GEOG 5680 / 6680
Introduction to R
00: Class Introduction

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Course Goals

- This course is designed to give an intensive introduction to R for analysis, programming and as a graphical tool. The aims are to:
  - Introduce R as a data analysis and statistical software tool
  - Learn about manipulating data in R
  - Use scripts and functions to help analyzing data
  - Cover basic to more advanced plotting
  - Look at the add-on packages that extend R's functions
  - Introduce basic statistical modeling in R

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- Designed as a series of modules: short video intro + computer exercises

Syllabus

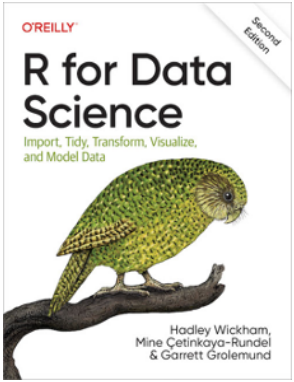
- 00: Class introduction
- 01: Data import and export
- 02: Data manipulation I
- 03: Basic plotting
- 04: Control functions and loops
- 05: R functions
- 06: Writing reports in R
- 07: Data manipulation II

Syllabus

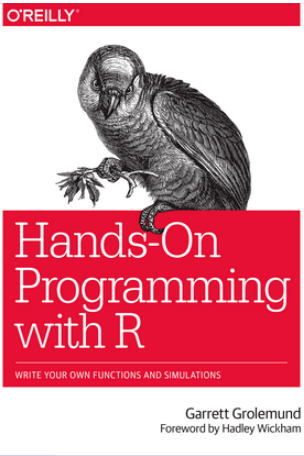
- 08: Extending basic plots with **ggplot2**
- 09: Simple inference tests
- 10: Introduction to statistical modeling in R
- 11: Data manipulation III
- 12: Making maps in R
- 13: Using Github with R
- 14: Web applications with Shiny
- 15: Optional modules (mixed-effects models, interactive maps, ...)

Reading material

Wickham, R for Data Science (O'Reilly)



Grolemund, Hands-on Programming with R (O'Reilly)



Course assessment

- In-class exercises (75 pts)
  - 2-3 short exercises per class
  - Designed to make you repeat the methods covered
  - Provide R code as a script
  - Copy-paste results and/or figures to Word document
  - Submission through Canvas
  - All exercises to be submitted by Friday, June 21

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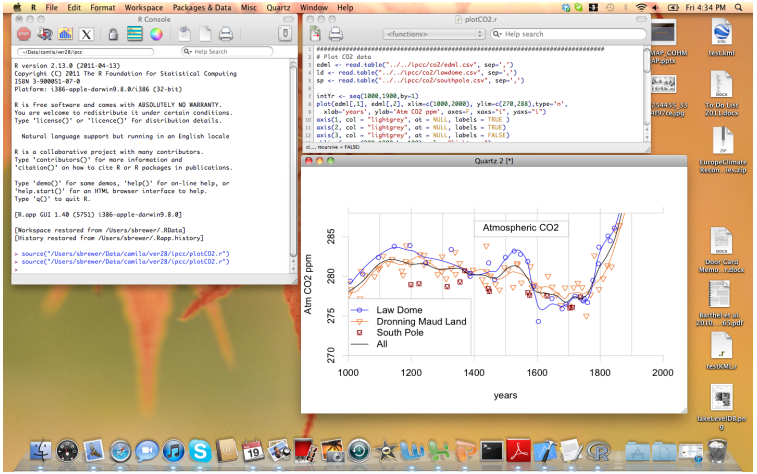
- Course project (25 pts)
  - Analysis of a dataset using one or more of the techniques covered in class (or use R to explore other techniques)
  - Project can be either:
    - One of three predefined datasets
    - Your own dataset

Course project

- Examples of projects
  - Investigating the link between house characteristics and price
  - Factors influencing companies profits
  - Results of cloud seeding experiment
- Project report - worth 55% of overall grade
  - Projects to be written in R Markdown (covered in module 06)
  - Include:
    - R Code
    - Results including figures
    - Brief discussion of project and results
  - Due Friday, June 21 through Canvas

Introduction to R

- GNU GPL (free) statistical language and environment
- Comprehensive R Archive Network (CRAN)
- www.r-project.org



What is R?

R is an integrated suite of software facilities for data manipulation, calculation and graphical display. Among other things it has

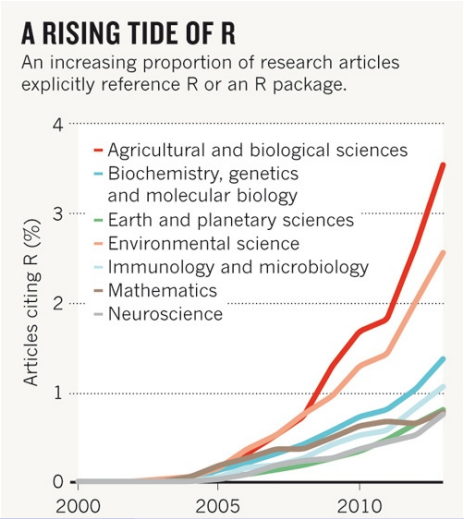
- an effective data handling and storage facility,
- a suite of operators for calculations on arrays, in particular matrices,
- a large, coherent, integrated collection of intermediate tools for data analysis,
- graphical facilities for data analysis and display either directly at the computer or on hardcopy, and
- a well developed, simple and effective programming language (called 'S') which includes conditionals, loops, user defined recursive functions and input and output facilities.

What is R?

- At heart, it's a programming language designed for the analysis of data
- Free, open source!
- Large number of existing functions/packages
  - APIs to many services
  - Ability to write personal functions
- Extensive graphics capability and extensions
- Works well with spatial data
  - Several add-on packages specifically designed for the analysis of time and space data
- Easily transferable — runs on Mac/Windows/Unix
- Increasingly used in many disciplines and industry

Why learn R?

- "Programming tools: Adventures with R"
- Tippman, Nature Dec. 2014



Why learn R?

- R is the 21st highest paid tech skill (Dice Tech Salary Survey, 2016)
- R second most used data science language after Python (Kaggle, 2016)
- R is #5 on list of most popular analytics jobs (Indeed.com, Feb. 2017)
- R is ranked second in usage in data science articles (Google scholar, Feb. 2017)
- R growing faster than any other data science language used in research (Google scholar, Feb. 2017)
- R is #5 on IEEE spectrum ranking (2019: search ranking, trends, social media, job postings)

Why learn R?

From www.datacamp.com

- R focuses on better, user friendly data analysis, statistics and graphical models
- Used by statisticians who need to do some programming

- Python emphasizes productivity and code readability
- Used by programmers who need to do some statistics

Why learn R?

But:

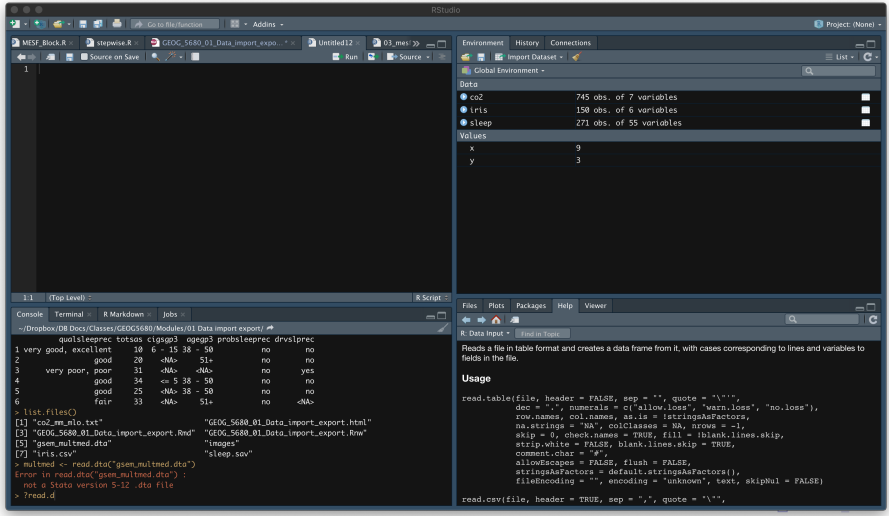
- No (or limited) graphical interface
- Data manipulation can be complex
- Limited documentation
- Steep learning curve

RStudio

Free integrated development enviroment (IDE) for R

- Better help functions
- Integrated script editor
- More useful package manager
- Access to current datasets
- Plot history

RStudio


RStudio
Go to file/function
Addins
Project: (None)
MESF_Block.R
stepwise.R
GEOG_5680_01_Data_import_expo...
Untitled12
03_mes:
Source on Save
Run
Source
1
1:1
(Top Level)
R Script
Environment
History
Connections
Import Dataset
List
Global Environment
Data
co2
745 obs. of 7 variables
iris
150 obs. of 6 variables
sleep
271 obs. of 55 variables
Values
x
9
y
3
Console
Terminal
R Markdown
Jobs
~/Dropbox/DB Docs/Classes/GEOG5680/Modules/01 Data import export/
quoisleeprec totsos cigsgp3 agegp3 probsleeprec drvslprec
1 very good, excellent 10 6 - 15 38 - 50 no no
2 good 20 <NA> 51+ no no
3 very poor, poor 31 <NA> <NA> no yes
4 good 34 <= 5 38 - 50 no no
5 good 25 <NA> 38 - 50 no no
6 fair 33 <NA> 51+ no <NA>
> list.files()
[1] "co2_mm_mlo.txt" "GEOG_5680_01_Data_import_export.html"
[3] "GEOG_5680_01_Data_import_export.Rmd" "GEOG_5680_01_Data_import_export.Rnw"
[5] "gsem_multmed.dta" "images"
[7] "iris.csv" "sleep.sav"
> multmed <- read.dta("gsem_multmed.dta")
Error in read.dta("gsem_multmed.dta") :
not a Stata version 5-12 .dta file
> ?read.d
Files
Plots
Packages
Help
Viewer
R: Data Input
Find in Topic
Reads a file in table format and creates a data frame from it, with cases corresponding to lines and variables to fields in the file.
Usage
read.table(file, header = FALSE, sep = "", quote = "\"'",
dec = ".", numerals = c("allow.loss", "warn.loss", "no.loss"),
row.names, col.names, as.is = !stringsAsFactors,
na.strings = "NA", colClasses = NA, nrows = -1,
skip = 0, check.names = TRUE, fill = !blank.lines.skip,
strip.white = FALSE, blank.lines.skip = TRUE,
comment.char = "#",
allowEscapes = FALSE, flush = FALSE,
stringsAsFactors = default.stringsAsFactors(),
fileEncoding = "", encoding = "unknown", text, skipNul = FALSE)
read.csv(file, header = TRUE, sep = ",", quote = "\"",