R packages

Rich FitzJohn

Why make a package?

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…including yourself, later

Functions and workflow

1. Long script file with a series of commands. Lots of cut and paste.

myproject.R

```
data <- read.table(file.choose(), header=T, sep=",")
data[[1]] <- as.character(data[[1]])

...

plot(data[[1]])
plot(data[[2]])

...

fit1 <- lm(data[[1]] ~ data[[2]] + data[[3]])
theresult <- fitted(fit1)
fit2 <- lm(data[[1]] ~ data[[2]])
theresult <- fitted(fit2) - theresult
```

Functions and workflow

2. Abstract into functions, put in its own file

project-fun.R

```
load.data <- function(filename) {
  dat <- read.csv(filename)
  ## Error checking
  ...
  ## Fix up data types
  ...
  ## Make transformed data
  ...
  dat
}

fit.models <- function(data.set) {
  ## Fit each model
  ...
  list(model1, model2, model3)
}
```

Functions and workflow

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  dat <- read.csv(filename)
  ## Error checking
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}

fit.models <- function(data.set) {
  ## Fit each model
  ...
  list(model1, model2, model3)
}
```

project.R

```
source("project-fun.R")
dat <- load.data("data/mydataset.csv")
obj <- fit.models(dat)
write.paper(obj) # still buggy.
```

Functions and workflow

3. Collect functions into package and use that

R package contents

- Some information for R
- R files containing functions
- A help file for each function

Optionally,

- Data sets
- PDF ``vignette'' documents
- Compiled code (C, C++, Fortran)

The "DESCRIPTION" file

DESCRIPTION
```
Package: hammer
Title: A Hammer
Description: An example package
Version: 1.0
Author: Rich FitzJohn
Maintainer: Rich FitzJohn <fitzjohn@zoology.ubc.ca>
License: Unlimited
```

- Tells R a few things about the package
- Used to construct the lists on CRAN
- Can be shown by `library(help=hammer)`

R files containing functions

R/functions.R

```
squash <- function(x)
  x * runif(length(x))
```

- Any number of R files that define functions
- Concatenated and `source()`d when the package is loaded

Help files

man/squash.Rd

```
\name{squash}
\alias{squash}
\title{Squash Some Numbers}
\usage{
  squash(x)
}
\arguments{
  \item{x}{A numeric vector of numbers to squash.}
}
\description{
  ...a longer description would go here...
}
\examples{
squash(1:10)
}
\author{Rich FitzJohn}
\keyword{model}
```

- Every function must be documented.

Loading packages

What happens when a package is loaded?

```
> library(hammer)
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```
> squash(1:5)

[1] 0.07671335 0.89909571 2.28221560
[4] 1.59110592 4.91386456
```

Loading packages

Before the package is loaded:

```
> search()
```

```
[1] ".GlobalEnv"         "package:stats"      "package:graphics"
[4] "package:grDevices" "package:utils"      "package:datasets"
[7] "package:methods"   "Autoloads"          "package:base"
```

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After loading…

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> library(hammer)
> search()
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After loading…

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> library(hammer)
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```

R will use functions found in the first position in this list.

Loading packages

Which is the source of this warning:

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> squash <- function(x) 1
> library(hammer)

 Attaching package: 'hammer'

 The following object(s) are masked _by_ '.GlobalEnv':

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```

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> library(hammer)

 Attaching package: 'hammer'

 The following object(s) are masked _by_ '.GlobalEnv':

    squash
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(But this is OK, as the global object is not a function…)

```
> squash <- 1
> library(hammer)
```

My packages

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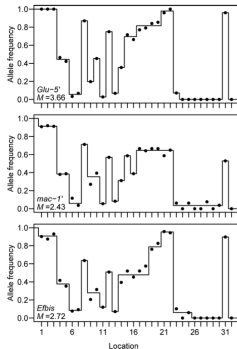
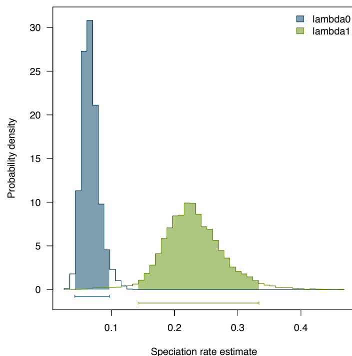


My packages

- TRAMPR: TRFLP Analysis and Matching Package for R
- ``Mosaic'' (with Leithen M'Gonigle)
- diversitree



Version Control

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5. …

In the end, there is a huge mess of files, and no record of *what* changed between versions.

Worse: different versions of functions depend on other versions of files/data.

Version control: solutions

Version control: revisit old versions

```
rich@kea <git log --graph --decorate --pretty=oneline --abbrev-commit> ~/Documents/Projects/di...
* 3185d16 (HEAD, origin/master, github/master, master) bib/studies.bib: Typo in Boucher-2012 entry diversitree/man/mcmc.Rd: Cl
* cd1f28c       * R/model-mkn-multitrait.R, R/model-musse-multitrait.R: restore        'pars.only' argument to multitrait fun
* c830849 Archive of the 0.9-2 release tarball
* d04efb7 (tag: v0.9-2, origin/release, github/release, release) Spelling, keyword change only.
* 16e9715 Website changes
* 0aa1a26 Improvements to documents, formatting, figures.
* 57b84a8       * R/check.R: Negative branch length check was being skipped.
*   f84bdce Merge branch 'master' of /Users/rich/Library/git/diversitree
|\
| * 1127f66 Formatting changes to tutorials.
* | e0b90c9 Fixed some display issues.
* | 634a255 Markdown fixes
* | 6b002ff Markdown fixes
* | 92a49f2 Basic readme file
|/
* 397da35 (ext) Reorder asr tests.
* 25e5079 First version of the extending diversitree manual done
* a600ad3       * R/check.R: typo in check.scalar(), more informative error in  check.loaded.symbol().
* 6e7491d Ignore temporary files
* e1ae37c Simplify push-www
* 6550cb2 Ignore file created.  Plus global www push.
* 885b376 Updated two scoping problems, updated website information.
* b3f02a3 Initial reworking of "extending diversitree" manual.  Mk2 reimplimentation done.
* 12098c5 Starting back on "extending diversitree"
* c5836e5 Website updates (old source archives, faq page missing from import)
* 331d6e3 Small changes to the tutorial so that it compiles.
:
```

Version control: see what you changed

Mar 23, 2012

* R/check.R: typo in check.scalar(), more informative error in
richfitz authored 6 days ago
a600ad30e5
Browse code

Mar 22, 2012

Updated two scoping problems, updated website information.
richfitz authored 7 days ago
885b37696d
Browse code

Initial reworking of "extending diversitree" manual. Mk2 reimplimenta...
richfitz authored 7 days ago
b3f02a3880
Browse code

* Too many files to list: huge rewrite of most behind the scenes
richfitz authored 7 days ago
b326bdb7cd
Browse code

Mar 13, 2012

* DESCRIPTION: Bump to 0.9-1, add mention of Classe and BiSSE-ness
richfitz authored 16 days ago
3650ad4217
Browse code

Feb 22, 2012

* R/model-bisseness.R: Added the "BiSSE-ness" model from Karen and S...
richfitz authored a month ago
99adc29dc5
Browse code

Feb 13, 2012

* DESCRIPTION: Bump R dependency up, and add support for current
richfitz authored a month ago
6f83cb141d
Browse code

Version control: see when you wrote that mistake

Commit	Line	Code
7fd4d683 » richfitz 2010-06-14 · R/constrain.R: Better constraining of cons...	62 63	`mcmc.loop <- function() {` `  for ( i in seq_len(nsteps) ) {`

c6ff3c25 » richfitz
2010-09-22 · DESCRIPTION: Bumped version number ...
	64
	65
	66
	67
		`    hist[[i]] <<- tmp <- sampler(posterior, x.init, y.init, w,`
		`                                 lower, upper, control)`
		`    x.init <- tmp[[1]]`
		`    y.init <- tmp[[2]]`

7fd4d683 » richfitz
2010-06-14 · R/constrain.R: Better constraining of cons...
	68
	69
	70
	71
		`    if ( print.every > 0 && i %% print.every == 0 )`
		`      cat(sprintf("%d: {%s} -> %2.5f\n", i,`
		`                   paste(sprintf("%2.4f", tmp[[1]]), collapse=", "),`
		`                   tmp[[2]]))`

6f83cb14 » richfitz
2012-02-13 · DESCRIPTION: Bump R dependency up,...
	72
	73
	74
	75
	76
	77
	78
		`    if ( save.every > 0 && i %% save.every == 0 ) {`
		`      ok <- try(write.csv(clean.hist(hist[seq_len(i)]),`
		`                          save.file, row.names=FALSE))`
		`      if ( inherits(ok, "try-error") )`
		`        warning("Error while writing progress file (continuing)",`
		`                immediate.=TRUE)`
		`    }`

7fd4d683 » richfitz 2010-06-14 · R/constrain.R: Better constraining of cons...	79	`  }`
35ed842c » richfitz 2010-06-23 · R/diversitree-branches.R: Many changes ...	80	`  hist`
7fd4d683 » richfitz 2010-06-14 · R/constrain.R: Better constraining of cons...	81	`}`

Version control: see when you wrote that mistake

```
51  59    mcmc.loop <- function() {
52  60      for ( i in seq_len(nsteps) ) {
53  61        hist[[i]] <<- tmp <- sampler(posterior, x.init, y.init, w,
... ... @@ -58,6 +66,13 @@ mcmc.default <- function(lik, x.init, nsteps, w, prior=NULL,
58  66          cat(sprintf("%d: {%s} -> %2.5f\n", i,
59  67                      paste(sprintf("%2.4f", tmp[[1]]), collapse=", "),
60  68                      tmp[[2]]))
    69 +      if ( save.every > 0 && i %% save.every == 0 ) {
    70 +        ok <- try(write.csv(clean.hist(hist[seq_len(i)]),
    71 +                            save.file, row.names=FALSE))
    72 +        if ( inherits(ok, "try-error") )
    73 +          warning("Error while writing progress file (continuing)",
    74 +                  immediate.=TRUE)
    75 +      }
61  76      }
62  77      hist
63  78    }
```

Questions?