LUKASZ ZAJAC LAB 1 ADZD

ASSIGNMENT:

Korzystając z operacji na RDD i pliku z logami Apache2:

1. Narysować wykres rankingu najpopularniejszych stron źródłowych (referer), z wyłączeniem domeny semicomplete.com
2. Narysować wykres rankingu pobieranych plików graficznych
3. Narysować średni dobowy wykres liczby wywołań (request) na minutę w zależności od czasu.
4. Narysować wykres (pie chart) popularności systemów operacyjnych klienta
5. Oszacować jaki procent ruchu generują boty. Porównać co najmniej 2 sposoby oszacowania.
6. Narysować mapę z lokalizacjami klientów

Introduction to Apache Spark Resilient Distributed Datasets (RDD)

```
!apt-get install openjdk-8-jdk-headless -qq > /dev/null
!wget -q https://archive.apache.org/dist/spark/spark-3.1.2/spark-3.1.2-bin-hadoop3.2.tgz
!tar -xvf spark-3.1.2-bin-hadoop3.2.tgz
!pip install -q findspark
import os
os.environ["JAVA_HOME"] = "/usr/lib/jvm/java-8-openjdk-amd64"
os.environ["SPARK_HOME"] = "/content/spark-3.1.2-bin-hadoop3.2"
import findspark
findspark.init()
from pyspark.sql import SparkSession

spark = SparkSession.builder.master("local[*]").getOrCreate()
```

Initialization

Starting Spark session:

```
from pyspark.sql import SparkSession
spark = SparkSession.builder.getOrCreate()
```

```
spark
```

SparkSession - in-memory

SparkContext

Spark UI

Version
```
v3.1.2
```
Master
```
local[*]
```
AppName
```
pyspark-shell
```

```
sc = spark.sparkContext
```

Reading text files

Download a file locally (just for the demo, for larger files use HDFS or S3):

```
import urllib.request
```

```
urllib.request.urlretrieve("http://raw.githubusercontent.com/elastic/examples/master/Common%20Data%20Formats/apache_logs/apache_logs",'
('apache_logs', <http.client.HTTPMessage at 0x7a7ee4d28490>)
```

Create a first RDD

```
lines = sc.textFile("apache_logs")
```

Perform a *transformation*

```
lineLengths = lines.map(lambda s: len(s))
```

Perform an *action*

```
totalLength = lineLengths.reduce(lambda a, b: a + b)
```

Finally evaluate (laziness!)

```
totalLength
```

```
2360789
```

Custom functions

```
def myFunc(s):
    words = s.split(" ")
    return len(words)
```

```
wordCounts = lines.map(myFunc)
```

```
wordCounts.max()
```

```
43
```

```
wordCounts.histogram([0,10,20,30,40,50])
```

```
([0, 10, 20, 30, 40, 50], [0, 4901, 4719, 378, 2])
```

```
wordCounts.count()
```

```
10000
```

Map-Reduce pattern

Let's look closer at our log file format:

```
99.158.0.150 - - [18/May/2015:04:05:37 +0000] "GET /images/jordan-80.png HTTP/1.1" 200 6146 "http://www.semicomplete.com/articles/dynamic-dns-wi
```

Count lines containing "Chrome":

```
chromeLines = lines.map(lambda s: (1 if "Chrome" in s else 0))
```

```
counts = chromeLines.reduce(lambda a, b: a + b)
```

```
counts
```

```
3172
```

Key-Value Pairs

Count IP addresses

```
regex = '([(\d\.)]+)'
```

```
import re
```

```
ip = re.match(regex, '99.158.0.150 - - ').group(0)
```

```
print(ip)
```

```
99.158.0.150
```

```
ips = lines.map(lambda s: (re.match(regex, s).group(0) ,1))
```

```
ipCounts = ips.reduceByKey(lambda a, b: a + b)
```

Get results

```
ipCounts.collect()
```

```
ipCounts.take(20)
```

```
[('83.149.9.216', 23),
 ('110.136.166.128', 6),
 ('46.105.14.53', 364),
 ('123.125.71.35', 1),
 ('200.49.190.100', 1),
 ('67.214.178.190', 2),
 ('207.241.237.220', 18),
 ('207.241.237.227', 17),
 ('207.241.237.228', 16),
 ('218.30.103.62', 16),
 ('71.212.224.97', 5),
 ('86.1.76.62', 6),
 ('107.170.41.69', 10),
 ('208.115.111.72', 83),
 ('174.37.205.76', 1),
 ('134.76.249.10', 8),
 ('123.125.71.117', 1),
 ('65.19.138.34', 3),
 ('5.102.173.71', 2),
 ('187.45.193.158', 8)]
```

Sort by values (ascending):

```
ipCounts.takeOrdered(10, lambda pair: pair[1])
```

```
[('123.125.71.35', 1),
 ('200.49.190.100', 1),
 ('174.37.205.76', 1),
 ('123.125.71.117', 1),
 ('180.76.5.27', 1),
 ('93.164.60.142', 1),
 ('94.175.135.116', 1),
 ('172.56.29.98', 1),
 ('173.252.73.114', 1),
 ('54.226.176.99', 1)]
```

Sort by values (descending):

```
topIPs = ipCounts.takeOrdered(10, lambda pair: -pair[1])
topIPs
```

```
[('66.249.73.135', 482),
 ('46.105.14.53', 364),
 ('130.237.218.86', 357),
 ('75.97.9.59', 273),
 ('50.16.19.13', 113),
 ('209.85.238.199', 102),
 ('68.180.224.225', 99),
 ('100.43.83.137', 84),
 ('208.115.111.72', 83),
 ('198.46.149.143', 82)]
```

Plotting

```
import pandas as pd
```

```
df = pd.DataFrame(topIPs, columns=['IP', 'Count'])
df
```

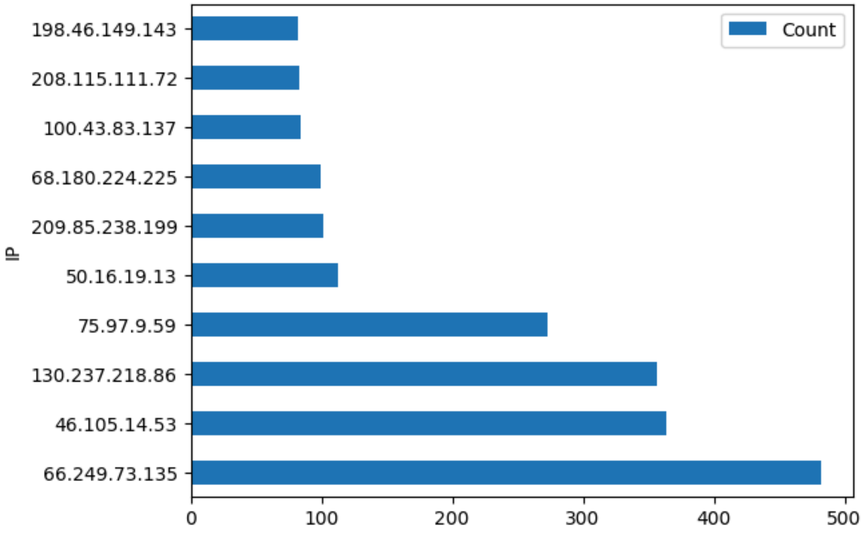
	IP	Count
0	66.249.73.135	482
1	46.105.14.53	364
2	130.237.218.86	357
3	75.97.9.59	273
4	50.16.19.13	113
5	209.85.238.199	102
6	68.180.224.225	99
7	100.43.83.137	84
8	208.115.111.72	83
9	198.46.149.143	82

Next steps: Generate code with df | View recommended plots | New interactive sheet

```
import matplotlib.pyplot as plt
```

```
df.plot.barh(x = 'IP')
```

```
<Axes: ylabel='IP'>
```



Closures and accumulators

Local variables are not passed to closures or functions, they remain local!

```
counter = 0

# Wrong: Don't do this!!
def increment_counter(x):
    global counter
    counter += x
```

```
wordCounts.foreach(increment_counter)

print("Counter value: ", counter)
```

```
Counter value:  0
```

Use *accumulators* instead

```
accum = sc.accumulator(0)
accum
```

```
Accumulator<id=0, value=0>
```

```
# Correct way is to use accumulators
def increment_counter(x):
    accum.add(x)

wordCounts.foreach(increment_counter)

print("Counter value: ", accum)
```

```
Counter value:  197956
```

Assignment solutions

Narysować wykres rankingu najpopularniejszych stron źródłowych (referer), z wyłączeniem domeny semicomplete.com

```
lines.collect()
```

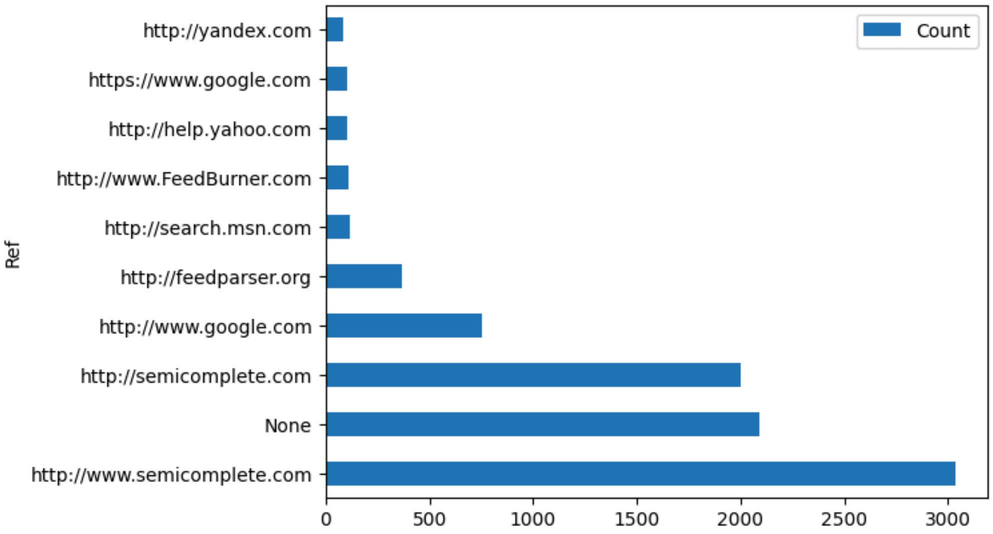
```
import regex as re
ref_regex = 'https?\:\/\/([^\/\)\"]*)'
test_str = """
17/May/2015:10:05:03 +0000] "GET /presentations/logstash-monitorama-2013/images/kibana-search.png HTTP/1.1" 200 203023 "http://semicom
 '83.149.9.216 - - [17/May/2015:10:05:43 +0000] "GET /presentations/logstash-monitorama-2013/images/kibana-dashboard3.png HTTP/1.1" 20
 '83.149.9.216 - - [17/May/2015:10:05:47 +0000] "GET /presentations/logstash-monitorama-2013/plugin/highlight/highlight.js HTTP/1.1" 2
 '83.149.9.216 - - [17/May/2015:10:05:12 +0000] "GET /presentations/logstash-monitorama-2013/plugin/zoom-js/zoom.js HTTP/1.1" 200 7697
 '83.149.9.216 - - [17/May/2015:10:05:07 +0000] "GET /presentations/logstash-monitorama-2013/plugin/notes/notes.js HTTP/1.1" 200 2892 '
 '83.149.9.216 - - [17/May/2015:10:05:34 +0000] "GET /presentations/logstash-monitorama-2013/images/sad-medic.png HTTP/1.1" 200 430406
"""
```

```
referers = lines.map( lambda l: (None,1) if re.search(ref_regex,l) is None else (re.search(ref_regex,l).group(0),1) )
referers.collect()
referers_count = referers.reduceByKey(lambda a, b: a + b)
referers_count = referers_count.collect()
```

```
df = pd.DataFrame(referers_count, columns=['Ref', 'Count'])
df.sort_values(by=['Count'], ascending=False, inplace=True)
```

```
df[:10].plot.barh(x = 'Ref')
```

```
<Axes: ylabel='Ref'>
```



Narysować wykres rankingu pobieranych plików graficznych

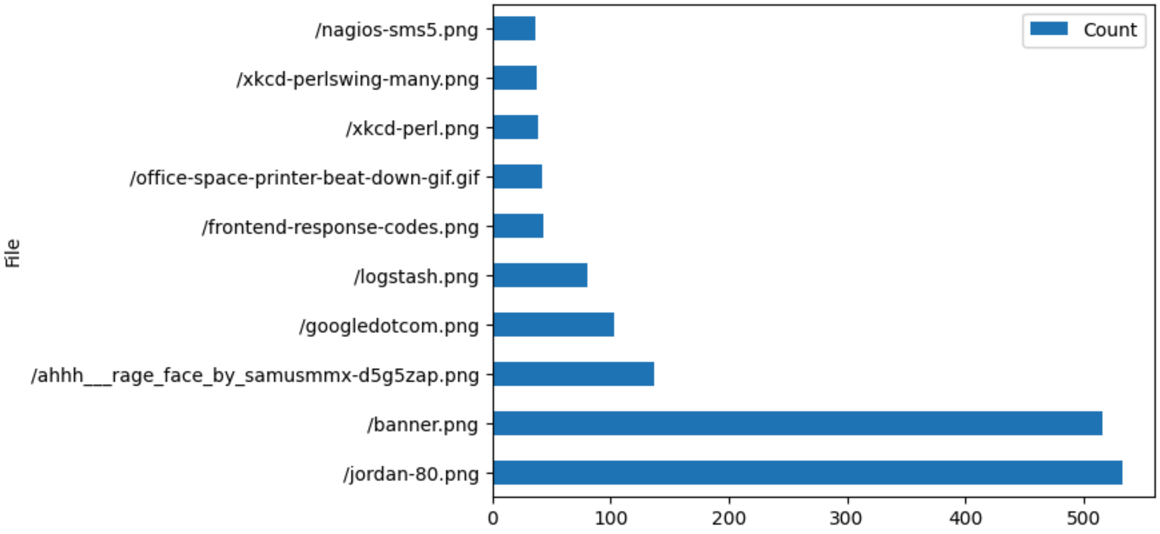
```
#zakladam ze obrazki maja rozszerzenia png lub jpg
file_regex = r'/([^/]+\.(?:png|jpg|jpeg|gif))'

# Find all matches

image_files = lines.map( lambda l: (None,1) if re.search(file_regex,l) is None else (re.search(file_regex,l).group(0),1) )
image_files.collect()
image_files_count = image_files.reduceByKey(lambda a, b: a + b)
image_files_count = image_files_count.collect()
df = pd.DataFrame(image_files_count, columns=['File', 'Count'])

df.sort_values(by=['Count'], ascending=False, inplace=True)
df[1:11].plot.barh(x = 'File')
```

```
<Axes: ylabel='File'>
```

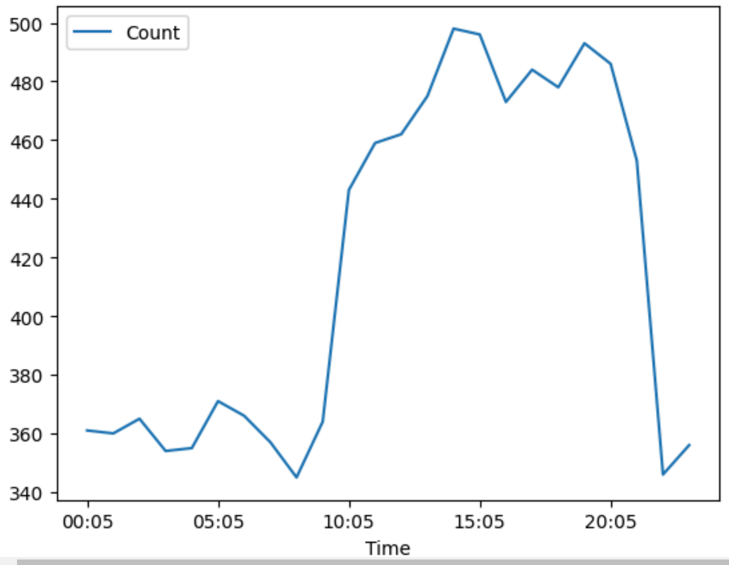


Narysować średni dobowy wykres liczby wywołań (request) na minutę w zależności od czasu.

```
time_regex = r'\[[^\]]*\:([0-9]{2}\:[0-9]{2})\:[0-9]{2} \+[0-9]{4}\]'


time_records = lines.map( lambda l: (None,1) if re.search(time_regex,l) is None else (re.search(time_regex,l).group(1),1) )
time_records.collect()
time_records_count = time_records.reduceByKey(lambda a, b: a + b)
time_records_count = time_records_count.collect()
df = pd.DataFrame(time_records_count, columns=['Time', 'Count'])
df = pd.DataFrame(time_records_count, columns=['Time', 'Count'])
df.sort_values(by=['Time'], ascending=True, inplace=True)
df.plot(x= 'Time')
```

```
<Axes: xlabel='Time'>
```



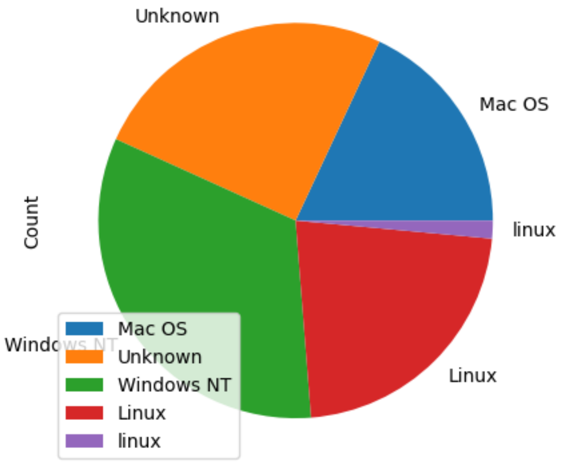
Narysować wykres (pie chart) popularności systemów operacyjnych klienta

```
#zakladam ze obrazki maja rozszerzenia png lub jpg
os_regex = r'(Windows NT|[L|l]inux|Mac OS)'

# Find all matches

os_records = lines.map( lambda l: ("Unknown",1) if re.search(os_regex,l) is None else (re.search(os_regex,l).group(0),1) )
os_records.collect()
os_records_count = os_records.reduceByKey(lambda a, b: a + b)
os_records_count = os_records_count.collect()
df = pd.DataFrame(os_records_count, columns=['OS', 'Count'])
df.plot.pie(y='Count', labels=df['OS'])
```

```
<Axes: ylabel='Count'>
```



Oszacować jaki procent ruchu generują boty. Porównać co najmniej 2 sposoby oszacowania.

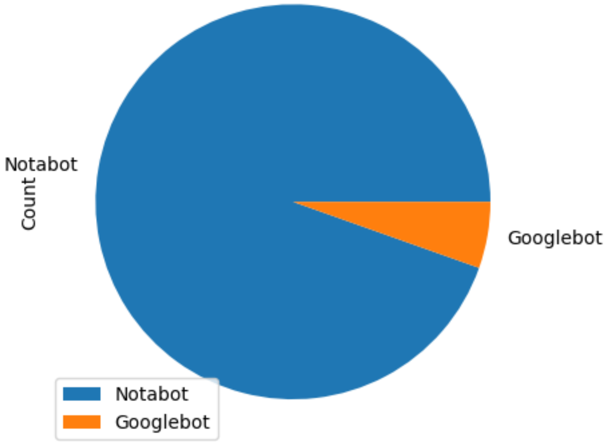
```
#zakladam ze obrazki maja rozszerzenia png lub jpg
bot_regex = r'Googlebot'

# Find all matches
```

```
bot_regex_found = lines.map( lambda l: ("Notabot",1) if re.search(bot_regex,l) is None else (re.search(bot_regex,l).group(0),1) )
bot_regex_found.collect()
bot_regex_count = bot_regex_found.reduceByKey(lambda a, b: a + b)
bot_regex_count = bot_regex_count.collect()
df = pd.DataFrame(bot_regex_count, columns=['Type', 'Count'])
df.plot.pie(y='Count', labels=df['Type'])

print(df['Count'][0]/df['Count'].sum())
```

```
0.9457
```



```
#zakladam ze obrazki maja rozszerzenia png lub jpg
bot_regex = r'Googlebot'

# Find all matches

bot_acumm = sc.accumulator(0)
all_acumm = sc.accumulator(0)

def increment_counter(x):
    if x == "Googlebot":
      bot_acumm.add(1)
    all_acumm.add(1)

bot_regex_found = lines.map( lambda l: "Notabot" if re.search(bot_regex,l) is None else re.search(bot_regex,l).group(0) )
bot_regex_found.foreach(increment_counter)


print(1 - bot_acumm.value/all_acumm.value)
```

```
0.9457
```

Narysować mapę z lokalizacjami klientów

```
pip install geoip2
```

```
import requests

def get_ip_geolocation(ip):
    # You can replace 'your_token' with your IP geolocation API token
    response = requests.get(f'https://ipinfo.io/{ip}/geo', params={'token': ADD_YOUR_TOKEN })
    if response.status_code == 200:
      longitude, latitude = response.json()['loc'].split(',')
      return [longitude,latitude]
    else:
      return [0,0]

get_ip_geolocation("83.149.9.216")
```

```
['55.7522', '37.6156']
```

```
#Import Geocoder
import geocoder

def printDetails(ip):
    return get_ip_geolocation(ip)

printDetails("83.149.9.216")
```

```
['55.7522', '37.6156']
```

Start coding or generate with AI.

```
PythonRDD[84] at collect at <ipython-input-91-4cd22bc3d850>:1
```

```
ip_loc = ipCounts.map( lambda x: printDetails(x[0]) )
```

```
locations = ip_loc.collect()
```

```
locations_l = [l for l in locations if l is not None]
```

```
locations_df = pd.DataFrame(locations_l, columns=['latitude', 'longitude'])
```

```
locations_df
```

	latitude	longitude
0	55.7522	37.6156
1	-7.7625	110.4317
2	48.5839	7.7455
3	31.2222	121.4581
4	14.6407	-90.5133
...	...	...
1748	50.6942	3.1746
1749	47.0056	28.8575
1750	32.6469	-97.3325
1751	59.9386	30.3141
1752	25.7743	-80.1937

1753 rows × 2 columns

Next steps: Generate code with `locations_df` View recommended plots New interactive sheet

```
locations_df['latitude'] = locations_df['latitude'].astype(float)
locations_df['longitude'] = locations_df['longitude'].astype(float)
```

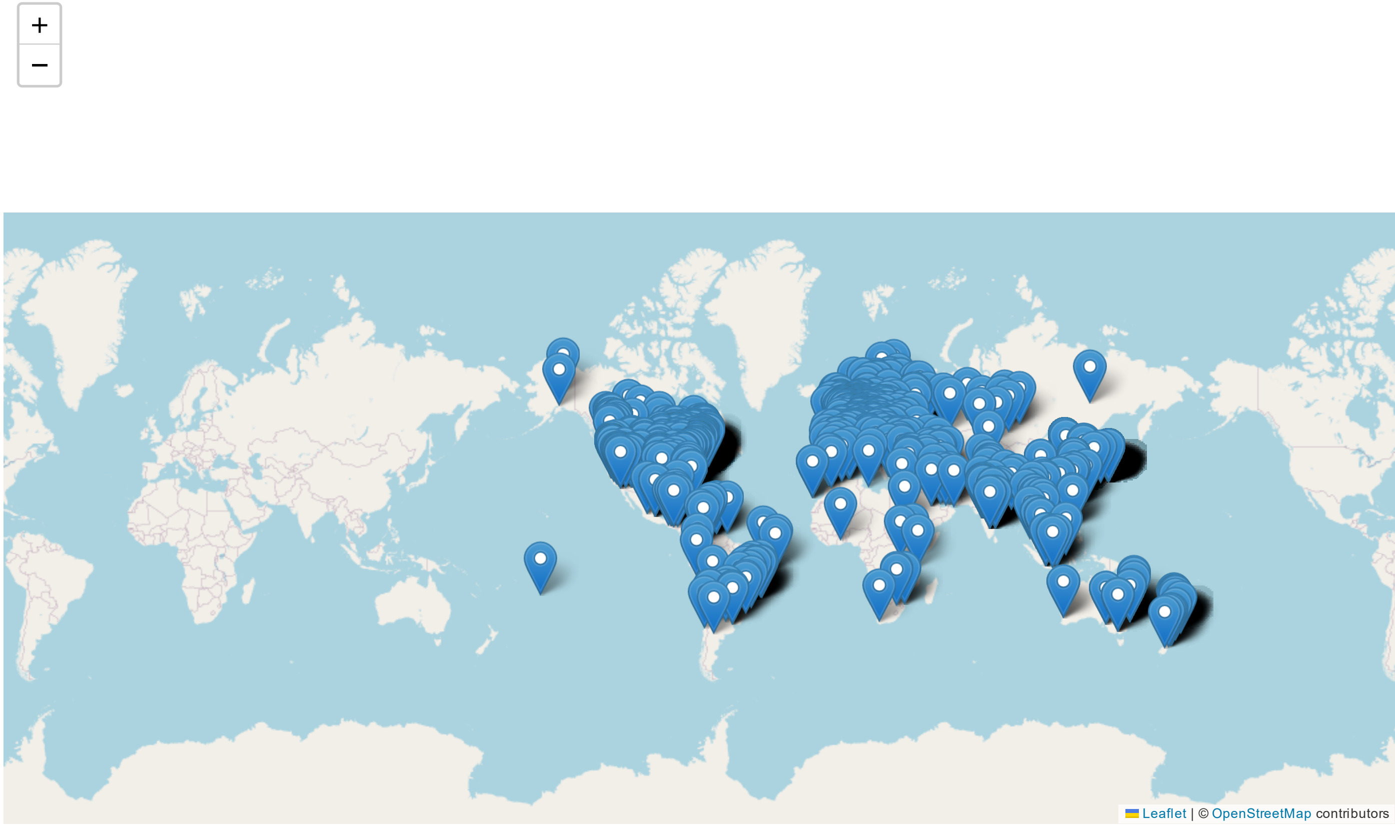
```
import folium

# Create a world map
world_map = folium.Map(zoom_start=2)

# Add markers for each geolocation
for location in locations_l:
    folium.Marker(location).add_to(world_map)

# Save the map as an HTML file
world_map.save('ip_geolocation_map.html')

display(world_map)
```


+
−
Leaflet | © OpenStreetMap contributors