GeoJSON & Leaflet Plugins

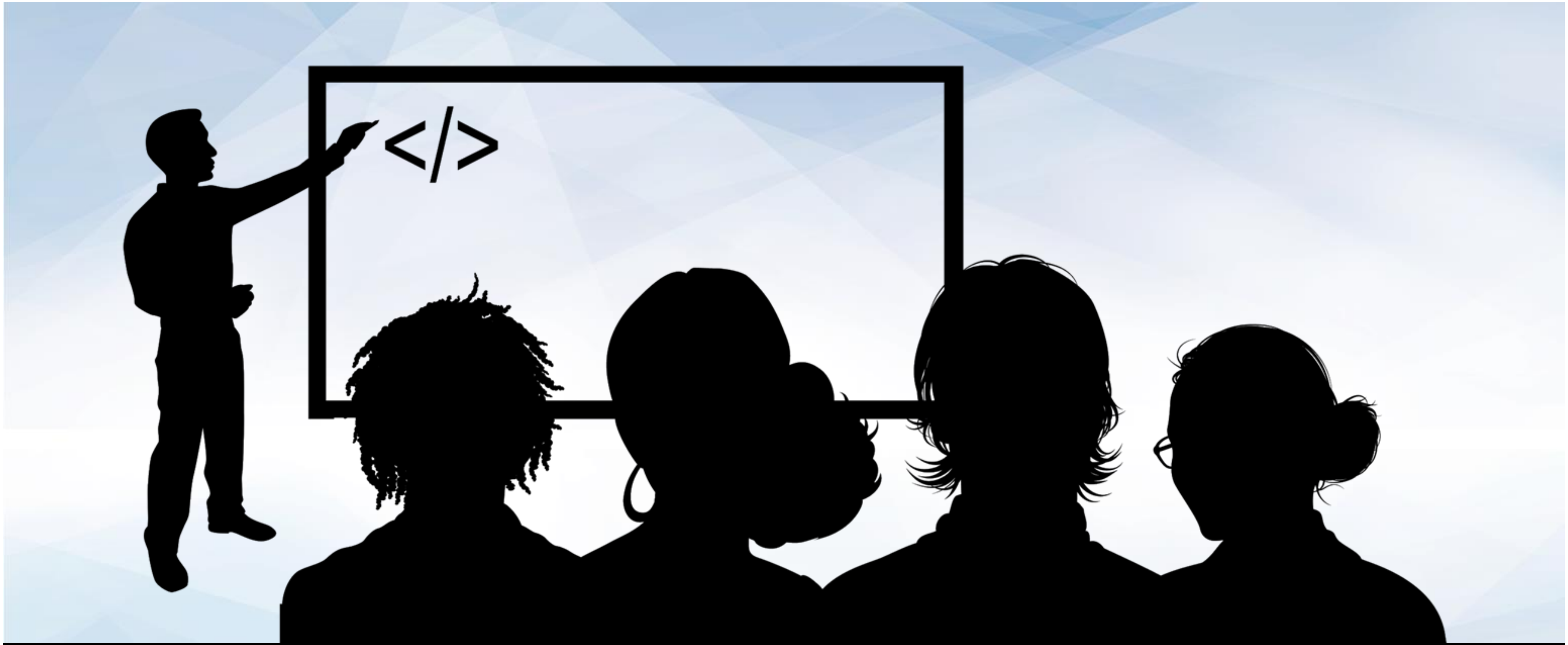
Data Boot Camp

Lesson 17.2

Class Objectives

By the end of today’s class you will be able to:

- Gain a firm grasp of mapping with GeoJSON.
- Learn about and practice using Leaflet plugins and third-party libraries.
- Learn how different maps can effectively visualize different datasets.



Instructor Demonstration

GeoJSON Review

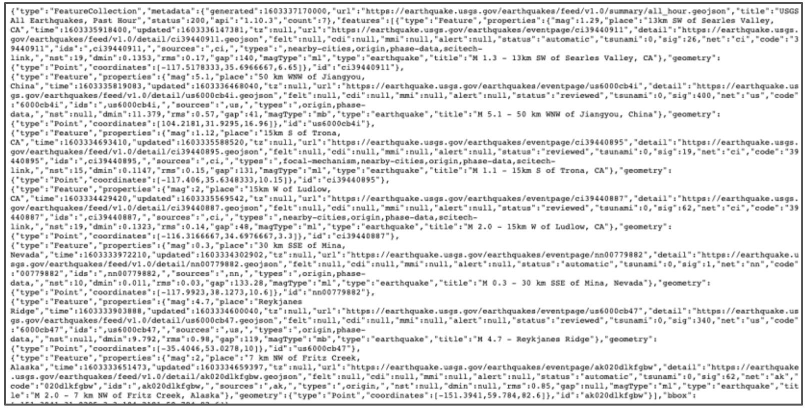
What is GeoJSON?

➔ Review

GeoJSON

○ GeoJSON is a geospatial data interchange format based on JavaScript Object Notation (JSON). It defines several types of JSON objects and the manner in which they are combined to represent data about geographic features, their properties, and their spatial extents.

GeoJSON Review



```
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CA","time":1603335918400,"updated":1603336147381,"tz":null,"url":"https://earthquake.usgs.gov/earthquakes/eventpage/ci39440911","detail":"https://earthquake.usgs.
gov/earthquakes/feed/v1.0/detail/ci39440911.geojson","felt":null,"cdi":null,"mmi":null,"alert":null,"status":"automatic","tsunami":0,"sig":26,"net":"ci","code":"3
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China","time":1603335819083,"updated":1603336468040,"tz":null,"url":"https://earthquake.usgs.gov/earthquakes/eventpage/us6000cb4i","detail":"https://earthquake.us
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gs.gov/earthquakes/feed/v1.0/detail/us6000cb47.geojson","felt":null,"cdi":null,"mmi":null,"alert":null,"status":"reviewed","tsunami":0,"sig":340,"net":"us","code"
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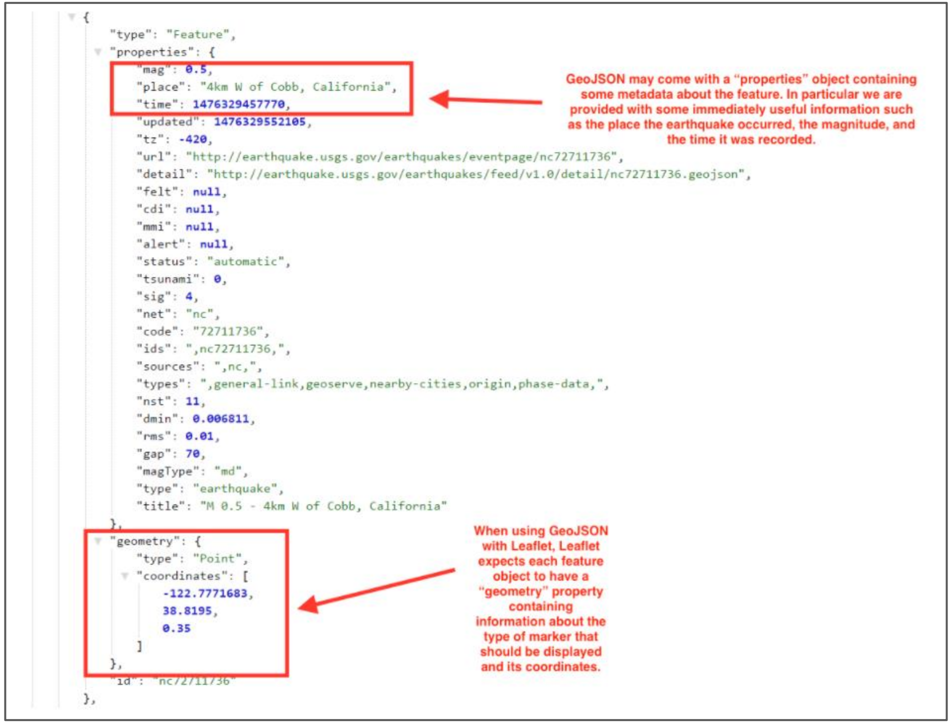
```



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        "rms": 0.01,
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            38.8195,
            0.35
        ]
    },
    "id": "nc72711736"
},
```

GeoJSON may come with a "properties" object containing some metadata about the feature. In particular we are provided with some immediately useful information such as the place the earthquake occurred, the magnitude, and the time it was recorded.

When using GeoJSON with Leaflet, Leaflet expects each feature object to have a "geometry" property containing information about the type of marker that should be displayed and its coordinates.

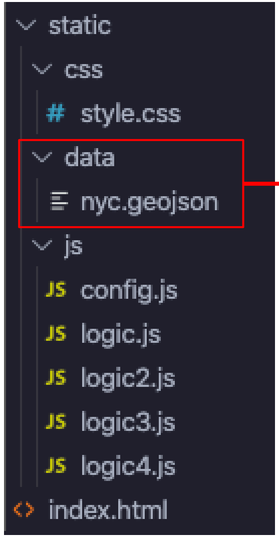
Everyone Do: NY Neighborhoods

In this activity, we all will be diving into some advance Leaflet/GeoJSON functionality. We are going to build a map of New york City broken down by boroughs and neighborhoods.

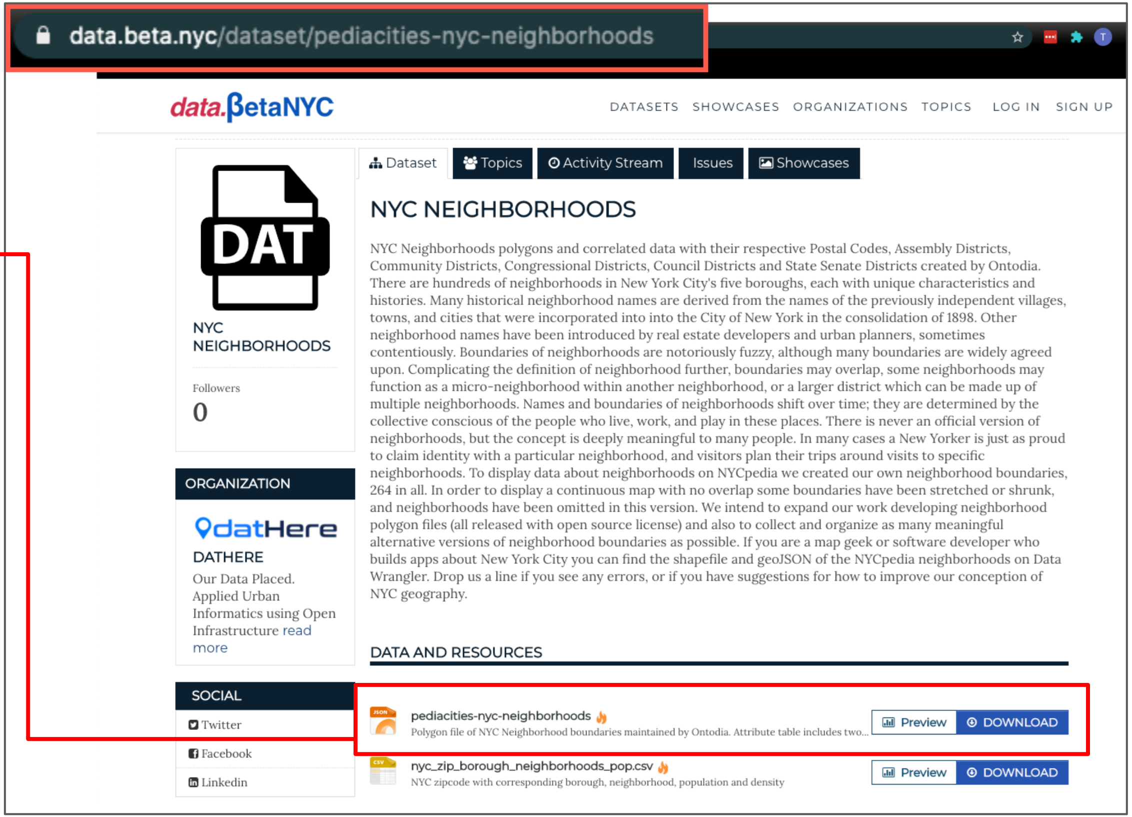
Suggested Time:
20 Minutes

Everyone Do: NY Neighborhoods

➔ File Structure



```
static
  css
    style.css
  data
    nyc.geojson
  js
    config.js
    logic.js
    logic2.js
    logic3.js
    logic4.js
index.html
```



data.beta.nyc/dataset/pediacities-nyc-neighborhoods

NYC NEIGHBORHOODS

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NYC NEIGHBORHOODS

NYC Neighborhoods polygons and correlated data with their respective Postal Codes, Assembly Districts, Community Districts, Congressional Districts, Council Districts and State Senate Districts created by Ontodia. There are hundreds of neighborhoods in New York City's five boroughs, each with unique characteristics and histories. Many historical neighborhood names are derived from the names of the previously independent villages, towns, and cities that were incorporated into into the City of New York in the consolidation of 1898. Other neighborhood names have been introduced by real estate developers and urban planners, sometimes contentiously. Boundaries of neighborhoods are notoriously fuzzy, although many boundaries are widely agreed upon. Complicating the definition of neighborhood further, boundaries may overlap, some neighborhoods may function as a micro-neighborhood within another neighborhood, or a larger district which can be made up of multiple neighborhoods. Names and boundaries of neighborhoods shift over time; they are determined by the collective conscious of the people who live, work, and play in these places. There is never an official version of neighborhoods, but the concept is deeply meaningful to many people. In many cases a New Yorker is just as proud to claim identity with a particular neighborhood, and visitors plan their trips around visits to specific neighborhoods. To display data about neighborhoods on NYCpedia we created our own neighborhood boundaries, 264 in all. In order to display a continuous map with no overlap some boundaries have been stretched or shrunk, and neighborhoods have been omitted in this version. We intend to expand our work developing neighborhood polygon files (all released with open source license) and also to collect and organize as many meaningful alternative versions of neighborhood boundaries as possible. If you are a map geek or software developer who builds apps about New York City you can find the shapefile and geoJSON of the NYCpedia neighborhoods on Data Wrangler. Drop us a line if you see any errors, or if you have suggestions for how to improve our conception of NYC geography.

DATA AND RESOURCES

pediacities-nyc-neighborhoods

Polygon file of NYC Neighborhood boundaries maintained by Ontodia. Attribute table includes two...

Preview | DOWNLOAD

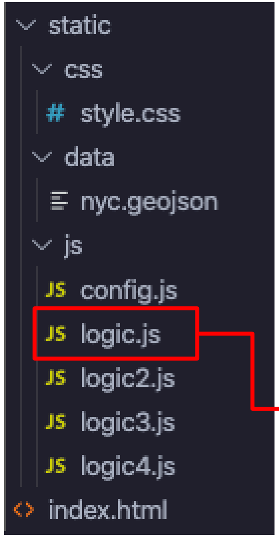
nyc_zip_borough_neighborhoods_pop.csv

NYC zipcode with corresponding borough, neighborhood, population and density

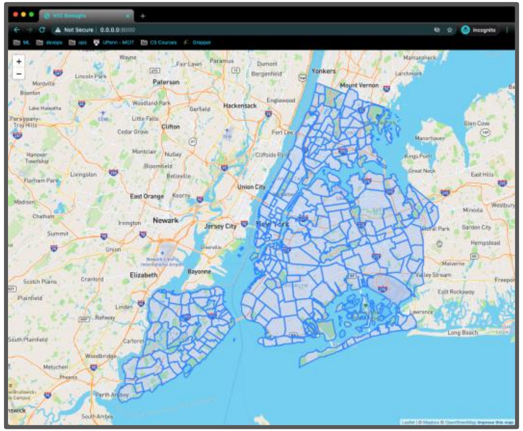
Preview | DOWNLOAD

Everyone Do: NY Neighborhoods

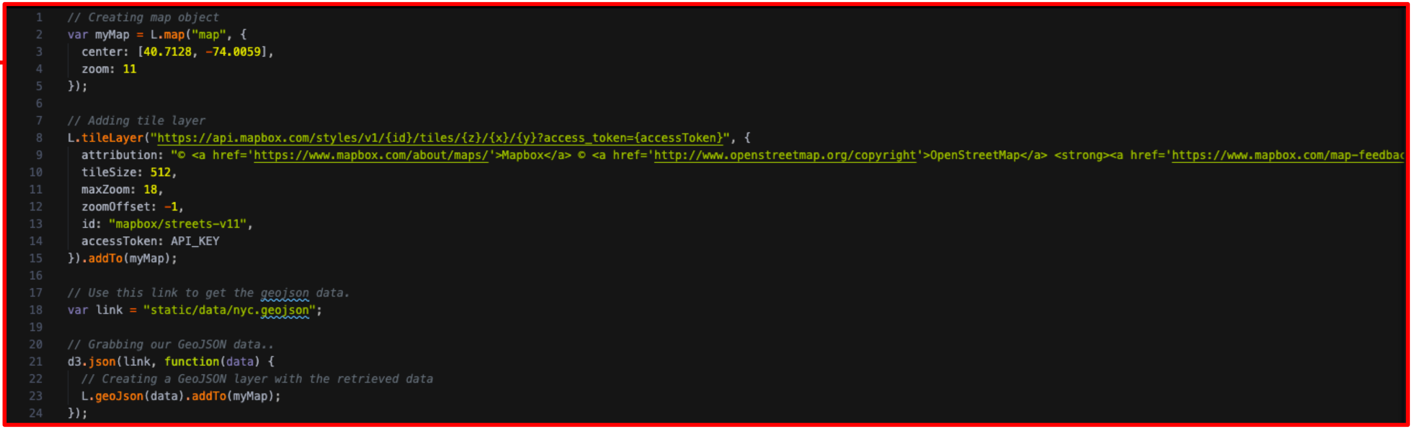
➔ File Structure



```
static
  css
    style.css
  data
    nyc.geojson
  js
    config.js
    logic.js
    logic2.js
    logic3.js
    logic4.js
index.html
```



- From the command line navigate to where `index.html` is and run: `python -m http.server`.
- Open http://0.0.0.0:8000/ in a browser.



```
// Creating map object
var myMap = L.map("map", {
  center: [40.7128, -74.0059],
  zoom: 11
});

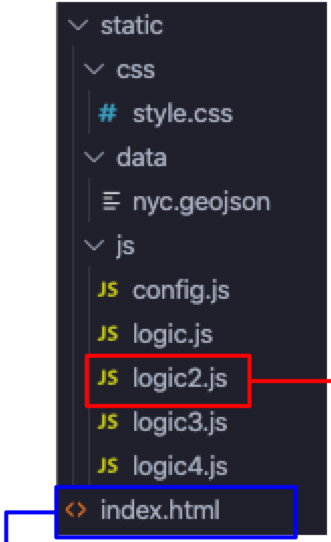
// Adding tile layer
L.tileLayer("https://api.mapbox.com/styles/v1/{id}/tiles/{z}/{x}/{y}?access_token={accessToken}", {
  attribution: "© <a href='https://www.mapbox.com/about/maps/'>Mapbox</a> © <a href='http://www.openstreetmap.org/copyright'>OpenStreetMap</a> <strong><a href='https://www.mapbox.com/map-feedbac
  tileSize: 512,
  maxZoom: 18,
  zoomOffset: -1,
  id: "mapbox/streets-v11",
  accessToken: API_KEY
}).addTo(myMap);

// Use this link to get the geojson data.
var link = "static/data/nyc.geojson";

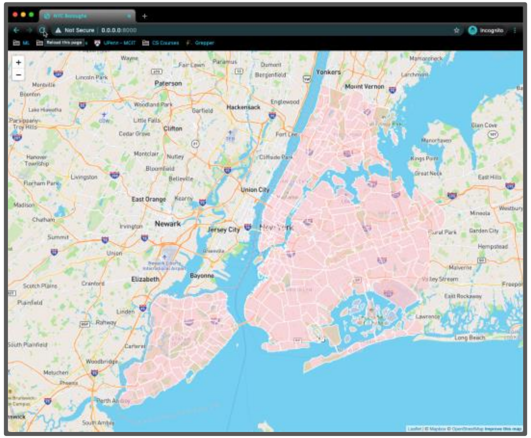
// Grabbing our GeoJSON data..
d3.json(link, function(data) {
  // Creating a GeoJSON layer with the retrieved data
  L.geoJson(data).addTo(myMap);
});
```

Everyone Do: NY Neighborhoods

➔ File Structure

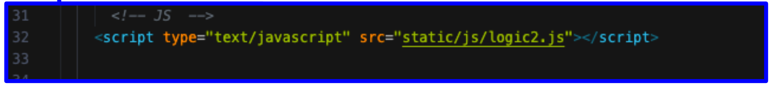


```
static
  css
    # style.css
  data
    nyc.geojson
  js
    JS config.js
    JS logic.js
    JS logic2.js
    JS logic3.js
    JS logic4.js
<> index.html
```

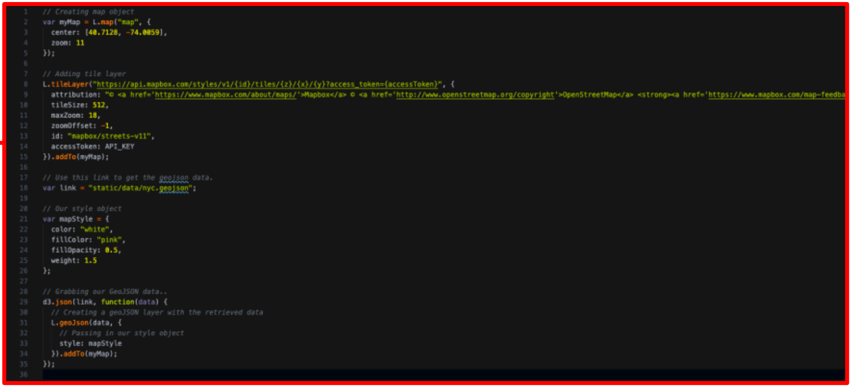

Not Secure | 0.0.0.0:8000
Incognito
Leaflet | © Mapbox © OpenStreetMap Improve this map

- From the command line navigate to where `index.html` is and run: `python -m http.server`.
- Open http://0.0.0.0:8000/ in a browser.

➔ In the `index.html` file change to `logic2.js`



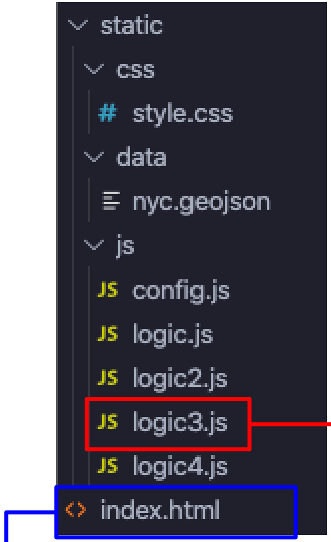
```html
<!-- JS -->
<script type="text/javascript" src="static/js/logic2.js"></script>
```



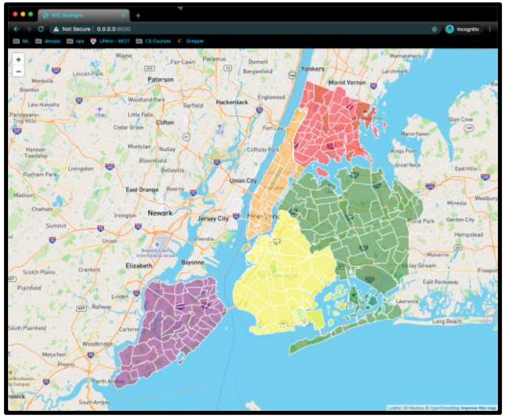
```javascript
// Creating map object
var myMap = L.map("map", {
  center: [40.7128, -74.0059],
  zoom: 11
});

// Adding tile layer
L.tileLayer("https://api.mapbox.com/styles/v1/{id}/tiles/{z}/{x}/{y}?access_token={accessToken}", {
  attribution: "© <a href='https://www.mapbox.com/about/maps/'>Mapbox</a> © <a href='http://www.openstreetmap.org/copyright'>OpenStreetMap</a> <strong><a href='https://www.mapbox.com/map-feedba
  tileSize: 512,
  maxZoom: 18,
  zoomOffset: -1,
  id: "mapbox/streets-v11",
  accessToken: API_KEY
}).addTo(myMap);

// Use this link to get the geojson data.
var link = "static/data/nyc.geojson";

// Our style object
var mapStyle = {
  color: "white",
  fillColor: "pink",
  fillOpacity: 0.5,
  weight: 1.5
};

// Grabbing our GeoJSON data..
d3.json(link, function(data) {
  // Creating a geoJSON layer with the retrieved data
  L.geoJson(data, {
    // Passing in our style object
    style: mapStyle
  }).addTo(myMap);
});
```

Everyone Do: NY Neighborhoods

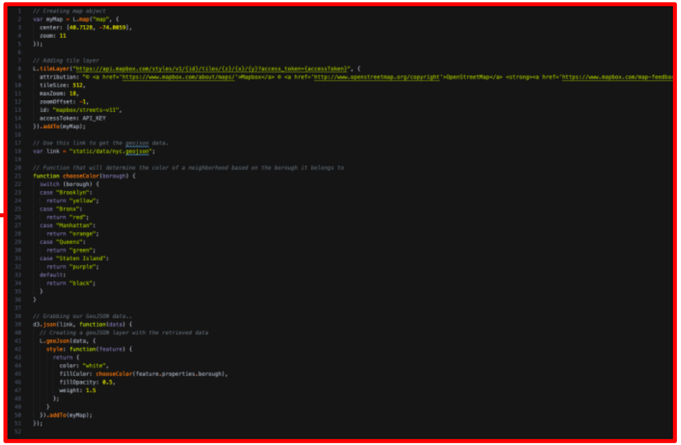
- ➔ File Structure



```
static
  css
    style.css
  data
    nyc.geojson
  js
    config.js
    logic.js
    logic2.js
    logic3.js
    logic4.js
index.html
```

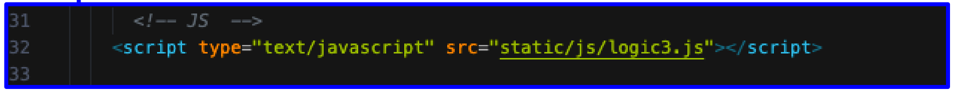


- From the command line navigate to where `index.html` is and run: `python -m http.server`.
- Open http://0.0.0.0:8000/ in a browser.



```javascript
// Creating map object
var myMap = L.map("map", {
  center: [40.7128, -74.0059],
  zoom: 11
});

// Adding tile layer
L.tileLayer("https://api.mapbox.com/styles/v1/{id}/tiles/{z}/{x}/{y}?access_token={accessToken}", {
  attribution: "© <a href='https://www.mapbox.com/about/maps/'>Mapbox</a> © <a href='http://www.openstreetmap.org/copyright'>OpenStreetMap</a> <strong><a href='https://www.mapbox.com/map-feedba
  tileSize: 512,
  maxZoom: 18,
  zoomOffset: -1,
  id: "mapbox/streets-v11",
  accessToken: API_KEY
}).addTo(myMap);

// Use this link to get the geojson data.
var link = "static/data/nyc.geojson";

// Function that will determine the color of a neighborhood based on the borough it belongs to
function chooseColor(borough) {
  switch (borough) {
  case "Brooklyn":
    return "yellow";
  case "Bronx":
    return "red";
  case "Manhattan":
    return "orange";
  case "Queens":
    return "green";
  case "Staten Island":
    return "purple";
  default:
    return "black";
  }
}

// Grabbing our GeoJSON data..
d3.json(link, function(data) {
  // Creating a geoJSON layer with the retrieved data
  L.geoJson(data, {
    style: function(feature) {
      return {
        color: "white",
        fillColor: chooseColor(feature.properties.borough),
        fillOpacity: 0.5,
        weight: 1.5
      };
    }
  }).addTo(myMap);
});
```

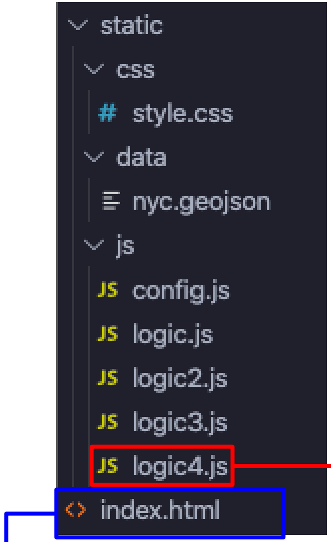
- ➔ In the `index.html` file change to `logic3.js`



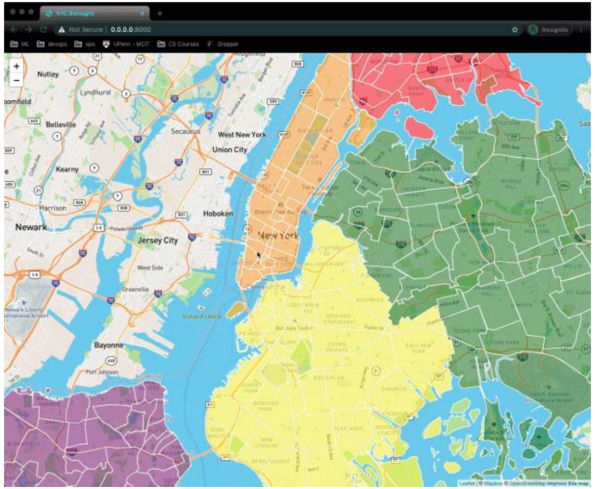
```html
  <!-- JS  -->
<script type="text/javascript" src="static/js/logic3.js"></script>
```

Everyone Do: NY Neighborhoods

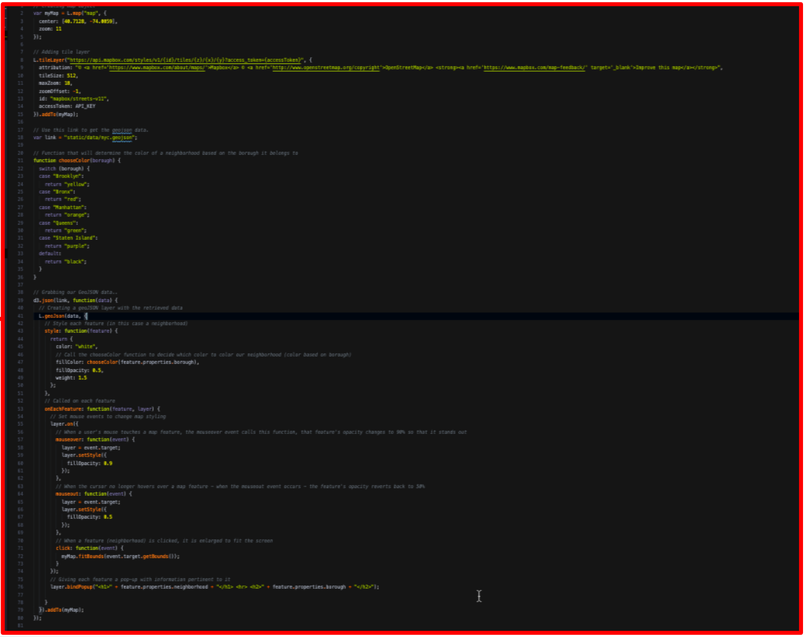
➔ File Structure



```
static
  css
    # style.css
  data
    nyc.geojson
  js
    JS config.js
    JS logic.js
    JS logic2.js
    JS logic3.js
    JS logic4.js
  <> index.html
```

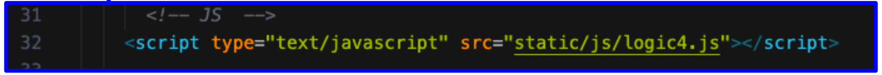


- From the command line navigate to where `index.html` is and run: `python -m http.server`.
- Open http://0.0.0.0:8000/ in a browser.



```javascript
// Creating map object
var myMap = L.map("map", {
  center: [40.7128, -74.0059],
  zoom: 11
});

// Adding tile layer
L.tileLayer("https://api.mapbox.com/styles/v1/{id}/tiles/{z}/{x}/{y}?access_token={accessToken}", {
  attribution: "© <a href='https://www.mapbox.com/about/maps/'>Mapbox</a> © <a href='http://www.openstreetmap.org/copyright'>OpenStreetMap</a> <strong><a href='https://www.mapbox.com/map-feedback/' target='_blank'>Improve this map</a></strong>",
  tileSize: 512,
  maxZoom: 18,
  zoomOffset: -1,
  id: "mapbox/streets-v11",
  accessToken: API_KEY
}).addTo(myMap);

// Use this link to get the geojson data.
var link = "static/data/nyc.geojson";

// Function that will determine the color of a neighborhood based on the borough it belongs to
function chooseColor(borough) {
  switch (borough) {
  case "Brooklyn":
    return "yellow";
  case "Bronx":
    return "red";
  case "Manhattan":
    return "orange";
  case "Queens":
    return "green";
  case "Staten Island":
    return "purple";
  default:
    return "black";
  }
}

// Grabbing our GeoJSON data..
d3.json(link, function(data) {
  // Creating a geoJSON layer with the retrieved data
  L.geoJson(data, {
    // Style each feature (in this case a neighborhood)
    style: function(feature) {
      return {
        color: "white",
        // Call the chooseColor function to decide which color to color our neighborhood (color based on borough)
        fillColor: chooseColor(feature.properties.borough),
        fillOpacity: 0.5,
        weight: 1.5
      };
    },
    // Called on each feature
    onEachFeature: function(feature, layer) {
      // Set mouse events to change map styling
      layer.on({
        // When a user's mouse touches a map feature, the mouseover event calls this function, that feature's opacity changes to 90% so that it stands out
        mouseover: function(event) {
          layer = event.target;
          layer.setStyle({
            fillOpacity: 0.9
          });
        },
        // When the cursor no longer hovers over a map feature - when the mouseout event occurs - the feature's opacity reverts back to 50%
        mouseout: function(event) {
          layer = event.target;
          layer.setStyle({
            fillOpacity: 0.5
          });
        },
        // When a feature (neighborhood) is clicked, it is enlarged to fit the screen
        click: function(event) {
          myMap.fitBounds(event.target.getBounds());
        }
      });
      // Giving each feature a pop-up with information pertinent to it
      layer.bindPopup("<h1>" + feature.properties.neighborhood + "</h1> <hr> <h2>" + feature.properties.borough + "</h2>");

    }
  }).addTo(myMap);
});
```

➔ In the `index.html` file change to `logic4.js`



```html
    <!-- JS -->
    <script type="text/javascript" src="static/js/logic4.js"></script>
```

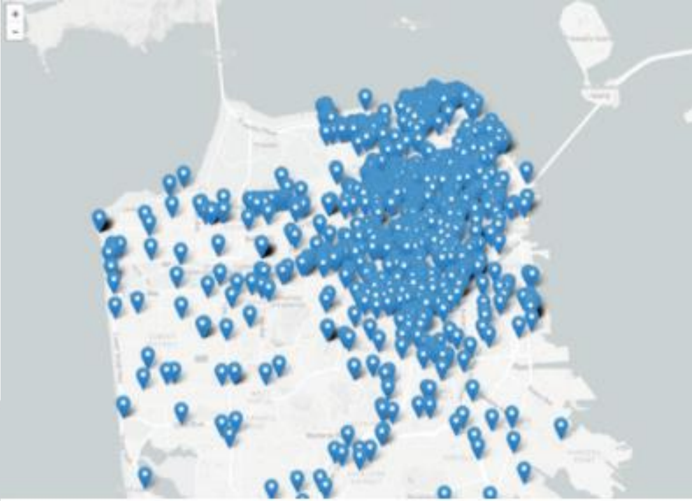
Everyone Do - Intro to Plugins: Heat Map of Crime in San Francisco

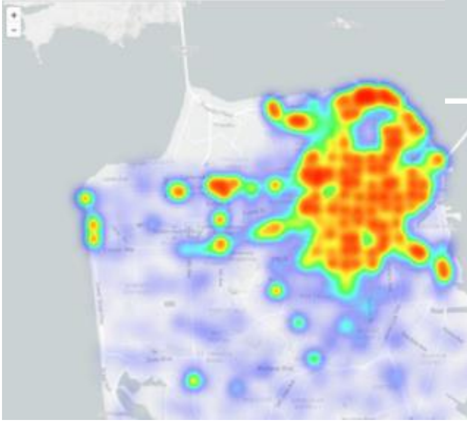
In this activity, we are all going to focus on plotting some basic data with vanilla Leaflet and adding a third party plugin to make a really cool map!

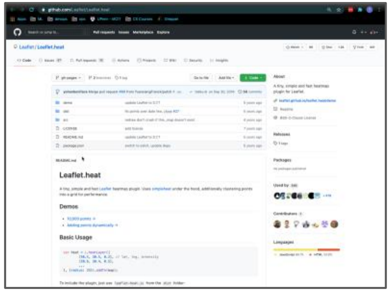
Suggested Time:
15 Minutes

Everyone Do - Intro to Plugins: Heat Map of Crime in SF

- → Live Code







github.com/Leaflet/Leaflet.heat

Leaflet / Leaflet.heat

Leaflet.heat

A tiny, simple and fast Leaflet heatmap plugin. Uses simpleheat under the hood, additionally clustering points into a grid for performance.

Demos

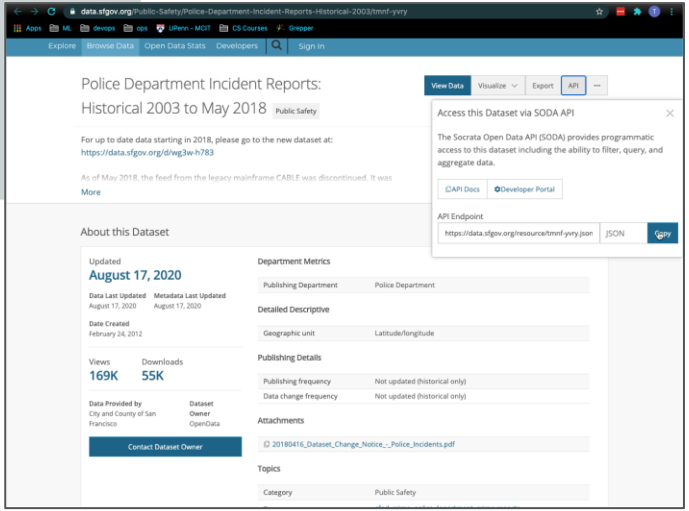
- 10,000 points →
- Adding points dynamically →

Basic Usage

```
var heat = L.heatLayer([
	[50.5, 30.5, 0.2], // lat, lng, intensity
	[50.6, 30.4, 0.5],
	...
], {radius: 25}).addTo(map);
```

About

A tiny, simple and fast heatmap plugin for Leaflet.



Police Department Incident Reports: Historical 2003 to May 2018

For up to date data starting in 2018, please go to the new dataset at: https://data.sfgov.org/d/wg3w-h783

As of May 2018, the feed from the legacy mainframe CABLE was discontinued. It was

More

Access this Dataset via SODA API

The Socrata Open Data API (SODA) provides programmatic access to this dataset including the ability to filter, query, and aggregate data.

API Docs | Developer Portal

API Endpoint: https://data.sfgov.org/resource/tmnf-yvry.json | JSON | Copy

About this Dataset

Updated
August 17, 2020

Data Last Updated: August 17, 2020
Metadata Last Updated: August 17, 2020

Date Created: February 24, 2012

Views: 169K
Downloads: 55K

Data Provided by: City and County of San Francisco
Dataset Owner: OpenData

Contact Dataset Owner

Department Metrics

Publishing Department	Police Department

Detailed Descriptive

Geographic unit	Latitude/longitude

Publishing Details

Publishing frequency	Not updated (historical only)
Data change frequency	Not updated (historical only)

Attachments

20180416_Dataset_Change_Notice_-_Police_Incidents.pdf

Topics

Category	Public Safety

Activity: Rat Cluster

In this activity, you will be taking data from NYC open data website and plotting it with the help of the Leaflet plugin.

Suggested Time:
30 Minutes

Activity: Quick Labeling Exercise

Instructions:

- You will getting your hands dirty visualizing rodent sightings in New York City! Gross!
- Check out the data for all 311 Service Requests in NYC (police non-emergency).
  - You are going to have to build a query URL from the above so that only rodent complaints from 2016 are returned.
  - You should limit the data returned to 10,000 data points.
- Once you have successfully plotted your rat data, work towards incorporating the Leaflet.markercluster plugin.
  - Cluster plugins can help to declutter a map with tons of data on it!
- **Hints**:
  - You can increase the data limit to 10,000 AFTER you get the cluster plugin working, but plotting 10,000 normal markers on a map may slow down your computer quite a bit.
- **Bonus**:
  - If you finish plotting rodent-sighting data on the map, use the 311 service Requests data to plot a similar graph with a different type of data.

Time’s Up! Let’s Review.

Countdown timer

15:00

(with alarm)

Partners Do: Choropleth

In this activity, you and your partner will be working to create a choropleth map that will visualize the median household incomes of LA and surrounding counties.

Suggested Time:
30 Minutes

Partners Do: Choropleth

Instructions:

- Over the course of this activity, you and your partner will be creating a choropleth map which will visualize the median household incomes of LA and surrounding counties.
  - A choropleth map is one in which areas are shaded or patterned in proportion to the statistical variable being represented.
  - The choropleth map provides an easy way to visualize how a measurement varies across a geographic area, showing the level of variability within a region.
- You and your partner will be using a new plugin called Leaflet-Choropleth to create this map which you can find HERE in the "dist" folder of the repository.
- You will be working your way through this activity step-by-step with your partner and the class will reconvene after each step has been accomplished in order to review.

- **Hints**:
  - You can increase the data limit to 10,000 AFTER you get the cluster plugin working, but plotting 10,000 normal markers on a map may slow down your computer quite a bit.
  - The colorbrewer2 website provides color schemes (in hex values) that you can use to customize a choropleth map.

Partners Do: Choropleth

Individual Steps:

- Step 1: Grab all of the data with d3 and plot it on the map.
- Step 2: Download the Leaflet-Choropleth repository, `choropleth.js`, place it in your js folder, and uncomment the `<script type="text/javascript" src="static/js/choropleth.js"></script>` in your `index.html` file.
- Step 3: Using the Leaflet-Choropleth documentation, create a new choropleth layer.
  - Make sure to change the `valueProperty` to the property that we wish our map to be based on.
  - Define an `onEachFeature` method that binds a popup containing the value of the feature to the layer.
- Step 4: Consult the examples and Leaflet documentation on how to add a legend.
  - Use `L.control` to add a control (and choose its position).
  - Use `L.DomUtil.create('div', 'info legend')` to create a div with the classes `info` & `legend`.
  - Loop through the colors and values of your choropleth data and add them with `div.innerHTML`.
  - Return div when done.

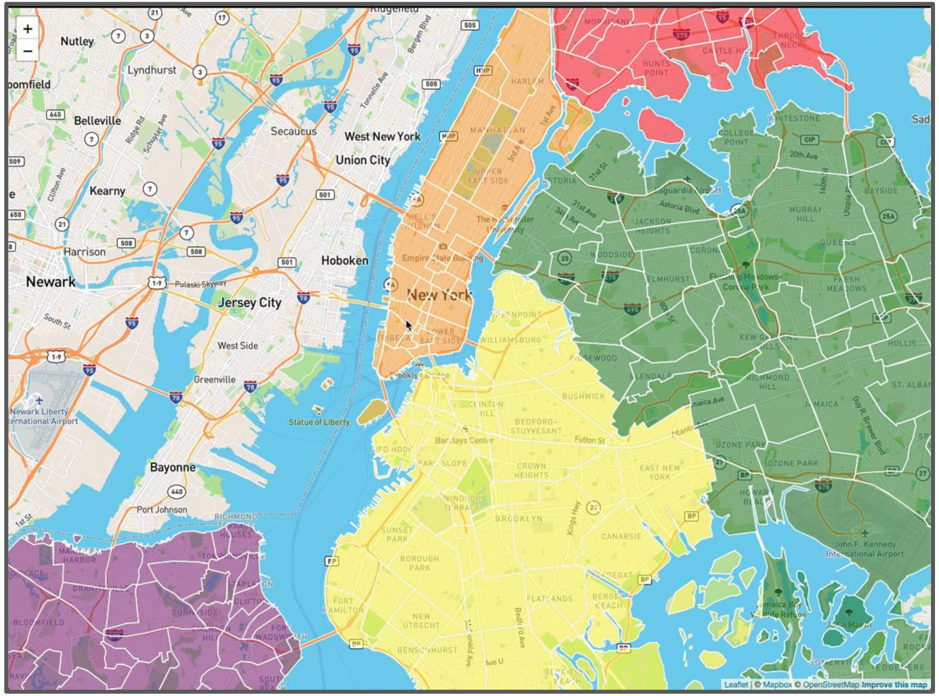
Time’s Up! Let’s Review.

Groups Do: A Map of Your Very Own

In this activity, you and your group will create a map from scratch.

Suggested Time:
30 Minutes

Everyone Do: Mini-Presentations on Maps



Nutley
Lyndhurst
oomfield
Belleville
Secaucus
West New York
Union City
Kearny
Harrison
Hoboken
Newark
Jersey City
West Side
Greenville
Newark Liberty International Airport
Statue of Liberty
Bayonne
Port Johnson
HARLEM
MANHATTAN
UPPER EAST SIDE
HELL'S KITCHEN
Empire State Building
New York
LOWER EAST SIDE
HUNTS POINT
CASTLE HILL
THROGS NECK
WHITESTONE
COLLEGE POINT
ASTORIA
JACKSON HEIGHTS
WOODSIDE
ELMHURST
CORONA
Flushing Meadows-Corona Park
MURRAY HILL
QUEENS
BAYSIDE
FRESH MEADOWS
HOLLIS
WILLIAMSBURG
RIDGEWOOD
GLENDALE
RICHMOND HILL
JAMAICA
ST. ALBANS
BUSHWICK
CLINTON HILL
BEDFORD-STUYVESANT
Barclays Center
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