makerlabs Documentation

Release 0.18

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Contents:

A python library for accessing online data about Makerspaces, Fab Labs, Hackerspaces, TechShop... and for formatting the data in order to give a unified API for understanding Maker platforms.

See an example of what can be done with the data on the MakerSpacesRadar and in the Tutorial how to generate the data for it. Source code for the MakerSpacesRadar is available here.

You can also download the tutorial as a `Jupyter Notebook`

Install it from pypi:

```
pip install makerlabs
```

Import a module of the package:

```
from makerlabs import fablabs_io
```

Get, for example, the labs:

```
labs_data = fablabs_io.get_labs(format="dict")
```

Some modules require access to the OpenCage API, please get your API key here .

See more here: modindex

CHAPTER 1

Tutorial

1.1 Import modules

In [1]:
```
# -*- coding: UTF-8 -*-

# Render our plots inline
%matplotlib inline

import pandas as pd
import matplotlib
import matplotlib.pyplot as plt
import numpy as np
import seaborn
import shutil

pd.set_option('display.max_columns', None) # Display all the columns

# Reference for color palettes: http://web.stanford.edu/~mwaskom/software/seaborn/tutorial/c

# Change the font
matplotlib.rcParams.update({'font.family': 'Source Sans Pro'})
```

In [2]:
```
from makerlabs import fablabs_io
from makerlabs import diybio_org
from makerlabs import hackerspaces_org
```

1.2 Load data

In [3]:
```
flio = fablabs_io.get_labs(format="pandas")
```

In [4]:
```
# Add the OpenCage API Key here, from https://geocoder.opencagedata.com/api
diybio = diybio_org.get_labs(format="pandas", open_cage_api_key="xxxxxxx")
```

```
In [5]: # Add the OpenCage API Key here, from https://geocoder.opencagedata.com/api
        hackerspaces = hackerspaces_org.get_labs(format="pandas", open_cage_api_key="xxxxxxx")
```

1.3 Check data

```
In [6]: flio.head()
```

```
Out[6]: address_1  \
        123
        1535fablab                              115A, Rue Emile Mark
        2188mk       2188 Maker Space, 2nd Floor, Business Center
        36incfablab                               City Center Mall
        3dbell                         Via Giovanni Amendola, n.9

                                                          address_2  \
        123
        1535fablab
        2188mk       Shenzhen Institute of Information Technology, ...
        36incfablab                                          3rd floor
        3dbell

                                             address_notes  \
        123
        1535fablab
        2188mk
        36incfablab  Go up the escalator to the third floor.
        3dbell

                                                            avatar  \
        123          http://fablabs.io.s3.amazonaws.com/2018/01/31/...
        1535fablab   http://fablabs.io.s3.amazonaws.com/2017/01/28/...
        2188mk       http://fablabs.io.s3.amazonaws.com/2017/01/28/...
        36incfablab  http://fablabs.io.s3.amazonaws.com/2017/01/28/...
        3dbell       http://fablabs.io.s3.amazonaws.com/2017/01/28/...

                                                             blurb  \
        123
        1535fablab
        2188mk       2188 Maker Space is a maker space supported by...
        36incfablab       Part of the State of Chhattisgarh Incubator.
        3dbell                                    "da IDEA a MATERIA"

                                                       capabilities  \
        123                                                      []
        1535fablab   [three_d_printing, cnc_milling, circuit_produc...
        2188mk       [three_d_printing, cnc_milling, circuit_produc...
        36incfablab  [three_d_printing, cnc_milling, circuit_produc...
        3dbell                                    [three_d_printing]

                                    city      continent        country country_code  \
        123                                 North America  United States          USA
        1535fablab            Differdange         Europe     Luxembourg          LUX
        2188mk                   Shenzhen           Asia          China          CHN
        36incfablab                Raipur           Asia          India          IND
        3dbell       Mercato San Severino         Europe          Italy          ITA

                        county                                        description  \
```

```
123
1535fablab              A Fab Lab (Fabrication Laboratory) is an open ...
2188mk       Guangdong  2188 Maker Space building as an important goal...
36incfablab         CG  36 Inc is the Technology and Business Incubato...
3dbell         Salerno

                                email    id lab_type latitude  \
123                                    832  Fab Lab   39.756
1535fablab   fablablux@technoport.lu   979  Fab Lab  49.5216
2188mk           jinyan@sziit.edu.cn  1069  Fab Lab        0
36incfablab          ceochips@nic.in  1092  Fab Lab        0
3dbell                info@3dbell.it   925  Fab Lab  40.7846

                                                          links longitude  \
123                         {u'twitter': u'', u'facebook': u''}  -100.713
1535fablab   {u'twitter': u'', u'facebook': u'', 1722: u'ht...   5.89988
2188mk       {1884: u'http://www.2188mk.com', u'twitter': u...         0
36incfablab  {1940: u'http://36inc.gov.in/fablab', u'twitte...         0
3dbell       {u'twitter': u'', 1619: u'http://www.3dbell.it...   14.7605

                                name             phone postal_code  \
123                              xyz
1535fablab             1535°C FabLab  +352 545 580 438      L-4620
2188mk       Fablab 2188 Maker Space  +86 755 89226685      518172
36incfablab            36 Inc Fablab   +91-771-4014158      492001
3dbell                 3DBell FabLab       0899764122       84085

                     slug      source                                    url
123                   123  fablabs.io          https://www.fablabs.io/labs/123
1535fablab    1535fablab  fablabs.io   https://www.fablabs.io/labs/1535fablab
2188mk            2188mk  fablabs.io       https://www.fablabs.io/labs/2188mk
36incfablab  36incfablab  fablabs.io  https://www.fablabs.io/labs/36incfablab
3dbell            3dbell  fablabs.io       https://www.fablabs.io/labs/3dbell
```

In [7]:
```
diybio.head()
```

Out[7]:
```
address_1        city      continent  \
berkeleybiolabs.com/             Berkeley  North America
bioartlab.com/                  Eindhoven         Europe
bioclub.org/                        Tokyo           Asia
biocurious.org/                 Sunnyvale  North America
biodidact.net/                 Los Alamos  North America

                                      country country_code  \
berkeleybiolabs.com/  United States of America          USA
bioartlab.com/                The Netherlands          NLD
bioclub.org/                            Japan          JPN
biocurious.org/       United States of America          USA
biodidact.net/        United States of America          USA

                                   county    lab_type latitude longitude  \
berkeleybiolabs.com/      Alameda County  DIYBio Lab  37.8708  -122.273
bioartlab.com/                      None  DIYBio Lab  51.4486   5.45012
bioclub.org/                        None  DIYBio Lab  34.2256   139.295
biocurious.org/       Santa Clara County  DIYBio Lab  37.3688  -122.036
biodidact.net/         Los Alamos County  DIYBio Lab  35.8814  -106.299

                                       name postal_code                 slug  \
berkeleybiolabs.com/  berkeleybiolabs.com/        None  berkeleybiolabs.com/
bioartlab.com/              bioartlab.com/        None        bioartlab.com/
```

```
bioclub.org/                  bioclub.org/        None          bioclub.org/
biocurious.org/             biocurious.org/       None        biocurious.org/
biodidact.net/               biodidact.net/       None         biodidact.net/

                            source          state                          url
berkeleybiolabs.com/  diybio.org     California  http://berkeleybiolabs.com/
bioartlab.com/        diybio.org  North Brabant        http://bioartlab.com/
bioclub.org/          diybio.org          Tokyo      http://www.bioclub.org/
biocurious.org/       diybio.org     California       http://biocurious.org/
biodidact.net/        diybio.org     New Mexico        http://biodidact.net/
```

In [8]:
```
hackerspaces.head()
```

Out[8]:
```
address_1  city continent  \
name
"Portsmouth_Makerspace"               NaN   NaN       NaN
*.*                              None None  None      None
-RWebLAB                 Cami des Castell    Maó    Europe
..::c0re1ndustries::..                       Labu      Asia
/dev/base                             NaN   NaN       NaN

                                          country country_code  \
name
"Portsmouth_Makerspace"                       NaN          NaN
*.*                                          None         None
-RWebLAB                 Spain (territorial waters)          ESP
..::c0re1ndustries::..                        PRC          CHN
/dev/base                                     NaN          NaN

                                  county  \
name
"Portsmouth_Makerspace"              NaN
*.*                                 None
-RWebLAB                          Menorca
..::c0re1ndustries::..   Chindu County
/dev/base                            NaN

                                                          email equipment  \
name
"Portsmouth_Makerspace"  portsmouthmakerspace@groups.facebook.com       NaN
*.*                                          josagal8@gmail.com       NaN
-RWebLAB                                                    NaN       NaN
..::c0re1ndustries::..                  thetanktheory@gmail.com       NaN
/dev/base                                                   NaN       NaN

                         eventbrite  \
name
"Portsmouth_Makerspace"         NaN
*.*                             NaN
-RWebLAB                        NaN
..::c0re1ndustries::..          NaN
/dev/base                       NaN

                                                                facebook  \
name
"Portsmouth_Makerspace"  https://www.facebook.com/groups/portsmouthmake...
*.*                                                                  NaN
-RWebLAB                                                             NaN
..::c0re1ndustries::..                                               NaN
/dev/base                                                            NaN
```

```
                                                                      fee  \
name
"Portsmouth_Makerspace"  Currently there is no fee, as meetings have no...
*.*                                                                   NaN
-RWebLAB                                                              NaN
..::c0re1ndustries::..                                                 NA
/dev/base                                                             NaN

                        flickr forum    founding googleplus ical  irc jabber  \
name
"Portsmouth_Makerspace"    NaN   NaN  2017/01/05        NaN  NaN  NaN    NaN
*.*                        NaN   NaN  2011/07/14        NaN  NaN  NaN    NaN
-RWebLAB                   NaN   NaN         NaN        NaN  NaN  NaN    NaN
..::c0re1ndustries::..     NaN   NaN  2010/01/26        NaN  NaN  NaN    NaN
/dev/base                  NaN   NaN  2017/08/18        NaN  NaN  NaN    NaN

                           lab_type latitude  \
name
"Portsmouth_Makerspace"  Hackerspace      NaN
*.*                      Hackerspace     None
-RWebLAB                 Hackerspace  39.8856
..::c0re1ndustries::..   Hackerspace  33.2664
/dev/base                Hackerspace      NaN

                                              logo longitude  \
name
"Portsmouth_Makerspace"  Makerspace Picture Linkedin.jpg       NaN
*.*                                                NaN      None
-RWebLAB                                           NaN   4.26835
..::c0re1ndustries::..                             NaN   97.1388
/dev/base                                          NaN       NaN

                                                          maillist  \
name
"Portsmouth_Makerspace"                                        NaN
*.*                                             josagal8@gmail.com
-RWebLAB                                                       NaN
..::c0re1ndustries::..   http://www.facebook.com/group.php?gid=44679852...
/dev/base                                                      NaN

                        membercount      phone postal_code  \
name
"Portsmouth_Makerspace"          13        NaN         NaN
*.*                               1  6057138**        None
-RWebLAB                          3        NaN       07702
..::c0re1ndustries::..           13        NaN        None
/dev/base                         5        NaN         NaN

                                          site size            source  \
name
"Portsmouth_Makerspace"                     NaN  NaN  hackerspaces.org
*.*                                         NaN  NaN  hackerspaces.org
-RWebLAB                   http://sevilleta.es  NaN  hackerspaces.org
..::c0re1ndustries::..   www.c0re1ndustries.com   NA  hackerspaces.org
/dev/base                                   NaN  NaN  hackerspaces.org

                                    state    status  \
name
```

```
"Portsmouth_Makerspace"              NaN  building
*.*                                 None   planned
-RWebLAB                 Balearic Islands  building
..::c0re1ndustries::..            Qinghai   planned
/dev/base                             NaN  building

                                                                    text  \
name
"Portsmouth_Makerspace"  \nOfficial group of the first Portsmouth (UK) ...
*.*
-RWebLAB                 \n-RWebLAB is a server-based hacklab from Spai...
..::c0re1ndustries::..   \nI am looking for a group of like-minded indi...
/dev/base

                        twitter ustream                       wiki youtube
name
"Portsmouth_Makerspace"     NaN     NaN                        NaN     NaN
*.*                         NaN     NaN                        NaN     NaN
-RWebLAB                    NaN     NaN  http://wiki.sevilleta.es     NaN
..::c0re1ndustries::..      NaN     NaN        www.c0re.wikia.com     NaN
/dev/base                   NaN     NaN                        NaN     NaN
```

1.4 Save data to csv

```
In [9]: flio.to_csv("flio.csv", encoding='utf-8')
```

```
In [10]: hackerspaces.to_csv("hs.csv", encoding='utf-8')
```

```
In [11]: diybio.to_csv("diybio.csv", encoding='utf-8')
```

1.5 Analyse data

```
In [12]: flio["country_code"].unique()
```

```
Out[12]: array([u'USA', u'LUX', u'CHN', u'IND', u'ITA', u'DEU', u'BRA', u'ARG',
                u'KOR', u'FRA', u'KAZ', u'ECU', u'SVK', u'RWA', u'BEL', u'POL',
                u'GEO', u'AUT', u'DNK', u'RUS', u'LBN', u'SGP', u'CAN', u'GUF',
                u'TWN', u'KWT', u'ESP', u'FIN', u'PRT', u'TUR', u'PHL', u'IRN',
                u'KHM', u'KEN', u'JPN', u'EGY', u'CHE', u'COL', u'CIV', u'GBR',
                u'NLD', u'BEN', u'SAU', u'ZAF', u'MAR', u'TTO', u'SEN', u'SRB',
                u'BGD', u'NZL', u'CMR', u'PAN', u'TUN', u'MLI', u'THA', u'SLV',
                u'HRV', u'CHL', u'ETH', u'AUS', u'AFG', u'ISL', u'JOR', u'MEX',
                u'GRC', u'PER', u'BHR', u'IDN', u'CZE', u'ROU', u'HUN', u'VNM',
                u'PRY', u'ARE', u'ISR', u'LTU', u'PAK', u'MYS', u'LVA', u'IRL',
                u'SVN', u'NOR', u'PSE', u'PRI', u'QAT', u'REU', u'SUR', u'SWE',
                u'MLT', u'CRI', u'NAM', u'UKR', u'NGA', u'BFA', u'OMN', u'BOL',
                u'HKG', u'GTM', u'GLP', u'MNE', u'MAC', u'URY', u'BGR', u'GHA',
                u'TGO', u'JAM'], dtype=object)
```

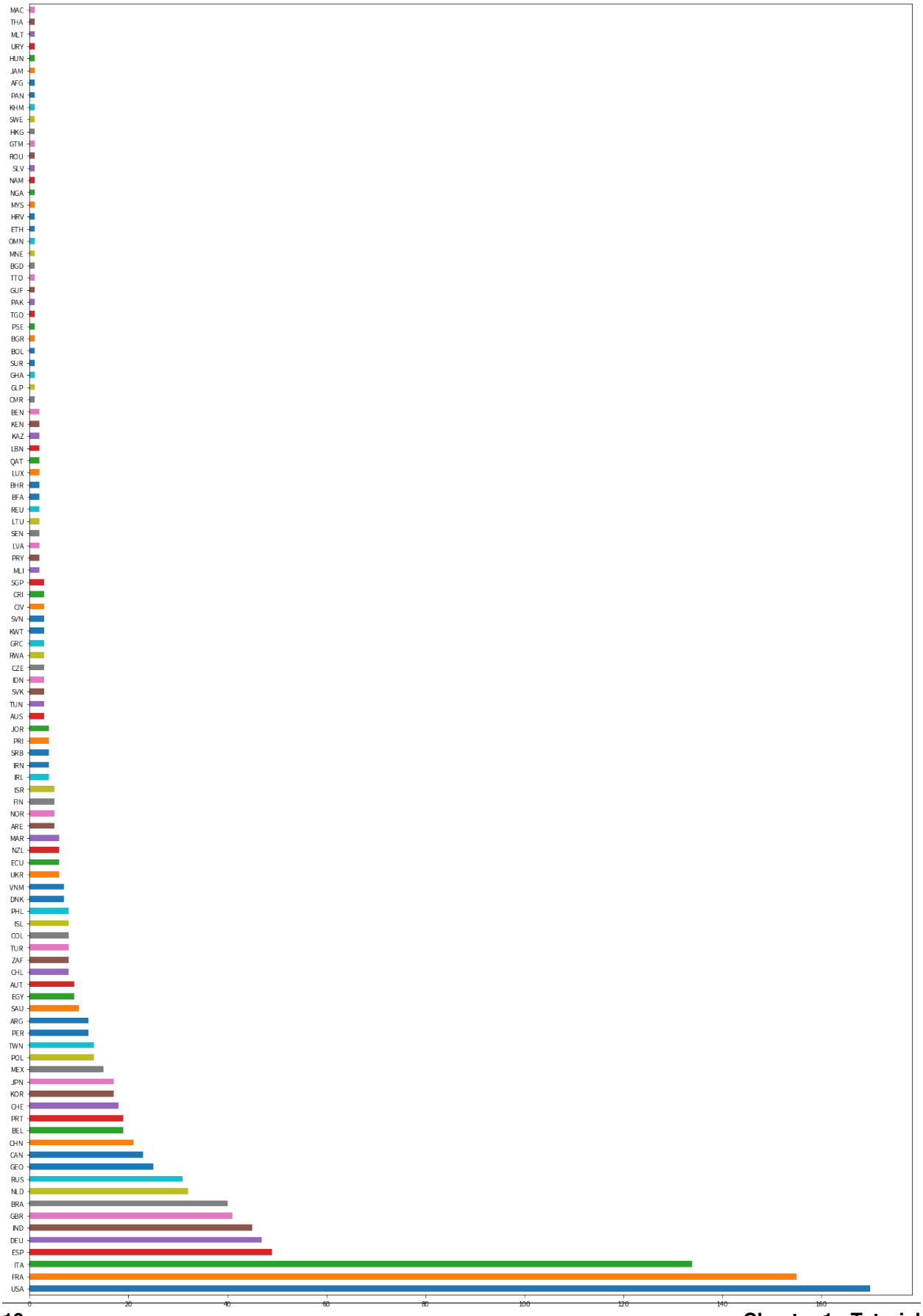
```
In [13]: flio["country_code"].value_counts()
```

```
Out[13]: USA    170
         FRA    155
         ITA    134
         ESP     49
         DEU     47
         IND     45
```

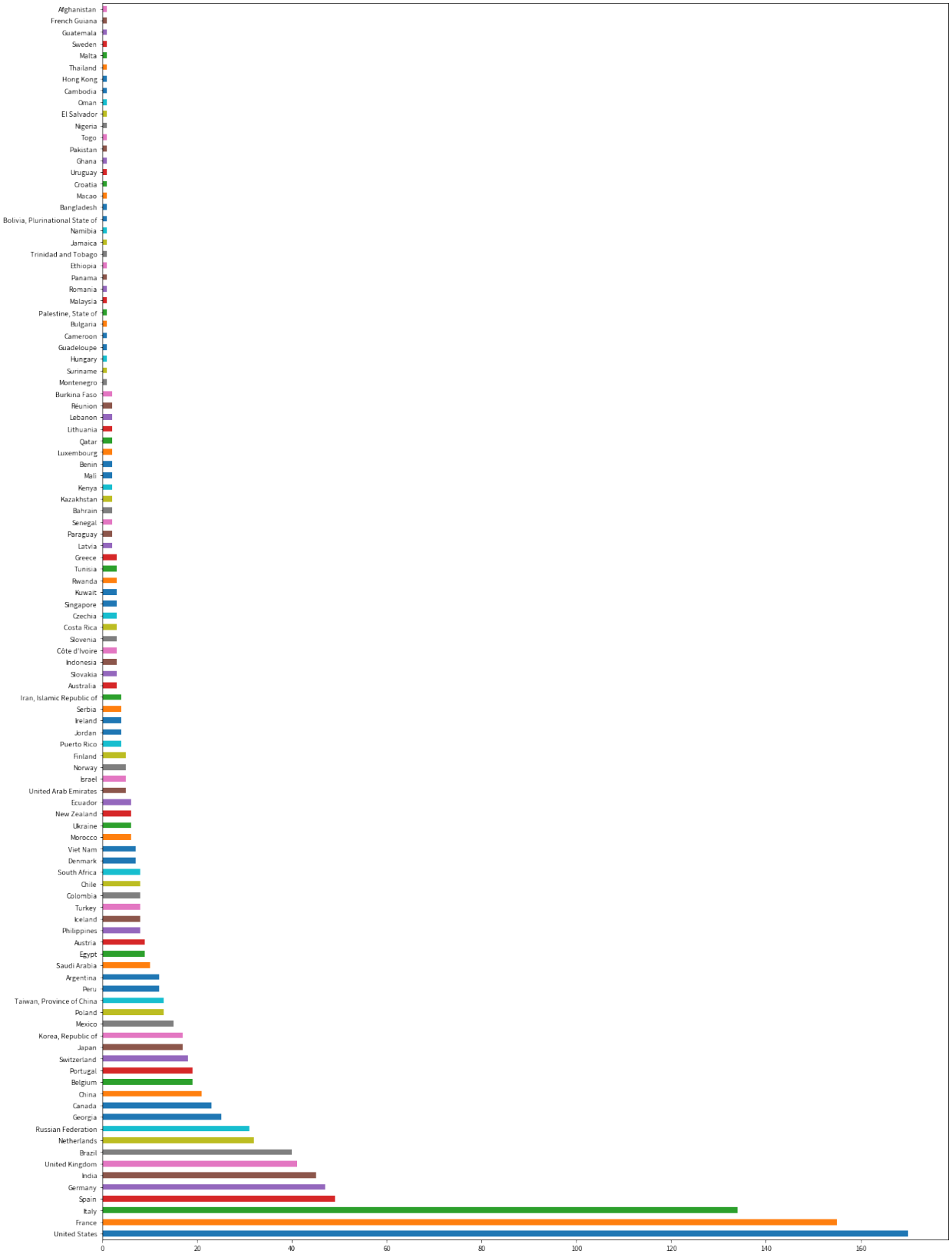
```
GBR     41
BRA     40
NLD     32
RUS     31
GEO     25
CAN     23
CHN     21
BEL     19
PRT     19
CHE     18
KOR     17
JPN     17
MEX     15
POL     13
TWN     13
PER     12
ARG     12
SAU     10
EGY      9
AUT      9
CHL      8
ZAF      8
TUR      8
COL      8
      ...
SUR      1
BOL      1
BGR      1
PSE      1
TGO      1
PAK      1
GUF      1
TTO      1
BGD      1
MNE      1
OMN      1
ETH      1
HRV      1
MYS      1
NGA      1
NAM      1
SLV      1
ROU      1
GTM      1
HKG      1
SWE      1
KHM      1
PAN      1
AFG      1
JAM      1
HUN      1
URY      1
MLT      1
THA      1
MAC      1
Name: country_code, Length: 106, dtype: int64
```

```
In [14]: flio["country_code"].value_counts().plot(kind="barh", figsize=(20,30))
```

```
Out[14]: <matplotlib.axes._subplots.AxesSubplot at 0x10ee26fd0>
```

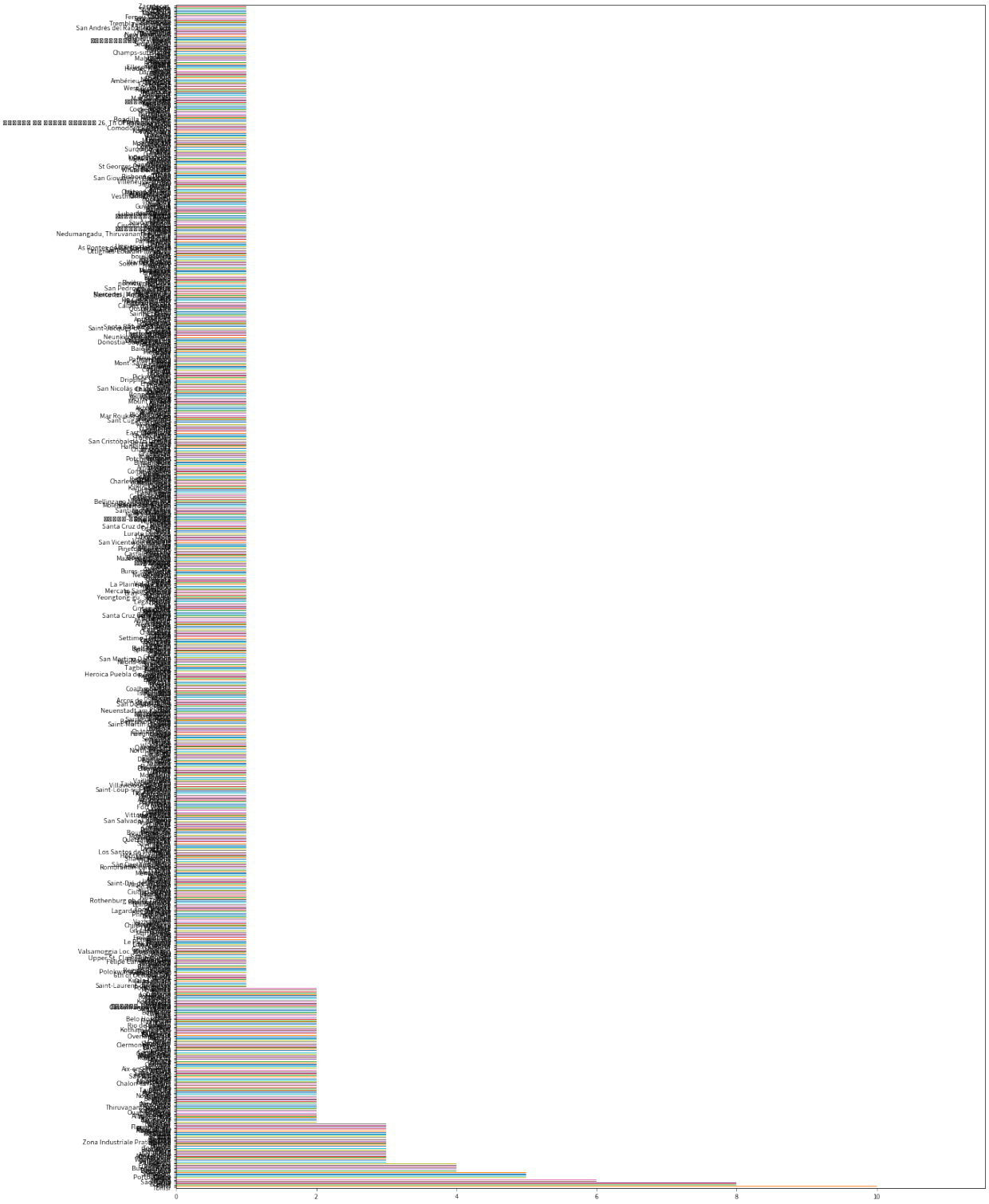

MAC
THA
MLT
URY
HUN
JAM
AFG
PAN
KHM
SWE
HKG
GTM
ROU
SLV
NAM
NGA
MYS
HRV
ETH
OMN
MNE
BGD
TTO
GUF
PAK
TGO
PSE
BGR
BOL
SUR
GHA
GLP
OMR
BEN
KEN
KAZ
LBN
QAT
LUX
BHR
BFA
REU
LTU
SEN
LVA
PRY
MLI
SGP
CRI
CIV
SVN
KWT
GRC
RWA
CZE
IDN
SVK
TUN
AUS
JOR
PRI
SRB
IRN
IRL
ISR
FIN
NOR
ARE
MAR
NZL
ECU
UKR
VNM
DNK
PHL
ISL
COL
TUR
ZAF
CHL
AUT
EGY
SAU
ARG
PER
TWN
POL
MEX
JPN
KOR
CHE
PRT
BEL
CHN
CAN
GEO
RUS
NLD
BRA
GBR
IND
DEU
ESP
ITA
FRA
USA
0
20
40
60
80
100
120
140
160

```
In [15]: flio["country"].value_counts().plot(kind="barh", figsize=(20,30))
Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x10f0e1690>
```



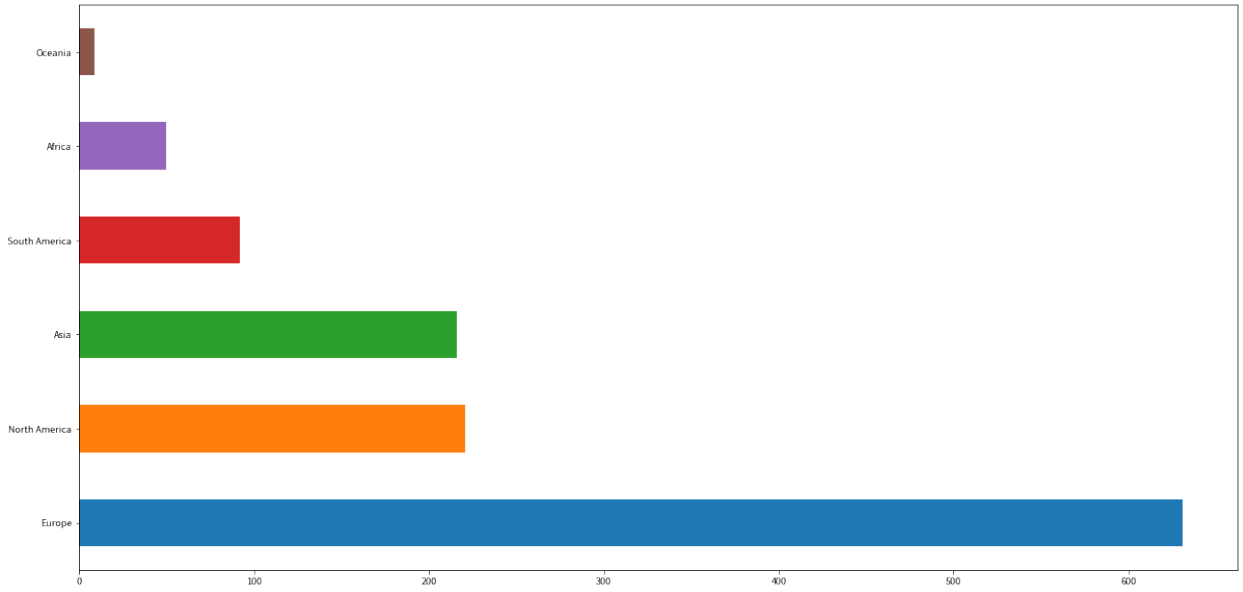

```
In [16]: flio["city"].value_counts().plot(kind="barh", figsize=(20,30))
```

```
Out[16]: <matplotlib.axes._subplots.AxesSubplot at 0x110897550>
```




```
In [17]: flio["continent"].value_counts().plot(kind="barh", figsize=(20,10))
```

```
Out[17]: <matplotlib.axes._subplots.AxesSubplot at 0x1113f21d0>
```



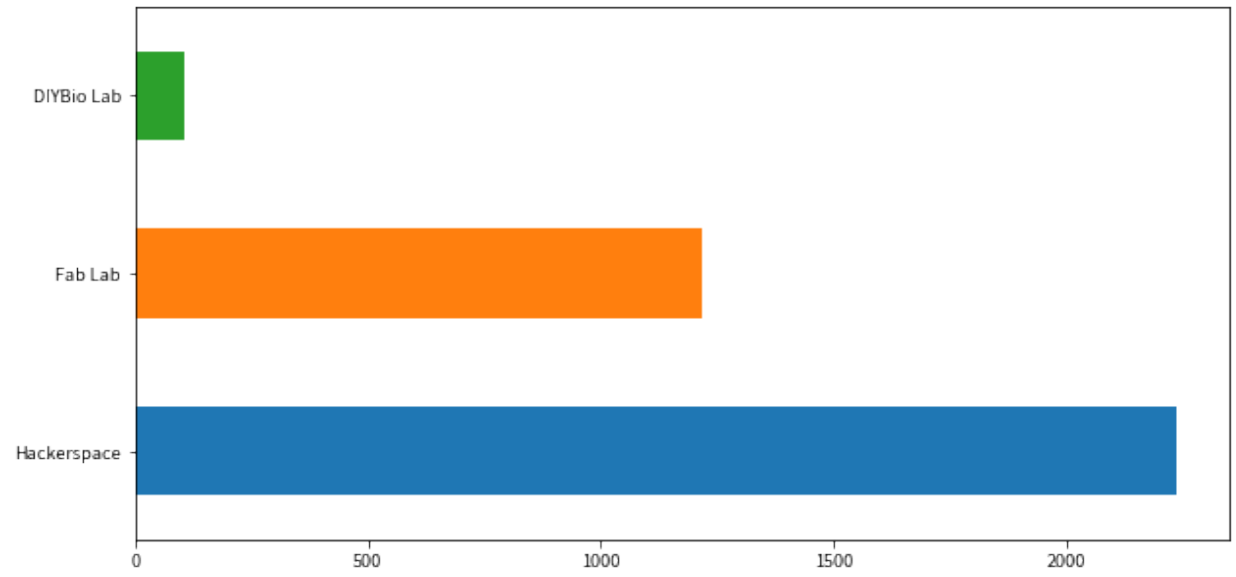
1.6 Data export for the MakerSpacesRadar

```
In [18]: # Concatenate the three DataFrames, in order to handle global data
         total_data = pd.concat([flio, diybio, hackerspaces])
```

1.6.1 00.csv

```
In [19]: # Number of each type of labs
         number_of_labs = total_data["lab_type"].value_counts()
         number_of_labs.plot(kind="barh", figsize=(10,5))
```

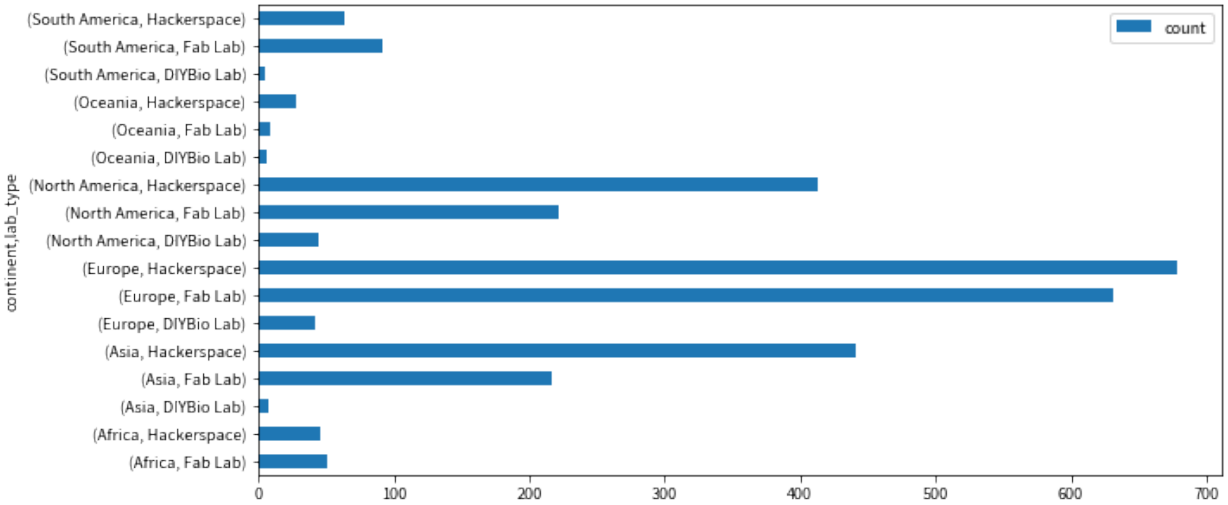
```
Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x111b01e90>
```



```
In [20]: # number_of_labs is a Series, convert it into a DataFrame with a cluster column and save it
         csv0 = pd.DataFrame()
         csv0["count"] = number_of_labs
         csv0["lab_type"] = number_of_labs.index
         csv0.insert(0, "cluster", "total")
         csv0.set_index('cluster', inplace=True)
         csv0 = csv0[["lab_type", "count"]]

In [21]: csv0

Out[21]: lab_type  count
         cluster
         total    Hackerspace   2238
         total        Fab Lab   1219
         total     DIYBio Lab    104

In [22]: csv0.to_csv("00.csv", encoding='utf-8')
```

1.6.2 01.csv

```
In [23]: # Number of each type of labs per continent
         csv1 = total_data.groupby(['continent', 'lab_type']).size().to_frame('count')
         csv1.plot(kind="barh", figsize=(10,5))

Out[23]: <matplotlib.axes._subplots.AxesSubplot at 0x112589ad0>
```




```
In [24]: csv1

Out[24]: count
                                 count
         continent     lab_type
         Africa        Fab Lab      50
                       Hackerspace  46
         Asia          DIYBio Lab    7
                       Fab Lab      216
                       Hackerspace  441
         Europe        DIYBio Lab   42
                       Fab Lab      631
                       Hackerspace  678
         North America DIYBio Lab   44
                       Fab Lab      221
                       Hackerspace  413
```

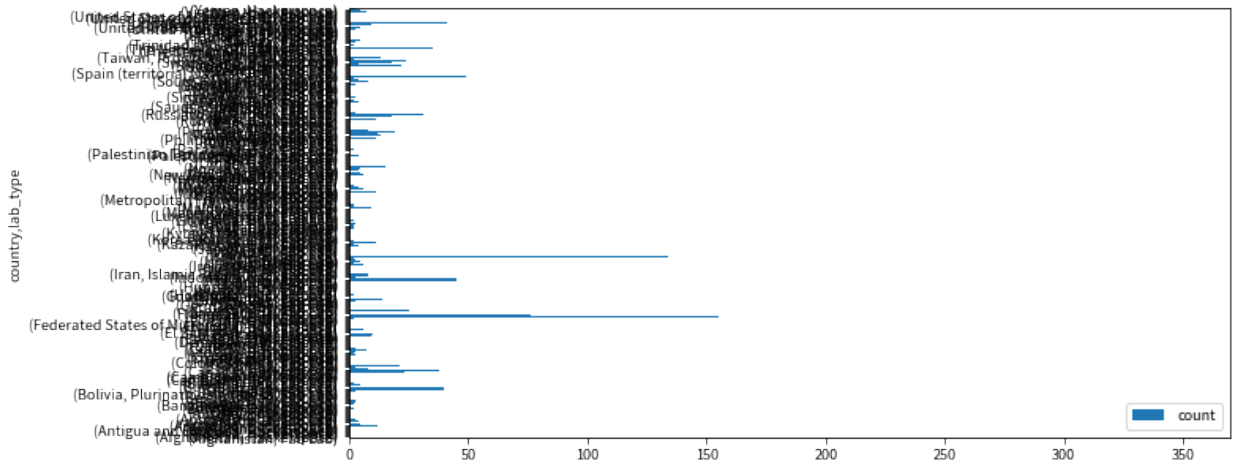
```
Oceania       DIYBio Lab       6
              Fab Lab          9
              Hackerspace     28
South America DIYBio Lab       5
              Fab Lab         92
              Hackerspace     63
```

```
In [25]: csv1.to_csv("01.csv", encoding='utf-8', header=True)
```

1.6.3 02.csv

```
In [26]: # Number of each type of labs per country
         csv2 = total_data.groupby(['country', 'lab_type']).size().to_frame('count')
         csv2.plot(kind="barh", figsize=(10,5))
```

```
Out[26]: <matplotlib.axes._subplots.AxesSubplot at 0x112397e90>
```




```
In [27]: csv2.head()
```

```
Out[27]: count
         country             lab_type
         Afghanistan         Fab Lab          1
                             Hackerspace      1
         Albania             Hackerspace      1
         Algeria             Hackerspace      4
         Antigua and Barbuda Hackerspace      1
```

```
In [28]: csv2.to_csv("02. csv", encoding='utf-8', header=True)
```

1.6.4 03.csv

```
In [29]: # Number of each type of labs per city
         csv3 = total_data.groupby(['city', 'lab_type']).size().to_frame('count')
```

```
In [30]: csv3.tail()
```

```
Out[30]: count
         city  lab_type
            Fab Lab          1
             Fab Lab         1
           Hackerspace      1
```

```
          Fab Lab          1
          Fab Lab          3
```

```
In [31]: csv3.sort_values(by="count").head()
```

```
Out[31]: count
         city            lab_type
         Lublin          Fab Lab          1
         Norfolk         Fab Lab          1
                         DIYBio Lab       1
         Noida           Hackerspace      1
         Nizhny Novgorod Hackerspace      1
```

```
In [32]: csv3.to_csv("03.csv", encoding='utf-8', header=True)
```

1.6.5 04.csv

```
In [33]: # Count labs
         csv4 = flio.groupby(["country", "country_code"])['country'].count().reset_index(name="count"
```

```
In [34]: # Reorder columns for plotly
         csv4 = csv4[["count", "country_code"]]
```

```
In [35]: # Check the data
         csv4.head()
```

```
Out[35]: count country_code
         country
         Afghanistan      1          AFG
         Argentina       12          ARG
         Australia        3          AUS
         Austria          9          AUT
         Bahrain          2          BHR
```

```
In [36]: # Save file
         csv4.to_csv("04.csv", encoding='utf-8', header=True)
```

1.6.6 05.csv

```
In [37]: # Count labs
         csv5 = hackerspaces.groupby(["country", "country_code"])['country'].count().reset_index(name
```

```
In [38]: # Reorder columns for plotly
         csv5 = csv5[["count", "country_code"]]
```

```
In [39]: # Check the data
         csv5.head()
```

```
Out[39]: count country_code
         country
         Afghanistan              1          AFG
         Albania                  1          ALB
         Algeria                  4          DZA
         Antigua and Barbuda      1          ATG
         Argentina                5          ARG
```

```
In [40]: # Save file
         csv5.to_csv("05.csv", encoding='utf-8', header=True)
```

1.6.7 06.csv

```
In [41]: # Count labs
         csv6 = diybio.groupby(["country", "country_code"])['country'].count().reset_index(name="cou

In [42]: # Reorder columns for plotly
         csv6 = csv6[["count", "country_code"]]

In [43]: # Check the data
         csv6.head()

Out[43]: count country_code
         country
         Argentina      1          ARG
         Australia      4          AUS
         Austria        1          AUT
         Belgium        3          BEL
         Brazil         3          BRA

In [44]: # Save file
         csv6.to_csv("06.csv", encoding='utf-8', header=True)
```

CHAPTER 2

Credits

makerlabs is based on several years of experimentation, which lead to the development of the module only in 2016.

The research leading to these results started in 2014 while Massimo Menichinelli was studying at Aalto University. This first development was later elaborated into a full software library and full analysis while working at IAAC | Fab City Research Lab in 2016-17 within the Horizon 2020 project MAKE-IT. Part of work on this software has received funding from the Horizon 2020 Programme of the European Union within the MAKE-IT project under grant agreement n° 688241. This publication reflects only the author's view and the Union is not liable for any use that may be made of the information contained therein.

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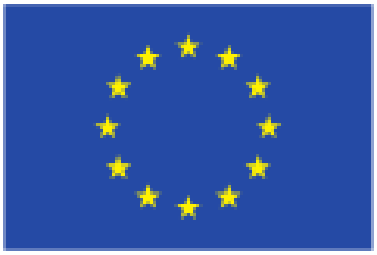

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CHAPTER 3

Indices and tables

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