

Foundations of R Software

Lecture 3

Introduction

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Packages and Libraries in R

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What is a Library?

A library is a collection of books or media that are easily accessible for use and not just for display Purposes only.



- Persons goes to library and search for suitable book.
- Get it issued and start using it.
- When done, return the book back to the library.

Libraries in R

R packages are the collections of programmes and data sets developed by different users and scientists. This increases the functionality and applications of R.

Commonly used important functions are added to base R functionalities.

If all the functionalities are added, the base package will become too big and every person may not like to use all the functionalities.

Libraries in R

Suppose someone is interested in cluster analysis.

It is not included in the base R package.

A package `cluster' is developed by the experts.

Whenever required, anyone can download it and use it for free!

Libraries in R

R provides many functions and one can also write own.

Functions and datasets are organised into libraries

To use a library, simply type the `library` function with the name of the library in brackets.

```
library(.)
```

For example, to load the `spatial` library type:

```
library(spatial)
```

Libraries in R

There are two type of libraries in R.

Some libraries are the part of base package.

Other libraries are user dependent and need based.

Libraries in R

Examples of libraries that come as a part of base package in R.

MASS : package associated with Venables and Ripley's book entitled *Modern Applied Statistics using S-Plus*.

mgcv : generalized additive models.

Libraries in R

Examples of libraries that do not come as a part of base package in R.

spatial : Used in Spatial analysis in statistics.

boot : Used in Bootstrapping analysis in statistics.

Libraries in R

`library()` is the command used to load a package, and it refers to the place where the package is contained.

A package is the collection of functions bundled conveniently.

Description of Libraries

The command `packageDescription()` provides the description file of a package.

Here is how we find the description of the `spatial` library:
`packageDescription("spatial")` returns

```
R Console
> packageDescription("spatial")
Package: spatial
Priority: recommended
Version: 7.3-14
Date: 2021-04-17
Depends: R (>= 3.0.0), graphics, stats, utils
Suggests: MASS
Authors@R: c(person("Brian", "Ripley", role = c("aut", "cre", "cph"),
  email = "ripley@stats.ox.ac.uk"), person("Roger", "Bivand", role
    = "ctb"), person("William", "Venables", role = "cph"))
Description: Functions for kriging and point pattern analysis.
Title: Functions for Kriging and Point Pattern Analysis
LazyLoad: yes
ByteCompile: yes
License: GPL-2 | GPL-3
```

followed by all the other details.

Contents of Libraries

It is easy to use the `help` function to discover the contents of library packages.

Here is how we find out about the contents of the `spatial` library:

```
library(help=spatial) returns  
Information on package 'spatial'
```

Description:

```
Package:      spatial  
Priority:     recommended  
Version:     7.3-14  
Date:        2021-04-17  
Depends:     R (>= 3.0.0), graphics, stats, utils  
Suggests:    MASS  
Authors@R:   c(person("Brian", "Ripley", role = c("aut", "cre",  
"cph"), email = "ripley@stats.ox.ac.uk"),  
person("Roger", "Bivand", role = "ctb"),
```

followed by a list of all the functions and data sets.

Then we get....

```
> library(help=spatial) |  
> |
```

Documentation for package 'spatial'

Information on package 'spatial'

Description:

```
Package:          spatial  
Priority:          recommended  
Version:          7.3-14  
Date:             2021-04-17  
Depends:          R (>= 3.0.0), graphics, stats, utils  
Suggests:         MASS  
Authors@R:        c(person("Brian", "Ripley", role = c("aut", "cre",  
                  "cph"), email = "ripley@stats.ox.ac.uk"),  
                  person("Roger", "Bivand", role = "ctb"),  
                  person("William", "Venables", role = "cph"))  
Description:      Functions for kriging and point pattern analysis.  
Title:            Functions for Kriging and Point Pattern Analysis  
LazyLoad:         yes  
ByteCompile:      yes  
License:          GPL-2 | GPL-3
```

Installing Packages and Libraries

The base R package contains programs for basic operations.

It does not contain some of the libraries necessary for advanced statistical work.

Specific requirements are met by special packages.

They are downloaded and their downloading is very simple.

Installing Packages and Libraries

To install any package,

- run the R program,
- then on the command line, use the `install.packages` function to download the libraries we want.

Installing Packages and Libraries

Examples :

- The package **boot** contains the statistical tools for bootstrap method.
- The package **cluster** contains statistical tools for clustering.

The packages **boot** or **cluster** can be installed by

```
install.packages("boot")
```

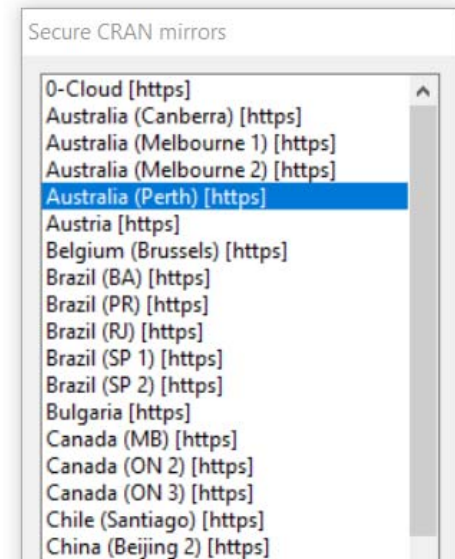
```
install.packages("cluster")
```

Then we get¹⁵...

install.packages("boot")

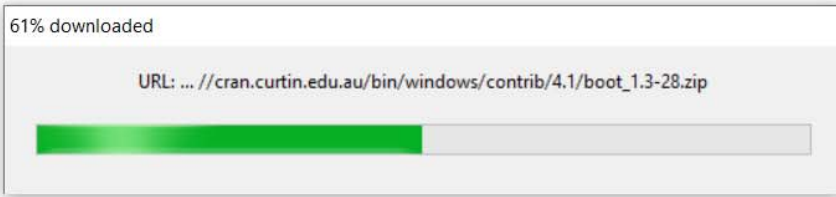
R Console

```
> install.packages("boot")  
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/4.1'  
(as 'lib' is unspecified)  
--- Please select a CRAN mirror for use in this session ---
```



```
R Console

> install.packages("boot")
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/4.1'
(as 'lib' is unspecified)
trying URL 'https://cran.curtin.edu.au/bin/windows/contrib/4.1/boot_1.3-28.zip'
Content type 'application/zip' length 641355 bytes (626 KB)
```



```
R Console

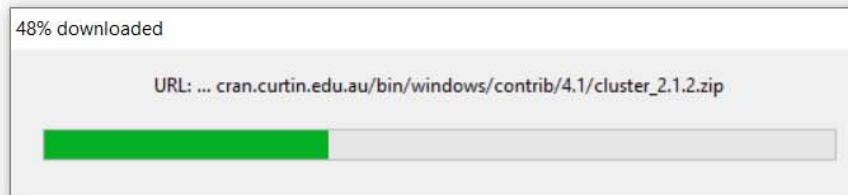
> install.packages("boot")
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/4.1'
(as 'lib' is unspecified)
--- Please select a CRAN mirror for use in this session ---
trying URL 'https://cran.curtin.edu.au/bin/windows/contrib/4.1/boot_1.3-28.zip'
Content type 'application/zip' length 641355 bytes (626 KB)
downloaded 626 KB

package 'boot' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
  C:\Users\Shalabh\AppData\Local\Temp\RtmpuAOPUm\downloaded_packages
> |
```

install.packages("cluster")

```
R Console
> install.packages("cluster")
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/4.1'
(as 'lib' is unspecified)
trying URL 'https://cran.curtin.edu.au/bin/windows/contrib/4.1/cluster_2.1.2.zip'
Content type 'application/zip' length 617983 bytes (603 KB)
```



```
R Console
> install.packages("cluster")
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/4.1'
(as 'lib' is unspecified)
trying URL 'https://cran.curtin.edu.au/bin/windows/contrib/4.1/cluster_2.1.2.zip'
Content type 'application/zip' length 617983 bytes (603 KB)
downloaded 603 KB

package 'cluster' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
  C:\Users\Shalabh\AppData\Local\Temp\RtmpuAOPUm\downloaded_packages
> |
```

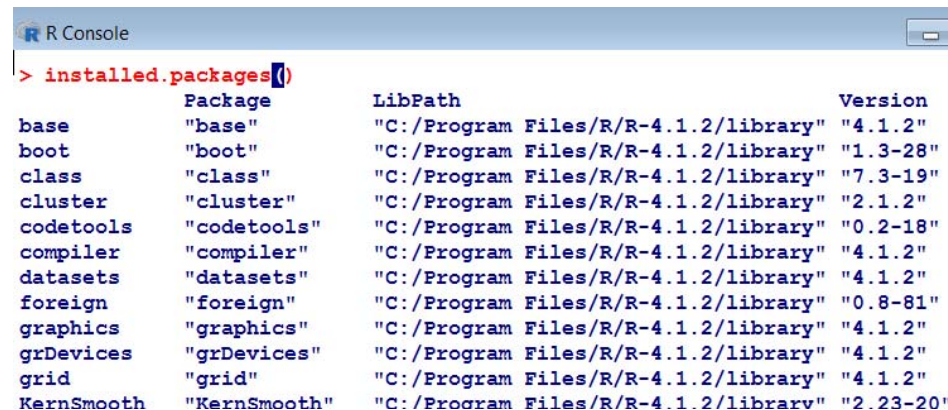
Which packages are installed on my computer

The command `installed.packages()` is used to see the installed packages on the computer.

```
> installed.packages()
```

```
> installed.packages()
```

	Package	LibPath	Version
base	"base"	"C:/Program Files/R/R-4.1.2/library"	"4.1.2"
boot	"boot"	"C:/Program Files/R/R-4.1.2/library"	"1.3-28"
class	"class"	"C:/Program Files/R/R-4.1.2/library"	"7.3-19"
cluster	"cluster"	"C:/Program Files/R/R-4.1.2/library"	"2.1.2"
codetools	"codetools"	"C:/Program Files/R/R-4.1.2/library"	"0.2-18"
compiler	"compiler"	"C:/Program Files/R/R-4.1.2/library"	"4.1.2"



```
R Console
> installed.packages()
      Package      LibPath      Version
base      "base"      "C:/Program Files/R/R-4.1.2/library" "4.1.2"
boot      "boot"      "C:/Program Files/R/R-4.1.2/library" "1.3-28"
class     "class"     "C:/Program Files/R/R-4.1.2/library" "7.3-19"
cluster   "cluster"   "C:/Program Files/R/R-4.1.2/library" "2.1.2"
codetools "codetools" "C:/Program Files/R/R-4.1.2/library" "0.2-18"
compiler  "compiler"  "C:/Program Files/R/R-4.1.2/library" "4.1.2"
datasets  "datasets"  "C:/Program Files/R/R-4.1.2/library" "4.1.2"
foreign   "foreign"   "C:/Program Files/R/R-4.1.2/library" "0.8-81"
graphics  "graphics"  "C:/Program Files/R/R-4.1.2/library" "4.1.2"
grDevices "grDevices" "C:/Program Files/R/R-4.1.2/library" "4.1.2"
grid       "grid"      "C:/Program Files/R/R-4.1.2/library" "4.1.2"
KernSmooth "KernSmooth" "C:/Program Files/R/R-4.1.2/librarv" "2.23-20"
```

Uninstalling packages installed on my computer

The command `remove.packages("package")` is used to see remove the installed packages on the computer.

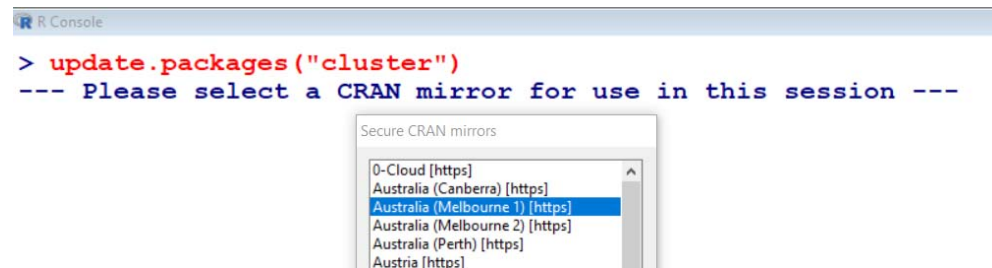
For example, if we want to remove the package `cluster` from the computer. Then use

```
remove.packages("cluster")
```

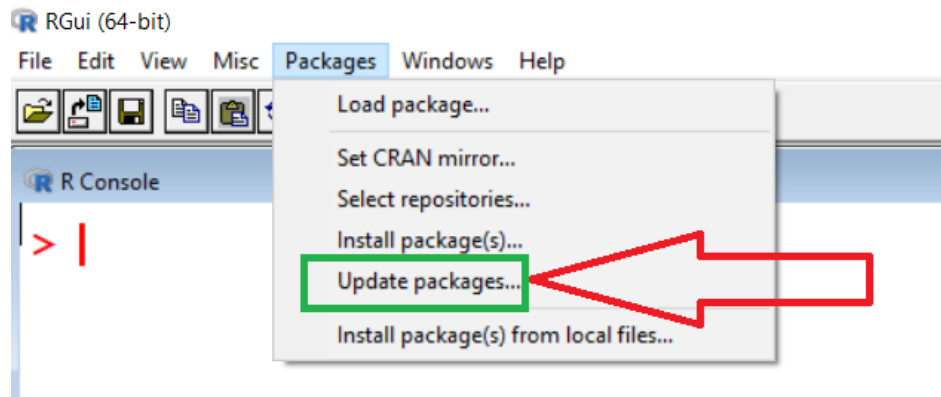
Updating packages installed on my computer

The command `update.packages()` is used to see update the installed packages on the computer.

`update.packages("cluster")`



Alternatively, go to R console

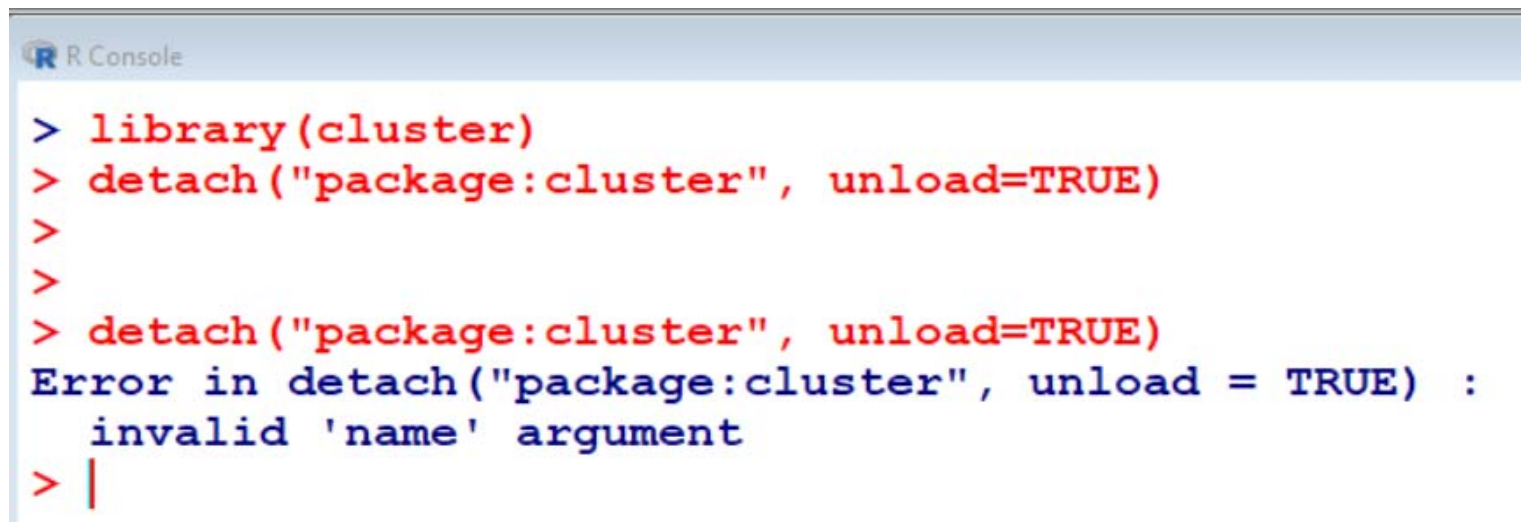


Unloading packages installed on my computer

The command

`detach("package:cluster", unload=TRUE)`

is used to unload the installed packages on the computer.



The screenshot shows an R console window with the following text:

```
R Console
> library(cluster)
> detach("package:cluster", unload=TRUE)
>
>
> detach("package:cluster", unload=TRUE)
Error in detach("package:cluster", unload = TRUE) :
  invalid 'name' argument
> |
```