R für Programmierer

Wenn der Nutzer zum Programmierer wird

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kamapu.net

16. August 2025

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- Geobotaniker
- Vegetationsökologist
- Kartograph
- Computerfreak
  - Statistisches Programmieren
  - Data-Science/KI
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Nächster Termin: **02. September 2025**

STATISTIK UND GRAPHIKEN MIT R (EINFÜHRUNGSKURS), 2 X WÖCHENTLICH

zurück

R ist eine Programmiersprache und kostenlose Software. Durch die vielfältigen Anwendungsmöglichkeiten und Schwerpunkte in Mathematik und Graphik ist R eines der beliebtesten Werkzeuge für Datenauswertungen. Dieser Kurs bietet einen Einstieg in die Grundlagen des statistischen Programmierens mit R und die Verwendung von Posit (RStudio). Wir werden am Beispiel verschiedener Datensätze Tabellen und Graphiken erzeugen. Der Kurs richtet sich an Anfänger, Vorkenntnisse sind daher nicht erforderlich.

Dr. Miguel Alvarez
Kursleitung

zum Dozentenprofil
weitere Kurse dieses Dozenten

Termine

#	Datum	Uhrzeit
1.	Di., 02.09.2025	18:00–20:30 Uhr
2.	Do., 04.09.2025	18:00–20:30 Uhr
3.	Di., 09.09.2025	18:00–20:30 Uhr
4.	Do., 11.09.2025	18:00–20:30 Uhr
5.	Di., 16.09.2025	18:00–20:30 Uhr
6.	Do., 18.09.2025	18:00–20:30 Uhr
7.	Di., 23.09.2025	18:00–20:30 Uhr
8.	Do., 25.09.2025	18:00–20:30 Uhr

R

Statistische Programmiersprache

- Programmiersprache
  - Mathematik/Statistik
  - Visualisierung (Grafiken)
- Interface/Terminal
- REPL-Umgebung (Read-Eval-Print-Loop)

- Open Source
- Freeware

R

```r
# Arithmetik
5 * (20 + 8)
```

```
[1] 140
```

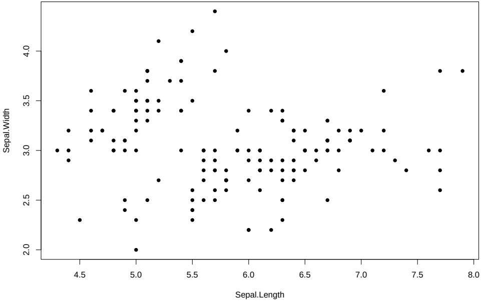
```r
# Statistik
summary(iris$Sepal.Length)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  4.300   5.100   5.800   5.843   6.400   7.900 
```

```r
# Eulersche Identität
round(exp(1i * pi) + 1)
```

```
[1] 0+0i
```

```r
# Visualisierung
plot(Sepal.Width ~ Sepal.Length,
  data = iris,
  pch = 16)
```



Siehe auch The R Graph Gallery

R

Geschichte

- S (1975)
  - S-PLUS
  - TIBCO Spotfire S+
- R (1992)

R ist die kostenlose Alternative zu **S**

Ross Ihaka
Robert Gentleman

R versus Python

R	Python
- Spezialist für Statistiken	- Allgemeine Verwendung
- Vektor als zentrale Datenstruktur	- Liste als zentrale Datenstruktur
- Index fängt bei 1	- Index fängt bei 0
- In der Regel interaktiv	- In der Regel nicht interaktiv

Beide Sprachen sind Bestandteile von Project Jupyter

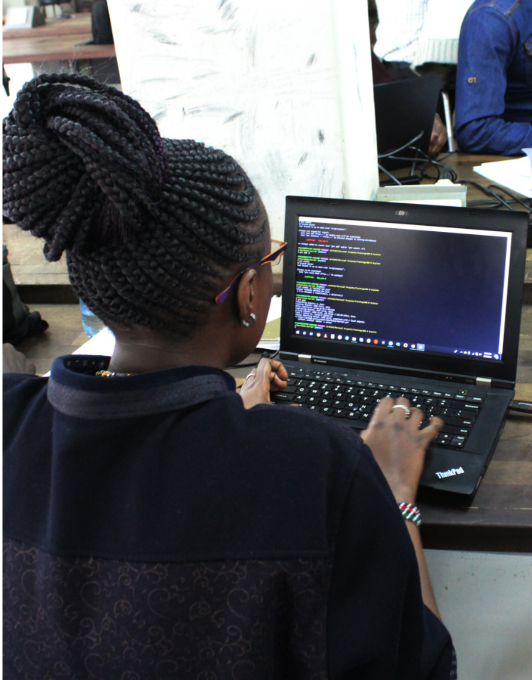
R IDEs

- **RStudio**
- **Tinn-R**
- **ECLIPSE**
  - StatET
- **Visual Studio Code**
  - R Extension

R für Programmierer

Einführungskurse in **R**

- ☒ Schleifen
- ☒ Funktionen
- ☒ `source()`
- ☐ Pakete
- ☐ Objekt-Orientiertes Programmieren
- ☐ Literarisches Programmieren



R Pakete

Comprehensive R Archive Network

CRAN

```
install.packages()
```

Weitere Repositorien

```
devtools::install_github()
devtools::install_gitlab()
devtools::install_bitbucket()
```

The Comprehensive R Archive Network

CRAN
Mirrors
What's new?
Search
CRAN Team

About R
R Homepage
The R Journal

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R Binaries
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Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

- Download R for Linux (Debian, Fedora/Redhat, Ubuntu)
- Download R for macOS
- Download R for Windows

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

Source Code for all Platforms

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2025-06-13, Great Square Root) R-4.5.1.tar.gz, read what's new in the latest version.
- The CRAN directory src/base-prerelease contains R alpha, beta, and rc releases as daily snapshots in time periods before a planned release.
- Between releases, the same directory src/base-prerelease contains snapshots of current patched and development versions. Please read about new features and bug fixes before filing corresponding feature requests or bug reports.
- Alternatively, daily snapshots are available here.
- Source code of older versions of R is available here.
- Contributed extension packages.

Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our answers to frequently asked questions before you send an email.

Supporting CRAN

- CRAN operations, most importantly hosting, checking, distributing, and archiving of R add-on packages for various platforms, crucially rely on technical, emotional, and financial support by the R community.

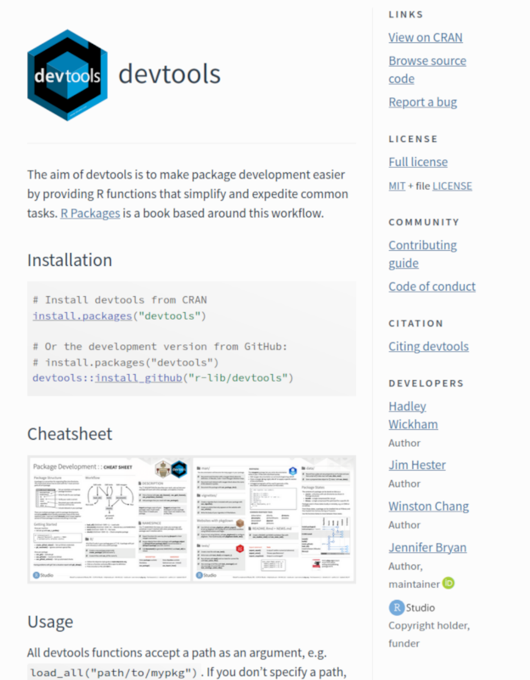
  Please consider making financial contributions to the R Foundation for Statistical Computing.

What are R and CRAN?

R Pakete

Paket **devtools**

- Paket-Entwicklung
  - **usethis**
  - **remotes**
  - **roxygen2**
  - **testthat**



devtools

The aim of devtools is to make package development easier by providing R functions that simplify and expedite common tasks. R Packages is a book based around this workflow.

Installation

```
# Install devtools from CRAN
install.packages("devtools")

# Or the development version from GitHub:
# install.packages("devtools")
devtools::install_github("r-lib/devtools")
```

Cheatsheet

Usage

All devtools functions accept a path as an argument, e.g. `load_all("path/to/mypkg")`. If you don't specify a path,

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CITATION

Citing devtools

DEVELOPERS

Hadley Wickham
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Author

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Author, maintainer

RStudio
Copyright holder, funder

R Pakete

Quellcode

```
man\
  - foo.Rd
R\
  - foo.R
.Rbuildignore
DESCRIPTION
NAMESPACE
```

R-Paket-Skelett erzeugen

```r
library(devtools)
create(".")
```

NAMESPACE und Dokumentation kann automatisch generiert werden

```r
devtools::document()
```

Sauber Codieren

lintr

```
lintr::lint_package()
```

styler

```
styler::style_pkg()
```

goodpractice

```
goodpractice::gp()
```

lintr

R-CMD-check passing codecov 99% CRAN 3.2.0 lifecycle stable

lintr provides static code analysis for R. It checks for adherence to a given style, identifying syntax errors and possible semantic issues, then reports them to you so you can take action. Watch lintr in action in the following animation:

lintr is complementary to the `{styler}` package which automatically restyles code, eliminating some of the problems that lintr can detect.

Installation

Install the stable version from CRAN:

```
install.packages("lintr")
```

Links

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Community

Contributing guide
Code of conduct
Getting help

Citation

Citing lintr

Developers

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Author
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Author
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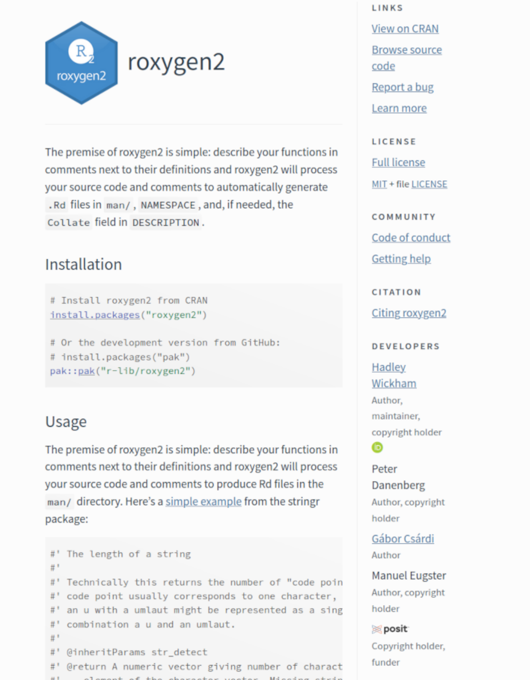
Author
More about authors...

Dokumentation

- Klassisch mit $\LaTeX$
- Mit **roxygen2**
    - dazu **Markdown**

… in **DESCRIPTION**

```
Roxygen: list(markdown = TRUE)
```



roxygen2

The premise of roxygen2 is simple: describe your functions in comments next to their definitions and roxygen2 will process your source code and comments to automatically generate `.Rd` files in `man/`, `NAMESPACE`, and, if needed, the `Collate` field in `DESCRIPTION`.

Installation

```
# Install roxygen2 from CRAN
install.packages("roxygen2")

# Or the development version from GitHub:
# install.packages("pak")
pak::pak("r-lib/roxygen2")
```

Usage

The premise of roxygen2 is simple: describe your functions in comments next to their definitions and roxygen2 will process your source code and comments to produce Rd files in the `man/` directory. Here's a simple example from the stringr package:

```
#' The length of a string
#'
#' Technically this returns the number of "code poin
#' code point usually corresponds to one character,
#' an u with a umlaut might be represented as a sing
#' combination a u and an umlaut.
#'
#' @inheritParams str_detect
#' @return A numeric vector giving number of charact
```

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DEVELOPERS

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posit
Copyright holder, funder

Dokumentation

Dokumentation im selben Skript

z.B. in fibonacci.R

```
#' @name fibonacci
#'
#' @title Fibonacci Sequence
#'
#' @description
#' A [Fibonacci sequence](https://en.wikipedia.org/wik
#' will be created upon requested length.
#'
#' @param n An integer value indicating the length
#'   of the requested sequence.
#'
#' @return A vector of class [fibonacci-class].
#'
#' @examples
#' fibonacci(6)
#'
#' @export
```

fibonacci {fibonacci} R Documentation

Fibonacci Sequence

Description

A Fibonacci sequence will be created upon requested length.

Usage

```
fibonacci(n)
```

Arguments

n	An integer value indicating the length of the requested sequence.

Value

A vector of class fibonacci.

Examples

Run examples

```
fibonacci(6)
```

[Package *fibonacci* version 0.0.0.9002 Index]

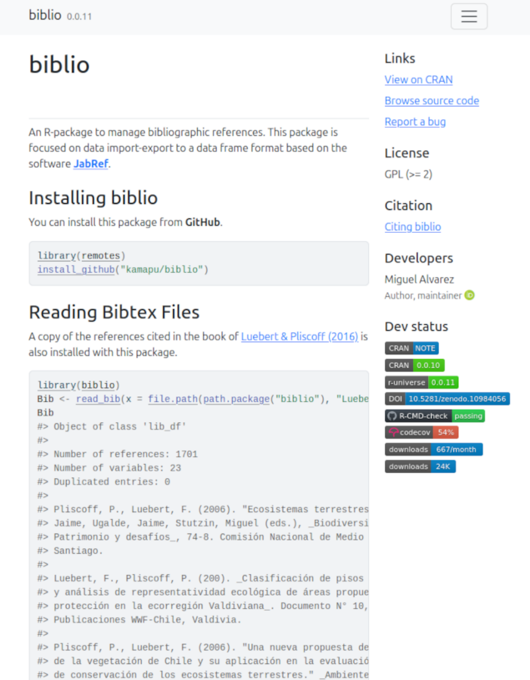
Dokumentation

README.md in Repo

Frameworks:

- **R Markdown**
- **Quarto**
- `pkgdown`
  - GitHub pages

Beispiel: `biblio`


biblio 0.0.11

biblio

An R-package to manage bibliographic references. This package is focused on data import-export to a data frame format based on the software **JabRef**.

Installing biblio

You can install this package from **GitHub**.

```
library(remotes)
install_github("kamapu/biblio")
```

Reading Bibtex Files

A copy of the references cited in the book of Luebert & Pliscoff (2016) is also installed with this package.

```
library(biblio)
Bib <- read_bib(x = file.path(path.package("biblio"), "Luebe
Bib
#> Object of class 'lib_df'
#>
#> Number of references: 1701
#> Number of variables: 23
#> Duplicated entries: 0
#>
#> Pliscoff, P., Luebert, F. (2006). "Ecosistemas terrestres
#> Jaime, Ugalde, Jaime, Stutzin, Miguel (eds.), _Biodiversi
#> Patrimonio y desafíos_, 74-8. Comisión Nacional de Medio
#> Santiago.
#>
#> Luebert, F., Pliscoff, P. (200). _Clasificación de pisos
#> y análisis de representatividad ecológica de áreas propue
#> protección en la ecorregión Valdiviana_. Documento N° 10,
#> Publicaciones WWF-Chile, Valdivia.
#>
#> Pliscoff, P., Luebert, F. (2006). "Una nueva propuesta de
#> de la vegetación de Chile y su aplicación en la evaluació
#> de conservación de los ecosistemas terrestres." _Ambiente
```

Links

View on CRAN

Browse source code

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License

GPL (>= 2)

Citation

Citing biblio

Developers

Miguel Alvarez

Author, maintainer

Dev status

CRAN NOTE

CRAN 0.0.10

r-universe 0.0.11

DOI 10.5281/zenodo.10984056

R-CMD-check passing

codecov 54%

downloads 667/month

downloads 24K

Dokumentation

Demos (interaktiv)

```
demo()
```

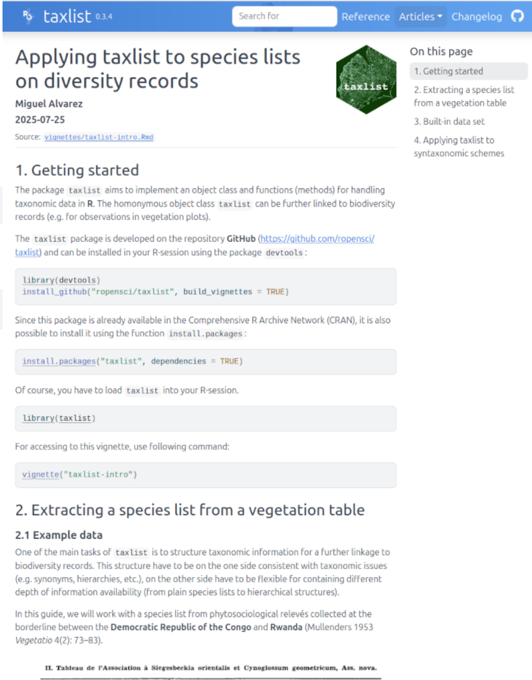
Vignettes

```
vignette()
```

Frameworks:

- utils::Sweave()
- knitr
- **R Markdown**
- **Quarto**

Beispiel: taxlist-intro



taxlist 0.3.4 | Search for | Reference | Articles | Changelog

Applying taxlist to species lists on diversity records

Miguel Alvarez

2025-07-25

Source: `vignettes/taxlist-intro.Rmd`

On this page
1. Getting started
2. Extracting a species list from a vegetation table
3. Built-in data set
4. Applying taxlist to syntaxonomic schemes

1. Getting started

The package `taxlist` aims to implement an object class and functions (methods) for handling taxonomic data in **R**. The homonymous object class `taxlist` can be further linked to biodiversity records (e.g. for observations in vegetation plots).

The `taxlist` package is developed on the repository **GitHub** (https://github.com/ropensci/taxlist) and can be installed in your R-session using the package `devtools`:

```
library(devtools)
install_github("ropensci/taxlist", build_vignettes = TRUE)
```

Since this package is already available in the Comprehensive R Archive Network (CRAN), it is also possible to install it using the function `install.packages`:

```
install.packages("taxlist", dependencies = TRUE)
```

Of course, you have to load `taxlist` into your R-session.

```
library(taxlist)
```

For accessing to this vignette, use following command:

```
vignette("taxlist-intro")
```

2. Extracting a species list from a vegetation table

2.1 Example data

One of the main tasks of `taxlist` is to structure taxonomic information for a further linkage to biodiversity records. This structure have to be on the one side consistent with taxonomic issues (e.g. synonyms, hierarchies, etc.), on the other side have to be flexible for containing different depth of information availability (from plain species lists to hierarchical structures).

In this guide, we will work with a species list from phytosociological relevés collected at the borderline between the **Democratic Republic of the Congo** and **Rwanda** (Mullenders 1953 *Vegetatio* 4(2): 73–83).

II. Tableau de l'Association à Siegesbeckia orientalis et Cynoglossum geometricum, Ass. nova.

Checks

R CMD check

```r
library(devtools)
pkg_loc <- build(path = "path",
    args = "--resave-data")
check_built(path = pkg_loc)
```

```
> # Build and check package
> pkg_loc <- build(path = "build-pkg", args = "--resave-data")
── R CMD build ─────────────────────────────────────────────────────
✔  checking for file '/media/miguel/miguel2022/workspaces/vegtable-universe/taxlist/DESCRIPTION' ...
─  preparing 'taxlist': (10.6s)
✔  checking DESCRIPTION meta-information ...
─  installing the package to build vignettes
✔  creating vignettes (4.6s)
─  checking for LF line-endings in source and make files and shell scripts (337ms)
─  checking for empty or unneeded directories
─  re-saving image files
─  building 'taxlist_0.3.4.tar.gz'

> # pkg_loc <- build(path = "build-pkg", args = "--resave-data", vignettes = FALSE)
> check_built(path = pkg_loc)
── Checking ────────────────────────────────────────────────────────
Setting env vars:
• _R_CHECK_CRAN_INCOMING_USE_ASPELL_           : TRUE
• _R_CHECK_CRAN_INCOMING_REMOTE_               : FALSE
• _R_CHECK_CRAN_INCOMING_                      : FALSE
• _R_CHECK_FORCE_SUGGESTS_                     : FALSE
• _R_CHECK_PACKAGES_USED_IGNORE_UNUSED_IMPORTS_: FALSE
── R CMD check ─────────────────────────────────────────────────────
─  using log directory '/tmp/RtmpDy3iIk/taxlist.Rcheck'
─  using R version 4.5.1 (2025-06-13)
─  using platform: x86_64-pc-linux-gnu
─  R was compiled by
       gcc (Ubuntu 13.3.0-6ubuntu2~24.04) 13.3.0
       GNU Fortran (Ubuntu 13.3.0-6ubuntu2~24.04) 13.3.0
─  running under: Ubuntu 24.04.2 LTS
─  using session charset: UTF-8
─  using options '--no-manual --as-cran'
✔  checking for file 'taxlist/DESCRIPTION'
─  this is package 'taxlist' version '0.3.4'
─  package encoding: UTF-8
✔  checking package namespace information ...
✔  checking package dependencies (816ms)
✔  checking if this is a source package ...
✔  checking if there is a namespace
✔  checking for executable files ...
✔  checking for hidden files and directories ...
✔  checking for portable file names ...
✔  checking for sufficient/correct file permissions
✔  checking whether package 'taxlist' can be installed (3.3s)


✔  checking for non-standard things in the check directory ...
✔  checking for detritus in the temp directory

   See
     '/tmp/RtmpDy3iIk/taxlist.Rcheck/00check.log'
   for details.

── R CMD check results ─────────────────────────────────────────────
Duration: 28.9s

❯ checking R/sysdata.rda ... OK
   WARNING
  'qpdf' is needed for checks on size reduction of PDFs

0 errors ✔ | 1 warning ✖ | 0 notes ✔
>
```

Test und Testabdeckung

testthat

```
tests/
  - testthat/
    - test-foo.R
  - testthat.R
```

covr

```r
covr::report()
```

OOP

S3

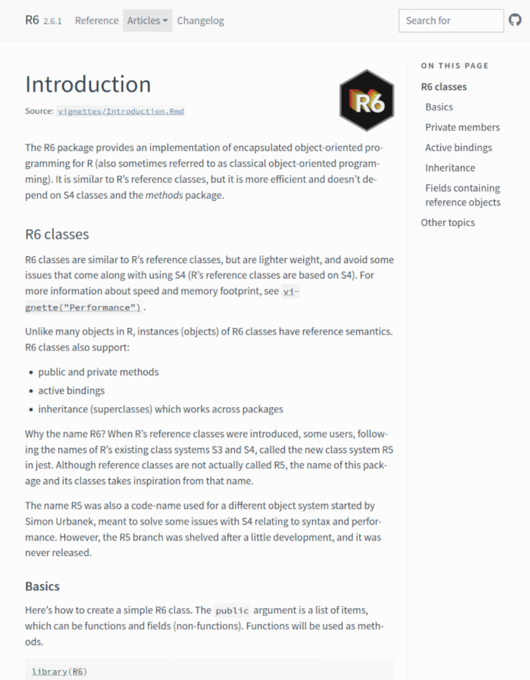
Ohne formale Klassendefinition.

S4

Mit formaler Definition von Klassen.
Klassen bestehen aus Slots.
Validierung.
(Siehe hier)

R6

Kapselung und mutable Objekten (wie bei Python).
Implementiert in Paket R6.



R6 2.6.1 Reference Articles Changelog Search for

Introduction

Source: vignettes/Introduction.Rmd

The R6 package provides an implementation of encapsulated object-oriented programming for R (also sometimes referred to as classical object-oriented programming). It is similar to R's reference classes, but it is more efficient and doesn't depend on S4 classes and the *methods* package.

R6 classes

R6 classes are similar to R's reference classes, but are lighter weight, and avoid some issues that come along with using S4 (R's reference classes are based on S4). For more information about speed and memory footprint, see `vignette("Performance")`.

Unlike many objects in R, instances (objects) of R6 classes have reference semantics. R6 classes also support:

- public and private methods
- active bindings
- inheritance (superclasses) which works across packages

Why the name R6? When R's reference classes were introduced, some users, following the names of R's existing class systems S3 and S4, called the new class system R5 in jest. Although reference classes are not actually called R5, the name of this package and its classes takes inspiration from that name.

The name R5 was also a code-name used for a different object system started by Simon Urbanek, meant to solve some issues with S4 relating to syntax and performance. However, the R5 branch was shelved after a little development, and it was never released.

Basics

Here's how to create a simple R6 class. The `public` argument is a list of items, which can be functions and fields (non-functions). Functions will be used as methods.

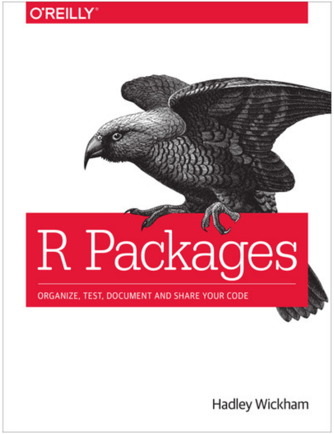
```
library(R6)
```

ON THIS PAGE

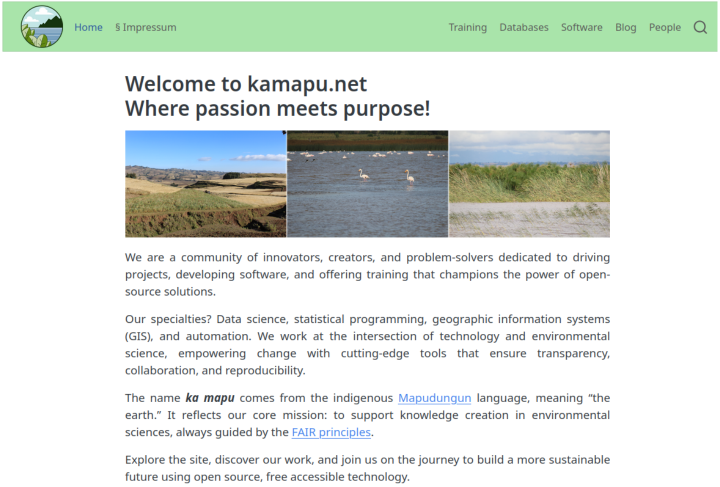
Lesenswert

fibonacci

Paket-Demo in GitLab



Besuchen Sie uns!



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Fragen?