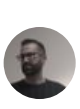
Accessing OpenStreetMap data with R

2018-11-03 · 0 Comments · visualization, R:elementary, R, mapping

The database of Open Street Maps

Recently I created a map of the distribution of gas stations and electric charging stations in Europe.



Dominic Royé
@dr_xeo

Population density through the number of gas stations in Europe. #dataviz @AGE_Oficial @mipazos @simongerman600 @openstreetmap

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How can you obtain this data?

Well, in this case I used points of interest (POIs) from the database of *Open Street Maps* (OSM). Obviously OSM not only contains streets and highways, but also information that can be useful when we use a map such as locations of hospitals or gas stations. To avoid downloading the entire OSM and extracting the required information, you can use an *overpass API*, which allows us to query the OSM database with our own criteria.

An easy way to access an *overpass API* is through overpass-turbo.eu, which even includes a wizard to build a query and display the results on a interactive map. A detailed explanation of the previous web can be found here. However, we have at our disposal a package *osmdata* that allows us to create and make queries directly from the R environment. Nevertheless, the use of the *overpass-turbo.eu* can be useful when we are not sure what we are looking for or when we have some difficulty in building the query.

Accessing the overpass API from R

The first step is to install several packages, in case they are not installed. In almost all my scripts I use *tidyverse* which is a fundamental collection of different packages, including *dplyr* (data manipulation), *ggplot2* (visualization), etc. The *sf* package is the new standard for working with spatial data and is compatible with *ggplot2* and *dplyr*. Finally, *ggmap* makes it easier for us to create maps.

```
#install the osmdata, sf, tidyverse and ggmap package
if(!require("osmdata")) install.packages("osmdata")
if(!require("tidyverse")) install.packages("tidyverse")
if(!require("sf")) install.packages("sf")
if(!require("ggmap")) install.packages("ggmap")

#load packages
library(tidyverse)
library(osmdata)
library(sf)
library(ggmap)
```

Build a query

Before creating a query, we need to know what we can filter. The `available_features( )` function returns a list of available OSM features that have different tags. More details are available in the OSM *wiki* here. For example, the feature *shop* contains several tags among others *supermarket*, *fishing*, *books*, etc.

```
#the first five features
head(available_features())
```

```
## [1] "4wd only"  "abandoned" "abutters"  "access"    "addr"      "addr:city"
```

```
#amenities
head(available_tags("amenity"))
```

```
## [1] "animal_boarding" "animal_shelter"  "arts_centre"     "atm"
## [5] "baby_hatch"      "baking_oven"
```

```
#shops
head(available_tags("shop"))
```

```
## [1] "agrarian"  "alcohol"   "anime"     "antiques"  "appliance" "art"
```

The first query: Where are cinemas in Madrid?

To build the query, we use the *pipe operator* `%>%`, which helps to chain several functions without assigning the result to a new object. Its use is very extended especially within the *tidyverse* package collection. If you want to know more about its use, you can find here a tutorial.

In the first part of the query we need to indicate the place where we want to extract the information. The `getbb( )` function creates a boundering box for a given place, looking for the name. The main function is `opq( )` which build the final query. We add our filter criteria with the `add_osm_feature( )` function. In this first query we will look for cinemas in Madrid. That's why we use as key *amenity* and *cinema* as tag. There are several formats to obtain the resulting spatial data of the query. The `osmdata_*( )` function sends the query to the server and, depending on the suffix * sf/sp/xml, returns a *simple feature*, *spatial* or *XML* format.

```
#building the query
q <- getbb("Madrid") %>%
      opq() %>%
       add_osm_feature("amenity", "cinema")

str(q) #query structure
```

```
## List of 4
##  $ bbox    : chr "40.3119774,-3.8889539,40.6437293,-3.5179163"
##  $ prefix  : chr "[out:xml][timeout:25];\n(\n"
##  $ suffix  : chr ");\n(._;>;);\nout body;"
##  $ features: chr " [\"amenity\"=\"cinema\"]"
##  - attr(*, "class")= chr [1:2] "list" "overpass_query"
```

```
cinema <- osmdata_sf(q)
cinema
```

```
## Object of class 'osmdata' with:
##                  $bbox : 40.3119774,-3.8889539,40.6437293,-3.5179163
##         $overpass_call : The call submitted to the overpass API
##                 $meta : metadata including timestamp and version numbers
##           $osm_points : 'sf' Simple Features Collection with 197 points
##            $osm_lines : NULL
##         $osm_polygons : 'sf' Simple Features Collection with 12 polygons
##       $osm_multilines : NULL
##    $osm_multipolygons : NULL
```

We see that the result is a list of different spatial objects. In our case, we are only interested in *osm_points*.

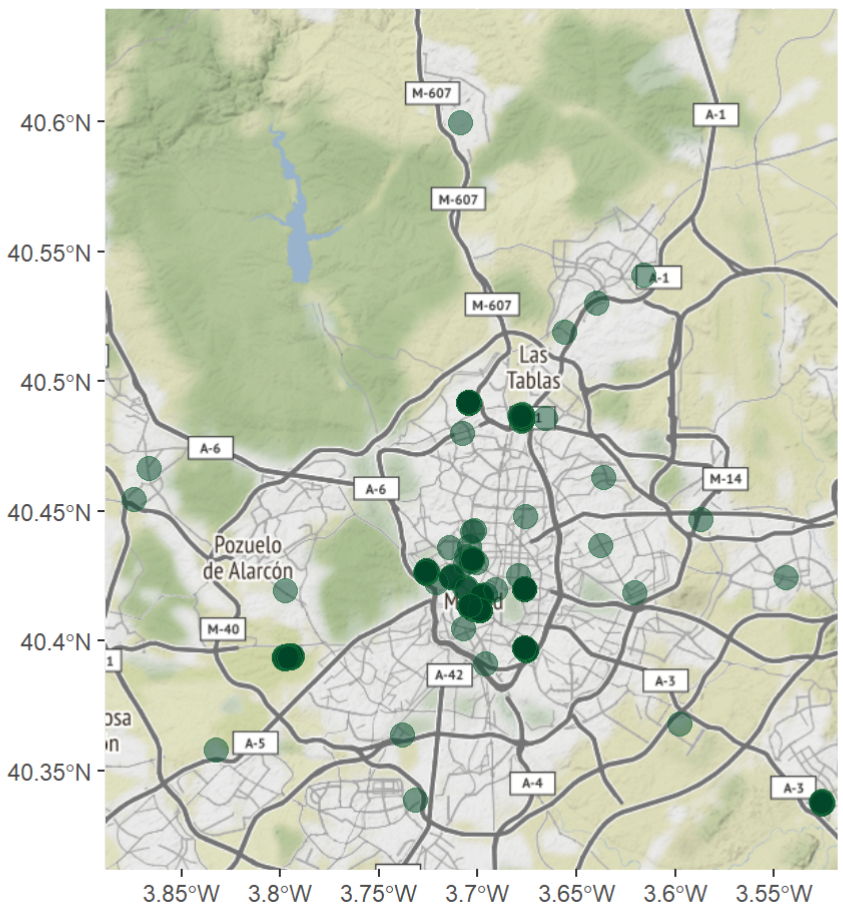
How can we visulise these points?

The advantage of *sf* objects is that for *ggplot2* already exists a geometry function `geom_sf( )`. Furthermore, we can include a background map using *ggmap*. The `get_map( )` function downloads the map for a given place. Alternatively, it can be an address, latitude/longitude or a bounding box. The *maptype* argument allows us to indicate the style or type of map. You can find more details in the help of the `?get_map` function.

When we build a graph with *ggplot* we usually start with `ggplot( )`. In this case, we start with `ggmap( )` that includes the object with our background map. Then we add with `geom_sf( )` the points of the cinemas in Madrid. It is important to indicate with the argument *inherit.aes = FALSE* that it has to use the *aesthetic mappings* of the spatial object *osm_points*. In addition, we change the color, fill, transparency (*alpha*), type and size of the circles.

```
#our background map
mad_map <- get_map(getbb("Madrid"), maptype = "toner-background")

#final map
ggmap(mad_map)+
  geom_sf(data = cinema$osm_points,
          inherit.aes = FALSE,
          colour = "#238443",
          fill = "#004529",
          alpha = .5,
          size = 4,
          shape = 21)+
  labs(x = "", y = "")
```



Where can we find Mercadona supermarkets?

Instead of obtaining a bounding box with the function *getbb()* we can build our own box. To do this, we create a vector of four elements, the order has to be West/South/East/North. In the query we use two features: *name* and *shop* to filter supermarkets that are of this particular brand. Depending on the area or volume of the query, it is necessary to extend the waiting time. By default, the limit is set at 25 seconds (*timeout*).

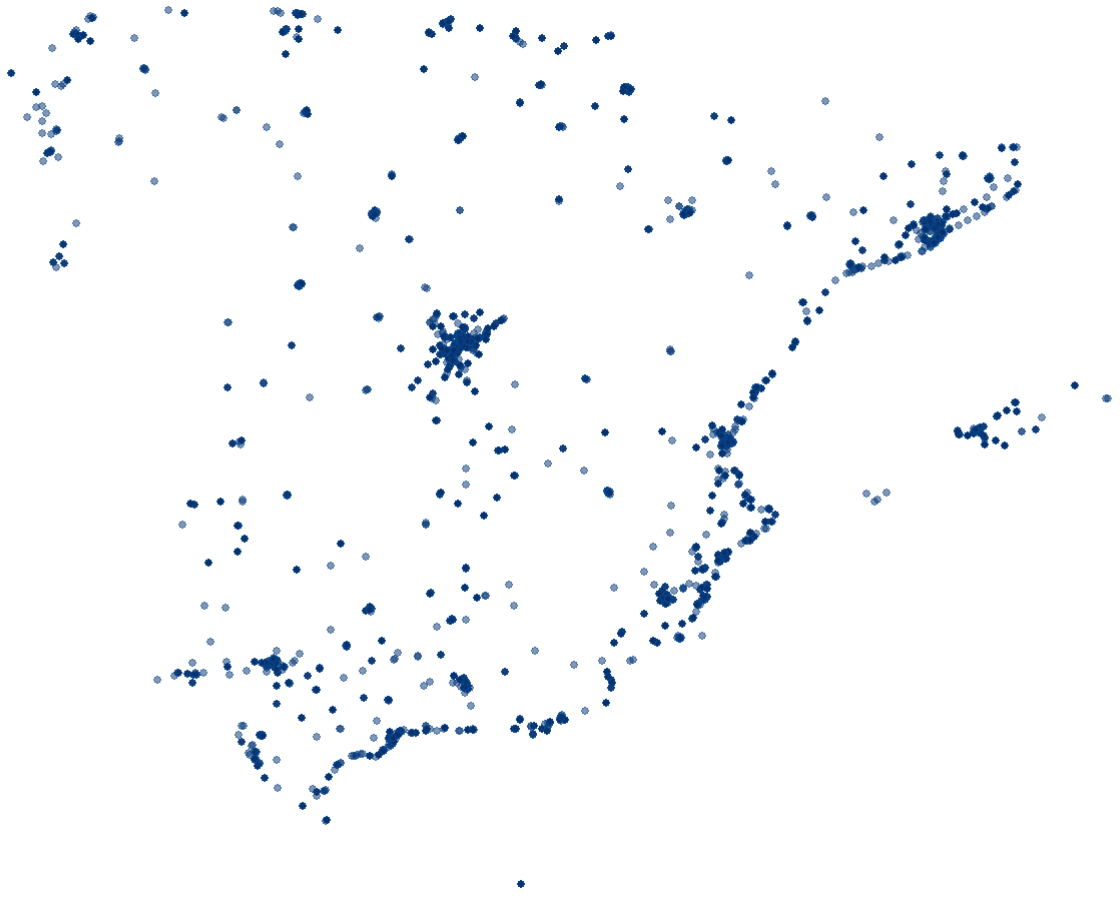
The map, we create in this case, consists only of the supermarket points. Therefore, we use the usual grammar by adding the geometry `geom_sf( )`. The `theme_void( )` function removes everything except for the points.

```
#bounding box for the Iberian Peninsula
m <- c(-10, 30, 5, 46)

#building the query
q <- m %>%
      opq (timeout = 25*100) %>%
         add_osm_feature("name", "Mercadona") %>%
         add_osm_feature("shop", "supermarket")

#query
mercadona <- osmdata_sf(q)

#final map
ggplot(mercadona$osm_points)+
  geom_sf(colour = "#08519c",
          fill = "#08306b",
          alpha = .5,
          size = 1,
          shape = 21)+
  theme_void()
```



database overpass API OSM Point of interest

Dr. Dominic Royé

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