

Introduction/Business Problem

I am looking for a locality in Manhattan to start a new restaurant. I am from Macedonia and it is difficult to obtain the data of Skopje in json format. I want the locality to have a lot of customers and at the same time less competition for my restaurant so that I can prosper in my business. I will be using the skills that I have learnt in this course to do the task.

Data

I would be needing the following data to proceed with the task:

- Different localities of Manhattan.
- The coordinates (latitude, longitude) of these localities of Manhattan from Open Street Map APIs
- From Foursquare we will need following venues data:
 - Different restaurant in the Localities
 - Offices in the Localities
 - Schools/Colleges in the Localities

I will then leverage the available data in order to determine which locality would be the most appropriate in order to locate my new restaurant.

Methodology

Importing the libraries that I would need in this notebook

In [0]:

```
import numpy as np
import time
import pandas as pd
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json
import requests
from pandas.io.json import json_normalize

from geopy.geocoders import Nominatim

import folium
from folium import plugins

# Plotting related libraries
import matplotlib.cm as cm
import matplotlib.colors as colors
import seaborn as sns

# Clustering - Unsupervised Machine
Learning from sklearn.cluster import KMeans

print('All the libraries required for this notebook are imported. You can proceed with your work now!')
```

All the libraries required for this notebook are imported. You can proceed with your work now!

Loading and Exploring the dataset

In [0]:

```
!wget -q -O 'newyork_data.json'
https://coc1.us/new_york_dataset print('Data is downloaded!')
```

Data is downloaded!

Loading the data

In [0]:

```
with open('newyork_data.json') as json_data:
    newyork_data = json.load(json_data)
```

Having a quick look at the data

In [0]:

```
newyork_data
```

Out[0]:

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-73.98111603592393,
40.70332149882874],
'borough': 'Brooklyn',
'name': 'Vinegar Hill',
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.93053108817338, 40.67503986503237],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.282',
'properties': {'annoangle': 0.0,
'annoline1': 'Weeksville',
'annoline2': None,
'annoline3': None,
'bbox': [-73.93053108817338,
40.67503986503237,
-73.93053108817338,
40.67503986503237],
'borough': 'Brooklyn',
'name': 'Weeksville',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.90331684852599, 40.67786104769531],
```

```

    'type': 'Point'},
  'geometry_name': 'geom',
  'id': 'nyu_2451_34572.283',
  'properties': {'annoangle': 0.0,
    'annoline1': 'Broadway',
    'annoline2': 'Junction',
    'annoline3': None,
    'bbox': [-73.90331684852599,
      40.67786104769531,
      -73.90331684852599,
      40.67786104769531],
    'borough': 'Brooklyn',
    'name': 'Broadway Junction',
    'stacked': 2},
  'type': 'Feature'},
{'geometry': {'coordinates': [-73.9887528074504, 40.70317632822692],
  'type': 'Point'},
  'geometry_name': 'geom',
  'id': 'nyu_2451_34572.284',
  'properties': {'annoangle': 0.0,
    'annoline1': 'Dumbo',
    'annoline2': None,
    'annoline3': None,
    'bbox': [-73.9887528074504,
      40.70317632822692,
      -73.9887528074504,
      40.70317632822692],
    'borough': 'Brooklyn',
    'name': 'Dumbo',
    'stacked': 1},
  'type': 'Feature'},
{'geometry': {'coordinates': [-74.12059399718001, 40.60180957631444],
  'type': 'Point'},
  'geometry_name': 'geom',
  'id': 'nyu_2451_34572.285',
  'properties': {'annoangle': 0.0,
    'annoline1': 'Manor',
    'annoline2': 'Heights',
    'annoline3': None,
    'bbox': [-74.12059399718001,
      40.60180957631444,
      -74.12059399718001,
      40.60180957631444],
    'borough': 'Staten Island',
    'name': 'Manor Heights',
    'stacked': 2},
  'type': 'Feature'},
{'geometry': {'coordinates': [-74.13208447484298, 40.60370692627371],
  'type': 'Point'},
  'geometry_name': 'geom',
  'id': 'nyu_2451_34572.286',
  'properties': {'annoangle': 0.0,
    'annoline1': 'Willowbrook',
    'annoline2': None,
    'annoline3': None,
    'bbox': [-74.13208447484298,
      40.60370692627371,
      -74.13208447484298,
      40.60370692627371],
    'borough': 'Staten Island',
    'name': 'Willowbrook',
    'stacked': 1},
  'type': 'Feature'},
{'geometry': {'coordinates': [-74.21776636068567, 40.541139922091766],
  'type': 'Point'},
  'geometry_name': 'geom',
  'id': 'nyu_2451_34572.287',
  'properties': {'annoangle': 0.0,
    'annoline1': 'Sandy',
    'annoline2': 'Ground',
    'annoline3': None,
    'bbox': [-74.21776636068567,
      40.541139922091766,
      -74.21776636068567,
      40.541139922091766],
    'borough': 'Staten Island',
    'name': 'Sandy Ground',

```

```
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-74.12727240604946, 40.579118742961214],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.288',
'properties': {'annoangle': 0.0,
'annoline1': 'Egbertville',
'annoline2': None,
'annoline3': None,
'bbox': [-74.12727240604946,
40.579118742961214,
-74.12727240604946,
40.579118742961214],
'borough': 'Staten Island',
'name': 'Egbertville',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.89213760232822, 40.56737588957032],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.289',
'properties': {'annoangle': 0.0,
'annoline1': 'Roxbury',
'annoline2': None,
'annoline3': None,
'bbox': [-73.89213760232822,
40.56737588957032,
-73.89213760232822,
40.56737588957032],
'borough': 'Queens',
'name': 'Roxbury',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.95918459428702, 40.598525095137255],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.290',
'properties': {'annoangle': 0.0,
'annoline1': 'Homecrest',
'annoline2': None,
'annoline3': None,
'bbox': [-73.95918459428702,
40.598525095137255,
-73.95918459428702,
40.598525095137255],
'borough': 'Brooklyn',
'name': 'Homecrest',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.88114319200604, 40.716414511158185],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.291',
'properties': {'annoangle': 0.0,
'annoline1': 'Middle',
'annoline2': 'Village',
'annoline3': None,
'bbox': [-73.88114319200604,
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-73.88114319200604,
40.716414511158185],
'borough': 'Queens',
'name': 'Middle Village',
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-74.20152556457658, 40.52626406734812],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.292',
'properties': {'annoangle': 0.0,
'annoline1': "Prince's",
'annoline2': 'Bay',
'annoline3': None,
'bbox': [-74.20152556457658,
40.52626406734812,
-74.20152556457658,
```

```
40.52626406734812],
'borough': 'Staten Island',
'name': "Prince's Bay",
'stacked': 2},
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'type': 'Point'},
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'id': 'nyu_2451_34572.293',
'properties': {'annoangle': 0.0,
'annoline1': 'Lighthouse',
'annoline2': 'Hill',
'annoline3': None,
'bbox': [-74.13792663771568,
40.57650629379489,
-74.13792663771568,
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'borough': 'Staten Island',
'name': 'Lighthouse Hill',
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-74.22957080626941, 40.51954145748909],
'type': 'Point'},
'geometry_name': 'geom',
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'properties': {'annoangle': 0.0,
'annoline1': 'Richmond',
'annoline2': 'Valley',
'annoline3': None,
'bbox': [-74.22957080626941,
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-74.22957080626941,
40.51954145748909],
'borough': 'Staten Island',
'name': 'Richmond Valley',
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.82667757138641, 40.79060155670148],
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'geometry_name': 'geom',
'id': 'nyu_2451_34572.295',
'properties': {'annoangle': 0.0,
'annoline1': 'Malba',
'annoline2': None,
'annoline3': None,
'bbox': [-73.82667757138641,
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-73.82667757138641,
40.79060155670148],
'borough': 'Queens',
'name': 'Malba',
'stacked': 1},
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{'geometry': {'coordinates': [-73.890345709872, 40.6819989345173],
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'geometry_name': 'geom',
'id': 'nyu_2451_34572.296',
'properties': {'annoangle': 0.0,
'annoline1': 'Highland',
'annoline2': 'Park',
'annoline3': None,
'bbox': [-73.890345709872,
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40.6819989345173],
'borough': 'Brooklyn',
'name': 'Highland Park',
'stacked': 2},
'type': 'Feature'},
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'type': 'Point'},
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'id': 'nyu_2451_34572.297',
'properties': {'annoangle': 0.0,
'annoline1': 'Madison',
'annoline2': None,
'annoline3': None,
```

```
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40.60937770113766,
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40.60937770113766],
'borough': 'Brooklyn',
'name': 'Madison',
'stacked': 1},
'type': 'Feature'},
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'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.298',
'properties': {'annoangle': 0.0,
'annoline1': 'Bronxdale',
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'annoline3': None,
'bbox': [-73.86172577555115,
40.85272297633017,
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'borough': 'Bronx',
'name': 'Bronxdale',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.85931863221647, 40.86578787802982],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.299',
'properties': {'annoangle': 0.0,
'annoline1': 'Allerton',
'annoline2': None,
'annoline3': None,
'bbox': [-73.85931863221647,
40.86578787802982,
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'borough': 'Bronx',
'name': 'Allerton',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.90152264513144, 40.8703923914147],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.300',
'properties': {'annoangle': 0.0,
'annoline1': 'Kingsbridge',
'annoline2': 'Heights',
'annoline3': None,
'bbox': [-73.90152264513144,
40.8703923914147,
-73.90152264513144,
40.8703923914147],
'borough': 'Bronx',
'name': 'Kingsbridge Heights',
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.94817709920184, 40.64692606658579],
'type': 'Point'},
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'id': 'nyu_2451_34572.301',
'properties': {'annoangle': 0.0,
'annoline1': 'Erasmus',
'annoline2': None,
'annoline3': None,
'bbox': [-73.94817709920184,
40.64692606658579,
-73.94817709920184,
40.64692606658579],
'borough': 'Brooklyn',
'name': 'Erasmus',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-74.00011136202637, 40.75665808227519],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.302',
'properties': {'annoangle': 0.0,
```



```

'annoline1': 'Hudson',
'annoline2': 'Yards',
'annoline3': None,
'bbox': [-74.00011136202637,
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-74.00011136202637,
40.75665808227519],
'borough': 'Manhattan',
'name': 'Hudson Yards',
'stacked': 2},
'type': 'Feature'},
{'geometry': {'coordinates': [-73.80553002968718, 40.58733774018741],
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'geometry_name': 'geom',
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'properties': {'annoangle': 0.0,
'annoline1': 'Hammels',
'annoline2': None,
'annoline3': None,
'bbox': [-73.80553002968718,
40.58733774018741,
-73.80553002968718,
40.58733774018741],
'borough': 'Queens',
'name': 'Hammels',
'stacked': 1},
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'id': 'nyu_2451_34572.304',
'properties': {'annoangle': 0.0,
'annoline1': 'Bayswater',
'annoline2': None,
'annoline3': None,
'bbox': [-73.76596781445627,
40.611321691283834,
-73.76596781445627,
40.611321691283834],
'borough': 'Queens',
'name': 'Bayswater',
'stacked': 1},
'type': 'Feature'},
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'type': 'Point'},
'geometry_name': 'geom',
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'properties': {'annoangle': 0.0,
'annoline1': 'Queensbridge',
'annoline2': None,
'annoline3': None,
'bbox': [-73.94563070334091,
40.756091297094706,
-73.94563070334091,
40.756091297094706],
'borough': 'Queens',
'name': 'Queensbridge',
'stacked': 1},
'type': 'Feature'},
{'geometry': {'coordinates': [-74.08173992211962, 40.61731079252983],
'type': 'Point'},
'geometry_name': 'geom',
'id': 'nyu_2451_34572.306',
'properties': {'annoangle': 0.0,
'annoline1': 'Fox',
'annoline2': 'Hills',
'annoline3': None,
'bbox': [-74.08173992211962,
40.61731079252983,
-74.08173992211962,
40.61731079252983],
'borough': 'Staten Island',
'name': 'Fox Hills',
'stacked': 2},
'type': 'Feature'}],
'totalFeatures': 306,

```

```
'type': 'FeatureCollection'}
```

We can see that a lot of relevant information is available in the features key. So, creating a new variable to store the information

```
In [0]:
```

```
neighborhoods_data = newyork_data['features']
```

Checking the size of this data

```
In [0]:
```

```
len(neighborhoods_data)
```

```
Out[0]:
```

```
306
```

Having a look at one random point of this data to get a feel of the data

```
In [0]:
```

```
neighborhoods_data[10]
```

```
Out[0]:
```

```
{'geometry': {'coordinates': [-73.83579759808117, 40.866858107252696],  
  'type': 'Point'},  
  'geometry_name': 'geom',  
  'id': 'nyu_2451_34572.11',  
  'properties': {'annoangle': 0.0,  
    'annoline1': 'Baychester',  
    'annoline2': None,  
    'annoline3': None,  
    'bbox': [-73.83579759808117,  
      40.866858107252696,  
      -73.83579759808117,  
      40.866858107252696],  
    'borough': 'Bronx',  
    'name': 'Baychester',  
    'stacked': 1},  
  'type': 'Feature'}
```

Transforming the data into a pandas dataframe

Creating an empty dataframe which will be populated

```
In [0]:
```

```
# define the dataframe columns  
column_names = ['Borough', 'Neighborhood', 'Latitude', 'Longitude']  
  
# instantiate the dataframe  
neighborhoods = pd.DataFrame(columns=column_names)
```

Looping through the data and filling in the dataframe

```
In [0]:
```

```
for data in neighborhoods_data:  
    borough = neighborhood_name = data['properties']['borough']  
    neighborhood_name = data['properties']['name']  
    neighborhood_latlon = data['geometry']['coordinates']  
    neighborhood_lat = neighborhood_latlon[1]  
    neighborhood_lon = neighborhood_latlon[0]
```

```
neighborhoods = neighborhoods.append({'Borough': borough,
                                     'Neighborhood': neighborhood_name,
                                     'Latitude': neighborhood_lat,
                                     'Longitude': neighborhood_lon}, ignore_index=True)
```

Looking at the top five rows of the populated dataframe

In [0]:

```
neighborhoods.head()
```

Out[0]:

	Borough	Neighborhood	Latitude	Longitude
0	Bronx	Wakefield	40.894705	-73.847201
1	Bronx	Co-op City	40.874294	-73.829939
2	Bronx	Eastchester	40.887556	-73.827806
3	Bronx	Fieldston	40.895437	-73.905643
4	Bronx	Riverdale	40.890834	-73.912585

As Newyork is a big city, I will be working only with Manhattan Borough.

In [0]:

```
manhattan_data = neighborhoods[neighborhoods['Borough'] == 'Manhattan'].reset_index(drop=True)
manhattan_data.head()
```

Out[0]:

	Borough	Neighborhood	Latitude	Longitude
0	Manhattan	Marble Hill	40.876551	-73.910660
1	Manhattan	Chinatown	40.715618	-73.994279
2	Manhattan	Washington Heights	40.851903	-73.936900
3	Manhattan	Inwood	40.867684	-73.921210
4	Manhattan	Hamilton Heights	40.823604	-73.949688

Creating a Map with the neighborhoods superimposed over it

In [0]:

```
address = 'Manhattan, NY'

geolocator = Nominatim(user_agent="ny_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Manhattan are {}, {}'.format(latitude, longitude))
```

The geograpical coordinate of Manhattan are 40.7900869, -73.9598295.

In [0]:

```
# create map of Manhattan using latitude and longitude values
map_manhattan = folium.Map(location=[latitude, longitude], zoom_start=11)

# add markers to map
for lat, lng, label in zip(manhattan_data['Latitude'], manhattan_data['Longitude'],
                           manhattan_data['Neighborhood']):
    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_manhattan)
```

map_manhattan

Out[0]:

Foursquare API credentials

In [0]:

```
CLIENT_ID = 'DVDB4FS3WRHM41RR0TQN51UNJ0R4L4EAU3TRBJHLKN3N3MLB' # your Foursquare ID  
CLIENT_SECRET = 'N51KOH4G0SYL5QG0RVIPKQ5QHKEZ1SAERZQCASFxPI44PAKM' # your Foursquare  
Secret VERSION = '20180605' # Foursquare API version  
  
print('Your credentials:')  
print('CLIENT_ID: ' + CLIENT_ID)  
print('CLIENT_SECRET:' + CLIENT_SECRET)
```

Your credentials:

CLIENT_ID: DVDB4FS3WRHM41RR0TQN51UNJ0R4L4EAU3TRBJHLKN3N3MLB

CLIENT_SECRET:N51KOH4G0SYL5QG0RVIPKQ5QHKEZ1SAERZQCASFxPI44PAKM

Exploring the first neighbourhood in our data

In [0]:

```
manhattan_data.loc[0, 'Neighborhood']
```

Out[0]:

'Marble Hill'

Getting the latitude and longitude of Marble Hill

In [0]:

```

neighborhood_latitude = manhattan_data.loc[0, 'Latitude'] # neighborhood latitude value
neighborhood_longitude = manhattan_data.loc[0, 'Longitude'] # neighborhood longitude value
neighborhood_name = manhattan_data.loc[0, 'Neighborhood'] # neighborhood name

print('Latitude and longitude values of {} are {}, {}'.format(neighborhood_name,
                                                             neighborhood_latitude,
                                                             neighborhood_longitude))

```

Latitude and longitude values of Marble Hill are 40.87655077879964, -73.91065965862981.

Getting the top hundred venues in Marble Hill

In [0]:

```

# type your answer here
radius = 500 # define
radius LIMIT = 100
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
    CLIENT_ID,
    CLIENT_SECRET, VERSION,
    neighborhood_latitude,
    neighborhood_longitude,
    radius,

    LIMIT)
url # display URL

```

Out[0]:

```

'https://api.foursquare.com/v2/venues/explore?
&client_id=DVDB4FS3WRHM41RR0TQN51UNJ0R4L4EAU3TRBJHLKN3N3MLB&client_secret=N51KOH4G0SYL5QG0RVIPKQ5QH
SAERZQCASFPI44PAKM&v=20180605&ll=40.87655077879964,-73.91065965862981&radius=500&limit=100'

```

In [0]:

```

results = requests.get(url).json()
results

```

Out[0]:

```

{'meta': {'code': 200, 'requestId': '5d809a8b6bdee60039272ef5'},
 'response': {'groups': [{'items': [{'reasons': {'count': 0,
 'items': [{'reasonName': 'globalInteractionReason',
 'summary': 'This spot is popular',
 'type': 'general'}]},
 'referralId': 'e-0-4b4429abf964a52037f225e3-0',
 'venue': {'categories': [{'icon': {'prefix':
 'https://ss3.4sqi.net/img/categories_v2/food/pizza_',
 'suffix': '.png'},
 'id': '4bf58dd8d48988dlca941735',
 'name': 'Pizza Place',
 'pluralName': 'Pizza Places',
 'primary': True,
 'shortName': 'Pizza'}]},
 'delivery': {'id': '72548',
 'provider': {'icon': {'name': '/delivery_provider_seamless_20180129.png',
 'prefix': 'https://fastly.4sqi.net/img/general/cap/',
 'sizes': [40, 50]},
 'name': 'seamless'},
 'url': 'https://www.seamless.com/menu/arturos-pizza-5189-broadway-ave-new-york/72548?
affiliate=1131&utm_source=foursquare-affiliate-
network&utm_medium=affiliate&utm_campaign=1131&utm_content=72548'},
 'id': '4b4429abf964a52037f225e3',
 'location': {'address': '5198 Broadway',
 'cc': 'US',
 'city': 'New York',
 'country': 'United States',
 'crossStreet': 'at 225th St.',
 'distance': 240,
 'formattedAddress': ['5198 Broadway (at 225th St.)',

```

```

    'New York, NY 10463',
    'United States'],
    'labeledLatLngs': [{'label': 'display',
        'lat': 40.87441177110231,
        'lng': -73.91027100981574}],
    'lat': 40.87441177110231,
    'lng': -73.91027100981574,
    'postalCode': '10463',
    'state': 'NY'},
    'name': "Arturo's",
    'photos': {'count': 0, 'groups': []}},
    {'reasons': {'count': 0,
        'items': [{'reasonName': 'globalInteractionReason',
            'summary': 'This spot is popular',
            'type': 'general'}]},
        'referralId': 'e-0-4baf59e8f964a520a6f93be3-1',
        'venue': {'categories': [{'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/shops/gym_yogastudio_',
            'suffix': '.png'},
            'id': '4bf58dd8d48988d102941735',
            'name': 'Yoga Studio',
            'pluralName': 'Yoga Studios',
            'primary': True,
            'shortName': 'Yoga Studio'}]},
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    'name': 'seamless'},
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```

```

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    'id': '4bf58dd8d48988d105951735',
    'name': 'Kids Store',
    'pluralName': 'Kids Stores',
    'primary': True,
    'shortName': 'Kids Store'}]},
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        'venue': {'categories': [{'icon': {'prefix':
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  'suffix': '.png'}},
    'id': '4bf58dd8d48988d103951735',
    'name': 'Clothing Store',
    'pluralName': 'Clothing Stores',
    'primary': True,
    'shortName': 'Apparel'}]},
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      'country': 'United States',
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        'lng': -73.90594,
        'postalCode': '10463',
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        {'reasons': {'count': 0,
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            'summary': 'This spot is popular',

```

```

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    'photos': {'count': 0, 'groups': []}},
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    'pluralName': 'Delis / Bodegas',
    'primary': True,
    'shortName': 'Deli / Bodega'}]},
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    'United States'],
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    'lng': -73.91274586964578}],
    'lat': 40.87647647652852,
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    'postalCode': '10034',
    'state': 'NY'},
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    'photos': {'count': 0, 'groups': []}}],
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    'suggestedFilters': {'filters': [{'key': 'openNow', 'name': 'Open now'}]},
    'header': 'Tap to show:}',
    'totalResults': 24}}

```

Defining a function to get the category type

In [0]:

```
# function that extracts the category of the venue
```

```
def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

    if len(categories_list) == 0:
        return None
    else:
        return categories_list[0]['name']
```

Cleaning of the json file and importing data into dataframe

In [0]:

```
venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues) # flatten JSON

# filter columns
filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat',
'venue.location.lng'] nearby_venues =nearby_venues.loc[:, filtered_columns]

# filter the category for each row
nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type, axis=1)

# clean columns
nearby_venues.columns = [col.split(".")[-1] for col in nearby_venues.columns]

nearby_venues.head()
```

Out[0]:

	name	categories	lat	lng
0	Arturo's	Pizza Place	40.874412	-73.910271
1	Bikram Yoga	Yoga Studio	40.876844	-73.906204
2	Tibbett Diner	Diner	40.880404	-73.908937
3	Starbucks	Coffee Shop	40.877531	-73.905582
4	Dunkin'	Donut Shop	40.877136	-73.906666

Exploring Neighborhoods in Manhattan

Defining a function to get similar kind of data for all the neighborhoods in Manhattan

In [0]:

```
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?
&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)

        # 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']

return(nearby_venues)

```

Creating a new dataframe containing the data of different neighborhoods in Manhattan

In [0]:

```

manhattan_venues = getNearbyVenues(names=manhattan_data['Neighborhood'],
    latitudes=manhattan_data['Latitude'],
    longitudes=manhattan_data['Longitude']
    )

```

Marble Hill
 Chinatown
 Washington Heights
 Inwood
 Hamilton Heights
 Manhattanville
 Central Harlem
 East Harlem
 Upper East Side
 Yorkville
 Lenox Hill
 Roosevelt Island
 Upper West Side
 Lincoln Square
 Clinton
 Midtown
 Murray Hill
 Chelsea
 Greenwich Village
 East Village
 Lower East Side
 Tribeca
 Little Italy
 Soho
 West Village
 Manhattan Valley
 Morningside Heights
 Gramercy
 Battery Park City
 Financial District
 Carnegie Hill
 Noho
 Civic Center
 Midtown South
 Sutton Place
 Turtle Bay
 Tudor City
 Stuyvesant Town
 Flatiron
 Hudson Yards

Having a look at the dataframe

In [0]:

```
print(manhattan_venues.shape)
manhattan_venues.head()
```

(3326, 7)

Out[0]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Marble Hill	40.876551	-73.91066	Arturo's	40.874412	-73.910271	Pizza Place
1	Marble Hill	40.876551	-73.91066	Bikram Yoga	40.876844	-73.906204	Yoga Studio
2	Marble Hill	40.876551	-73.91066	Tibbett Diner	40.880404	-73.908937	Diner
3	Marble Hill	40.876551	-73.91066	Starbucks	40.877531	-73.905582	Coffee Shop
4	Marble Hill	40.876551	-73.91066	Dunkin'	40.877136	-73.906666	Donut Shop

Grouping the venues by Neighborhood

In [0]:

```
manhattan_venues.groupby('Neighborhood').count()
```

Out[0]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
	Battery Park City	100	100	100	100	100	100
	Carnegie Hill	100	100	100	100	100	100
	Central Harlem	46	46	46	46	46	46
	Chelsea	100	100	100	100	100	100
	Chinatown	100	100	100	100	100	100
	Civic Center	100	100	100	100	100	100
	Clinton	100	100	100	100	100	100
	East Harlem	45	45	45	45	45	45
	East Village	100	100	100	100	100	100
	Financial District	100	100	100	100	100	100
	Flatiron	100	100	100	100	100	100
	Gramercy	100	100	100	100	100	100
	Greenwich Village	100	100	100	100	100	100
	Hamilton Heights	61	61	61	61	61	61
	Hudson Yards	76	76	76	76	76	76
	Inwood	57	57	57	57	57	57
	Lenox Hill	100	100	100	100	100	100
	Lincoln Square	100	100	100	100	100	100
	Little Italy	100	100	100	100	100	100
	Lower East Side	61	61	61	61	61	61
	Manhattan Valley	63	63	63	63	63	63
	Manhattanville	44	44	44	44	44	44
	Marble Hill	24	24	24	24	24	24
	Midtown	100	100	100	100	100	100
	Midtown South	100	100	100	100	100	100
	Morningside Heights	40	40	40	40	40	40
	Murray Hill	100	100	100	100	100	100
	Noho	100	100	100	100	100	100
	Roosevelt Island	24	24	24	24	24	24

Soho	Neighborhood	Latitude	Neighborhood	Longitude	Venue	Venue	Latitude	Venue	Longitude	Venue	Category
		100		100	100		100		100		100
	Neighborhood										
	Stuyvesant Town	17		17	17		17		17		17
	Sutton Place	100		100	100		100		100		100
	Tribeca	100		100	100		100		100		100
	Tudor City	82		82	82		82		82		82
	Turtle Bay	100		100	100		100		100		100
	Upper East Side	100		100	100		100		100		100
	Upper West Side	100		100	100		100		100		100
	Washington Heights	86		86	86		86		86		86
	West Village	100		100	100		100		100		100
	Yorkville	100		100	100		100		100		100

Looking at the unique categories

In [0]:

```
print('There are {} unique categories.'.format(len(manhattan_venues['Venue Category'].unique())))
```

There are 338 unique categories.

Analyzing Each Neighborhood

In [0]:

```
# one hot encoding
manhattan_onehot = pd.get_dummies(manhattan_venues[['Venue Category']], prefix="", prefix_sep="")

# add neighborhood column back to dataframe
manhattan_onehot['Neighborhood'] = manhattan_venues['Neighborhood']

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

manhattan_onehot.head()
```

Out[0]:

	Neighborhood	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	American Restaurant	Animal Shelter	Antique Shop	Arcade	Arepa Restaurant	Argentinian Restaurant	Gall
0	Marble Hill	0	0	0	0	0	0	0	0	0	0	
1	Marble Hill	0	0	0	0	0	0	0	0	0	0	
2	Marble Hill	0	0	0	0	0	0	0	0	0	0	
3	Marble Hill	0	0	0	0	0	0	0	0	0	0	
4	Marble Hill	0	0	0	0	0	0	0	0	0	0	

Grouping by neighborhoods and taking mean of frequency of occurrence

In [0]:

```
manhattan_grouped =
manhattan_onehot.groupby('Neighborhood').mean().reset_index() manhattan_grouped
```

Out[0]:

Neighborhood	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	American Restaurant	Animal Shelter	Antique Shop	Arcade	Arepa Restaurant	Argentinian Restaurant	G
--------------	----------------------	-------------------	----------------------	-----------------------	------------------------	-------------------	-----------------	--------	---------------------	---------------------------	---

	Neighborhood	Accessories	Adult	Afghan	African	American	Animal	Antique	Arcade	Arepa	Argentinian	G
0	Battery Park City	Store 0.000000	Boutique 0.00	Restaurant 0.00	Restaurant 0.000000	Restaurant 0.010000	Shelter 0.00	Shop 0.00	0.00	Restaurant 0.000000	Restaurant 0.000000	0.0
1	Carnegie Hill	0.000000	0.00	0.00	0.000000	0.010000	0.00	0.00	0.00	0.000000	0.000000	0.0
2	Central Harlem	0.000000	0.00	0.00	0.065217	0.043478	0.00	0.00	0.00	0.000000	0.000000	0.0
3	Chelsea	0.000000	0.00	0.00	0.000000	0.030000	0.00	0.00	0.00	0.000000	0.000000	0.0
4	Chinatown	0.000000	0.00	0.00	0.000000	0.040000	0.00	0.00	0.00	0.000000	0.000000	0.0
5	Civic Center	0.000000	0.00	0.00	0.000000	0.030000	0.00	0.01	0.00	0.000000	0.000000	0.0
6	Clinton	0.000000	0.00	0.00	0.000000	0.040000	0.00	0.00	0.00	0.000000	0.000000	0.0
7	East Harlem	0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0
8	East Village	0.000000	0.00	0.00	0.000000	0.020000	0.00	0.01	0.00	0.020000	0.010000	0.0
9	Financial District	0.010000	0.00	0.00	0.000000	0.030000	0.00	0.00	0.00	0.000000	0.000000	0.0
10	Flatiron	0.000000	0.00	0.00	0.000000	0.040000	0.00	0.00	0.00	0.000000	0.000000	0.0
11	Gramercy	0.000000	0.00	0.00	0.000000	0.040000	0.00	0.00	0.01	0.000000	0.000000	0.0
12	Greenwich Village	0.000000	0.00	0.00	0.000000	0.020000	0.00	0.00	0.00	0.000000	0.000000	0.0
13	Hamilton Heights	0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0
14	Hudson Yards											
15	Inwood	0.000000	0.00	0.00	0.000000	0.065789	0.00	0.00	0.00	0.000000	0.000000	0.0
16	Lenox Hill	0.000000	0.00	0.00	0.000000	0.035088	0.00	0.00	0.00	0.000000	0.000000	0.0
17	Lincoln Square	0.000000	0.00	0.01	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0
18	Little Italy	0.000000	0.00	0.00	0.000000	0.020000	0.00	0.00	0.00	0.000000	0.000000	0.0
19	Lower East Side	0.000000	0.00	0.00	0.000000	0.010000	0.01	0.00	0.00	0.000000	0.000000	0.0
20	Manhattan Valley	0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.016393	0.0
21	Manhattanville	0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0
22	Marble Hill											
23	Midtown	0.000000	0.00	0.00	0.000000	0.022727	0.00	0.00	0.00	0.000000	0.000000	0.0
24	Midtown South	0.000000	0.00	0.00	0.000000	0.041667	0.00	0.00	0.00	0.000000	0.000000	0.0
25	Morningside Heights	0.000000	0.00	0.00	0.000000	0.020000	0.00	0.00	0.00	0.000000	0.000000	0.0
26	Murray Hill	0.000000	0.00	0.00	0.000000	0.030000	0.00	0.00	0.00	0.000000	0.000000	0.0
27	Noho	0.000000	0.00	0.00	0.000000	0.075000	0.00	0.00	0.00	0.000000	0.000000	0.0
28	Roosevelt Island	0.000000	0.00	0.00	0.000000	0.030000	0.00	0.00	0.00	0.000000	0.000000	0.0
29	Soho	0.000000	0.01	0.00	0.000000	0.020000	0.00	0.00	0.00	0.000000	0.010000	0.0
30	Stuyvesant Town	0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0
31	Sutton Place											
32	Tribeca	0.010000	0.00	0.00	0.000000	0.010000	0.00	0.00	0.00	0.000000	0.000000	0.0
33	Tudor City	0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0
34	Turtle Bay	0.000000	0.01	0.00	0.000000	0.030000	0.00	0.00	0.00	0.000000	0.000000	0.0
35	Upper East Side	0.000000	0.00	0.00	0.000000	0.050000	0.00	0.00	0.00	0.000000	0.010000	0.0
36	Upper West Side	0.000000	0.00	0.00	0.000000	0.012195	0.00	0.00	0.00	0.000000	0.000000	0.0
37	Washington Heights	0.000000	0.00	0.00	0.000000	0.010000	0.00	0.00	0.00	0.000000	0.000000	0.0
38	West Village	0.000000	0.00	0.00	0.000000	0.020000	0.00	0.00	0.00	0.000000	0.000000	0.0
39	Yorkville	0.010000	0.00	0.00	0.000000	0.020000	0.00	0.00	0.00	0.000000	0.000000	0.0
		0.011628	0.00	0.00	0.000000	0.011628	0.00	0.00	0.00	0.011628	0.000000	0.0
		0.010000	0.00	0.00	0.000000	0.040000	0.00	0.00	0.00	0.000000	0.000000	0.0
		0.000000	0.00	0.00	0.000000	0.000000	0.00	0.00	0.00	0.000000	0.000000	0.0

In [0]:

```
num_top_venues = 5

for hood in manhattan_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = manhattan_grouped[manhattan_grouped['Neighborhood'] == hood].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('\n')
```

----Battery Park City----

	venue	freq
0	Park	0.09
1	Coffee Shop	0.07
2	Hotel	0.05
3	Gym	0.04
4	Memorial Site	0.04

----Carnegie Hill----

	venue	freq
0	Coffee Shop	0.06
1	Pizza Place	0.06
2	Cosmetics Shop	0.04
3	Café	0.04
4	Yoga Studio	0.03

----Central Harlem----

	venue	freq
0	Chinese Restaurant	0.07
1	African Restaurant	0.07
2	Gym / Fitness Center	0.04
4	Public Art	0.04

----Chelsea----

	venue	freq
0	Coffee Shop	0.06
1	Italian Restaurant	0.05
2	Bakery	0.05
3	Ice Cream Shop	0.05
4	Nightclub	0.04

----Chinatown----

	venue	freq
0	Chinese Restaurant	0.09
1	Cocktail Bar	0.05
2	American Restaurant	0.04
3	Vietnamese Restaurant	0.04
4	Bakery	0.04

----Civic Center----

	venue	freq
0	Gym / Fitness Center	0.05
1	Coffee Shop	0.04
2	Italian Restaurant	0.04
3	French Restaurant	0.04
4	Hotel	0.04

----Clinton----

	venue	freq
0	Theater	0.11
1	Gym / Fitness Center	0.05
2	American Restaurant	0.04
3	Italian Restaurant	0.04
4	Spa	0.04

----East Harlem----

	venue	freq
0	Mexican Restaurant	0.13
2	Deli / Bodega	0.07
3	Latin American Restaurant	0.04
4	Thai Restaurant	0.04

----East Village----- freq

	venue	
0	Bar	0.07
1	Ice Cream Shop	0.05
2	Wine Bar	0.05
3	Pizza Place	0.04
4	Mexican Restaurant	0.04

----Financial District----

	venue	freq
0	Coffee Shop	0.09
1	Pizza Place	0.04
2	Gym	0.04
3	Hotel	0.04
4	Wine Shop	0.04

----Flatiron----

	venue	freq
0	Gym / Fitness Center	0.06
1	Yoga Studio	0.04
2	American Restaurant	0.04
3	Japanese Restaurant	0.04
4	Gym	0.04

----Gramercy---- venue freq

0	Bar	0.06
1	Italian Restaurant	0.05
2	American Restaurant	0.04
3	Pizza Place	0.04
4	Bagel Shop	0.04

----Greenwich Village----

	venue	freq
0	Italian Restaurant	0.13
1	Clothing Store	0.05
2	Sushi Restaurant	0.04
4	Seafood Restaurant	0.03

----Hamilton Heights---- freq

	venue	
0	Café	0.07
1	Mexican Restaurant	0.07
2	Pizza Place	0.07
3	Coffee Shop	0.05
4	Deli / Bodega	0.05

----Hudson Yards----

	venue	freq
0	American Restaurant	0.07
1	Italian Restaurant	0.05
3	Gym / Fitness Center	0.05
4	Restaurant	0.04

----Inwood----

	venue	freq
0	Mexican Restaurant	0.09
1	Lounge	0.07

```

2          Café  0.07
3      Pizza Place  0.05
4          Park   0.04
----Lenox Hill----      freq

          venue
0      Italian Restaurant  0.07
1Coffee Shop  0.07
2Pizza Place  0.05
3Sushi Restaurant  0.04
4 Gym / Fitness Center  0.03

----Lincoln Square----      freq
0          venue
          Theater  0.06
1 Gym / Fitness Center  0.06

3      Italian Restaurant  0.05
4Concert Hall  0.05

----Little Italy----
          venue  freq
0          Bakery  0.06

2 Salon / Barbershop  0.03

4      Clothing Store  0.03

----Lower East Side----
          venue  freq
0      Pizza Place  0.07
1Coffee Shop  0.07
2          Café  0.05
3Art Gallery  0.05
4 Ramen Restaurant  0.03

----Manhattan Valley----
          venue  freq
0 Indian Restaurant  0.05
1Pizza Place  0.05
2Coffee Shop  0.05
3Yoga Studio  0.03
4Playground  0.03

----Manhattanville----
          venue  freq
0          Coffee Shop  0.07
1 Italian Restaurant  0.05 2
Mexican Restaurant  0.05 3
Seafood Restaurant  0.05 4
Fried Chicken Joint  0.05

----Marble Hill----
          venue  freq
0      Sandwich Place  0.08
1Coffee Shop  0.08
2Yoga Studio  0.04
3          Bank  0.04
4 Department Store  0.04

----Midtown----
          venue  freq
0          Hotel  0.07
1Cocktail Bar  0.04
2Coffee Shop  0.04
3Theater  0.04
4 Clothing Store  0.04

```

----Midtown South----

	venue	freq
0	Korean Restaurant	0.14
1	Hotel Bar	0.05
3	Japanese Restaurant	0.04
4	Cosmetics Shop	0.04

----Morningside Heights----

	venue	freq
0	Coffee Shop	0.08
1	American Restaurant	0.08
3	Bookstore	0.08
4	Deli / Bodega	0.05

----Murray Hill----

	venue	freq
0	Coffee Shop	0.05
1	Japanese Restaurant	0.04
2	Sandwich Place	0.04
3	Hotel	0.04
4	Gym	0.03

----Noho----- venue freq

0	Italian Restaurant	0.06
1	French Restaurant	0.04
2	Cocktail Bar	0.04
3	Art Gallery	0.04
4	Gift Shop	0.03

----Roosevelt Island----

	venue	freq
0	Park	0.08
1	Coffee Shop	0.08
2	Sandwich Place	0.08
3	Metro Station	0.04
4	Liquor Store	0.04

----Soho-----

	venue	freq
0	Clothing Store	0.10
1	Boutique	0.06
2	Women's Store	0.04
3	Shoe Store	0.04
4	Art Gallery	0.04

----Stuyvesant Town----

	venue	freq
0	Bar	0.12
1	Park	0.12
2	Playground	0.12
3	Farmers Market	0.06
4	Fountain	0.06

----Sutton Place----

	venue	freq
0	Gym / Fitness Center	0.06
1	Italian Restaurant	0.04
2	Indian Restaurant	0.04
3	Furniture / Home Store	0.04
4	American Restaurant	0.03

----Tribeca----- freq

0	venue	
	Park	0.05
1	Café	0.05
2	American Restaurant	0.05


```

3   Italian Restaurant  0.05
4           Boutique  0.04

```

----Tudor City----

```

           venue  freq
0  Mexican Restaurant  0.06
1           Park  0.06
2           Café  0.06
3   Sushi Restaurant  0.05
4Greek Restaurant  0.05

```

----Turtle Bay----

```

           venue  freq
0   Italian Restaurant  0.07
1Sushi Restaurant  0.06
2Steakhouse  0.05
3Coffee Shop  0.04
4           Wine Bar  0.04

```

----Upper East Side----

```

           venue  freq
0   Italian Restaurant  0.08
1           Exhibit  0.07
2           Bakery  0.05
3Art Gallery  0.05
4Coffee Shop  0.04

```

----Upper West Side----

```

           venue  freq
0   Italian Restaurant  0.06
1Coffee Shop  0.04
2           Wine Bar  0.04
4   Indian Restaurant  0.03

```

----Washington Heights freq----

```

0           venue
           Café  0.06
1           Bakery  0.05
2  Mobile Phone Shop  0.03
3Grocery Store  0.03
4Sandwich Place  0.03

```

----West Village----

```

           venue  freq
0   Italian Restaurant  0.09
1Cosmetics Shop  0.06
2  New American Restaurant  0.06
3           Cocktail Bar  0.04
4American Restaurant  0.04

```

----Yorkville----

```

           venue  freq
0   Italian Restaurant  0.06
2           Coffee Shop  0.06
4           Pizza Place  0.05

```

Putting all of the data in a dataframe

```

In [0]:
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]
```

In [0]:

```
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):
    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'] = manhattan_grouped['Neighborhood']

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

neighborhoods_venues_sorted.head()
```

Out[0]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Battery Park City	Park	Coffee Shop	Hotel	Gym	Memorial Site	Italian Restaurant	Wine Shop	Food Court	Shopping Mall	Sandwich Place
1	Carnegie Hill	Coffee Shop	Pizza Place	Cosmetics Shop	Café	Japanese Restaurant	Grocery Store	French Restaurant	Yoga Studio	Bookstore	Bar
2	Central Harlem	Chinese Restaurant	African Restaurant	Gym / Fitness Center	French Restaurant	Seafood Restaurant	Public Art	American Restaurant	Bar	Caribbean Restaurant	Southern / Soul Food Restaurant
3	Chelsea	Coffee Shop	Italian Restaurant	Bakery	Ice Cream Shop	Nightclub	Hotel	American Restaurant	Theater	Seafood Restaurant	Tapas Restaurant
4	Chinatown	Chinese Restaurant	Cocktail Bar	Vietnamese Restaurant	American Restaurant	Bakery	Spa	Salon / Barbershop	Bubble Tea Shop	Boutique	Optical Shop

Clustering the neighborhoods

In [0]:

```
# set number of
clusters kclusters = 5

manhattan_grouped_clustering = manhattan_grouped.drop('Neighborhood', 1)

# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(manhattan_grouped_clustering)

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

Out[0]:

```
array([3, 3, 0, 3, 0, 3, 3, 2, 0, 3], dtype=int32)
```

In [0]:

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

manhattan_merged = manhattan_data
```

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

manhattan_merged.head() # check the last columns!
```

Out[0]:

	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7 C
0	Manhattan	Marble Hill	40.876551	- 73.910660	2	Sandwich Place	Coffee Shop	Yoga Studio	Pizza Place	Supplement Shop	Steakhouse	S Re
1	Manhattan	Chinatown	40.715618	- 73.994279	0	Chinese Restaurant	Cocktail Bar	Vietnamese Restaurant	American Restaurant	Bakery	Spa	Bar
2	Manhattan	Washington Heights	40.851903	- 73.936900	2	Café	Bakery	Mobile Phone Shop	Sandwich Place	Grocery Store	Cosmetics Shop	
3	Manhattan	Inwood	40.867684	- 73.921210	2	Mexican Restaurant	Café	Lounge	Pizza Place	Bakery	Deli / Bodega	Ph
4	Manhattan	Hamilton Heights	40.823604	- 73.949688	2	Mexican Restaurant	Café	Pizza Place	Deli / Bodega	Coffee Shop	Yoga Studio	

Visualizing the resulting clusters

In [0]:

```
# 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 in zip(manhattan_merged['Latitude'], manhattan_merged['Longitude'],
manhattan_merged['Neighborhood'], manhattan_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + 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)

map_clusters
```

Out[0]:

Looking at the clusters

In [0]:

```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 0, manhattan_merged.columns[[1] +
list(range(5, manhattan_merged.shape[1]))]]
```

Out[0]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Chinatown	Chinese Restaurant	Cocktail Bar	Vietnamese Restaurant	American Restaurant	Bakery	Spa	Salon / Barbershop	Bubble Tea Shop	Boutique	Optical Shop
6	Central Harlem	Chinese Restaurant	African Restaurant	Gym / Fitness Center	French Restaurant	Seafood Restaurant	Public Art	American Restaurant	Bar	Caribbean Restaurant	Southern / Soul Food Restaurant
19	East Village	Bar	Ice Cream Shop	Wine Bar	Mexican Restaurant	Pizza Place	Chinese Restaurant	Ramen Restaurant	Vegetarian / Vegan Restaurant	Cocktail Bar	Coffee Shop
27	Gramercy	Bar	Italian Restaurant	American Restaurant	Pizza Place	Bagel Shop	Cocktail Bar	Mexican Restaurant	Ice Cream Shop	Hotel	Grocery Store

In [0]:

```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 1, manhattan_merged.columns[[1] +
list(range(5, manhattan_merged.shape[1]))]]
```

Out[0]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
33	Midtown South	Korean Restaurant	Hotel Bar	Hotel	Japanese Restaurant	Cosmetics Shop	American Restaurant	Coffee Shop	Dessert Shop	Gym / Fitness Center	Yoga Studio

In [0]:

```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 2, manhattan_merged.columns[[1] +
list(range(5, manhattan_merged.shape[1]))]]
```

Out[0]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Marble Hill	Sandwich Place	Coffee Shop	Yoga Studio	Pizza Place	Supplement Shop	Steakhouse	Seafood Restaurant	Clothing Store	Deli / Bodega	Department Store
2	Washington Heights	Café	Bakery	Mobile Phone Shop	Sandwich Place	Grocery Store	Cosmetics Shop	Coffee Shop	New American Restaurant	Latin American Restaurant	Park
3	Inwood	Mexican Restaurant	Café	Lounge	Pizza Place	Bakery	Deli / Bodega	Pharmacy	Park	Chinese Restaurant	Spanish Restaurant
4	Hamilton Heights	Mexican Restaurant	Café	Pizza Place	Deli / Bodega	Coffee Shop	Yoga Studio	Liquor Store	Indian Restaurant	Park	Sushi Restaurant

5	Neighborhood Manhattanville	1st Most Common Coffee Shop <small>Venue</small>	2nd Most Common Italian Restaurant <small>Venue</small>	3rd Most Common Mexican Restaurant <small>Venue</small>	4th Most Common Park <small>Venue</small>	5th Most Common Fried Chicken Joint <small>Venue</small>	6th Most Common Seafood Restaurant <small>Venue</small>	7th Most Common Café <small>Venue</small>	8th Most Common Lounge <small>Venue</small>	9th Most Common Bike Trail <small>Venue</small>	10th Most Common Sushi Restaurant <small>Venue</small>
7		Mexican		Deli /	Latin	Thai	Cocktail	Grocery	Donut	Coffee	French
	East Harlem	Restaurant	Bakery	Bodega	American Restaurant	Restaurant	Bar	Store	Shop	Shop	Restauran
9	Yorkville	Italian Restaurant	Gym	Bar	Coffee Shop	Pizza Place	Deli / Bodega	Sushi Restaurant	Wine Shop	Mexican Restaurant	Dine
11	Roosevelt Island	Park	Sandwich Place	Coffee Shop	Liquor Store	Café	Outdoors & Recreation	Metro Station	Greek Restaurant	School	Gym
20	Lower East Side	Pizza Place	Coffee Shop	Art Gallery	Café	Japanese Restaurant	Park	Sandwich Place	Bakery	Ramen Restaurant	Chinese Restauran
25	Manhattan Valley	Coffee Shop	Pizza Place	Indian Restaurant	Mexican Restaurant	Thai Restaurant	Spa	French Restaurant	Deli / Bodega	Yoga Studio	Ba
26	Morningside Heights	American Restaurant	Bookstore	Coffee Shop	Park	Deli / Bodega	Tennis Court	Sandwich Place	Food Truck	Burger Joint	Ice Cream Shop
36	Tudor City	Café	Park	Mexican Restaurant	Greek Restaurant	Sushi Restaurant	Deli / Bodega	Pizza Place	Garden	Dog Run	Spanish Restauran

In [0]:

```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 3, manhattan_merged.columns[[1] +
list(range(5, manhattan_merged.shape[1]))]]
```

Out[0]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Common Co
8	Upper East Side	Italian Restaurant	Exhibit	Art Gallery	Bakery	Coffee Shop	Juice Bar	French Restaurant	Gym / Fitness Center		Hotel
10	Lenox Hill	Italian Restaurant	Coffee Shop	Pizza Place	Restaurant	Sushi Joint	Burger Café	Gym	Gym / Fitness Center	Sporting Goods Shop	Cos
12	Upper West Side	Italian Restaurant		Coffee Shop	Indian Restaurant		Bakery Bar	Vegetarian / Vegan Restaurant	Thai	Pub	Bo
13	Lincoln Square	Theater	Gym / Fitness Center	Café	Plaza	Concert Hall	Italian Restaurant	Park	Performing Arts Venue	Indie Movie Theater	Res
14	Clinton	Theater	Gym / Fitness Center	American Restaurant		Italian Restaurant		French Wine Shop	Restaurant	Coffee Shop	C
15	Midtown	Hotel		Coffee Shop	Cocktail Bar	Clothing Store		Sporting Goods Shop		Japanese Restaurant	Bo
16	Murray Hill	Coffee Shop	Sandwich Place		Japanese Hotel	Italian Restaurant	French Restaurant	Gym / Fitness Center	American Restaurant	Gym	Res
17	Chelsea	Coffee Shop	Italian Restaurant	Bakery	Ice Cream Shop	Nightclub	Hotel	American Restaurant	Theater	Seafood Restaurant	Res
18	Greenwich Village	Italian Restaurant	Clothing Store	Sushi Restaurant	Café	Seafood Restaurant	Indian Restaurant	Cosmetics Shop	Chinese Restaurant	French Restaurant	Vietn Res
21	Tribeca	Italian Restaurant	American Restaurant	Park	Café	Boutique	Spa	Wine Shop	Greek Restaurant	Gym	
22	Little Italy	Bakery	Café	Sandwich Place	Clothing Store	Salon / Barbershop	Mediterranean Restaurant	Thai Restaurant	Hotel	Ice Cream Shop	
23	Soho	Clothing Store	Boutique	Art Gallery	Shoe Store	Women's Store	Italian Restaurant	Sporting Goods Shop	Men's Store	Mediterranean Restaurant	Fur
24	West Village	Italian Restaurant	Cosmetics Shop	New American Restaurant		Cocktail Bar		American Wine Bar		Ice	
28	Battery Park City	Park	Coffee Shop	Hotel	Gym	Memorial Site	Italian Restaurant	Wine Shop	Food Court	Shopping Mall	Sa
29	Financial District	Coffee Shop	Pizza Place	Wine Shop	Hotel	Gym	Event Space	American Restaurant	Gym / Fitness	Cocktail Bar	Stea

		1st Most	2nd Most	3rd Most	4th Most	5th Most	6th Most	7th Most	8th Most	9th Most	10th Most
30	Neighborhood Carnegie Hill	Coffee Shop Venue	Pizza Place Venue	Cosmetics Shop Venue	Common Café Venue	Japanese Restaurant Venue	Common Grocery Store Venue	French Restaurant Venue	Yoga Studio Venue	Common Bookstore Venue	Common Coffee Shop Venue
31	Noho	Italian Restaurant	Art Gallery	Cocktail Bar	French Restaurant	Rock Club	Pizza Place	Bookstore	Boutique	Coffee Shop	Gym
32	Civic Center	Gym / Fitness Center	Italian Restaurant	Coffee Shop	French Restaurant	Hotel	Sandwich Place	Sporting Goods Shop	American Restaurant	Cocktail Bar	
34	Sutton Place	Gym / Fitness Center	Italian Restaurant	Indian Restaurant	Furniture / Home Store	Gym	Dessert Shop	American Restaurant	Coffee Shop	Pizza Place	Res
35	Turtle Bay	Italian Restaurant	Sushi Restaurant	Steakhouse	Wine Bar	Coffee Shop	Park	Café	Ramen Restaurant	French Restaurant	Res
38	Flatiron	Gym / Fitness Center	Yoga Studio	American Restaurant		Japanese Restaurant	Salon / Barbershop		Clothing Store	Coffee Shop	Cos
39	Hudson Yards	American Restaurant	Italian Restaurant	Gym / Fitness Center	Café	Hotel	Restaurant	Ice Cream Shop	Theater	Coffee Shop	

In [0]:

```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 4, manhattan_merged.columns[[1] +
list(range(5, manhattan_merged.shape[1]))]]
```

Out[0]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
37	Stuyvesant Town	Bar	Park	Playground	Fountain	Bistro	Baseball Field	Harbor / Marina	Cocktail Bar	Coffee Shop	Heliport

Results

Now that I have clusters of the venues which are most visited. I can decide to pick a locality to start my new restaurant.

Discussion

I have done the analysis only for Manhattan borough. The same kind of analysis can be done for the entire of New York city too. This notebook can be used for similar kind of analysis for a different city. One needs to have the json information of the city to do this analysis.

Conclusion

I have learned a lot during the course of this project. I have learned about open street maps, Foursquare API and also about the folium library. Thanks to the course content creators and every one of my peers who have graded my assignments.