Dynamic Reporting with RMarkdown

Universal Template (PDF, HTML, Word)

2025-12-22

Abstract

This document serves as a universal template. It is designed to be rendered into HTML, PDF, or MS Word without requiring changes to the code. It demonstrates automatic table formatting and bibliography handling.

Contents

1 Introduction

This report demonstrates how to write **one** RMarkdown file that compiles cleanly to PDF, HTML, and Word. We avoid using `kableExtra` or raw `<div>` tags, relying instead on pure Pandoc Markdown.

2 Tables

To ensure tables look good in Word, PDF, and HTML simultaneously, we use `knitr::kable` with the markdown format.

```r
head(mtcars[, 1:4]) |>
  kable(caption = "A Universal Table Example",
        format = "markdown")  # "markdown" format is safest for cross-compatibility
```

Table 1: A Universal Table Example

	mpg	cyl	disp	hp
Mazda RX4	21.0	6	160	110
Mazda RX4 Wag	21.0	6	160	110
Datsun 710	22.8	4	108	93
Hornet 4 Drive	21.4	6	258	110
Hornet Sportabout	18.7	8	360	175
Valiant	18.1	6	225	105

3 Graphics

3.1 Standard Vector Graphics

Standard graphics are rendered as vectors (in PDF) or high-quality images (HTML/Word) by default.

Graphics can be embedded into the documents as shown below.

3.1.1 Package: base

3.1.2 Package: ggplot2

See the cheat sheet for ggplot2 graphics for details: https://posit.co/wp-content/uploads/2022/10/data-visualization-1.pdf

The use of chunk options to set captions allows for dynamic numbering and list of figures generation. This works also for `base` graphics (see above). Check the chunk option `fig.asp=0.5` that is responsible for the altered aspect ratio.

```r
ggplot(iris, aes(x = Sepal.Width, y = Petal.Width)) +
  geom_point(aes(color = Species))
```

3.2 Large Datasets & Rasterization

When plotting datasets with thousands of points (like the `diamonds` dataset), vector graphics can make the final file huge and slow to load.

To solve this, we use the chunk option `dev='png'` and `dpi=300`. This forces this specific plot to render as a flat image (raster), keeping the document size small while maintaining transparency.
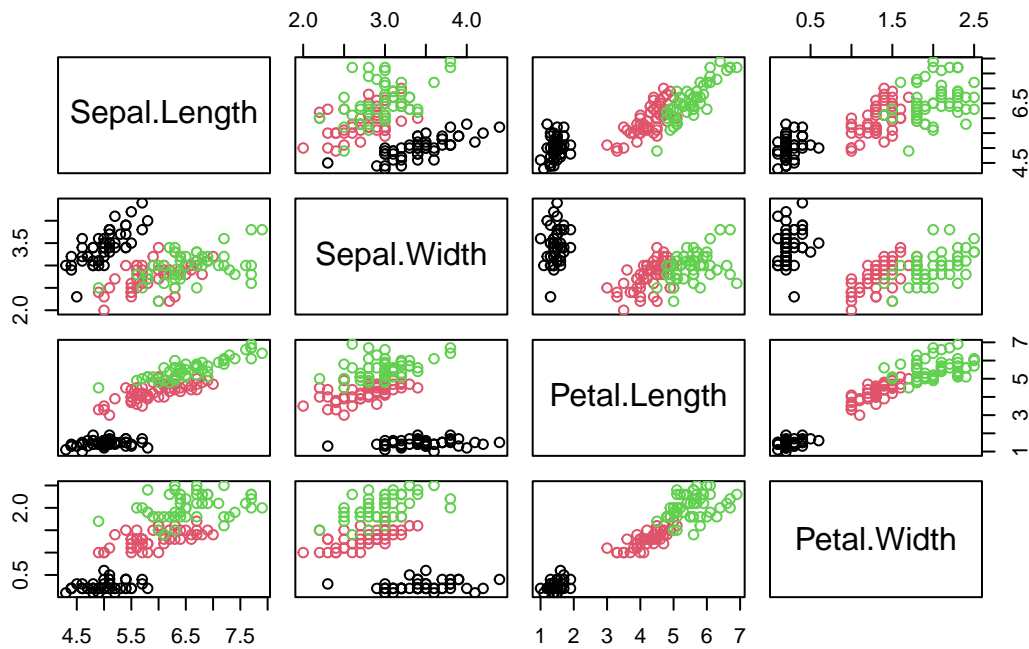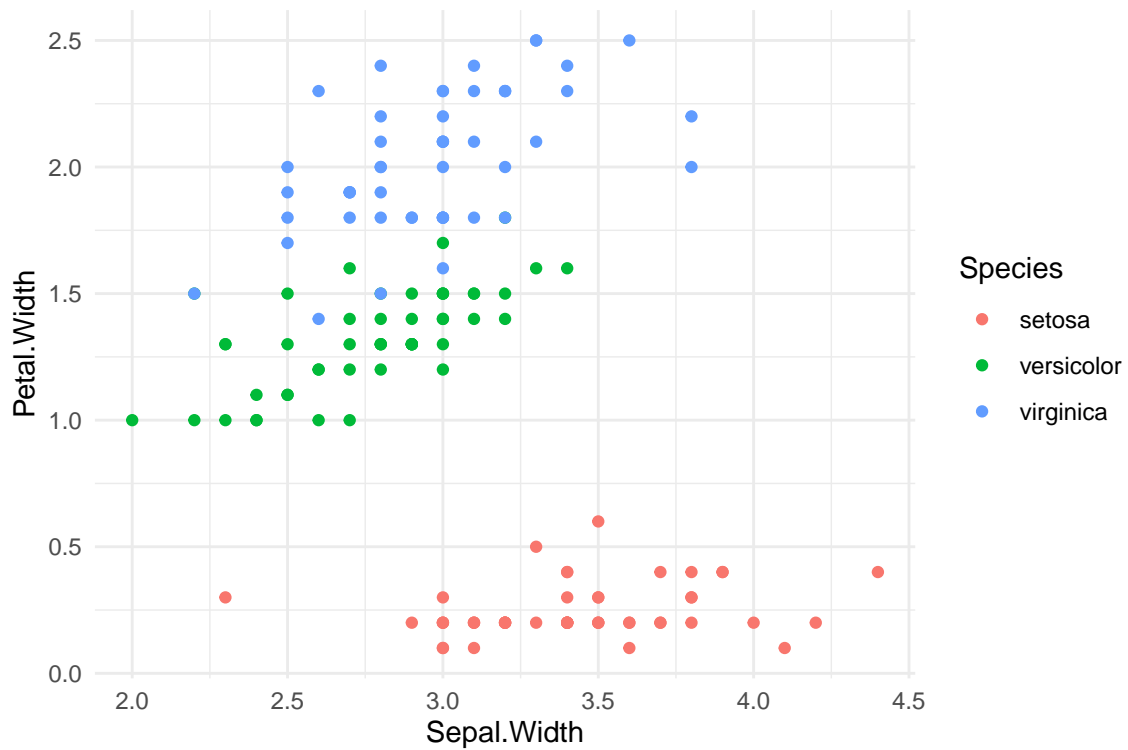
Figure 1: This is a **base** graphic

Figure 2: **ggplot** graphic. Captions with dynamic content are also possible, e.g., Date and Time: 2025-12-22 16:38:53.372487
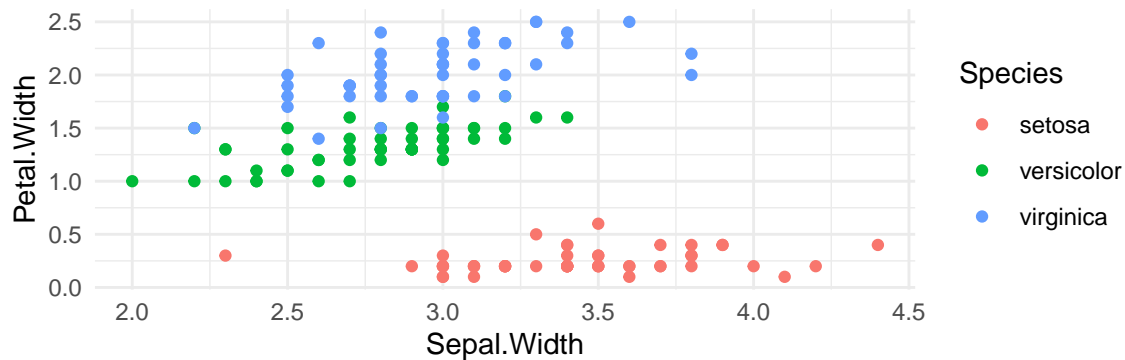
Figure 3: **ggplot** graphic with different aspect ratio.

```r
# The 'alpha' parameter adds transparency to reveal density
diamonds %>%
ggplot(aes(x = carat, y = price, color = cut)) +
  geom_point(alpha = 0.1) +
  labs(title = "Diamonds: Price vs Carat",
       subtitle = "50,000+ points rendered as PNG to save space",
       x = "Carat",
       y = "Price") +
  theme(legend.position = "bottom")
```

4 Summary Statistics

We can also include raw text outputs, which are rendered as code blocks in all formats.

```r
summary(mtcars$mpg)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   10.40   15.43   19.20   20.09   22.80   33.90
```

5 Citations

The information about the citations used are stored in `bibtex` style in the additional file `references.bib` which the last line of the YAML header is referencing to.

You can cite entries using the syntax `[@key]`.

We are using the **knitr** package (Xie 2025) for processing and **ggplot2** (Wickham et al. 2025) for visualization. References will be placed automatically at the end of the document or where we specify the placement div.

There are alternative ways to cite:

- Indirect citation: This report was built using the knitr package (Xie 2025).
- Direct citation: Wickham et al. (2025) describes the grammar of graphics.
- Multiple citations: RMarkdown is powerful (Allaire et al. 2025; Xie 2025).

6 Literature

Allaire, JJ, Yihui Xie, Christophe Dervieux, Jonathan McPherson, Javier Luraschi, Kevin Ushey, Aron Atkins, et al. 2025. *Rmarkdown: Dynamic Documents for r*. https://github.com/rstudio/rmarkdown.
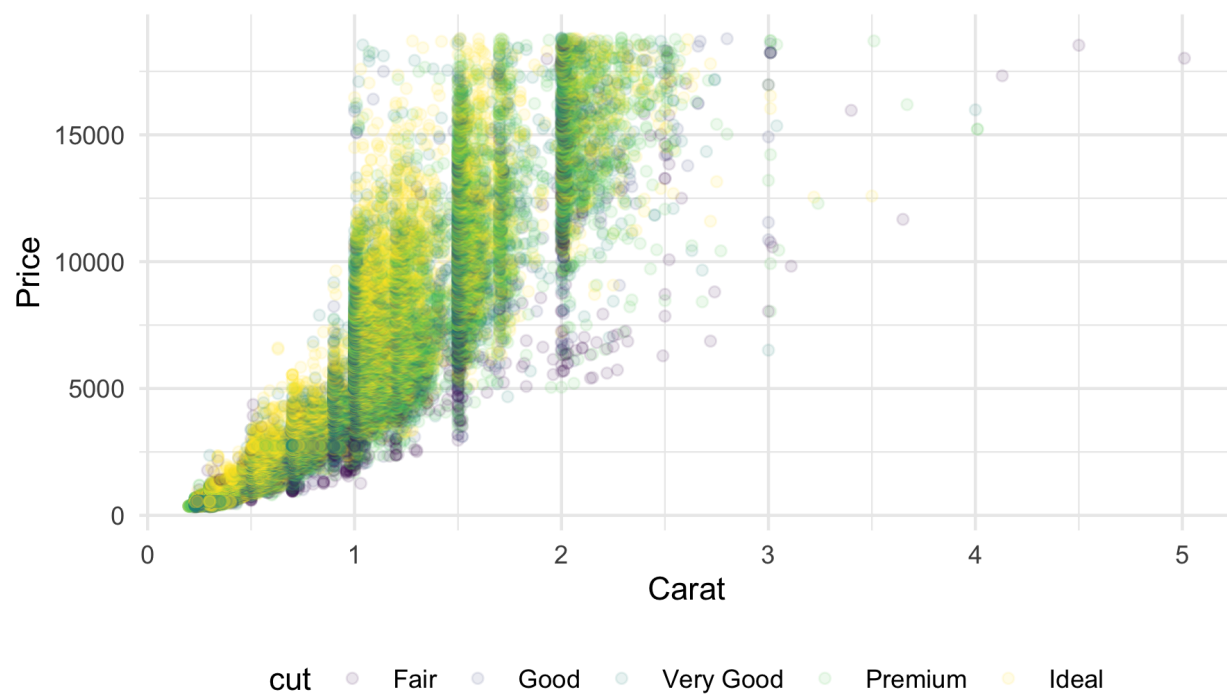
Figure 4: Figure 2: Rasterized plot (PNG) of 50,000+ points.

Wickham, Hadley, Winston Chang, Lionel Henry, Thomas Lin Pedersen, Kohske Takahashi, Claus Wilke, Kara Woo, Hiroaki Yutani, Dewey Dunnington, and Teun van den Brand. 2025. *Ggplot2: Create Elegant Data Visualisations Using the Grammar of Graphics.* https://ggplot2.tidyverse.org.

Xie, Yihui. 2025. *Knitr: A General-Purpose Package for Dynamic Report Generation in r.* https://yihui.org/knitr/.

7 Appendix

7.1 Appendix A: System Information

Because we placed the `<div id="refs"></div>` above, this Appendix will correctly appear **after** the references in the final document.

```r
sessionInfo()
```

```
## R version 4.4.0 (2024-04-24)
## Platform: aarch64-apple-darwin20
## Running under: macOS 26.0.1
##
## Matrix products: default
## BLAS:   /Library/Frameworks/R.framework/Versions/4.4-arm64/Resources/lib/libRblas.0.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/4.4-arm64/Resources/lib/libRlapack.dylib;  LAPACK v
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## time zone: Europe/Berlin
## tzcode source: internal
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
## [1] dplyr_1.1.4   ggplot2_3.5.1 knitr_1.47
##
## loaded via a namespace (and not attached):
##  [1] vctrs_0.6.5       cli_3.6.2         rlang_1.1.4       xfun_0.44
##  [5] generics_0.1.3    labeling_0.4.3    glue_1.7.0        colorspace_2.1-0
##  [9] htmltools_0.5.8.1 scales_1.3.0      fansi_1.0.6       rmarkdown_2.27
## [13] grid_4.4.0        evaluate_0.24.0   munsell_0.5.1     tibble_3.2.1
## [17] fastmap_1.2.0     yaml_2.3.8        lifecycle_1.0.4   compiler_4.4.0
## [21] pkgconfig_2.0.3   rstudioapi_0.16.0 farver_2.1.2      digest_0.6.35
## [25] viridisLite_0.4.2 R6_2.5.1          tidyselect_1.2.1  utf8_1.2.4
## [29] pillar_1.9.0      magrittr_2.0.3    withr_3.0.0       tools_4.4.0
## [33] gtable_0.3.5
```