Reproducible analysis workflows

A short introduction into reproducible analysis tools: Rmarkdown, Github and others

ReproducibiliTea

Cornelius Hennch

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Why do we need reproducible data analysis?

“Reproducibility is the ability to obtain identical results from the same statistical analysis and the same data”

= **long-term** and **cross-platform** reproducibility of data analyses

– Peikert and Brandmeier (2021)

Reproducibility ≠ Replicability

(same analysis **new data**)

Goals of reproducible workflows

1. **Reported** results are consistent with the **actual** results
2. Computational reproducibility (= hardware and software change over time)
3. Version control (= keep track of any changes at any time)

Four essential tools for reproducible workflows

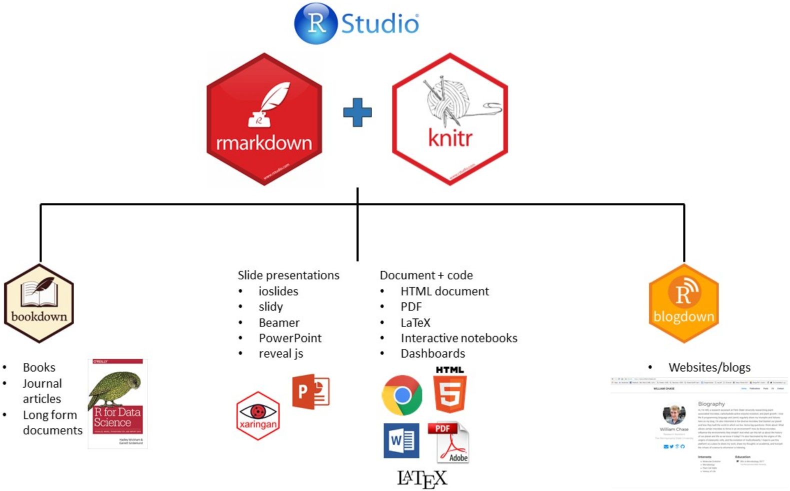
1. Dynamic reports → **R Markdown**

2. Version control → **Git & Github**

3. Dependency management → **Make**

4. Containerization → **Docker**

Highly versatile dynamic documents with R Markdown



- Books
- Journal articles
- Long form documents

Slide presentations

- ioslides
- slidy
- Beamer
- PowerPoint
- reveal js

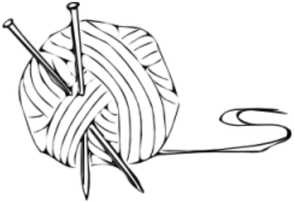
Document + code

- HTML document
- PDF
- LaTeX
- Interactive notebooks
- Dashboards

- Websites/blogs

https://rmarkdown.rstudio.com/authoring_quick_tour.html

Happy knitting!



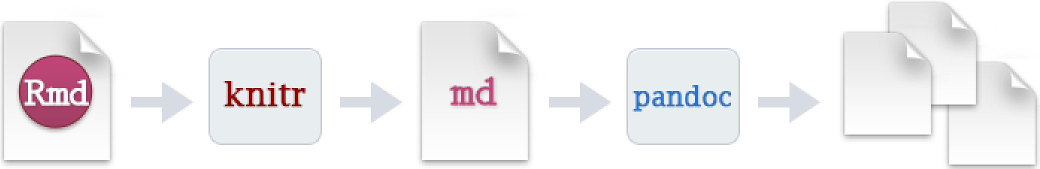


Figure 1: R Markdown under the hood

https://rmarkdown.rstudio.com/authoring_quick_tour.html

Git & Github

Git

- “Distributed version control system”
- Track and document changes (“commits”)
- Retrieve older versions of code
- Enables collaboration on any kind of programming projects (scalable!)

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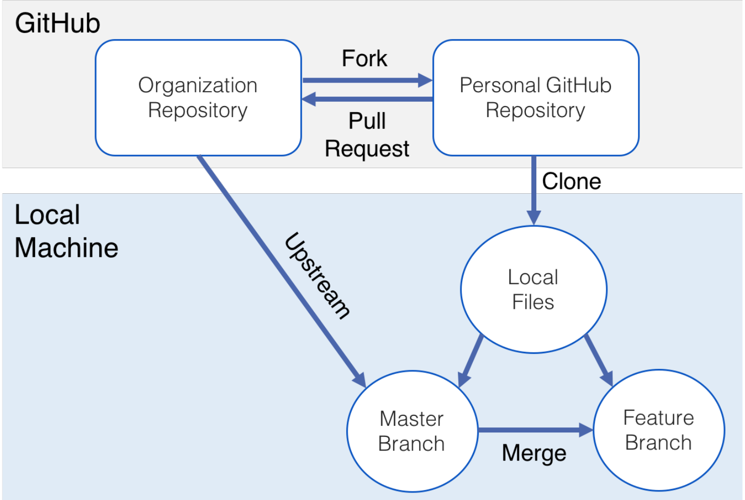
Github

- Git repository hosting service
- **Collaboration**:
  - Many features for team/project management (scalable!)
  - Report bugs/issues, get help
  - Contribute to open-source projects
- Post-publication platform

Collaboration with Git & Github



How to Update a Fork in Git

Docker

Docker is a tool that allows encapsulation, sharing, and re-creation of a computational environment on most operating systems (Windows, macOS, & Linux).

Reproducible data analysis in action

Hypothesis: R skills predict early PhD completion

Simulate and vizualize data

Get the data

link/QR code to google forms

Run the code!

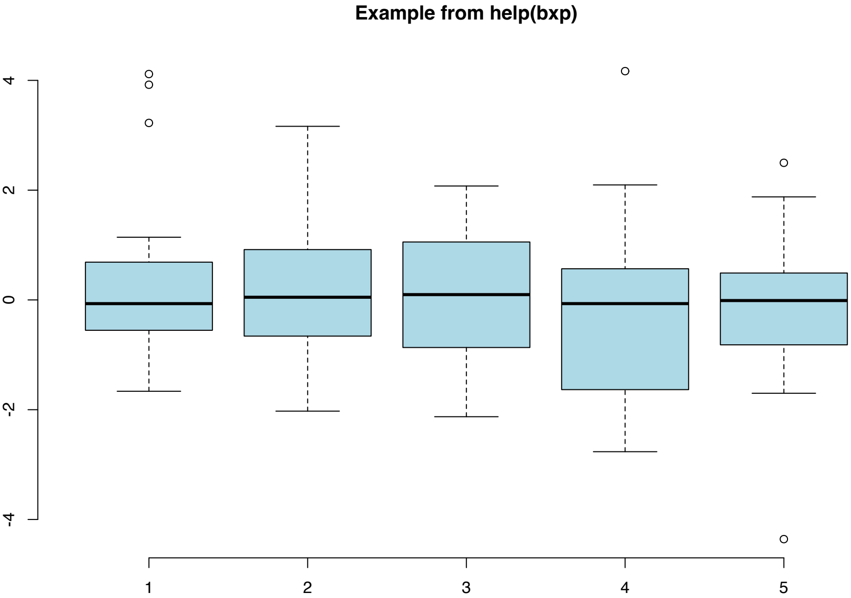
Where to start

Links/ressources for these tools

R Appendix: R Figure Example

The following code generates the plot on the next slide (taken from `help(bxp)` and modified slightly):

R Appendix: R Figure Example



R Appendix: R Table Example

A simple `knitr::kable` example:

Table 1: (Parts of) the mtcars dataset

	mpg	cyl	disp	hp	drat	wt	qsec	vs
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0

References

Peikert, Aaron, and Andreas Brandmeier. 2021. "A Reproducible Data Analysis Workflow with R Markdown, Git, Make, and Docker Aaron." *Preprint*, 1–47.