

Einführung in R und RStudio

[Termine 5 & 6]

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- ▶ Objekten
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- ▶ Fortgeschrittenes Programmieren
- ▶ Erstellen von Dokumenten
- ▶ Abschluss

Funktion

```
foo(par1 = arg1, ..., parn =  
argn)
```

Funktionen und Argumente (Parameter)
werden dokumentiert.
Achte auf Standardeinstellungen (default
values).

```
A <- c(1, NA, 3, 5)  
mean(A)  
## [1] NA  
mean(A, na.rm = TRUE)  
## [1] 3
```

Matrix

- ▶ Typ von Inhalt (mode()).
- ▶ Zwei Dimensionen.

```
M <- matrix(1:20, nrow = 4)
```

```
M
```

```
##      [,1] [,2] [,3] [,4] [,5]  
## [1,]    1    5    9   13   17  
## [2,]    2    6   10   14   18  
## [3,]    3    7   11   15   19  
## [4,]    4    8   12   16   20
```

```
class(M)
```

```
## [1] "matrix" "array"
```

```
mode(M)
```

```
## [1] "numeric"
```

```
length(M)
```

```
## [1] 20
```

```
dim(M)
```

```
## [1] 4 5
```

Datensatz

Spaltenorientierte Tabelle
(data.frame)

```
head(iris)
```

```
##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1         5.1         3.5         1.4         0.2   setosa
## 2         4.9         3.0         1.4         0.2   setosa
## 3         4.7         3.2         1.3         0.2   setosa
## 4         4.6         3.1         1.5         0.2   setosa
## 5         5.0         3.6         1.4         0.2   setosa
## 6         5.4         3.9         1.7         0.2   setosa
```

```
str(iris)
```

```
## 'data.frame':   150 obs. of  5 variables:
##  $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4
##  $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9
##  $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7
##  $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.2
##  $ Species      : Factor w/ 3 levels "setosa"
```

Liste

Liste (Sammlung) von Objekten, inklusive Listen.

Achte, dass `data.frame` eine spezielle Form von `list` ist.

```
MeineListe <- list(  
  A = 1:10,  
  B = matrix(1:10, nrow = 2),  
  C = "Dies ist eine Liste")  
MeineListe  
  
## $A  
## [1] 1 2 3 4 5 6 7 8 9 10  
##  
## $B  
##      [,1] [,2] [,3] [,4] [,5]  
## [1,]    1    3    5    7    9  
## [2,]    2    4    6    8   10  
##  
## $C  
## [1] "Dies ist eine Liste"
```

CRAN

(Comprehensive R Archive Network)

- ▶ `install.packages()`
- ▶ `update.packages()`

```
install.packages("ade4")
update.packages(ask = FALSE)
```

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

Available CRAN Packages By Name

ABCDEFGHIJKLMNOPQRSTUVWXYZ

[A3](#)
[AATools](#)
[ABACUS](#)
[abbreviate](#)
[abbyyR](#)
[abc](#)
[abc.data](#)
[ABC.RAP](#)
[abcADM](#)
[ABCanalysis](#)
[abclass](#)
[ABCOptim](#)
[ABCp2](#)
[abcrf](#)
[abcrlda](#)
[abctools](#)
[abd](#)
[abdiv](#)
[abe](#)
[abess](#)
[abglasso](#)
[ABHgenotypeR](#)
[abind](#)
[abjData](#)
[abjutils](#)
[abmR](#)
[abn](#)
[abnormality](#)
[abodOutlier](#)
[ABPS](#)
[abstr](#)
[abstractr](#)
[abtest](#)
[abundant](#)
[Ac3net](#)
[ACA](#)
[academictwitter](#)

Accurate, Adaptable, and Accessible Error Metrics for Predictive Models
 Reliability and Scoring Routines for the Approach-Avoidance Task
 Apps Based Activities for Communicating and Understanding Statistics
 Readable String Abbreviation
 Access to Abbyy Optical Character Recognition (OCR) API
 Tools for Approximate Bayesian Computation (ABC)
 Data Only: Tools for Approximate Bayesian Computation (ABC)
 Array Based CpG Region Analysis Pipeline
 Fit Accumulated Damage Models and Estimate Reliability using ABC
 Computed ABC Analysis
 Angle-Based Large-Margin Classifiers
 Implementation of Artificial Bee Colony (ABC) Optimization
 Approximate Bayesian Computational Model for Estimating P2
 Approximate Bayesian Computation via Random Forests
 Asymptotically Bias-Corrected Regularized Linear Discriminant Analysis
 Tools for ABC Analyses
 The Analysis of Biological Data
 Alpha and Beta Diversity Measures
 Augmented Backward Elimination
 Fast Best Subset Selection
 Adaptive Bayesian Graphical Lasso
 Easy Visualization of ABH Genotypes
 Combine Multidimensional Arrays
 Databases Used Routinely by the Brazilian Jurimetrics Association
 Useful Tools for Jurimetrics Analysis Used by the Brazilian Jurimetrics Association
 Agent-Based Models in R
 Modelling Multivariate Data with Additive Bayesian Networks
 Measure a Subject's Abnormality with Respect to a Reference Population
 Angle-Based Outlier Detection
 The Abnormal Blood Profile Score to Detect Blood Doping
 R Interface to the A/B Street Transport System Simulation Software
 An R-Shiny Application for Creating Visual Abstracts
 Bayesian A/B Testing
 High-Dimensional Principal Fitted Components and Abundant Regression
 Inferring Directional Conservative Causal Core Gene Networks
 Abrupt Change-Point or Aberration Detection in Point Series
 Access the Twitter Academic Research Product Track V2 API Endpoint

devtools

- ▶ `install()`
- ▶ `install_github()`

<https://ropensci.org/>

devtools 2.4.5 Reference Articles ▼ News ▼



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")
```


- ▶ readLines()
- ▶ read.table()
 - ▶ read.csv()
 - ▶ read.csv2()

```
Bonn2021 <- read.csv("Bevoelkerung-2021.csv")  
str(Bonn2021)
```

```
## 'data.frame':    67 obs. of  13 variables:  
## $ BezirkNr      : int  110 111 112 113 114 115 1  
## $ BezirkName    : chr  "Zentrum-Rheinviertel" "Z  
## $ Gesamt        : int  2343 3161 6768 8906 5157 6  
## $ DichteKm2     : int  6508 6585 11874 16193 433  
## $ Maenner       : int  1166 1537 3189 4575 2481 3  
## $ MaennerProzent : num  49.8 48.6 47.1 51.4 48.1 4  
## $ Frauen        : int  1177 1624 3579 4331 2675 3  
## $ FrauenProzent  : num  50.2 51.4 52.9 48.6 51.9 5  
## $ Zuwanderer    : int  753 1092 1762 2732 1873 2  
## $ ZuwandererProzent : num  32.1 34.5 26 30.7 36.3 35  
## $ Auslaender    : int  494 813 1145 2010 1235 12  
## $ AuslaenderProzent : num  65.6 74.5 65 73.6 65.9 55  
## $ AuslaenderProzent2: logi  NA NA NA NA NA NA ...
```

- ▶ readLines()
- ▶ read.table()
 - ▶ read.csv()
 - ▶ read.csv2()
- ▶ write.table()
 - ▶ write.csv()
 - ▶ write.csv2()

```
write.csv(iris, file = "iris.csv")  
write.csv2(iris, file = "iris2.csv")
```

Pakete können eigene Funktionen für Importieren und Exportieren anbieten.

▶ **xlsx**

- ▶ `read.xlsx()`
- ▶ `write.xlsx()`

▶ **readODS**

- ▶ `read_ods()`
- ▶ `write_ods()`

R Data Import/Export

This is a guide to importing and exporting data to and from R.

This manual is for R, version 4.3.0 Under development (2022-10-23).

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R-Images

- ▶ Workspace
 - ▶ `save()`
 - ▶ `load()`
 - ▶ Dateierweiterung **.rda** oder **.RData**
- ▶ Einzelnes Objekt
 - ▶ `saveRDS()`
 - ▶ `readRDS()`
 - ▶ Dateierweiterung **.rds**

Vielen Dank!

```
library(fortunes)  
fortune(10)
```

```
##  
## Overall, SAS is about 11 years behind R and S-Plus in statistical capabilities  
## (last year it was about 10 years behind) in my estimation.  
## -- Frank Harrell (SAS User, 1969-1991)  
## R-help (September 2003)
```