

Visualising Data using R

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2022-07-21

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Chapter 1

Overview

The R programming language provides researchers with access to a large range of fully customisable data visualisation options, which are typically not available in point-and-click software. These visualisations are not only visually appealing, but can increase transparency about the distribution of the underlying data, rather than relying on commonly used visualisations of aggregations.

In this introductory section of our course, we will provide a practical introduction to using R, particularly in how to visualise data which you will use throughout the course. First, we will explain the rationale behind using R for data visualisation using the `ggplot2` package. This package will allow us to begin with common plotting outputs such as histograms and boxplots, and extend to more complex structures used within spatial data visualisation.

1.1 Setting up R and RStudio

You need to have access to R for this course. You can download R for free from CRAN.

R is available for Windows, Mac OS and Linux as well as some less common platforms.

You can download the standard version of R from CRAN.

1.1.1 Downloading and installing R for Windows

To download the Windows installer of R, just enter the following URL (or click on the link).

<https://cran.r-project.org/bin/windows/base/release.html>

This will download the most installer for the most recent version of R. Alternatively, you can go to the main CRAN page, <https://cran.r-project.org/>, and then click on “Download R for Windows”, click on “base” and then on “Download R x.y.z for Windows” (where x.y.z is the current version number of R).

You can then run the installer, accepting all default settings.

1.1.2 Downloading and installing R for Mac

To download the Windows installer for Mac, just enter the following URL (or click on the link).

<https://cran.r-project.org/bin/macosx/>

From here, select the most recent version of R and the .pkg file will automatically download. This file will be in the form “R-x.y.z” (where x.y.z is the current version number of R).

Once the file is opened, the installer will open and you can select the default settings.

1.2 RStudio

It is recommended that you also download and install RStudio Desktop, a powerful integrated development environment (IDE) for R. RStudio contains a much better code editor. It has, for example, syntax highlighting, i.e. it will automatically display your code in different colours to make it easier and quicker to read the code.

RStudio is just a front-end for R, so to be able make use of RStudio, you need to also have R installed.

RStudio Desktop Open Source is available for free from RStudio.

1.2.1 Installing RStudio for Windows/Mac

Go to

<https://www.rstudio.com/products/rstudio/download/>

and scroll down to the section “All installers”, then click on “RStudio-x-y-z.exe” in the first row of the table for a Windows install, or click on “RStudio-x-y-z.dmg” for a macOS install. This should start the download of the RStudio installer.

You can then run the installer, accepting all default settings (for macOS, you will need to drag and drop the application into the applications folder once open).

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 4.

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 (Xie, 2022) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015).

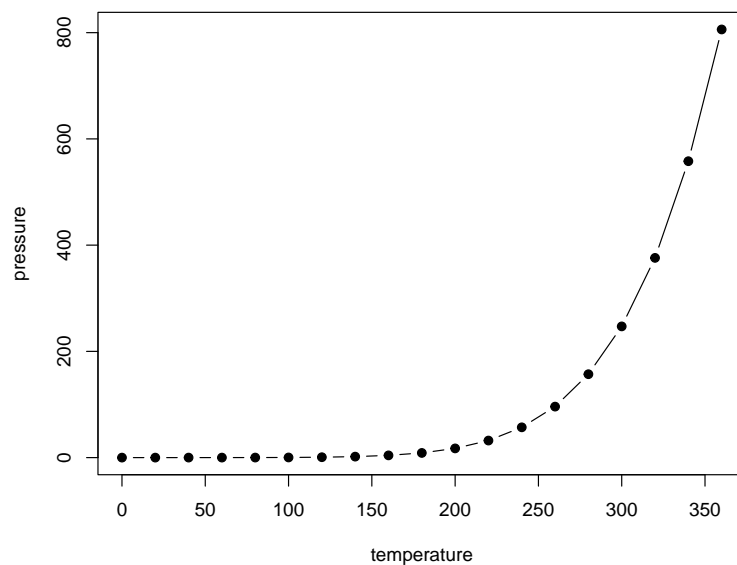


Figure 2.1: Here is a nice figure!

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

Chapter 3

Literature

Here is a review of existing methods.

Chapter 4

Methods

We describe our methods in this chapter.

Math can be added in body using usual syntax like this

4.1 math example

p is unknown but expected to be around $1/3$. Standard error will be approximated

$$SE = \sqrt{\left(\frac{p(1-p)}{n}\right)} \approx \sqrt{\frac{1/3(1-1/3)}{300}} = 0.027$$

You can also use math in footnotes like this¹.

We will approximate standard error to 0.027^2

¹where we mention $p = \frac{a}{b}$

² p is unknown but expected to be around $1/3$. Standard error will be approximated

$$SE = \sqrt{\left(\frac{p(1-p)}{n}\right)} \approx \sqrt{\frac{1/3(1-1/3)}{300}} = 0.027$$

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.

Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2022). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.27.