

Construção de Pacotes em R: da Teoria à Prática Utilizando o RStudio

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13/12/2021

Por que criar um pacote no R?

- Organização de funções, exemplos e conjuntos de dados associados a um mesmo tema.
- Divulgação:
 - Fácil distribuição;
 - Comunidade familiarizada com a instalação e utilização de pacotes.

Pré-Requisitos

- Programar em R
- R, RStudio e RTools atualizados
- Pacotes:
 - “devtools” - atualizar o pacote, simular instalação
 - “roxygen2” - criar documentação
 - “testthat” - testes de funções, validações
 - “usethis” - substituto do “devtools” (mais intuitivo)
 - “knitr” - Rmarkdown
- git instalado - versionamento
- compilador de LaTeX instalado - “vignettes” (manuais)

Estrutura de um pacote no R

- Arquivo “DESCRIPTION” - metadados do pacote (nome, autor, versão, licença etc)
- Arquivo “NAMESPACE” - lista funções que estarão disponíveis para os usuários
- Diretório “R” - funções (arquivos .R)
- Diretório “man” - manuais (arquivos .Rd).
- Opcionais:
 - Diretório “data” - arquivos de dados para exemplos ou testes
 - Diretório “tests” - testes das funções do pacote
 - Diretório “vignettes” - explicações mais didáticas sobre as funções e o pacote

Passo a Passo - Preparação

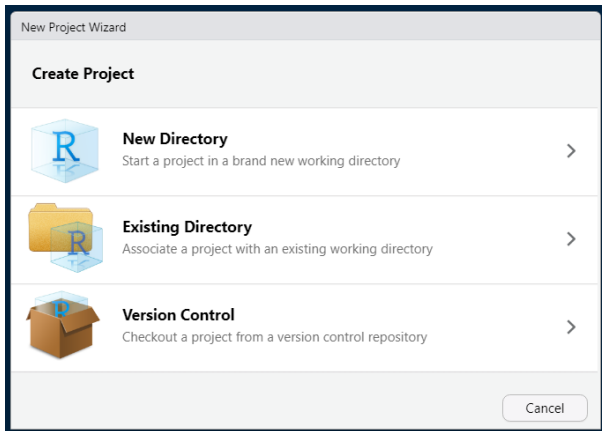


Figura: RStudio: File - New Project - New Directory

Passo a Passo - Preparação

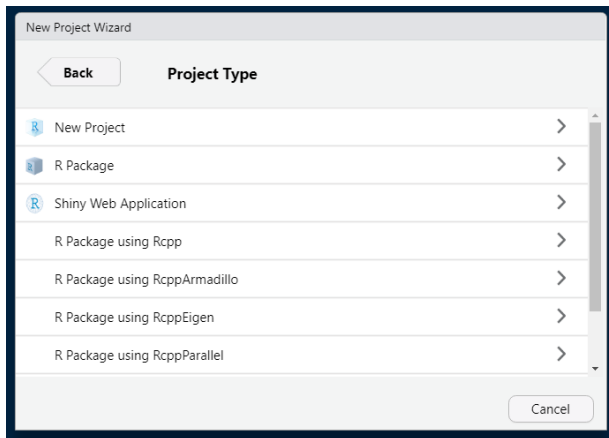



Figura: R package

Passo a Passo - Preparação

New Project Wizard

Back **Create R Package**



Type: Package Package name: HelloWorld

Create package based on source files:

Add... Remove

Create project as subdirectory of:

~/UFRJ/IC/Aula R Packages/2 - ENCE Browse...

☒ Create a git repository ☐ Use renv with this project

☐ Open in new session

Create Project Cancel

Figura: Pacote “HelloWorld”

Passo a Passo - Preparação

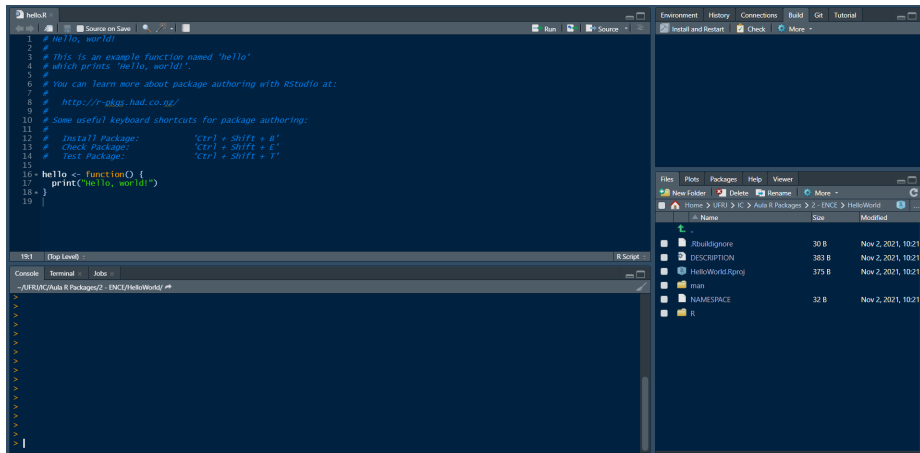
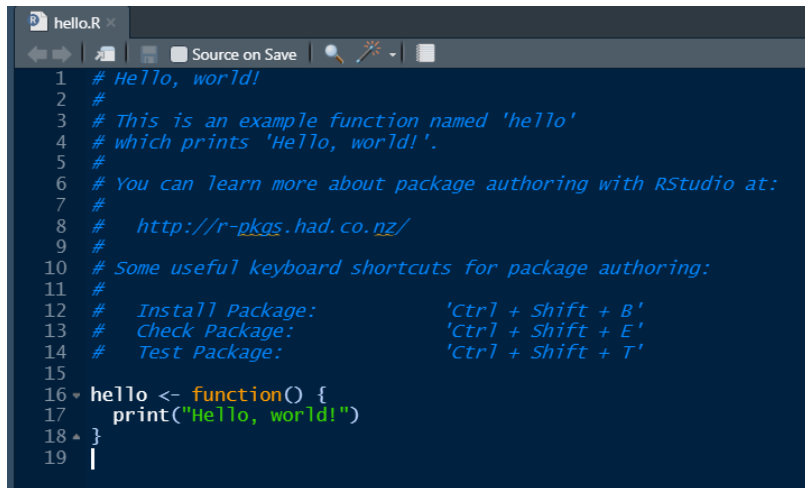


Figura: Tela Inicial

Passo a Passo - Preparação



```
1 # Hello, world!
2 #
3 # This is an example function named 'hello'
4 # which prints 'Hello, world!'.
5 #
6 # You can learn more about package authoring with RStudio at:
7 #
8 # http://r-pkgs.had.co.nz/
9 #
10 # Some useful keyboard shortcuts for package authoring:
11 #
12 #   Install Package:      'Ctrl + Shift + B'
13 #   Check Package:       'Ctrl + Shift + E'
14 #   Test Package:        'Ctrl + Shift + T'
15
16 hello <- function() {
17   print("Hello, world!")
18 }
19 |
```

Figura: Função “hello”

Passo a Passo - Preparação

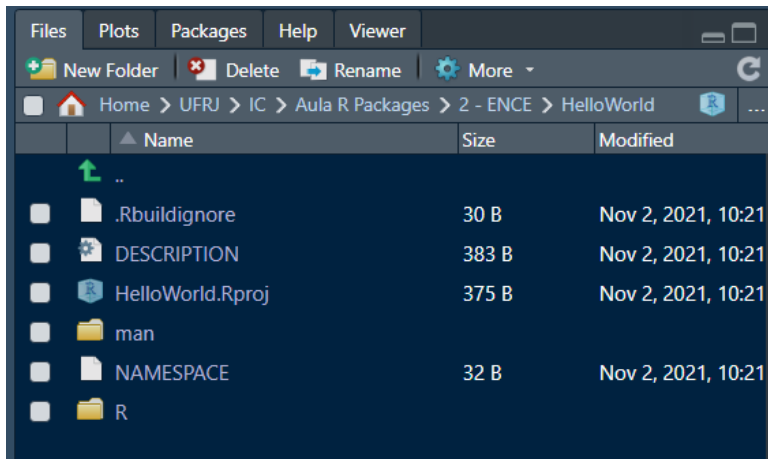


Figura: Arquivos Padrão

Passo a Passo - Preparação

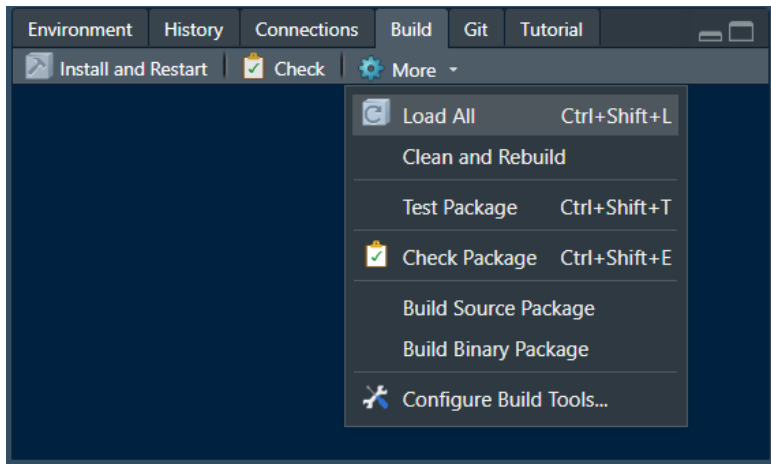


Figura: Aba “Build”

Passo a Passo - Preparação

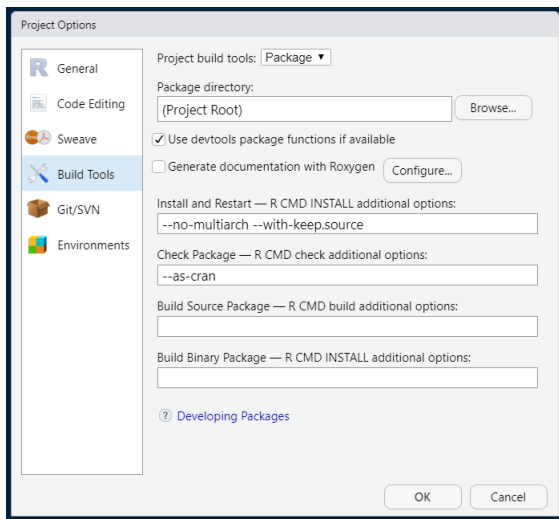


Figura: “Project Options”

Passo a Passo - Preparação

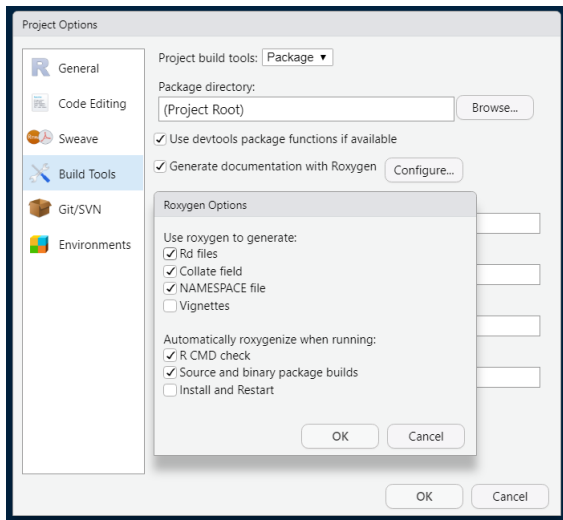


Figura: Geração de arquivos com o “Roxygen”

Passo a Passo - Construção

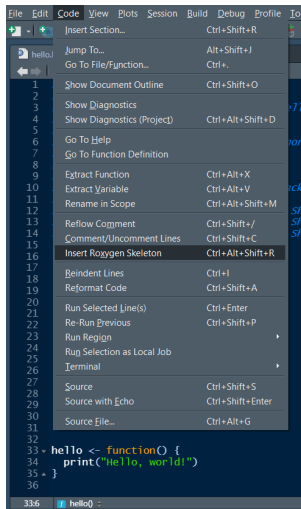


Figura: Documentação com o “Roxygen” - função (“Insert Roxygen Skeleton”)

Passo a Passo - Construção

```
17
18 #' Title
19 #'
20 #' @return
21 #' @export
22 #'
23 #' @examples
24 hello <- function() {
25   print("Hello, world!")
26 }
27
```

Figura: Documentação com o “Roxygen” - estrutura padrão

Passo a Passo - Construção

```
18 #' Funcao Hello nomeada
19 #'
20 #' Funcao modificada para usar um nome como argumento
21 #'
22 #' @param nome nome desejado
23 #'
24 #' @return frase com o nome escolhido
25 #'
26 #' @examples
27 #' hello("Bruno")
28 #'
29 #' @export
30 hello <- function(nome) {
31   print(paste("Hello, ", nome, "!", sep=""))
32 }
33
```

Figura: Documentação com o “Roxygen” - estrutura preenchida

Passo a Passo - Construção

```
==> devtools::document(roclets = c('rd', 'collate', 'namespace'))  
  
Updating HelloWorld documentation  
First time using roxygen2. Upgrading automatically...  
Updating roxygen version in C:\Users\pedro\OneDrive\Documentos\UFRJ\I  
C\Aula R Packages\2 - ENCE\HelloWorld\DESCRIPTION  
Loading HelloWorld  
Warning: The existing 'hello.Rd' file was not generated by roxygen2,  
and will not be overwritten.  
Warning: The existing 'NAMESPACE' file was not generated by roxygen2,  
and will not be overwritten.  
Documentation completed
```

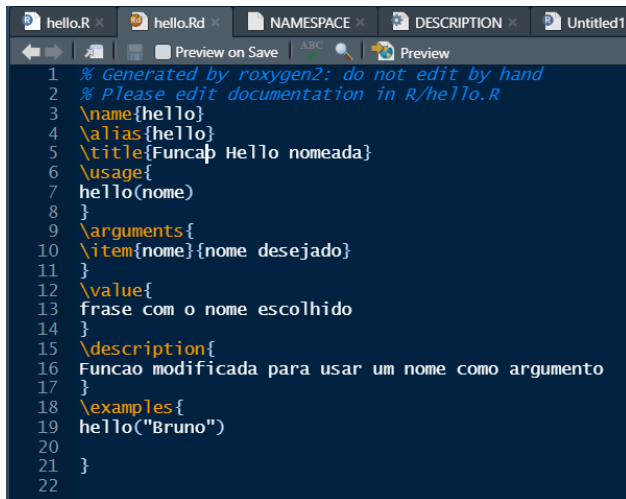
Figura: Documentação com o “Roxygen” - comando “Document”

Passo a Passo - Construção

```
==> devtools::document(roclets = c('rd', 'collate', 'namespace'))  
  
Updating HelloWorld documentation  
First time using roxygen2. Upgrading automatically...  
Loading HelloWorld  
Writing NAMESPACE  
Writing hello.Rd  
Writing NAMESPACE  
Documentation completed
```

Figura: Documentação com o “Roxygen” - comando “Document”

Passo a Passo - Construção



```
1 % Generated by roxygen2: do not edit by hand
2 % Please edit documentation in R/hello.R
3 \name{hello}
4 \alias{hello}
5 \title{Funcao Hello nomeada}
6 \usage{
7   hello(nome)
8 }
9 \arguments{
10  \item{nome}{nome desejado}
11 }
12 \value{
13   frase com o nome escolhido
14 }
15 \description{
16   Funcao modificada para usar um nome como argumento
17 }
18 \examples{
19   hello("Bruno")
20 }
21
22
```

Figura: Documentação com o “Roxygen” - Diretório “man” - hello.Rd

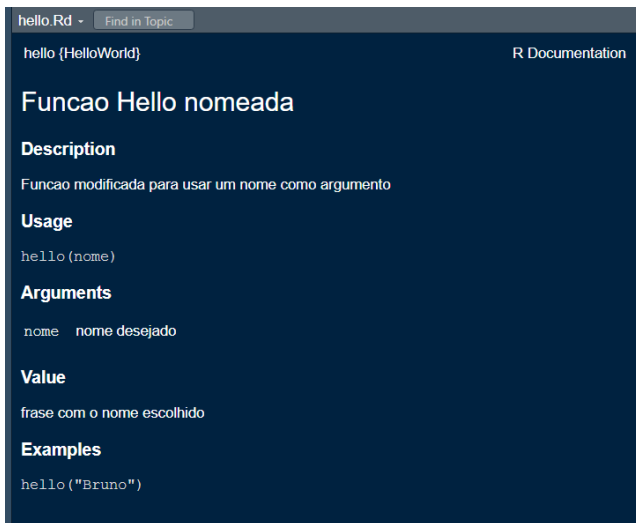
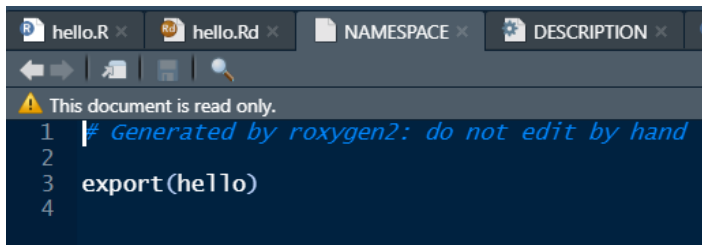


Figura: Documentação com o “Roxygen” - ajuda da função hello()

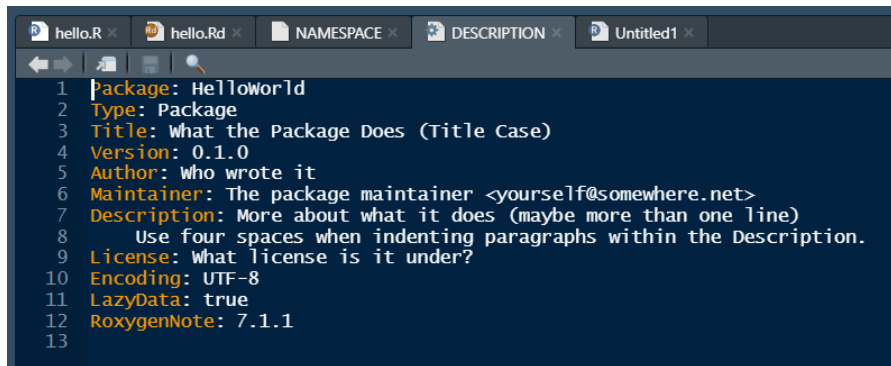
Passo a Passo - Construção



```
1 # Generated by roxygen2: do not edit by hand
2
3 export(hello)
4
```

Figura: Documentação com o “Roxygen” - arquivo “Namespace”

Passo a Passo - Construção

A screenshot of a code editor window showing the contents of a file named 'DESCRIPTION'. The editor has a dark blue background with light blue and yellow text. The file is open in a tab labeled 'DESCRIPTION'. The code is as follows:

```
1 Package: HelloWorld
2 Type: Package
3 Title: what the Package Does (Title Case)
4 Version: 0.1.0
5 Author: Who wrote it
6 Maintainer: The package maintainer <yourself@somewhere.net>
7 Description: More about what it does (maybe more than one line)
8               Use four spaces when indenting paragraphs within the Description.
9 License: what license is it under?
10 Encoding: UTF-8
11 LazyData: true
12 RoxygenNote: 7.1.1
13
```

Figura: Arquivo “Description” - padrão

Passo a Passo - Construção

```
hello.R x DESCRIPTION x hello.Rd x NAMESPACE x DESCRIPTION x Untitled1 x
1 Package: BayesSampling
2 Type: Package
3 Title: Bayes Linear Estimators for Finite Population
4 Version: 1.1.0
5 Date: 2021-04-24
6 Authors@R: c(person("Pedro", "Soares Figueiredo",
7                     role = c("aut", "cre"),
8                     email = "pedrosfig@hotmail.com",
9                     comment = c(ORCID = "0000-0003-2279-2881")),
10             person("Kelly C.", "M. Gonçalves",
11                   role = c("aut", "ths"),
12                   email = "kelly@dme.ufrrj.br",
13                   comment = c(ORCID = "0000-0002-4524-547X")))
14 Maintainer: Pedro Soares Figueiredo <pedrosfig@hotmail.com>
15 Description: Allows the user to apply the Bayes Linear approach to finite population with the Simple Random Sampling - BLE_SRS() - and
16               the Stratified Simple Random Sampling design - BLE_SSRSQ - (both without replacement), to the Ratio estimator (using auxiliary
17               information) - BLE_RatioO - and to categorical data - BLE_Categorical().
18               The Bayes linear estimation approach is applied to a general linear regression model for finite population prediction in BLE_RegO
19               and it is also possible to achieve the design based estimators using vague prior distributions.
20               Based on Gonçalves, K.C.M, Moura, F.A.S and Migon, H.S.(2014) <https://www.150.statcan.gc.ca/n1/en/catalogue/12-001-X201400111886>.
21 URL: https://www.150.statcan.gc.ca/n1/en/catalogue/12-001-X201400111886, https://github.com/pedrosfig/BayesSampling
22 License: GPL-3
23 Encoding: UTF-8
24 LazyData: true
25 RoxygenNote: 7.1.1
26 Depends: R (>= 3.5)
27 Imports:
28   MASS,
29   Matrix,
30   stats,
31   matrixcalc
32 Suggests:
33   knitr,
34   rmarkdown,
35   TeachingSampling
36 VignetteBuilder: knitr
37 Language: en-US
38
```

Figura: Arquivo “Description” - pacote “BayesSampling”

Passo a Passo - Construção

```
20
21 ginv <- MASS::ginv
22
23 bdiag <- Matrix::bdiag
24 #Diagonal <- Matrix::Diagonal
25
26 var <- stats::var
27
28 sample <- base::sample
29 colnames <- base::colnames
30
31 is.symmetric.matrix <- matrixcalc::is.symmetric.matrix
32 is.positive.definite <- matrixcalc::is.positive.definite
33
34
```

17:1 (Top Level) ▾

Console

Terminal ×

Jobs ×

~/UFRJ/IC/Aula R Packages/2 - ENCE/HelloWorld/ ➔

>

>

>

>

>

> usethis::use_package|

◆ use_package {usethis}

◆ use_package_doc {usethis}

use_package(package, type = "Imports", min_version = NULL)

use_package() adds a CRAN package dependency to DESCRIPTION and offers a little advice about how to best use it. use_dev_package() adds a versioned dependency on an in-development GitHub package, adding the repo to Remotes so it will be automatically installed from the correct location.

Press F1 for additional help

Figura: Funções importadas de outros pacotes - “usethis”

Passo a Passo - Git

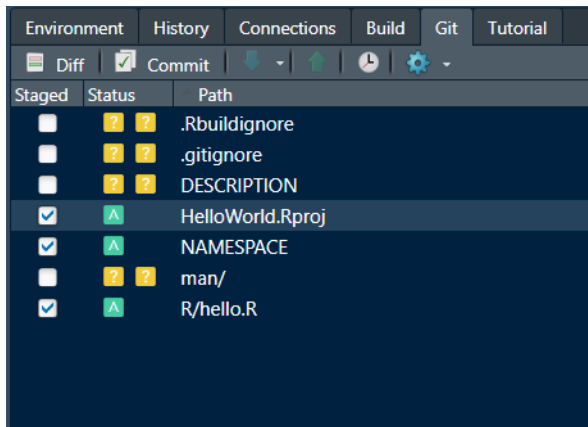


Figura: Git - versionamento

Passo a Passo - Git

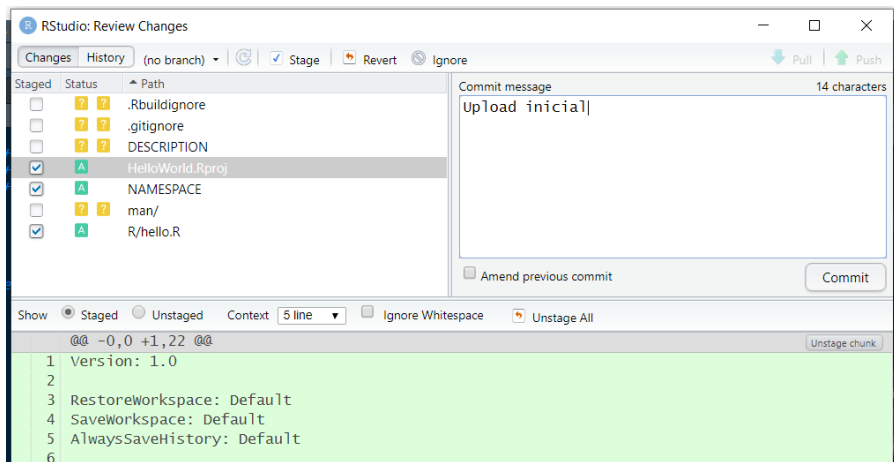
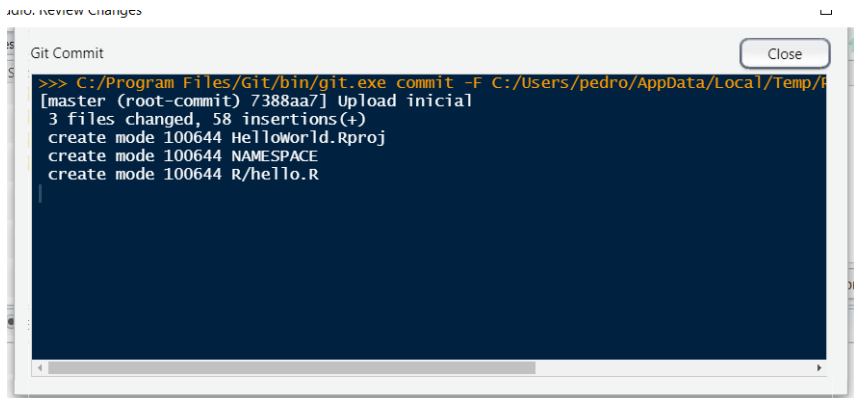


Figura: Git - preparando "Commit"

Passo a Passo - Git



The screenshot shows a 'Git Commit' dialog box with a dark blue background and white text. The title bar says 'Git Commit' and there is a 'Close' button in the top right corner. The text inside the dialog shows the command used to commit and the details of the commit.

```
>>> C:/Program Files/Git/bin/git.exe commit -F C:/Users/pedro/AppData/Local/Temp/R
[master (root-commit) 7388aa7] Upload inicial
3 files changed, 58 insertions(+)
create mode 100644 HelloWorld.Rproj
create mode 100644 NAMESPACE
create mode 100644 R/hello.R
```

Figura: Git - "Commit" feito

Passo a Passo - Git

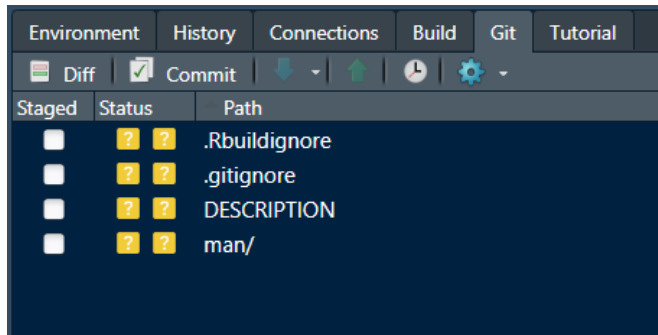


Figura: Git - arquivos atualizados não aparecem mais

Passo a Passo - Git

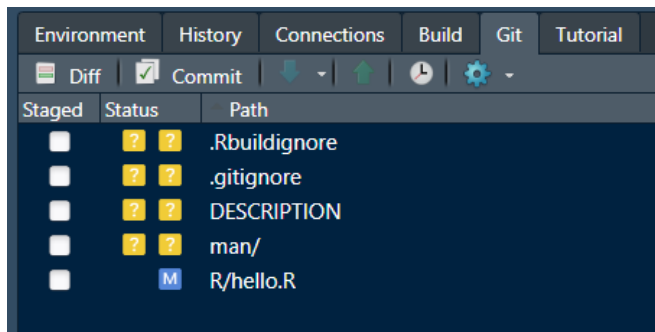


Figura: Git - arquivo hello.R modificado

Passo a Passo - Git

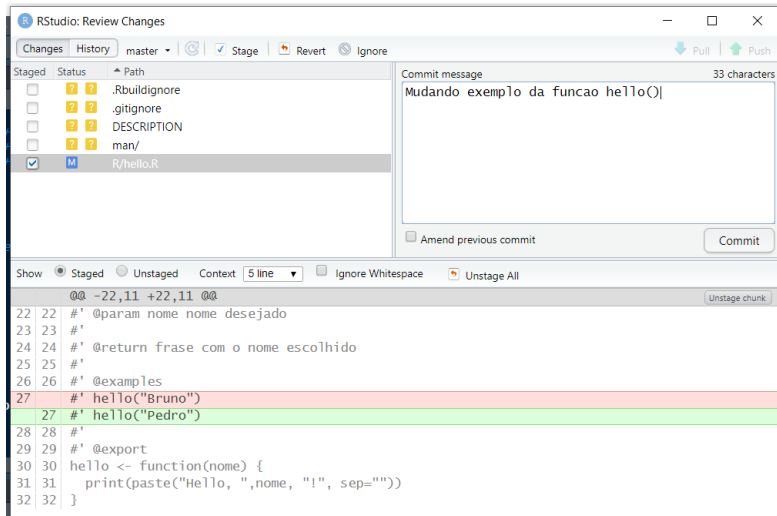
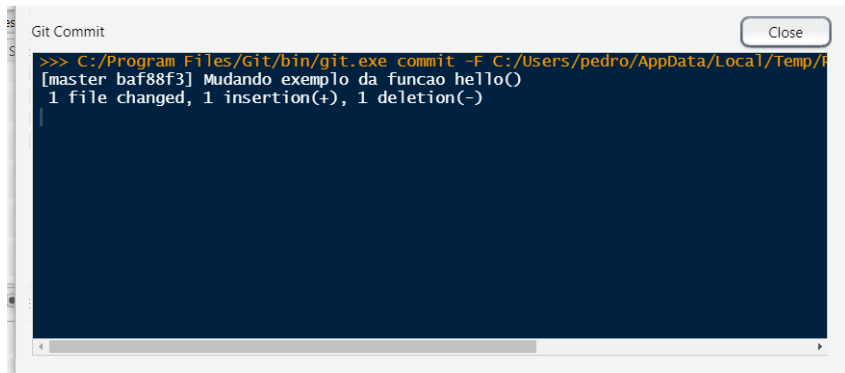


Figura: Git - mudanças evidenciadas

Passo a Passo - Git

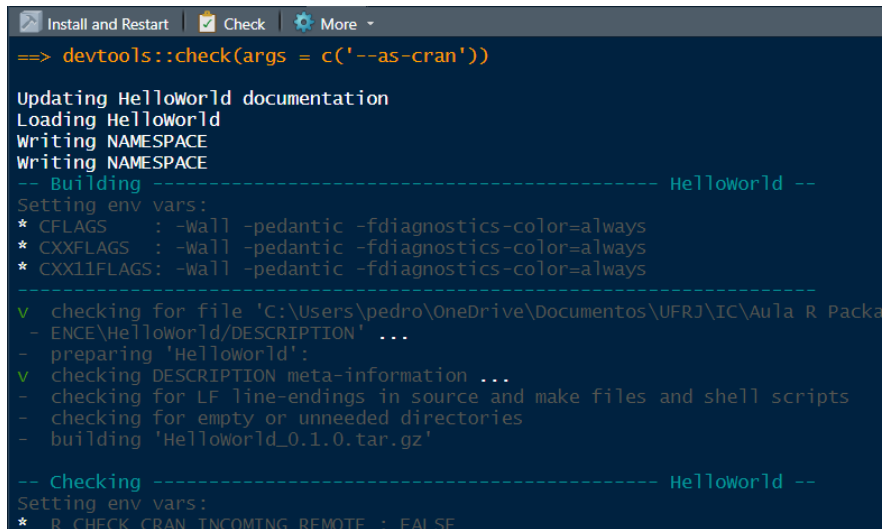


The screenshot shows a 'Git Commit' dialog box with a dark blue background. The title bar says 'Git Commit' and there is a 'Close' button in the top right corner. The main text area contains the following text:

```
>>> C:/Program Files/Git/bin/git.exe commit -F C:/Users/pedro/AppData/Local/Temp/f
[master baf88f3] Mudando exemplo da funcao hello()
1 file changed, 1 insertion(+), 1 deletion(-)
```

Figura: Git - arquivo alterado

Passo a Passo - CRAN



```
==> devtools::check(args = c('--as-cran'))

Updating HelloWorld documentation
Loading HelloWorld
Writing NAMESPACE
Writing NAMESPACE
-- Building ----- HelloWorld --
Setting env vars:
* CFLAGS      : -Wall -pedantic -fdiagnostics-color=always
* CXXFLAGS    : -Wall -pedantic -fdiagnostics-color=always
* CXX11FLAGS  : -Wall -pedantic -fdiagnostics-color=always
-----
v checking for file 'C:\Users\pedro\OneDrive\Documentos\UFRJ\IC\Aula R Packa
- ENCE\HelloWorld\DESCRIPTION' ...
- preparing 'HelloWorld':
v checking DESCRIPTION meta-information ...
- checking for LF line-endings in source and make files and shell scripts
- checking for empty or unneeded directories
- building 'HelloWorld_0.1.0.tar.gz'

-- Checking ----- HelloWorld --
Setting env vars:
* R_CHECK_CRAN_INCOMING_REMOTE : FALSE
```

Figura: Check - “devtools”

Passo a Passo - CRAN

```
v checking for detritus in the temp directory ...  
  
See  
  'C:/Users/pedro/OneDrive/Documentos/UFRJ/IC/Aula R Packages/2 - ENCE/HelloWorld.Rcheck/00check.log'  
for details.  
  
-- R CMD check results ----- HelloWorld 0.1.0 -----  
Duration: 26.2s  
  
> checking DESCRIPTION meta-information ... WARNING  
Non-standard license specification:  
  What license is it under?  
Standardizable: FALSE  
  
0 errors v | 1 warning x | 0 notes v  
Erro: R CMD check found WARNINGS  
Execução interrompida  
  
Exited with status 1.
```

Figura: Check - warning

Passo a Passo - CRAN

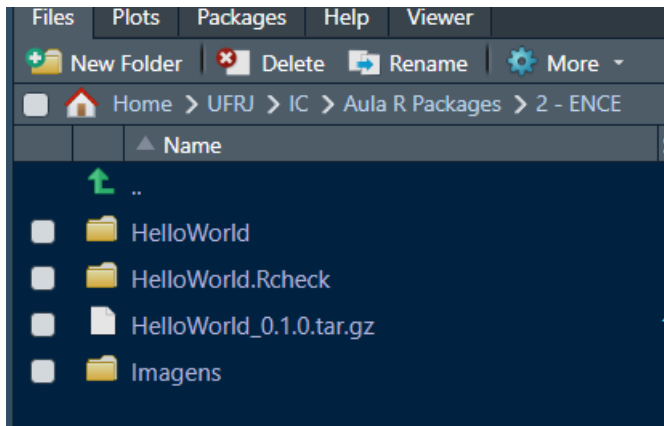
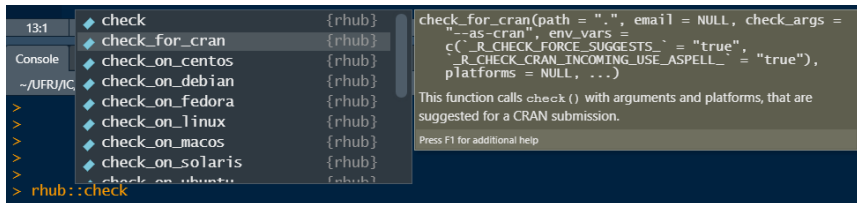


Figura: Check - diretório criado

Passo a Passo - CRAN



The screenshot shows an R console window with a list of functions on the left and a help window on the right. The functions listed are:

- check {rhub}
- check_for_cran {rhub}
- check_on_centos {rhub}
- check_on_debian {rhub}
- check_on_fedora {rhub}
- check_on_linux {rhub}
- check_on_macos {rhub}
- check_on_solaris {rhub}
- check_on_ubuntu {rhub}

The help window for the `check_for_cran` function is displayed, showing the following code:

```
check_for_cran(path = ".", email = NULL, check_args =  
  "--as-cran", env_vars =  
  c('_R_CHECK_FORCE_SUGGESTS_' = "true",  
    '_R_CHECK_CRAN_INCOMING_USE_ASPELL_' = "true"),  
  platforms = NULL, ...)
```

Below the code, the help text reads: "This function calls `check()` with arguments and platforms, that are suggested for a CRAN submission." and "Press F1 for additional help".


Figura: Check - pacote "rhub"

Passo a Passo - CRAN

The Comprehensive R Archive Network

https://cran.r-project.org/submit.html

Submit package to CRAN



CRAN
[Mirrors](#)
[What's new?](#)
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[R Sources](#)
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[Manuals](#)
[FAQs](#)
[Contributed](#)

**Step 1
(Upload)**

**Step 2
(Submission)**

**Step 3
(Confirmation)**

Your name*:

Your email*:

Package*: Nenhum arquivo escolhido
(*tar.gz files only, max 100 MB size)

Optional comment:

***: Required Fields**

Before uploading please ensure the following:

- The package contains a DESCRIPTION file.
- DESCRIPTION file contains valid maintainer field "NAME <EMAIL>".
- You submit a tar.gz created with R CMD build.
- You are familiar with the rest of the [CRAN policies](#)

In case of technical problems regarding the website or the submission interface, contact the [CRAN sysadmin team](#).
In case of problems related to the package, its check results or the partly automated check system, contact the [CRAN team](#).

This service will be offline Dec 21, 2021 - Jan 3, 2022
(CRAN team vacation and maintenance work).

Figura: Submissão ao CRAN

Pacote BayesSampling - CRAN

BayesSampling: Bayes Linear Estimators for Finite Population

Allows the user to apply the Bayes Linear approach to finite population with the Simple Random Sampling - BLE_SRS() - and the Stratified Simple Random Sampling design - BLE_SSRS() - (both without replacement), to the Ratio estimator (using auxiliary information) - BLE_Ratio() - and to categorical data - BLE_Categorical(). The Bayes linear estimation approach is applied to a general linear regression model for finite population prediction in BLE_Reg() and it is also possible to achieve the design based estimators using vague prior distributions. Based on Gonçalves, K.C.M, Moura, F.A.S and Migon, H.S.(2014) <<https://www150.statcan.gc.ca/n1/en/catalogue/12-001-X201400111886>>.

Version: 1.1.0
Depends: R (≥ 3.5)
Imports: MASS, Matrix, stats, matrixcalc
Suggests: knitr, rmarkdown, TeachingSampling
Published: 2021-05-01
Author: Pedro Soares Figueiredo  [aut, cre], Kelly C. M. Gonçalves  [aut, ths]
Maintainer: Pedro Soares Figueiredo <pedrosofig at hotmail.com>
License: GPL-3
URL: <https://www150.statcan.gc.ca/n1/en/catalogue/12-001-X201400111886>,
<https://github.com/pedrosofig/BayesSampling>
NeedsCompilation: no
Language: en-US
Materials: README
CRAN checks: [BayesSampling results](#)

Figura: CRAN - BayesSampling

Pacote BayesSampling - CRAN

Materials: [README](#)

CRAN checks: [BayesSampling results](#)

Documentation:

Reference manual: [BayesSampling.pdf](#)

Vignettes: [BLE_Categorical](#)
[BLE_Ratio](#)
[BLE_Reg](#)
[BLE_SRS](#)
[BLE_SSRS](#)
[BayesSampling](#)

Downloads:

Package source: [BayesSampling_1.1.0.tar.gz](#)

Windows binaries: r-devel: [BayesSampling_1.1.0.zip](#), r-release: [BayesSampling_1.1.0.zip](#), r-oldrel: [BayesSampling_1.1.0.zip](#)

macOS binaries: r-release (arm64): [BayesSampling_1.1.0.tgz](#), r-release (x86_64): [BayesSampling_1.1.0.tgz](#), r-oldrel: [BayesSampling_1.1.0.tgz](#)

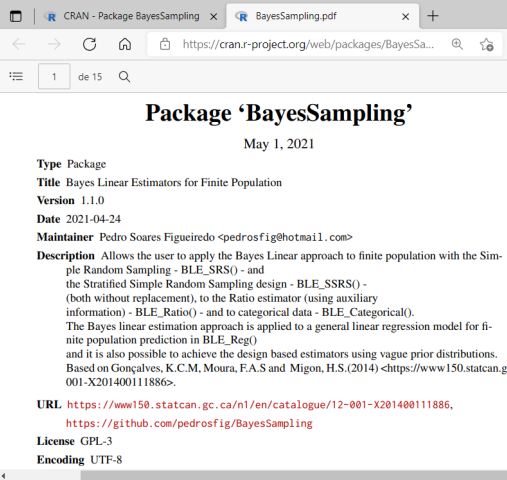
Old sources: [BayesSampling archive](#)

Linking:

Please use the canonical form <https://CRAN.R-project.org/package=BayesSampling> to link to this page.

Figura: CRAN - BayesSampling

Pacote BayesSampling - CRAN



The image is a screenshot of a web browser displaying the CRAN package page for 'BayesSampling'. The browser's address bar shows the URL 'https://cran.r-project.org/web/packages/BayesSa...'. The page title is 'Package 'BayesSampling''. Below the title, the date 'May 1, 2021' is displayed. The package details are listed as follows: Type: Package; Title: Bayes Linear Estimators for Finite Population; Version: 1.1.0; Date: 2021-04-24; Maintainer: Pedro Soares Figueiredo <pedrosfig@hotmail.com>. The Description section explains that the package allows users to apply the Bayes Linear approach to finite populations using various sampling designs (Simple Random Sampling, Stratified Simple Random Sampling, Ratio estimator, and categorical data) and the Bayes linear estimation approach. It also mentions that it is possible to achieve design-based estimators using vague prior distributions, citing Gonçalves, K.C.M., Moura, F.A.S., and Migon, H.S. (2014). The URL section provides links to the package's website and GitHub repository. The License is GPL-3, and the Encoding is UTF-8.

Package 'BayesSampling'

May 1, 2021

Type Package

Title Bayes Linear Estimators for Finite Population

Version 1.1.0

Date 2021-04-24

Maintainer Pedro Soares Figueiredo <pedrosfig@hotmail.com>

Description Allows the user to apply the Bayes Linear approach to finite population with the Simple Random Sampling - BLE_SRS() - and the Stratified Simple Random Sampling design - BLE_SSRS() - (both without replacement), to the Ratio estimator (using auxiliary information) - BLE_Ratio() - and to categorical data - BLE_Categorical(). The Bayes linear estimation approach is applied to a general linear regression model for finite population prediction in BLE_Reg() and it is also possible to achieve the design based estimators using vague prior distributions. Based on Gonçalves, K.C.M., Moura, F.A.S and Migon, H.S.(2014) <[https://www150.statcan.gc](https://www150.statcan.gc.ca/001-X201400111886)

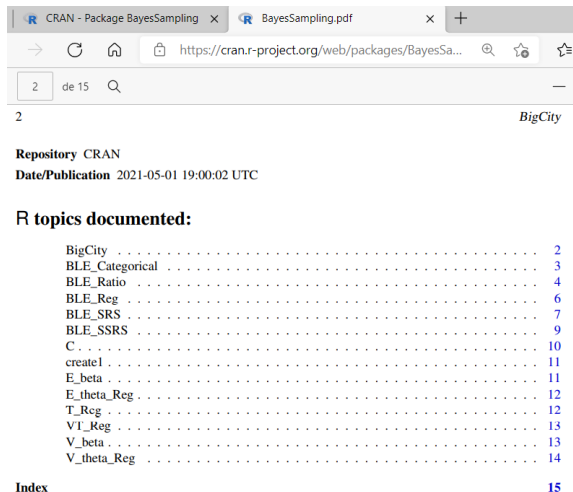
URL <https://www150.statcan.gc.ca/n1/en/catalogue/12-001-X201400111886>,
<https://github.com/pedrosfig/BayesSampling>

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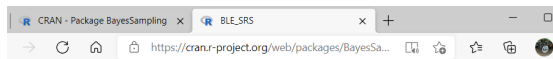
Figura: CRAN - manual padrão: BayesSampling.pdf

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BLE_SRS

```
library(BayesSampling)
```

Application of the BLE to the Simple Random Sample design

(From Section 2.3.1 of the “[Gonçalves, Moura and Migon: Bayes linear estimation for finite population with emphasis on categorical data](#)”)

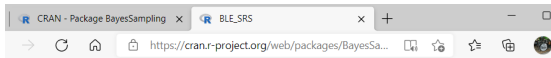
In a simple model, where there is no auxiliary variable, and a Simple Random Sample was taken from the population, we can calculate the Bayes Linear Estimator for the individuals of the population with the `BLE_SRS()` function, which receives the following parameters:

- y_s - either a vector containing the observed values or just the value for the sample mean (σ and n parameters will be required in this case);
- N - total size of the population;
- m - prior mean. If `NULL`, sample mean will be used (non-informative prior);
- v - prior variance of an element from the population ($> \sigma^2$). If `NULL`, it will tend to infinity (non-informative prior);
- σ - prior estimate of variability (standard deviation) within the population. If `NULL`, sample variance will be used;
- n - sample size. Necessary only if y_s represent sample mean (will not be used otherwise).

Vague Prior Distribution

Figura: “vignette” - função `BLE_SRS()`

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Vague Prior Distribution

Letting $v \rightarrow \infty$ and keeping σ^2 fixed, that is, assuming prior ignorance, the resulting estimator will be the same as the one seen in the design-based context for the simple random sampling case.

This can be achieved using the `BLE_SRS()` function by omitting either the prior mean and/or the prior variance, that is:

- $m = NULL$ - the sample mean will be used
- $v = NULL$ - prior variance will tend to infinity

Examples

1. We will use the TeachingSampling's BigCity dataset for this example (actually we have to take a sample of size 10000 from this dataset so that R can perform the calculations). Imagine that we want to estimate the mean or the total Expenditure of this population, after taking a simple random sample of only 20 individuals, but applying a prior information (taken from a previous study or an expert's judgment) about the mean expenditure (a priori mean = 300).

```
data(BigCity)
set.seed(1)
Expend <- sample(BigCity$Expenditure, 10000)
mean(Expend)           #Real mean expenditure value, goal of the estimation
#> [1] 375.586
ys <- sample(Expend, size = 20, replace = FALSE)
```

Our design-based estimator for the mean will be the sample mean:

```
mean(ys)
#> [1] 479.869
```

Figura: “vignette” - função BLE_SRS()

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```
CRAN - Package BayesSampling x BLE_SRS x +  
→ ↺ ↻ 🔒 https://cran.r-project.org/web/packages/BayesSa...  
ys <- sample(Expend, size = 20, replace = FALSE)
```

Our design-based estimator for the mean will be the sample mean:

```
mean(ys)  
#> [1] 479.869
```

Applying the prior information about the population we can get a better estimate, especially in cases when only a small sample is available:

```
Estimator <- BLE_SRS(ys, N = 10000, m=300, v=10.1^5, sigma = sqrt(10^5))  
  
Estimator$est.beta  
#>      Beta  
#> 1 390.8338  
  
Estimator$Vest.beta  
#>      V1  
#> 1 2524.999  
  
Estimator$est.mean[1,]  
#> [1] 390.8338  
  
Estimator$Vest.mean[1:5,1:5]  
#>      V1      V2      V3      V4      V5  
#> 1 102524.999 2524.999 2524.999 2524.999 2524.999  
#> 2 2524.999 102524.999 2524.999 2524.999 2524.999  
#> 3 2524.999 2524.999 102524.999 2524.999 2524.999  
#> 4 2524.999 2524.999 2524.999 102524.999 2524.999  
#> 5 2524.999 2524.999 2524.999 2524.999 102524.999
```

2. Example from the help page

Figura: “vignette” - função BLE_SRS()



Gonçalves, K.C.M, Moura, F.A.S and Migon, H.S.(2014). Bayes Linear Estimation for Finite Population with emphasis on categorical data. Survey Methodology, 40, 15-28.



Hartigan, J. A. (1969). Linear Bayesian methods. J. Roy. Statist. Soc. Ser. B, 31, 440–454.



Roger D. Peng, Sean Kross, and Brooke Anderson (2017). Mastering Software Development in R: <https://bookdown.org/rdpeng/RprogDA/>



Zacks, S. (2002). In the footsteps of Basu: The predictive modelling approach to sampling from finite population. Sankhyā: The Indian Journal of Statistics, Series A, 64, 532-544.

Muito Obrigado!

Agradecimentos:



- Contato: pedrosfig@hotmail.com
- Pacote: <https://cran.r-project.org/package=BayesSampling>
- Links: https://github.com/pedrosfig/Sem_ENCE_Pacotes_R