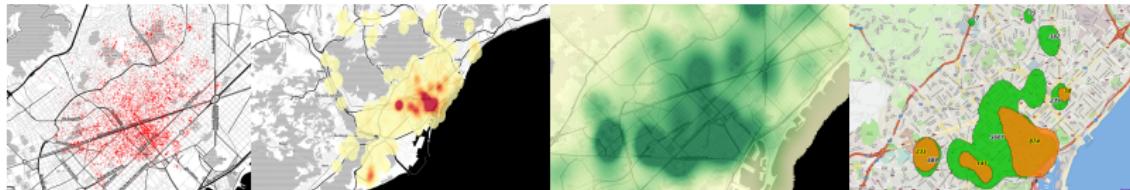


# Analysing GeoLocated Data from Social Media with QGIS

Joana Simões <sup>1</sup>

<sup>1</sup>Bdigital, CASA, CICS.NOVA

March 23, 2015



# Table of Contents

- 1 Introduction
- 2 Getting the Tweets Coordinates
- 3 Importing the Tweets into QGIS
- 4 Creating an Heatmap
- 5 Creating Clusters
- 6 3D Viz

## What do we want to do?

- Nowadays social media is a major source for information sharing. In some cases the user also shares some attributes, such as **geolocation**. By using this information as a proxy for human presence, and with the adequate methods, we are able to provide powerful representations of the distribution of social media users within the territory.

## What do we want to do?

- Nowadays social media is a major source for information sharing. In some cases the user also shares some attributes, such as **geolocation**. By using this information as a proxy for human presence, and with the adequate methods, we are able to provide powerful representations of the distribution of social media users within the territory.
- Due to its willingness in sharing data, Twitter has been a prime *playground*, for researchers and practitioners around the world.

## What do we want to do?

- Nowadays social media is a major source for information sharing. In some cases the user also shares some attributes, such as **geolocation**. By using this information as a proxy for human presence, and with the adequate methods, we are able to provide powerful representations of the distribution of social media users within the territory.
- Due to its willingness in sharing data, Twitter has been a prime *playground*, for researchers and practitioners around the world.
- The objective of this workshop is to provide a workflow for enhancing the visualization of geolocated Tweets.

Getting the Tweets Coordinates  
Importing the Tweets into QGIS  
Creating an Heatmap  
Creating Clusters  
3D Viz

## How are we going to do it?

## How are we going to do it?

- Pull data stored in a NoSQL database.

## How are we going to do it?

- Pull data stored in a NoSQL database.
- Create an Heatmap expressing Tweet density.

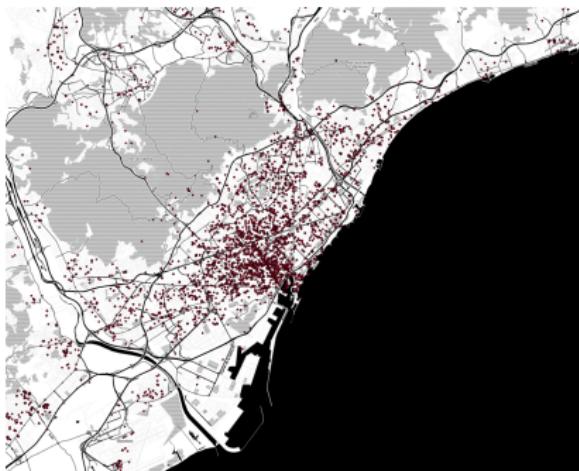
## How are we going to do it?

- Pull data stored in a NoSQL database.
- Create an Heatmap expressing Tweet density.
- Produce clusters from the heatmap.

## How are we going to do it?

- Pull data stored in a NoSQL database.
- Create an Heatmap expressing Tweet density.
- Produce clusters from the heatmap.
- Produce a 3D visualization, on a webpage.

# Objective



Before: Raw tweets



After: 3D visualization of the clusters of tweets

# Stack

- MongoDB
- QGIS + Python Plugins



# Stack

- MongoDB
- QGIS + Python Plugins
  - Heatmap



# Stack

- MongoDB
- QGIS + Python Plugins
  - Heatmap
  - OpenLayers



# Stack

- MongoDB
- QGIS + Python Plugins
  - Heatmap
  - OpenLayers
  - Qgis2threejs



# Approach

This will be a hands-on workshop.

# Approach

This will be a hands-on workshop.

- People will partner up in small teams.

# Approach

This will be a hands-on workshop.

- People will partner up in small teams.
- I will introduce each one of the micro-tasks, and I will do it while you watch.

## Approach

This will be a hands-on workshop.

- People will partner up in small teams.
- I will introduce each one of the micro-tasks, and I will do it while you watch.
- Then I will provide help to everyone who needs it to complete the task.

# Approach

This will be a hands-on workshop.

- People will partner up in small teams.
- I will introduce each one of the micro-tasks, and I will do it while you watch.
- Then I will provide help to everyone who needs it to complete the task.
- **For the impatient:** If you don't want to wait for everyone to complete, you may attempt to complete the exercises on your own ;-)  
View the complete presentation here:  
<http://tinyurl.com/pltwc2>

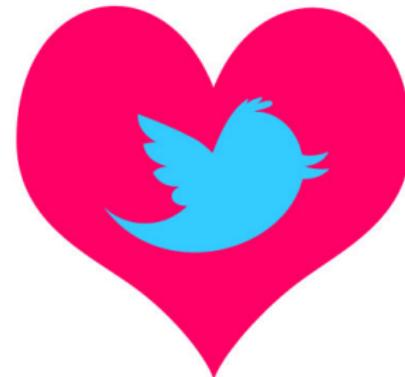
# Approach

This will be a hands-on workshop.

- People will partner up in small teams.
- I will introduce each one of the micro-tasks, and I will do it while you watch.
- Then I will provide help to everyone who needs it to complete the task.
- **For the impatient:** If you don't want to wait for everyone to complete, you may attempt to complete the exercises on your own ;-)  
View the complete presentation here:  
<http://tinyurl.com/pltwc2>
- **For the guru:** If you have finished everything and are bored, you may want to read some of the links, on the last page, or help your colleagues to complete the tasks ;-)

# Twitter Data

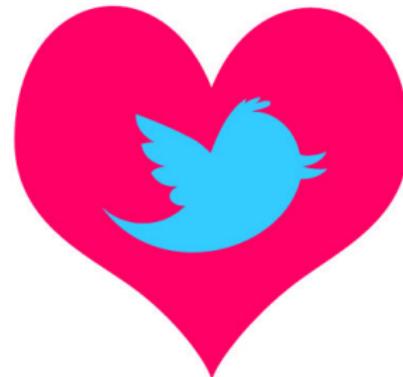
- Users on Twitter generate over 400 million tweets everyday.
- A proportion of these tweets is available to researchers and practitioners through public APIs, free of any charges.



Why we love Twitter

# Twitter Data

- Users on Twitter generate over 400 million tweets everyday.
- A proportion of these tweets is available to researchers and practitioners through public APIs, free of any charges.
- Approximately 1% of all Tweets published on Twitter are geolocated.



Why we love Twitter

Importing the Tweets into QGIS  
Creating an Heatmap  
Creating Clusters  
3D Viz

# Twitter APIs

# Twitter APIs

- REST APIs.

# Twitter APIs

- REST APIs.
- Stream APIs.

# Twitter APIs

- REST APIs.
- Stream APIs.
  - User streams.

# Twitter APIs

- REST APIs.
- Stream APIs.
  - User streams.
  - Site streams.

# Twitter APIs

- REST APIs.
- Stream APIs.
  - User streams.
  - Site streams.
  - Public Streams.

# Twitter APIs

- REST APIs.
- Stream APIs.
  - User streams.
  - Site streams.
  - Public Streams.
- These APIs are accessed only via authenticated requests (OAuth).

# Twitter APIs

- REST APIs.
- Stream APIs.
  - User streams.
  - Site streams.
  - Public Streams.
- These APIs are accessed only via authenticated requests (OAuth).
- Access to APIs is also limited to a specific number of requests within a time window (rate limit).

# Twitter APIs

- REST APIs.
- Stream APIs.
  - User streams.
  - Site streams.
  - Public Streams.
- These APIs are accessed only via authenticated requests (OAuth).
- Access to APIs is also limited to a specific number of requests within a time window (rate limit).
- Responses from Twitter are in JSON format.

# JSON in a Nutshell



## JSON

```
{  
  "siblings": [  
    {"firstName": "Anna", "lastName": "Clayton"},  
    {"lastName": "Alex", "lastName": "Clayton"}  
  ]  
}
```

## XML

```
<siblings>  
  <sibling>  
    <firstName>Anna</firstName>  
    <lastName>Clayton</lastName>  
  </sibling>  
  <sibling>  
    <firstName>Alex</firstName>  
    <lastName>Clayton</lastName>  
  </sibling>  
</siblings>
```

# Mongo loves JSON

- NoSQL Database.
- Document-Oriented Storage.



## Hands-on

- Objective: Connect to the tweets database and view one record.

## Hands-on

- Objective: Connect to the tweets database and view one record.
- Tool: Mongodb command line client.
- Database properties:
  - host: 54.72.72.228 (on aws).
  - database: tweets\_workshop
  - username: workshop
  - password: geohipster
  - collection: tweets
- Reference: <http://docs.mongodb.org/manual/#>.

## Hands-on

- Objective: Connect to the tweets database and view one record.
- Tool: Mongodb command line client.
- Database properties:
  - host: 54.72.72.228 (on aws).
  - database: tweets\_workshop
  - username: workshop
  - password: geohipster
  - collection: tweets
- Reference: <http://docs.mongodb.org/manual/#>.
- `mongo -host 54.72.72.228 tweets_workshop -u workshop -p geohipster`
- `db.tweets.find().limit( 1 )`

## Hands-on (cont.)

- Objective: Export tweets coordinates into a csv file.

## Hands-on (cont.)

- Objective: Export tweets coordinates into a csv file.
- Take notice of the long, lat fields.
- Exit the client.
- Use mongoexport to write the values on a text file.
- Reference: <http://docs.mongodb.org/manual/core/import-export/>.

## Hands-on (cont.)

- Objective: Export tweets coordinates into a csv file.
- Take notice of the long, lat fields.
- Exit the client.
- Use mongoexport to write the values on a text file.
- Reference: <http://docs.mongodb.org/manual/core/import-export/>.
- ```
mongoexport -host 54.72.72.228 -u workshop -p geohipster
-db tweets_workshop -collection tweets -csv -out
out_tweets.csv -fields
geoLocation.longitude,geoLocation.latitude -query
'geoLocation: $ne: null'
```
- View the exported file:e.g.: `cat /tmp/out/out_tweets.csv`

# QGIS

QGIS is a Free and Open-Source GIS System:



# QGIS

QGIS is a Free and Open-Source GIS System:

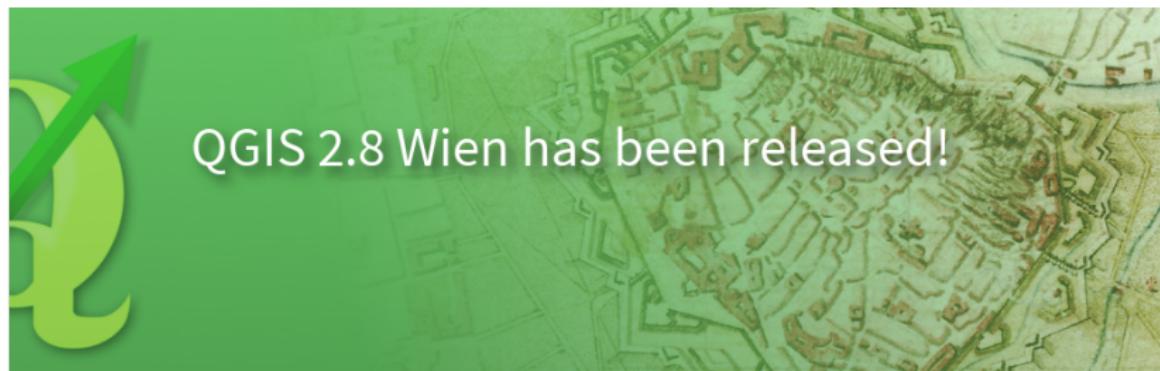
- Cross-platform (Windows, Mac, Linux and Android).



# QGIS

QGIS is a Free and Open-Source GIS System:

- Cross-platform (Windows, Mac, Linux and Android).
- Easy to use.



# QGIS

QGIS is a Free and Open-Source GIS System:

- Cross-platform (Windows, Mac, Linux and Android).
- Easy to use.
- Great community support.



# QGIS

QGIS is a Free and Open-Source GIS System:

- Cross-platform (Windows, Mac, Linux and Android).
- Easy to use.
- Great community support.
- Latest version has been translated into 46 languages.



# Bug Affecting the Heatmap Plugin

Problem with QGIS Heatmap Plugin - Geographic Information Systems Stack Exchange - Mozilla Firefox <2>

gis.stackexchange.com/questions/139829/problem-with-qgis-heatmap-plugin

Most Visited Getting Started Spatial Framework Fo...

## Geographic Information Systems

Questions Tags Users Badges Unanswered Ask Question

### Problem with QGIS Heatmap Plugin

I am experiencing some issues with the Heatmap Plugin (0.2) on QGIS 2.8.1, and I wanted to double-check if I am doing something wrong, or if there is some sort of bug lying around. As a background, I have to mention I was able to produce heatmaps before.

I have a Shapefile with tweet locations.

Asked Today  
Viewed 7 Times

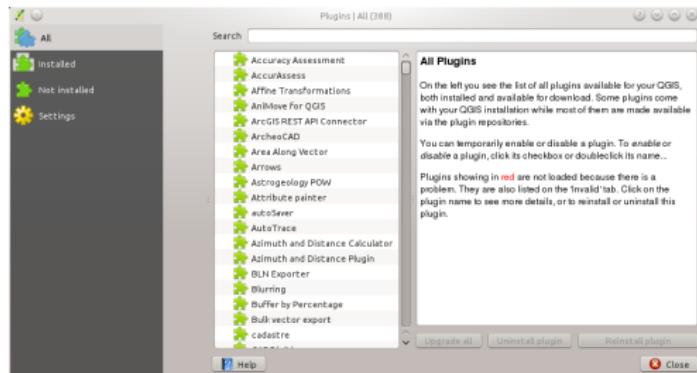
Featured on Meta  
 Let's improve our site navigation

Linked  
7 How to use Heatmap plugin and its output?

Related  
3 heatmap plugin slow/unresponsive in QGIS 1.8  
1 Stats problem: QGIS heatmap  
3 Which parameter values should I use with QGIS Heatmap plugin?  
4 How to create a Human

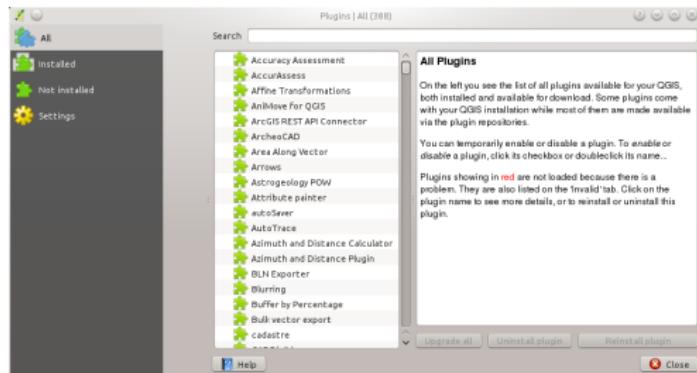
# There is a Plugin for Everything

- The core of QGIS is extended through user-submited Python plugins.



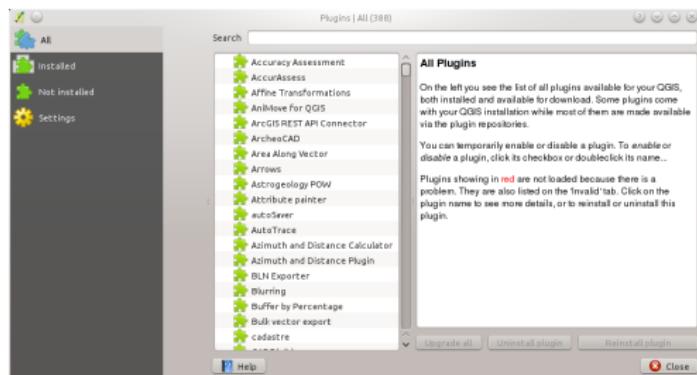
# There is a Plugin for Everything

- The core of QGIS is extended through user-submited Python plugins.



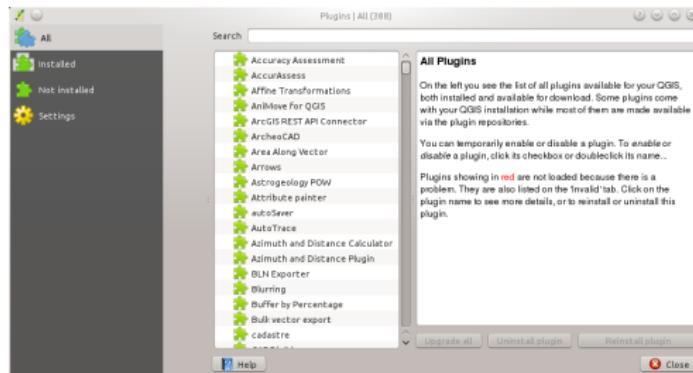
# There is a Plugin for Everything

- The core of QGIS is extended through user-submited Python plugins.
- Plugins can be easily installed through the plugin manager.



# There is a Plugin for Everything

- The core of QGIS is extended through user-submited Python plugins.
- Plugins can be easily installed through the plugin manager.
- In this workshop we will use three plugins (one is already installed).



# Isn't there a Plugin to connect to MongoDB?

- A plugin was written in 2011.

The screenshot shows a Firefox browser window with the title "MongoDB Plugin for Quantum GIS - Mozilla Firefox 24". The page content is as follows:

**MongoDB Plugin for Quantum GIS**  
Written by mackie April 15, 2011

I recently had the need to plot geographic data stored in **MongoDB** on a map. The data was in a CSV file, and I was working on a project at **WHERE, Inc.**. I was using **Quantum GIS** to do the plotting. The problem was you can't CSV files back in the day at **Archivis** this was called "adding a layer". I went Thru... So the process was to first import the CSV into MongoDB into a CSV file, adding that file into the Quantum GIS project, adding it to the layers, and then loading this added file into Quantum GIS. This was one more, maybe twice, but after that I was looking for a more automated solution. This is what led me to my MongoDB plugin for Quantum GIS.

This plugin can be found in the [Quantum GIS plugin repository](#) (direct link to the [MongoDBLayer.py](#) source code).

Writing this plugin has been a lot of a challenge because I have not used Python before. A big thanks goes to [Jesse Ramkumar](#) for helping me get up and running with Python. After getting past the initial challenges, I ran into some specific issues with

Connecting to esd-54-212-8-31.ar-west-1.compute.amazonaws.com:27017

Isn't there a Plugin to connect to MongoDB?

- A plugin was written in 2011.



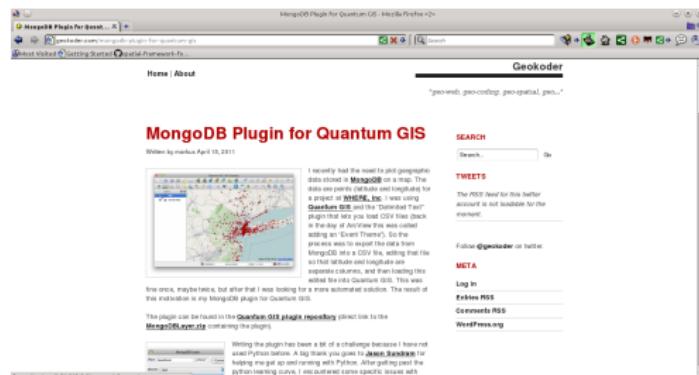
# Isn't there a Plugin to connect to MongoDB?

- A plugin was written in 2011.
- There seemed to be some issues with it, and sadly it hasn't been ported to the latest versions of QGIS.



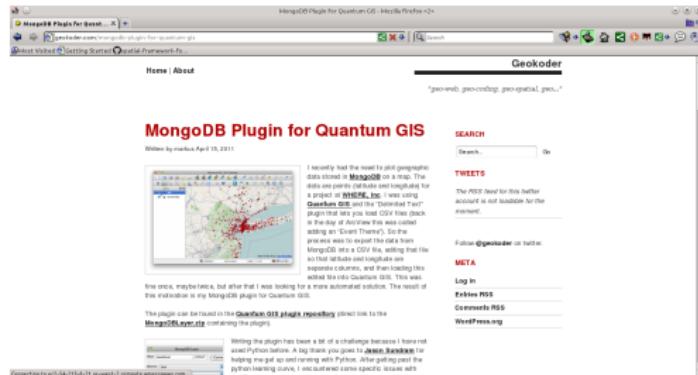
# Isn't there a Plugin to connect to MongoDB?

- A plugin was written in 2011.
- There seemed to be some issues with it, and sadly it hasn't been ported to the latest versions of QGIS.
- The project appears to be now dead.



# Isn't there a Plugin to connect to MongoDB?

- A plugin was written in 2011.
- There seemed to be some issues with it, and sadly it hasn't been ported to the latest versions of QGIS.
- The project appears to be now dead.
- The community would really welcome a new attempt for a MongoDB connector on QGIS.



## Hands-on

- Objective: Display the tweets coordinates in QGIS, with background map.
- Tool: QGIS + OpenLayers plugin.
- Steps:



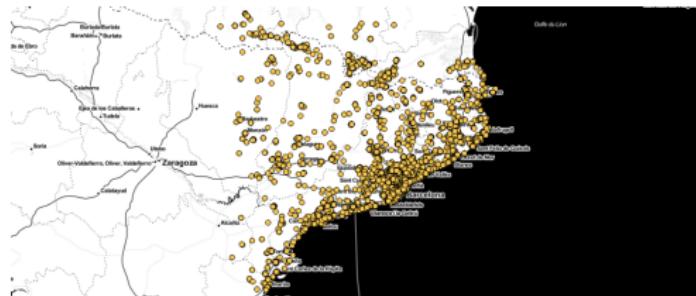
## Hands-on

- Objective: Display the tweets coordinates in QGIS, with background map.
- Tool: QGIS + OpenLayers plugin.
- Steps:
  - Start QGIS and create a project.
  - Download and enable the *OpenLayers* plugin (Plugins→Manage and Install Plugins).
  - Choose a background map (e.g.: OSM, Bing Maps, etc).
  - Import the JSON file, using the Text Layer Importer (Layer→Add Layer→Add Delimited Text Layer).



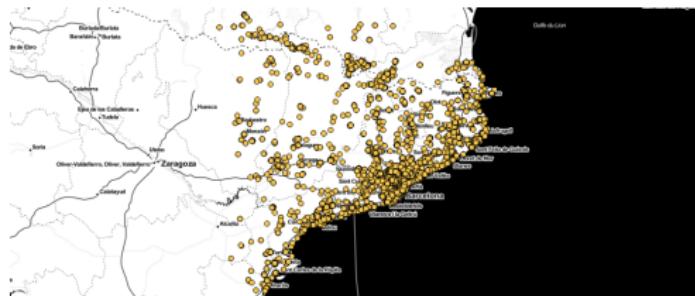
## Hands-on (cont.)

- Objective: Save the tweets from the region of Catalunya, in a Shapefile.
- Steps:



## Hands-on (cont.)

- Objective: Save the tweets from the region of Catalunya, in a Shapefile.
- Steps:
  - Zoom into the desired location using the zoom tool (View→Zoom in) .
  - Select the visible points using the select tool.
  - Save the selected features in a Shapefile.
    - Pay attention to the crs.
    - Make sure you save **only** the selected features.



# Heatmaps

Heatmaps enhance the visualization of the density distribution of a phenomena (e.g.: crime, accidents, tweets).



# Heatmaps

Heatmaps enhance the visualization of the density distribution of a phenomena (e.g.: crime, accidents, tweets).

- The *heat* in the term refers to the concentration of the geographic entity within any given spot.



# Heatmaps

Heatmaps enhance the visualization of the density distribution of a phenomena (e.g.: crime, accidents, tweets).

- The *heat* in the term refers to the concentration of the geographic entity within any given spot.
- Sometimes they are referred as *hot spot* mapping or *clustering*.



# Heatmaps

Heatmaps enhance the visualization of the density distribution of a phenomena (e.g.: crime, accidents, tweets).

- The *heat* in the term refers to the concentration of the geographic entity within any given spot.
- Sometimes they are referred as *hot spot* mapping or *clustering*.
- They are great tools to detect spatial patterns.



## Heatmaps (cont.)

- Creating heatmaps involves interpolating discrete points to create a continuous surface known as a **density surface**.

## Heatmaps (cont.)

- Creating heatmaps involves interpolating discrete points to create a continuous surface known as a **density surface**.
- There are three key parameters involved in this calculation:

## Heatmaps (cont.)

- Creating heatmaps involves interpolating discrete points to create a continuous surface known as a **density surface**.
- There are three key parameters involved in this calculation:
  - Cell size of the output raster file.
  - Bandwidth or search radius.
  - Interpolation algorithm.

## Hands-on

- Objective: Create heatmap depicting tweet density.
- Tool: QGIS + Heatmap plugin.
- Steps:

## Hands-on

- Objective: Create heatmap depicting tweet density.
- Tool: QGIS + Heatmap plugin.
- Steps:
  - Ensure the heatmap plugin is enabled.
  - Create the heatmap using the plugin (Raster→Heatmap).
  - Pay special attention to the following parameters:

## Hands-on

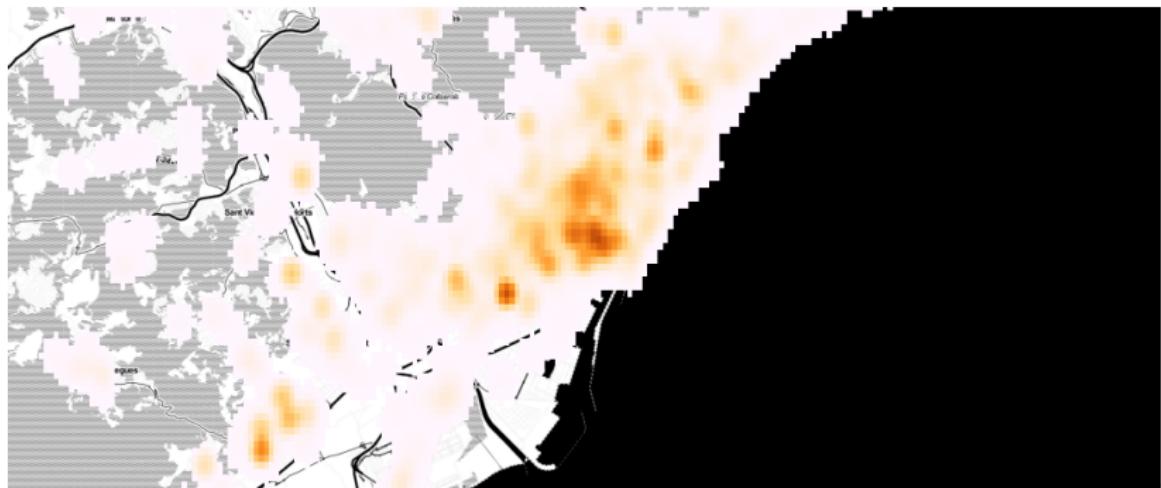
- Objective: Create heatmap depicting tweet density.
- Tool: QGIS + Heatmap plugin.
- Steps:
  - Ensure the heatmap plugin is enabled.
  - Create the heatmap using the plugin (Raster→Heatmap).
  - Pay special attention to the following parameters:
    - Radius: search radius in meters.
    - Rows and columns: cell size of the output raster.
    - Kernel shape: QGIS uses one of the following decay algorithms.

## Hands-on

- Objective: Create heatmap depicting tweet density.
- Tool: QGIS + Heatmap plugin.
- Steps:
  - Ensure the heatmap plugin is enabled.
  - Create the heatmap using the plugin (Raster→Heatmap).
  - Pay special attention to the following parameters:
    - Radius: search radius in meters.
    - Rows and columns: cell size of the output raster.
    - Kernel shape: QGIS uses one of the following decay algorithms.
  - Customize the color scheme, by right clicking the layer and choosing properties.

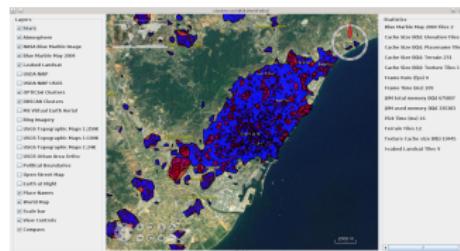
## Hands-on (cont.)

- Suggestion: try different combinations of parameters and different visualizations.
- Tip: Use the identify tool to ensure the maximum is being correctly picked up.



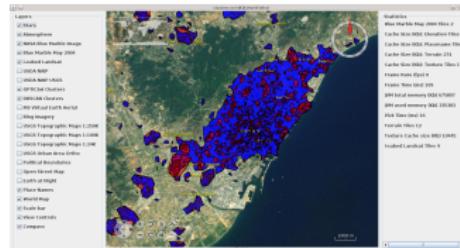
# Clustering

- It is a descriptive data mining technique, often used for dimensionality reduction.



# Clustering

- It is a descriptive data mining technique, often used for dimensionality reduction.
- It corresponds to a family of unsupervised machine learning algorithms.



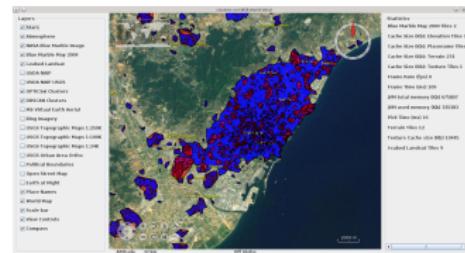
# Clustering

- It is a descriptive data mining technique, often used for dimensionality reduction.
- It corresponds to a family of unsupervised machine learning algorithms.
- It groups a set of objects in such a way that objects in the same group are more similar to each other, than to object in other groups.



# Clustering

- It is a descriptive data mining technique, often used for dimensionality reduction.
  - It corresponds to a family of unsupervised machine learning algorithms.
  - It groups a set of objects in such a way that objects in the same group are more similar to each other, than to object in other groups.
  - Density based clusters are separated from each other by contiguous regions of low density of objects.



## Clustering (cont.)

- In June 2014, it was released (the first?) QGIS plugin for *spatially constrained clustering*: clusterpy.
  - [https://plugins.qgis.org/plugins/clusterpy\\_qgis\\_plugin/](https://plugins.qgis.org/plugins/clusterpy_qgis_plugin/)
- In this workshop we will use an alternative method to define areas with high density.
  - [http://www.qgistutorials.com/en/docs/creating\\_heatmaps.html](http://www.qgistutorials.com/en/docs/creating_heatmaps.html)

## Hands-on

- Objective: Detect areas with higher density of tweets.
- Tool: QGIS.
- Steps:

## Hands-on

- Objective: Detect areas with higher density of tweets.
- Tool: QGIS.
- Steps:
  - Use the identify tool to establish a threshold; from that value on, pixels will be considered part of an high-density cluster.
  - Use the raster calculator, to select pixels above that threshold (Raster→Raster Calculator).
  - Example of a select expression: "*heatmap@1*" > 150

## Hands-on

- Objective: Detect areas with higher density of tweets.
- Tool: QGIS.
- Steps:
  - Use the identify tool to establish a threshold; from that value on, pixels will be considered part of an high-density cluster.
  - Use the raster calculator, to select pixels above that threshold (Raster→Raster Calculator).
  - Example of a select expression: "*heatmap@1*" > 150
  - The new map **only** contains binary values (1: above the threshold; 0: bellow the threshold).
  - Tip: ensure the legend picks up correctly the values on the dataset.

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).
- Check out the attribute table of the Shapefile: verify the polygons have a value of 0, or 1 (right click + Open attribute table).

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).
- Check out the attribute table of the Shapefile: verify the polygons have a value of 0, or 1 (right click + Open attribute table).
- If we filter out the polygons with value 0, we will have the areas with high density.

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).
- Check out the attribute table of the Shapefile: verify the polygons have a value of 0, or 1 (right click + Open attribute table).
- If we filter out the polygons with value 0, we will have the areas with high density.
  - Select by expression: " $DN = 1$ ".

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).
- Check out the attribute table of the Shapefile: verify the polygons have a value of 0, or 1 (right click + Open attribute table).
- If we filter out the polygons with value 0, we will have the areas with high density.
  - Select by expression: " $DN = 1$ ".
- Save the selection as a new Shapefile.

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).
- Check out the attribute table of the Shapefile: verify the polygons have a value of 0, or 1 (right click + Open attribute table).
- If we filter out the polygons with value 0, we will have the areas with high density.
  - Select by expression: " $DN = 1$ ".
- Save the selection as a new Shapefile.
- Enhancement: count the number of tweets that fall within each polygon (Vector→ Analysis Tools→Count Points in Polygon).

## Hands-on (cont.)

- Vectorize this raster file (Raster→Conversion→Polygonize (Raster to Vector)).
- Check out the attribute table of the Shapefile: verify the polygons have a value of 0, or 1 (right click + Open attribute table).
- If we filter out the polygons with value 0, we will have the areas with high density.
  - Select by expression: " $DN = 1$ ".
- Save the selection as a new Shapefile.
- Enhancement: count the number of tweets that fall within each polygon (Vector→Analysis Tools→Count Points in Polygon).
- Display the number of tweets within each polygon (right-click the layer to call the properties, and select "Labels").

# Three.js

Lightweight cross-browser JavaScript library used to create and display animated 3D computer graphics on a Web browser.



# Three.js

Lightweight cross-browser JavaScript library used to create and display animated 3D computer graphics on a Web browser.

- It relies on WebGL, a JavaScript API for rendering interactive 3D computer graphics and 2D graphics within any compatible web browser without the use of plug-ins.



# Three.js

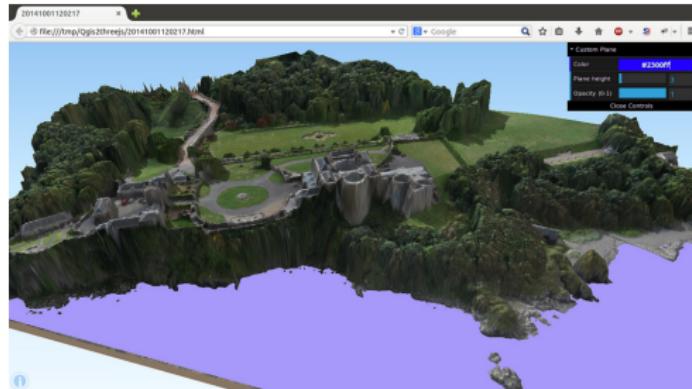
Lightweight cross-browser JavaScript library used to create and display animated 3D computer graphics on a Web browser.

- It relies on WebGL, a JavaScript API for rendering interactive 3D computer graphics and 2D graphics within any compatible web browser without the use of plug-ins.
- WebGL itself is based on OpenGL ES 2.0, a subset of the OpenGL, an API for rendering hardware-accelerated graphics using a graphics processing unit (GPU).



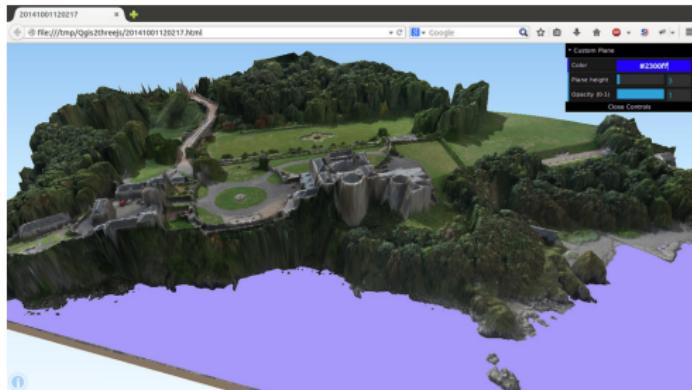
## Three.js in QGGIS

- The Qgis2threejs plugin exports terrain data, map canvas image and vector data to a webpage.



## Three.js in QGGIS

- The Qgis2threejs plugin exports terrain data, map canvas image and vector data to a webpage.
- The exported 3D objects can be viewed on any web browser which supports WebGL.



## Hands-on

- Objective: create webpage with 3d visualization of the clusters.
- Tool: QGIS + Qgis2threejs plugin.
- Steps:

## Hands-on

- Objective: create webpage with 3d visualization of the clusters.
- Tool: QGIS + Qgis2threejs plugin.
- Steps:
  - Ensure that Qgis2threejs is installed and enabled.

## Hands-on

- Objective: create webpage with 3d visualization of the clusters.
- Tool: QGIS + Qgis2threejs plugin.
- Steps:
  - Ensure that Qgis2threejs is installed and enabled.
  - Prepare the scene you want to render (e.g.: visible layers, styles, etc).

## Hands-on

- Objective: create webpage with 3d visualization of the clusters.
- Tool: QGIS + Qgis2threejs plugin.
- Steps:
  - Ensure that Qgis2threejs is installed and enabled.
  - Prepare the scene you want to render (e.g.: visible layers, styles, etc).
  - Run Qgis2threejs (Web→Qgis2threejs→Qgis2threejs)

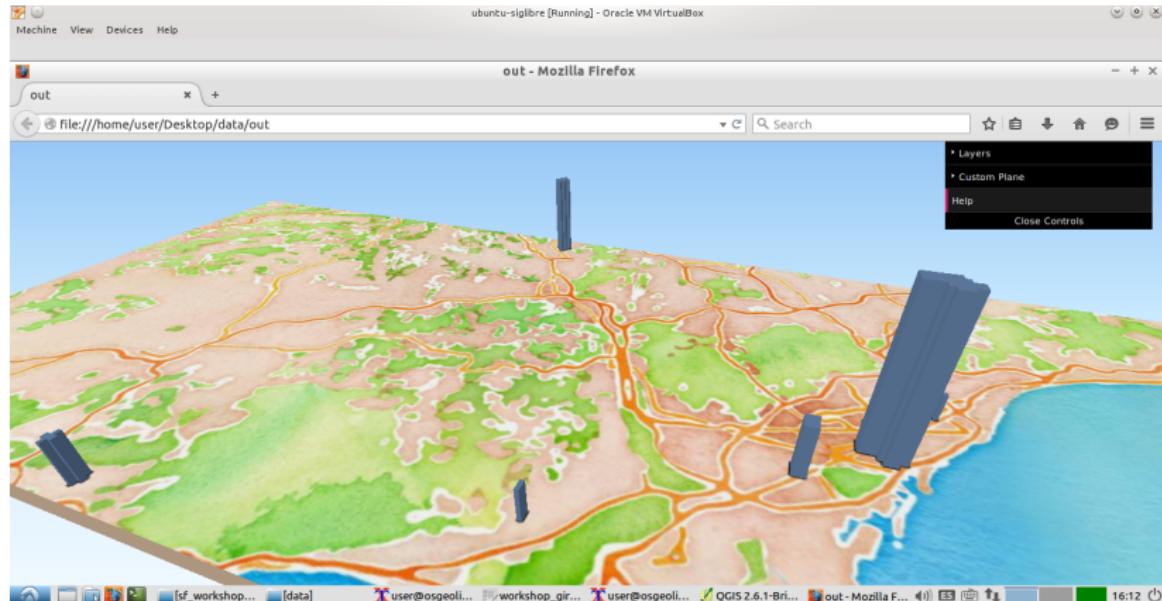
## Hands-on

- Objective: create webpage with 3d visualization of the clusters.
- Tool: QGIS + Qgis2threejs plugin.
- Steps:
  - Ensure that Qgis2threejs is installed and enabled.
  - Prepare the scene you want to render (e.g.: visible layers, styles, etc).
  - Run Qgis2threejs (Web→Qgis2threejs→Qgis2threejs)
  - Costumize the visualization. Some things to pay attention to:

## Hands-on

- Objective: create webpage with 3d visualization of the clusters.
- Tool: QGIS + Qgis2threejs plugin.
- Steps:
  - Ensure that Qgis2threejs is installed and enabled.
  - Prepare the scene you want to render (e.g.: visible layers, styles, etc).
  - Run Qgis2threejs (Web→Qgis2threejs→Qgis2threejs)
  - Costumize the visualization. Some things to pay attention to:
    - Enable the layers you want to extrude (in this case, the clusters).
    - The height value should be read from the count field (PNTCNT).
    - You may want to exagerate the vertical scale by a factor.
    - The output HTML file path defines where you will save the result webpage (and associated files).

# Well Done!



# References

- <http://tweattracker.fulton.asu.edu/tda/TwitterDataAnalytics.pdf>
- <http://www2.qgis.org>
- <http://plugins.qgis.org/plugins/>
- <http://geokoder.com/mongodb-plugin-for-quantum-gis>
- <http://www.gislounge.com/heat-maps-in-gis/>
- <https://alastairra.wordpress.com/2011/02/23/heat-mapping-crime-data-with-bing-maps-and-html5-canvas/>
- [http://docs.qgis.org/2.0/en/docs/user\\_manual/plugins/plugins\\_heatmap.html](http://docs.qgis.org/2.0/en/docs/user_manual/plugins/plugins_heatmap.html)
- [http://en.wikipedia.org/wiki/Kernel\\_%28statistics%29#Kernel\\_functions\\_in\\_common\\_use](http://en.wikipedia.org/wiki/Kernel_%28statistics%29#Kernel_functions_in_common_use)
- [http://en.wikipedia.org/wiki/Cluster\\_analysis](http://en.wikipedia.org/wiki/Cluster_analysis)
- [https://plugins.qgis.org/plugins/clusterpy\\_qgis\\_plugin/](https://plugins.qgis.org/plugins/clusterpy_qgis_plugin/)
- <http://www.rise-group.org/section/Software/clusterPy/>
- <http://threejs.org/>
- <http://anitagraser.com/2014/03/15/3d-viz-with-qgis-three-js/>

Introduction  
Getting the Tweets Coordinates  
Importing the Tweets into QGIS  
Creating an Heatmap  
Creating Clusters