https://github.com/bmtgoncalves/WebSci17

Analyzing Geolocated Data with Twitter
Practice

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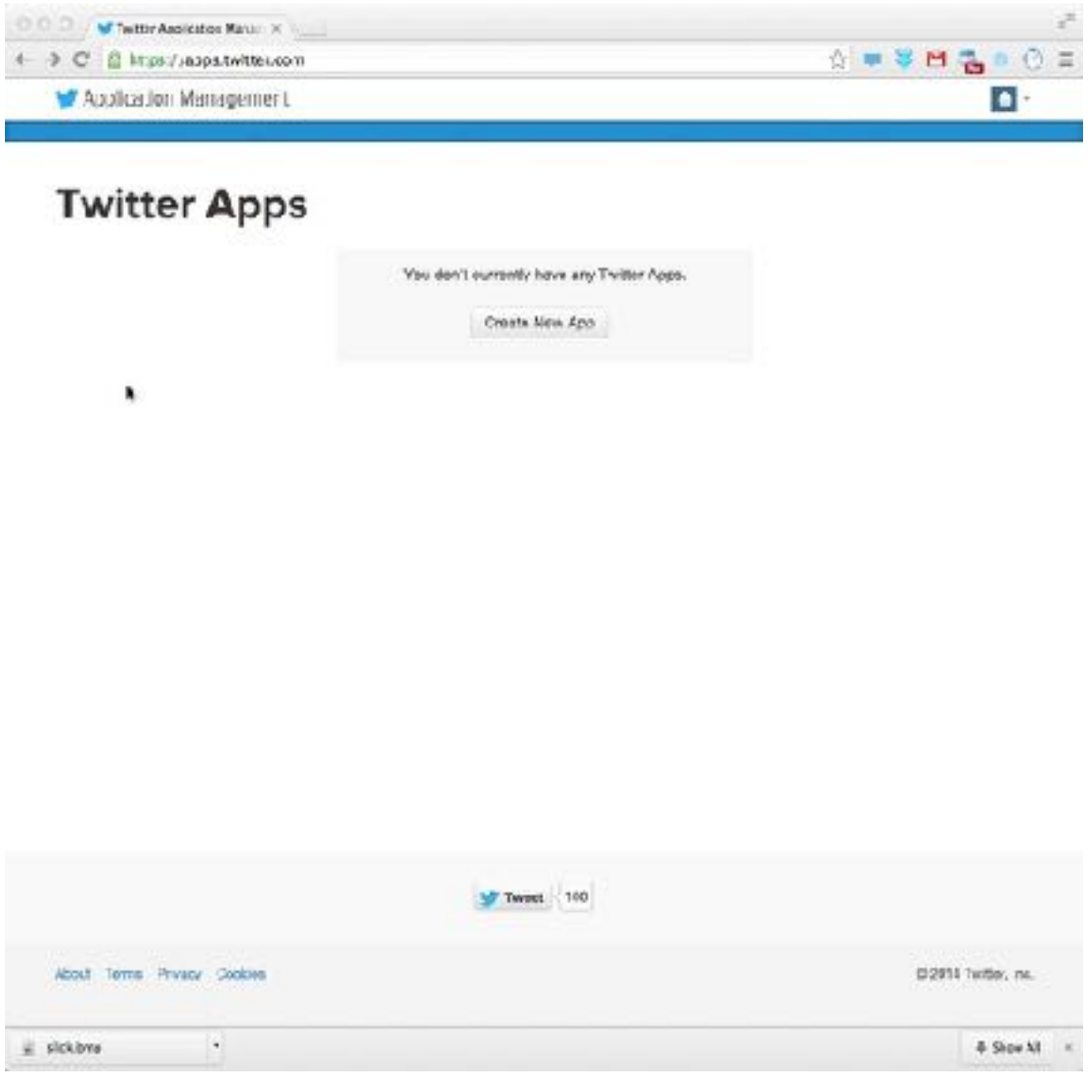
DATA SCIENCE

Requirements

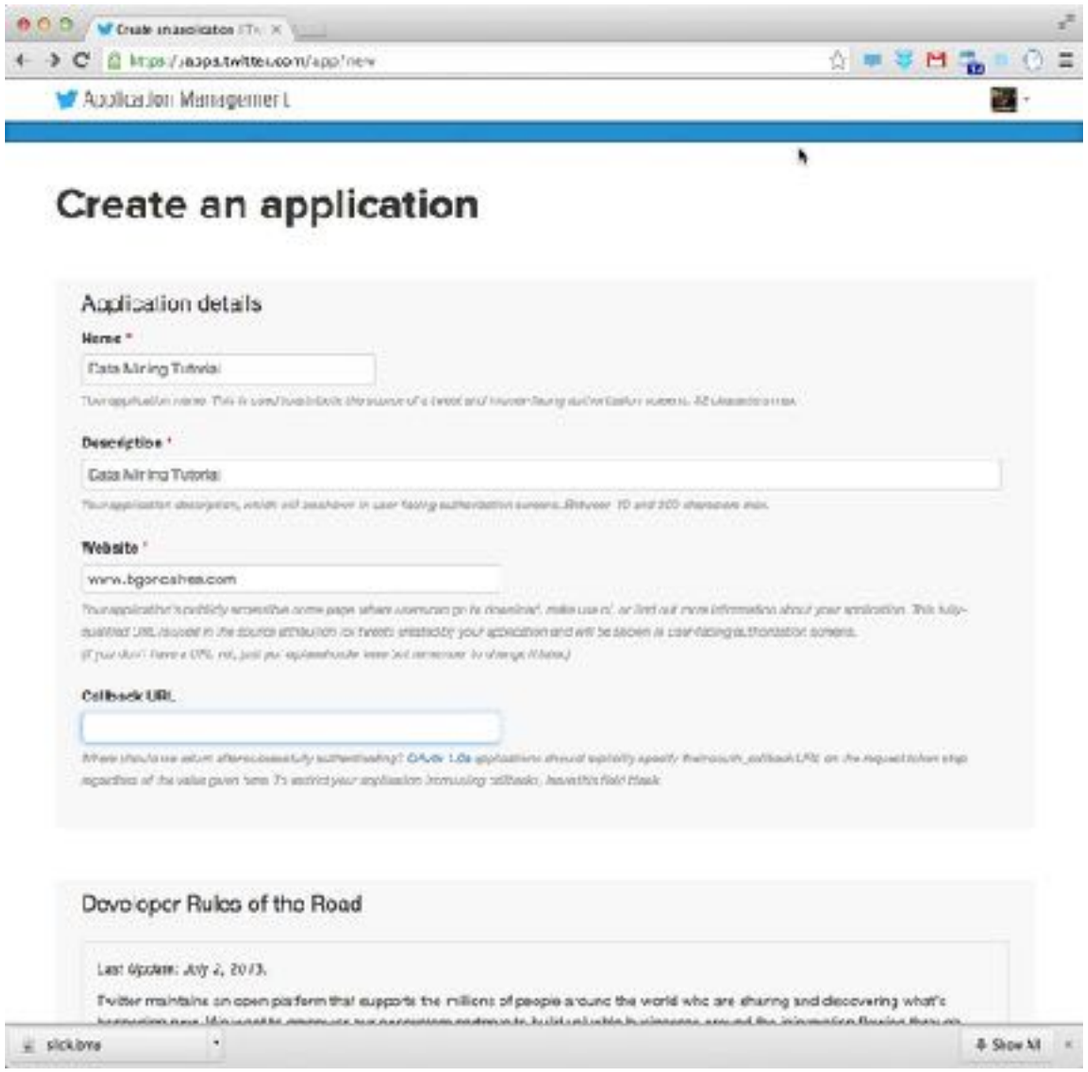
ANACONDA

python 3.5

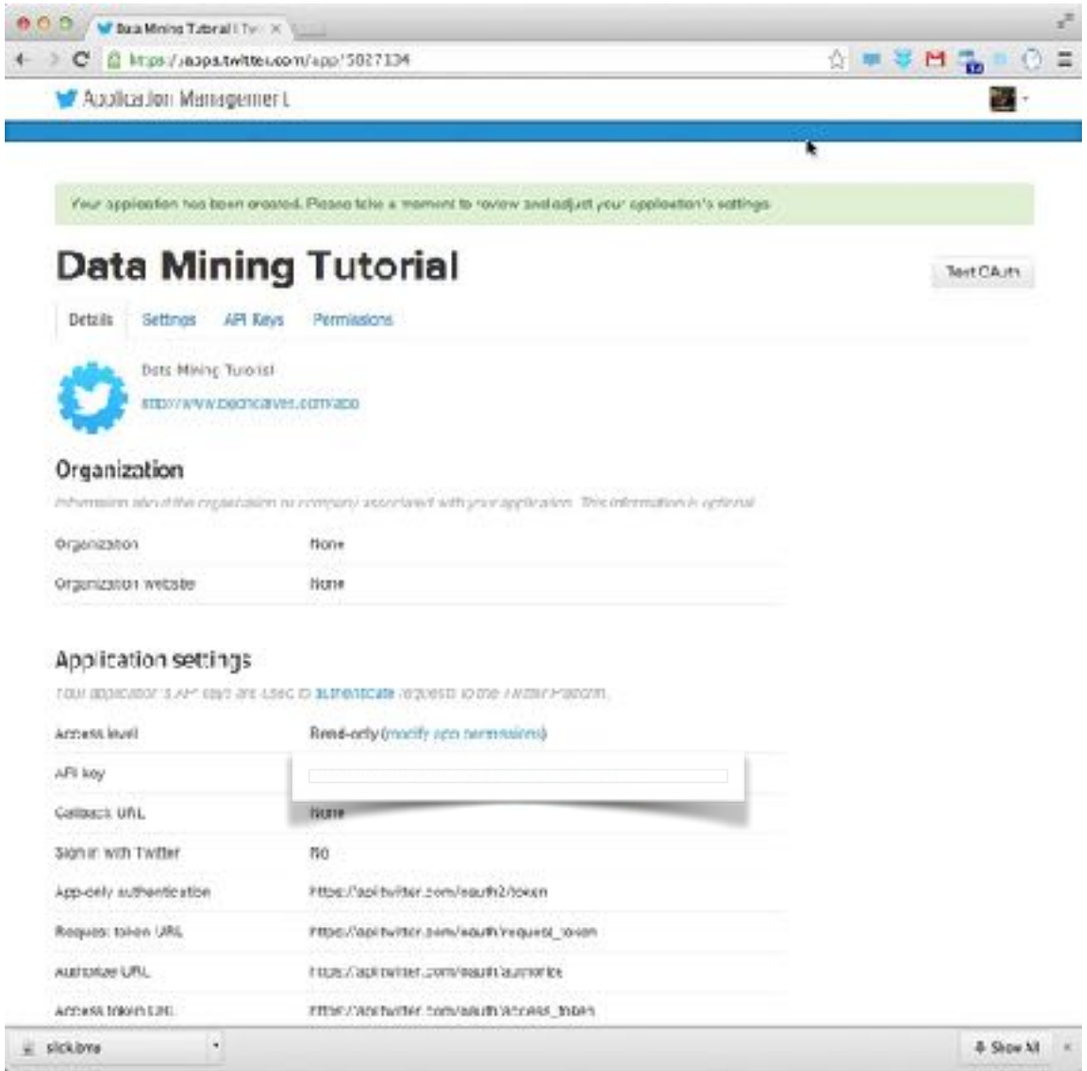
Registering an Application



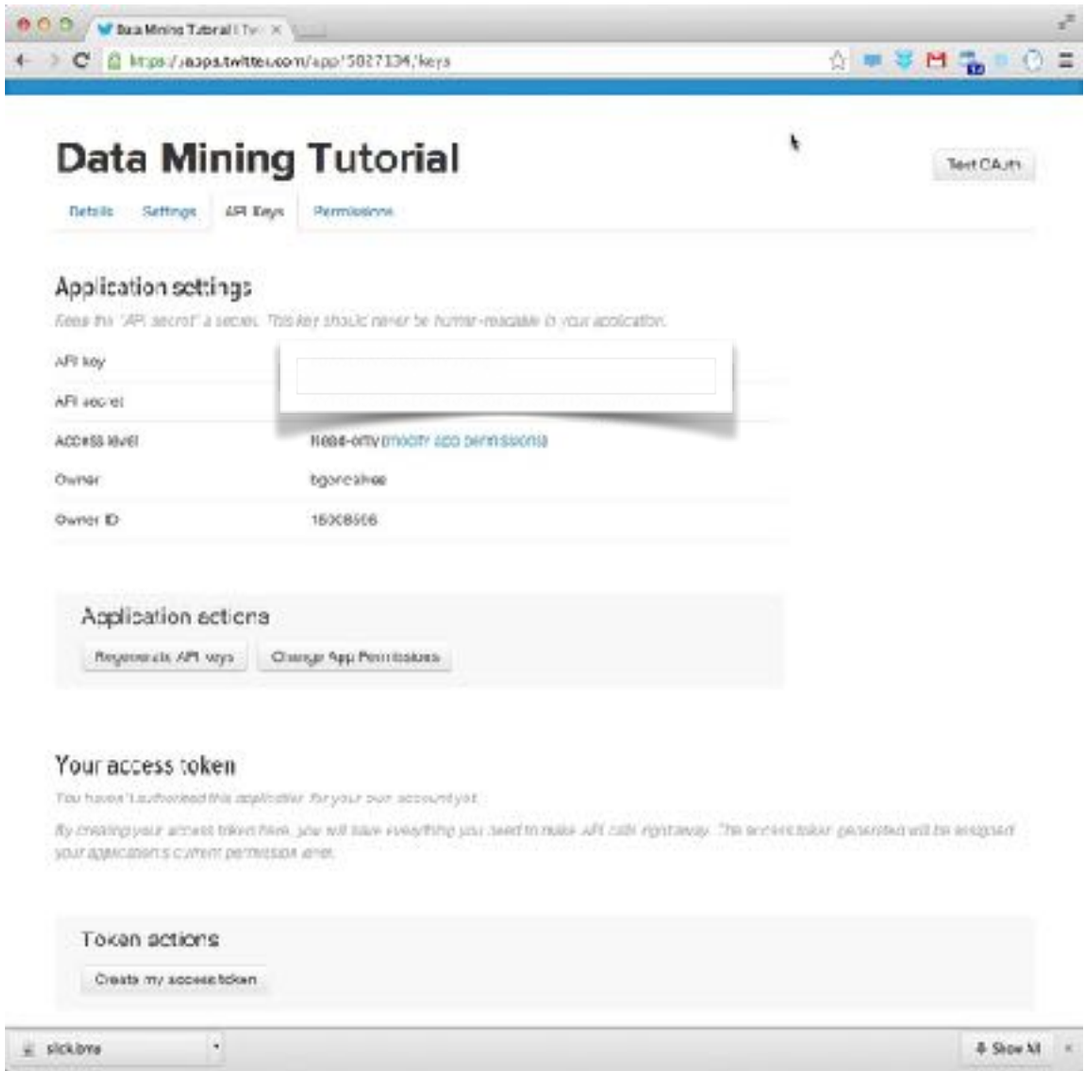
Registering an Application



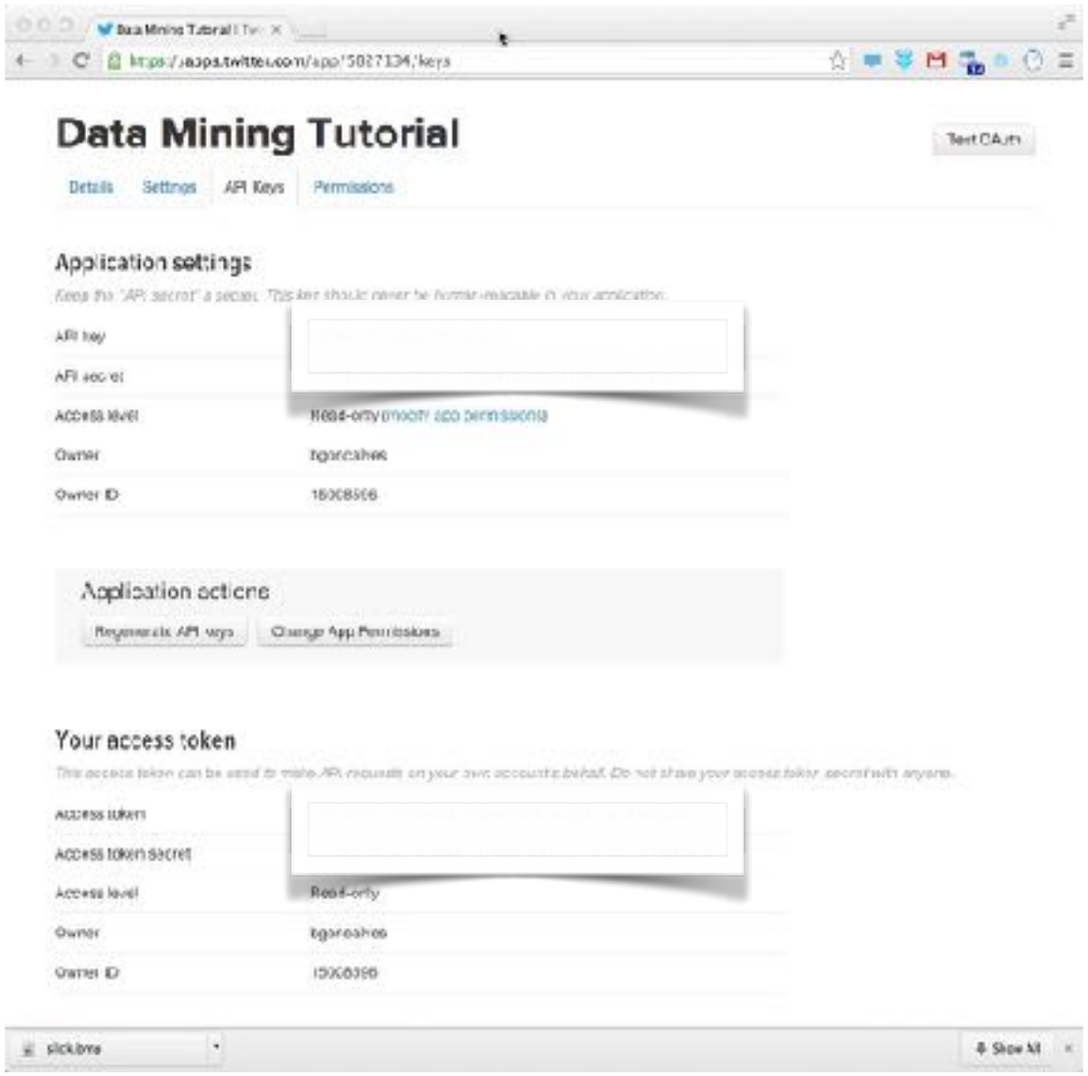
Registering an Application



Registering an Application



Registering an Application



API Basics

https://dev.twitter.com/docs

- The twitter module provides the oauth interface. We just need to provide the right credentials.
- Best to keep the credentials in a dict and parametrize our calls with the dict key. This way we can switch between different accounts easily.
- .Twitter(auth) takes an OAuth instance as argument and returns a Twitter object that we can use to interact with the API
- Twitter methods mimic API structure
- 4 basic types of objects:
  - Tweets
  - Users
  - Entities
  - Places

Authenticating with the API

```
import tweepy
from twitter_accounts import accounts

app = accounts["social"]

auth = twitter.oauth.OAuth(app["token"],
                           app["token_secret"],
                           app["api_key"],
                           app["api_secret"])

twitter_api = twitter.Twitter(auth=auth)
```

- In the remainder of this course, the accounts dict will live inside the twitter_accounts.py file
- 4 basic types of objects:
  - Tweets
  - Users
  - Entities
  - Places

twitter_authentication.py

Searching for Tweets

https://dev.twitter.com/docs/api/1.1/get/search/tweets

- .search.tweets(query, count)
  - query is the content to search for
  - count is the maximum number of results to return
- returns dict with a list of "statuses" and "search_metadata"

```
{u'completed_in': 0.027,
 u'count': 15,
 u'max_id': 438088492577345536,
 u'max_id_str': u'438088492577345536',
 u'next_results': u'?max_id=438088485145034752&q=soccer&include_entities=1',
 u'query': u'soccer',
 u'refresh_url': u'?since_id=438088492577345536&q=soccer&include_entities=1',
 u'since_id': 0,
 u'since_id_str': u'0'}
```

  - search_results["search_metadata"]["next_results"] can be used to get the next page of results

Searching for Tweets

https://dev.twitter.com/docs/api/1.1/get/search/tweets

```
query = "instagram"
count = 200

search_results = twitter_api.search.tweets(q=query, count=count)

statuses = search_results["statuses"]
tweet_count = 0

while True:
    try:
        next_results = search_results["search_metadata"]["next_results"]

        args = dict(parse.parse_qsl(next_results[1:]))

        search_results = twitter_api.search.tweets(**args)
        statuses = search_results["statuses"]

        print(search_results["search_metadata"]["max_id"])

        for tweet in statuses:
            tweet_count += 1

            if tweet_count % 10000 == 0:
                print(tweet_count,file=sys.stderr)

            print (tweet["text"])
    except:
        break
```

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twitter_search.py

Social Connections

https://dev.twitter.com/docs/api/1.1/get/friends/ids
https://dev.twitter.com/docs/api/1.1/get/followers/ids

- .friends.ids() and .followers.ids() returns a list of up to 5000 of a users friends or followers for a given screen_name or user_id

- result is a dict containing multiple fields:

```
[u'next_cursor_str',
 u'previous_cursor',
 u'ids',
 u'next_cursor',
 u'previous_cursor_str']
```

- ids are contained in results[“ids”].

- results[“next_cursor”] allows us to obtain the next page of results.

- .friends.ids(screen_name=screen_name, cursor=results[“next_cursor”]) will return the next page of results

- cursor=0 means no more results

Social Connections

https://dev.twitter.com/docs/api/1.1/get/friends/ids
https://dev.twitter.com/docs/api/1.1/get/followers/ids

```
import twitter
from twitter_accounts import accounts

app = accounts["social"]

auth = twitter.oauth.OAuth(app["token"],
                           app["token_secret"],
                           app["api_key"],
                           app["api_secret"])

twitter_api = twitter.Twitter(auth=auth)

screen_name = "stephen_wolfram"

cursor = -1
followers = []

while cursor != 0:
    result = twitter_api.followers.ids(screen_name=screen_name,
cursor=cursor)

    followers += result["ids"]
    cursor = result["next_cursor"]

print("Found", len(followers), "Followers")
```


twitter_followers.py

User Timeline

https://dev.twitter.com/docs/api/1.1/get/statuses/user_timeline

- .statuses.user_timeline() returns a set of tweets posted by a single user
- Important options:
  - include_rts='true' to Include retweets by this user
  - count=200 number of tweets to return in each call
  - trim_user='true' to not include the user information (save bandwidth and processing time)
  - max_id=1234 to include only tweets with an id lower than 1234
- Returns at most 200 tweets in each call. Can get all of a users tweets (up to 3200) with multiple calls using max_id

User Timeline

https://dev.twitter.com/docs/api/1.1/get/statuses/user_timeline

```
import twitter
from twitter_accounts import accounts

app = accounts["social"]

auth = twitter.oauth.OAuth(app["token"],
                           app["token_secret"],
                           app["api_key"],
                           app["api_secret"])

twitter_api = twitter.Twitter(auth=auth)
screen_name = "BarackObama"

args = { "count" : 200,
         "trim_user": "true",
         "include_rts": "true"
        }

tweets = twitter_api.statuses.user_timeline(screen_name = screen_name, **args)
tweets_new = tweets

while len(tweets_new) > 0:
    max_id = tweets[-1]["id"] - 1
    tweets_new = twitter_api.statuses.user_timeline(screen_name = screen_name, max_id=max_id, **args)
    tweets += tweets_new

print("Found", len(tweets), "tweets")
```


twitter_timeline.py

Social Interactions

```
import twitter
from twitter_accounts import accounts

app = accounts["social"]

auth = twitter.oauth.OAuth(app["token"],
                           app["token_secret"],
                           app["api_key"],
                           app["api_secret"])

twitter_api = twitter.Twitter(auth=auth)
screen_name = "BarackObama"
args = { "count" : 200, "trim_user": "true", "include_rts": "true"}

tweets = twitter_api.statuses.user_timeline(screen_name=screen_name, **args)
tweets_new = tweets

while len(tweets_new) > 0:
    max_id = tweets[-1]["id"] - 1
    tweets_new = twitter_api.statuses.user_timeline(screen_name=screen_name, max_id=max_id, **args)
    tweets += tweets_new

user = tweets[0]["user"]["id"]

for tweet in tweets:
    if "retweeted_status" in tweet:
        print(user, "->", tweet["retweeted_status"]["user"]["id"])
    elif tweet["in_reply_to_user_id"]:
        print(tweet["in_reply_to_user_id"], "->", user)
```


twitter_interactions.py

NetworkX

- High productivity software for complex networks
- Simple Python interface
- Four types of graphs supported:
  - Graph - UnDirected
  - DiGraph - Undirected
  - MultiGraph - Multi-edged Graph
  - MultiDiGraph - Directed Multigraph
- Similar interface for all types of graphs
- Nodes can be any type of Python object - Practical way to manage relationships

Growing Graphs

- .add_node(node_id) Add a single node with ID node_id
- .add_nodes_from() Add a list of node ids
- .add_edge(node_i, node_j) Adds an edge between node_i and node_j
- .add_edges_from() Adds a list of edges. Individual edges are represented by tuples
- .remove_node(node_id)/.remove_nodes_from() Removing a node removes all associated edges
- .remove_edge(node_i, node_j)/.remove_edges_from()

Graph Properties

- .nodes() Returns the list of nodes
- .edges() Returns the list of edges
- .degree() Returns a dict with each nodes degree .in_degree()/.out_degree() returns dicts with in/out degree for DiGraphs
- .is_connected() Returns true if the node is connected
- .is_weakly_connected()/.is_strongly_connected() for DiGraph
- .connected_components() A list of nodes for each connected component

NetworkX - Example

```python
import networkx as NX
import numpy as np
from collections import Counter
import matplotlib.pyplot as plt

def BarabasiAlbert(N=1000000):
    G = NX.Graph()

    nodes = range(N)
    G.add_nodes_from(nodes)

    edges = [0,1,1,2,2,0]

    for node_i in range(3, N):
        pos = np.random.randint(len(edges))
        node_j = edges[pos]

        edges.append(node_i)
        edges.append(node_j)

    edges = zip(nodes, edges[1::2])

    G.add_edges_from(edges)

    return G
```


networkx_demo.py

NetworkX - Example

```
import networkx as NX
import numpy as np
from collections import Counter
import matplotlib.pyplot as plt

(…)

net = BarabasiAlbert()

degrees = net.degree()
Pk = np.array(list(Counter(degrees.values()).items()))

plt.loglog(Pk.T[0], Pk.T[1], 'b*')
plt.xlabel('k')
plt.ylabel('P[k]')
plt.savefig('Pk.png')
plt.close()

print("Number of nodes:", net.number_of_nodes())
print("Number of edges:", net.number_of_edges())
```


networkx_demo.py

Snowball Sampling

- Commonly used in Social Science and Computer Science

    1. Start with a single node (or small number of nodes)

    2. Get "friends" list

    3. For each friend get the "friend" list

    4. Repeat for a fixed number of layers or until enough users have been connected

- Generates a connected component from each seed

- Quickly generates a *lot* of data/API calls

Snowball Sampling

```python
import networkx as NX

def snowball(net, seed, max_depth = 3, maxnodes=1000):
    seen = set()
    queue = set()

    queue.add(seed)
    queue2 = set()

    for _ in range(max_depth+1):
        while queue:
            user_id = queue.pop()
            seen.add(user_id)

            NN = net.neighbors(user_id)

            for node in NN:
                if node not in seen:
                    queue2.add(node)

        queue.update(queue2)
        queue2 = set()

    return seen

net = NX.connected_watts_strogatz_graph(10000, 4, 0.01)
neve = snowball(net, 0)

print(neve)
```

snowball.py

Streaming Geocoded data

https://dev.twitter.com/streaming/overview/request-parameters#locations

- The Streaming api provides realtime data, subject to filters
- Use TwitterStream instead of Twitter object (.TwitterStream(auth=twitter_api.auth))
- .status.filter(track=q) will return tweets that match the query q in real time
  - Returns generator that you can iterate over
- .status.filter(locations=bb) will return tweets that occur within the bounding box bb in real time
- bb is a comma separated pair of lon/lat coordinates.
  - -180,-90,180,90 - World
  - -74,40,-73,41 - NYC

Streaming Geocoded data

https://dev.twitter.com/streaming/overview/request-parameters#locations

```
import twitter
from twitter_accounts import accounts
import sys
import gzip

app = accounts["social"]

auth = twitter.oauth.OAuth(app["token"],
                           app["token_secret"],
                           app["api_key"],
                           app["api_secret"])

stream_api = twitter.TwitterStream(auth=auth)

query = "-74,40,-73,41"  # NYC
stream_results = stream_api.statuses.filter(locations=query)
tweet_count = 0

fp = gzip.open("NYC.json.gz", "a")

for tweet in stream_results:
    try:
        tweet_count += 1
        print (tweet_count, tweet["id"])
        print(tweet, file=fp)
    except:
        pass

    if tweet_count % 10000 == 0:
        print(tweet_count, file=sys.stderr)
        break
```

twitter_location.py

shapefiles

http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf

- Open specification developed by ESRI, still the current leader in commercial GIS software
- shapefiles aren't actual (individual) files…
- but actually a set of files sharing the same name but with different extensions:

```
(py35) (master) bgoncalves@underdark:$ls -l
total 4856
-rw-r--r--@ 1 bgoncalves  staff      537 Apr 17 12:40 nybb.dbf
-rw-r--r--@ 1 bgoncalves  staff      562 Apr 17 12:40 nybb.prj
-rw-r--r--@ 1 bgoncalves  staff  1217376 Apr 17 12:40 nybb.shp
-rw-r--r--@ 1 bgoncalves  staff    12905 Apr 17 12:40 nybb.shp.xml
-rw-r--r--@ 1 bgoncalves  staff      140 Apr 17 12:40 nybb.shx
-rw-r--r--  1 bgoncalves  staff      536 Apr 17 12:40 nybb_wgs84.dbf
-rw-r--r--  1 bgoncalves  staff      143 Apr 17 12:40 nybb_wgs84.prj
-rw-r--r--  1 bgoncalves  staff      257 Apr 17 12:40 nybb_wgs84.qpj
-rw-r--r--  1 bgoncalves  staff  1217376 Apr 17 12:40 nybb_wgs84.shp
-rw-r--r--  1 bgoncalves  staff      140 Apr 17 12:40 nybb_wgs84.shx
(py35) (master) bgoncalves@underdark:$
```

- the actual set of files changes depending on the contents, but three files are usually present:
  - .shp - also commonly referred to as "the" shapefile. Contains the geometric information
  - .dbf - a simple database containing the feature attribute table.
  - .shx - a spatial index, not strictly required

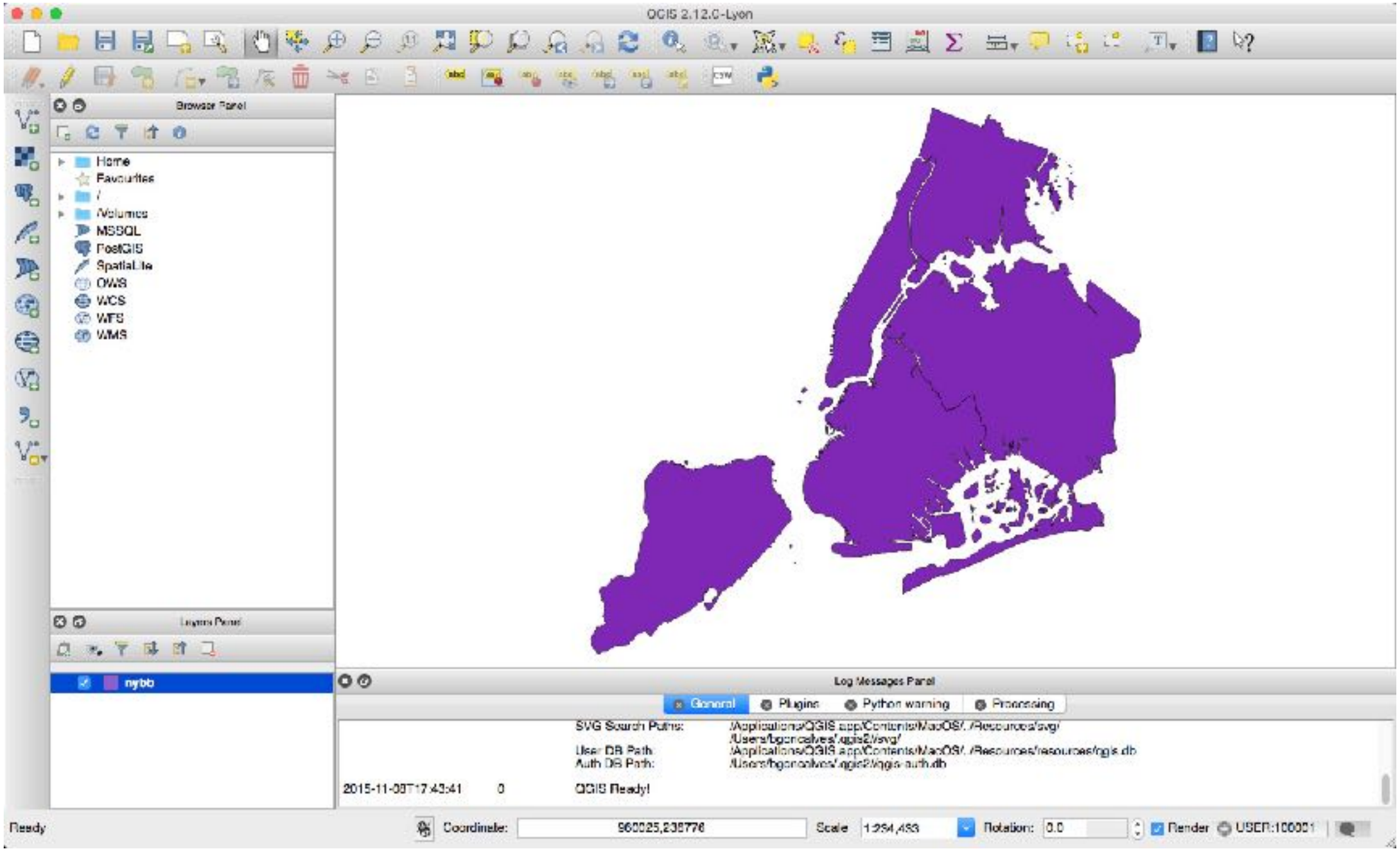
Shapefiles

http://www.nyc.gov/html/dcp/html/bytes/districts_download_metadata.shtml#bcd

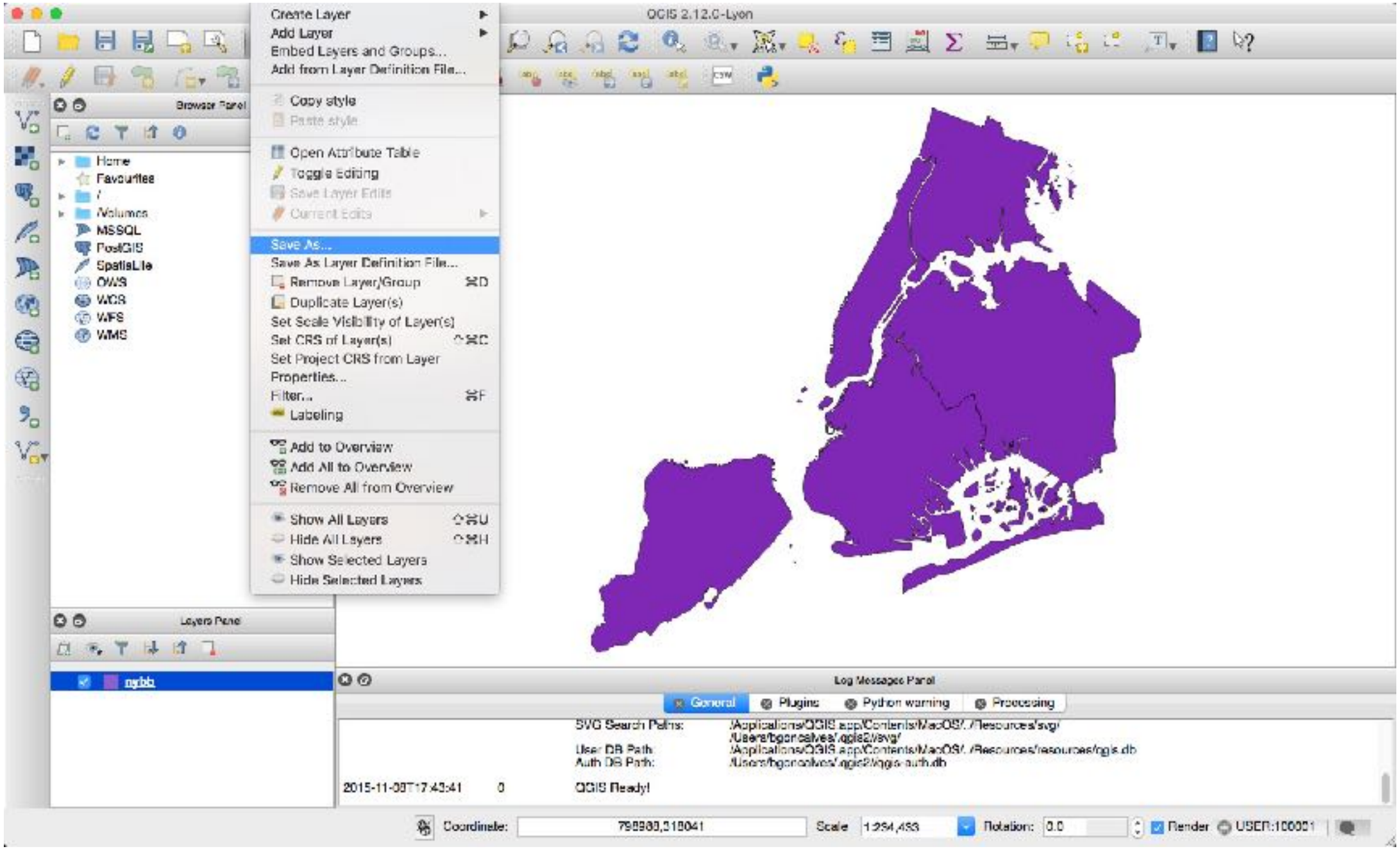
Borough Boundaries & Community Districts	Download	Metadata
Borough Boundaries (Clipped to Shoreline)	(645k)	
Borough Boundaries (Water Areas Included)	(31k)	
Community Districts (Clipped to Shoreline)	(772k)	

- Unfortunately it doesn't use the right reference system (WGS84), so we must convert it.

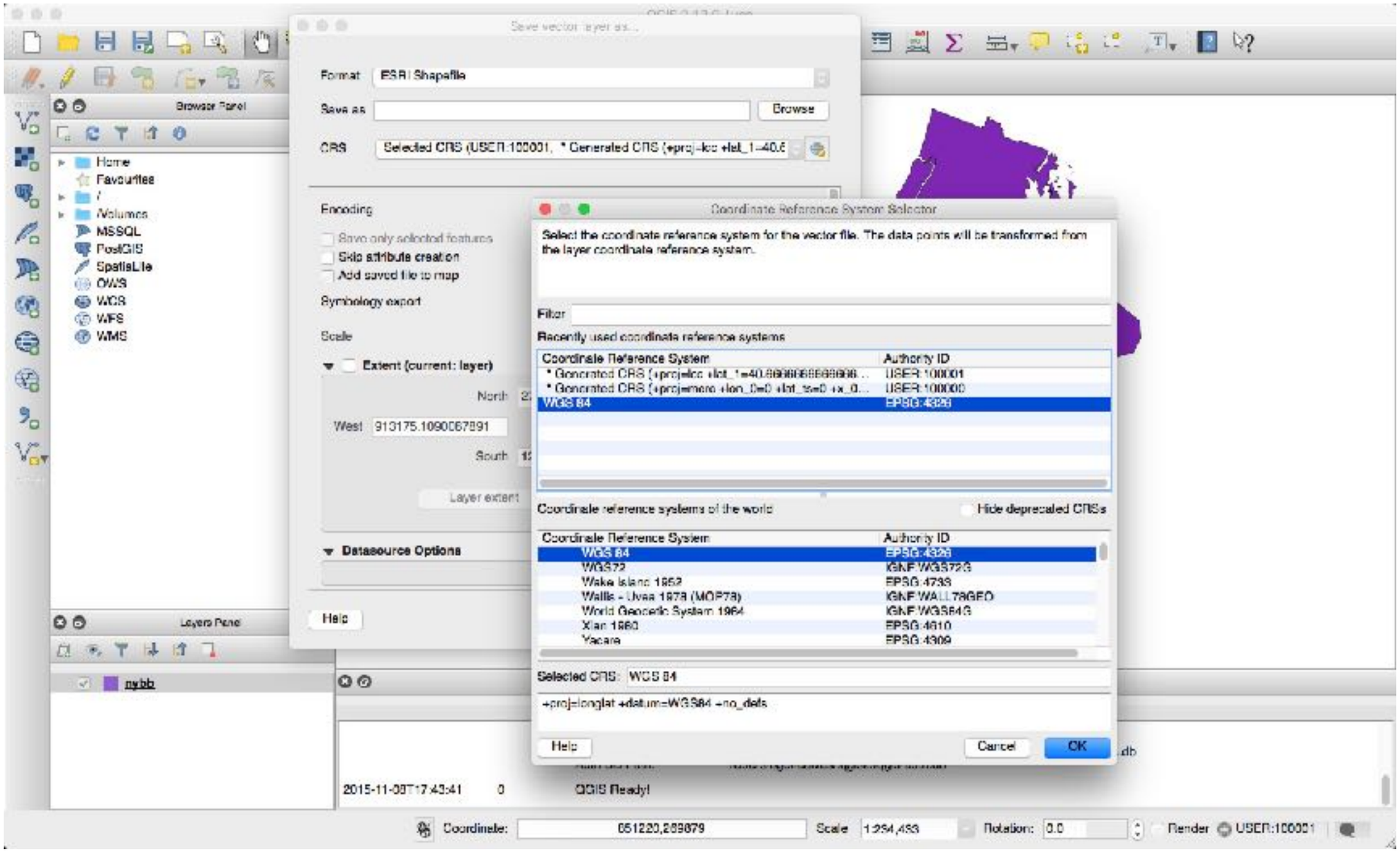
Shapefiles


QGIS 2.12.0-Lyon
Browser Panel
Home
Favourites
/
Volumes
MSSQL
PostGIS
SpatiaLite
OWS
WCS
WFS
WMS
Layers Panel
nybb
Log Messages Panel
General
Plugins
Python warning
Processing
SVG Search Paths:
User DB Path:
Auth DB Path:
2015-11-08T17:43:41
0
QGIS Ready!
Ready
Coordinate:
Scale
Rotation:
0.0
Render
EPSG:102001

Shapefiles


QGIS 2.12.0-Lyon
Browser Panel
Home
Favourites
/
/Volumes
MSSQL
PostGIS
SpatiaLite
OWS
WCS
WFS
WMS
Create Layer
Add Layer
Embed Layers and Groups...
Add from Layer Definition File...
Copy style
Paste style
Open Attribute Table
Toggle Editing
Save Layer Edits
Current Edits
Save As...
Save As Layer Definition File...
Remove Layer/Group
Duplicate Layer(s)
Set Scale Visibility of Layer(s)
Set CRS of Layer(s)
Set Project CRS from Layer
Properties...
Filter...
Labeling
Add to Overview
Add All to Overview
Remove All from Overview
Show All Layers
Hide All Layers
Show Selected Layers
Hide Selected Layers
Layers Panel
nyblk
Log Messages Panel
General
Plugins
Python warning
Processing
SVG Search Paths:
User DB Path:
Auth DB Path:
2015-11-08T17:43:41
QGIS Ready!
Coordinate:
Scale
Rotation:
Render

Shapefiles


Save vector layer as...
Format
ESRI Shapefile
Save as
Browse
CRS
Encoding
Save only selected features
Skip attribute creation
Add saved file to map
Symbology export
Scale
Extent (current: layer)
West
Datasource Options
Help
Coordinate Reference System Selector
Select the coordinate reference system for the vector file. The data points will be transformed from the layer coordinate reference system.
Filter
Recently used coordinate reference systems
Coordinate Reference System
Authority ID
WGS 84
Coordinate reference systems of the world
Hide deprecated CRSs
Selected CRS:
+proj=longlat +datum=WGS84 +no_defs
Cancel
OK
Browser Panel
Home
Favourites
Volumes
MSSQL
PostGIS
SpatiaLite
OWS
WCS
WFS
WMS
Layers Panel
nybb
QGIS Ready!
Coordinate:
Scale
Rotation:
Render

pyshp

https://github.com/GeospatialPython/pyshp

- pyshp defines utility functions to load and manipulate Shapefiles programmatically.
- The shapefile module handles the most common operations:
  - .Reader(filename) - Returns a Reader object
- Reader.records()/Reader.iterRecords() returns/iterates over the different records present in the shapefile
- Reader.shapes()/Reader.iterShapes() - returns/Iterates over the different shapes present in the shapefile
- Reader.shapeRecords()/Reader.iterShapeRecords() returns/Iterates over both shapes and records present in the shapefile
- Reader.record(index)/Reader.shape(index)/Reader.shapeRecord(index) - return the record/shape/shapeRecord at index position index
- Reader.numRecords - returns the number of records in the shapefile

pyshp

https://github.com/GeospatialPython/pyshp

```
import sys
import shapefile

shp = shapefile.Reader('geofiles/nybb_15c/nybb_wgs84.shp')

print("Found", shp.numRecords, "records:")

recordDict = dict(zip([record[1] for record in shp.iterRecords()], range(shp.numRecords)))

for record, id in recordDict.items():
    print(id, record)
```


shapefile_load.py

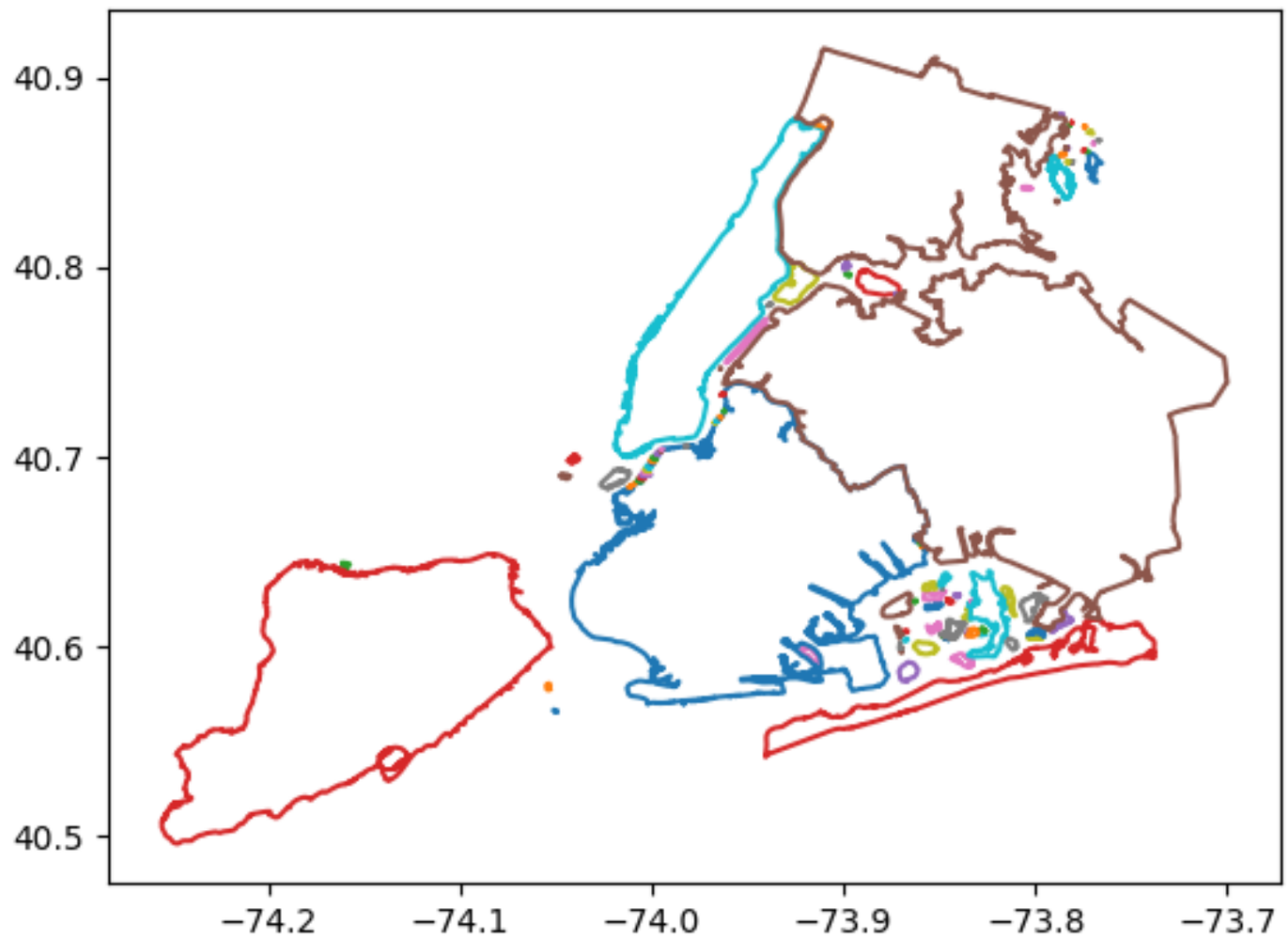
pyshp

https://github.com/GeospatialPython/pyshp
http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf

- shape objects contain several fields:
  - bbox - lower left and upper right x,y coordinates (long/lat) - optional
  - parts - list of indexes for the first point of each of the parts making up the shape.
  - points - x,y coordinates for each point in the shape.
  - shapeType - integer representing the shape type - all shapes in a shapefile are required to be of the same shapeType or null.

Value	Shape Type
0	Null Shape
1	Point
3	PolyLine
5	Polygon
8	MultiPoint
11	PointZ
13	PolyLineZ
15	PolygonZ
18	MultiPointZ
21	PointM
23	PolyLineM
25	PolygonM
28	MultiPointM
31	MultiPatch

Simple shapefile plot



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shapely

http://toblerity.org/shapely/manual.html

- Shapely defines geometric objects under shapely.geometry:
  - Point
  - Polygon
  - MultiPolygon
  - shape() Convenience function that creates the appropriate geometric object
- and common operations
  - .crosses(shape) - if it partially overlaps shape
  - .contains(shape) - wether it contains or not the object shape
  - .within(shape)- wether it is contained by object shape
  - .touches(shape) - if the boudaries of this object touch shape

shapely

http://toblerity.org/shapely/manual.html

- shape objects provide useful fields to query a shapes properties:
  - .centroid - The centroid ("center of mass") of the object
  - .area - returns the area of the object
  - .bounds - the MBR of the shape in (minx, miny, maxx, maxy) format
  - .length - the length of the shape
  - .geom_type - the Geometry Type of the object
- shapely.shape is also able to easily load pyshp's shape objects to allow for further manipulations.

shapely

http://toblerity.org/shapely/manual.html

```
import sys
import shapefile
from shapely.geometry import shape

shp = shapefile.Reader('geofiles/nybb_15c/nybb_wgs84.shp')

recordDict = dict(zip([record[1] for record in shp.iterRecords()], range(shp.numRecords)))

manhattan = shape(shp.shape(recordDict["Manhattan"]))

print("Centroid:", manhattan.centroid)
print("Bounding box:", manhattan.bounds)
print("Geometry type:", manhattan.geom_type)
print("Length:", manhattan.length)
```

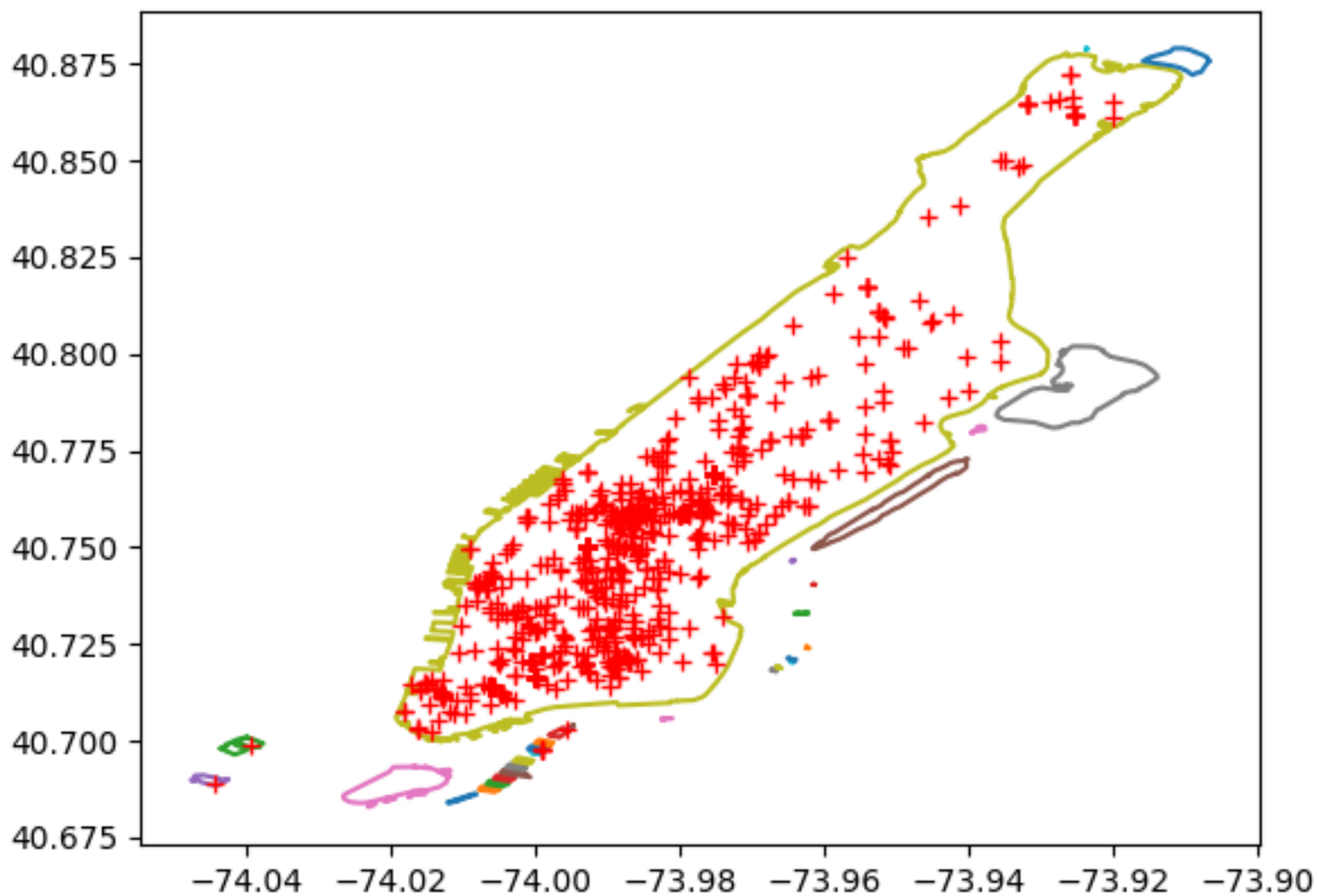

shapefile_shape_properties.py

Filter points within a Shapefile

```
import sys
import shapefile
from shapely.geometry import shape, Point
import gzip

shp = shapefile.Reader('geofiles/nybb_15c/nybb_wgs84.shp')

recordDict = dict(zip([record[1] for record in shp.iterRecords()], range(shp.numRecords)))

manhattan = shape(shp.shape(recordDict["Manhattan"]))
fp = gzip.open("Manhattan.json.gz", "w")

for line in gzip.open("NYC.json.gz"):
    try:
        tweet = eval(line.strip())

        if "coordinates" in tweet and tweet["coordinates"] is not None:
            point = Point(tweet["coordinates"]["coordinates"])

            if manhattan.contains(point):
                fp.write(line)
    except:
        pass

fp.close()
```

shapefile_filter.py

Filter points within a Shapefile



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Twitter places

- As we saw before, Twitter defines a "coordinates" field in tweets
- There is also a "place" field that we glossed over.
- The **place** object contains also geographical information, but at a courser resolution than the **coordinates** field.
- Each place has a unique place_id, a bounding_box and some geographical information, such as **country** and **full_name**:

```
{'attributes': {},
 'bounding_box': {'coordinates': [[[-74.041878, 40.570842],
    [-74.041878, 40.739434],
    [-73.855673, 40.739434],
    [-73.855673, 40.570842]]],
  'type': 'Polygon'},
 'country': 'United States',
 'country_code': 'US',
 'full_name': 'Brooklyn, NY',
 'id': '011add077f4d2da3',
 'name': 'Brooklyn',
 'place_type': 'city',
 'url': 'https://api.twitter.com/1.1/geo/id/011add077f4d2da3.json'}
```

The bounding_box field is GeoJSON formatted and compatible with pyshp.shape

- places can be of several different types: 'admin', 'city', 'neighborhood', 'poi'

Twitter places

https://dev.twitter.com/overview/api/places

Place Attributes

Place Attributes are metadata about places. An attribute is a key-value pair of arbitrary strings, but with some conventions.

Below are a number of well-known place attributes which may, or may not exist in the returned data. These attributes are provided when the place was created in the Twitter places database.

Key	Description
street_address	
locality	the city the place is in
region	the administrative region the place is in
iso3	the country code
postal_code	in the preferred local format for the place
phone	in the preferred local format for the place, include long distance code
twitter	twitter screen-name, without @
url	official/canonical URL for place
app:id	An ID or comma separated list of IDs representing the place in the applications place database.

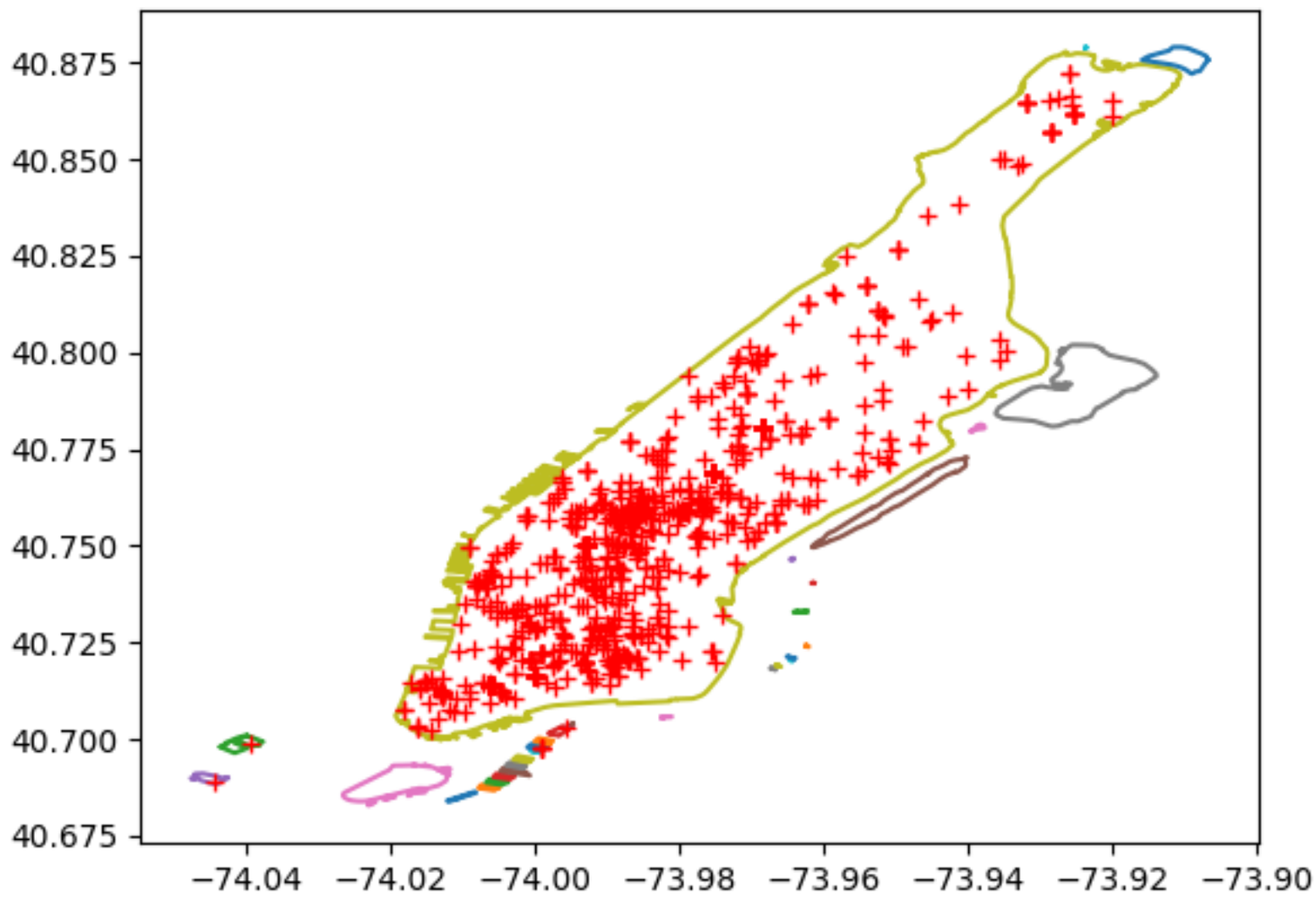
Keys can be no longer than 140 characters in length. Values are unicode strings and are restricted to 2000 characters.

Filter points and places

```
import sys
import shapefile
from shapely.geometry import shape, Point
import gzip

shp = shapefile.Reader('geofiles/nybb_15c/nybb_wgs84.shp')

recordDict = dict(zip([record[1] for record in shp.iterRecords()], range(shp.numRecords)))

manhattan = shape(shp.shape(recordDict["Manhattan"]))
fp = gzip.open("Manhattan_places.json.gz", "w")

for line in gzip.open("NYC.json.gz"):
    try:
        tweet = eval(line.strip())
        point = None

        if "coordinates" in tweet and tweet["coordinates"] is not None:
            point = Point(tweet["coordinates"]["coordinates"])
        else:
            if "place" in tweet and tweet["place"]["bounding_box"] is not None:
                bbox = shape(tweet["place"]["bounding_box"])
                point = bbox.centroid

        if point is not None and manhattan.contains(point):
            fp.write(line)
    except:
        pass

fp.close()
```

shapefile_filter_places.py

Filter points and places



@bgoncalves

Filter

```python
import sys
import gzip
import numpy as np
import shapefile
from shapely.geometry import shape, Point
import matplotlib.pyplot as plt

shp = shapefile.Reader('geofiles/nybb_15c/nybb_wgs84.shp')
recordDict = dict(zip([record[1] for record in shp.iterRecords()],
range(shp.numRecords)))

manhattan = shp.shape(recordDict["Manhattan"])

points = np.array(manhattan.points)
parts = manhattan.parts
parts.append(len(manhattan.points))

for i in range(len(parts)-1):
    plt.plot(points.T[0][parts[i]:parts[i+1]], points.T[1][parts[i]:parts[i+1]])

points_X = []
points_Y = []

manhattan = shape(shp.shape(recordDict["Manhattan"]))

for line in gzip.open(sys.argv[1]):
    try:
        tweet = eval(line.strip())
        point = None

        if "coordinates" in tweet and tweet["coordinates"] is not None:
            point = Point(tweet["coordinates"]["coordinates"])
        else:
            if "place" in tweet and tweet["place"]["bounding_box"] is not None:
                bbox = shape(tweet["place"]["bounding_box"])
                point = bbox.centroid

        if point is not None and manhattan.contains(point):
            points_X.append(point.x)
            points_Y.append(point.y)
    except:
        pass

plt.plot(points_X, points_Y, 'r+')
plt.savefig(sys.argv[1] + '.png')
```

plot_shapefile_points.py

@bgonca

Aggregation

```python
import sys
import numpy as np
import shapefile
from shapely.geometry import shape, Point
import matplotlib.pyplot as plt
import gzip

def map_points(xllcorner, yllcorner, cellsize, nrows, x, y):
    x = int((x-xllcorner)/cellsize)
    y = (nrows-1)-int((y-yllcorner)/cellsize)

    return x, y

def save_asc(data, xllcorner, yllcorner, cellsize, filename):
    fp = open(filename, "w")

    nrows, ncols = data.shape

    print("ncols", ncols, file=fp)
    print("nrows", nrows, file=fp)
    print("xllcorner", xllcorner, file=fp)
    print("yllcorner", yllcorner, file=fp)
    print("cellsize", cellsize, file=fp)
    print("NODATA_value", "-9999", file=fp)

    for i in range(nrows):
        for j in range(ncols):
            print(("%u " % data[i, j]), end="", file=fp)

        print("\n", end="", file=fp)

    fp.close()
```

shapefile_filter_aggregate.py

```python
shp = shapefile.Reader('geofiles/nybb_15c/nybb_wgs84.shp')
recordDict = dict(zip([record[1] for record in shp.iterRecords()], range(shp.numRecords)))
manhattan = shape(shp.shape(recordDict["Manhattan"]))

xllcorner, yllcorner, xurcorner, yurcorner = manhattan.bounds
cellsize = 0.01

ncols = int((xurcorner-xllcorner)/cellsize)
nrows = int((yurcorner-yllcorner)/cellsize)

data = np.zeros((nrows, ncols), dtype='int')

for line in gzip.open("NYC.json.gz"):
    try:
        tweet = eval(line.strip())
        point = None

        if "coordinates" in tweet and tweet["coordinates"] is not None:
            point = Point(tweet["coordinates"]["coordinates"])
        else:
            if "place" in tweet and tweet["place"]["bounding_box"] is not None:
                bbox = shape(tweet["place"]["bounding_box"])
                point = bbox.centroid

        if point is not None and manhattan.contains(point):
            coord_x, coord_y = map_points(xllcorner, yllcorner, cellsize, nrows, point.x, point.y)
            data[coord_y, coord_x] += 1

    except:
        pass


save_asc(data, xllcorner, yllcorner, cellsize, "Manhattan.asc")

plt.imshow(np.log(data+1))
plt.colorbar()
plt.savefig('Manhattan_cells.png')
```

shapefile_filter_aggregate.py

Aggregation