Geocoding with R

The SF package

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Hertie School | I2DS Tools for Data Science workshop

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What is the package good for?

Geocoding, spatial analysis and SF

What is **geocoding**?

Process of *taking an address or a name of a place and turning it into a geographic position on the earth's surface.*

☑ Input Data: Relative or Absolute

🔍 Coordinate System: Longitude and Latitude

Why do **spatial analysis**?

The performance of analytic tasks that explicitly incorporate the spatial properties of a dataset.

Visibility and votes: A spatial analysis of anti-immigrant voting in Sweden

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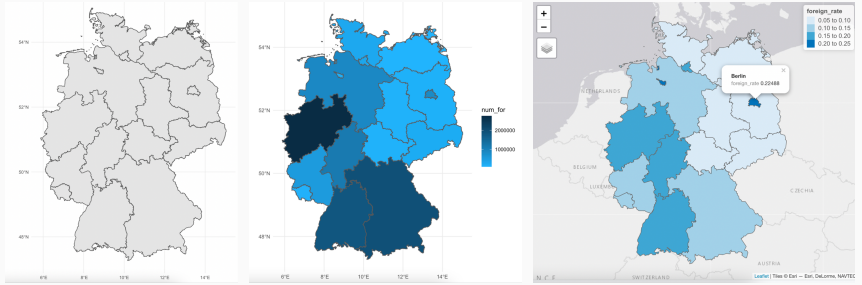
Abstract

The mechanisms by which negative attitudes toward immigrants become votes for anti-immigrant parties are not fully understood. Yet, voting for political parties with anti-immigrant platforms is arguably the most common expression of these sentiments in Europe. I use anti-immigrant attitudes as a starting point and hypothesize that superficial intergroup contact, or immigrant 'visibility', brings these attitudes to the fore as politically salient. A spatial analysis of electoral data from each polling station in Sweden for the 2010 parliamentary election (n= 5,688) provides support for the hypothesis. Much of the variance in district-level voting can be accounted for by the percent of non-western residents in adjacent neighborhoods. The findings suggest that the probability of anti-immigrant attitudes translating into votes increases in neighborhoods where residents are likely to have fleeting contact with immigrants and I test this further with a city-level case study. I collected observational data on the visibility of non-westerners in a mid-size Swedish city and find that votes for the Sweden Democrats are above the national average where immigrants are most visible. Furthermore, the effect of non-western residents on anti-immigrant voting is most pronounced in regions without histories of significant non-western immigration, suggesting that the negative effects of superficial contact diminish over time.

Keywords: immigration, voting, contact, attitudes

Relevance for Public Policies

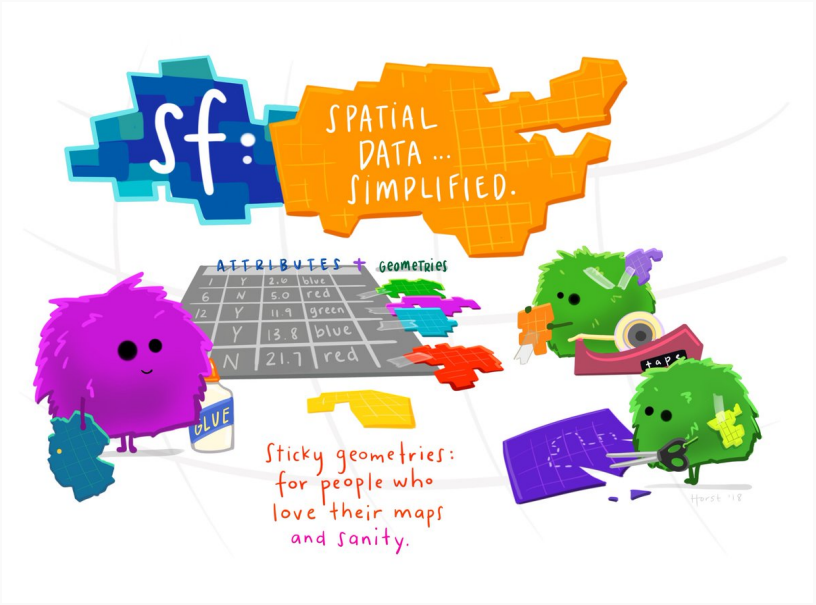
- public health, such as the pandemic evolution
- security, such as crime trends

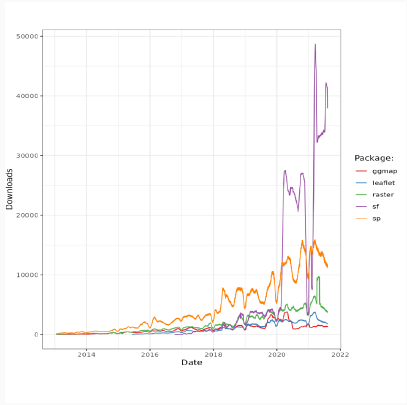


In its best form, allows people to easily understand complex geographical information: *Adding more information conveys and increasingly rich and informative story*

The **SF** package 

- Geographic information science has been performed in a geographic information system (“GIS”), which is an integrated software platform for the management, processing, analysis, and visualization of geographic data
- R packages exist for handling these tasks, allowing R to function as a capable substitute





- The next-generation alternative to sp for spatial data analysis in R
- Advantages:
  - sf objects can be treated as data frames in most operations
  - sf function names are relatively consistent and intuitive
  - sf functions can be combined using %>% operator
  - 👍 integrates seamlessly with **tidyverse tools** 👍

How can we use it??

Geometry basics

Simple features

thing or a object, which have "a **geometry** describing where on Earth is located (*spatial attribute*), and other attributes, which describe other properties (non-spatial attributes)"

- Dimensions or coordinates: X and Y (longitude and latitude), Z (altitude) and M (denotes some associated measure, such as time of measurement)

- Geometry types

type	description
POINT	zero-dimensional geometry containing a single point
LINESTRING	sequence of points connected by straight, non-self intersecting line pieces; one-dimensional geometry
POLYGON	geometry with a positive area (two-dimensional); sequence of points form a closed, non-self intersecting ring; the first ring denotes the exterior ring, zero or more subsequent rings denote holes in this exterior ring
MULTIPOINT	set of points; a MULTIPOINT is simple if no two Points in the MULTIPOINT are equal
MULTILINESTRING	set of linestrings
MULTIPOLYGON	set of polygons
GEOMETRYCOLLECTION	set of geometries of any type except GEOMETRYCOLLECTION

Shape files

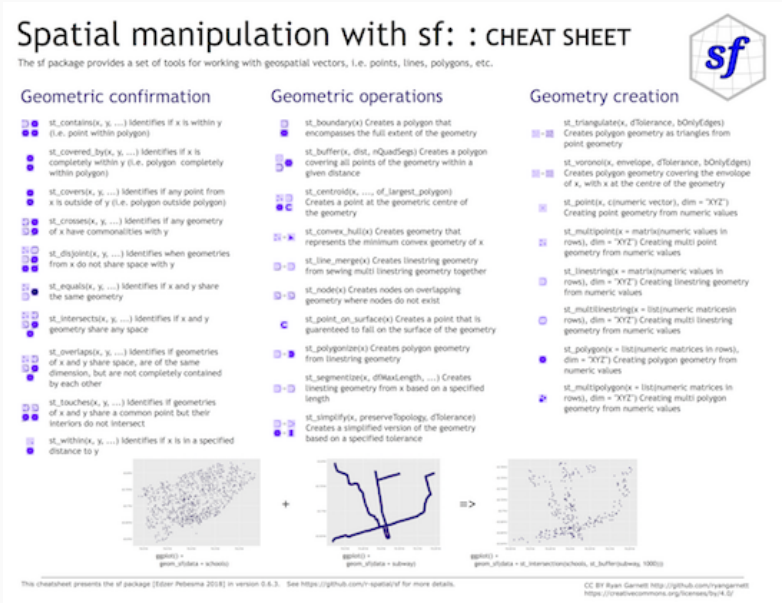
- The way as *geographic information* is normally shared
- zip file with a **.shp**, which stores the geographic coordinates of the geographic features (e.g. country, state, county)

Key Features

Tools

SF: reading, writing, handling, and manipulating simple

st_read	st_as_sf
imports a spatial data file and converts it to a simple feature *data frame*	*convert* foreign object to an sf object



Pratical Application

Tutorial Preview

How to?

Downloading and Visualizing geometric data

```
R> # Save file as a .zip with link
R> brazil_file ← "https://biogeo.ucdavis.edu/data/diva/adm/BRA_adm.zip"
R>
R> # Download .zip
R> download.file(brazil_file, destfile = "BRA.zip")
R>
R> # Unzip the file
R> unzip("BRA.zip")
R>
R> # Examine the file .zip file (list()) to find the shapefile and then save the shapefile as a dataframe
R> brazil ← sf::read_sf("BRA_adm1.shp")
```

The Geometry column

```
R> brazil %>%
+   dplyr::select(geometry) %>%
+   knitr::kable(col.names = c("Geometry")) %>%
+   kableExtra::kable_minimal()
```

Geometry
MULTIPOLYGON (((-73.33251 -...
MULTIPOLYGON (((-35.90153 -...
MULTIPOLYGON (((-50.02403 0...
MULTIPOLYGON (((-67.32623 2...
MULTIPOLYGON (((-38.69708 -...
MULTIPOLYGON (((-38.47542 -...
MULTIPOLYGON (((-48.03603 -...

But if I don't have a geometry column?

- Longitude and Latitude

```
R> coordinates_br ← readr::read_csv("br.csv")
```

You will need to check the **CRS** (coordinate reference system) code

```
R> sf::st_crs(brazil)
```

In our case: "EPSG",4326

Then, conversion

```
R> coord_geo ← coordinates_br %>%
+   sf::st_as_sf(coords = c("lng", "lat"), crs = 4326)
R>
R> coord_geo %>%
+   dplyr::select(geometry) %>%
+   knitr::kable(col.names = c("Geometry")) %>%
+   kableExtra::kable_minimal()
```

Geometry
POINT (-46.6339 -23.5504)
POINT (-43.1964 -22.9083)
POINT (-43.9419 -19.9281)
POINT (-47.8828 -15.7939)

Next Steps

What about when I don't have longitude and latitude?

geocoding

And what about spatial analysis?

```
R> brplot ← ggplot2::ggplot() +
+   geom_sf(data = brazil) +
+   geom_sf(data = coord_geo %>%
+             dplyr::filter(!is.na(capital)), color = '
+    geom_sf_label(data = coord_geo %>%
+                dplyr::filter(population_proper ⩾ 15
+                aes(label = city),  size = 3, hjust =
```

```
R> brplot
```

Learn More

Sources