000000
33	0.000000	0.000000	0.250000
34	0.000000	0.000000	0.000000
35	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.250000
37	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.058824
40	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000
43	0.000000	0.000000	0.000000
44	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000
50	0.250000	0.000000	0.000000
51	0.000000	0.000000	0.000000
52	0.000000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.000000	0.000000	0.333333
55	0.000000	0.000000	0.000000
56	0.000000	0.000000	0.000000
57	0.000000	0.000000	0.000000
58	0.000000	0.000000	0.000000
59	0.000000	0.000000	0.000000
60	0.000000	0.000000	0.000000
61	0.000000	0.000000	0.000000
62	0.000000	0.000000	0.000000
63	0.000000	0.000000	0.500000
64	0.000000	0.000000	0.000000
65	0.000000	0.000000	0.000000
66	0.000000	0.000000	0.000000
67	0.100000	0.000000	0.000000
68	0.000000	0.000000	0.000000
69	0.000000	0.000000	0.000000
70	0.000000	0.500000	0.000000
71	0.000000	0.000000	0.000000
72	0.000000	0.000000	0.000000
73	0.000000	0.000000	0.000000
74	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000

76	0.000000	0.000000	0.000000
77	0.000000	0.000000	0.000000
78	0.000000	0.000000	0.125000
79	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000

	Chinese Restaurant	Dumpling Restaurant	Falafel Restaurant \
0	0.000000	0.000000	0.0
1	0.000000	0.000000	0.0
2	0.000000	0.000000	0.0
3	0.000000	0.000000	0.0
4	0.000000	0.000000	0.0
5	0.000000	0.000000	0.0
6	0.000000	0.000000	0.0
7	0.000000	0.000000	1.0
8	0.000000	0.000000	0.0
9	0.000000	0.000000	0.0
10	0.000000	0.000000	0.0
11	0.000000	0.000000	0.0
12	0.000000	0.000000	0.0
13	0.000000	0.000000	0.0
14	0.000000	0.000000	0.0
15	0.200000	0.000000	0.0
16	0.000000	0.000000	0.0
17	0.034483	0.000000	0.0
18	0.000000	0.000000	0.0
19	0.000000	0.000000	0.0
20	0.103448	0.034483	0.0
21	0.000000	0.333333	0.0
22	0.000000	0.000000	0.0
23	0.000000	0.000000	0.0
24	0.000000	0.000000	0.0
25	0.000000	0.000000	0.0
26	0.000000	0.000000	0.0
27	0.000000	0.000000	0.0
28	0.000000	0.000000	0.0
29	0.000000	0.000000	0.0
30	0.000000	0.000000	0.0
31	0.000000	0.000000	0.0
32	0.000000	0.000000	0.0
33	0.000000	0.000000	0.0
34	0.000000	0.000000	0.0
35	0.000000	0.000000	0.0
36	0.000000	0.000000	0.0
37	0.000000	0.000000	0.0
38	0.166667	0.000000	0.0
39	0.117647	0.000000	0.0

40	0.000000	0.000000	0.0
41	0.500000	0.000000	0.0
42	0.166667	0.000000	0.0
43	0.000000	0.000000	0.0
44	0.000000	0.000000	0.0
45	0.000000	0.000000	0.0
46	0.000000	0.000000	0.0
47	0.000000	0.000000	0.0
48	0.000000	0.000000	0.0
49	0.000000	0.000000	0.0
50	0.000000	0.000000	0.0
51	0.000000	0.000000	0.0
52	0.000000	0.000000	0.0
53	0.000000	0.000000	0.0
54	0.000000	0.000000	0.0
55	0.000000	0.000000	0.0
56	0.000000	0.000000	0.0
57	0.125000	0.000000	0.0
58	0.000000	0.000000	0.0
59	0.095238	0.000000	0.0
60	0.000000	0.000000	0.0
61	0.000000	0.000000	0.0
62	0.000000	0.000000	0.0
63	0.000000	0.000000	0.0
64	0.142857	0.000000	0.0
65	0.000000	0.000000	0.0
66	0.000000	0.000000	0.0
67	0.000000	0.000000	0.0
68	0.000000	0.000000	0.0
69	0.333333	0.000000	0.0
70	0.000000	0.000000	0.0
71	0.000000	0.000000	0.0
72	0.000000	0.000000	0.0
73	0.000000	0.000000	0.0
74	0.000000	0.000000	0.0
75	0.000000	0.000000	0.0
76	0.000000	0.000000	0.0
77	0.000000	0.000000	0.0
78	0.125000	0.000000	0.0
79	0.000000	0.000000	0.0
80	0.166667	0.000000	0.0

	Fast Food Restaurant	Hyderabadi Restaurant	Indian Chinese Restaurant \
0	0.500000	0.000000	0.000000
1	0.125000	0.000000	0.000000
2	0.166667	0.000000	0.000000
3	0.111111	0.111111	0.000000

4	0.125000	0.000000	0.000000
5	0.166667	0.000000	0.000000
6	0.500000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.500000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.200000	0.000000	0.000000
12	0.000000	0.000000	0.000000
13	0.125000	0.000000	0.000000
14	0.000000	0.000000	0.000000
15	0.066667	0.000000	0.066667
16	0.125000	0.000000	0.000000
17	0.172414	0.000000	0.000000
18	0.000000	0.000000	0.000000
19	0.047619	0.000000	0.000000
20	0.068966	0.000000	0.000000
21	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000
23	0.187500	0.000000	0.000000
24	0.500000	0.000000	0.000000
25	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000
28	1.000000	0.000000	0.000000
29	0.000000	0.000000	0.000000
30	0.125000	0.000000	0.000000
31	0.000000	0.000000	0.000000
32	0.200000	0.000000	0.000000
33	0.000000	0.000000	0.000000
34	0.000000	0.000000	0.000000
35	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000
37	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.000000
40	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000
43	0.400000	0.000000	0.000000
44	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.000000
46	1.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000
49	0.125000	0.000000	0.000000
50	0.250000	0.000000	0.000000



51	0.000000	0.000000	0.000000
52	0.100000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.000000	0.000000	0.000000
55	0.000000	0.000000	0.000000
56	1.000000	0.000000	0.000000
57	0.250000	0.000000	0.000000
58	0.333333	0.000000	0.000000
59	0.000000	0.000000	0.000000
60	0.000000	0.000000	0.000000
61	1.000000	0.000000	0.000000
62	0.000000	0.000000	0.000000
63	0.000000	0.000000	0.000000
64	0.142857	0.000000	0.000000
65	0.000000	0.000000	0.000000
66	0.333333	0.000000	0.000000
67	0.300000	0.000000	0.000000
68	0.125000	0.000000	0.000000
69	0.000000	0.000000	0.000000
70	0.000000	0.000000	0.000000
71	0.666667	0.000000	0.000000
72	0.000000	0.000000	0.000000
73	0.000000	0.000000	0.000000
74	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000
76	0.000000	0.000000	0.000000
77	0.000000	0.000000	0.000000
78	0.250000	0.000000	0.000000
79	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000

	Indian Restaurant	Italian Restaurant	Karnataka Restaurant	\
0	0.000000	0.000000	0.000000	
1	0.750000	0.000000	0.000000	
2	0.333333	0.000000	0.166667	
3	0.444444	0.111111	0.000000	
4	0.750000	0.000000	0.000000	
5	0.833333	0.000000	0.000000	
6	0.500000	0.000000	0.000000	
7	0.000000	0.000000	0.000000	
8	0.000000	0.000000	0.500000	
9	0.500000	0.000000	0.000000	
10	0.500000	0.000000	0.000000	
11	0.300000	0.000000	0.100000	
12	0.000000	0.000000	0.000000	
13	0.750000	0.000000	0.000000	
14	0.500000	0.000000	0.000000	

15	0.133333	0.066667	0.066667
16	0.750000	0.000000	0.000000
17	0.586207	0.000000	0.000000
18	0.500000	0.000000	0.000000
19	0.761905	0.000000	0.000000
20	0.379310	0.000000	0.000000
21	0.333333	0.000000	0.000000
22	0.000000	0.000000	0.000000
23	0.625000	0.000000	0.000000
24	0.500000	0.000000	0.000000
25	0.750000	0.000000	0.000000
26	0.666667	0.000000	0.166667
27	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000
29	1.000000	0.000000	0.000000
30	0.750000	0.000000	0.000000
31	0.000000	0.000000	1.000000
32	0.600000	0.000000	0.000000
33	0.500000	0.000000	0.000000
34	1.000000	0.000000	0.000000
35	0.750000	0.000000	0.000000
36	0.500000	0.000000	0.000000
37	0.000000	0.200000	0.000000
38	0.833333	0.000000	0.000000
39	0.705882	0.000000	0.000000
40	1.000000	0.000000	0.000000
41	0.500000	0.000000	0.000000
42	0.500000	0.000000	0.000000
43	0.200000	0.200000	0.000000
44	0.500000	0.000000	0.000000
45	1.000000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.333333	0.000000	0.000000
48	0.400000	0.000000	0.000000
49	0.750000	0.000000	0.000000
50	0.500000	0.000000	0.000000
51	0.500000	0.000000	0.000000
52	0.500000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.333333	0.333333	0.000000
55	0.500000	0.000000	0.000000
56	0.000000	0.000000	0.000000
57	0.500000	0.000000	0.000000
58	0.333333	0.000000	0.000000
59	0.714286	0.047619	0.047619
60	0.866667	0.066667	0.000000
61	0.000000	0.000000	0.000000

62	0.500000	0.000000	0.000000
63	0.500000	0.000000	0.000000
64	0.285714	0.000000	0.000000
65	0.750000	0.000000	0.000000
66	0.000000	0.000000	0.000000
67	0.500000	0.000000	0.000000
68	0.750000	0.000000	0.000000
69	0.333333	0.000000	0.000000
70	0.000000	0.000000	0.000000
71	0.000000	0.000000	0.000000
72	0.500000	0.000000	0.000000
73	1.000000	0.000000	0.000000
74	1.000000	0.000000	0.000000
75	1.000000	0.000000	0.000000
76	1.000000	0.000000	0.000000
77	0.666667	0.000000	0.000000
78	0.375000	0.000000	0.125000
79	1.000000	0.000000	0.000000
80	0.166667	0.000000	0.000000

	Kerala Restaurant	Korean Restaurant	Mediterranean Restaurant \
0	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000
3	0.111111	0.000000	0.000000
4	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.500000
11	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000
15	0.000000	0.133333	0.000000
16	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000
20	0.000000	0.034483	0.034483
21	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.062500
24	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.000000

26	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000
29	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000
31	0.000000	0.000000	0.000000
32	0.000000	0.000000	0.000000
33	0.000000	0.000000	0.000000
34	0.000000	0.000000	0.000000
35	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000
37	0.000000	0.000000	0.200000
38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.000000
40	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000
43	0.000000	0.000000	0.000000
44	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.200000
49	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000
51	0.000000	0.000000	0.000000
52	0.000000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.000000	0.000000	0.000000
55	0.000000	0.000000	0.000000
56	0.000000	0.000000	0.000000
57	0.000000	0.000000	0.000000
58	0.000000	0.000000	0.000000
59	0.047619	0.000000	0.000000
60	0.066667	0.000000	0.000000
61	0.000000	0.000000	0.000000
62	0.500000	0.000000	0.000000
63	0.000000	0.000000	0.000000
64	0.000000	0.000000	0.000000
65	0.000000	0.000000	0.000000
66	0.000000	0.000000	0.000000
67	0.100000	0.000000	0.000000
68	0.000000	0.000000	0.000000
69	0.000000	0.000000	0.000000
70	0.000000	0.000000	0.000000
71	0.000000	0.000000	0.000000
72	0.000000	0.000000	0.000000

73	0.000000	0.000000	0.000000
74	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000
76	0.000000	0.000000	0.000000
77	0.000000	0.000000	0.000000
78	0.000000	0.000000	0.000000
79	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.166667

	Mexican Restaurant	Middle Eastern Restaurant	Modern European Restaurant \
0	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.034483
18	0.000000	0.250000	0.000000
19	0.000000	0.000000	0.000000
20	0.034483	0.034483	0.000000
21	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000
24	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000
29	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000
31	0.000000	0.000000	0.000000
32	0.000000	0.000000	0.000000
33	0.000000	0.000000	0.000000
34	0.000000	0.000000	0.000000
35	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000

37	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.000000
40	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000
43	0.000000	0.000000	0.000000
44	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000
51	0.000000	0.000000	0.000000
52	0.000000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.000000	0.000000	0.000000
55	0.000000	0.000000	0.000000
56	0.000000	0.000000	0.000000
57	0.000000	0.000000	0.000000
58	0.000000	0.000000	0.000000
59	0.000000	0.000000	0.000000
60	0.000000	0.000000	0.000000
61	0.000000	0.000000	0.000000
62	0.000000	0.000000	0.000000
63	0.000000	0.000000	0.000000
64	0.000000	0.000000	0.000000
65	0.000000	0.000000	0.000000
66	0.000000	0.000000	0.000000
67	0.000000	0.000000	0.000000
68	0.000000	0.000000	0.000000
69	0.000000	0.000000	0.000000
70	0.000000	0.000000	0.000000
71	0.000000	0.000000	0.000000
72	0.000000	0.000000	0.000000
73	0.000000	0.000000	0.000000
74	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000
76	0.000000	0.000000	0.000000
77	0.000000	0.000000	0.000000
78	0.000000	0.000000	0.000000
79	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000

	Multicuisine Indian Restaurant	North Indian Restaurant \
0	0.000000	0.000000

1	0.000000	0.000000
2	0.000000	0.000000
3	0.000000	0.000000
4	0.000000	0.000000
5	0.000000	0.000000
6	0.000000	0.000000
7	0.000000	0.000000
8	0.000000	0.000000
9	0.000000	0.000000
10	0.000000	0.000000
11	0.000000	0.000000
12	1.000000	0.000000
13	0.000000	0.000000
14	0.000000	0.000000
15	0.000000	0.000000
16	0.000000	0.000000
17	0.034483	0.000000
18	0.000000	0.000000
19	0.000000	0.000000
20	0.000000	0.000000
21	0.000000	0.000000
22	0.000000	0.000000
23	0.000000	0.000000
24	0.000000	0.000000
25	0.000000	0.000000
26	0.000000	0.000000
27	0.000000	0.000000
28	0.000000	0.000000
29	0.000000	0.000000
30	0.000000	0.000000
31	0.000000	0.000000
32	0.000000	0.000000
33	0.000000	0.000000
34	0.000000	0.000000
35	0.000000	0.000000
36	0.000000	0.000000
37	0.000000	0.200000
38	0.000000	0.000000
39	0.000000	0.058824
40	0.000000	0.000000
41	0.000000	0.000000
42	0.000000	0.000000
43	0.000000	0.000000
44	0.000000	0.000000
45	0.000000	0.000000
46	0.000000	0.000000
47	0.000000	0.000000

48	0.000000	0.000000
49	0.000000	0.000000
50	0.000000	0.000000
51	0.000000	0.000000
52	0.000000	0.000000
53	1.000000	0.000000
54	0.000000	0.000000
55	0.000000	0.000000
56	0.000000	0.000000
57	0.000000	0.000000
58	0.000000	0.000000
59	0.000000	0.000000
60	0.000000	0.000000
61	0.000000	0.000000
62	0.000000	0.000000
63	0.000000	0.000000
64	0.000000	0.000000
65	0.000000	0.000000
66	0.333333	0.000000
67	0.000000	0.000000
68	0.000000	0.000000
69	0.000000	0.000000
70	0.000000	0.000000
71	0.000000	0.000000
72	0.000000	0.500000
73	0.000000	0.000000
74	0.000000	0.000000
75	0.000000	0.000000
76	0.000000	0.000000
77	0.000000	0.000000
78	0.000000	0.000000
79	0.000000	0.000000
80	0.000000	0.000000

	Punjabi Restaurant	Rajasthani Restaurant	Restaurant	Seafood Restaurant \
0	0.000000	0.000	0.000000	0.000000
1	0.000000	0.125	0.000000	0.000000
2	0.000000	0.000	0.333333	0.000000
3	0.000000	0.000	0.000000	0.000000
4	0.000000	0.125	0.000000	0.000000
5	0.000000	0.000	0.000000	0.000000
6	0.000000	0.000	0.000000	0.000000
7	0.000000	0.000	0.000000	0.000000
8	0.000000	0.000	0.000000	0.000000
9	0.000000	0.000	0.000000	0.000000
10	0.000000	0.000	0.000000	0.000000
11	0.000000	0.000	0.100000	0.100000



12	0.000000	0.000	0.000000	0.000000
13	0.000000	0.125	0.000000	0.000000
14	0.000000	0.000	0.000000	0.000000
15	0.000000	0.000	0.133333	0.000000
16	0.000000	0.125	0.000000	0.000000
17	0.000000	0.000	0.000000	0.000000
18	0.000000	0.000	0.000000	0.000000
19	0.000000	0.000	0.000000	0.047619
20	0.000000	0.000	0.068966	0.000000
21	0.000000	0.000	0.000000	0.000000
22	0.000000	0.000	1.000000	0.000000
23	0.000000	0.000	0.062500	0.000000
24	0.000000	0.000	0.000000	0.000000
25	0.000000	0.000	0.000000	0.000000
26	0.000000	0.000	0.000000	0.000000
27	0.000000	0.000	0.000000	0.000000
28	0.000000	0.000	0.000000	0.000000
29	0.000000	0.000	0.000000	0.000000
30	0.000000	0.125	0.000000	0.000000
31	0.000000	0.000	0.000000	0.000000
32	0.000000	0.000	0.200000	0.000000
33	0.000000	0.000	0.000000	0.000000
34	0.000000	0.000	0.000000	0.000000
35	0.000000	0.000	0.250000	0.000000
36	0.000000	0.000	0.000000	0.000000
37	0.000000	0.000	0.200000	0.000000
38	0.000000	0.000	0.000000	0.000000
39	0.000000	0.000	0.058824	0.000000
40	0.000000	0.000	0.000000	0.000000
41	0.000000	0.000	0.000000	0.000000
42	0.000000	0.000	0.000000	0.000000
43	0.000000	0.000	0.200000	0.000000
44	0.000000	0.000	0.250000	0.000000
45	0.000000	0.000	0.000000	0.000000
46	0.000000	0.000	0.000000	0.000000
47	0.000000	0.000	0.666667	0.000000
48	0.200000	0.000	0.200000	0.000000
49	0.000000	0.125	0.000000	0.000000
50	0.000000	0.000	0.000000	0.000000
51	0.000000	0.000	0.500000	0.000000
52	0.000000	0.000	0.200000	0.000000
53	0.000000	0.000	0.000000	0.000000
54	0.000000	0.000	0.000000	0.000000
55	0.000000	0.000	0.000000	0.000000
56	0.000000	0.000	0.000000	0.000000
57	0.000000	0.000	0.000000	0.000000
58	0.000000	0.000	0.000000	0.000000

59	0.000000	0.000	0.000000	0.000000
60	0.000000	0.000	0.000000	0.000000
61	0.000000	0.000	0.000000	0.000000
62	0.000000	0.000	0.000000	0.000000
63	0.000000	0.000	0.000000	0.000000
64	0.000000	0.000	0.000000	0.000000
65	0.000000	0.000	0.000000	0.000000
66	0.000000	0.000	0.000000	0.000000
67	0.000000	0.000	0.000000	0.000000
68	0.000000	0.125	0.000000	0.000000
69	0.000000	0.000	0.333333	0.000000
70	0.000000	0.000	0.000000	0.000000
71	0.000000	0.000	0.000000	0.000000
72	0.000000	0.000	0.000000	0.000000
73	0.000000	0.000	0.000000	0.000000
74	0.000000	0.000	0.000000	0.000000
75	0.000000	0.000	0.000000	0.000000
76	0.000000	0.000	0.000000	0.000000
77	0.000000	0.000	0.333333	0.000000
78	0.000000	0.000	0.000000	0.000000
79	0.000000	0.000	0.000000	0.000000
80	0.166667	0.000	0.166667	0.166667

	South Indian Restaurant	Thai Restaurant	Tibetan Restaurant \
0	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.100000	0.000000	0.000000
12	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000
17	0.034483	0.000000	0.000000
18	0.250000	0.000000	0.000000
19	0.047619	0.000000	0.000000
20	0.000000	0.034483	0.034483
21	0.333333	0.000000	0.000000
22	0.000000	0.000000	0.000000

23	0.000000	0.000000	0.000000
24	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000
29	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000
31	0.000000	0.000000	0.000000
32	0.000000	0.000000	0.000000
33	0.000000	0.000000	0.000000
34	0.000000	0.000000	0.000000
35	0.000000	0.000000	0.000000
36	0.250000	0.000000	0.000000
37	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.000000
40	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000
43	0.000000	0.000000	0.000000
44	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000
51	0.000000	0.000000	0.000000
52	0.000000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.000000	0.000000	0.000000
55	0.000000	0.000000	0.000000
56	0.000000	0.000000	0.000000
57	0.125000	0.000000	0.000000
58	0.000000	0.000000	0.000000
59	0.047619	0.000000	0.000000
60	0.000000	0.000000	0.000000
61	0.000000	0.000000	0.000000
62	0.000000	0.000000	0.000000
63	0.000000	0.000000	0.000000
64	0.142857	0.000000	0.000000
65	0.250000	0.000000	0.000000
66	0.333333	0.000000	0.000000
67	0.000000	0.000000	0.000000
68	0.000000	0.000000	0.000000
69	0.000000	0.000000	0.000000

70	0.500000	0.000000	0.000000
71	0.000000	0.000000	0.000000
72	0.000000	0.000000	0.000000
73	0.000000	0.000000	0.000000
74	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000
76	0.000000	0.000000	0.000000
77	0.000000	0.000000	0.000000
78	0.000000	0.000000	0.000000
79	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000

	Udupi Restaurant	Vegetarian / Vegan Restaurant	Vietnamese Restaurant
0	0.0	0.000000	0.000000
1	0.0	0.000000	0.000000
2	0.0	0.000000	0.000000
3	0.0	0.000000	0.111111
4	0.0	0.000000	0.000000
5	0.0	0.000000	0.000000
6	0.0	0.000000	0.000000
7	0.0	0.000000	0.000000
8	0.0	0.500000	0.000000
9	0.0	0.000000	0.000000
10	0.0	0.000000	0.000000
11	0.0	0.000000	0.000000
12	0.0	0.000000	0.000000
13	0.0	0.000000	0.000000
14	0.5	0.000000	0.000000
15	0.0	0.066667	0.000000
16	0.0	0.000000	0.000000
17	0.0	0.000000	0.000000
18	0.0	0.000000	0.000000
19	0.0	0.047619	0.000000
20	0.0	0.034483	0.000000
21	0.0	0.000000	0.000000
22	0.0	0.000000	0.000000
23	0.0	0.000000	0.000000
24	0.0	0.000000	0.000000
25	0.0	0.000000	0.000000
26	0.0	0.000000	0.000000
27	0.0	1.000000	0.000000
28	0.0	0.000000	0.000000
29	0.0	0.000000	0.000000
30	0.0	0.000000	0.000000
31	0.0	0.000000	0.000000
32	0.0	0.000000	0.000000
33	0.0	0.250000	0.000000

34	0.0	0.000000	0.000000
35	0.0	0.000000	0.000000
36	0.0	0.000000	0.000000
37	0.0	0.200000	0.000000
38	0.0	0.000000	0.000000
39	0.0	0.000000	0.000000
40	0.0	0.000000	0.000000
41	0.0	0.000000	0.000000
42	0.0	0.333333	0.000000
43	0.0	0.000000	0.000000
44	0.0	0.250000	0.000000
45	0.0	0.000000	0.000000
46	0.0	0.000000	0.000000
47	0.0	0.000000	0.000000
48	0.0	0.000000	0.000000
49	0.0	0.000000	0.000000
50	0.0	0.000000	0.000000
51	0.0	0.000000	0.000000
52	0.0	0.200000	0.000000
53	0.0	0.000000	0.000000
54	0.0	0.000000	0.000000
55	0.0	0.500000	0.000000
56	0.0	0.000000	0.000000
57	0.0	0.000000	0.000000
58	0.0	0.333333	0.000000
59	0.0	0.000000	0.000000
60	0.0	0.000000	0.000000
61	0.0	0.000000	0.000000
62	0.0	0.000000	0.000000
63	0.0	0.000000	0.000000
64	0.0	0.285714	0.000000
65	0.0	0.000000	0.000000
66	0.0	0.000000	0.000000
67	0.0	0.000000	0.000000
68	0.0	0.000000	0.000000
69	0.0	0.000000	0.000000
70	0.0	0.000000	0.000000
71	0.0	0.333333	0.000000
72	0.0	0.000000	0.000000
73	0.0	0.000000	0.000000
74	0.0	0.000000	0.000000
75	0.0	0.000000	0.000000
76	0.0	0.000000	0.000000
77	0.0	0.000000	0.000000
78	0.0	0.000000	0.000000
79	0.0	0.000000	0.000000
80	0.0	0.000000	0.000000

```
[32]: bangalore_grouped.shape
```

```
[32]: (81, 32)
```

### Top 3 restaurants for each Neighborhood based on cuisine

```
[33]: num_top_venues = 5
for neighbor in bangalore_grouped['Neighborhood']:
    print("----"+neighbor+"----")
    temp = bangalore_grouped[bangalore_grouped['Neighborhood'] == neighbor].T.
    ↪reset_index()
    temp.columns = ['venue', 'freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).
    ↪head(num_top_venues))
    print("-----")
    print('\n')
```

----Achitnagar ----

	venue	freq
0	Asian Restaurant	0.5
1	Fast Food Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Adarangi , Hulikal , Kudur , Marasandra , Mayasandra , Sirigiripura ,  
Sugganahalli ----

	venue	freq
0	Indian Restaurant	0.75
1	Fast Food Restaurant	0.12
2	Rajasthani Restaurant	0.12
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Adugodi ----

	venue	freq
0	Restaurant	0.33
1	Indian Restaurant	0.33
2	Karnataka Restaurant	0.17
3	Fast Food Restaurant	0.17
4	Afghan Restaurant	0.00

-----

----Agara , Koramangala I Block , Koramangala , St. John Medical College ----

	venue	freq
0	Indian Restaurant	0.44
1	Vietnamese Restaurant	0.11
2	Kerala Restaurant	0.11
3	Fast Food Restaurant	0.11
4	Hyderabadi Restaurant	0.11

-----

----Ajjanahalli ----

	venue	freq
0	Indian Restaurant	0.75
1	Fast Food Restaurant	0.12
2	Rajasthani Restaurant	0.12
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Amruthahalli , Byatarayanapura , Kodigehalli , Sahakaranagar P.O ----

	venue	freq
0	Indian Restaurant	0.83
1	Fast Food Restaurant	0.17
2	Afghan Restaurant	0.00
3	Middle Eastern Restaurant	0.00
4	Vegetarian / Vegan Restaurant	0.00

-----

----Anandnagar , H.A. Farm , Hebbal Kempapura ----

	venue	freq
0	Fast Food Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Arabic College , Venkateshapura ----

	venue	freq
0	Falafel Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0

3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Arebomnahalli , Baragenahalli , Billanakote , Devarahosahalli , Dobbespeth , Heggunda , Kambalu , Kuluvaiahalli , Lakkur , Maralakunte , Narasipura , Shivagange , Yelekyathanahalli ----

	venue	freq
0	Vegetarian / Vegan Restaurant	0.5
1	Karnataka Restaurant	0.5
2	Afghan Restaurant	0.0
3	Mexican Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Ashoknagar , Banashankari , Dasarahalli(Srinagar) , State Bank Of Mysore Colony ----

	venue	freq
0	Fast Food Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Austin Town , Viveknagar ----

	venue	freq
0	Mediterranean Restaurant	0.5
1	Indian Restaurant	0.5
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----B Sk II Stage , Jayanagar West , Padmanabhnagar , Tyagrajnagar ----

	venue	freq
0	Indian Restaurant	0.3
1	Fast Food Restaurant	0.2
2	South Indian Restaurant	0.1
3	Asian Restaurant	0.1
4	Karnataka Restaurant	0.1

-----



----Bagalgunte , Chikkabidarkal , Nagasandra , Nelakadiranahalli ----

	venue	freq
0	Multicuisine Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Baginigere , Biskur , Doddamudigere , Doddasomanahalli , Gangonahalli ,  
Hullenahalli , Sankighatta , Thippasandra ----

	venue	freq
0	Indian Restaurant	0.75
1	Fast Food Restaurant	0.12
2	Rajasthani Restaurant	0.12
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Banashankari III Stage , Girinagar , Kathriguppe ----

	venue	freq
0	Udupi Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Mexican Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Banaswadi , Horamavu , Jalavayuvihar , Kalyananagar ----

	venue	freq
0	Chinese Restaurant	0.20
1	Restaurant	0.13
2	Korean Restaurant	0.13
3	Indian Restaurant	0.13
4	Indian Chinese Restaurant	0.07

-----

----Banavadi , Bylakere , Gudemaranahalli , Lakkenahalli , Madigondanahalli ,  
Manniganahalli , Marikuppe , Motagondanahalli , Narasandra , Solur , Udukunte ,  
Yennegere ----

	venue	freq
0	Indian Restaurant	0.75
1	Fast Food Restaurant	0.12
2	Rajasthani Restaurant	0.12

3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Bangalore Bazaar , Bangalore G.P.O., CMM Court Complex , Dr. Ambedkar Veedhi , HighCourt , Legislators Home , Mahatma Gandhi Road , Rajbhavan , Vasanthanagar , Vidhana Soudha ----

	venue	freq
0	Indian Restaurant	0.59
1	Fast Food Restaurant	0.17
2	American Restaurant	0.07
3	Afghan Restaurant	0.03
4	Modern European Restaurant	0.03

-----

----Bangalore City , Bangalore Corporation Building ----

	venue	freq
0	Indian Restaurant	0.50
1	South Indian Restaurant	0.25
2	Middle Eastern Restaurant	0.25
3	Afghan Restaurant	0.00
4	Mexican Restaurant	0.00

-----

----Bangalore Dist Offices Bldg , K. G. Road ----

	venue	freq
0	Indian Restaurant	0.76
1	South Indian Restaurant	0.05
2	Vegetarian / Vegan Restaurant	0.05
3	Asian Restaurant	0.05
4	Fast Food Restaurant	0.05

-----

----Bangalore Sub Foreign Post , CMP Centre And School , Museum Road , Richmond Town ----

	venue	freq
0	Indian Restaurant	0.38
1	Chinese Restaurant	0.10
2	Restaurant	0.07
3	Fast Food Restaurant	0.07
4	Thai Restaurant	0.03

-----

----Bannerghatta Road , Hulimavu , Hulimavu , JP Nagar VIII phase , Mico Layout  
, Mount St Joseph ----

	venue	freq
0	Dumpling Restaurant	0.33
1	South Indian Restaurant	0.33
2	Indian Restaurant	0.33
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Bapagrama , Herohalli , Kodigehalli , Viswaneedam ----

	venue	freq
0	Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Basavanagudi , Mavalli , Pampamahakavi Road , Thyagarajnagar ----

	venue	freq
0	Indian Restaurant	0.62
1	Fast Food Restaurant	0.19
2	Mediterranean Restaurant	0.06
3	Asian Restaurant	0.06
4	Restaurant	0.06

-----

----Basaveshwaranagar , K H B Colony , Kamakshipalya ----

	venue	freq
0	Fast Food Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Begur , Bommanahalli , Madivala , Singasandra ----

	venue	freq
0	Indian Restaurant	0.75
1	Asian Restaurant	0.25
2	Afghan Restaurant	0.00
3	Middle Eastern Restaurant	0.00
4	Vegetarian / Vegan Restaurant	0.00

-----

----Bellandur , Panathur ----

	venue	freq
0	Indian Restaurant	0.67
1	Asian Restaurant	0.17
2	Karnataka Restaurant	0.17
3	Afghan Restaurant	0.00
4	Restaurant	0.00

-----

----Benson Town , Jayamahar Road ----

	venue	freq
0	Vegetarian / Vegan Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Udupi Restaurant	0.0
4	Tibetan Restaurant	0.0

-----

----Bettahalsur , Chikkajala , Doddajala , Hunasamaranahalli , Tarahunise ,  
Vidyanagara ----

	venue	freq
0	Fast Food Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----C.V.Raman Nagar ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Chamarajasagara ----

	venue	freq
0	Indian Restaurant	0.75
1	Fast Food Restaurant	0.12

2	Rajasthani Restaurant	0.12
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Chamrajpet ----

	venue	freq
0	Karnataka Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Chandra Lay Out , Vijayanagar East , Vijayanagar ----

	venue	freq
0	Indian Restaurant	0.6
1	Fast Food Restaurant	0.2
2	Restaurant	0.2
3	Afghan Restaurant	0.0
4	Middle Eastern Restaurant	0.0

-----

----Chickpet ----

	venue	freq
0	Indian Restaurant	0.50
1	Vegetarian / Vegan Restaurant	0.25
2	Asian Restaurant	0.25
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Deepanjalinagar , Governmemnt Electric Factory ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Devasandra , Krishnarajapuram ----

	venue	freq
--	-------	------

0	Indian Restaurant	0.75
1	Restaurant	0.25
2	Afghan Restaurant	0.00
3	Mexican Restaurant	0.00
4	Vegetarian / Vegan Restaurant	0.00

-----

----Dharmaram College , Tavarekere ----

	venue	freq
0	Indian Restaurant	0.50
1	Asian Restaurant	0.25
2	South Indian Restaurant	0.25
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Doddagubbi , Dr. Shivarama Karanth Nagar , Kothanur ----

	venue	freq
0	Mediterranean Restaurant	0.2
1	Vegetarian / Vegan Restaurant	0.2
2	Restaurant	0.2
3	Italian Restaurant	0.2
4	North Indian Restaurant	0.2

-----

----Doddanekkundi , Kundalahalli , Marathahalli Colony , Rameshnagar ----

	venue	freq
0	Indian Restaurant	0.83
1	Chinese Restaurant	0.17
2	Afghan Restaurant	0.00
3	Middle Eastern Restaurant	0.00
4	Vegetarian / Vegan Restaurant	0.00

-----

----Domlur ----

	venue	freq
0	Indian Restaurant	0.71
1	Chinese Restaurant	0.12
2	Asian Restaurant	0.06
3	North Indian Restaurant	0.06
4	Restaurant	0.06

-----

----Doorvaninagar , Krishnarajapuram R S , Ramamurthy Nagar ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Electronics City , Wipro Limited ----

	venue	freq
0	Chinese Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Fraser Town ----

	venue	freq
0	Indian Restaurant	0.50
1	Vegetarian / Vegan Restaurant	0.33
2	Chinese Restaurant	0.17
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Gaviopuram Extension ----

	venue	freq
0	Fast Food Restaurant	0.4
1	Restaurant	0.2
2	Italian Restaurant	0.2
3	Indian Restaurant	0.2
4	Afghan Restaurant	0.0

-----

----Gayathrinagar , Srirampuram ----

	venue	freq
0	Indian Restaurant	0.50
1	Vegetarian / Vegan Restaurant	0.25
2	Restaurant	0.25
3	Afghan Restaurant	0.00
4	Mexican Restaurant	0.00

-----

```

----Gunjur , Muthusandra , Vartur ----
      venue  freq
0      Indian Restaurant  1.0
1      Afghan Restaurant  0.0
2      Mexican Restaurant  0.0
3  Vegetarian / Vegan Restaurant  0.0
4      Udupi Restaurant  0.0
-----

```

```

----H.A.L II Stage , Hulsur Bazaar ----
      venue  freq
0      Fast Food Restaurant  1.0
1      Afghan Restaurant  0.0
2      Mexican Restaurant  0.0
3  Vegetarian / Vegan Restaurant  0.0
4      Udupi Restaurant  0.0
-----

```

```

----H.K.P. Road ----
      venue  freq
0      Restaurant  0.67
1      Indian Restaurant  0.33
2      Afghan Restaurant  0.00
3      Mexican Restaurant  0.00
4  Vegetarian / Vegan Restaurant  0.00
-----

```

```

----HSR Layout ----
      venue  freq
0      Indian Restaurant  0.4
1  Mediterranean Restaurant  0.2
2      Restaurant  0.2
3      Punjabi Restaurant  0.2
4      Mexican Restaurant  0.0
-----

```

```

----Hampinagar ----
      venue  freq
0      Indian Restaurant  0.75
1      Fast Food Restaurant  0.12
2      Rajasthani Restaurant  0.12
3      Afghan Restaurant  0.00

```



4 Middle Eastern Restaurant 0.00

-----

----Hoodi , Mahadevapura ----

	venue	freq
0	Indian Restaurant	0.50
1	American Restaurant	0.25
2	Fast Food Restaurant	0.25
3	Afghan Restaurant	0.00
4	Restaurant	0.00

-----

----ISRO Anthariksha Bhavan , R.M.V. Extension II Stage ----

	venue	freq
0	Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Mexican Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Industrial Estate , Rajajinagar , Rajajinagar IVth Block ----

	venue	freq
0	Indian Restaurant	0.5
1	Vegetarian / Vegan Restaurant	0.2
2	Restaurant	0.2
3	Fast Food Restaurant	0.1
4	Afghan Restaurant	0.0

-----

----J P Nagar , JP Nagar III Phase , Kumaraswamy Layout , Yelachenahalli ----

	venue	freq
0	Multicuisine Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----J.C.Nagar , Training Command IAF ----

	venue	freq
0	Asian Restaurant	0.33
1	Italian Restaurant	0.33

2	Indian Restaurant	0.33
3	Afghan Restaurant	0.00
4	Restaurant	0.00

-----

----Jalahalli ----

	venue	freq
0	Vegetarian / Vegan Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Mexican Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Jalahalli East ----

	venue	freq
0	Fast Food Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Jayanagar , Tilaknagar ----

	venue	freq
0	Indian Restaurant	0.50
1	Fast Food Restaurant	0.25
2	South Indian Restaurant	0.12
3	Chinese Restaurant	0.12
4	Multicuisine Indian Restaurant	0.00

-----

----Jayangar III Block , Madhavan Park ----

	venue	freq
0	Vegetarian / Vegan Restaurant	0.33
1	Fast Food Restaurant	0.33
2	Indian Restaurant	0.33
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Jeevanbhimanager , New Thippasandra ----

	venue	freq
--	-------	------

0	Indian Restaurant	0.71
1	Chinese Restaurant	0.10
2	Kerala Restaurant	0.05
3	South Indian Restaurant	0.05
4	Karnataka Restaurant	0.05

-----

----Koramangala VI Bk ----

	venue	freq
0	Indian Restaurant	0.87
1	Kerala Restaurant	0.07
2	Italian Restaurant	0.07
3	Afghan Restaurant	0.00
4	Rajasthani Restaurant	0.00

-----

----Laggere , Peenya I Stage , Peenya Small Industries ----

	venue	freq
0	Fast Food Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Lingarajapuram , St. Thomas Town ----

	venue	freq
0	Indian Restaurant	0.5
1	Kerala Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Mahalakshmpuram Layout , West of Chord Road II stage ----

	venue	freq
0	Asian Restaurant	0.5
1	Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Middle Eastern Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Malleswaram , Palace Guttahalli , Swimming Pool Extn , Vyalikaval Extn ----

	venue	freq
0	Indian Restaurant	0.29
1	Vegetarian / Vegan Restaurant	0.29
2	South Indian Restaurant	0.14
3	Chinese Restaurant	0.14
4	Fast Food Restaurant	0.14

-----

----Malleswaram West ----

	venue	freq
0	Indian Restaurant	0.75
1	South Indian Restaurant	0.25
2	Afghan Restaurant	0.00
3	Mexican Restaurant	0.00
4	Vegetarian / Vegan Restaurant	0.00

-----

----Maruthi Sevanagar ----

	venue	freq
0	South Indian Restaurant	0.33
1	Fast Food Restaurant	0.33
2	Multicuisine Indian Restaurant	0.33
3	Afghan Restaurant	0.00
4	Mexican Restaurant	0.00

-----

----Mathikere , Msrit , Sri Chowdeshwari ----

	venue	freq
0	Indian Restaurant	0.5
1	Fast Food Restaurant	0.3
2	American Restaurant	0.1
3	Kerala Restaurant	0.1
4	Afghan Restaurant	0.0

-----

----Mullahalli ----

	venue	freq
0	Indian Restaurant	0.75
1	Fast Food Restaurant	0.12
2	Rajasthani Restaurant	0.12
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----NAL , Vimanapura ----

	venue	freq
0	Chinese Restaurant	0.33
1	Restaurant	0.33
2	Indian Restaurant	0.33
3	Afghan Restaurant	0.00
4	Middle Eastern Restaurant	0.00

-----

----Nagarbhavi ----

	venue	freq
0	Andhra Restaurant	0.5
1	South Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Mexican Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Nandinilayout ----

	venue	freq
0	Fast Food Restaurant	0.67
1	Vegetarian / Vegan Restaurant	0.33
2	Afghan Restaurant	0.00
3	Mexican Restaurant	0.00
4	Udupi Restaurant	0.00

-----

----P&T Col. Kavalbyrasandra , R T Nagar ----

	venue	freq
0	Indian Restaurant	0.5
1	North Indian Restaurant	0.5
2	Afghan Restaurant	0.0
3	Mexican Restaurant	0.0
4	Vegetarian / Vegan Restaurant	0.0

-----

----Peenya Dasarahalli ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0

4	Udupi Restaurant	0.0
---	------------------	-----

-----

----Rajarajeshwarinagar ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Rv Niketan ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Sampangiramnagar , Shanthinagar , Wilson Garden ----

	venue	freq
0	Indian Restaurant	1.0
1	Afghan Restaurant	0.0
2	Mexican Restaurant	0.0
3	Vegetarian / Vegan Restaurant	0.0
4	Udupi Restaurant	0.0

-----

----Science Institute ----

	venue	freq
0	Indian Restaurant	0.67
1	Restaurant	0.33
2	Afghan Restaurant	0.00
3	Mexican Restaurant	0.00
4	Vegetarian / Vegan Restaurant	0.00

-----

----Seshadripuram ----

	venue	freq
0	Indian Restaurant	0.38
1	Fast Food Restaurant	0.25

```

2      Asian Restaurant  0.12
3      Chinese Restaurant  0.12
4      Karnataka Restaurant  0.12
-----

```

----Thalaghattapura ----

```

              venue  freq
0      Indian Restaurant  1.0
1      Afghan Restaurant  0.0
2      Mexican Restaurant  0.0
3  Vegetarian / Vegan Restaurant  0.0
4      Udupi Restaurant  0.0
-----

```

----Yeshwanthpur Bazar , Yeswanthpura ----

```

              venue  freq
0  Mediterranean Restaurant  0.17
1      Chinese Restaurant  0.17
2      Seafood Restaurant  0.17
3      Restaurant  0.17
4      Indian Restaurant  0.17
-----

```

**Creating a new dataframe with the above results for each neighborhood**

```

[34]: # A function to sort the venues in descending order
def return_most_common_venues(row, num_top_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=False)
    return row_categories_sorted.index.values[0:num_top_venues]

[35]: #Creating a new dataframe and displaying the top 10 restaurants based on
      ↳ occurrence and cuisine for each neighborhood
num_top_venues = 10
indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}-{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

```

```
# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = bangalore_grouped['Neighborhood']

for ind in np.arange(bangalore_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] =
    ↪return_most_common_venues(bangalore_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head()
```

```
[35]:
```

	Neighborhood	1st Most Common Venue	\
0	Achitnagar	Asian Restaurant	
1	Adarangi , Hulikal , Kudur , Marasandra , Maya...	Indian Restaurant	
2	Adugodi	Restaurant	
3	Agara , Koramangala I Block , Koramangala , St...	Indian Restaurant	
4	Ajjanahalli	Indian Restaurant	

	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	\
0	Fast Food Restaurant	Vietnamese Restaurant	Korean Restaurant	
1	Rajasthani Restaurant	Fast Food Restaurant	Vietnamese Restaurant	
2	Indian Restaurant	Fast Food Restaurant	Karnataka Restaurant	
3	Vietnamese Restaurant	Fast Food Restaurant	Hyderabadi Restaurant	
4	Rajasthani Restaurant	Fast Food Restaurant	Vietnamese Restaurant	

	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	\
0	American Restaurant	Andhra Restaurant	Chinese Restaurant	
1	Korean Restaurant	American Restaurant	Andhra Restaurant	
2	Vietnamese Restaurant	Korean Restaurant	American Restaurant	
3	Italian Restaurant	Kerala Restaurant	Korean Restaurant	
4	Korean Restaurant	American Restaurant	Andhra Restaurant	

	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Dumpling Restaurant	Falafel Restaurant	Hyderabadi Restaurant
1	Asian Restaurant	Chinese Restaurant	Dumpling Restaurant
2	Andhra Restaurant	Asian Restaurant	Chinese Restaurant
3	American Restaurant	Andhra Restaurant	Asian Restaurant
4	Asian Restaurant	Chinese Restaurant	Dumpling Restaurant

## Custering Neighborhoods using K-means

### Finding the best k

```
[36]: # Creating new dataframe to determine best k value by dropping first column
bangalore_clustering_testing = bangalore_grouped.drop('Neighborhood', 1)
```

```
[37]: def plot(x, y, xlabel, ylabel):
        plt.figure(figsize=(20,10))
```



```

plt.plot(np.arange(2, x), y, 'o-')
plt.xlabel(xlabel)
plt.ylabel(ylabel)
plt.xticks(np.arange(2, x))
plt.show()

indices = []
scores = []
max_range = 20

for kclusters in range(2, max_range) :

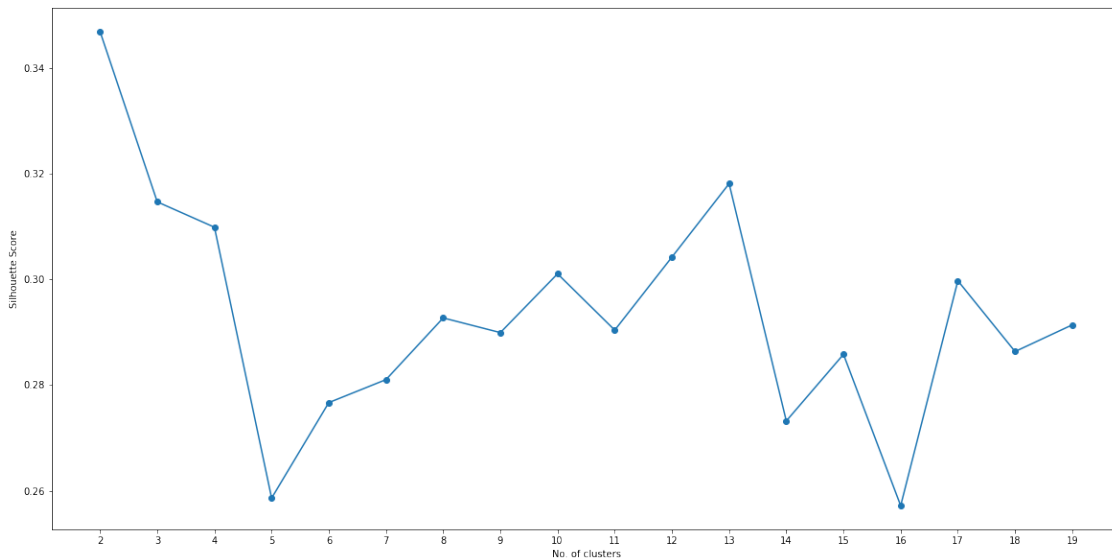
    # Run k-means clustering
    lct = bangalore_clustering_testing
    kmeans = KMeans(n_clusters = kclusters, init = 'k-means++', random_state = 0).fit_predict(lct)

    # Gets the score for the clustering operation performed
    score = silhouette_score(lct, kmeans)

    # Appending the index and score to the respective lists
    indices.append(kclusters)
    scores.append(score)

# Silhouette method
plot(max_range, scores, "No. of clusters", "Silhouette Score")

```



From the graph the optimal number is found out to be considered for our clustering

```
[38]: opt = np.argmax(scores) + 2 # Finds the optimal value
      opt
      # visually also we can see peak value is at opt number
```

```
[38]: 2
```

```
[75]: #Elbow Method for finding the optimal number of clusters
      #set.seed(123)
      # Compute and plot wss for k = 2 to k = 15.
      #k.max <- 15
      #data <- bangalore_clustering_testing
      #wss <- sapply(1:k.max,
      #              function(k){kmeans(data, k, nstart=50, iter.max = 15 )$tot.
      #                ↪ withinss})
      #wss
      #plot(1:k.max, wss,
      #      type="b", pch = 19, frame = FALSE,
      #      xlab="Number of clusters K",
      #      ylab="Total within-clusters sum of squares")
```

```
[39]: # set number of clusters
      kclusters = opt

      bangalore_grouped_clustering = bangalore_grouped.drop('Neighborhood', 1)

      # run k-means clustering
      kmeans = KMeans(n_clusters=kclusters, random_state=1).
      ↪ fit(bangalore_grouped_clustering)

      # check cluster labels generated for each row in the dataframe
      print(kmeans.labels_[0:10])
      print(len(kmeans.labels_))
```

```
[1 0 1 0 0 0 0 1 1 0]
```

```
81
```

Creating a new dataframe that includes the cluster as well as the top 10 venues for each neighborhood.

```
[40]: # add clustering labels
      neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

      bangalore_merged = bangalore_restaurants

      # merge toronto_grouped with toronto_data to add latitude/longitude for each
      ↪ neighborhood
      bangalore_merged = bangalore_merged.join(neighborhoods_venues_sorted.
      ↪ set_index('Neighborhood'), on='Neighborhood')
```

```
bangalore_merged.fillna(0)
bangalore_merged.head() # check the last columns!
```

```
[40]:
```

	Neighborhood	Neighborhood	Latitude	\
1	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
2	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
4	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
5	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	
7	Bangalore Bazaar , Bangalore G.P.O., CMM Court...		12.979185	

	Neighborhood	Longitude	Venue	Venue	Latitude	\
1		77.606623	Samarkand		12.980616	
2		77.606623	Coast 2 Coast		12.975305	
4		77.606623	Shiv Sagar		12.981879	
5		77.606623	MTR 1924 commercial street		12.982062	
7		77.606623	Ebony		12.975180	

	Venue	Longitude	Venue	Category	Cluster	Labels	\
1		77.604668	Afghan Restaurant			0	
2		77.605625	Indian Restaurant			0	
4		77.608322	Indian Restaurant			0	
5		77.607314	South Indian Restaurant			0	
7		77.605090	Modern European Restaurant			0	

	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	\
1	Indian Restaurant	Fast Food Restaurant	American Restaurant	
2	Indian Restaurant	Fast Food Restaurant	American Restaurant	
4	Indian Restaurant	Fast Food Restaurant	American Restaurant	
5	Indian Restaurant	Fast Food Restaurant	American Restaurant	
7	Indian Restaurant	Fast Food Restaurant	American Restaurant	

	4th Most Common Venue	5th Most Common Venue	\
1	Afghan Restaurant	Multicuisine Indian Restaurant	
2	Afghan Restaurant	Multicuisine Indian Restaurant	
4	Afghan Restaurant	Multicuisine Indian Restaurant	
5	Afghan Restaurant	Multicuisine Indian Restaurant	
7	Afghan Restaurant	Multicuisine Indian Restaurant	

	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	\
1	South Indian Restaurant	Chinese Restaurant	Modern European Restaurant	
2	South Indian Restaurant	Chinese Restaurant	Modern European Restaurant	
4	South Indian Restaurant	Chinese Restaurant	Modern European Restaurant	
5	South Indian Restaurant	Chinese Restaurant	Modern European Restaurant	
7	South Indian Restaurant	Chinese Restaurant	Modern European Restaurant	

9th Most Common Venue	10th Most Common Venue
-----------------------	------------------------

```

1    Italian Restaurant    Indian Chinese Restaurant
2    Italian Restaurant    Indian Chinese Restaurant
4    Italian Restaurant    Indian Chinese Restaurant
5    Italian Restaurant    Indian Chinese Restaurant
7    Italian Restaurant    Indian Chinese Restaurant

```

### Number of venues belonging to each cluster

```
[41]: bangalore_merged['Cluster Labels'].value_counts()
```

```

[41]: 0    365
      1     90
      Name: Cluster Labels, dtype: int64

```

### Creating map for each cluster for better visualization

```

[42]: # create map
map_clusters = folium.Map(location=[latitude,longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i+x+(i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster, vc in zip(bangalore_merged['Venue Latitude'],
    ↳bangalore_merged['Venue Longitude'], bangalore_merged['Venue'],
    ↳bangalore_merged['Cluster Labels'], bangalore_merged['Venue Category']):
    label = folium.Popup(str(poi) + ' (' +str(vc) + ') [' + str(cluster)+']',
    ↳parse_html=True)
    folium.CircleMarker([lat, lon], radius=5, popup=label,
    ↳color=rainbow[cluster-1], fill=True, fill_color=rainbow[cluster-1],
    ↳fill_opacity=0.7).add_to(map_clusters)
    #count += 1
map_clusters

```

```
[42]: <folium.folium.Map at 0x7ff6d83c2780>
```

**Final analysis of each cluster** Now, examining each cluster and determining the discriminating restaurants that distinguish each cluster. Based on the restaurants, we can then assign a name to each cluster.

### Cluster 1

```
[43]: c1 = bangalore_merged.loc[bangalore_merged['Cluster Labels'] == 0,
↳ bangalore_merged.columns[[0]+list(range(8, bangalore_merged.shape[1]))]]
c1.drop_duplicates()
```

```
[43]: Neighborhood \
1    Bangalore Bazaar , Bangalore G.P.O. , CMM Court...
37   Bangalore City , Bangalore Corporation Building
55   Basavanagudi , Mavalli , Pampamahakavi Road , ...
80                                     Fraser Town
90                                     J.C.Nagar , Training Command IAF
96                                     Bangalore Dist Offices Bldg , K. G. Road
119  Industrial Estate , Rajajinagar , Rajajinagar...
136                                     Science Institute
139                                     Jalahalli
142  Doorvaninagar , Krishnarajapuram R S , Ramamur...
144                                     NAL , Vimanapura
168                                     Gayathrinagar , Srirampuram
185    Anandnagar , H.A. Farm , Hebbal Kempapura
194  Bangalore Sub Foreign Post , CMP Centre And Sc...
246  Deepanjalinagar , Governmemnt Electric Factory
250  Sampangiramnagar , Shanthinagar , Wilson Garden
257                                     Dharmaram College , Tavarekere
272    P&T Col. Kavalbyrasandra , R T Nagar
279  Agara , Koramangala I Block , Koramangala , St...
295    Devasandra , Krishnarajapuram
300  Doddanekkundi , Kundalahalli , Marathahalli Co...
311  Chandra Lay Out , Vijayanagar East , Vijayanag...
318    Jayanagar , Tilaknagar
369    Austin Town , Viveknagar
372    Hoodi , Mahadevapura
377  Ashoknagar , Banashankari , Dasarahalli(Srina...
383    Chickpet
387    Mathikere , Msrit , Sri Chowdeshwari
401    Malleswaram West
414    Peenya Dasarahalli
417    Rv Niketan
422  Begur , Bommanahalli , Madivala , Singasandra
445    Domlur
483    Jeevanbhimannagar , New Thippasandra
508  Bannerghatta Road , Hulimavu , Hulimavu , JP N...
524  Basaveshwaranagar , K H B Colony , Kamakshipalya
531    Lingarajapuram , St. Thomas Town
536  Banashankari III Stage , Girinagar , Kathrighu...
538  Mahalakshmpuram Layout , West of Chord Road I...
543    Gunjur , Muthusandra , Vartur
545  Amruthahalli , Byatarayanapura , Kodigehalli ,...
554    C.V.Raman Nagar
```

566 ISRO Anthariksha Bhavan , R.M.V. Extension II ...  
 572 Koramangala VI Bk  
 601 Rajarajeshwarinagar  
 604 Electronics City , Wipro Limited  
 609 HSR Layout  
 623 Bellandur , Panathur  
 630 Hampinagar  
 646 Thalaghattapura  
 652 Adarangi , Hulikal , Kudur , Marasandra , Maya...  
 662 Ajjanahalli  
 675 Mullahalli  
 685 Chamarajasagara  
 696 Banavadi , Bylakere , Gudemaranahalli , Lakken...  
 706 Baginigere , Biskur , Doddamudigere , Doddasom...

	1st Most Common Venue	2nd Most Common Venue \
1	Indian Restaurant	Fast Food Restaurant
37	Indian Restaurant	South Indian Restaurant
55	Indian Restaurant	Fast Food Restaurant
80	Indian Restaurant	Vegetarian / Vegan Restaurant
90	Asian Restaurant	Indian Restaurant
96	Indian Restaurant	Fast Food Restaurant
119	Indian Restaurant	Restaurant
136	Indian Restaurant	Restaurant
139	Indian Restaurant	Vegetarian / Vegan Restaurant
142	Indian Restaurant	Vietnamese Restaurant
144	Chinese Restaurant	Restaurant
168	Indian Restaurant	Restaurant
185	Fast Food Restaurant	Indian Restaurant
194	Indian Restaurant	Chinese Restaurant
246	Indian Restaurant	Vietnamese Restaurant
250	Indian Restaurant	Vietnamese Restaurant
257	Indian Restaurant	Asian Restaurant
272	North Indian Restaurant	Indian Restaurant
279	Indian Restaurant	Vietnamese Restaurant
295	Indian Restaurant	Restaurant
300	Indian Restaurant	Chinese Restaurant
311	Indian Restaurant	Restaurant
318	Indian Restaurant	Fast Food Restaurant
369	Mediterranean Restaurant	Indian Restaurant
372	Indian Restaurant	American Restaurant
377	Fast Food Restaurant	Indian Restaurant
383	Indian Restaurant	Asian Restaurant
387	Indian Restaurant	Fast Food Restaurant
401	Indian Restaurant	South Indian Restaurant
414	Indian Restaurant	Vietnamese Restaurant
417	Indian Restaurant	Vietnamese Restaurant

422	Indian Restaurant	Asian Restaurant
445	Indian Restaurant	Chinese Restaurant
483	Indian Restaurant	Chinese Restaurant
508	South Indian Restaurant	Dumpling Restaurant
524	Fast Food Restaurant	Indian Restaurant
531	Indian Restaurant	Kerala Restaurant
536	Udupi Restaurant	Indian Restaurant
538	Asian Restaurant	Indian Restaurant
543	Indian Restaurant	Vietnamese Restaurant
545	Indian Restaurant	Fast Food Restaurant
554	Indian Restaurant	Vietnamese Restaurant
566	Restaurant	Indian Restaurant
572	Indian Restaurant	Italian Restaurant
601	Indian Restaurant	Vietnamese Restaurant
604	Chinese Restaurant	Indian Restaurant
609	Indian Restaurant	Mediterranean Restaurant
623	Indian Restaurant	Asian Restaurant
630	Indian Restaurant	Rajasthani Restaurant
646	Indian Restaurant	Vietnamese Restaurant
652	Indian Restaurant	Rajasthani Restaurant
662	Indian Restaurant	Rajasthani Restaurant
675	Indian Restaurant	Rajasthani Restaurant
685	Indian Restaurant	Rajasthani Restaurant
696	Indian Restaurant	Rajasthani Restaurant
706	Indian Restaurant	Rajasthani Restaurant

	3rd Most Common Venue	4th Most Common Venue \
1	American Restaurant	Afghan Restaurant
37	Middle Eastern Restaurant	Vietnamese Restaurant
55	Mediterranean Restaurant	Asian Restaurant
80	Chinese Restaurant	Vietnamese Restaurant
90	Italian Restaurant	Vietnamese Restaurant
96	Vegetarian / Vegan Restaurant	Asian Restaurant
119	Vegetarian / Vegan Restaurant	Fast Food Restaurant
136	Vietnamese Restaurant	Korean Restaurant
139	Vietnamese Restaurant	Korean Restaurant
142	Korean Restaurant	American Restaurant
144	Indian Restaurant	Vietnamese Restaurant
168	Vegetarian / Vegan Restaurant	Vietnamese Restaurant
185	Vietnamese Restaurant	Korean Restaurant
194	Fast Food Restaurant	Restaurant
246	Korean Restaurant	American Restaurant
250	Korean Restaurant	American Restaurant
257	South Indian Restaurant	Vietnamese Restaurant
272	Vietnamese Restaurant	Korean Restaurant
279	Fast Food Restaurant	Hyderabadi Restaurant
295	Vietnamese Restaurant	Korean Restaurant

300	Vietnamese Restaurant	Korean Restaurant
311	Fast Food Restaurant	Vietnamese Restaurant
318	South Indian Restaurant	Chinese Restaurant
369	Korean Restaurant	American Restaurant
372	Fast Food Restaurant	Vietnamese Restaurant
377	Vietnamese Restaurant	Korean Restaurant
383	Vegetarian / Vegan Restaurant	Vietnamese Restaurant
387	American Restaurant	Kerala Restaurant
401	Vietnamese Restaurant	Korean Restaurant
414	Korean Restaurant	American Restaurant
417	Korean Restaurant	American Restaurant
422	Vietnamese Restaurant	Korean Restaurant
445	Asian Restaurant	Restaurant
483	South Indian Restaurant	Italian Restaurant
508	Indian Restaurant	Vietnamese Restaurant
524	Vietnamese Restaurant	Korean Restaurant
531	Vietnamese Restaurant	Korean Restaurant
536	Vietnamese Restaurant	Korean Restaurant
538	Vietnamese Restaurant	Korean Restaurant
543	Korean Restaurant	American Restaurant
545	Vietnamese Restaurant	Korean Restaurant
554	Korean Restaurant	American Restaurant
566	Vietnamese Restaurant	Korean Restaurant
572	Kerala Restaurant	Vietnamese Restaurant
601	Korean Restaurant	American Restaurant
604	Vietnamese Restaurant	Korean Restaurant
609	Restaurant	Punjabi Restaurant
623	Karnataka Restaurant	Vietnamese Restaurant
630	Fast Food Restaurant	Vietnamese Restaurant
646	Korean Restaurant	American Restaurant
652	Fast Food Restaurant	Vietnamese Restaurant
662	Fast Food Restaurant	Vietnamese Restaurant
675	Fast Food Restaurant	Vietnamese Restaurant
685	Fast Food Restaurant	Vietnamese Restaurant
696	Fast Food Restaurant	Vietnamese Restaurant
706	Fast Food Restaurant	Vietnamese Restaurant

	5th Most Common Venue	6th Most Common Venue \
1	Multicuisine Indian Restaurant	South Indian Restaurant
37	Kerala Restaurant	American Restaurant
55	Restaurant	Korean Restaurant
80	Korean Restaurant	American Restaurant
90	Korean Restaurant	American Restaurant
96	South Indian Restaurant	Seafood Restaurant
119	Vietnamese Restaurant	Kerala Restaurant
136	American Restaurant	Andhra Restaurant
139	American Restaurant	Andhra Restaurant



142	Andhra Restaurant	Asian Restaurant
144	Korean Restaurant	American Restaurant
168	Kerala Restaurant	American Restaurant
185	American Restaurant	Andhra Restaurant
194	Korean Restaurant	Vegetarian / Vegan Restaurant
246	Andhra Restaurant	Asian Restaurant
250	Andhra Restaurant	Asian Restaurant
257	Korean Restaurant	American Restaurant
272	American Restaurant	Andhra Restaurant
279	Italian Restaurant	Kerala Restaurant
295	American Restaurant	Andhra Restaurant
300	American Restaurant	Andhra Restaurant
311	Korean Restaurant	American Restaurant
318	Vietnamese Restaurant	Korean Restaurant
369	Andhra Restaurant	Asian Restaurant
372	Korean Restaurant	Andhra Restaurant
377	American Restaurant	Andhra Restaurant
383	Korean Restaurant	American Restaurant
387	Vietnamese Restaurant	Korean Restaurant
401	American Restaurant	Andhra Restaurant
414	Andhra Restaurant	Asian Restaurant
417	Andhra Restaurant	Asian Restaurant
422	American Restaurant	Andhra Restaurant
445	North Indian Restaurant	Vietnamese Restaurant
483	Karnataka Restaurant	Kerala Restaurant
508	Korean Restaurant	American Restaurant
524	American Restaurant	Andhra Restaurant
531	American Restaurant	Andhra Restaurant
536	American Restaurant	Andhra Restaurant
538	American Restaurant	Andhra Restaurant
543	Andhra Restaurant	Asian Restaurant
545	American Restaurant	Andhra Restaurant
554	Andhra Restaurant	Asian Restaurant
566	American Restaurant	Andhra Restaurant
572	Korean Restaurant	American Restaurant
601	Andhra Restaurant	Asian Restaurant
604	American Restaurant	Andhra Restaurant
609	Kerala Restaurant	American Restaurant
623	Korean Restaurant	American Restaurant
630	Korean Restaurant	American Restaurant
646	Andhra Restaurant	Asian Restaurant
652	Korean Restaurant	American Restaurant
662	Korean Restaurant	American Restaurant
675	Korean Restaurant	American Restaurant
685	Korean Restaurant	American Restaurant
696	Korean Restaurant	American Restaurant
706	Korean Restaurant	American Restaurant

	7th Most Common Venue	8th Most Common Venue \
1	Chinese Restaurant	Modern European Restaurant
37	Andhra Restaurant	Asian Restaurant
55	American Restaurant	Andhra Restaurant
80	Andhra Restaurant	Asian Restaurant
90	Andhra Restaurant	Chinese Restaurant
96	Vietnamese Restaurant	Italian Restaurant
119	American Restaurant	Andhra Restaurant
136	Asian Restaurant	Chinese Restaurant
139	Asian Restaurant	Chinese Restaurant
142	Chinese Restaurant	Dumpling Restaurant
144	Andhra Restaurant	Asian Restaurant
168	Andhra Restaurant	Asian Restaurant
185	Asian Restaurant	Chinese Restaurant
194	Mexican Restaurant	Middle Eastern Restaurant
246	Chinese Restaurant	Dumpling Restaurant
250	Chinese Restaurant	Dumpling Restaurant
257	Andhra Restaurant	Chinese Restaurant
272	Asian Restaurant	Chinese Restaurant
279	Korean Restaurant	American Restaurant
295	Asian Restaurant	Chinese Restaurant
300	Asian Restaurant	Dumpling Restaurant
311	Andhra Restaurant	Asian Restaurant
318	American Restaurant	Andhra Restaurant
369	Chinese Restaurant	Dumpling Restaurant
372	Asian Restaurant	Chinese Restaurant
377	Asian Restaurant	Chinese Restaurant
383	Andhra Restaurant	Chinese Restaurant
387	Andhra Restaurant	Asian Restaurant
401	Asian Restaurant	Chinese Restaurant
414	Chinese Restaurant	Dumpling Restaurant
417	Chinese Restaurant	Dumpling Restaurant
422	Chinese Restaurant	Dumpling Restaurant
445	Kerala Restaurant	American Restaurant
483	Vietnamese Restaurant	Korean Restaurant
508	Andhra Restaurant	Asian Restaurant
524	Asian Restaurant	Chinese Restaurant
531	Asian Restaurant	Chinese Restaurant
536	Asian Restaurant	Chinese Restaurant
538	Chinese Restaurant	Dumpling Restaurant
543	Chinese Restaurant	Dumpling Restaurant
545	Asian Restaurant	Chinese Restaurant
554	Chinese Restaurant	Dumpling Restaurant
566	Asian Restaurant	Chinese Restaurant
572	Andhra Restaurant	Asian Restaurant
601	Chinese Restaurant	Dumpling Restaurant

604	Asian Restaurant	Dumpling Restaurant
609	Andhra Restaurant	Asian Restaurant
623	Andhra Restaurant	Chinese Restaurant
630	Andhra Restaurant	Asian Restaurant
646	Chinese Restaurant	Dumpling Restaurant
652	Andhra Restaurant	Asian Restaurant
662	Andhra Restaurant	Asian Restaurant
675	Andhra Restaurant	Asian Restaurant
685	Andhra Restaurant	Asian Restaurant
696	Andhra Restaurant	Asian Restaurant
706	Andhra Restaurant	Asian Restaurant

	9th Most Common Venue	10th Most Common Venue
1	Italian Restaurant	Indian Chinese Restaurant
37	Chinese Restaurant	Dumpling Restaurant
55	Chinese Restaurant	Dumpling Restaurant
80	Dumpling Restaurant	Falafel Restaurant
90	Dumpling Restaurant	Falafel Restaurant
96	Indian Chinese Restaurant	Hyderabadi Restaurant
119	Asian Restaurant	Chinese Restaurant
136	Dumpling Restaurant	Falafel Restaurant
139	Dumpling Restaurant	Falafel Restaurant
142	Falafel Restaurant	Fast Food Restaurant
144	Dumpling Restaurant	Falafel Restaurant
168	Chinese Restaurant	Dumpling Restaurant
185	Dumpling Restaurant	Falafel Restaurant
194	Mediterranean Restaurant	Asian Restaurant
246	Falafel Restaurant	Fast Food Restaurant
250	Falafel Restaurant	Fast Food Restaurant
257	Dumpling Restaurant	Falafel Restaurant
272	Dumpling Restaurant	Falafel Restaurant
279	Andhra Restaurant	Asian Restaurant
295	Dumpling Restaurant	Falafel Restaurant
300	Falafel Restaurant	Fast Food Restaurant
311	Chinese Restaurant	Dumpling Restaurant
318	Asian Restaurant	Dumpling Restaurant
369	Falafel Restaurant	Fast Food Restaurant
372	Dumpling Restaurant	Falafel Restaurant
377	Dumpling Restaurant	Falafel Restaurant
383	Dumpling Restaurant	Falafel Restaurant
387	Chinese Restaurant	Dumpling Restaurant
401	Dumpling Restaurant	Falafel Restaurant
414	Falafel Restaurant	Fast Food Restaurant
417	Falafel Restaurant	Fast Food Restaurant
422	Falafel Restaurant	Fast Food Restaurant
445	Andhra Restaurant	Dumpling Restaurant
483	American Restaurant	Andhra Restaurant

508	Chinese Restaurant	Falafel Restaurant
524	Dumpling Restaurant	Falafel Restaurant
531	Dumpling Restaurant	Falafel Restaurant
536	Dumpling Restaurant	Falafel Restaurant
538	Falafel Restaurant	Fast Food Restaurant
543	Falafel Restaurant	Fast Food Restaurant
545	Dumpling Restaurant	Falafel Restaurant
554	Falafel Restaurant	Fast Food Restaurant
566	Dumpling Restaurant	Falafel Restaurant
572	Chinese Restaurant	Dumpling Restaurant
601	Falafel Restaurant	Fast Food Restaurant
604	Falafel Restaurant	Fast Food Restaurant
609	Chinese Restaurant	Dumpling Restaurant
623	Dumpling Restaurant	Falafel Restaurant
630	Chinese Restaurant	Dumpling Restaurant
646	Falafel Restaurant	Fast Food Restaurant
652	Chinese Restaurant	Dumpling Restaurant
662	Chinese Restaurant	Dumpling Restaurant
675	Chinese Restaurant	Dumpling Restaurant
685	Chinese Restaurant	Dumpling Restaurant
696	Chinese Restaurant	Dumpling Restaurant
706	Chinese Restaurant	Dumpling Restaurant

```
[44]: c1_table = bangalore_merged.loc[bangalore_merged['Cluster Labels'] == 0,
↳ bangalore_merged.columns[[0]+[3]+[4]+[5]+list(range(8, bangalore_merged.
↳ shape[1]))]]

# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, neigh in zip(c1_table['Venue Latitude'], c1_table['Venue_
↳ Longitude'], c1_table['Venue'], c1_table['Neighborhood'] ):
    label = folium.Popup(str(poi) + ', ' + str(neigh), parse_html=True)

    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[int(cluster)-1],
```

```

        fill=True,
        fill_color=rainbow[int(cluster)-1],
        fill_opacity=0.7).add_to(map_clusters)
    #count += 1
map_clusters

```

[44]: <folium.folium.Map at 0x7ff6b8d33f98>

## Cluster 2

```

[45]: c2 = bangalore_merged.loc[bangalore_merged['Cluster Labels'] == 1,
    ↪bangalore_merged.columns[[0]+list(range(8, bangalore_merged.shape[1]))]]
c2.drop_duplicates()

```

```

[45]:
Neighborhood \
44  Malleswaram , Palace Guttahalli , Swimming Poo...
95      H.A.L II Stage , Hulsur Bazaar
133    Jayangar III Block , Madhavan Park
141      Jalahalli East
149    Chamrajpet
152    Gaviopuram Extension
158    Seshadripuram
175    Yeshwanthpur Bazar , Yeswanthpura
263      Adugodi
276    Maruthi Sevanagar
333  Banaswadi , Horamavu , Jalavayuvihar , Kalyana...
364    Arabic College , Venkateshapura
368    Benson Town , Jayamahar Road
380      H.K.P. Road
415  Laggere , Peenya I Stage , Peenya Small Indust...
428  B Sk II Stage , Jayanagar West , Padmanabhnaga...
479      Nagarbhavi
482  Bagalgunte , Chikkabidarkal , Nagasandra , Ne...
514  Doddagubbi , Dr. Shivarama Karanth Nagar , Kot...
521  J P Nagar , JP Nagar III Phase , Kumaraswamy L...
544  Bapagrama , Herohalli , Kodigehalli , Viswanee...
593      Nandinilayout
642      Achitnagar
672  Arebomnahalli , Baragenahalli , Billanakote ,...
716  Bettahalsur , Chikkajala , Doddajala , Hunasam...

1st Most Common Venue      2nd Most Common Venue \
44      Indian Restaurant  Vegetarian / Vegan Restaurant
95      Fast Food Restaurant      Vietnamese Restaurant
133     Fast Food Restaurant      Indian Restaurant
141     Fast Food Restaurant      Vietnamese Restaurant
149     Karnataka Restaurant      Vietnamese Restaurant

```

152	Fast Food Restaurant	Restaurant
158	Indian Restaurant	Fast Food Restaurant
175	Mediterranean Restaurant	Indian Restaurant
263	Restaurant	Indian Restaurant
276	South Indian Restaurant	Fast Food Restaurant
333	Chinese Restaurant	Korean Restaurant
364	Falafel Restaurant	Vietnamese Restaurant
368	Vegetarian / Vegan Restaurant	Vietnamese Restaurant
380	Restaurant	Indian Restaurant
415	Fast Food Restaurant	Vietnamese Restaurant
428	Indian Restaurant	Fast Food Restaurant
479	Andhra Restaurant	South Indian Restaurant
482	Multicuisine Indian Restaurant	Vietnamese Restaurant
514	Mediterranean Restaurant	Vegetarian / Vegan Restaurant
521	Multicuisine Indian Restaurant	Vietnamese Restaurant
544	Restaurant	Vietnamese Restaurant
593	Fast Food Restaurant	Vegetarian / Vegan Restaurant
642	Asian Restaurant	Fast Food Restaurant
672	Karnataka Restaurant	Vegetarian / Vegan Restaurant
716	Fast Food Restaurant	Vietnamese Restaurant

	3rd Most Common Venue	4th Most Common Venue \
44	South Indian Restaurant	Chinese Restaurant
95	Korean Restaurant	American Restaurant
133	Vegetarian / Vegan Restaurant	Vietnamese Restaurant
141	Korean Restaurant	American Restaurant
149	Korean Restaurant	American Restaurant
152	Indian Restaurant	Italian Restaurant
158	Asian Restaurant	Chinese Restaurant
175	Chinese Restaurant	Seafood Restaurant
263	Fast Food Restaurant	Karnataka Restaurant
276	Multicuisine Indian Restaurant	Vietnamese Restaurant
333	Restaurant	Indian Restaurant
364	Korean Restaurant	American Restaurant
368	Korean Restaurant	American Restaurant
380	Vietnamese Restaurant	Korean Restaurant
415	Korean Restaurant	American Restaurant
428	Karnataka Restaurant	Asian Restaurant
479	Vietnamese Restaurant	Korean Restaurant
482	Korean Restaurant	American Restaurant
514	Italian Restaurant	Restaurant
521	Korean Restaurant	American Restaurant
544	Korean Restaurant	American Restaurant
593	Vietnamese Restaurant	Korean Restaurant
642	Vietnamese Restaurant	Korean Restaurant
672	Vietnamese Restaurant	Korean Restaurant
716	Korean Restaurant	American Restaurant

	5th Most Common Venue	6th Most Common Venue \
44	Fast Food Restaurant	Vietnamese Restaurant
95	Andhra Restaurant	Asian Restaurant
133	Korean Restaurant	American Restaurant
141	Andhra Restaurant	Asian Restaurant
149	Andhra Restaurant	Asian Restaurant
152	Vietnamese Restaurant	Korean Restaurant
158	Karnataka Restaurant	Vietnamese Restaurant
175	Restaurant	Punjabi Restaurant
263	Vietnamese Restaurant	Korean Restaurant
276	Kerala Restaurant	American Restaurant
333	Indian Chinese Restaurant	Vegetarian / Vegan Restaurant
364	Andhra Restaurant	Asian Restaurant
368	Andhra Restaurant	Asian Restaurant
380	American Restaurant	Andhra Restaurant
415	Andhra Restaurant	Asian Restaurant
428	South Indian Restaurant	Seafood Restaurant
479	American Restaurant	Asian Restaurant
482	Andhra Restaurant	Asian Restaurant
514	North Indian Restaurant	Fast Food Restaurant
521	Andhra Restaurant	Asian Restaurant
544	Andhra Restaurant	Asian Restaurant
593	American Restaurant	Andhra Restaurant
642	American Restaurant	Andhra Restaurant
672	American Restaurant	Andhra Restaurant
716	Andhra Restaurant	Asian Restaurant

	7th Most Common Venue	8th Most Common Venue \
44	Kerala Restaurant	American Restaurant
95	Chinese Restaurant	Dumpling Restaurant
133	Andhra Restaurant	Asian Restaurant
141	Chinese Restaurant	Dumpling Restaurant
149	Chinese Restaurant	Dumpling Restaurant
152	American Restaurant	Andhra Restaurant
158	Korean Restaurant	American Restaurant
175	Fast Food Restaurant	Italian Restaurant
263	American Restaurant	Andhra Restaurant
276	Andhra Restaurant	Asian Restaurant
333	Andhra Restaurant	Karnataka Restaurant
364	Chinese Restaurant	Dumpling Restaurant
368	Chinese Restaurant	Dumpling Restaurant
380	Asian Restaurant	Chinese Restaurant
415	Chinese Restaurant	Dumpling Restaurant
428	Restaurant	Italian Restaurant
479	Chinese Restaurant	Dumpling Restaurant
482	Chinese Restaurant	Dumpling Restaurant

514	Indian Restaurant	Indian Chinese Restaurant
521	Chinese Restaurant	Dumpling Restaurant
544	Chinese Restaurant	Dumpling Restaurant
593	Asian Restaurant	Chinese Restaurant
642	Chinese Restaurant	Dumpling Restaurant
672	Asian Restaurant	Chinese Restaurant
716	Chinese Restaurant	Dumpling Restaurant

	9th Most Common Venue	10th Most Common Venue
44	Andhra Restaurant	Asian Restaurant
95	Falafel Restaurant	Hyderabadi Restaurant
133	Chinese Restaurant	Dumpling Restaurant
141	Falafel Restaurant	Hyderabadi Restaurant
149	Falafel Restaurant	Fast Food Restaurant
152	Asian Restaurant	Chinese Restaurant
158	Andhra Restaurant	Dumpling Restaurant
175	Indian Chinese Restaurant	Hyderabadi Restaurant
263	Asian Restaurant	Chinese Restaurant
276	Chinese Restaurant	Dumpling Restaurant
333	Italian Restaurant	Fast Food Restaurant
364	Fast Food Restaurant	Hyderabadi Restaurant
368	Falafel Restaurant	Fast Food Restaurant
380	Dumpling Restaurant	Falafel Restaurant
415	Falafel Restaurant	Hyderabadi Restaurant
428	Indian Chinese Restaurant	Hyderabadi Restaurant
479	Falafel Restaurant	Fast Food Restaurant
482	Falafel Restaurant	Fast Food Restaurant
514	Hyderabadi Restaurant	Falafel Restaurant
521	Falafel Restaurant	Fast Food Restaurant
544	Falafel Restaurant	Fast Food Restaurant
593	Dumpling Restaurant	Falafel Restaurant
642	Falafel Restaurant	Hyderabadi Restaurant
672	Dumpling Restaurant	Falafel Restaurant
716	Falafel Restaurant	Hyderabadi Restaurant

```
[46]: c2_table = bangalore_merged.loc[bangalore_merged['Cluster Labels'] == 1,
↳ bangalore_merged.columns[[0]+[3]+[4]+[5]+list(range(8, bangalore_merged.
↳ shape[1]))]]

# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]
```



```

# add markers to the map
markers_colors = []
for lat, lon, poi, neigh in zip(c2_table['Venue Latitude'], c2_table['Venue_
↳Longitude'], c2_table['Venue'], c2_table['Neighborhood'] ):
    label = folium.Popup(str(poi) + ', ' +str(neigh), parse_html=True)

    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='blue',
        fill_opacity=0.7).add_to(map_clusters)
    #count += 1
map_clusters

```

[46]: <folium.folium.Map at 0x7ff6e2a339b0>

[ ]:

Cluster	Most Common Restaurant	Least Common Restaurant	2nd Least Common Restaurant
1	Indian	Filipino	Asian Restaurant
2	Indian	Asian Restaurant	French

## Results

### 1.6 5. Discussion

The results can be approached in two ways;

If XYZ company want to open a restaurant in preferred location and irrespective of cuisine, refer to that neighborhood in specific cluster and chose cuisine with the least common restaurant for better profits If XYZ company want to open a restaurant with a preferred cuisine and irrespective of location, refer to the cluster with the least number of restaurants with that specific cuisine and select one among the neighborhoods based on company's preference.

### 1.7 6. Conclusion

This analysis is performed on limited data. This may be right or may be wrong. But if good amount of data is available there is scope to come up with better results. If there are lot of restaurants probably there is lot of demand. London has so many restaurants, yet certain neighborhood or borough doesn't have a specific cuisine restaurant available. As per the neighborhood or restaurant type mentioned like Indian Restaurant analysis can be checked. A venue with lowest risk and competition can be identified.

[ ]: