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# Using Python Visualization Tools

## There are a number of Python modules and tools useful for doing many types of visualizations.

In this notebook, we'll be coving a number of different modules:

- Pandas (matplotlib)
  - Pandas DataFrame
- Bokeh

In [1]:

```
import pandas as pd
from bokeh.io import output_file, output_notebook, show
from bokeh.models import ColumnDataSource, GMapOptions, Label
from bokeh.plotting import gmap, figure, output_file, show

output_notebook()

GOOGLE_API_KEY = "PUT_GOOGLE_API_KEY_HERE"

%matplotlib inline
```

```
(https://bokeh.pydata.org)BokehJS 1.0.4 successfully loaded.
```

1. Now that we use pandas .read_csv to import some raw data: patron checkouts and patron checkins by transaction timestamp)

In [2]:

```
# this may come in handy later

# map_plot = figure(
#     plot_width=800, plot_height=600,
#     # tools=(logo=False),
#     tools="wheel_zoom, reset, pan",
#     # toolbar.logo=None,
#     active_drag="pan",
#     active_scroll="wheel_zoom",
#     x_range=(-9439892.8192696, -9373101.124793636),
#     y_range=(4807984.493190501, 4707357.536267922),
#     x_axis_type="mercator",
#     y_axis_type="mercator"
# )
# map_plot.add_tile(STAMEN_TERRAIN_RETINA)
# show(map_plot)
```

In [3]:

```
patron_data = pd.read_csv('./patron_data.csv')
patron_data_active_no_circs = pd.read_csv(
    './patron_data_active_no_circs.csv')
branches = pd.read_csv('./branches.csv')
patron_data_zipcodes = pd.read_csv(
    'patron_data_zipcode_group.csv')

print('number of patrons             : {}'
      .format(len(patron_data)))
print('number of patrons (no circs)  : {}'
      .format(len(patron_data_active_no_circs)))
print('number of branches            : {}'
      .format(len(branches)))
print('\nnumber of patron zipcodes            : {}'
      .format(len(patron_data_zipcodes)))
```

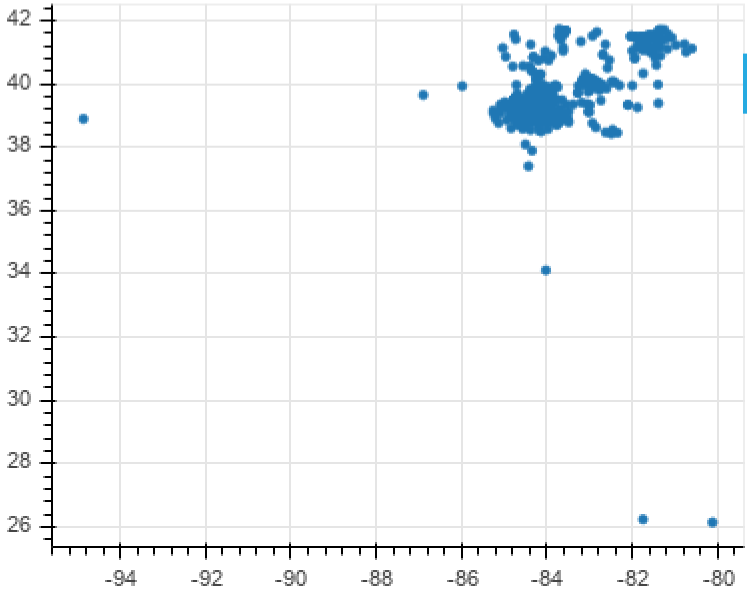
```
number of patrons             : 103814
number of patrons (no circs)  : 181993
number of branches            : 42

number of patron zipcodes            : 373
```

```
In [15]: patron_data['patron_zipcode'].head()
```

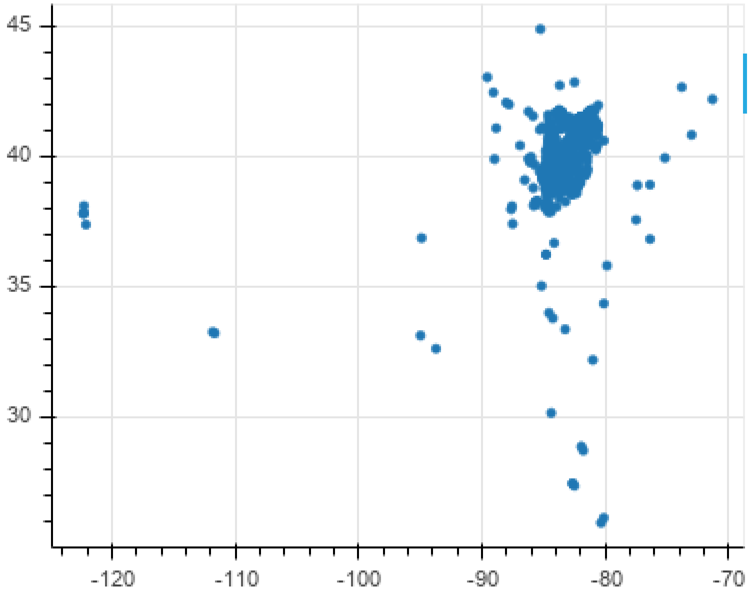
```
Out[15]: 0    45233
         1    45039
         2    45230
         3    45208
         4    45208
         Name: patron_zipcode, dtype: int64
```

```
In [5]: # scatter plot of patron latiude, and longitude
        plot = figure(plot_width=400, plot_height=300)
        plot.scatter(patron_data.patron_longitude,
                     patron_data.patron_latitude)
        show(plot)
```



(http

In [6]:
```
plot = figure(plot_width=400, plot_height=300)
plot.scatter(patron_data_active_no_circs.patron_longitude,
             patron_data_active_no_circs.patron_latitude)
show(plot)
```



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In [7]:
```
median_patron_latitude = patron_data.patron_latitude.median()
median_patron_longitude = patron_data.patron_longitude.median()

print('median_patron_latitude : {}'.format(median_patron_latitude))
print('median_patron_longitude: {}'.format(median_patron_longitude))
```

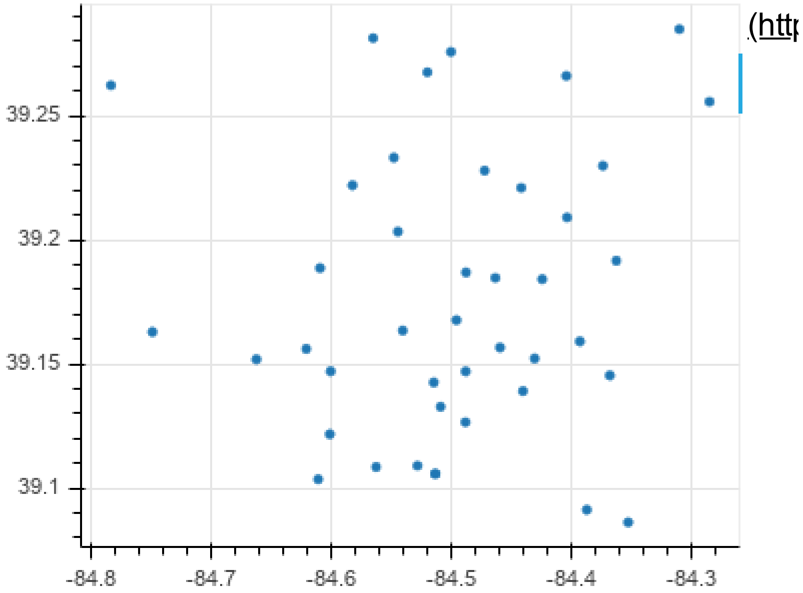
```
median_patron_latitude : 39.18468
median_patron_longitude: -84.47425
```

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

Out[8]:

| | location_code | branch_latitude | branch_longitude |
|---|---|---|---|
| **0** | 1 | 39.10577 | -84.51331 |
| **1** | an | 39.08623 | -84.35268 |
| **2** | av | 39.14699 | -84.48798 |
| **3** | ba | 39.22980 | -84.37373 |
| **4** | bh | 39.18465 | -84.46331 |

In [9]:
```
# scatter plot of branch latiude, and longitude
plot = figure(plot_width=400, plot_height=300)
plot.scatter(branches.branch_longitude, branches.branch_latitude)
show(plot)
```



In [10]:
```
patron_data_zipcodes.head()
```

Out[10]:

| | patron_zipcode | count |
|---|---|---|
| **0** | 30518 | 1 |
| **1** | 33304 | 1 |
| **2** | 34109 | 1 |
| **3** | 40355 | 1 |
| **4** | 40409 | 1 |

In [11]:

```
# comment / uncomment depending on if we want output to external file
#output_file("gmap.html")

map_options = GMapOptions(lat=39.16346, lng=-84.54043,
                          map_type="roadmap", zoom=11)

p = gmap(GOOGLE_API_KEY,
         map_options,
         title="Cincy - PLCH",
         plot_width=900,
         plot_height=700,
#          plot_width=1920,
#          plot_height=1080,
#           plot_width=1024,
#           plot_height=768,
#          plot_width=3840,
#          plot_height=2160,
         tools="wheel_zoom, reset, pan, save, box_zoom",
         active_drag="pan",
         active_scroll="wheel_zoom"
)

# plot the patrons with activity, but no circulations
# patron_data_active_no_circs
source = ColumnDataSource(
    data=dict(lat=patron_data_active_no_circs.patron_latitude,
              lon=patron_data_active_no_circs.patron_longitude)
)
p.triangle(x="lon", y="lat", size=5, fill_color="yellow",
           fill_alpha=0.3, source=source)

# plot the patrons with circulations
source = ColumnDataSource(
    data=dict(lat=patron_data.patron_latitude,
              lon=patron_data.patron_longitude)
)
p.circle(x="lon", y="lat", size=5, fill_color="blue",
         fill_alpha=0.3, source=source)

# plot the brances
source = ColumnDataSource(
    data=dict(lat=branches.branch_latitude,
              lon=branches.branch_longitude)
)

p.square(x="lon", y="lat", size=10, fill_color="firebrick",
         fill_alpha=0.3, source=source)
```

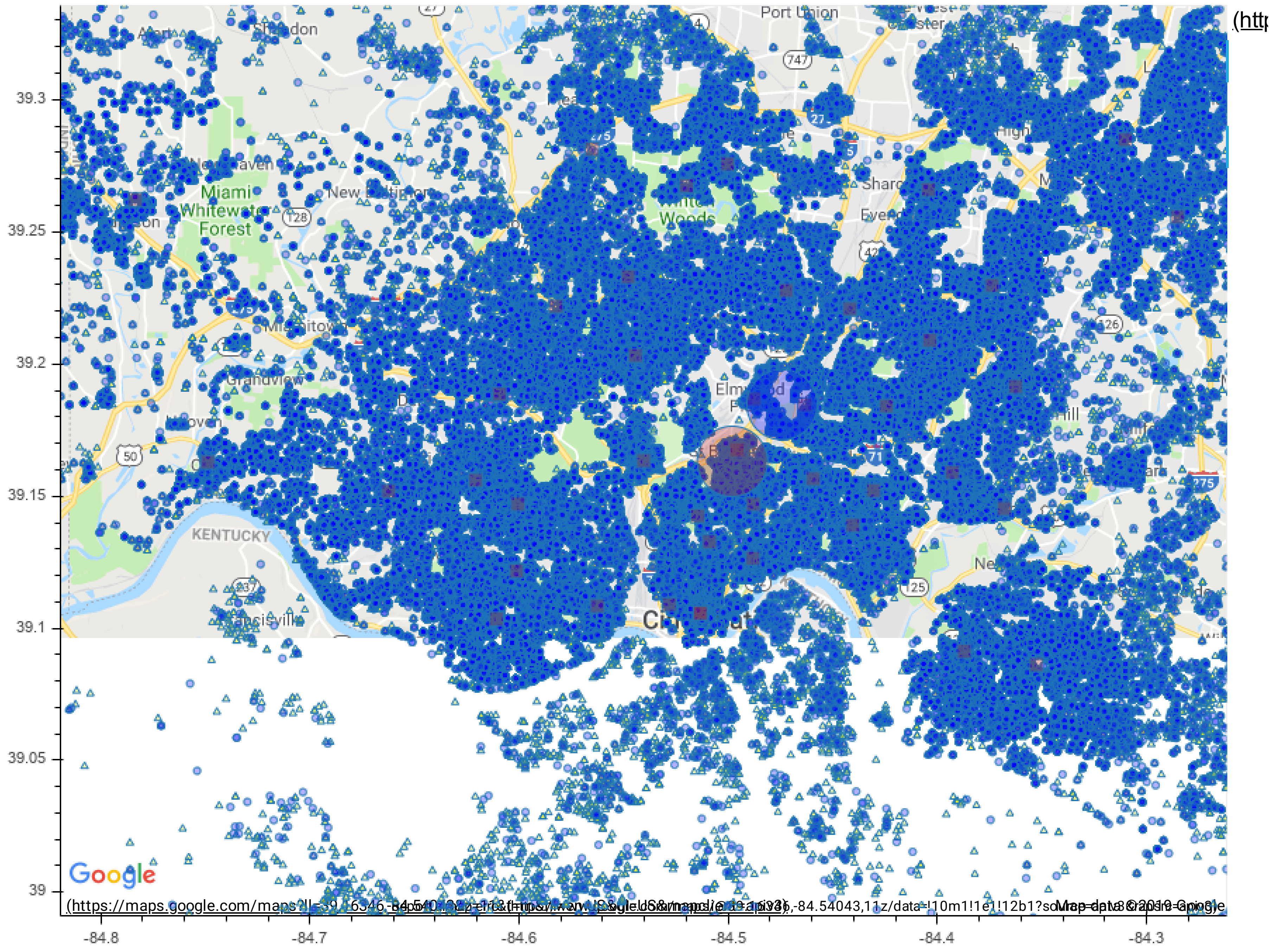
```
# plot the median location of the branches
source = ColumnDataSource(
    data=dict(lat=[branches.branch_latitude.median()],
              lon=[branches.branch_longitude.median()]
    )
)
p.circle(x="lon", y="lat", size=50, fill_color="firebrick",
         fill_alpha=0.3, source=source)


# plot the median location of the patrons
source = ColumnDataSource(
    data=dict(lat=[patron_data.patron_latitude.median()],
              lon=[patron_data.patron_longitude.median()]
    )
)
p.circle(x="lon", y="lat", size=50, fill_color="blue",
         fill_alpha=0.3, source=source)

# # plot me!
# source = ColumnDataSource(
#     data=dict(lat=[39.21725],
#               lon=[-84.39353])
# )
# p.triangle(x="lon", y="lat", size=10, fill_color="green",
#    fill_alpha=0.8, source=source)


show(p)
```

Cincy - PLCH


(http
39.3
39.25
39.2
39.15
39.1
39.05
39
-84.8
-84.7
-84.6
-84.5
-84.4
-84.3
Port Union
Sheldon
Miami Whitewater Forest
New Haven
New Baltimore
Winton Woods
Sharonville
Evendale
Mitchell
Grandview
Hooven
Elmwood Place
KENTUCKY
Taylorsville
Cincinnati
Google
(https://maps.google.com/maps?ll=39.16346,-84.54043&z=11&t=m&hl=en-US&gl=US&mapclient=apiv3)
,-84.54043,11z/data=!10m1!1e1!12b1?source=apiv3
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