Fundamentals of Spatial Analysis in R

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Chapter 1

Prerequisites

This is a *sample* book written in **Markdown**. You can use anything that Pandoc's Markdown supports, e.g., a math equation $a^2 + b^2 = c^2$.

The **bookdown** package can be installed from CRAN or Github:

```
install.packages("bookdown")
# or the development version
# devtools::install_github("rstudio/bookdown")
```

Remember each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading `#`.

To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): https://yihui.name/tinytex/.

Chapter 2

Introduction

You can label chapter and section titles using `{#label}` after them, e.g., we can reference Chapter 2. If you do not manually label them, there will be automatic labels anyway, e.g., Chapter **??**.

Figures and tables with captions will be placed in `figure` and `table` environments, respectively.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

Reference a figure by its code chunk label with the `fig:` prefix, e.g., see Figure 2.1. Similarly, you can reference tables generated from `knitr::kable()`, e.g., see Table 2.1.

```
knitr::kable(
  head(iris, 20), caption = 'Here is a nice table!',
  booktabs = TRUE
)
```

You can write citations, too. For example, we are using the **bookdown** package [**?**] in this sample book, which was built on top of R Markdown and **knitr** [**?**].

2.0.1 geocoding

- geocoding example with tmaptools using open street map

```
# uses OSM
library(tmap)
library(tmaptools)
library(dplyr)
tex_cap <-tmaptools::geocode_OSM("Texas Capital",
```

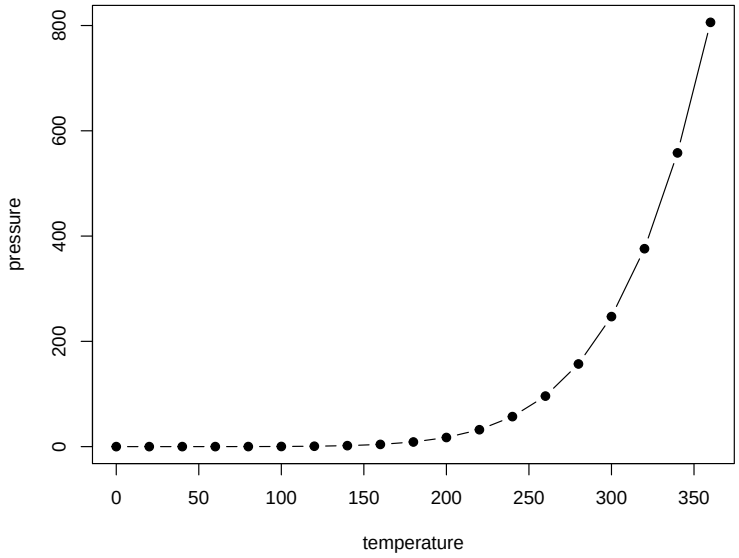


Figure 2.1: Here is a nice figure!

Table 2.1: Here is a nice table!

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa
4.6	3.4	1.4	0.3	setosa
5.0	3.4	1.5	0.2	setosa
4.4	2.9	1.4	0.2	setosa
4.9	3.1	1.5	0.1	setosa
5.4	3.7	1.5	0.2	setosa
4.8	3.4	1.6	0.2	setosa
4.8	3.0	1.4	0.1	setosa
4.3	3.0	1.1	0.1	setosa
5.8	4.0	1.2	0.2	setosa
5.7	4.4	1.5	0.4	setosa
5.4	3.9	1.3	0.4	setosa
5.1	3.5	1.4	0.3	setosa
5.7	3.8	1.7	0.3	setosa
5.1	3.8	1.5	0.3	setosa

```
        as.sf = TRUE) %>%
  glimpse()
```

```
## Observations: 1
## Variables: 8
## $ query    <chr> "Texas Capital"
## $ lat      <dbl> -31.46748
## $ lon      <dbl> -64.22844
## $ lat_min  <dbl> -31.46748
## $ lat_max  <dbl> -31.46748
## $ lon_min  <dbl> -64.22995
## $ lon_max  <dbl> -64.22723
## $ geometry <POINT [°]> POINT (-64.22844 -31.46748)
```

2.0.2 interactive mapping

```
library(mapview)
mapview(tex_cap)
```

```
## PhantomJS not found. You can install it with webshot::install_phantomjs(). If it is installed,
```

2.0.3 Choropleth map

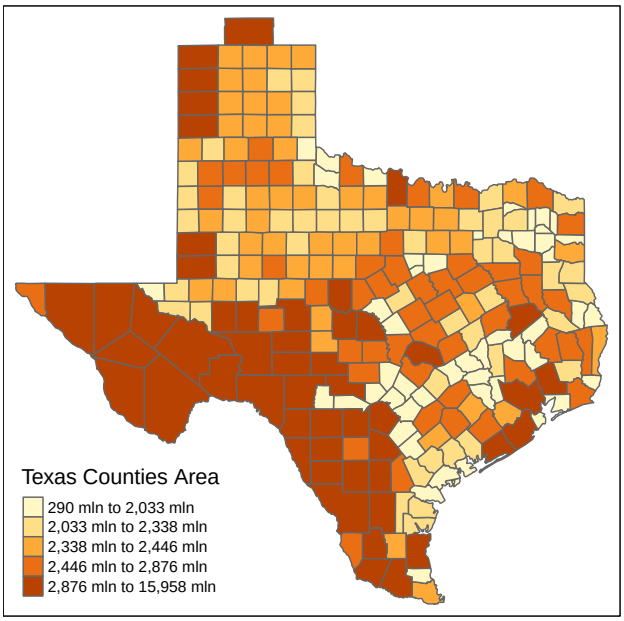
The package maps (automatically installed and loaded with ggplot2) provides maps of the USA, with state and county borders, that can be retrieved and converted as sf objects:

```
library(sf)
library(maps)
counties <- st_as_sf(map("county", plot = FALSE, fill = TRUE))
counties <- subset(counties, grepl("texas", counties$ID) & !grepl('missouri,texas',counties$ID))
counties$area <- as.numeric(st_area(counties))
head(counties)
```

```
## Simple feature collection with 6 features and 2 fields
## geometry type:  MULTIPOLYGON
## dimension:      XY
## bbox:           xmin: -103.0751 ymin: 28.14942 xmax: -94.13123 ymax: 37.00161
## epsg (SRID):    4326
## proj4string:    +proj=longlat +datum=WGS84 +no_defs
##                            geometry             ID       area
## 2168 MULTIPOLYGON (((-101.6255 3... oklahoma,texas 5434507068
## 2491 MULTIPOLYGON (((-95.75271 3... texas,anderson 2817584981
## 2492 MULTIPOLYGON (((-102.2042 3...  texas,andrews 3962852909
## 2493 MULTIPOLYGON (((-94.13123 3... texas,angelina 2200352194
## 2494 MULTIPOLYGON (((-96.80122 2...  texas,aransas  290370313
```

```
## 2495 MULTIPOLYGON (((-98.42269 3...   texas,archer 2422607253
```

```
tm_shape(counties) +
  tm_polygons("area",
              style="quantile",
              title="Texas Counties Area")
```



example-1.bb

2.1 Challenge: Does this work?

Did my .css styling adjustment work?

2.1.1 Answer

1. Yes
2. No

Chapter 3

Vector data with sf

Load `tidycensus` - you'll need to set your Census API key. A key can be obtained from here.

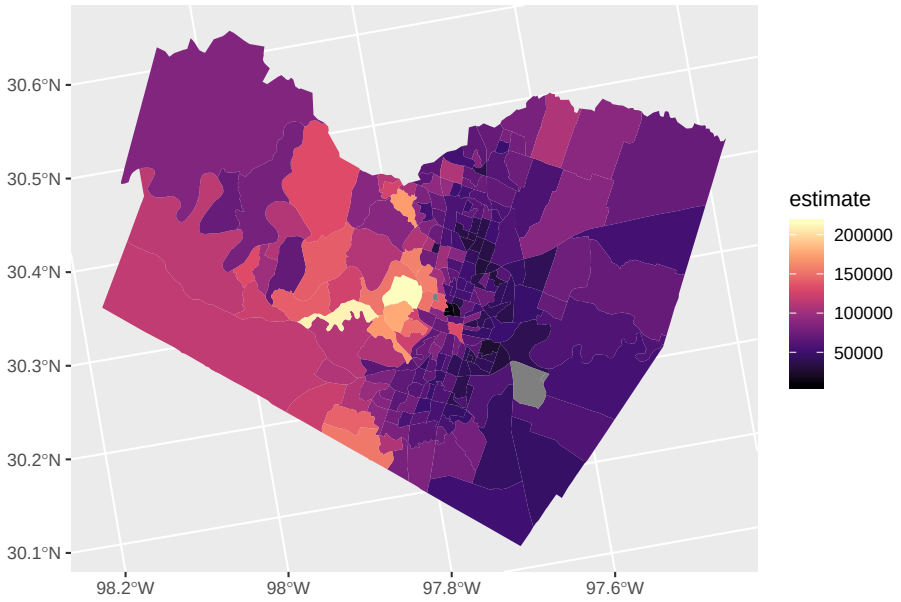
```
library(tidycensus)
library(tidyverse)

census_api_key("YOUR API KEY GOES HERE")
```

```
library(tidycensus)
library(ggplot2)
options(tigris_use_cache = TRUE)
austin_tracts <- get_acs(state = 'TX', county = 'Travis', geography = "tract",
                         variables = "B19013_001", geometry = TRUE)
```

```
## Getting data from the 2013-2017 5-year ACS
```

```
austin_tracts %>%
  ggplot(aes(fill = estimate)) +
  geom_sf(color = NA) +
  coord_sf(crs = 26911) +
  scale_fill_viridis_c(option = "magma")
```


30.6°N
30.5°N
30.4°N
30.3°N
30.2°N
30.1°N
98.2°W
98°W
97.8°W
97.6°W
estimate
200000
150000
100000
50000

Chapter 4

Raster data

Chapter 5

Applications

Some *significant* applications are demonstrated in this chapter.

5.1 Example one

5.2 Example two

Chapter 6

Final Words

We have finished a nice book.

References

6.0.1 R Spatial Resources

- R Spatial - **Spatial Data Science with R**
- **Geocomputation with R**
- **R Spatial Task View**
- **Modern Geospatial Data Analysis with R by Zev Ross**
- **Spatial Data Science - Pebesma and Bivand**
- **Spatial Data Science Course- Prof. Adam Wilson**
- **Introduction to Mapping and Spatial Analysis with R**
- **Google R Style Guide**
- **Advanced R by Hadley Wickham**
- **Intro to GIS and Spatial Analysis by Manuel Gimond**
- **FOSS4G2019 R for Geospatial Processing**
- **An Introduction to Spatial Analysis and Mapping in R**

6.0.2 R Vector Processing / Simple Features Resources

- **Simple Features for R**
- **Spatial Data in R: New Directions**
- **sp-sf Migration**
- **An Exploration of Simple Features for R**
- **Simple Features: Building Spatial Data Pipelines in R**
- **Tidy spatial data in R: using dplyr, tidyr, and ggplot2 with sf**

6.0.3 R Raster Resources

- Wageningen University **Intro to Raster**
- Wageningen University **Advanced Raster Analysis**
- **The Visual Raster Cheat Sheet GitHub Repo**
- **Rastervis**
- **stars - spatiotemporal arrays**

6.0.4 R Mapping Resources

- **mapview**
- **Leaflet for R**
- **tmap**
- Zev Ross **Creating beautiful demographic maps in R with the `tidycensus` and `tmap` packages**
- Geocomputation with R: **Making maps with R**
- Ryan Peek: **Mapping in R**