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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 an- swer to that is, 'No'. The long answer to that is, 'No!'."

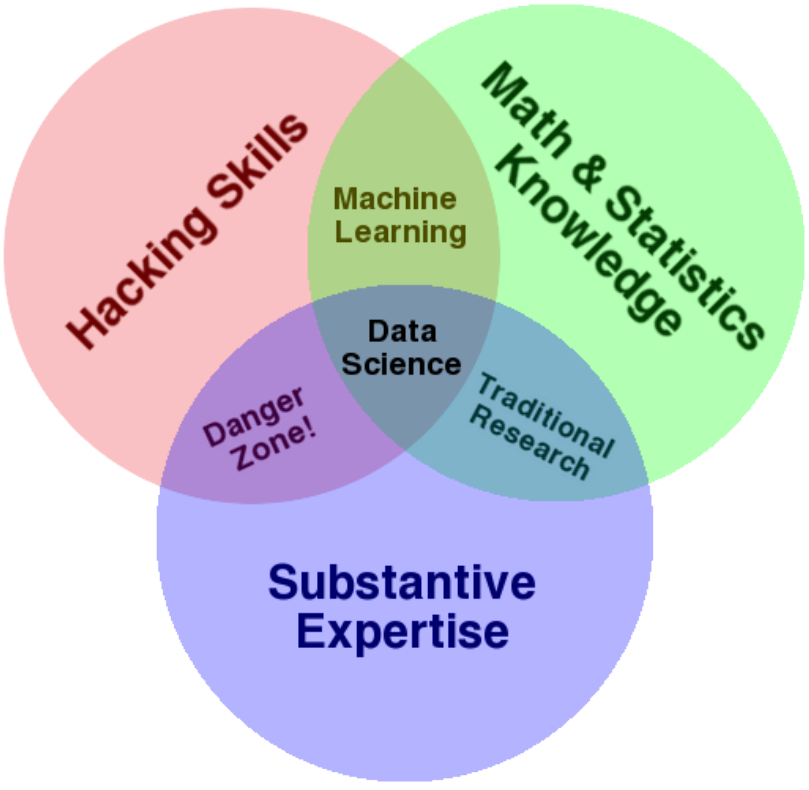
– Frank Harrell, 1999 S-PLUS User Conference, New Orleans (October 1999)

But this should be easy

"Managing fisheries is hard: it's like managing a forest, in which the trees are invisible and keep moving around"

- Professor John Shepherd

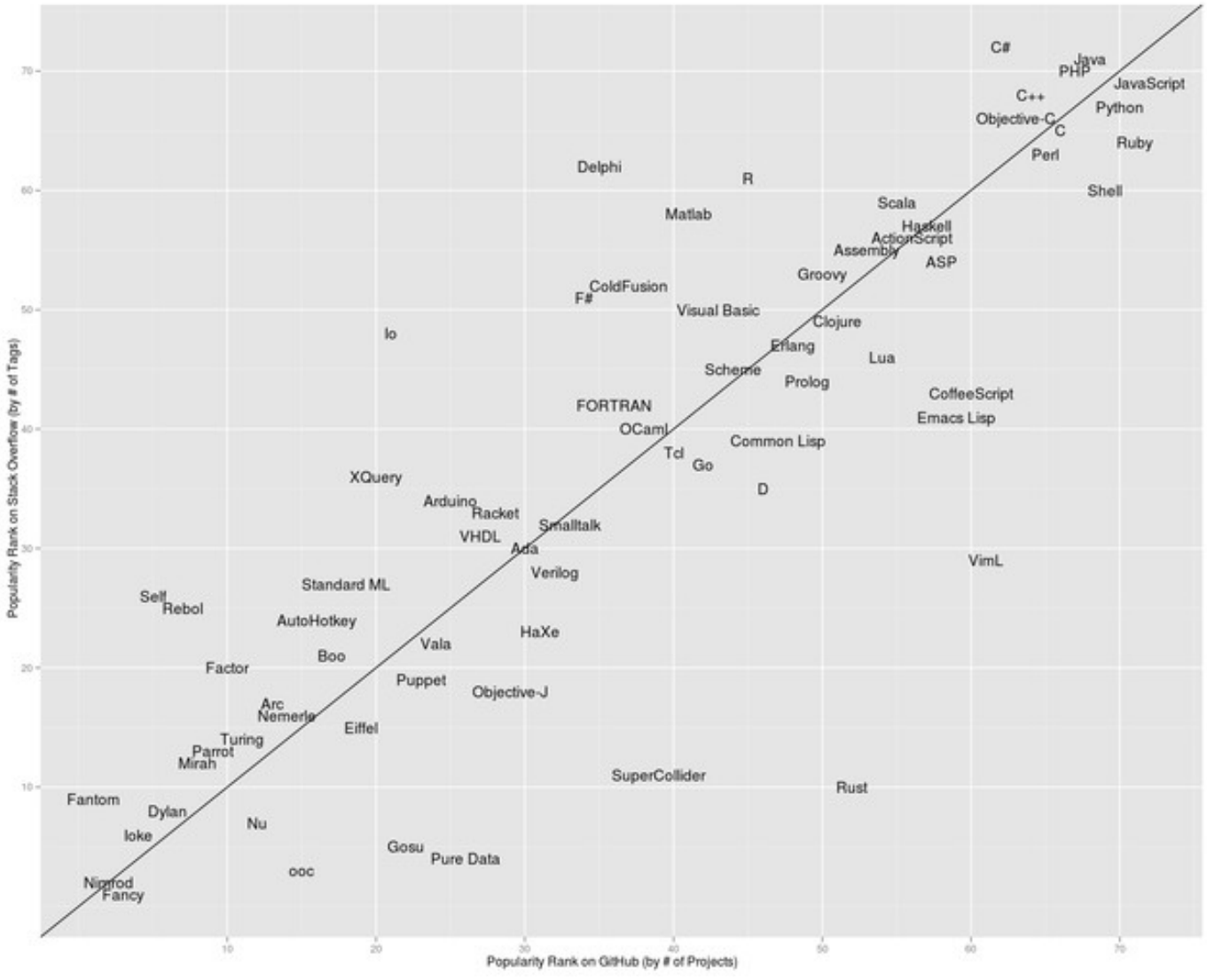
Data analist



What is R

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

Why R?


C#
Java
PHP
JavaScript
C++
Python
Objective-C
C
Ruby
Perl
Delphi
R
Shell
Scala
Matlab
Haskell
ActionScript
Assembly
ASP
Groovy
ColdFusion
F#
Visual Basic
Clojure
Io
Erlang
Lua
Scheme
Prolog
CoffeeScript
FORTRAN
Emacs Lisp
OCaml
Common Lisp
Tcl
Go
XQuery
D
Arduino
Racket
Smalltalk
VHDL
Ada
VimL
Verilog
Standard ML
Self
Rebol
AutoHotkey
HaXe
Vala
Boo
Factor
Puppet
Objective-J
Arc
Nemerle
Eiffel
Turing
Parrot
Mirah
SuperCollider
Rust
Fantom
Dylan
Nu
Ioke
Gosu
Pure Data
ooc
Nimrod
Fancy
Popularity Rank on Stack Overflow (by # of Tags)
Popularity Rank on GitHub (by # of Projects)

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.

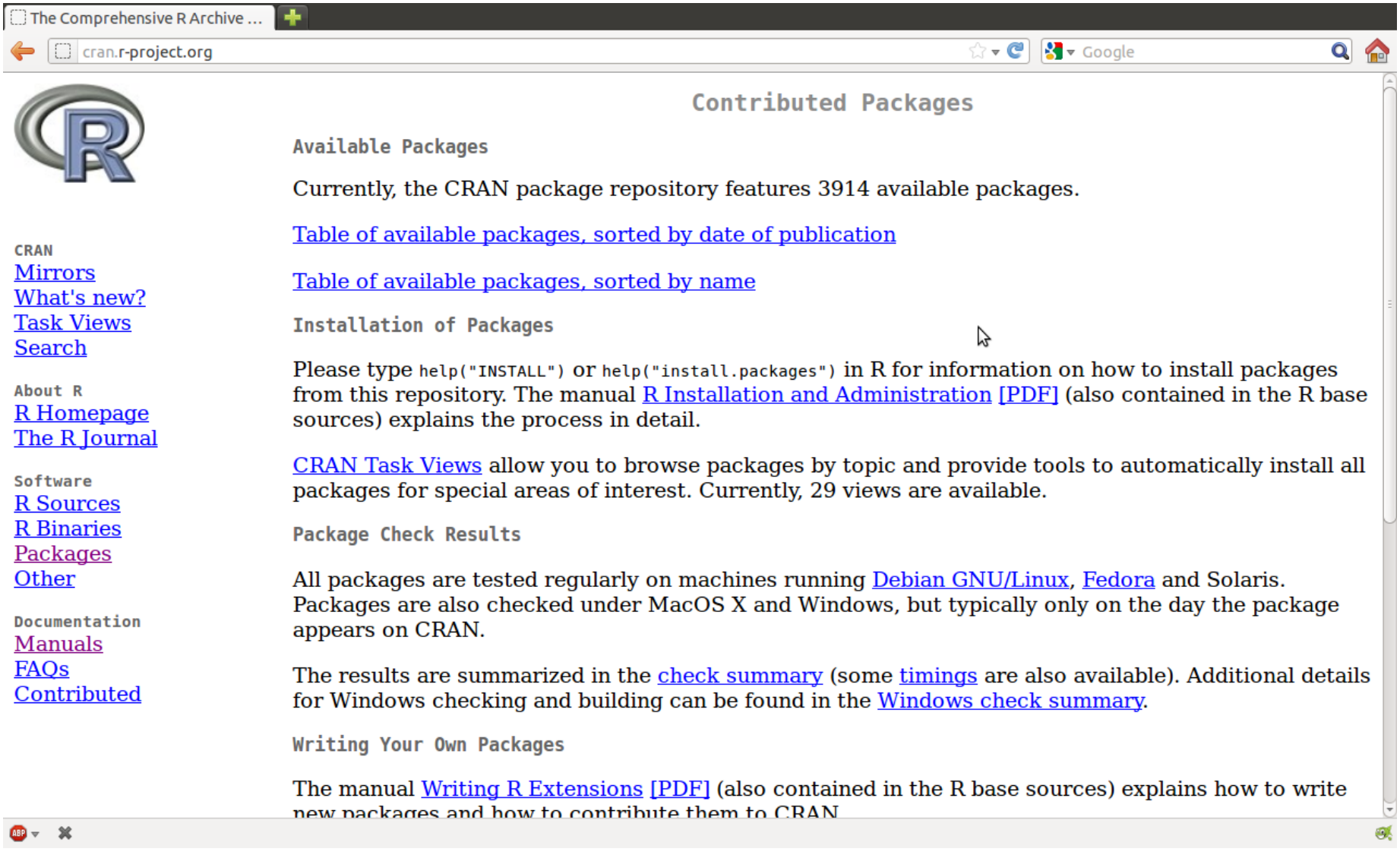
Contents [hide]

GNU General Public License

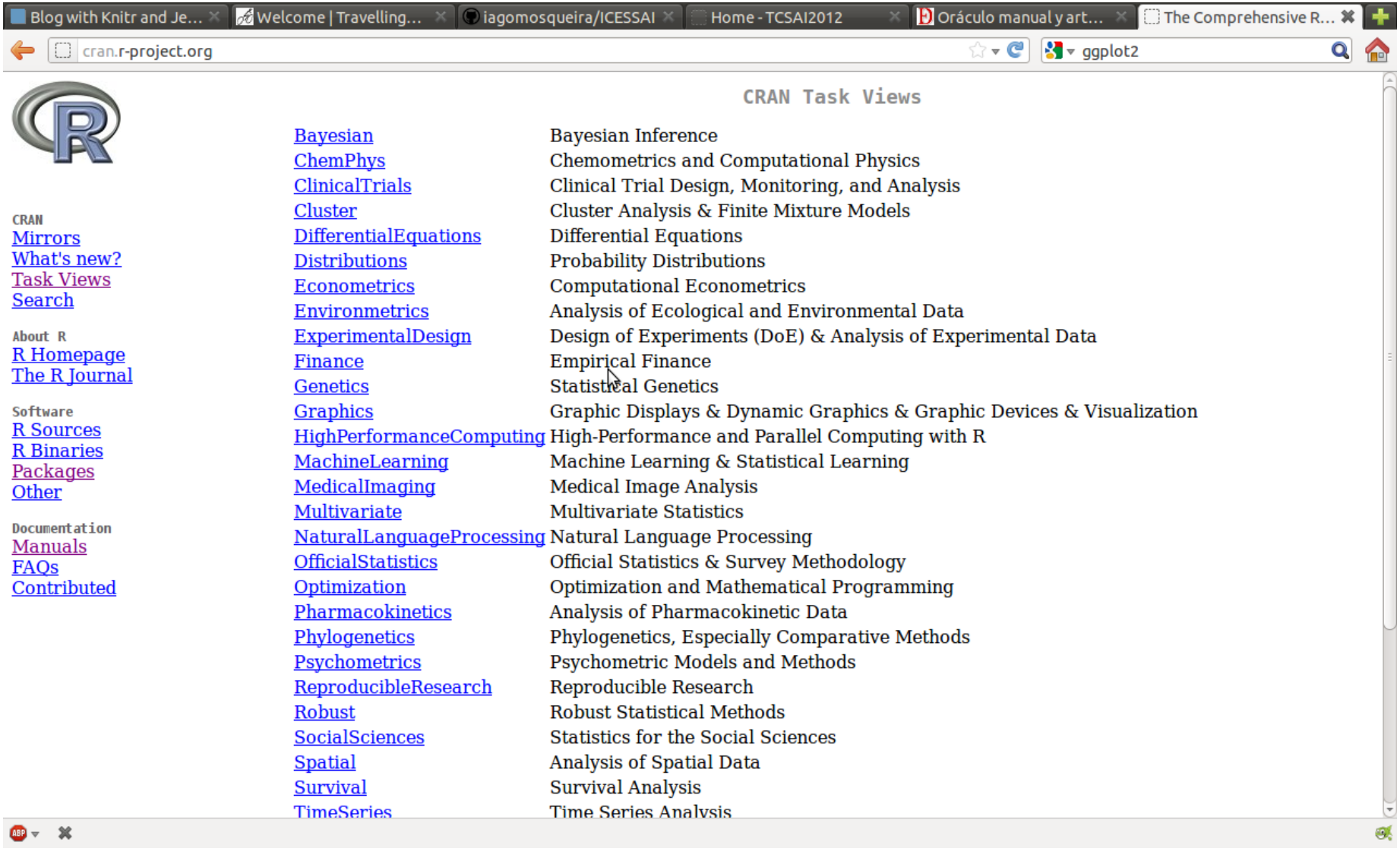
GNU GPLv3 Logo

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

CRAN


The Comprehensive R Archive ...
cran.r-project.org
Google
CRAN
Mirrors
What's new?
Task Views
Search
About R
R Homepage
The R Journal
Software
R Sources
R Binaries
Packages
Other
Documentation
Manuals
FAQs
Contributed
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

Task views


Blog with Knitr and Je...
Welcome | Travelling...
iagomosqueira/ICESSAI
Home - TCSAI2012
Oráculo manual y art...
The Comprehensive R...
cran.r-project.org
ggplot2
CRAN Task Views
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Software
R Sources
R Binaries
Packages
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Documentation
Manuals
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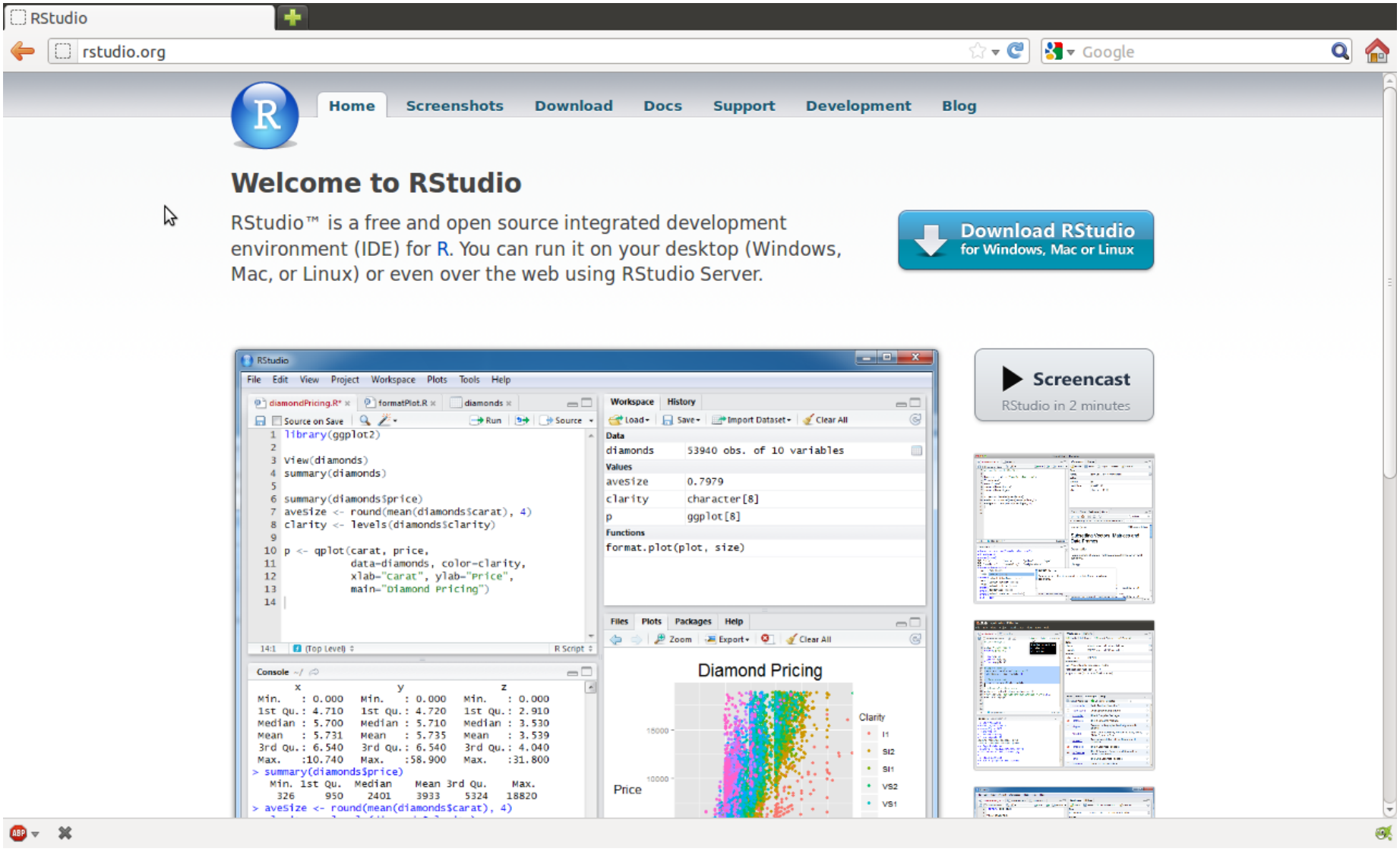
Contributed
Bayesian Bayesian Inference
ChemPhys Chemometrics and Computational Physics
ClinicalTrials Clinical Trial Design, Monitoring, and Analysis
Cluster Cluster Analysis & Finite Mixture Models
DifferentialEquations Differential Equations
Distributions Probability Distributions
Econometrics Computational 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


RStudio
rstudio.org
Google
Home
Screenshots
Download
Docs
Support
Development
Blog
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
Screencast
RStudio in 2 minutes
Diamond Pricing
Price
Clarity

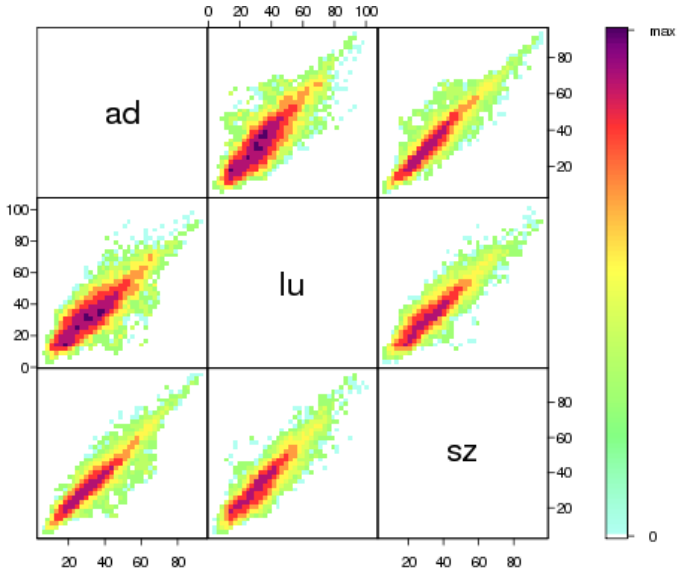
Basic features

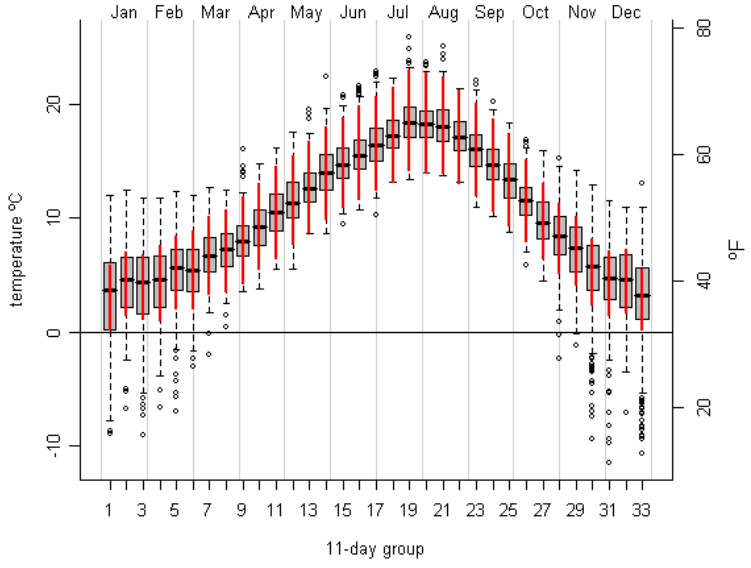
- Numerous procedures (algebra, matrix, stats)
- Named storage (everything is an object)
- Functions
- Classes and methods (S3, S4)
- Special values (NA, NaN, Inf, NULL)
- Logical objects and boolean algebra
- basic_features .R

What else can it do?

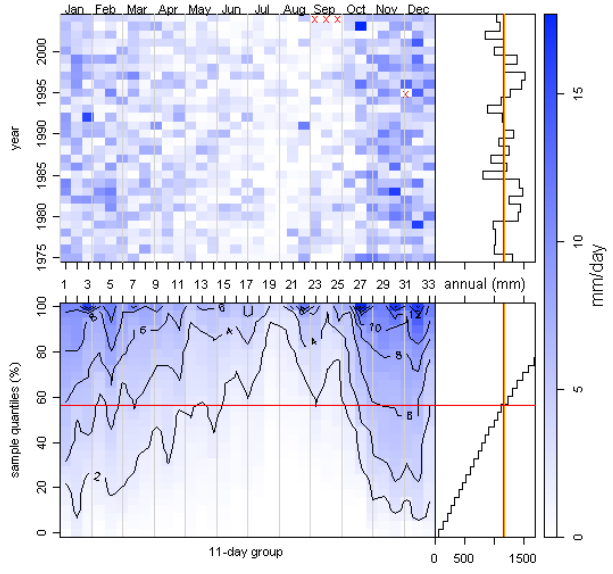
- Data handling and storage
- Matrix algebra
- Regular expressions
- Statistics!
- OOP
- Programming
- Graphics

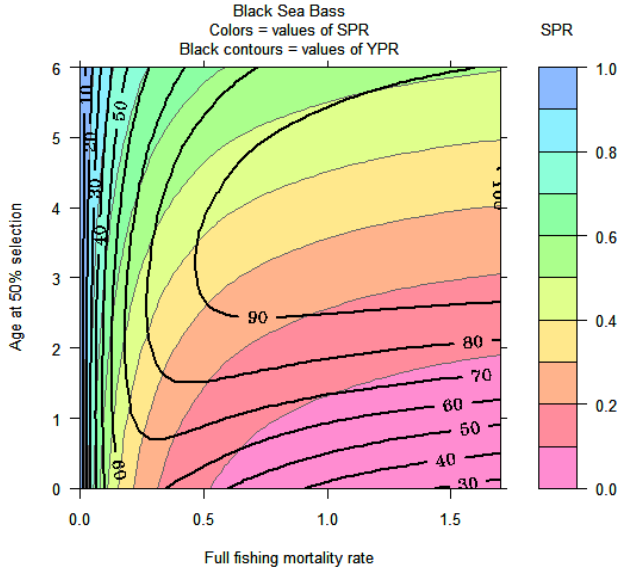
Eye candy


ad
lu
sz
max
0

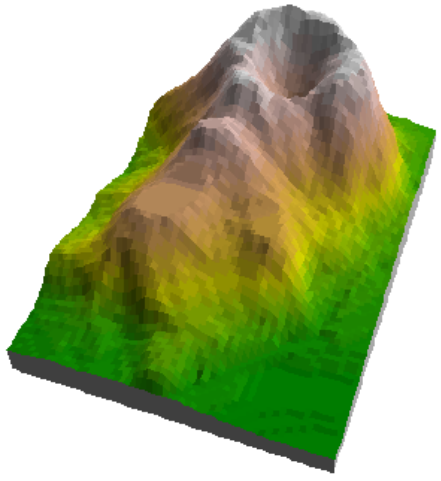

Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
temperature °C
°F
11-day group

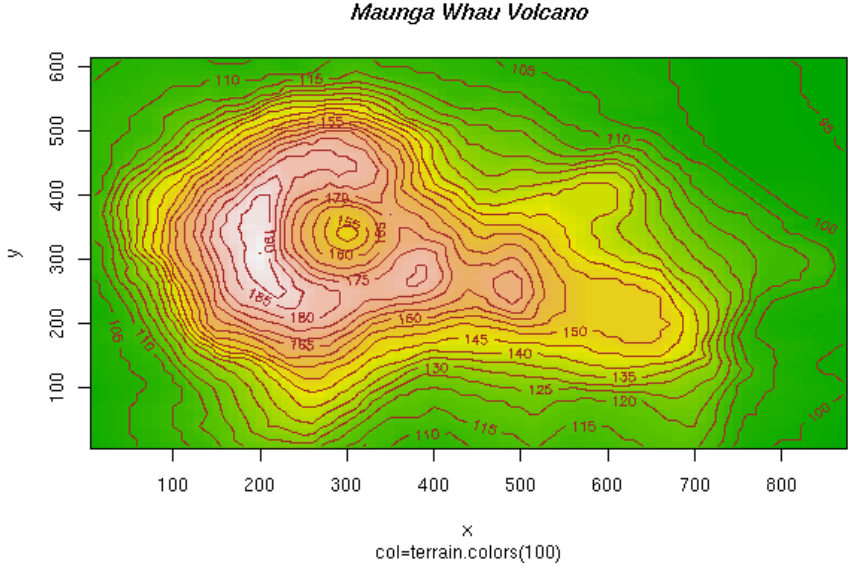
Eye candy


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
year
2000
1995
1990
1985
1980
1975
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33
annual (mm)
sample quantiles (%)
100
80
60
40
20
0
11-day group
0 500 1500
mm/day
15
10
5
0


Black Sea Bass
Colors = values of SPR
Black contours = values of YPR
SPR
1.0
0.8
0.6
0.4
0.2
0.0
Age at 50% selection
6
5
4
3
2
1
0
0.0
0.5
1.0
1.5
Full fishing mortality rate
10
20
30
40
50
60
80
90
100
70

Eye candy




Maunga Whau Volcano
y
x
col=terrain.colors(100)
100
200
300
400
500
600
700
800

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 commerciasl support, but community
- Think for you

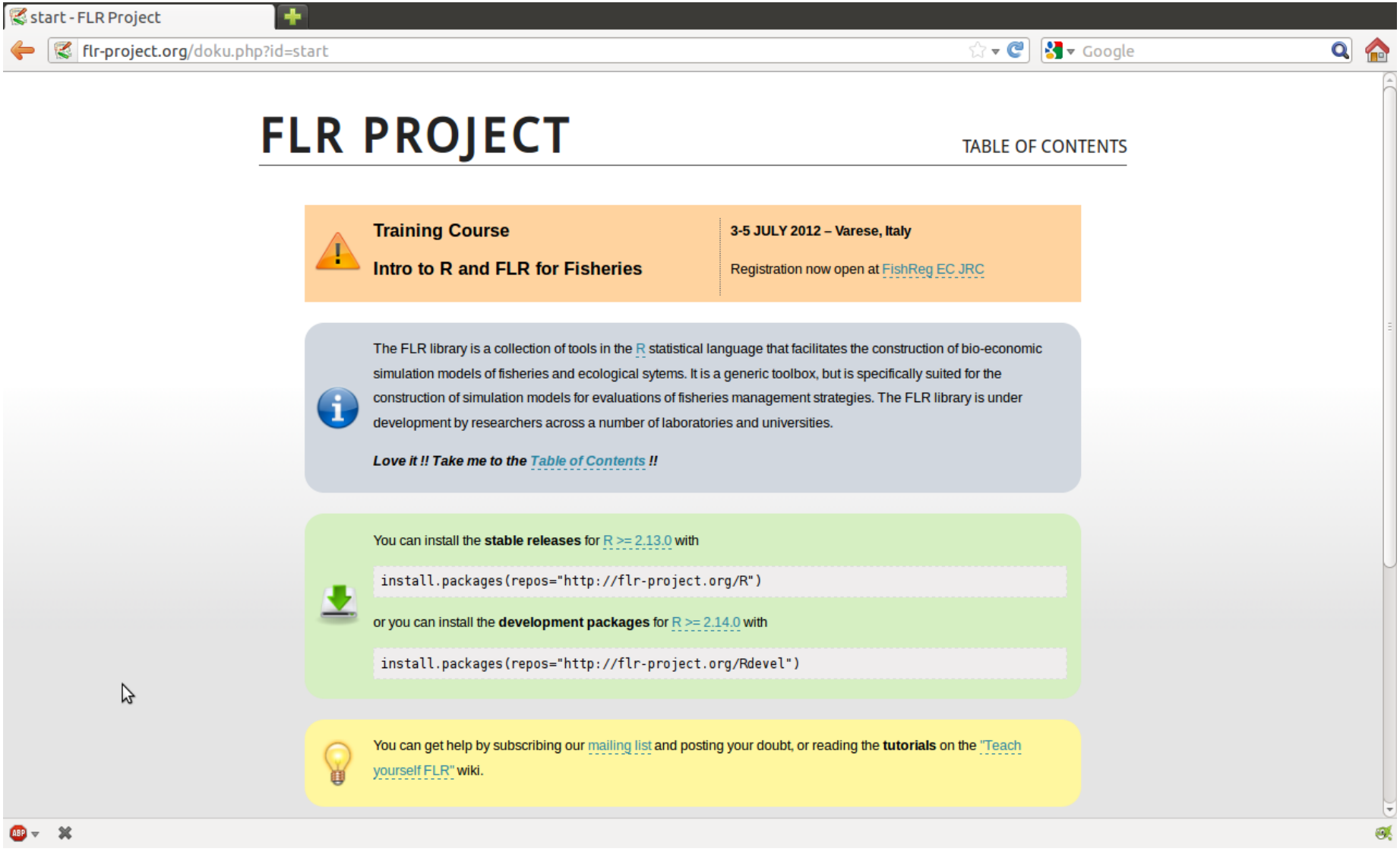
Help!

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

FLR

- 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, . . .)

flr-project.org



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