

# facebook\_demographic\_research

April 26, 2017

## 1 Demographic Research with the Facebook Marketing API

### 2 Outline

1. Using Python in the terminal
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4. Register for Facebook Marketing API access
5. Explore pySocialWatcher module
6. Use pySocialWatcher to analyze a specific behavior (new movers)
7. Plot total new movers in subset dataframe

#### 2.1 Using Python in the terminal

- open the terminal in Mac by pressing the spacebar and command to open spotlight
  - type terminal in the spotlight search to open the terminal
- navigate to the directory that you downloaded or cloned the workshop to with `cd`
  - e.g. `cd tutorials/paa_2017_social_media` will change to the `paa_2017_social_media` folder within the tutorials directory
- open a jupyter notebook web browser with the command `jupyter notebook`

#### 2.2 Install pySocialWatcher

- **pySocialWatcher is currently only compatible with Python2.7**
  - if you downloaded Anaconda for Python3.x you can create a conda environment with Python2.7
    - \* first type `conda create -n py27 python=2.7` in the terminal to create a Python2.7 environment named `py27`
    - \* then type `source activate py27` to activate the `py27` environment
  - setup notebook in `py27` environment
    - \* `conda install notebook ipykernel matplotlib`
    - \* `ipython kernel install --user`
- install pySocialWatcher with the following commands in your terminal

- first, navigate into the pySocialWatcher in the Estimate\_Facebook\_Audience folder
- then, type the following two commands in the terminal ~ `pip install -r requirements.txt`  
`python setup.py install ~`

- pySocialWatcher [examples and documentation](#)
- [quick tutorial](#) on pySocialWatcher module

## 2.3 Import modules

- `import` is a Python module
- gives the current namespace access to the code in another module by the process of importing it
- equivalent to `library(package)` in R
- [import documentation](#)

### 2.3.1 import features

- import specific functions from a module
  - example: `from collections import OrderedDict`
- create an alias for a module names by using “as”
  - example: `import pandas as pd` imports the pandas module but assigns this module the name “pd” in the namespace
  - alias allows quicker access to functions:
    - \* example: instead of using `pandas.read_csv()` to read a .csv file can now type `pd.read_csv()`
- use `import` to import custom code/functions from a Python .py file in the current directory
  - example: `from utils import *`
  - `utils.py` is a script with two functions for this module

```
In [1]: # uncomment the line below to view the functions in utils.py
        ## cat utils.py
```

```
In [2]: import os
        import re
        import sys
        import csv
        import json
        import glob
        import numpy as np
        import pandas as pd
        from datetime import datetime
        import matplotlib.pyplot as plt
        from collections import OrderedDict
        from pysocialwatcher import watcherAPI
        from utils import *
```

### 2.3.2 module documentation

- standard library modules:

- `os`
- `re`
- `csv`
- `sys`
- `json`
- `glob`
- `datetime`
- `collections`

- open source modules:

- `numpy`
- `pandas`
- `matplotlib`
- `pySocialWatcher`

### 2.3.3 Python classes and functions

- modules allow for the creation of object classes and specific functions
- a class is an object that has certain features
  - [class documentation](#)
- using a function within a Python module
  - functions within a module are accessed by typing the name for the module in the namespace and then a period (.)
    - \* example: view current working directory (function) within the `os` module
    - \* `os.getcwd()`
    - \* similar to `getwd()` in R

```
In [ ]: os.getcwd()
```

## 2.4 Register for Facebook Marketing API access:

- Go to <https://developers.facebook.com/apps/>
- Click “Get Started” in the top right
- Create a new app by clicking on “+ Add a New App” and follow the process minimally
- In the app’s dashboard page, click “+ Add product” in the toolbar on the left
- Select “Marketing” Product Setup
- Click “Get Access Token”
- Click “Extend Access Token” button (at the bottom) (the button may not show up right away, just refresh the page)
  - The access token that shows up under the form is the one you want! It will look something like this: EAAHMon-BRQ5kBALhYvCnLRsNRyO9YJH8l6ZBKwby5cLrS4V2GZAC2GT2MbDHXjpwnfvkPB0ZBv7knZAP1

- Finally, you want to get your Ads Manager Account ID.
- Go to <https://www.facebook.com/business/> and click “Create Advert”
- In URL, copy the part starting with act= such as: <https://www.facebook.com/ads/manager/creation/creat>
- `### Create facebook_credentials.csv`
- change directory to the credentials folder
  - create a .csv file named “facebook\_credentials.csv”
  - paste your Facebook Access Token in the first row, first column
  - paste your Ads Manager Account ID in the first row, second column

### 2.4.1 Load Facebook credentials

- `watcherAPI()` is a class within the `pySocialWathcer` module that makes requests with the Facebook Marketing API
  - `watcherAPI()` has multiple attributes including credentials
- `load_credentials_file` is a function within the `watcher` class that allows users to upload a .csv of Facebook Marketing API credentials
- `check_tokens_account_valid` is a function that sends a generic example request to the Facebook Marketing API to assess the validity of the credentials loaded from the `load_credentials_file` function

```
In [3]: watcher = watcherAPI()
        watcher.load_credentials_file("../credentials/facebook_credentials.csv")
        watcher.check_tokens_account_valid()
```

```
2017-04-26 09:47:32 Kivans-MacBook-Pro.local root[5468] INFO Testing tokens and acc
2017-04-26 09:47:32 Kivans-MacBook-Pro.local root[5468] INFO          Sending in req
2017-04-26 09:47:32 Kivans-MacBook-Pro.local requests.packages.urllib3.connectionpo
2017-04-26 09:47:34 Kivans-MacBook-Pro.local root[5468] INFO All tokens and respect
```

### 2.4.2 Explore pySocialWatcher module

- Can gather demographic and event parameters available on the Marketing API
  - [Demographic and event targeting parameters](#)
- **ALL** search parameters, such as city name must map to a (numeric) key value known the the Marketing API
- `print_geo_locations_given_query_and_location_type`
  - function to search for Facebook key of cities by name
    - \* e.g. search for cities that have “new” in their name

```
In [ ]: watcherAPI.print_geo_locations_given_query_and_location_type("new", ["city"]
In [4]: watcher.print_bad_joke()
```

I used to think the brain was the most important organ.  
Then I thought, look what’s telling me that.

### 2.4.3 view available “behaviors” parameters

- can segment demographic groups by multiple parameters including “behaviors”

```
In [ ]: watcher.print_behaviors_list()
```

- read in a .csv file with pandas module’s read\_table function
  - converts a .csv file into a dataframe
- this .csv contains all 50 US states and their correspond Facebook Marketin API location key (FB\_key)

```
In [5]: US_states = pd.read_table("../data/US_states.csv", sep = ",", header=0)
US_states.head()
```

```
Out[5]:
```

	Abbreviation	State Name	FB_key
0	AL	Alabama	3843
1	AK	Alaska	3844
2	AZ	Arizona	3845
3	AR	Arkansas	3846
4	CA	California	3847

### 2.4.4 View an entire row in a dataframe

```
In [6]: US_states.iloc[12]
```

```
Out[6]:
```

Abbreviation	IL
State Name	Illinois
FB_key	3856

Name: 12, dtype: object

### 2.4.5 Making API request with pySocialWatcher

- watcher class has a run\_data\_collection function
- run\_data\_collection takes a .json file as an input and creates an API request
- output from run\_data\_collection is a pandas dataframe and .csv files

#### creating .json input files

- the following code creates a dictionary and saves a .json file (“IL\_example.json”) in the data folder
- we can convert Python dictionaries into .json files for the run\_data\_collection function

```
In [7]: illinois_dic={"name": "IL_example", "geo_locations": [{"name": "regions",
                                                             "values": [{"key": "location_types":
                                                             "genders": [0,1,2],
                                                             "ages_ranges": [{"min":13, "max":65}]}]}
```

```
illinois_dic_ordered = OrderedDict(sorted(illinois_dic.items(),key=lambda t
```

```

illinois_dic_json=json.dumps(illinois_dic_ordered, indent = 4)
print illinois_dic_json

file_name = "IL_example.json"

with open('../data/%s' % file_name, 'w') as outfile:
    outfile.write(json.dumps(illinois_dic_ordered, indent = 4))
{
  "name": "IL_example",
  "genders": [
    0,
    1,
    2
  ],
  "ages_ranges": [
    {
      "max": 65,
      "min": 13
    }
  ],
  "geo_locations": [
    {
      "values": [
        {
          "key": "3856"
        }
      ],
      "name": "regions",
      "location_types": [
        "home"
      ]
    }
  ]
}

```

make a request to the Marketing API with the example dictionary created above

```
In [ ]: watcher.run_data_collection("../data/%s" % file_name)
```

## 2.5 Use pySocialWatcher to analyze a specific behavior

### 2.5.1 get data on new movers

6029662272682 | This Life Event segment contains consumers who are likely to be new movers in the last 6 months. | New mover

- the following code creates a new dictionary that incorporates (new mover) behavior and saves a .json file ("IL\_example\_new\_movers.json") in the data folder

```
In [ ]: illinois_dic_new_movers={"name": "IL_example", "geo_locations": [{"name": "
                                             "values": [{"key": "
                                             "location_types": "
    "genders": [0,1,2],
    "ages_ranges": [{"min":13, "max":65}],
    "behavior":[{"or": [6029662272682], "name": "new_mover"}]}

illinois_dic_new_movers_ordered = OrderedDict(sorted(illinois_dic_new_movers_ordered.items(),
illinois_dic_new_movers_json=json.dumps(illinois_dic_new_movers_ordered, indent=4))
print illinois_dic_new_movers_json

file_name = "IL_example_new_movers.json"

with open('../data/%s' % file_name, 'w') as outfile:
    outfile.write(json.dumps(illinois_dic_new_movers_ordered, indent = 4))
```

make a request to the Marketing API with the new movers dictionary created above

```
In [ ]: watcher.run_data_collection("../data/%s" % file_name)
```

## 2.6 Comparing states

- use pandas to subset US\_states dataframe

```
In [8]: state_subset = US_states.loc[US_states['Abbreviation'].isin(["CA", "NY", "TX"])
# reindex state_subset
state_subset.index = [0,1,2,3]
state_subset
```

```
Out[8]:
```

	Abbreviation	State Name	FB_key
0	CA	California	3847
1	IL	Illinois	3856
2	NY	New York	3875
3	TX	Texas	3886

- loop through subset dataframe to create folders

```
In [ ]: for state in range(0, len(state_subset["State Name"])):
    if not os.path.exists('../data/new_movers_by_state/%s' % state_subset["State Name"]):
        os.makedirs('../data/new_movers_by_state/%s' % state_subset["State Name"])
```

- create (UN) age groups, another parameter that can be iterated through during API requests

```
In [ ]: UN_age_min = [13,15, 20, 25, 30, 35, 40, 45, 50, 55, 60]
UN_age_max = [65,19, 24, 29, 34, 39, 44, 49, 54, 59, 65]
UN_age_table = {'age_min': UN_age_min, 'age_max': UN_age_max}
UN_age_table_df = pd.DataFrame(data=UN_age_table, index=None)
UN_age_table_df = UN_age_table_df[["age_min", "age_max"]]
UN_age_table_df.to_csv("../data/UN_age_table.csv", index=None)
```

- loop through each state in the subset dataframe and create .json files for estimating new movers

```
In [ ]: ctr = 0
        for state in range(0, len(state_subset["State Name"])):
            state_dic={"name": str(state_subset["State Name"][state])+"_new_movers",
                       "geo_locations": [{"name": "regions", "values": [{"key":str
                                       "location_types":

                               "genders": [0,1,2],
                               "ages_ranges": [{"min":13, "max":65}],
                               "behavior":[{"or": [6029662272682], "name": "new_movers"}]}
            state_dic["geo_locations"][0]["values"][0]['key'] = str(state_subset["State Name"][state])
            state_dic_ordered = OrderedDict(sorted(state_dic.items(),key=lambda t:
            state_dic_json=json.dumps(state_dic_ordered, indent = 4)
            gender_dict = {'0':'female_male_total_pop'}
            file_name = str(state_subset["State Name"][state])+"_new_movers"+"_new_movers.json"
            state_folder = state_subset["State Name"][state]

            if not os.path.exists('../data/new_movers_by_state/%s/api_requests_json' % state_subset["State Name"][state]):
                os.makedirs('../data/new_movers_by_state/%s/api_requests_json' % state_subset["State Name"][state])

            if not os.path.exists('../data/new_movers_by_state/%s/api_requests_csv' % state_subset["State Name"][state]):
                os.makedirs('../data/new_movers_by_state/%s/api_requests_csv' % state_subset["State Name"][state])

            with open('../data/new_movers_by_state/%s/api_requests_json/%s' % (state_subset["State Name"][state], state_folder), 'w') as outfile:
                outfile.write(json.dumps(state_dic_ordered, indent = 4))

            state_api_request = watcher.run_data_collection('../data/new_movers_by_state/%s/api_requests_csv' % state_subset["State Name"][state])
            state_api_request.insert(0, "state",state_subset["State Name"][state])
            csv_filename = file_name.split(".")[0]+".csv"
            state_api_request.to_csv("../data/new_movers_by_state/%s/api_requests_csv/%s" % (state_subset["State Name"][state], state_folder),
                                    index=False)

            ctr = ctr +1
            total =len(state_subset["State Name"])
            print("file %.f of %.f " % (ctr,total))
            print(file_name)
```

```
In [ ]: %rm collect_finished* dataframe_collecting* dataframe_skeleton*
```

use merge\_subdirectories function from utils to merge all folders directory of new movers by state into one .csv file

```
In [ ]: merge_subdirectories('../data/new_movers_by_state/',
                           'raw_new_movers_data.csv')
```

read in merged .csv file of new movers by state



```
In [9]: raw_new_movers_data = pd.read_csv("../data/raw_new_movers_data.csv")
raw_new_movers_data.head()
```

```
Out[9]:
```

	state	name	ages_ranges	\
0	California	California_new_movers	{u'max': 65, u'min': 13}	
1	California	California_new_movers	{u'max': 65, u'min': 13}	
2	California	California_new_movers	{u'max': 65, u'min': 13}	
3	Illinois	Illinois_new_movers	{u'max': 65, u'min': 13}	
4	Illinois	Illinois_new_movers	{u'max': 65, u'min': 13}	

	geo_locations	genders	interests	\
0	{u'values': [{u'key': u'3847'}], u'name': u're...	0.0	NaN	
1	{u'values': [{u'key': u'3847'}], u'name': u're...	1.0	NaN	
2	{u'values': [{u'key': u'3847'}], u'name': u're...	2.0	NaN	
3	{u'values': [{u'key': u'3856'}], u'name': u're...	0.0	NaN	
4	{u'values': [{u'key': u'3856'}], u'name': u're...	1.0	NaN	

	behavior	scholarities	language	\
0	{u'or': [6029662272682], u'name': u'new_movers'}	NaN	Na	
1	{u'or': [6029662272682], u'name': u'new_movers'}	NaN	Na	
2	{u'or': [6029662272682], u'name': u'new_movers'}	NaN	Na	
3	{u'or': [6029662272682], u'name': u'new_movers'}	NaN	Na	
4	{u'or': [6029662272682], u'name': u'new_movers'}	NaN	Na	

	family_statuses	all_fields	\
0	NaN ((('genders', 0), ('ages_ranges', {u'max': 65, ...		
1	NaN ((('genders', 1), ('ages_ranges', {u'max': 65, ...		
2	NaN ((('genders', 2), ('ages_ranges', {u'max': 65, ...		
3	NaN ((('genders', 0), ('ages_ranges', {u'max': 65, ...		
4	NaN ((('genders', 1), ('ages_ranges', {u'max': 65, ...		

	targeting	\
0	{'flexible_spec': [{'behaviors': [{'id': 60296...	
1	{'flexible_spec': [{'behaviors': [{'id': 60296...	
2	{'flexible_spec': [{'behaviors': [{'id': 60296...	
3	{'flexible_spec': [{'behaviors': [{'id': 60296...	
4	{'flexible_spec': [{'behaviors': [{'id': 60296...	

	response	audience
0	{"data":{"users":540000,"bid_estimations":[{"u...	540000
1	{"data":{"users":240000,"bid_estimations":[{"u...	240000
2	{"data":{"users":290000,"bid_estimations":[{"u...	290000
3	{"data":{"users":220000,"bid_estimations":[{"u...	220000
4	{"data":{"users":97000,"bid_estimations":[{"un...	97000

```
In [10]: print("the data has %s rows and %s columns" % (raw_new_movers_data.shape[0], raw_new_movers_data.shape[1]))
print(raw_new_movers_data.dtypes)
```

the data has 12 rows and 14 columns

```

state                object
name                 object
ages_ranges          object
geo_locations        object
genders              float64
interests            float64
behavior             object
scholarities         float64
languages            float64
family_statuses      float64
all_fields           object
targeting            object
response             object
audience            int64
dtype: object

```

use `process_facebook_data` function from `utils` to munge dataframe of merged movers

```

In [11]: merged_new_movers_data = process_facebook_data(raw_new_movers_data)
        merged_new_movers_data.head()

```

```

utils.py:58: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

```

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```

df["behavior"] = df.loc[:, ("behavior")].apply(lambda x: re.findall(r'\d+',x))

```

```

utils.py:59: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

```

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```

df["behavior"] = df.loc[:, ("behavior")].apply(lambda x: ''.join(x))

```

```

utils.py:60: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

```

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```

df["genders"] = df.loc[:, ("genders")].astype('string')

```

```

utils.py:61: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

```

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```

df["genders"] = df.loc[:, ("genders")].replace(gender_map)

```

```

utils.py:62: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.

```

Try using `.loc[row_indexer,col_indexer] = value` instead

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```
df["ages_ranges"] = df["ages_ranges"].apply(lambda x: age_map[x[-3:-1]])
```

utils.py:63: SettingWithCopyWarning:

A value is trying to be set on a copy of a slice from a DataFrame.

Try using `.loc[row_indexer,col_indexer] = value` instead

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```
df["genders"] = df.loc[:, ("genders")].astype('string')
```

utils.py:64: SettingWithCopyWarning:

A value is trying to be set on a copy of a slice from a DataFrame.

Try using `.loc[row_indexer,col_indexer] = value` instead

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/>

```
df["genders"] = df.loc[:, ("genders")].replace(gender_map)
```

```
Out[11]:
```

	state	name	ages_ranges	genders \
0	California	California_new_movers	ages_13_65	total population
1	California	California_new_movers	ages_13_65	female
2	California	California_new_movers	ages_13_65	male
3	Illinois	Illinois_new_movers	ages_13_65	total population
4	Illinois	Illinois_new_movers	ages_13_65	female

	behavior	audience
0	6029662272682	540000
1	6029662272682	240000
2	6029662272682	290000
3	6029662272682	220000
4	6029662272682	97000

- use pandas `group_by` function to group data by a column

```
In [12]: merged_new_movers_data_genders = merged_new_movers_data.groupby("genders")
merged_new_movers_data_genders["audience"].sum()
```

```
Out[12]: genders
female           627000
male             780000
total population 1440000
Name: audience, dtype: int64
```

## 2.7 Plot total new movers in subset dataframe

- create a new dataframe that is a the total population audience estimate of new movers for each state and the state name
- create a dataframe that is just the state population estimate
- create labels

- plot the population estimates and labels

```
In [13]: new_movers_total_pop = merged_new_movers_data.loc[merged_new_movers_data['state'] == 'California']
new_movers_total_pop
```

```
Out[13]:
```

	state	audience
0	California	540000
3	Illinois	220000
6	New York	240000
9	Texas	440000

```
In [14]: new_movers_audience = new_movers_total_pop["audience"]
new_movers_audience
```

```
Out[14]: 0    540000
3    220000
6    240000
9    440000
Name: audience, dtype: int64
```

```
In [15]: labels = [i for i in state_subset["Abbreviation"]]
labels
```

```
Out[15]: ['CA', 'IL', 'NY', 'TX']
```

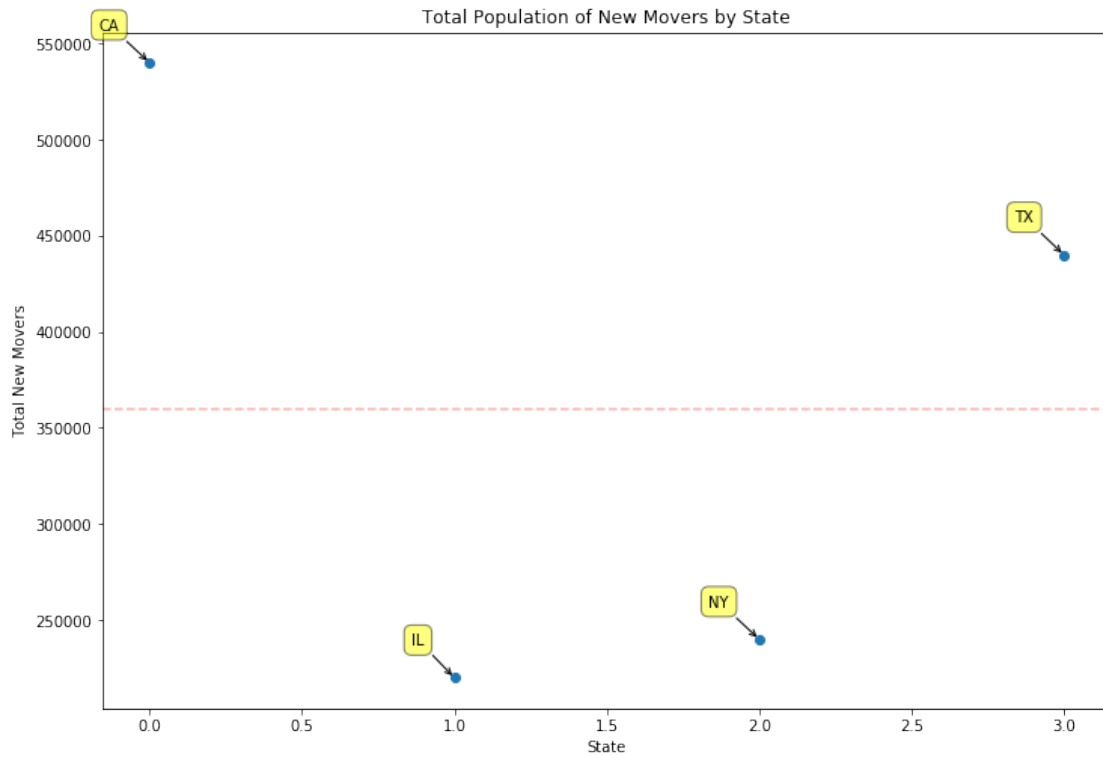
```
In [16]: new_movers_audience.mean()
```

```
Out[16]: 360000.0
```

```
In [17]: plt.subplots(1, figsize=(12, 8))
plt.subplots_adjust(bottom = 0.1)
plt.scatter(np.arange(len(new_movers_audience)), new_movers_audience)
for label, x, y in zip(labels, np.arange(len(new_movers_audience)), new_movers_audience):
    plt.annotate(
        label,
        xy=(x, y), xytext=(-20, 20),
        textcoords='offset points', ha='right', va='bottom',
        bbox=dict(boxstyle='round,pad=0.5', fc='yellow', alpha=0.5),
        arrowprops=dict(arrowstyle = '->', connectionstyle='arc3,rad=0'))

plt.axhline(new_movers_audience.mean(), linestyle='--', color='red', alpha=0.5)
plt.title("Total Population of New Movers by State")
plt.xlabel("State")
plt.ylabel("Total New Movers")

plt.show()
```



```
In [18]: import matplotlib
print("System and module version information: \n")
print('Python version:', sys.version_info)
print('numpy version:', np.__version__)
print('pandas version:', pd.__version__)
print('matplotlib version:', matplotlib.__version__)
```

System and module version information:

```
('Python version:', sys.version_info(major=2, minor=7, micro=12, releaselevel='final', serial=0))
('numpy version:', '1.12.0')
('pandas version:', u'0.19.0')
('matplotlib version:', '2.0.0')
```