ai-project

April 11, 2022

[ ]:
```
#STEP 1- Scraping WikiPedia and Creating Data Frame

# install and import libraries
#neighbourhood maps from open.toronto.ca


# Install a pip package in the current Jupyter kernel
import sys
!{sys.executable} -m pip install bs4
!{sys.executable} -m pip install pandas
!{sys.executable} -m pip install requests
!{sys.executable} -m pip install folium
!{sys.executable} -m pip install numpy
!{sys.executable} -m pip install lxml
!{sys.executable} -m pip install html5lib

!{sys.executable} -m pip install geopy
!{sys.executable} -m pip install sklearn
!{sys.executable} -m pip install Matplotlib
!{sys.executable} -m pip install pgeocode

import pgeocode
#library to handle JSON files
import json

# Convert an address  into latitude and longitude values
from geopy.geocoders import Nominatim

# 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
```

```
from bs4 import BeautifulSoup
import requests
import pandas as pd
import numpy as np
import folium

print('Libraries installed & imported.')

# Get the dataset metadata by passing package_id to the package_search endpoint
# For example, to retrieve the metadata for this dataset:

url = "https://ckan0.cf.opendata.inter.prod-toronto.ca/api/3/action/
 ↪package_show"
params = { "id": "4def3f65-2a65-4a4f-83c4-b2a4aed72d46"}
package = requests.get(url, params = params).json()
```

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Requirement already satisfied: bs4 in c:\users\ryzengrind\appdata\local\packages
\pythonsoftwarefoundation.python.3.10_qbz5n2kfra8p0\localcache\local-
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Requirement already satisfied: numpy>=1.21.0 in c:\users\ryzengrind\appdata\loca
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Requirement already satisfied: branca>=0.3.0 in c:\users\ryzengrind\appdata\loca
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Requirement already satisfied: pillow>=6.2.0 in c:\users\ryzengrind\appdata\loca
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kages\pythonsoftwarefoundation.python.3.10_qbz5n2kfra8p0\localcache\local-
packages\python310\site-packages (from python-dateutil>=2.8.1->pandas->pgeocode)
(1.16.0)
Libraries installed & imported.
```

[ ]:
```
# Getting the data, preprocessing, and cleaning the data

url = 'https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
source = requests.get(url)
postal_code_url = requests.get('https://en.wikipedia.org/wiki/
 ↪List_of_postal_codes_of_Canada:_M').text

soup = BeautifulSoup(source.text, 'html')

#using soup object, iterate the wikitable to get the data from the HTML page␣
 ↪and store it into a list
data = []
columns = []
table = soup.find("tbody")

#function for finding italics
def has_italics_not_assigned(tag):
    return tag.has_attr('i') and not tag.has_attr('a')

def extract_postal(pcode):
    return pcode[0:3]

def extract_borough(borough):
    borough = borough[3:len(borough)]
    borough = borough.rpartition("(")[0]
    return borough

def extract_neighbourhood(nbhood):
    nbhood = nbhood.rpartition("(")[2]
    nbhood = nbhood.rpartition(")")[0]
    return nbhood

postals = []
boroughs = []
neighbourhoods =  []

for index, tr in enumerate(table.find_all('tr')):
    section = []
    for td in tr.find_all(['th','td']):
            td_string = td.text.strip()
            borough = td_string[3:len(td_string)]

            if (borough != "Not assigned"):
                section.append(extract_postal(td_string) + " " + borough)

                postals.append(extract_postal(td_string))
                boroughs.append(extract_borough(td_string))
```

```
                neighbourhoods.append(extract_neighbourhood(td_string))

            else:
                section.append("")
    #First row of data is the header
    """if (index == 0):
        columns = ['M1_', 'M2_', 'M3_', 'M4_', 'M5_', 'M6_', 'M7_', 'M8_',␣
 ↪'M9_']
    else:
        data.append(section)"""

#convert list into Pandas DataFrame
"""Toronto_cleaned_df = pd.DataFrame(data = data, columns = columns)
Toronto_df"""

data = {"Postal Code": postals, "Borough": boroughs, "Neighbourhood":␣
 ↪neighbourhoods}
Toronto_cleaned_df = pd.DataFrame(data)
Toronto_cleaned_df
```

[ ]:

	Postal Code	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Regent Park / Harbourfront
3	M6A	North York	Lawrence Manor / Lawrence Heights
4	M7A	Queen's Park	Ontario Provincial Government
..	…	…	…
98	M8X	Etobicoke	The Kingsway / Montgomery Road / Old Mill North
99	M4Y	Downtown Toronto	Church and Wellesley
100	M7Y	East TorontoBusiness reply mail Processing Cen…	Enclave of M4L
101	M8Y	Etobicoke	Old Mill South / King's Mill Park / Sunnylea /…
102	M8Z	Etobicoke	Mimico NW / The Queensway West / South of Bloo…

[103 rows x 3 columns]

[ ]:
```
# STEP 2: Getting the coordinates of each neighbourhood

# getting the coordinates in a new data frame
pcode = Toronto_cleaned_df['Postal Code'].tolist()
nomi = pgeocode.Nominatim('ca')
New_df = nomi.query_postal_code(pcode)
New_df

# adding coordinate from New_df to the Toronto_cleaned_df
Toronto_cleaned_df['Latitude'] = New_df['latitude']
Toronto_cleaned_df['Longitude'] = New_df['longitude']


#Correcting the coordinates for rows 76.
Toronto_cleaned_df.loc[76,['Latitude', 'Longitude']] = 43.6364,-79.6157

Toronto_cleaned_df
```

[ ]:

	Postal Code	Borough	Neighbourhood	Latitude	Longitude
0	M3A	North York	Parkwoods	43.7545	-79.3300
1	M4A	North York	Victoria Village	43.7276	-79.3148
2	M5A	Downtown Toronto	Regent Park / Harbourfront	43.6555	-79.3626
3	M6A	North York	Lawrence Manor / Lawrence Heights	43.7223	-79.4504
4	M7A	Queen's Park	Ontario Provincial Government	43.6641	-79.3889
..	…	…	…	…	…
98	M8X	Etobicoke	The Kingsway / Montgomery Road / Old Mill North	43.6518	-79.5076
99	M4Y	Downtown Toronto	Church and Wellesley	43.6656	-79.3830
100	M7Y	East TorontoBusiness reply mail Processing Cen…	Enclave of M4L	43.7804	-79.2505
101	M8Y	Etobicoke	Old Mill South / King's Mill Park / Sunnylea /…	43.6325	-79.4939
102	M8Z	Etobicoke	Mimico NW / The Queensway West / South of Bloo…	43.6256	-79.5231

[103 rows x 5 columns]

[ ]:
```
#Step 3 - Clustering Neighboorhood

# Get coordinates of Toronto
address = 'Toronto, ON, CA'

geolocator = Nominatim(user_agent="TR_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinates of Toronto are {}, {}.'.format(latitude,␣
 ↪longitude))



#making a list of boroughs in Toronto to be used in visualization
boroughs = list(set(Toronto_cleaned_df['Borough']))

# create map of Toronto using latitude and longitude values
map_toronto = folium.Map(location=[latitude, longitude], zoom_start=11)
colors= ['#0000FF','#FF4040', '#66CD00', '#00CDCD', '#CAFF70', '#9932CC',␣
 ↪'#EEC900', '#808080', '#FF69B4', '#FFFFE0', '#FF0000', '#FFA500', '#BDB76B',␣
 ↪'#006400', '#00FF00' , '#AFEEEE' , '#4169E1' ]

# add markers to map
for lat, lng, borough, neighbourhood in zip(Toronto_cleaned_df['Latitude'],␣
 ↪Toronto_cleaned_df['Longitude'], Toronto_cleaned_df['Borough'],␣
 ↪Toronto_cleaned_df['Neighbourhood']):
    label = '{}, {}'.format(neighbourhood, borough)
    label = folium.Popup(label, parse_html=True)
    for i in range(0, len(boroughs)) :
        if boroughs[i] == borough :
            c = colors[i]
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color= c,
        fill=True,
        fill_color= c,
        fill_opacity=0.7,
        parse_html=False).add_to(map_toronto)

map_toronto
```

```
The geograpical coordinates of Toronto are 43.6534817, -79.3839347.
```

[ ]:
```
<folium.folium.Map at 0x1fbcf26b310>
```

[ ]:
```
#North York Clustering
nyork_data = Toronto_cleaned_df[Toronto_cleaned_df['Borough'] == 'North York'].
 ↪reset_index(drop=True)
nyork_data.head()

# Getting coordinates of North York
address = 'North York, ON, CA'

geolocator = Nominatim(user_agent="nyork_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of North York are {}, {}.'.format(latitude,␣
 ↪longitude))

# create map of North York using latitude and longitude values
map_nyork = folium.Map(location=[latitude, longitude], zoom_start=12)

# add markers to map
for lat, lng, label in zip(nyork_data['Latitude'], nyork_data['Longitude'],␣
 ↪nyork_data['Neighbourhood']):
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='blue',
        fill_opacity=0.7,
        parse_html=False).add_to(map_nyork)

map_nyork
```

```
The geograpical coordinate of North York are 43.7543263, -79.44911696639593.
```

[ ]:
```
<folium.folium.Map at 0x1fbceb4f490>
```

[ ]:
```
#Create function for FSQ API calls
APIKEY = 'fsq3Sl1rMVbkkKn6h2Of0j//V/kM4JJOxpn5Y/SMMgsvoRQ='

def getNearbyVenues(names, latitudes, longitudes, radius, limit):
    headers = {
        'Accept': 'application/json',
        'Authorization': 'APIKEY'
    }
```

```
    URL = 'https://api.foursquare.com/v3/places/search?ll={}&radius={}&limit={}'

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

        url = URL.format(str(lat) + '%2C' + str(lng), radius, limit)
        print(url)
        #response = requests.get(url, headers=headers)
        response = requests.request("GET", url, headers=headers)
        #data = requests.get(url, headers=headers).json()
        data = json.loads(response.text)
        # do stuff here to process venues_list
        for record in data['results']:
            venues_list.append({
                'Neighborhood': name,
                'Neighborhood Latitude': lat,
                'Neighborhood Longitude': lng,
                'Venue': record['name'],
                'Venue Latitude': record['geocodes']['main']['latitude'],
                'Venue Longitude': record['geocodes']['main']['longitude'],
                'Venue Category': record['categories'][0]['name'],
            })

    # do stuff here to create your dataframe
    nearby_venues = pd.DataFrame(venues_list)

    return(nearby_venues)

print(data)
#getNearbyVenues(nyork_data['Neighbourhood'], nyork_data['Latitude'],␣
 ↪nyork_data['Longitude'], 500, 50)
#getNearbyVenues(Toronto_cleaned_df['Neighbourhood'],␣
 ↪Toronto_cleaned_df['Latitude'], Toronto_cleaned_df['Longitude'], 500, 50)
```

```
{'Postal Code': ['M3A', 'M4A', 'M5A', 'M6A', 'M7A', 'M9A', 'M1B', 'M3B', 'M4B',
'M5B', 'M6B', 'M9B', 'M1C', 'M3C', 'M4C', 'M5C', 'M6C', 'M9C', 'M1E', 'M4E',
'M5E', 'M6E', 'M1G', 'M4G', 'M5G', 'M6G', 'M1H', 'M2H', 'M3H', 'M4H', 'M5H',
'M6H', 'M1J', 'M2J', 'M3J', 'M4J', 'M5J', 'M6J', 'M1K', 'M2K', 'M3K', 'M4K',
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'M4V', 'M5V', 'M8V', 'M9V', 'M1W', 'M4W', 'M5W', 'M8W', 'M9W', 'M1X', 'M4X',
'M5X', 'M8X', 'M4Y', 'M7Y', 'M8Y', 'M8Z'], 'Borough': ['North York', 'North
York', 'Downtown Toronto', 'North York', "Queen's Park", 'Etobicoke',
'Scarborough', 'North York', 'East York', 'Downtown Toronto', 'North York',
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'Etobicoke', 'Scarborough', 'North York(Don Mills)South', 'East York', 'Downtown Toronto', 'York', 'Etobicoke', 'Scarborough', 'East Toronto', 'Downtown Toronto', 'York', 'Scarborough', 'East York', 'Downtown Toronto', 'Downtown Toronto', 'Scarborough', 'North York', 'North York', 'East York', 'Downtown Toronto', 'West Toronto', 'Scarborough', 'North York', 'North York', 'East YorkEast Toronto', 'Downtown Toronto', 'West Toronto', 'Scarborough', 'North York', 'North York(Downsview)East ', 'East Toronto', 'Downtown Toronto', 'West Toronto', 'Scarborough', 'North York', 'North York', 'East Toronto', 'Downtown Toronto', 'North York', 'North York', 'Scarborough', 'North York', 'North York', 'East Toronto', 'North York', 'York', 'North York', 'Scarborough', 'North York', 'North York', 'Central Toronto', 'Central Toronto', 'York', 'York', 'Scarborough', 'North York', 'Central Toronto', 'Central Toronto', 'West Toronto', 'Etobicoke', 'Scarborough', 'North York', 'Central Toronto', 'Central Toronto', 'West Toronto', 'MississaugaCanada Post Gateway Processing Centre', 'Etobicoke', 'Scarborough', 'Central Toronto', 'Downtown Toronto', 'West Toronto', 'Scarborough', 'Central Toronto', 'Downtown Toronto', 'Scarborough', 'Central Toronto', 'Downtown Toronto', 'Etobicoke', 'Etobicoke', 'Scarborough', 'Downtown Toronto', 'Downtown TorontoStn A PO Boxes25 The Esplanade', 'Etobicoke', 'EtobicokeNorthwest', 'Scarborough', 'Downtown Toronto', 'Downtown Toronto', 'Etobicoke', 'Downtown Toronto', 'East TorontoBusiness reply mail Processing Centre969 Eastern', 'Etobicoke', 'Etobicoke'], 'Neighbourhood': ['Parkwoods', 'Victoria Village', 'Regent Park / Harbourfront', 'Lawrence Manor / Lawrence Heights', 'Ontario Provincial Government', 'Islington Avenue', 'Malvern / Rouge', 'Don Mills', 'Parkview Hill / Woodbine Gardens', 'Garden District, Ryerson', 'Glencairn', 'West Deane Park / Princess Gardens / Martin Grove / Islington / Cloverdale', 'Rouge Hill / Port Union / Highland Creek', 'Flemingdon Park', 'Woodbine Heights', 'St. James Town', 'Humewood-Cedarvale', 'Eringate / Bloordale Gardens / Old Burnhamthorpe / Markland Wood', 'Guildwood / Morningside / West Hill', 'The Beaches', 'Berczy Park', 'Caledonia-Fairbanks', 'Woburn', 'Leaside', 'Central Bay Street', 'Christie', 'Cedarbrae', 'Hillcrest Village', 'Bathurst Manor / Wilson Heights / Downsview North', 'Thorncliffe Park', 'Richmond / Adelaide / King', 'Dufferin / Dovercourt Village', 'Scarborough Village', 'Fairview / Henry Farm / Oriole', 'Northwood Park / York University', 'The Danforth East', 'Harbourfront East / Union Station / Toronto Islands', 'Little Portugal / Trinity', 'Kennedy Park / Ionview / East Birchmount Park', 'Bayview Village', 'CFB Toronto', 'The Danforth West / Riverdale', 'Toronto Dominion Centre / Design Exchange', 'Brockton / Parkdale Village / Exhibition Place', 'Golden Mile / Clairlea / Oakridge', 'York Mills / Silver Hills', 'Downsview', 'India Bazaar / The Beaches West', 'Commerce Court / Victoria Hotel', 'North Park / Maple Leaf Park / Upwood Park', 'Humber Summit', 'Cliffside / Cliffcrest / Scarborough Village West', 'Willowdale / Newtonbrook', 'Downsview', 'Studio District', 'Bedford Park / Lawrence Manor East', 'Del Ray / Mount Dennis / Keelsdale and Silverthorn', 'Humberlea / Emery', 'Birch Cliff / Cliffside West', 'Willowdale', 'Downsview', 'Lawrence Park', 'Roselawn', 'Runnymede / The Junction North', 'Weston', 'Dorset Park / Wexford Heights / Scarborough Town Centre', 'York Mills West', 'Davisville North', 'Forest Hill North & West', 'High Park / The Junction South', 'Westmount', 'Wexford / Maryvale', 'Willowdale', 'North Toronto West', 'The Annex / North Midtown /

Yorkville', 'Parkdale / Roncesvalles', 'Enclave of L4W', 'Kingsview Village / St. Phillips / Martin Grove Gardens / Richview Gardens', 'Agincourt', 'Davisville', 'University of Toronto / Harbord', 'Runnymede / Swansea', "Clarks Corners / Tam O'Shanter / Sullivan", 'Moore Park / Summerhill East', 'Kensington Market / Chinatown / Grange Park', "Milliken / Agincourt North / Steeles East / L'Amoreaux East", 'Summerhill West / Rathnelly / South Hill / Forest Hill SE / Deer Park', 'CN Tower / King and Spadina / Railway Lands / Harbourfront West / Bathurst Quay / South Niagara / Island airport', 'New Toronto / Mimico South / Humber Bay Shores', 'South Steeles / Silverstone / Humbergate / Jamestown / Mount Olive / Beaumond Heights / Thistletown / Albion Gardens', "Steeles West / L'Amoreaux West", 'Rosedale', 'Enclave of M5E', 'Alderwood / Long Branch', 'Clairville / Humberwood / Woodbine Downs / West Humber / Kipling Heights / Rexdale / Elms / Tandridge / Old Rexdale', 'Upper Rouge', 'St. James Town / Cabbagetown', 'First Canadian Place / Underground city', 'The Kingsway / Montgomery Road / Old Mill North', 'Church and Wellesley', 'Enclave of M4L', "Old Mill South / King's Mill Park / Sunnylea / Humber Bay / Mimico NE / The Queensway East / Royal York South East / Kingsway Park South East", 'Mimico NW / The Queensway West / South of Bloor / Kingsway Park South West / Royal York South West']}