

Iago Mosqueira

Introduction to R (and computing)

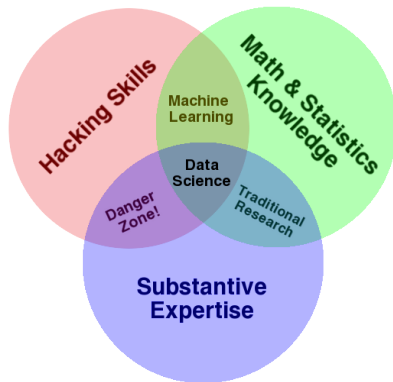
July 9, 2012

Why programming?

“Can one be a good data analyst without being a half-good programmer? The short answer to that is, ‘No’. The long answer to that is, ‘No!’.”

– Frank Harrell, 1999 S-PLUS User Conference, New Orleans (October 1999)

Data analyst

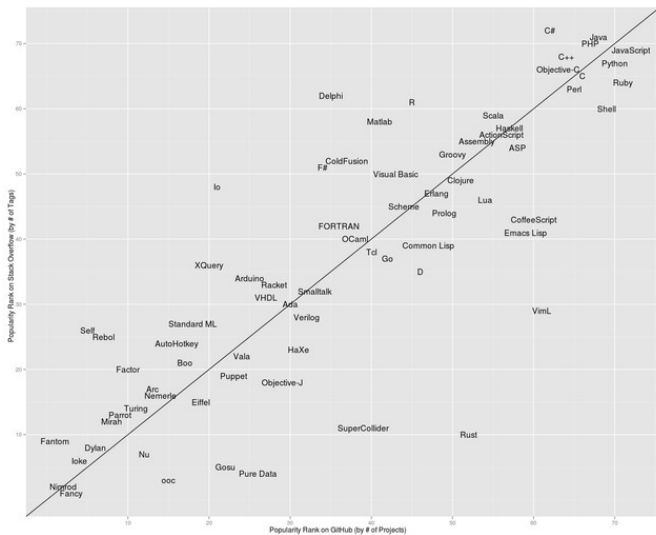


What is R



- Data analysis and statistics environment
- Interpreted computer language
- Open-source software project
- Active community of developers and practitioners
- Current version: 2.15.1, 2012-06-22, Roasted Marshmallows

Why R?



GPL v3.0

GNU General Public License

From Wikipedia, the free encyclopedia

"*GPL*" *redirects here*. For other uses, see *GPL (disambiguation)*.

The **GNU General Public License** (**GNU GPL** or simply **GPL**) is the most widely used^[5] *free software license*. It was originally written by *Richard Stallman* for the *GNU Project*.

The GPL is the first *copyleft* license for general use, which means that derived works can only be distributed under the same license terms. Under this philosophy, the GPL grants the recipients of a computer program the rights of the *free software definition* and uses copyleft to ensure the freedoms are preserved, even when the work is changed or added to. This is in distinction to *permissive free software licenses*, of which the *BSD licenses* are the standard examples.

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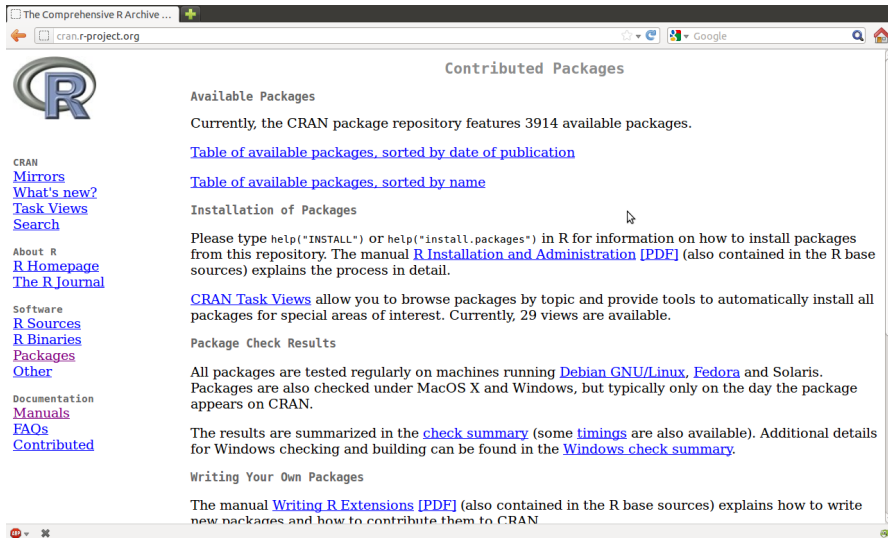
GNU General Public License



Free as in Freedom

GNU GPLv3 Logo


Author	Free Software Foundation
Version	3
Publisher	Free Software Foundation, Inc.
Published	29 June 2007
DFSG compatible	Yes ^[1]
FSF approved	Yes ^[2]
OSI approved	Yes ^[3]
Copyleft	Yes ^{[2][4]}
Linking from code with a different license	No (except for linking GNU AGPLv3 with GNU GPLv3 – see section)
Website	www.gnu.org/licenses

A screenshot of a web browser displaying the CRAN (Comprehensive R Archive Network) website. The browser's address bar shows 'cran.r-project.org'. The page features the CRAN logo on the left and a sidebar with navigation links. The main content area is titled 'Contributed Packages' and includes sections for 'Available Packages', 'Installation of Packages', 'Package Check Results', and 'Writing Your Own Packages'. Each section contains descriptive text and links to further resources.

The Comprehensive R Archive ...

cran.r-project.org

Google



Contributed Packages

Available Packages

Currently, the CRAN package repository features 3914 available packages.

[Table of available packages, sorted by date of publication](#)

[Table of available packages, sorted by name](#)

Installation of Packages

Please type `help("INSTALL")` or `help("install.packages")` in R for information on how to install packages from this repository. The manual [R Installation and Administration \[PDF\]](#) (also contained in the R base sources) explains the process in detail.

[CRAN Task Views](#) allow you to browse packages by topic and provide tools to automatically install all packages for special areas of interest. Currently, 29 views are available.

Package Check Results

All packages are tested regularly on machines running [Debian GNU/Linux](#), [Fedora](#) and Solaris. Packages are also checked under MacOS X and Windows, but typically only on the day the package appears on CRAN.

The results are summarized in the [check summary](#) (some [timings](#) are also available). Additional details for Windows checking and building can be found in the [Windows check summary](#).

Writing Your Own Packages

The manual [Writing R Extensions \[PDF\]](#) (also contained in the R base sources) explains how to write new packages and how to contribute them to CRAN.

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Task views

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cran.r-project.org ggplot2



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CRAN Task Views

Bayesian	Bayesian Inference
ChemPhys	Chemometrics and Computational Physics
ClinicalTrials	Clinical Trial Design, Monitoring, and Analysis
Cluster	Cluster Analysis & Finite Mixture Models
DifferentialEquations	Differential Equations
Distributions	Probability Distributions
Econometrics	Computational Econometrics
Environmetrics	Analysis of Ecological and Environmental Data
ExperimentalDesign	Design of Experiments (DoE) & Analysis of Experimental Data
Finance	Empirical Finance
Genetics	Statistical Genetics
Graphics	Graphic Displays & Dynamic Graphics & Graphic Devices & Visualization
HighPerformanceComputing	High-Performance and Parallel Computing with R
MachineLearning	Machine Learning & Statistical Learning
MedicalImaging	Medical Image Analysis
Multivariate	Multivariate Statistics
NaturalLanguageProcessing	Natural Language Processing
OfficialStatistics	Official Statistics & Survey Methodology
Optimization	Optimization and Mathematical Programming
Pharmacokinetics	Analysis of Pharmacokinetic Data
Phylogenetics	Phylogenetics, Especially Comparative Methods
Psychometrics	Psychometric Models and Methods
ReproducibleResearch	Reproducible Research
Robust	Robust Statistical Methods
SocialSciences	Statistics for the Social Sciences
Spatial	Analysis of Spatial Data
Survival	Survival Analysis
TimeSeries	Time Series Analysis


RStudio

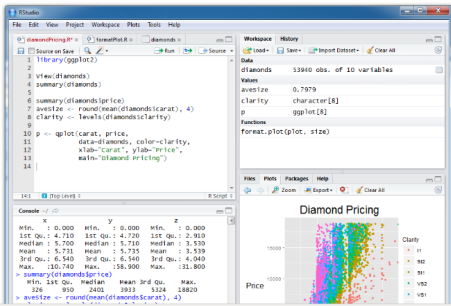


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Welcome to RStudio

RStudio™ is a free and open source integrated development environment (IDE) for [R](#). You can run it on your desktop (Windows, Mac, or Linux) or even over the web using RStudio Server.

**Download RStudio**
for Windows, Mac or Linux



The screenshot shows the RStudio IDE interface. The top menu bar includes File, Edit, View, Project, Workspace, Plots, Tools, and Help. The main editor window displays a script for analyzing diamond data using ggplot2. The console window at the bottom shows the output of the summary and aveSize functions. The Plots pane on the right displays a scatter plot titled 'Diamond Pricing' with Price on the y-axis and Clarity on the x-axis, showing a positive correlation between the two variables.

```
1 library(ggplot2)
2
3 view(diamonds)
4 summary(diamonds)
5
6 summary(diamonds$price)
7 aveSize <- round(mean(diamonds$carat, 4)
8 clarity <- levels(diamonds$clarity)
9
10 p <- ggplot(carat, price,
11 data=diamonds, color=clarity,
12 xlab="carat", ylab="price",
13 main="diamond pricing")
14
```

Console output:

```
summary(diamonds$price)
   min. 1st Qu.  Median    mean 3rd Qu.  Max.
 0.0000  4.7100  5.7000  5.7710  6.5400 11.0740

summary(diamonds$clarity)
   SI     S1    VS2    VS1    VSI
 11     90    111    112    113
 14     91    114    115    116
 17     92    117    118    119
 20     93    120    121    122
 23     94    123    124    125
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```

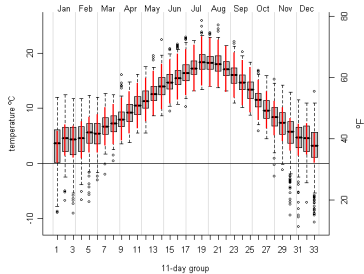
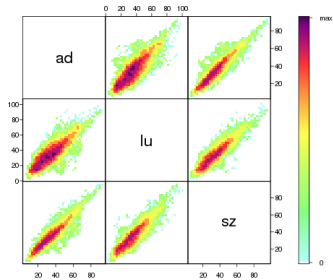
Basic features

- Numerous procedures (algebra, matrix, stats)
- Named storage (everything is an object)
- Functions
- Classes and methods (S3, S4)
- Special values (NA, NaN, Inf, NULL)
- Logical objects and boolean algebra
- `basic_features.R`

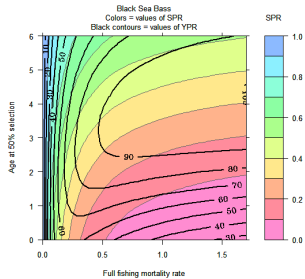
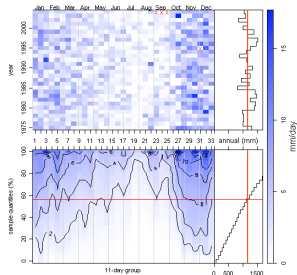
What else can it do?

- Data handling and storage
- Matrix algebra
- Regular expressions
- Statistics!
- OOP
- Programming
- Graphics

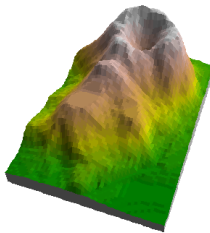
Eye candy



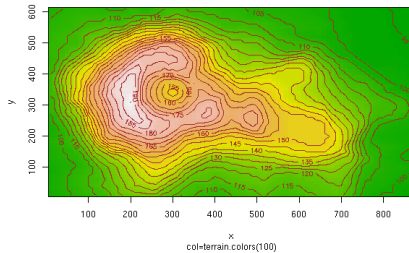
Eye candy



Eye candy



Maunga Whau Volcano



What doesn't it do

- No DB, but connections (SQL, NoSQL, Spreadsheets)
- No GUI, but IDE & GUI toolsets - CLI
- Slow, but C/C++, HPC
- No commercial support, but community
- Think for you

Help!



- Help for each function and data type
- ?mean
- ??mean
- ?help
- <http://rseek.org>
- stackoverflow, <http://stackoverflow.com/questions/tagged/r>
- Mailing lists

- Stock assessment and provision of management advice
 - ▶ Well tested, robust methods
 - ▶ Open to detailed inspection
- Data and model validation through simulation
- Risk analysis
- Capacity development & education
- Promote collaboration and openness in quantitative fisheries science
 - ▶ Open source
 - ▶ Community involvement
 - ▶ R as lingua franca
- Support the development of new models and methods
 - ▶ Extensible toolset
 - ▶ Links to other tools (ADMB, BUGS, ...)


start - FLR Project

flr-project.org/doku.php?id=start


Google

FLR PROJECT

TABLE OF CONTENTS


**Training Course**
Intro to R and FLR for Fisheries

3-5 JULY 2012 – Varese, Italy
Registration now open at [FishReg EC JRC](#)



The FLR library is a collection of tools in the [R](#) statistical language that facilitates the construction of bio-economic simulation models of fisheries and ecological systems. It is a generic toolbox, but is specifically suited for the construction of simulation models for evaluations of fisheries management strategies. The FLR library is under development by researchers across a number of laboratories and universities.

Love it !! Take me to the [Table of Contents](#) !!




You can install the **stable releases** for [R >= 2.13.0](#) with

```
install.packages(repos="http://flr-project.org/R")
```

or you can install the **development packages** for [R >= 2.14.0](#) with

```
install.packages(repos="http://flr-project.org/Rdevel")
```



You can get help by subscribing our [mailing list](#) and posting your doubt, or reading the **tutorials** on the ["Teach yourself FLR" wiki](#).

Tools of the trade

- Version Control Systems
 - ▶ CVS
 - ▶ SVN
 - ▶ git
- Editors & IDEs
- Literate Programming
 - ▶ Sweave
 - ▶ knitr
- Validation, Verification and Testing (VV&T)

Sexy data analysis



Setting up R & RStudio

- <http://cran.r-project.org>
- <http://rstudio.org>