

my-projects (/github/shoang22/my-projects/tree/master)

/ chicago-crime-clusters (/github/shoang22/my-projects/tree/master/chicago-crime-clusters)

In [1]:

```
import numpy as np # Library to handle data in a vectorized manner

import pandas as pd
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # Library to handle JSON files

from geopy.geocoders import Nominatim # Convert an address into Latitude and Longitude

import requests # Library to handle requests
from pandas.io.json import json_normalize # transform JSON file into a pandas DataFrame

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors

# Import k-means from clustering stage
from sklearn.cluster import KMeans

import folium # Map rendering Library

#SQL Libraries
import ibm_db
import ibm_db_sa
import ibm_db_dbi
```

In [2]:

```
%load_ext sql
```

In [3]:

```
# Connect to Db2 instance
%sql ibm_db_sa://vcc60770:rzxhtplrb5v0t9%403@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
```

Out[3]:

```
'Connected: vcc60770@BLUDB'
```

In [10]:

```
df = %sql SELECT * from CRIMES

* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
Done.
```

In [17]:

```
%sql select COUNT(*) from CRIMES
```

```
* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.bluemix  
Done.
```

Out[17]:

```
1
```

```
533
```

In [18]:

```
%sql select COUNT(*) from CRIMES\  
      where ARREST = 'TRUE'
```

```
* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.blue  
Done.
```

Out[18]:

```
1
```

```
163
```

In [16]:

```
%sql select DISTINCT PRIMARY_TYPE from CRIMES
```

```
* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.ibm.com Done.
```

Out[16]:

primary_type
ARSON
ASSAULT
BATTERY
BURGLARY
CONCEALED CARRY LICENSE VIOLATION
CRIM SEXUAL ASSAULT
CRIMINAL DAMAGE
CRIMINAL TRESPASS
DECEPTIVE PRACTICE
DOMESTIC VIOLENCE
GAMBLING
HOMICIDE
HUMAN TRAFFICKING
INTERFERENCE WITH PUBLIC OFFICER
INTIMIDATION
KIDNAPPING
LIQUOR LAW VIOLATION
MOTOR VEHICLE THEFT
NARCOTICS
NON - CRIMINAL
NON-CRIMINAL
NON-CRIMINAL (SUBJECT SPECIFIED)
OBSCENITY
OFFENSE INVOLVING CHILDREN
OTHER NARCOTIC VIOLATION
OTHER OFFENSE
PROSTITUTION
PUBLIC INDECENCY
PUBLIC PEACE VIOLATION
RITUALISM
ROBBERY
SEX OFFENSE

STALKING

THEFT

WEAPONS VIOLATION

```
In [22]: crime_df = df.DataFrame()  
crime_df.head()
```

```
Out[22]:
```

	id	case_number	DATE	block	iucr	primary_type	description	location_des
0	3512276	HK587712	2004-08-28 17:50:56	047XX S KEDZIE AVE	890	THEFT	FROM BUILDING	SMALL
1	3406613	HK456306	2004-06-26 12:40:00	009XX N CENTRAL PARK AVE	820	THEFT	\$500 AND UNDER	
2	8002131	HT233595	2011-04-04 05:45:00	043XX S WABASH AVE	820	THEFT	\$500 AND UNDER	NL HOME/RETIR
3	7903289	HT133522	2010-12-30 16:30:00	083XX S KINGSTON AVE	840	THEFT	FINANCIAL ID THEFT: OVER \$300	RESI
4	10402076	HZ138551	2016-02-02 19:30:00	033XX W 66TH ST	820	THEFT	\$500 AND UNDER	

```
In [24]: census = %sql select * from CENSUS  
census_df = census.DataFrame()  
census_df = census_df[['community_area_name', 'community_area_number']].dropna()  
census_df.head()
```

* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
Done.

```
Out[24]:
```

	community_area_name	community_area_number
0	Rogers Park	1.0
1	West Ridge	2.0
2	Uptown	3.0
3	Lincoln Square	4.0
4	North Center	5.0

```
In [27]: merged_df = pd.merge(crime_df,census_df,left_on='community_area_number',right_on='community_area_number',how='left')
merged_df.head()
```

Out[27]:

	id	case_number	DATE	block	iucr	primary_type	description
0	3512276	HK587712	2004-08-28 17:50:56	047XX S KEDZIE AVE	890	THEFT	FROM BUILDING
1	7937542	HT169840	2011-02-18 19:30:00	029XX W 36TH ST	1310	CRIMINAL DAMAGE	TO PROPERTY
2	7881407	HT112422	2011-01-09 18:27:00	039XX S ROCKWELL ST	1310	CRIMINAL DAMAGE	TO PROPERTY
3	10770065	HZ535494	2016-11-30 22:00:00	033XX W 38TH ST	1320	CRIMINAL DAMAGE	TO VEHICLE
4	7502426	HS305355	2010-05-13 11:00:00	035XX S WASHTENAW AVE	1821	NARCOTICS	MANU/DEL:CANNABIS 10GM OR LESS

```
In [28]: chicago_df = merged_df[['id','primary_type', 'latitude', 'longitude', 'community_area_name']]
chicago_df.head()
```

Out[28]:

	id	primary_type	latitude	longitude	community_area_name
0	3512276	THEFT	41.80744050	-87.70395585	Brighton Park
1	7937542	CRIMINAL DAMAGE	41.82818901	-87.69879200	Brighton Park
2	7881407	CRIMINAL DAMAGE	41.82167019	-87.68970283	Brighton Park
3	10770065	CRIMINAL DAMAGE	41.82435275	-87.70784072	Brighton Park
4	7502426	NARCOTICS	41.82890791	-87.69234919	Brighton Park

```
In [29]: address = 'Chicago, IL'

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

The geograpical coordinate of Chicago are 41.8755616, -87.6244212.

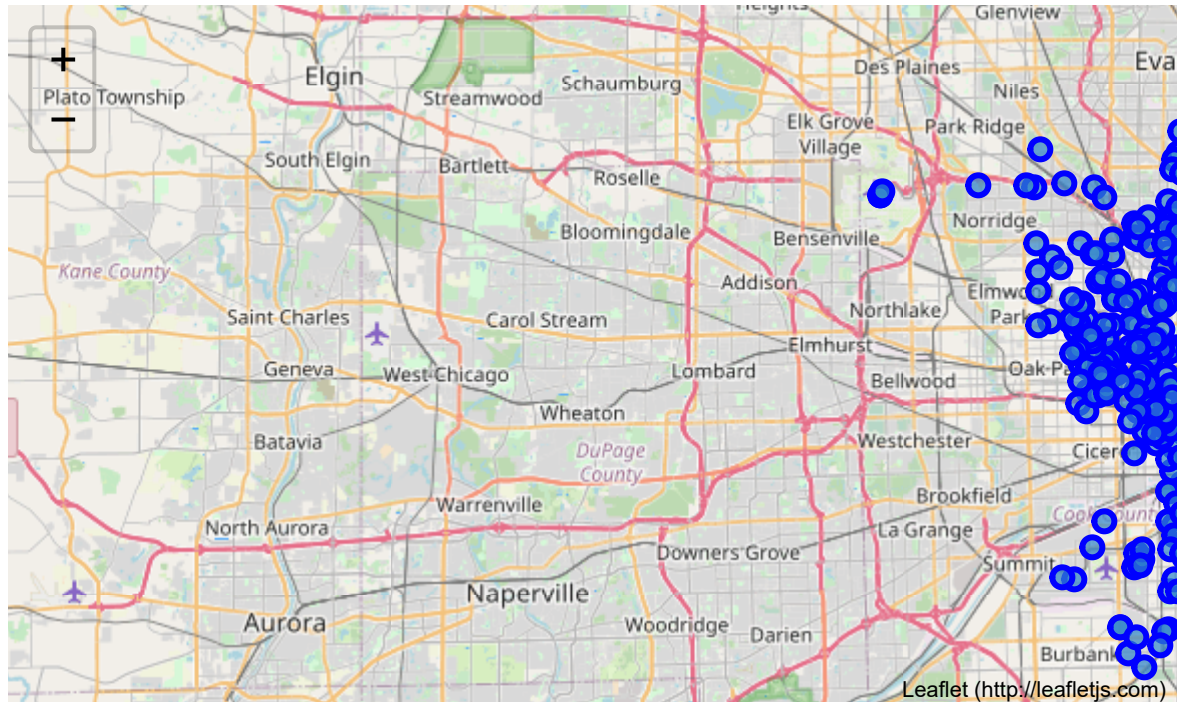
In [31]:

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

# add markers of incident locations to map
for lat, lng, community, crime in zip(chicago_df['latitude'], chicago_df['lon
    label = '{}, {}'.format(community, crime)
    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_chicago)

map_chicago
```

Out[31]:



In [32]:

```
CLIENT_ID = '5BLMRFCXXDZWTGCWEY0WRLEFDWGGYY5BTARJX45C04ZYXPME'
CLIENT_SECRET = 'BZLR4TQY2PIIRZG12ZGDPOTK3PLQCJCDGDCS2A0NWCSALFTZ'
VERSION = '20180605'

print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET: ' + CLIENT_SECRET)

Your credentails:
CLIENT_ID: 5BLMRFCXXDZWTGCWEY0WRLEFDWGGYY5BTARJX45C04ZYXPME
CLIENT_SECRET: BZLR4TQY2PIIRZG12ZGDPOTK3PLQCJCDGDCS2A0NWCSALFTZ
```

```
In [35]: community_latitude = chicago_df.loc[0, 'latitude'] # community latitude value
community_longitude = chicago_df.loc[0, 'longitude'] # community longitude value

community_name = chicago_df.loc[0, 'community_area_name'] # community name

print('Latitude and longitude values of {} are {}, {}'.format(community_name,
                                                             community_latitude,
                                                             community_longitude))
```

Latitude and longitude values of Brighton Park are 41.80744050, -87.70395585

```
In [36]: LIMIT = 100 # limit of number of venues returned by Foursquare API

radius = 500 # define radius

# create URL
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&version={}&lat={}&lon={}&radius={}&limit={}'
      .format(CLIENT_ID,
              CLIENT_SECRET,
              VERSION,
              community_latitude,
              community_longitude,
              radius,
              LIMIT)
url # display URL
```

```
Out[36]: 'https://api.foursquare.com/v2/venues/explore?&client_id=5BLMRFCXXDZWTGCh'
```

```
In [37]: results = requests.get(url).json()
results
```

```
Out[37]: {'meta': {'code': 200, 'requestId': '5ea7073329ce6a001bed3c03'},
'response': {'suggestedFilters': {'header': 'Tap to show:',
'filters': [{'name': 'Open now', 'key': 'openNow'},
{'name': '$-$$$$', 'key': 'price'}]},
'headerLocation': 'Brighton Park',
'headerFullLocation': 'Brighton Park, Chicago',
'headerLocationGranularity': 'neighborhood',
'totalResults': 32,
'suggestedBounds': {'ne': {'lat': 41.8119405045, 'lng': -87.6979300033007}
'sw': {'lat': 41.802940495499996, 'lng': -87.7099816966993}},
'groups': [{'type': 'Recommended Places',
'name': 'recommended',
'items': [{'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}]}],
'venue': {'id': '4b93f135f964a520975b34e3',
'name': "Pete's Fresh Market",
'location': {'address': '4700 S Kedzie Ave',
'lat': 41.80776733903465,
'lng': -87.7042837308118,
'labeledLatLngs': [{'label': 'display',
'lat': 41.80776733903465,
'lng': -87.7042837308118},
{'label': '?', 'lat': 41.806898, 'lng': -87.705038}]},
'distance': 45,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['4700 S Kedzie Ave',
'Chicago, IL 60632',
'United States']},
'categories': [{'id': '4bf58dd8d48988d118951735',
'name': 'Grocery Store',
'pluralName': 'Grocery Stores',
'shortName': 'Grocery Store',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/fo',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-4b93f135f964a520975b34e3-0'},
{'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}]}],
'venue': {'id': '4aef9687f964a5206dd921e3',
'name': 'Carnitas Don Rafa',
'location': {'address': '4617 S Kedzie Ave',
'lat': 41.809205930975416,
'lng': -87.70396292599497,
'labeledLatLngs': [{'label': 'display',
'lat': 41.809205930975416,
```



```
    'lng': -87.70396292599497},
    {'label': '?', 'lat': 41.80937, 'lng': -87.703894}],
    'distance': 196,
    'postalCode': '60632',
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['4617 S Kedzie Ave',
        'Chicago, IL 60632',
        'United States']],
    'categories': [{'id': '4bf58dd8d48988d1c1941735',
        'name': 'Mexican Restaurant',
        'pluralName': 'Mexican Restaurants',
        'shortName': 'Mexican',
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/mex',
            'suffix': '.png'},
        'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4aef9687f964a5206dd921e3-1'},
    {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason'}]}],
    'venue': {'id': '4fe34113754a0767553e5fcb',
        'name': "LaCoco's Pizza & Pasta",
        'location': {'address': '3350 W 47th St',
            'crossStreet': 'at Homan Ave',
            'lat': 41.80838,
            'lng': -87.708364,
            'labeledLatLngs': [{'label': 'display',
                'lat': 41.80838,
                'lng': -87.708364},
                {'label': '?', 'lat': 41.808288, 'lng': -87.708412}],
            'distance': 380,
            'postalCode': '60632',
            'cc': 'US',
            'city': 'Chicago',
            'state': 'IL',
            'country': 'United States',
            'formattedAddress': ['3350 W 47th St (at Homan Ave)',
                'Chicago, IL 60632',
                'United States']],
        'categories': [{'id': '4bf58dd8d48988d110941735',
            'name': 'Italian Restaurant',
            'pluralName': 'Italian Restaurants',
            'shortName': 'Italian',
            'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/ita',
                'suffix': '.png'},
            'primary': True}],
        'delivery': {'id': '121122',
            'url': 'https://www.grubhub.com/restaurant/la-cocos-pizza--pasta-335',
            'provider': {'name': 'grubhub',
                'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
                    'sizes': [40, 50],
                    'name': '/delivery_provider_grubhub_20180129.png'}}},
        'photos': {'count': 0, 'groups': []],
```

```
'venuePage': {'id': '33714250'}},
'referralId': 'e-0-4fe34113754a0767553e5fcb-2'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4d489a579544a09335791fe7',
  'name': 'Town & Country Self-Service Liquor Mart',
  'location': {'address': '2944 W 47th Street',
    'lat': 41.80834071302504,
    'lng': -87.69833207130432,
    'labeledLatLngs': [{'label': 'display',
      'lat': 41.80834071302504,
      'lng': -87.69833207130432},
    {'label': '?', 'lat': 41.808302, 'lng': -87.698478}],
    'distance': 477,
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['2944 W 47th Street',
      'Chicago, IL',
      'United States']}},
'categories': [{'id': '4bf58dd8d48988d186941735',
  'name': 'Liquor Store',
  'pluralName': 'Liquor Stores',
  'shortName': 'Liquor Store',
  'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/fo',
    'suffix': '.png'},
  'primary': True}],
'photos': {'count': 0, 'groups': []},
'venuePage': {'id': '1358733758'}},
'referralId': 'e-0-4d489a579544a09335791fe7-3'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4e54253588770c1e5226ef36',
  'name': 'T.J. Maxx',
  'location': {'address': '4932 S Kedzie Ave',
    'crossStreet': 'at Steeple Center',
    'lat': 41.8036205,
    'lng': -87.7052622,
    'labeledLatLngs': [{'label': 'display',
      'lat': 41.8036205,
      'lng': -87.7052622}],
    'distance': 438,
    'postalCode': '60632',
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['4932 S Kedzie Ave (at Steeple Center)',
      'Chicago, IL 60632',
      'United States']}},
'categories': [{'id': '4bf58dd8d48988d1f6941735',
  'name': 'Department Store',
```

```

    'pluralName': 'Department Stores',
    'shortName': 'Department Store',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/de',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4e54253588770c1e5226ef36-4'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]}},
    'venue': {'id': '4e4cef1cbd413c4cc66d58b4',
    'name': 'Subway',
    'location': {'address': '4711 S Kedzie Ave',
    'lat': 41.807602918837674,
    'lng': -87.70326385273859,
    'labeledLatLngs': [{'label': 'display',
    'lat': 41.807602918837674,
    'lng': -87.70326385273859},
    {'label': '?', 'lat': 41.807613, 'lng': -87.703352}]},
    'distance': 60,
    'postalCode': '60632',
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['4711 S Kedzie Ave',
    'Chicago, IL 60632',
    'United States']},
    'categories': [{'id': '4bf58dd8d48988d1c5941735',
    'name': 'Sandwich Place',
    'pluralName': 'Sandwich Places',
    'shortName': 'Sandwiches',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/del',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4e4cef1cbd413c4cc66d58b4-5'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]}},
    'venue': {'id': '4caf48b51463a1434d3a93a9',
    'name': 'T-Mobile',
    'location': {'address': '4612 S Kedzie Ave',
    'lat': 41.809523,
    'lng': -87.704245,
    'labeledLatLngs': [{'label': 'display',
    'lat': 41.809523,
    'lng': -87.704245},
    {'label': '?', 'lat': 41.809492, 'lng': -87.704138}]},
    'distance': 233,
    'postalCode': '60632',
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',

```

```
'formattedAddress': ['4612 S Kedzie Ave',
'Chicago, IL 60632',
'United States']]],
'categories': [{ 'id': '4f04afc02fb6e1c99f3db0bc',
'name': 'Mobile Phone Shop',
'pluralName': 'Mobile Phone Shops',
'shortName': 'Mobile Phones',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/mo',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []}},
'referralId': 'e-0-4caf48b51463a1434d3a93a9-6'},
{'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason' } ]}],
'venue': { 'id': '4e3975ecbd4180188ce3453a',
'name': 'Dollar Tree',
'location': { 'address': '4756 South Kedzie Ave',
'lat': 41.8065723449043,
'lng': -87.70452913048803,
'labeledLatLngs': [{ 'label': 'display',
'lat': 41.8065723449043,
'lng': -87.70452913048803},
{ 'label': '?', 'lat': 41.806595, 'lng': -87.704153}],
'distance': 107,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['4756 South Kedzie Ave',
'Chicago, IL 60632',
'United States']]],
'categories': [{ 'id': '52dea92d3cf9994f4e043dbb',
'name': 'Discount Store',
'pluralName': 'Discount Stores',
'shortName': 'Discount Store',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/di',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []}},
'referralId': 'e-0-4e3975ecbd4180188ce3453a-7'},
{'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason' } ]}],
'venue': { 'id': '4b51cb67f964a520ce5527e3',
'name": "Dunkin'",
'location': { 'address': '4701 S Kedzie Ave',
'crossStreet': 'at 47th St.',
'lat': 41.80797104818447,
'lng': -87.70329367881868,
'labeledLatLngs': [{ 'label': 'display',
'lat': 41.80797104818447,
'lng': -87.70329367881868},
{ 'label': '?', 'lat': 41.807907, 'lng': -87.703361}],
```

```
'distance': 80,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['4701 S Kedzie Ave (at 47th St.)',
'Chicago, IL 60632',
'United States']],
'categories': [{ 'id': '4bf58dd8d48988d148941735',
'name': 'Donut Shop',
'pluralName': 'Donut Shops',
'shortName': 'Donuts',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/donut.png',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []}],
'referralId': 'e-0-4b51cb67f964a520ce5527e3-8'},
{ 'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason' } ] },
'venue': { 'id': '4c4e655e92b6a593ae95d46f',
'name': "Madd Anthony's Bar",
'location': { 'address': '3350 W 47th St',
'lat': 41.80824399151883,
'lng': -87.70835932296178,
'labeledLatLngs': [{ 'label': 'display',
'lat': 41.80824399151883,
'lng': -87.70835932296178 } ] },
'distance': 376,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['3350 W 47th St',
'Chicago, IL 60632',
'United States']],
'categories': [{ 'id': '4bf58dd8d48988d116941735',
'name': 'Bar',
'pluralName': 'Bars',
'shortName': 'Bar',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/nightlife/bar.png',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []}],
'referralId': 'e-0-4c4e655e92b6a593ae95d46f-9'},
{ 'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason' } ] },
'venue': { 'id': '4af8666bf964a520de0c22e3',
'name': 'Cafe El Meson',
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'location': {'address': '3018 W 47th St',
'lat': 41.808432,
'lng': -87.699926,
'labeledLatLngs': [{'label': 'display',
'lat': 41.808432,
'lng': -87.699926},
{'label': '?', 'lat': 41.808277, 'lng': -87.699923}],
'distance': 352,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['3018 W 47th St',
'Chicago, IL 60632',
'United States']},
'categories': [{'id': '4bf58dd8d48988d1ce941735',
'name': 'Seafood Restaurant',
'pluralName': 'Seafood Restaurants',
'shortName': 'Seafood',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/sea',
'suffix': '.png'},

```

```
    'primary': True]],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4f32959719836c91c7e61331-28'},
  {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
      'type': 'general',
      'reasonName': 'globalInteractionReason'}]},
    'venue': {'id': '4f43f2a0e5e8645fdc9eef44',
      'name': 'Dots Fashions',
      'location': {'address': '4938 S Kedzie Ave',
        'crossStreet': 'at W 51st St',
        'lat': 41.803354999999996,
        'lng': -87.705389,
        'labeledLatLngs': [{'label': 'display',
          'lat': 41.803354999999996,
          'lng': -87.705389}],
        'distance': 470,
        'postalCode': '60632',
        'cc': 'US',
        'city': 'Chicago',
        'state': 'IL',
        'country': 'United States',
        'formattedAddress': ['4938 S Kedzie Ave (at W 51st St)',
          'Chicago, IL 60632',
          'United States']}],
      'categories': [{'id': '4bf58dd8d48988d108951735',
        'name': "Women's Store",
        'pluralName': "Women's Stores",
        'shortName': "Women's Store",
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/ap',
          'suffix': '.png'}},
        'primary': True]],
      'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4f43f2a0e5e8645fdc9eef44-29'},
    {'reasons': {'count': 0,
      'items': [{'summary': 'This spot is popular',
        'type': 'general',
        'reasonName': 'globalInteractionReason'}]},
        'venue': {'id': '4e1602df18a8addae8cf80bd',
          'name': 'The Athletes Foot',
          'location': {'address': '4824 s. Kedzie',
            'lat': 41.803354999999996,
            'lng': -87.705389,
            'labeledLatLngs': [{'label': 'display',
              'lat': 41.803354999999996,
              'lng': -87.705389}],
            'distance': 470,
            'cc': 'US',
            'city': 'Chicago',
            'state': 'IL',
            'country': 'United States',
            'formattedAddress': ['4824 s. Kedzie',
              'Chicago, IL',
              'United States']}],
          'categories': [{'id': '4bf58dd8d48988d107951735',
            'name': 'Shoe Store',
            'pluralName': 'Shoe Stores',
```



```

    'shortName': 'Shoes',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/ap',
             'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4e1602df18a8addae8cf80bd-30'},
    {'reasons': {'count': 0,
                  'items': [{'summary': 'This spot is popular',
                              'type': 'general',
                              'reasonName': 'globalInteractionReason'}]}],
    'venue': {'id': '4d226427bdd7a093d423fdce',
               'name': "Lugano's Pizza",
               'location': {'address': '4460 S Kedzie Ave',
                             'lat': 41.811809000000004,
                             'lng': -87.704466,
                             'labeledLatLngs': [{'label': 'display',
                                                    'lat': 41.811809000000004,
                                                    'lng': -87.704466},
                                                  {'label': '?', 'lat': 41.811821, 'lng': -87.70424}]},
               'distance': 488,
               'postalCode': '60632',
               'cc': 'US',
               'city': 'Chicago',
               'state': 'IL',
               'country': 'United States',
               'formattedAddress': ['4460 S Kedzie Ave',
                                    'Chicago, IL 60632',
                                    'United States']},
    'categories': [{'id': '4bf58dd8d48988d1ca941735',
                     'name': 'Pizza Place',
                     'pluralName': 'Pizza Places',
                     'shortName': 'Pizza',
                     'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/piz',
                               'suffix': '.png'},
                     'primary': True}],
    'delivery': {'id': '31097',
                  'url': 'https://www.grubhub.com/restaurant/luganos-pizza-4460-s-kedz',
                  'provider': {'name': 'grubhub',
                                'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
                                          'sizes': [40, 50],
                                          'name': '/delivery_provider_grubhub_20180129.png'}}},
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4d226427bdd7a093d423fdce-31'}]]]]}

```

```
In [39]: # 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']
```

```
In [40]: venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues) # flatten JSON

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

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

# clean columns
nearby_venues.columns = [col.split(".")[0] for col in nearby_venues.columns]

nearby_venues.head()
```

```
Out[40]:
```

	name	categories	lat	lng
0	Pete's Fresh Market	Grocery Store	41.807767	-87.704284
1	Carnitas Don Rafa	Mexican Restaurant	41.809206	-87.703963
2	LaCoco's Pizza & Pasta	Italian Restaurant	41.808380	-87.708364
3	Town & Country Self-Service Liquor Mart	Liquor Store	41.808341	-87.698332
4	T.J. Maxx	Department Store	41.803621	-87.705262

```
In [42]: print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))
```

32 venues were returned by Foursquare.

In [43]:

```
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={}&version={}&lat={}&lng={}&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 = ['Community',
                             'Community Latitude',
                             'Community Longitude',
                             'Venue',
                             'Venue Latitude',
                             'Venue Longitude',
                             'Venue Category']

    return(nearby_venues)
```

In [45]:

```
chicago_venues = getNearbyVenues(names=chicago_df['community_area_name'],
                                  latitudes=chicago_df['latitude'],
                                  longitudes=chicago_df['longitude']
                                  )

print(chicago_venues.shape) # please note: this might return an error if nun
```

[illegible]

[illegible]

[illegible]

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Riverdale
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Bridgeport
Norwood Park
Norwood Park
Norwood Park
Hyde Park
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East Side
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West Pullman
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Jefferson Park
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Montclair
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Avalon Park
Avalon Park
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Avalon Park
Near South Side
Hermosa
Hermosa
Hermosa
Forest Glen
(9345, 7)

In [46]:

```
chicago_venues.head()
```

Out[46]:

	Community	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Brighton Park	41.80744050	-87.70395585	Pete's Fresh Market	41.807767	-87.704284	Grocery Store
1	Brighton Park	41.80744050	-87.70395585	Carnitas Don Rafa	41.809206	-87.703963	Mexican Restaurant
2	Brighton Park	41.80744050	-87.70395585	LaCoco's Pizza & Pasta	41.808380	-87.708364	Italian Restaurant
3	Brighton Park	41.80744050	-87.70395585	Town & Country Self-Service Liquor Mart	41.808341	-87.698332	Liquor Store
4	Brighton Park	41.80744050	-87.70395585	T.J. Maxx	41.803621	-87.705262	Department Store

In [47]:

```
chicago_venues.groupby('Community').count()
```

Out[47]:

	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Community						
Albany Park	134	134	134	134	134	134
Ashburn	48	48	48	48	48	48
Auburn Gresham	114	114	114	114	114	114
Austin	373	373	373	373	373	373
Avalon Park	59	59	59	59	59	59
Avondale	217	217	217	217	217	217
Belmont Cragin	85	85	85	85	85	85
Beverly	69	69	69	69	69	69
Bridgeport	20	20	20	20	20	20
Brighton Park	139	139	139	139	139	139
Burnside	3	3	3	3	3	3
Calumet Heights	96	96	96	96	96	96
Chatham	122	122	122	122	122	122
Chicago Lawn	124	124	124	124	124	124
Clearing	36	36	36	36	36	36
Douglas	76	76	76	76	76	76
Dunning	22	22	22	22	22	22
East Garfield Park	73	73	73	73	73	73
East Side	14	14	14	14	14	14
Edgewater	85	85	85	85	85	85
Englewood	161	161	161	161	161	161
Forest Glen	12	12	12	12	12	12
Fuller Park	28	28	28	28	28	28
Gage Park	67	67	67	67	67	67
Garfield Ridge	24	24	24	24	24	24
Grand Boulevard	88	88	88	88	88	88
Greater Grand Crossing	104	104	104	104	104	104
Hegewisch	5	5	5	5	5	5
Hermosa	48	48	48	48	48	48
Humboldt park	234	234	234	234	234	234

	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Community						
Hyde Park	54	54	54	54	54	54
Irving Park	202	202	202	202	202	202
Jefferson Park	26	26	26	26	26	26
Kenwood	43	43	43	43	43	43
Lake View	689	689	689	689	689	689
Lincoln Park	241	241	241	241	241	241
Lincoln Square	119	119	119	119	119	119
Logan Square	345	345	345	345	345	345
Loop	558	558	558	558	558	558
Lower West Side	278	278	278	278	278	278
McKinley Park	32	32	32	32	32	32
Montclair	18	18	18	18	18	18
Morgan Park	5	5	5	5	5	5
Near North Side	1050	1050	1050	1050	1050	1050
Near South Side	7	7	7	7	7	7
Near West Side	373	373	373	373	373	373
New City	93	93	93	93	93	93
North Center	175	175	175	175	175	175
North Lawndale	136	136	136	136	136	136
Norwood Park	38	38	38	38	38	38
O'Hare	271	271	271	271	271	271
Portage Park	83	83	83	83	83	83
Pullman	22	22	22	22	22	22
Riverdale	3	3	3	3	3	3
Rogers Park	149	149	149	149	149	149
Roseland	59	59	59	59	59	59
South Chicago	59	59	59	59	59	59
South Deering	44	44	44	44	44	44
South Lawndale	117	117	117	117	117	117
South Shore	128	128	128	128	128	128
Uptown	197	197	197	197	197	197
Washington Height	27	27	27	27	27	27
West Elsdon	58	58	58	58	58	58
West Englewood	52	52	52	52	52	52

	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Community						
West Garfield Park	118	118	118	118	118	118
West Lawn	101	101	101	101	101	101
West Pullman	23	23	23	23	23	23
West Ridge	140	140	140	140	140	140
West Town	469	469	469	469	469	469
Woodlawn	63	63	63	63	63	63

In [48]:

```
print('There are {} uniques categories.'.format(len(chicago_venues['Venue Ca
```

There are 385 uniques categories.

In [49]:

```
# one hot encoding
chicago_onehot = pd.get_dummies(chicago_venues[['Venue Category']], prefix='

# add community column back to dataframe
chicago_onehot['Community'] = chicago_venues['Community']

# move community column to the first column
fixed_columns = [chicago_onehot.columns[-1]] + list(chicago_onehot.columns[:
chicago_onehot = chicago_onehot[fixed_columns]

chicago_onehot.head()
```

Out[49]:

	Community	ATM	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	Airport	Airport Lounge	Airport Service
0	Brighton Park	0	0	0	0	0	0	0	0
1	Brighton Park	0	0	0	0	0	0	0	0
2	Brighton Park	0	0	0	0	0	0	0	0
3	Brighton Park	0	0	0	0	0	0	0	0
4	Brighton Park	0	0	0	0	0	0	0	0


```
In [50]: chicago_grouped = chicago_onehot.groupby('Community').mean().reset_index()
chicago_grouped
```

Out[50]:

[illegible]

	Community	ATM	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	Airport	Airport Lounge
26	Greater Grand Crossing	0.000000	0.000000	0.000000	0.000000	0.019231	0.000000	0.000000
27	Hegewisch	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
28	Hermosa	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
29	Humboldt park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
30	Hyde Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
31	Irving Park	0.000000	0.000000	0.000000	0.004950	0.000000	0.000000	0.000000
32	Jefferson Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
33	Kenwood	0.000000	0.000000	0.000000	0.000000	0.023256	0.000000	0.000000
34	Lake View	0.000000	0.000000	0.001451	0.000000	0.000000	0.000000	0.000000
35	Lincoln Park	0.004149	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
36	Lincoln Square	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
37	Logan Square	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
38	Loop	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
39	Lower West Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
40	McKinley Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
41	Montclair	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
42	Morgan Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
43	Near North Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
44	Near South Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
45	Near West Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
46	New City	0.000000	0.010753	0.000000	0.000000	0.000000	0.000000	0.000000
47	North Center	0.000000	0.000000	0.005714	0.000000	0.000000	0.000000	0.000000
48	North Lawndale	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
49	Norwood Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50	O'Hare	0.000000	0.033210	0.000000	0.000000	0.000000	0.01107	0.08850

[illegible]

In [51]:

```
num_top_venues = 5

for hood in chicago_grouped['Community']:
    print("----"+hood+"----")
    temp = chicago_grouped[chicago_grouped['Community'] == 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')
```

----Albany Park----

	venue	freq
0	Mexican Restaurant	0.09
1	Middle Eastern Restaurant	0.04
2	Bakery	0.04
3	Pizza Place	0.04
4	Asian Restaurant	0.03

----Ashburn----

	venue	freq
0	Park	0.15
1	Pizza Place	0.08
2	Cosmetics Shop	0.06
3	Martial Arts Dojo	0.04
4	Mexican Restaurant	0.04

----Auburn Gresham----

	venue	freq
0	Discount Store	0.10
1	Pharmacy	0.08
2	Seafood Restaurant	0.06
3	Grocery Store	0.06
4	Fast Food Restaurant	0.05

----Austin----

	venue	freq
0	Fast Food Restaurant	0.07
1	Sandwich Place	0.05
2	Discount Store	0.05
3	Park	0.05
4	BBQ Joint	0.05

----Avalon Park----

	venue	freq
0	Fast Food Restaurant	0.12
1	Sandwich Place	0.07
2	Burger Joint	0.07
3	Grocery Store	0.05
4	Diner	0.05

----Avondale----

	venue	freq
0	Mexican Restaurant	0.05
1	Park	0.04
2	Bus Station	0.04
3	Bar	0.04
4	Grocery Store	0.03

----Belmont Cragin----

	venue	freq
0	Mexican Restaurant	0.13
1	Pizza Place	0.09
2	Sandwich Place	0.07
3	Pharmacy	0.07
4	Fast Food Restaurant	0.07

----Beverly----

	venue	freq
0	Cosmetics Shop	0.09
1	Park	0.06
2	Mobile Phone Shop	0.04
3	Pizza Place	0.04
4	Fast Food Restaurant	0.04

----Bridgeport----

	venue	freq
0	Pizza Place	0.10
1	Mediterranean Restaurant	0.10
2	Park	0.10
3	Bar	0.10
4	Bakery	0.05

----Brighton Park----

	venue	freq
0	Mexican Restaurant	0.10
1	Pizza Place	0.04
2	Clothing Store	0.04
3	Taco Place	0.04
4	Fast Food Restaurant	0.04

----Burnside----

	venue	freq
0	Bus Station	0.33
1	Park	0.33
2	Construction & Landscaping	0.33
3	Organic Grocery	0.00
4	Parking	0.00

----Calumet Heights----

	venue	freq
0	Fast Food Restaurant	0.08
1	Pharmacy	0.08
2	Chinese Restaurant	0.05
3	Discount Store	0.04
4	Wings Joint	0.04

----Chatham----

	venue	freq
0	Sandwich Place	0.07
1	Fast Food Restaurant	0.07
2	Pizza Place	0.05
3	Bus Station	0.04
4	Women's Store	0.03

----Chicago Lawn----

	venue	freq
0	Fast Food Restaurant	0.12
1	Discount Store	0.09
2	Sandwich Place	0.05
3	Chinese Restaurant	0.05
4	Fried Chicken Joint	0.04

----Clearing----

	venue	freq
0	Mexican Restaurant	0.08
1	Restaurant	0.08
2	Pizza Place	0.08
3	Hot Dog Joint	0.06
4	Construction & Landscaping	0.06

----Douglas----

	venue	freq
0	Park	0.08
1	Sandwich Place	0.07
2	Bus Station	0.07
3	Asian Restaurant	0.04
4	Fast Food Restaurant	0.04

----Dunning----

	venue	freq
0	Bar	0.14
1	American Restaurant	0.09
2	Liquor Store	0.09
3	Hot Dog Joint	0.05
4	Café	0.05

----East Garfield Park----

	venue	freq
0	Discount Store	0.14
1	Diner	0.10

2	Pharmacy	0.10
3	American Restaurant	0.08
4	Southern / Soul Food Restaurant	0.07

----East Side----

	venue	freq
0	Mexican Restaurant	0.14
1	ATM	0.07
2	Pizza Place	0.07
3	Deli / Bodega	0.07
4	Taco Place	0.07

----Edgewater----

	venue	freq
0	Mexican Restaurant	0.04
1	Gym	0.04
2	Coffee Shop	0.04
3	Sandwich Place	0.04
4	Burger Joint	0.04

----Englewood----

	venue	freq
0	Fast Food Restaurant	0.12
1	Park	0.07
2	Café	0.06
3	Train Station	0.05
4	Sandwich Place	0.04

----Forest Glen----

	venue	freq
0	Pizza Place	0.08
1	Taco Place	0.08
2	BBQ Joint	0.08
3	Cosmetics Shop	0.08
4	Ice Cream Shop	0.08

----Fuller Park----

	venue	freq
0	Fast Food Restaurant	0.14
1	Park	0.11
2	Fried Chicken Joint	0.07
3	Pizza Place	0.07
4	Women's Store	0.07

----Gage Park----

	venue	freq
0	Mexican Restaurant	0.21
1	Pharmacy	0.04
2	Pizza Place	0.04
3	Fried Chicken Joint	0.04
4	Food & Drink Shop	0.04

----Garfield Ridge----

	venue	freq
0	Pizza Place	0.12
1	Business Service	0.08
2	Breakfast Spot	0.04
3	Liquor Store	0.04
4	Thai Restaurant	0.04

----Grand Boulevard----

	venue	freq
0	Park	0.11
1	Discount Store	0.06
2	BBQ Joint	0.05
3	Grocery Store	0.05
4	Food Truck	0.03

----Greater Grand Crossing----

	venue	freq
0	American Restaurant	0.09
1	Fast Food Restaurant	0.08
2	Currency Exchange	0.07
3	Lounge	0.06
4	Seafood Restaurant	0.06

----Hegewisch----

	venue	freq
0	Bar	0.4
1	Intersection	0.2
2	Fast Food Restaurant	0.2
3	Resort	0.2
4	Organic Grocery	0.0

----Hermosa----

	venue	freq
0	Mexican Restaurant	0.17
1	Latin American Restaurant	0.06
2	Pizza Place	0.06
3	Historic Site	0.04
4	Pharmacy	0.04

----Humboldt park----

	venue	freq
0	Park	0.10
1	Mexican Restaurant	0.07
2	Grocery Store	0.06
3	Donut Shop	0.05
4	Fast Food Restaurant	0.04

----Hyde Park----

	venue	freq
0	Sandwich Place	0.09
1	Bus Station	0.07
2	Thai Restaurant	0.06
3	Grocery Store	0.06
4	Bookstore	0.04

----Irving Park----

	venue	freq
0	Bar	0.06
1	Mexican Restaurant	0.04
2	Sandwich Place	0.04
3	Pizza Place	0.04
4	Convenience Store	0.04

----Jefferson Park----

	venue	freq
0	Pizza Place	0.12
1	Park	0.08
2	Train Station	0.08
3	Pub	0.08
4	Bar	0.08

----Kenwood----

	venue	freq
0	Discount Store	0.09
1	Fast Food Restaurant	0.09
2	Fried Chicken Joint	0.07
3	Asian Restaurant	0.05
4	Convenience Store	0.05

----Lake View----

	venue	freq
0	Mexican Restaurant	0.05
1	Bar	0.04
2	Pizza Place	0.03
3	Spa	0.03
4	Sandwich Place	0.03

----Lincoln Park----

	venue	freq
0	Coffee Shop	0.05
1	Pizza Place	0.03
2	Hot Dog Joint	0.03
3	Sushi Restaurant	0.03
4	Bus Station	0.02

----Lincoln Square----

	venue	freq
0	Bar	0.08
1	Café	0.03

2	Pub	0.03
3	Gym	0.03
4	Park	0.03

----Logan Square----

	venue	freq
0	Mexican Restaurant	0.04
1	Coffee Shop	0.04
2	Bar	0.04
3	Grocery Store	0.02
4	Bus Station	0.02

----Loop----

	venue	freq
0	Coffee Shop	0.07
1	Sandwich Place	0.05
2	Hotel	0.05
3	Theater	0.04
4	Mediterranean Restaurant	0.03

----Lower West Side----

	venue	freq
0	Mexican Restaurant	0.19
1	Pizza Place	0.05
2	Art Gallery	0.05
3	Bar	0.04
4	Taco Place	0.03

----McKinley Park----

	venue	freq
0	Mexican Restaurant	0.09
1	Video Store	0.09
2	Train Station	0.06
3	Supermarket	0.06
4	Gas Station	0.03

----Montclair----

	venue	freq
0	Liquor Store	0.17
1	Park	0.11
2	Dive Bar	0.06
3	Grocery Store	0.06
4	Pharmacy	0.06

----Morgan Park----

	venue	freq
0	Currency Exchange	0.2
1	BBQ Joint	0.2
2	Park	0.2
3	Track	0.2
4	Intersection	0.2

----Near North Side----

	venue	freq
0	Hotel	0.08
1	Italian Restaurant	0.06
2	Coffee Shop	0.04
3	American Restaurant	0.04
4	Bar	0.03

----Near South Side----

	venue	freq
0	Shipping Store	0.14
1	Train Station	0.14
2	Gym / Fitness Center	0.14
3	Fast Food Restaurant	0.14
4	Bus Line	0.14

----Near West Side----

	venue	freq
0	Park	0.05
1	Bus Station	0.05
2	Sandwich Place	0.05
3	Fast Food Restaurant	0.04
4	Chinese Restaurant	0.03

----New City----

	venue	freq
0	Mexican Restaurant	0.06
1	Park	0.05
2	Cocktail Bar	0.05
3	Intersection	0.05
4	Discount Store	0.05

----North Center----

	venue	freq
0	Bus Station	0.07
1	Bar	0.05
2	Salon / Barbershop	0.04
3	Liquor Store	0.03
4	Pizza Place	0.03

----North Lawndale----

	venue	freq
0	Fast Food Restaurant	0.14
1	Sandwich Place	0.05
2	Pharmacy	0.04
3	Liquor Store	0.04
4	Cosmetics Shop	0.04

----Norwood Park----

	venue	freq
0	Pizza Place	0.16
1	Bar	0.08
2	Jewelry Store	0.05
3	Bookstore	0.05
4	Café	0.05

----O'Hare----

	venue	freq
0	Coffee Shop	0.09
1	Airport Lounge	0.09
2	Airport Service	0.08
3	Snack Place	0.07
4	Electronics Store	0.04

----Portage Park----

	venue	freq
0	Sandwich Place	0.05
1	Discount Store	0.05
2	Pizza Place	0.05
3	Mexican Restaurant	0.05
4	Gas Station	0.05

----Pullman----

	venue	freq
0	Park	0.14
1	Sandwich Place	0.09
2	Train Station	0.09
3	ATM	0.05
4	Sporting Goods Shop	0.05

----Riverdale----

	venue	freq
0	Park	0.67
1	Harbor / Marina	0.33
2	Nail Salon	0.00
3	Parking	0.00
4	Paper / Office Supplies Store	0.00

----Rogers Park----

	venue	freq
0	Mexican Restaurant	0.13
1	Sandwich Place	0.07
2	Chinese Restaurant	0.05
3	Pizza Place	0.05
4	Breakfast Spot	0.04

----Roseland----

	venue	freq
0	Food	0.12
1	Chinese Restaurant	0.08

2	Bus Station	0.07
3	Convenience Store	0.07
4	Park	0.07

----South Chicago----

	venue	freq
0	Pizza Place	0.12
1	Food	0.08
2	Mexican Restaurant	0.08
3	Train Station	0.07
4	Park	0.05

----South Deering----

	venue	freq
0	Park	0.09
1	Fast Food Restaurant	0.09
2	Cosmetics Shop	0.07
3	Women's Store	0.05
4	Fried Chicken Joint	0.05

----South Lawndale----

	venue	freq
0	Mexican Restaurant	0.25
1	Fast Food Restaurant	0.05
2	Taco Place	0.05
3	Sandwich Place	0.04
4	Bus Station	0.04

----South Shore----

	venue	freq
0	Pizza Place	0.09
1	Fried Chicken Joint	0.06
2	Discount Store	0.06
3	American Restaurant	0.05
4	Grocery Store	0.05

----Uptown----

	venue	freq
0	Vietnamese Restaurant	0.06
1	Coffee Shop	0.05
2	Bus Station	0.05
3	Pizza Place	0.05
4	Mexican Restaurant	0.05

----Washington Height----

	venue	freq
0	Fried Chicken Joint	0.15
1	Pizza Place	0.11
2	Shop & Service	0.07
3	Intersection	0.07
4	Discount Store	0.07

----West Elsdon----

	venue	freq
0	Mexican Restaurant	0.10
1	Bar	0.09
2	Pharmacy	0.07
3	Ice Cream Shop	0.07
4	Rental Service	0.05

----West Englewood----

	venue	freq
0	Fast Food Restaurant	0.12
1	Park	0.08
2	Cosmetics Shop	0.06
3	Discount Store	0.06
4	Liquor Store	0.04

----West Garfield Park----

	venue	freq
0	Fast Food Restaurant	0.14
1	Shoe Store	0.08
2	Train Station	0.07
3	Sandwich Place	0.06
4	Clothing Store	0.05

----West Lawn----

	venue	freq
0	Shoe Store	0.14
1	Discount Store	0.06
2	Mobile Phone Shop	0.06
3	Kids Store	0.04
4	Fast Food Restaurant	0.04

----West Pullman----

	venue	freq
0	Bar	0.17
1	Convenience Store	0.09
2	Bus Station	0.09
3	Food	0.09
4	Fast Food Restaurant	0.09

----West Ridge----

	venue	freq
0	Grocery Store	0.09
1	Korean Restaurant	0.06
2	Indian Restaurant	0.05
3	Pizza Place	0.04
4	Bakery	0.04

----West Town----

	venue	freq
0	Mexican Restaurant	0.05
1	Coffee Shop	0.04
2	Bar	0.04
3	Pizza Place	0.03
4	Bus Station	0.02

----Woodlawn----

	venue	freq
0	Fast Food Restaurant	0.11
1	American Restaurant	0.06
2	Train Station	0.06
3	Food	0.06
4	Cosmetics Shop	0.06

In [52]:

```
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 [53]:

```
num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Community']
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
community_venues_sorted = pd.DataFrame(columns=columns)
community_venues_sorted['Community'] = chicago_grouped['Community']

for ind in np.arange(chicago_grouped.shape[0]):
    community_venues_sorted.iloc[ind, 1:] = return_most_common_venues(chicago_grouped['Community'][ind], num_top_venues)

community_venues_sorted.head()
```

Out[53]:

	Community	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	
0	Albany Park	Mexican Restaurant	Bakery	Middle Eastern Restaurant	Pizza Place	Ice Cream Shop	Park	Bus Station	R
1	Ashburn	Park	Pizza Place	Cosmetics Shop	Liquor Store	Bus Station	Grocery Store	Bar	
2	Auburn Gresham	Discount Store	Pharmacy	Grocery Store	Seafood Restaurant	Fast Food Restaurant	Home Service	Sandwich Place	
3	Austin	Fast Food Restaurant	Fried Chicken Joint	Park	Sandwich Place	Discount Store	BBQ Joint	Grocery Store	R
4	Avalon Park	Fast Food Restaurant	Burger Joint	Sandwich Place	Grocery Store	Pharmacy	Diner	ATM	


```
In [55]: # set number of clusters
kclusters = 5

chicago_grouped_clustering = chicago_grouped.drop('Community', 1)

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

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

```
Out[55]: array([0, 0, 1, 1, 1, 0, 0, 1, 0, 0])
```

```
In [56]: # add clustering labels
community_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
```

```
In [58]: chicago_merged = chicago_df

# merge chicago_merged with chicago_df to add latitude/longitude for each community
chicago_merged = chicago_merged.join(community_venues_sorted.set_index('Community', 'Cluster Labels'))

chicago_merged.sort_values('primary_type').head()
```

```
Out[58]:
```

	id	primary_type	latitude	longitude	community_area_name	Cluster Labels	1st I Com Ve
467	4607081	ARSON	41.67980945	-87.62587044	West Pullman	1	
453	9692995	ARSON	41.65371054	-87.60952871	Riverdale	4	
396	4681320	ASSAULT	41.75501329	-87.66598631	Auburn Gresham	1	Disc ξ
397	3661130	ASSAULT	41.74047635	-87.65468280	Auburn Gresham	1	Disc ξ
431	10502099	ASSAULT	41.87014181	-87.69703716	East Garfield Park	1	Disc ξ

In [59]:

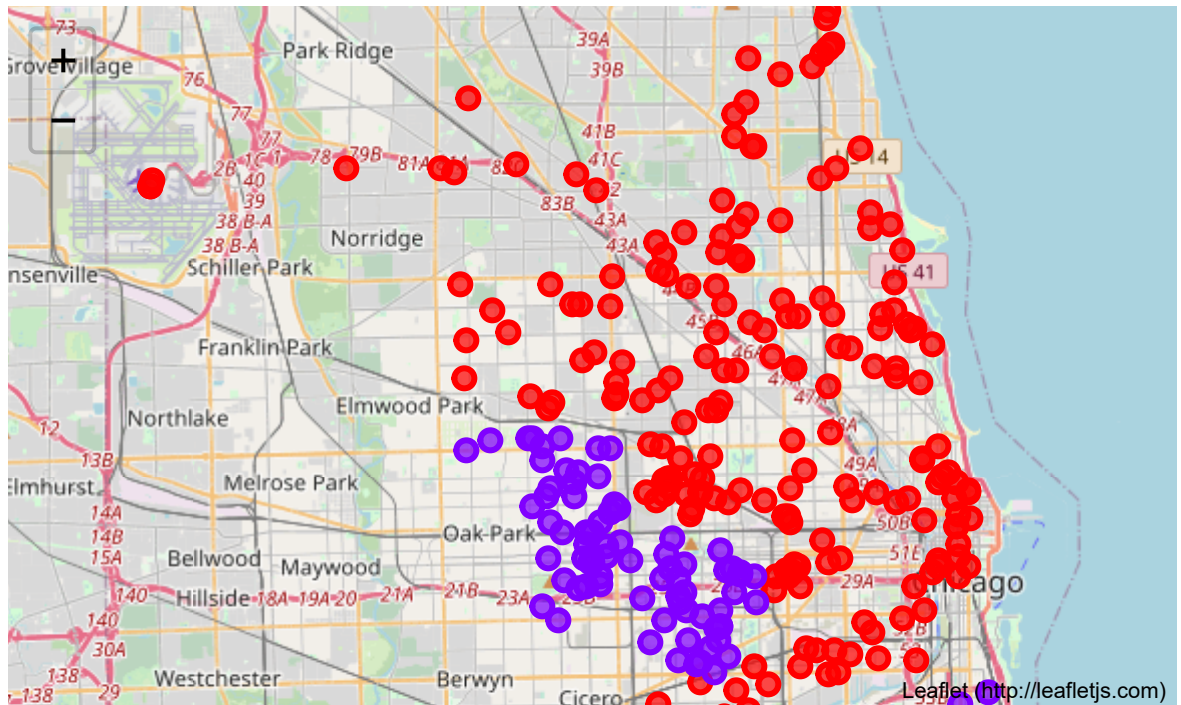
```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# 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, lng, poi, crime, cluster in zip(chicago_merged['latitude'], chicago_merged['longitude'],
    chicago_merged['poi'], chicago_merged['crime'], chicago_merged['cluster']):
    label = '{} , {}'.format(poi, crime)
    label = folium.Popup(label + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        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[59]:



In [61]:

```
# select rows by cluster and include columns 2 - 15
cluster0 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 0, chicago_merged.columns[2:16]]
print(cluster0.shape)
```

(249, 12)

```
In [66]: cluster1 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 1, chicago_merged]
print(cluster1.shape)
```

```
(234, 12)
```

```
In [67]: cluster2 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 2, chicago_merged]
print(cluster2.shape)
```

```
(1, 12)
```

```
In [68]: cluster3 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 3, chicago_merged]
print(cluster3.shape)
```

```
(1, 12)
```

```
In [69]: cluster4 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 4, chicago_merged]
print(cluster4.shape)
```

```
(2, 12)
```

```
In [36]: cluster4['1st Most Common Venue'].value_counts().to_frame()
```

```
Out[36]:
```

1st Most Common Venue	
Fast Food Restaurant	124
Park	32
Food	19
Pizza Place	18
Discount Store	17
Sandwich Place	13
American Restaurant	11
Diner	8
Pharmacy	5
Cosmetics Shop	4
Fried Chicken Joint	3
Shoe Store	3
Resort	1

```
In [ ]:
```