PalmBeachCounty

April 21, 2020

New Construction and Potential for New Businesses in Neighborhoods in Palm Beach County

0.1 Introduction

In this report, we take data from Palm Beach County Planning, Zoning and Building, 2019 Building Permit Reports, (found here http://discover.pbcgov.org/pzb/planning/Pages/Permit-Activity-Reports.aspx) to find where the county is permitting new housing construction. Also, we will use the Foursquare API to explore neighborhoods in Palm Beach County. We will do analysis to determine what venues maybe needed to service these new planned housing developments. We will use the **explore** function to get the most common venue categories in each neighborhood, and then use this feature to group the neighborhoods into clusters. You will use the *k*-means clustering algorithm to complete this task. Finally, we will use the Folium library to visualize the neighborhoods in Palm Beach County and their emerging clusters.

0.2 Table of Contents

Import libraries

[162]:
```
{
    "tags":[
        "remove_output",
    ]
}

import requests # library to handle requests
import pandas as pd # library for data analsysis
import numpy as np # library to handle data in a vectorized manner
import json  #library to handle json files
import random # library for random number generation
```

```
#scraping pdf
!pip install tabula-py
!pip install tabulate
import tabula
import tabulate

#excell files
import xlrd


!conda install -c conda-forge geopy --yes
from geopy.geocoders import Nominatim # module to convert an address into␣
 ↪latitude and longitude values

# matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors
import matplotlib.pyplot as plt


# import k-means for clustering
from sklearn.cluster import KMeans

#libraries for displaying images
from IPython.display import Image
from IPython.core.display import HTML

#tranforming json file into a pandas dataframe library
from pandas.io.json import json_normalize

!conda install -c conda-forge folium=0.5.0 --yes
import folium # plotting library

print('Folium installed')
print('Libraries imported.')
```

```
Requirement already satisfied: tabula-py in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (2.1.0)
Requirement already satisfied: distro in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from tabula-py)
(1.5.0)
Requirement already satisfied: pandas>=0.25.3 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from tabula-py)
(1.0.3)
Requirement already satisfied: numpy in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from tabula-py)
(1.18.1)
```

```
Requirement already satisfied: pytz>=2017.2 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
pandas>=0.25.3->tabula-py) (2019.3)
Requirement already satisfied: python-dateutil>=2.6.1 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
pandas>=0.25.3->tabula-py) (2.8.1)
Requirement already satisfied: six>=1.5 in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from python-
dateutil>=2.6.1->pandas>=0.25.3->tabula-py) (1.14.0)
Requirement already satisfied: tabulate in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (0.8.7)
Collecting package metadata (current_repodata.json): done
Solving environment: done

# All requested packages already installed.

Collecting package metadata (current_repodata.json): done
Solving environment: done

# All requested packages already installed.

Folium installed
Libraries imported.
```

[2]:
```
import os
print (os.getcwd())
```

```
/resources/labs/DP0701EN
```

We created a new excell dataframe which cordinates the Cities in the Municipality columns with their cordinates found by this website www.lat-long.com or https://www.findlatitudeandlongitude.com/ or latlong.net

[3]:
```
lat_lon = pd.read_excel(r'/resources/labs/DP0701EN/Palm Beach County Cities and␣
↪Zips.xlsx')
lat_lon.head()
```

[3]:

	MUNICIPALITIES	Latitude	Longitude
0	Atlantis	26.590902	-80.100876
1	Belle Glade	26.684510	-80.667558
2	Boca Raton	26.358688	-80.083098
3	Boynton Beach	26.525349	-80.066431
4	Briny Breezes town	26.508405	-80.050875

For the pdf dataframe … we used the tabula technology to extract the dataframe to a cvs file https://tabula.technology/

[4]:
```
PAR = pd.read_csv(r'/resources/labs/DP0701EN/
↪tabula-4thQuarterPermitActivityReport.csv', sep=',', header=None,  names =␣
↪["MUNICIPALITIES", "SINGLE FAMILY UNITS", "SFU VALUE", "MULTI FAMILY UNITS",␣
↪"MFU VALUE", "TOTAL UNITS", "TOTAL UNITS VALUE"])
PAR.head()
```

[4]:

	MUNICIPALITIES	SINGLE FAMILY UNITS	SFU VALUE	MULTI FAMILY UNITS	MFU VALUE	TOTAL UNITS	TOTAL UNITS VALUE
0	Atlantis	1	$720,000	0	$0	1	$720,000
1	Belle Glade	2	$300,000	0	$0	2	$300,000
2	Boca Raton	26	$20,294,965	5	$576,252	31	$20,871,217
3	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954
4	Briny Breezes town	0	$0	0	$0	0	$0

[5]:
```
#sorting values by total units and take the top 5 Municipalities of new␣
↪construction to look at.
Top5 =PAR.sort_values(by = 'TOTAL UNITS', ascending = False).head()
Top5
```

[5]:

	MUNICIPALITIES	SINGLE FAMILY UNITS	SFU VALUE	MULTI FAMILY UNITS	MFU VALUE	TOTAL UNITS	TOTAL UNITS VALUE
26	Palm Beach County Unincorporated Area	543	$191,834,714	156	$8,566,105	699	$200,400,819
37	West Palm Beach	17	$4,036,764	558	$56,036,486	575	$60,073,250
3	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954
38	Westlake	76	$17,596,144	0	$0	76	$17,596,144
27	Palm Beach Gardens	53	$24,789,011	20	$1,981,103	73	$26,770,114

merge dataframes

[6]:
```
#merge dataframes
PBC_df= pd.merge( Top5,lat_lon, on='MUNICIPALITIES')
PBC_df
```

[6]:

	MUNICIPALITIES	SINGLE FAMILY UNITS	SFU VALUE	MULTI FAMILY UNITS	MFU VALUE	TOTAL UNITS	TOTAL UNITS VALUE	Latitude	Longitude
0	Palm Beach County Unincorporated Area	543	$191,834,714	156	$8,566,105	699	$200,400,819	26.709723	-80.064163
1	West Palm Beach	17	$4,036,764	558	$56,036,486	575	$60,073,250	26.715300	-80.053400
2	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349	-80.066431
3	Westlake	76	$17,596,144	0	$0	76	$17,596,144	26.747000	-80.307700
4	Palm Beach Gardens	53	$24,789,011	20	$1,981,103	73	$26,770,114	26.839600	-80.101900

EXPLORE AND CLUSTER

[7]:
```
## MAP OF TOP 5 Municipalities of new construction
```

[8]:
```
address = 'Palm Beach County'

geolocator = Nominatim(user_agent="PBC_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Palm Beach County are {}, {}.'
 ↪format(latitude, longitude))
```

```
The geograpical coordinate of Palm Beach County are 26.6279798, -80.4494174.
```

[9]:
```
map_PBC = folium.Map(location=[latitude,longitude],zoom_start=10)

for lat,lng,municipality in␣
 ↪zip(PBC_df['Latitude'],PBC_df['Longitude'],PBC_df['MUNICIPALITIES']):
    label = '{}'.format(municipality)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
    [lat,lng],
    radius=2,
    popup=label,
    color='blue',
    fill=True,
```

```
    fill_color='#3186cc',
    fill_opacity=0.7,
    parse_html=False).add_to(map_PBC)
map_PBC
```

[9]: <folium.folium.Map at 0x7f423883bb00>

Next, we are going to start utilizing the Foursquare API to explore the neighborhoods and segment them.

0.3 Define Foursquare Credentials and Version

[10]:
```
CLIENT_ID = 'LAUAGY5VQH2DJ4VUXN4OXSNGEGCKTOTLXSDASO4FL1XB4SES' # your␣
 ↪Foursquare ID
CLIENT_SECRET = 'D3CTWFSGB2D5XWODQO2ZB2VGVOI2IZMIOISACKDSVCLOMEV2' # your␣
 ↪Foursquare Secret
VERSION = '20180605'

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

```
Your credentails:
CLIENT_ID: LAUAGY5VQH2DJ4VUXN4OXSNGEGCKTOTLXSDASO4FL1XB4SES
CLIENT_SECRET:D3CTWFSGB2D5XWODQO2ZB2VGVOI2IZMIOISACKDSVCLOMEV2
```

0.4 Let's explore the neighborhood of Palm Beach County

get venues

[11]:
```
LIMIT = 100 # limit of number of venues returned by Foursquare API
radius = 100000 # define radius
```

[12]:
```
# create URL
url = 'https://api.foursquare.com/v2/venues/explore?
 ↪&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    latitude,
    longitude,
    radius,
    LIMIT)
url # display URL
```

[12]: 'https://api.foursquare.com/v2/venues/explore?&client_id=LAUAGY5VQH2DJ4VUXN4OXSN
GEGCKTOTLXSDASO4FL1XB4SES&client_secret=D3CTWFSGB2D5XWODQO2ZB2VGVOI2IZMIOISACKDS
VCLOMEV2&v=20180605&ll=26.6279798,-80.4494174&radius=100000&limit=100'

send Get request to examn the results

[13]:
```
results = requests.get(url).json()
```

[14]:
```
# 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']
```

1 Clean Data in JSon File put it in panda dataframe

[15]:
```
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()
```

```
/home/jupyterlab/conda/envs/python/lib/python3.6/site-
packages/ipykernel_launcher.py:3: FutureWarning: pandas.io.json.json_normalize
is deprecated, use pandas.json_normalize instead
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[15]:

	name	categories	lat	\
0	Trader Joe's	Grocery Store	26.636809	
1	Whole Foods Market	Grocery Store	26.641351	
2	Chick-fil-A	Fast Food Restaurant	26.676292	

```
3                  La Perrada del Gordo    Spanish Restaurant  26.638005
4  Morikami Museum And Japanese Gardens                 Garden  26.428870

         lng
0 -80.205553
1 -80.205912
2 -80.201740
3 -80.112046
4 -80.156608
```

[16]:
```
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 = ['MUNICIPALITIES',
                  'Municipality Latitude',
                  'Municipality Longitude',
                  'Venue',
                  'Venue Latitude',
```

```
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

[17]:
```
PBC_venues = getNearbyVenues(names=PBC_df['MUNICIPALITIES'],
                                    latitudes=PBC_df['Latitude'],
                                    longitudes=PBC_df['Longitude']
                                   )
```

```
Palm Beach County Unincorporated Area
West Palm Beach
Boynton Beach
Westlake
Palm Beach Gardens
```

Get new dataframe with venues

[18]:
```
PBC_venues.head()
```

[18]:

	MUNICIPALITIES	Municipality Latitude	Municipality Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Palm Beach County Unincorporated Area	26.709723	-80.064163	Victoria's Secret PINK	26.706917	-80.060949	Lingerie Store
1	Palm Beach County Unincorporated Area	26.709723	-80.064163	West Palm Beach Marriott	26.707069	-80.063349	Hotel
2	Palm Beach County Unincorporated Area	26.709723	-80.064163	Okeechobee & Parker RR Xing	26.706047	-80.062406	Rest Area
3	Palm Beach County Unincorporated Area	26.709723	-80.064163	Bistro Ten Zero One	26.707419	-80.063645	Diner
4	Palm Beach County Unincorporated Area	26.709723	-80.064163	Shoes For Crews LLC	26.712893	-80.064453	Shoe Store

Group by Municipality

[19]:
```
PBC_venues.groupby('MUNICIPALITIES').count().head()
```

[19]:

MUNICIPALITIES	Municipality Latitude	Municipality Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Boynton Beach	6	6	6	6	6	6

```
Palm Beach County Unincorporated Area                    8
Palm Beach Gardens                                      20
West Palm Beach                                         71
Westlake                                                 2

                                    Municipality Longitude  Venue  \
MUNICIPALITIES
Boynton Beach                                            6      6
Palm Beach County Unincorporated Area                    8      8
Palm Beach Gardens                                      20     20
West Palm Beach                                         71     71
Westlake                                                 2      2

                                    Venue Latitude  Venue Longitude  \
MUNICIPALITIES
Boynton Beach                                    6                6
Palm Beach County Unincorporated Area            8                8
Palm Beach Gardens                              20               20
West Palm Beach                                 71               71
Westlake                                         2                2

                                    Venue Category
MUNICIPALITIES
Boynton Beach                                    6
Palm Beach County Unincorporated Area            8
Palm Beach Gardens                              20
West Palm Beach                                 71
Westlake                                         2
```

[20]:
```
print('There are {} uniques categories.'.format(len(PBC_venues['Venue␣
 ↪Category'].unique())))
```

```
There are 65 uniques categories.
```

Merge dataframes to get the new family units built by each Municipalities

[21]:
```
NewHousingPBC = pd.merge(PAR, PBC_venues, on='MUNICIPALITIES')
NewHousingPBC.head()
```

[21]:

	MUNICIPALITIES	SINGLE FAMILY UNITS	SFU VALUE	MULTI FAMILY UNITS	MFU VALUE	TOTAL UNITS	TOTAL UNITS VALUE	Municipality Latitude
0	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349
1	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349
2	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349
3	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349
4	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349

```
1  $6,217,584          119        $6,929,954              26.525349
2  $6,217,584          119        $6,929,954              26.525349
3  $6,217,584          119        $6,929,954              26.525349
4  $6,217,584          119        $6,929,954              26.525349
```

```
   Municipality Longitude                                          Venue  \
0              -80.066431  Schoolhouse Children's Museum & Learning Center
1              -80.066431                                   Sailfish Cafe
2              -80.066431                                South Beach Baby
3              -80.066431                           Concrete Solutions Fl
4              -80.066431                                     Mulch Park

   Venue Latitude  Venue Longitude              Venue Category
0       26.527577       -80.062953                      Museum
1       26.526408       -80.063509                       Café
2       26.523549       -80.063925                       Beach
3       26.524458       -80.063360  Construction & Landscaping
4       26.526872       -80.062625                  Playground
```

2 Analyze Each Neighborhood

[22]:
```
# one hot encoding
PBC_onehot = pd.get_dummies(PBC_venues[['Venue Category']], prefix="",␣
 ↪prefix_sep="")

# add neighborhood column back to dataframe
PBC_onehot['MUNICIPALITIES'] = PBC_venues['MUNICIPALITIES']

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

PBC_onehot.head()
```

[22]:
```
                          MUNICIPALITIES  American Restaurant  \
0  Palm Beach County Unincorporated Area                    0
1  Palm Beach County Unincorporated Area                    0
2  Palm Beach County Unincorporated Area                    0
3  Palm Beach County Unincorporated Area                    0
4  Palm Beach County Unincorporated Area                    0

   Asian Restaurant  Bank  Bar  Baseball Field  Beach  Bistro  Breakfast Spot  \
0                 0     0    0               0      0       0               0
1                 0     0    0               0      0       0               0
2                 0     0    0               0      0       0               0
3                 0     0    0               0      0       0               0
```

```
4                 0     0    0               0      0       0               0

   Brewery  …  Sandwich Place  Sculpture Garden  Shipping Store  Shoe Store  \
0        0  …               0                 0               0           0
1        0  …               0                 0               0           0
2        0  …               0                 0               0           0
3        0  …               0                 0               0           0
4        0  …               0                 0               0           1

   Shopping Mall  Steakhouse  Sushi Restaurant  Theater  Train Station  \
0              0           0                 0        0              0
1              0           0                 0        0              0
2              0           0                 0        0              0
3              0           0                 0        0              0
4              0           0                 0        0              0

   Wine Bar
0         0
1         0
2         0
3         0
4         0

[5 rows x 66 columns]
```

Next, let's group rows by neighborhood and by taking the mean of the frequency of occurrence of each category

[23]:
```
PBC_grouped = PBC_onehot.groupby('MUNICIPALITIES').mean().reset_index()
PBC_grouped.head()
```

[23]:
```
                        MUNICIPALITIES  American Restaurant  \
0                         Boynton Beach             0.166667
1  Palm Beach County Unincorporated Area             0.000000
2                     Palm Beach Gardens             0.050000
3                        West Palm Beach             0.014085
4                               Westlake             0.000000

   Asian Restaurant      Bank       Bar  Baseball Field     Beach    Bistro  \
0          0.000000  0.000000  0.000000             0.0  0.166667  0.000000
1          0.000000  0.000000  0.000000             0.0  0.000000  0.000000
2          0.000000  0.000000  0.000000             0.0  0.000000  0.000000
3          0.042254  0.042254  0.056338             0.0  0.000000  0.014085
4          0.000000  0.000000  0.000000             0.5  0.000000  0.000000

   Breakfast Spot   Brewery  …  Sandwich Place  Sculpture Garden  \
0        0.000000  0.000000  …        0.000000          0.000000
```

```
1        0.000000  0.000000  …        0.000000          0.000000
2        0.050000  0.000000  …        0.000000          0.000000
3        0.014085  0.014085  …        0.028169          0.014085
4        0.000000  0.000000  …        0.000000          0.000000

   Shipping Store  Shoe Store  Shopping Mall  Steakhouse  Sushi Restaurant  \
0            0.00       0.000           0.00        0.00          0.000000
1            0.00       0.125           0.00        0.00          0.000000
2            0.05       0.050           0.05        0.05          0.050000
3            0.00       0.000           0.00        0.00          0.014085
4            0.00       0.000           0.00        0.00          0.000000

    Theater  Train Station  Wine Bar
0  0.000000       0.000000  0.000000
1  0.000000       0.000000  0.000000
2  0.000000       0.000000  0.000000
3  0.014085       0.014085  0.014085
4  0.000000       0.000000  0.000000

[5 rows x 66 columns]
```

Let's print each neighborhood along with the top 5 most common venues

[24]:
```
num_top_venues = 5

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

```
----Boynton Beach----
                venue  freq
0  American Restaurant  0.17
1                Beach  0.17
2               Museum  0.17
3           Playground  0.17
4                 Café  0.17


----Palm Beach County Unincorporated Area----
            venue  freq
0     Bus Station  0.25
```

```
1           Diner  0.12
2           Hotel  0.12
3  Lingerie Store  0.12
4       Rest Area  0.12


----Palm Beach Gardens----
                 venue  freq
0                Hotel  0.10
1  American Restaurant  0.05
2           Donut Shop  0.05
3     Sushi Restaurant  0.05
4           Steakhouse  0.05


----West Palm Beach----
               venue  freq
0                Bar  0.06
1        Pizza Place  0.06
2        Coffee Shop  0.04
3  French Restaurant  0.04
4     Farmers Market  0.04


----Westlake----
                venue  freq
0        Intersection   0.5
1      Baseball Field   0.5
2  Mexican Restaurant   0.0
3            Pharmacy   0.0
4                Park   0.0
```

[25]:
```
#function to sort in decending order
def return_most_common_venues(row, num_top_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=False)

    return row_categories_sorted.index.values[0:num_top_venues]
```

[26]:
```
num_top_venues = 10

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

# create columns according to number of top venues
columns = ['MUNICIPALITIES']
```

```
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['MUNICIPALITIES'] = PBC_grouped['MUNICIPALITIES']

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

neighborhoods_venues_sorted.head()
```

[26]:

	MUNICIPALITIES	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	Boynton Beach	American Restaurant	Beach	Playground	Museum	Café	Construction & Landscaping	Greek Restaurant	Gastropub	Gas Station	Concert Hall
1	Palm Beach County Unincorporated Area	Bus Station	Hotel	Shoe Store	Diner	Business Service	Rest Area	Lingerie Store	Gastropub	Gas Station	Concert Hall
2	Palm Beach Gardens	Hotel	Hotel Pool	Pharmacy	Breakfast Spot	Chocolate Shop	Coffee Shop	Donut Shop	Gas Station	Greek Restaurant	Grocery Store
3	West Palm Beach	Bar	Pizza Place	Farmers Market	Asian Restaurant	Bank	French Restaurant	Park	Middle Eastern Restaurant	Gastropub	Coffee Shop
4	Westlake	Intersection	Baseball Field	Wine Bar	Gas Station	Diner	Donut Shop	Farmers Market	Fountain	French Restaurant	Greek Restaurant

2.1 Cluster Neighborhoods

Run k-means to cluster the neighborhood into 5 clusters.

[27]:
```
# set number of clusters
kclusters = 5

PBC_grouped_clustering = PBC_grouped.drop('MUNICIPALITIES', 1)

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

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

[27]:
```
array([2, 3, 1, 4, 0], dtype=int32)
```

[28]:
```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

PBC_merged = PBC_df

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

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

[28]:

	MUNICIPALITIES	SINGLE FAMILY UNITS	SFU VALUE	MULTI FAMILY UNITS	MFU VALUE	TOTAL UNITS	TOTAL UNITS VALUE	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue
0	Palm Beach County Unincorporated Area	543	$191,834,714	156	$8,566,105	699	$200,400,819	26.709723	-80.064163	3	Bus Station	Hotel
1	West Palm Beach	17	$4,036,764	558	$56,036,486	575	$60,073,250	26.715300	-80.053400	4	Bar	Pizza Place
2	Boynton Beach	3	$712,370	116	$6,217,584	119	$6,929,954	26.525349	-80.066431	2	American Restaurant	Beach
3	Westlake	76	$17,596,144	0	$0	76	$17,596,144	26.747000	-80.307700	0	Intersection	Baseball Field
4	Palm Beach Gardens	53	$24,789,011	20	$1,981,103	73	$26,770,114	26.839600	-80.101900	1	Hotel	Hotel Pool

```
  3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
0            Shoe Store                 Diner      Business Service
1        Farmers Market      Asian Restaurant                  Bank
2            Playground               Museum                  Café
3              Wine Bar          Gas Station                 Diner
4              Pharmacy        Breakfast Spot        Chocolate Shop

        6th Most Common Venue 7th Most Common Venue  \
0                   Rest Area        Lingerie Store
1           French Restaurant                 Park
2  Construction & Landscaping      Greek Restaurant
3                  Donut Shop        Farmers Market
4                Coffee Shop            Donut Shop

       8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
0                  Gastropub           Gas Station           Concert Hall
1  Middle Eastern Restaurant             Gastropub            Coffee Shop
2                  Gastropub           Gas Station           Concert Hall
3                   Fountain     French Restaurant       Greek Restaurant
4                Gas Station      Greek Restaurant          Grocery Store
```

Finally, let's visualize the resulting clusters

[29]:
```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=10)

# 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(PBC_merged['Latitude'],␣
 ↪PBC_merged['Longitude'], PBC_merged['MUNICIPALITIES'], PBC_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
```

[29]: <folium.folium.Map at 0x7f42386d40b8>

Let's print each neighborhood along with the 20 least common venues

[30]:
```
num_least_venues = 5

for hood in PBC_grouped['MUNICIPALITIES']:
    print("----"+hood+"----")
    temp = PBC_grouped[PBC_grouped['MUNICIPALITIES'] == 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=True).reset_index(drop=True).
 ↪head(num_least_venues))
    print('\n')
```

```
----Boynton Beach----
                venue  freq
0          Hotel Pool   0.0
1      Ice Cream Shop   0.0
2        Intersection   0.0
3           Irish Pub   0.0
4  Italian Restaurant   0.0


----Palm Beach County Unincorporated Area----
                 venue  freq
0  American Restaurant   0.0
1       Ice Cream Shop   0.0
2         Intersection   0.0
3            Irish Pub   0.0
4   Italian Restaurant   0.0


----Palm Beach Gardens----
                  venue  freq
0             Wine Bar   0.0
1                  Gym   0.0
2  Gym / Fitness Center   0.0
3        Sandwich Place   0.0
4            Hobby Shop   0.0


----West Palm Beach----
                venue  freq
```

```
0         Hotel Pool   0.0
1          Irish Pub   0.0
2  Health Food Store   0.0
3     Lingerie Store   0.0
4   Greek Restaurant   0.0


----Westlake----
                 venue  freq
0  American Restaurant   0.0
1            Irish Pub   0.0
2   Italian Restaurant   0.0
3            Juice Bar   0.0
4       Lingerie Store   0.0
```

[159]:
```
#function to sort in decending order
def return_least_common_venues(row, num_least_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=True)

    return row_categories_sorted.index.values[0:num_least_venues]
```

[160]:
```
num_least_venues = 20

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

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

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['MUNICIPALITIES'] = PBC_grouped['MUNICIPALITIES']

for ind in np.arange(PBC_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] =␣
 ↪return_least_common_venues(PBC_grouped.iloc[ind, :], num_least_venues)

neighborhoods_venues_sorted.head()
```

[160]:

	MUNICIPALITIES	1st Least Common Venue	2nd Least Common Venue	3rd Least Common Venue	4th Least Common Venue	5th Least Common Venue	6th Least Common Venue	7th Least Common Venue	8th Least Common Venue	9th Least Common Venue	…
0	Boynton Beach	Hotel Pool	Ice Cream Shop	Intersection	Irish Pub	Italian Restaurant	Juice Bar	Lingerie Store	Lounge	Mediterranean Restaurant	…
1	Palm Beach County Unincorporated Area	American Restaurant	Ice Cream Shop	Intersection	Irish Pub	Italian Restaurant	Juice Bar	Lounge	Mediterranean Restaurant	Mexican Restaurant	…
2	Palm Beach Gardens	Wine Bar	Gym	Gym / Fitness Center	Sandwich Place	Hobby Shop	Salad Place	Train Station	Ice Cream Shop	Intersection	…
3	West Palm Beach	Hotel Pool	Irish Pub	Health Food Store	Lingerie Store	Greek Restaurant	Museum	Gas Station	Playground	Rest Area	…
4	Westlake	American Restaurant	Irish Pub	Italian Restaurant	Juice Bar	Lingerie Store	Lounge	Mediterranean Restaurant	Mexican Restaurant	Middle Eastern Restaurant	…

	11th Least Common Venue	12th Least Common Venue	13th Least Common Venue	14th Least Common Venue	15th Least Common Venue	16th Least Common Venue	17th Least Common Venue	18th Least Common Venue	19th Least Common Venue
0	Middle Eastern Restaurant	Music Venue	Nightclub	Park	Train Station	Pharmacy	Pub	Rest Area	Restaurant
1	Museum	Music Venue	Nightclub	Park	Pharmacy	Pizza Place	Playground	Pub	Restaurant
2	Italian Restaurant	Sculpture Garden	Juice Bar	Lounge	Mediterranean Restaurant	Restaurant	Middle Eastern Restaurant	Museum	Music Venue
3	Construction & Landscaping	Hotel	Chocolate Shop	Intersection	Café	Steakhouse	Baseball Field	Beach	Shoe Store
4	Music Venue	Nightclub	Park	Pharmacy	Ice Cream Shop	Pizza Place			

```
4                         Pub                Rest Area                Restaurant

  20th Least Common Venue
0                    Road
1                    Road
2               Nightclub
3           Shopping Mall
4                    Road

[5 rows x 21 columns]
```

Let's decide which venues are nessisary and look at what Municipalities of new development they are lacking. In order to suggest these services to move into the neighborhood.

3 lets look at venue categories to get a better idea

[51]:
```
VenueC = PBC_venues['Venue Category'].unique()
VenueC
```

[51]:
```
array(['Lingerie Store', 'Hotel', 'Rest Area', 'Diner', 'Shoe Store',
       'Bus Station', 'Business Service', 'Salad Place', 'Hobby Shop',
       'Mexican Restaurant', 'Middle Eastern Restaurant', 'Bar',
       'Sushi Restaurant', 'Coffee Shop', 'Pub', 'Italian Restaurant',
       'Gastropub', 'Asian Restaurant', 'Farmers Market',
       'French Restaurant', 'Gym / Fitness Center', 'Nightclub',
       'Burrito Place', 'Wine Bar', 'American Restaurant', 'Lounge',
       'Donut Shop', 'Theater', 'Mediterranean Restaurant', 'Pizza Place',
       'Park', 'Restaurant', 'Train Station', 'Bistro', 'Brewery',
       'Juice Bar', 'Fountain', 'Sandwich Place', 'Candy Store', 'Road',
       'Ice Cream Shop', 'Bank', 'Music Venue', 'Sculpture Garden',
       'Pharmacy', 'Concert Hall', 'Breakfast Spot', 'Grocery Store',
       'Gym', 'Museum', 'Café', 'Beach', 'Construction & Landscaping',
       'Playground', 'Intersection', 'Baseball Field', 'Greek Restaurant',
       'Irish Pub', 'Health Food Store', 'Steakhouse', 'Gas Station',
       'Shipping Store', 'Shopping Mall', 'Hotel Pool', 'Chocolate Shop'],
      dtype=object)
```

3.0.1 What we see is there is a restraurant column and then many different kinds of restaurants under there type in their own column Also there is a Bar and a Pub and Wine Bar and Lounge and Brewery which seems the same. This means the Venue Category is confusing

[139]:
```
```

```
new_column= np.array(['Clothing', 'Hospitality', 'Park', 'Restaurant',␣
 ↪'Clothing', 'Bus', 'Business Service', 'Restaurant','Hobby Shop',␣
 ↪'Restaurant','Restaurant','Bar','Restaurant','Cafe', 'Bar',␣
 ↪'Restaurant','Bar','Restaurant','Grocery','Restaurant','Gym','Nightclub','Restaurant','Bar'
 ↪'Restaurant','Train','Restaurant','Bar','Bar','Park','Restaurant','Grocery','Road','Restaur
 ↪Station','Business Service','Clothing','Hospitality','Grocery'])
dataset = pd.DataFrame({'Venue Category': VenueC, 'Category': new_column},␣
 ↪columns=['Venue Category', 'Category'])
dataset
```

[139]:

	Venue Category	Category
0	Lingerie Store	Clothing
1	Hotel	Hospitality
2	Rest Area	Park
3	Diner	Restaurant
4	Shoe Store	Clothing
..	…	…
60	Gas Station	Gas Station
61	Shipping Store	Business Service
62	Shopping Mall	Clothing
63	Hotel Pool	Hospitality
64	Chocolate Shop	Grocery

[65 rows x 2 columns]

This new dataframe has narrowed down the search because there were multiple of the same services in different categories

[140]:
```
CategoryPBC = pd.merge(NewHousingPBC, dataset, on='Venue Category')
CategoryPBC
```

[140]:

	MUNICIPALITIES	SINGLE FAMILY UNITS	SFU VALUE	MULTI FAMILY UNITS	\
0	Boynton Beach	3	$712,370	116	
1	Boynton Beach	3	$712,370	116	
2	Boynton Beach	3	$712,370	116	
3	Boynton Beach	3	$712,370	116	
4	Boynton Beach	3	$712,370	116	
..	…	…	…	…	
102	West Palm Beach	17	$4,036,764	558	
103	West Palm Beach	17	$4,036,764	558	
104	West Palm Beach	17	$4,036,764	558	
105	Westlake	76	$17,596,144	0	
106	Westlake	76	$17,596,144	0	

	MFU VALUE	TOTAL UNITS	TOTAL UNITS VALUE	Municipality Latitude	\
0	$6,217,584	119	$6,929,954	26.525349	
1	$6,217,584	119	$6,929,954	26.525349	

```
2     $6,217,584          119        $6,929,954              26.525349
3     $6,217,584          119        $6,929,954              26.525349
4     $6,217,584          119        $6,929,954              26.525349
..           …          …                 …                      …
102  $56,036,486          575       $60,073,250              26.715300
103  $56,036,486          575       $60,073,250              26.715300
104  $56,036,486          575       $60,073,250              26.715300
105           $0           76       $17,596,144              26.747000
106           $0           76       $17,596,144              26.747000

     Municipality Longitude                                        Venue  \
0               -80.066431  Schoolhouse Children's Museum & Learning Center
1               -80.066431                                   Sailfish Cafe
2               -80.066431                                South Beach Baby
3               -80.066431                           Concrete Solutions Fl
4               -80.066431                                     Mulch Park
..                     …                                              …
102             -80.053400                    Sandi The Sand Christmas Tree
103             -80.053400                            Ford Stage @ Sunfest
104             -80.053400                              Gym @ 610 Clematis
105             -80.307700                       Seminal Pratt & Sycamore
106             -80.307700                    Seminole Ridge Baseball Fields

     Venue Latitude  Venue Longitude              Venue Category      Category
0         26.527577       -80.062953                      Museum        Museum
1         26.526408       -80.063509                       Café          Cafe
2         26.523549       -80.063925                       Beach          Park
3         26.524458       -80.063360  Construction & Landscaping  Construction
4         26.526872       -80.062625                  Playground          Park
..              …              …                           …           …
102       26.713049       -80.049560           Sculpture Garden          Park
103       26.713149       -80.049118               Concert Hall       Theater
104       26.712944       -80.057572                        Gym           Gym
105       26.746012       -80.307793               Intersection  Intersection
106       26.746715       -80.309458            Baseball Field          Park

[107 rows x 14 columns]
```

[141]:
```
CategoryPBC.groupby('Category').count().head()
```

[141]:
```
                  MUNICIPALITIES  SINGLE FAMILY UNITS  SFU VALUE  \
Category
Bank                           3                    3          3
Bar                           13                   13         13
Bus                            2                    2          2
Business Service               2                    2          2
Cafe                           8                    8          8
```

```
                  MULTI FAMILY UNITS  MFU VALUE  TOTAL UNITS  \
Category
Bank                               3          3            3
Bar                               13         13           13
Bus                                2          2            2
Business Service                   2          2            2
Cafe                               8          8            8

                  TOTAL UNITS VALUE  Municipality Latitude  \
Category
Bank                              3                     3
Bar                              13                    13
Bus                               2                     2
Business Service                  2                     2
Cafe                              8                     8

                  Municipality Longitude  Venue  Venue Latitude  \
Category
Bank                                   3      3               3
Bar                                   13     13              13
Bus                                    2      2               2
Business Service                       2      2               2
Cafe                                   8      8               8

                  Venue Longitude  Venue Category
Category
Bank                            3               3
Bar                            13              13
Bus                             2               2
Business Service                2               2
Cafe                            8               8
```

[142]:
```
small_df=CategoryPBC.loc[:,['MUNICIPALITIES','Category','Venue␣
↪Category','Venue','TOTAL UNITS']]
small_df.head()
```

[142]:
```
  MUNICIPALITIES      Category              Venue Category  \
0  Boynton Beach        Museum                      Museum
1  Boynton Beach          Cafe                       Café
2  Boynton Beach          Park                      Beach
3  Boynton Beach  Construction  Construction & Landscaping
4  Boynton Beach          Park                  Playground

                                          Venue  TOTAL UNITS
0  Schoolhouse Children's Museum & Learning Center          119
1                                Sailfish Cafe          119
```

```
2                                South Beach Baby          119
3                             Concrete Solutions Fl        119
4                                       Mulch Park          119
```

4 DATA FRAMES FOR EACH CITY WITH TYPES OF CATEGORY AND COUNTS OF EACH CATEGORY AND TOTAL NEW UNITS BEING BUILT IN CITY

[143]:
```
small_df['MUNICIPALITIES'].unique()
```

[143]:
```
array(['Boynton Beach', 'Palm Beach Gardens', 'West Palm Beach',
       'Palm Beach County Unincorporated Area', 'Westlake'], dtype=object)
```

4.1 BOYNTON BEACH

[144]:
```
Boynton_Beach=small_df[small_df['MUNICIPALITIES']=='Boynton Beach']
Boynton_Beach_c=Boynton_Beach['Category'].value_counts().to_frame(name='Count')
Boynton_Beach
```

[144]:
```
  MUNICIPALITIES      Category              Venue Category  \
0  Boynton Beach        Museum                     Museum
1  Boynton Beach          Cafe                       Café
2  Boynton Beach          Park                      Beach
3  Boynton Beach  Construction  Construction & Landscaping
4  Boynton Beach          Park                  Playground
5  Boynton Beach    Restaurant         American Restaurant

                                          Venue  TOTAL UNITS
0  Schoolhouse Children's Museum & Learning Center          119
1                                  Sailfish Cafe          119
2                               South Beach Baby          119
3                            Concrete Solutions Fl        119
4                                     Mulch Park          119
5                                      John G''s          119
```

[156]:
```
Boynton_Beach_c
```

[156]:
```
              Count
Park              2
Construction      1
Restaurant        1
Cafe              1
Museum            1
```

[158]:
```
Boynton_Beach_c.plot()
```

[158]: <matplotlib.axes._subplots.AxesSubplot at 0x7f422df04780>

4.2 PALM BEACH GARDENS

[145]:
```
Palm_Beach_Gardens=small_df[small_df['MUNICIPALITIES']=='Palm Beach Gardens']
Palm_Beach_Gardens_c=Palm_Beach_Gardens['Category'].value_counts().
 ↪to_frame(name='Count')
Palm_Beach_Gardens
```

[145]:

	MUNICIPALITIES	Category	Venue Category
6	Palm Beach Gardens	Restaurant	American Restaurant
10	Palm Beach Gardens	Hospitality	Hotel
11	Palm Beach Gardens	Hospitality	Hotel
15	Palm Beach Gardens	Clothing	Shoe Store
19	Palm Beach Gardens	Restaurant	Greek Restaurant
20	Palm Beach Gardens	Bar	Irish Pub
21	Palm Beach Gardens	Grocery	Grocery Store
23	Palm Beach Gardens	Restaurant	Mexican Restaurant
26	Palm Beach Gardens	Pharmacy	Pharmacy
28	Palm Beach Gardens	Grocery	Health Food Store
29	Palm Beach Gardens	Cafe	Coffee Shop
33	Palm Beach Gardens	Restaurant	Steakhouse
34	Palm Beach Gardens	Gas Station	Gas Station
35	Palm Beach Gardens	Cafe	Donut Shop
38	Palm Beach Gardens	Restaurant	Sushi Restaurant

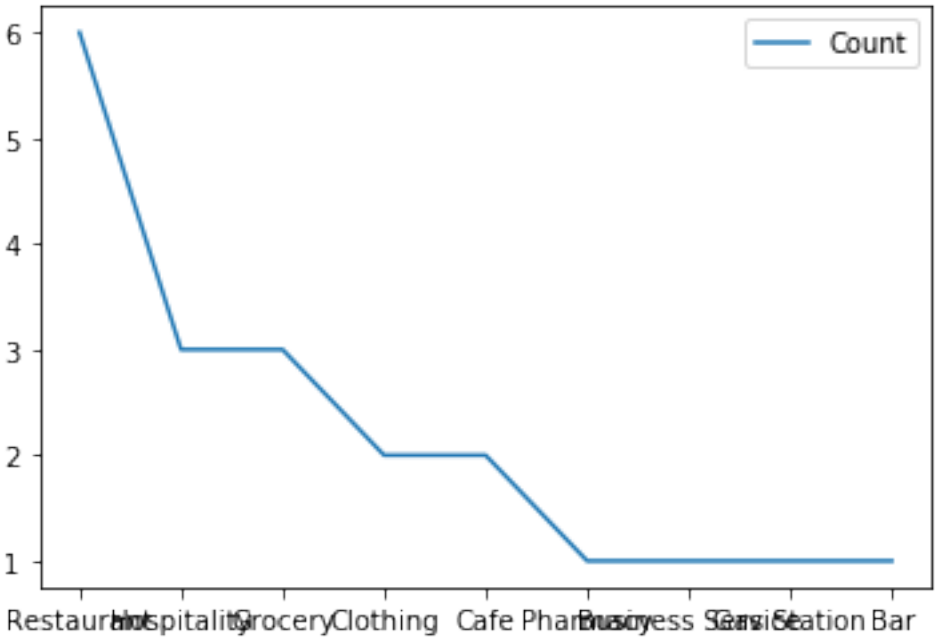
```
40  Palm Beach Gardens  Business Service       Shipping Store
41  Palm Beach Gardens        Restaurant       Breakfast Spot
43  Palm Beach Gardens          Clothing        Shopping Mall
44  Palm Beach Gardens       Hospitality           Hotel Pool
45  Palm Beach Gardens           Grocery       Chocolate Shop
```

	Venue	TOTAL UNITS
6	Cafe Chardonnay	73
10	DoubleTree by Hilton	73
11	Palm Beach Gardens Marriott	73
15	The Shoe Spa	73
19	Mr. Gyros - Mediterranean Grill	73
20	Paddy Mac's Irish Pub & Restaurant	73
21	Publix	73
23	Tacueria Taco Chula	73
26	CVS pharmacy	73
28	Mother Nature's Pantry	73
29	Starbucks	73
33	Outback Steakhouse	73
34	Shell	73
35	Dunkin'	73
38	Sushi Yama Asian Bistro	73
40	The UPS Store	73
41	Boulevard Restaurant & Gourmet	73
43	Garden Square Shops	73
44	Poolside At The Embassy Suites	73
45	Hoffman's Chocolates	73

[154]:
```
Palm_Beach_Gardens_c.plot()
Palm_Beach_Gardens_c
```

[154]:

	Count
Restaurant	6
Hospitality	3
Grocery	3
Clothing	2
Cafe	2
Pharmacy	1
Business Service	1
Gas Station	1
Bar	1



4.3 WEST PALM BEACH

[147]:
```
West_Palm_Beach=small_df[small_df['MUNICIPALITIES']=='West Palm Beach']
West_Palm_Beach_c=West_Palm_Beach['Category'].value_counts().
 ↪to_frame(name='Count')
West_Palm_Beach
```

[147]:

	MUNICIPALITIES	Category	Venue Category	\
7	West Palm Beach	Restaurant	American Restaurant	
22	West Palm Beach	Grocery	Grocery Store	
24	West Palm Beach	Restaurant	Mexican Restaurant	
25	West Palm Beach	Restaurant	Mexican Restaurant	
27	West Palm Beach	Pharmacy	Pharmacy	
..	…	…	…	
100	West Palm Beach	Theater	Music Venue	
101	West Palm Beach	Theater	Music Venue	
102	West Palm Beach	Park	Sculpture Garden	
103	West Palm Beach	Theater	Concert Hall	
104	West Palm Beach	Gym	Gym	

	Venue	TOTAL UNITS
7	Duffy's Sports Grill	575
22	Green Olive Market Place	575
24	Rocco's Tacos and Tequila Bar	575
25	Banko Cantina	575

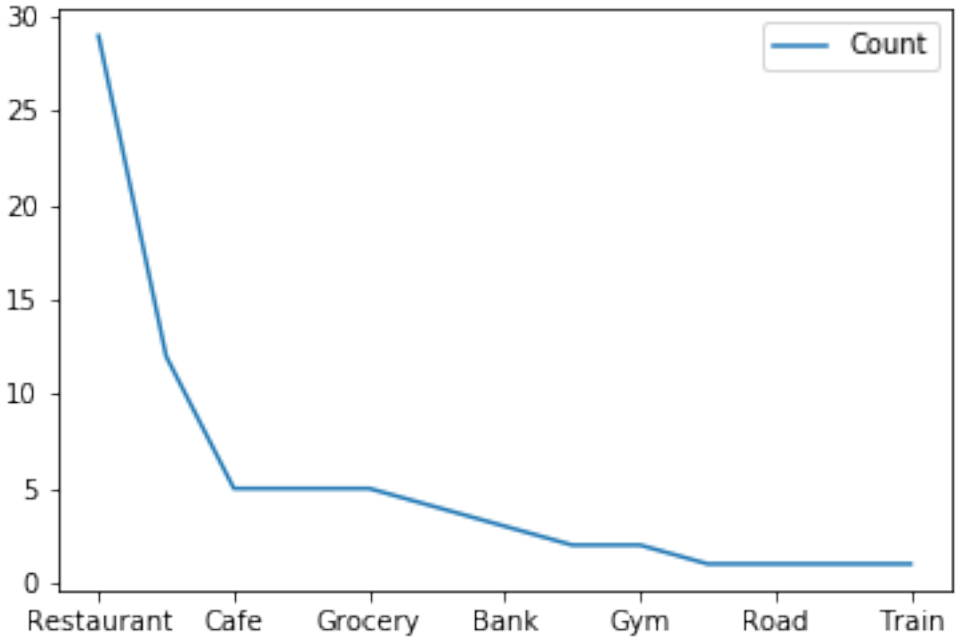
```
27                    CVS Pharmacy          575
..                             …           …
100                   CLUB SUNFEST          575
101         Respectable Street Cafe          575
102  Sandi The Sand Christmas Tree          575
103            Ford Stage @ Sunfest          575
104              Gym @ 610 Clematis          575

[71 rows x 5 columns]
```

[148]:
```
West_Palm_Beach_c
```

[148]:
```
             Count
Restaurant      29
Bar             12
Cafe             5
Park             5
Grocery          5
Theater          4
Bank             3
Nightclub        2
Gym              2
Hobby Shop       1
Road             1
Pharmacy         1
Train            1
```

[149]:
```
West_Palm_Beach_c.plot()
```

[149]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f422e14a080>
```



4.4 PALM BEACH COUNTY UNINCORPORATED AREA

[150]:
```
PBC_Unincorporated=small_df[small_df['MUNICIPALITIES']=='Palm Beach County␣
↪Unincorporated Area']
PBC_Unincorporated_c=PBC_Unincorporated['Category'].value_counts().
↪to_frame(name='Count')
PBC_Unincorporated
```

[150]:

	MUNICIPALITIES	Category	Venue Category	Venue	TOTAL UNITS
8	Palm Beach County Unincorporated Area	Clothing	Lingerie Store	Victoria's Secret PINK	699
9	Palm Beach County Unincorporated Area	Hospitality	Hotel	West Palm Beach Marriott	699
12	Palm Beach County Unincorporated Area	Park	Rest Area	Okeechobee & Parker RR Xing	699
13	Palm Beach County Unincorporated Area	Restaurant	Diner	Bistro Ten Zero One	699
14	Palm Beach County Unincorporated Area	Clothing	Shoe Store	Shoes For Crews LLC	699
16	Palm Beach County Unincorporated Area	Bus	Bus Station	Greyhound Bus Lines	699
17	Palm Beach County Unincorporated Area	Bus	Bus Station		
18	Palm Beach County Unincorporated Area	Business Service	Business Service		

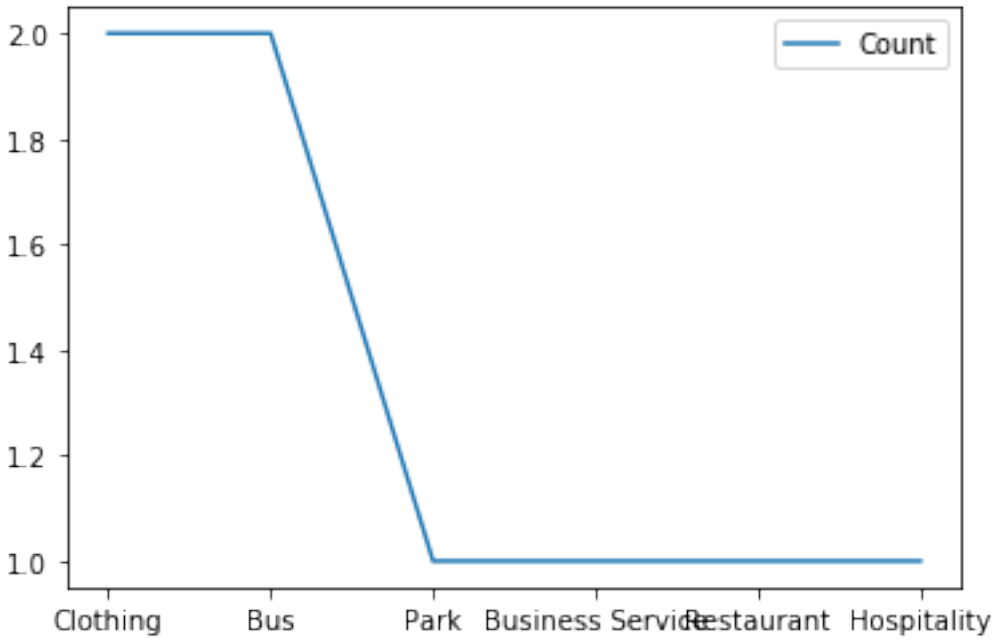
```
17  West  Palm Beach Intermodal Transport Center          699
18                                     Robert Half          699
```

[151]:
```
PBC_Unincorporated_c
```

[151]:
```
                   Count
Clothing               2
Bus                    2
Park                   1
Business Service       1
Restaurant             1
Hospitality            1
```

[152]:
```
PBC_Unincorporated_c.plot()
```

[152]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f422e0d1cc0>
```



4.5 WESTLAKE

[153]:
```
Westlake=small_df[small_df['MUNICIPALITIES']=='Westlake']
Westlake=Westlake.drop(columns=['MUNICIPALITIES'])
Westlake_c=Westlake['Category'].value_counts().to_frame(name='Count')
Westlake_c
```

[153]:

	Count
Intersection	1
Park	1

5 CONCLUSION

After observing the data given regarding the venues surrounding the new housing developments in Palm Beach County where the 5 most areas are being developed in the 4th quarter of 2019. It seems that there is a need for a lot of commercial development needed. Yet since I live in Palm Beach County, I am sure that the foursquare data is incorrect and there are much more venues then what is listed. Therefore I would not make recommendations using that dataset.

by Heidi Peterson

[ ]: