Training in ade4 in R - Module I: Basic methods

Introduction

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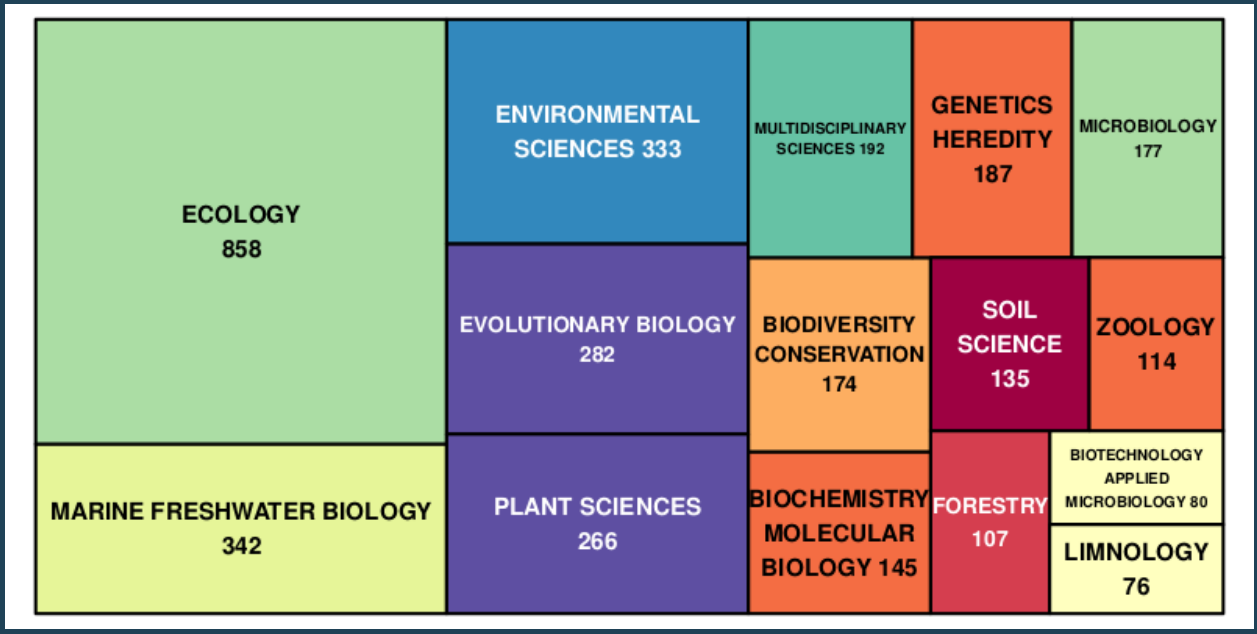
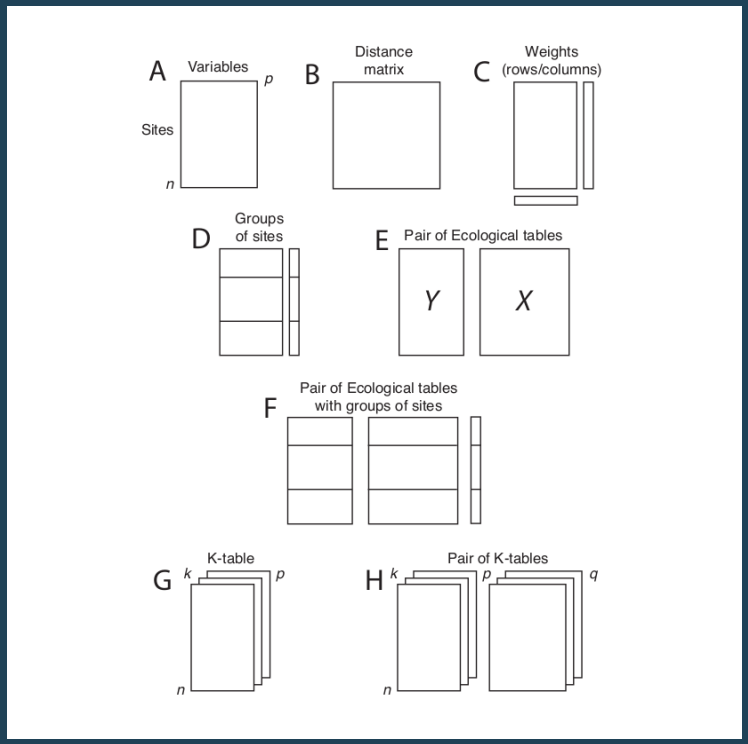
2021-04-15

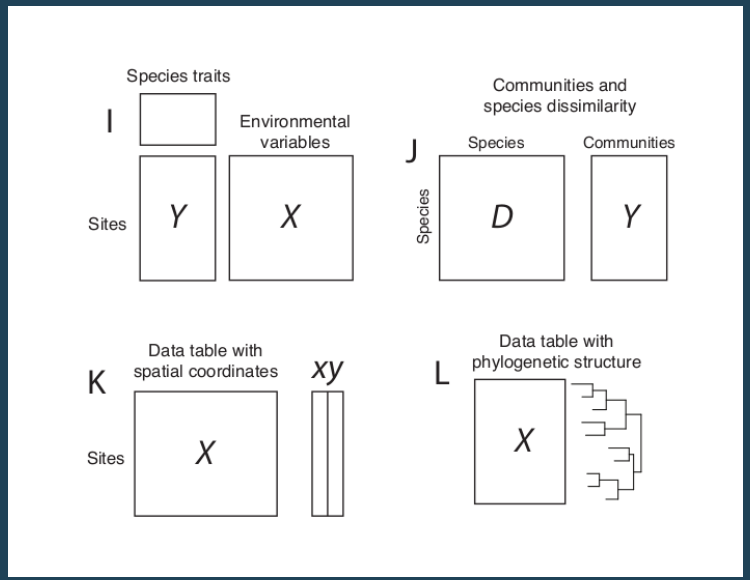
ade4

- R package since 2002
- Exploratory analysis of ecological data
  - Multivariate methods
  - Graphical functions

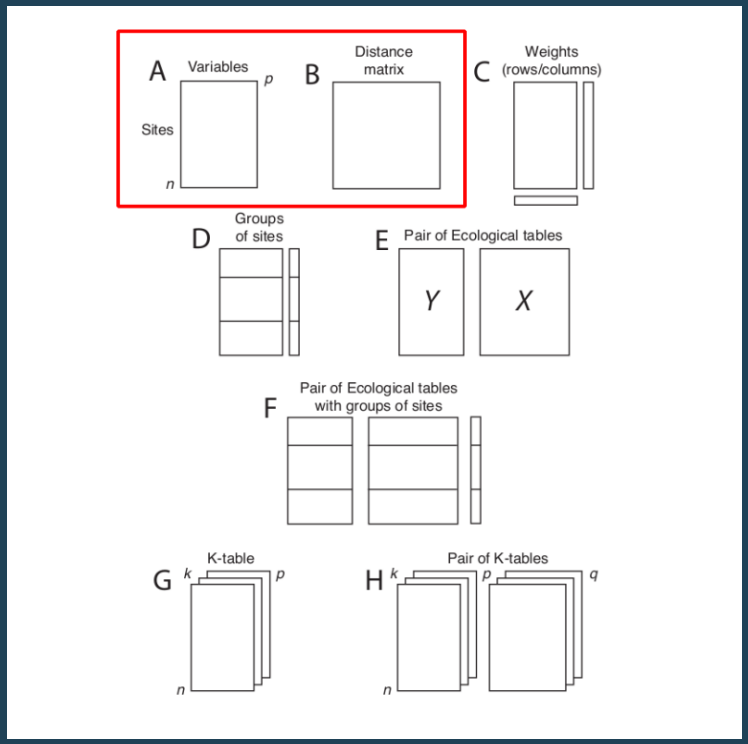


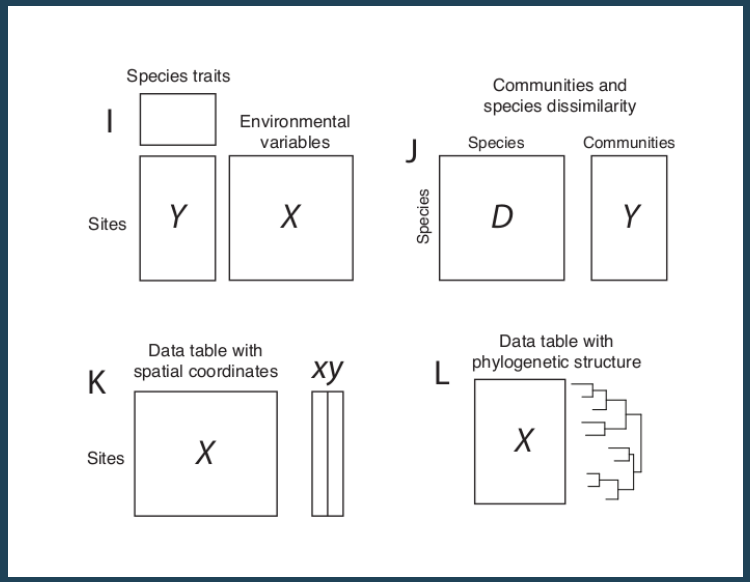
Data structure



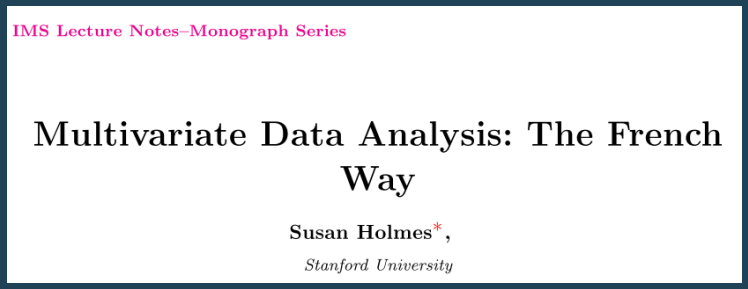


Data structure





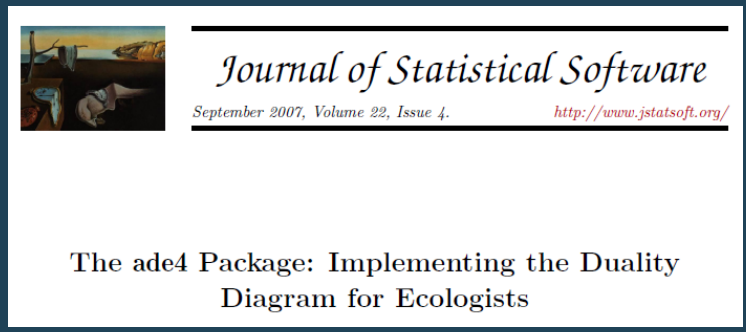
ade4: the French way


IMS Lecture Notes–Monograph Series

Multivariate Data Analysis: The French Way

Susan Holmes*,

Stanford University

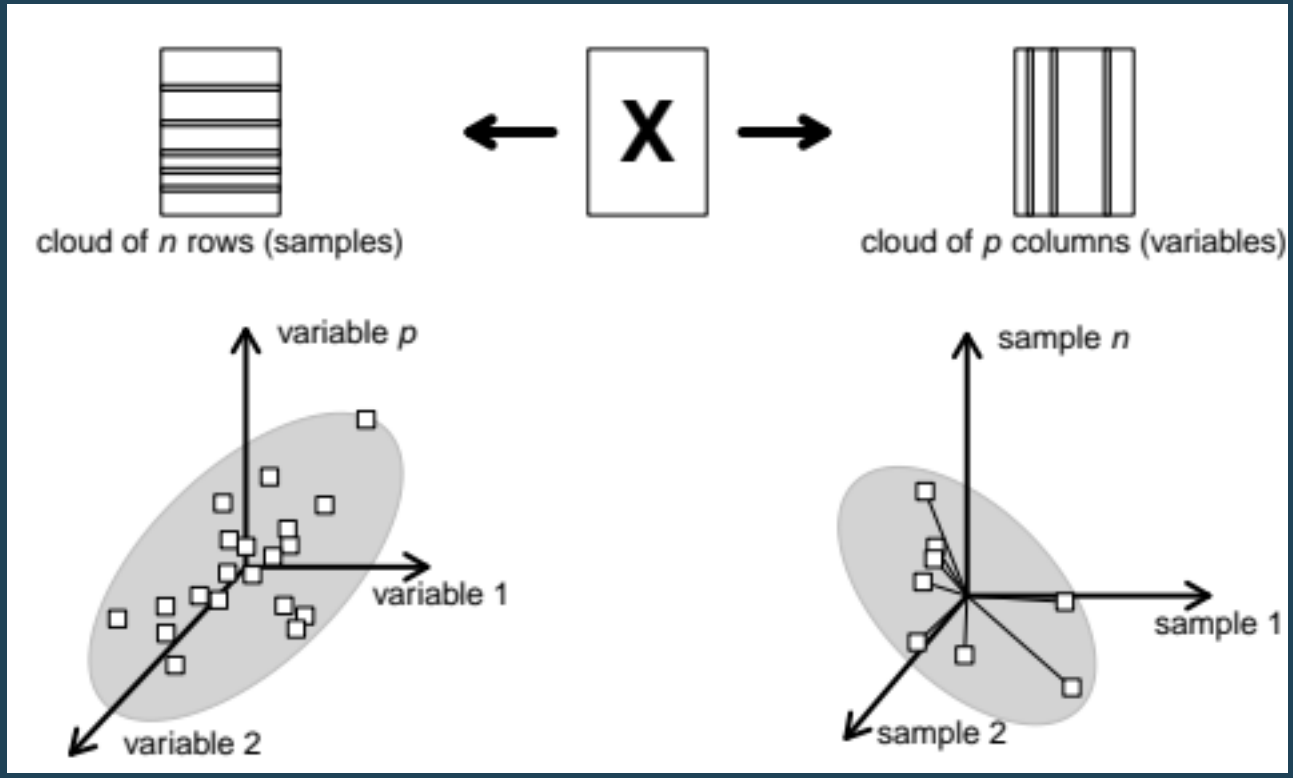


Journal of Statistical Software

September 2007, Volume 22, Issue 4. *http://www.jstatsoft.org/*

The ade4 Package: Implementing the Duality Diagram for Ecologists

Two geometric views



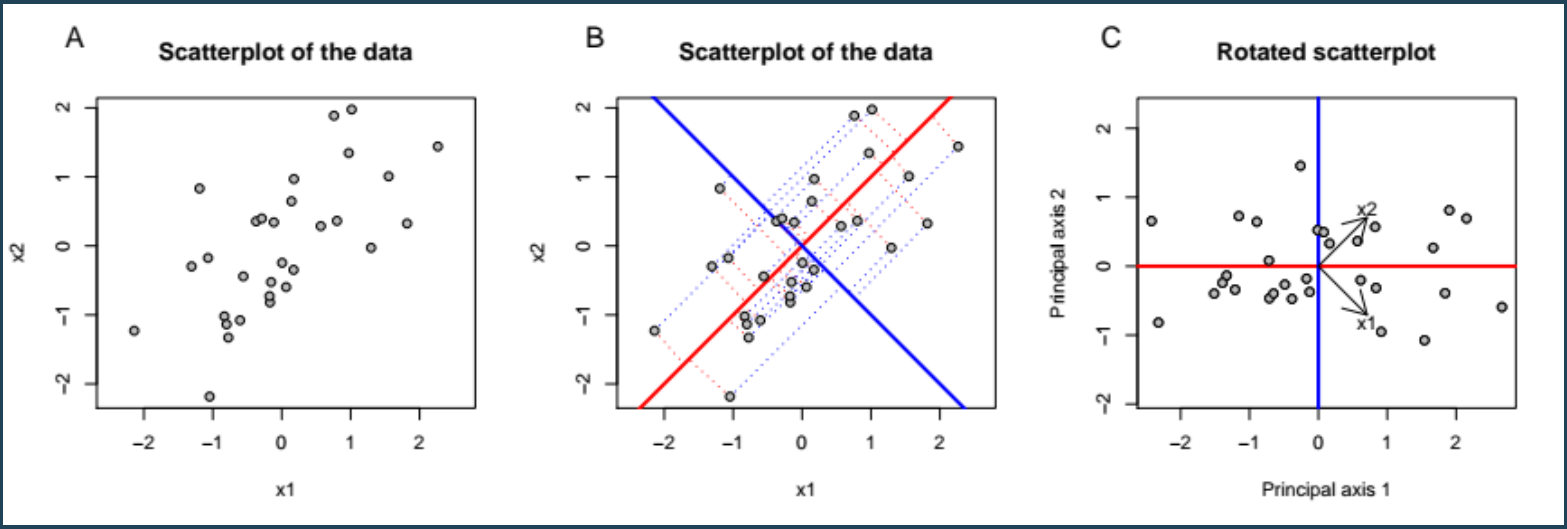
what are the main similarities and differences between the individuals ?

what are the main relationships between the variables ?

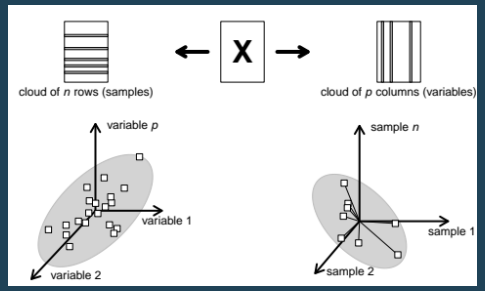
Explore the space of individuals

Go to practical 1

Geometric view for individuals



Two geometric views



- The principal axes

$$\mathbf{X}^\top\mathbf{DXQA} = \mathbf{A\Lambda}$$

- The row scores

$$\mathbf{L} = \mathbf{XQA}$$

- Maximization of

$$Q(\mathbf{a}) = \mathbf{a}^\top\mathbf{Q}^\top\mathbf{X}^\top\mathbf{DXQa} = \lambda$$

$$Q(\mathbf{a}) = \|\mathbf{XQa}\|^2_{\mathbf{D}} = \lambda$$

- The principal components

$$\mathbf{XQX}^\top\mathbf{DK} = \mathbf{B\Lambda}$$

- The column scores

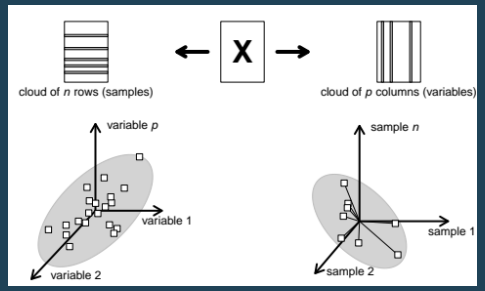
$$\mathbf{C} = \mathbf{X}^\top\mathbf{DB}$$

- Maximization of

$$S(\mathbf{b}) = \mathbf{b}^\top\mathbf{D}^\top\mathbf{XQX}^\top\mathbf{Db} = \lambda$$

$$S(\mathbf{b}) = \|\mathbf{X}^\top\mathbf{Db}\|^2_{\mathbf{Q}} = \lambda$$

The `dudi` class in `ade4`



- The principal axes

  `$c1`

- The row scores

  `$li`

- Maximization of

  `$eig`

- The principal components

  `$l1`

- The column scores

  `$co`

- Maximization of

  `$eig`

Methods for `dudi` objects

- `print`
- `summary`
- `screeplot`
- `scatter` / `biplot`
- `score`
- `is`
- `t`
- `inertia`
- `suprow` / `supcol`
- `reconst`
- `dist.dudi`

Implementaion in ade4

- The `as.dudi` function is an internal function
- It takes three arguments and returns an object of class `dudi`
- It is called by user-friendly functions corresponding to different analyses
- It can be used by experimented users to define their own analysis

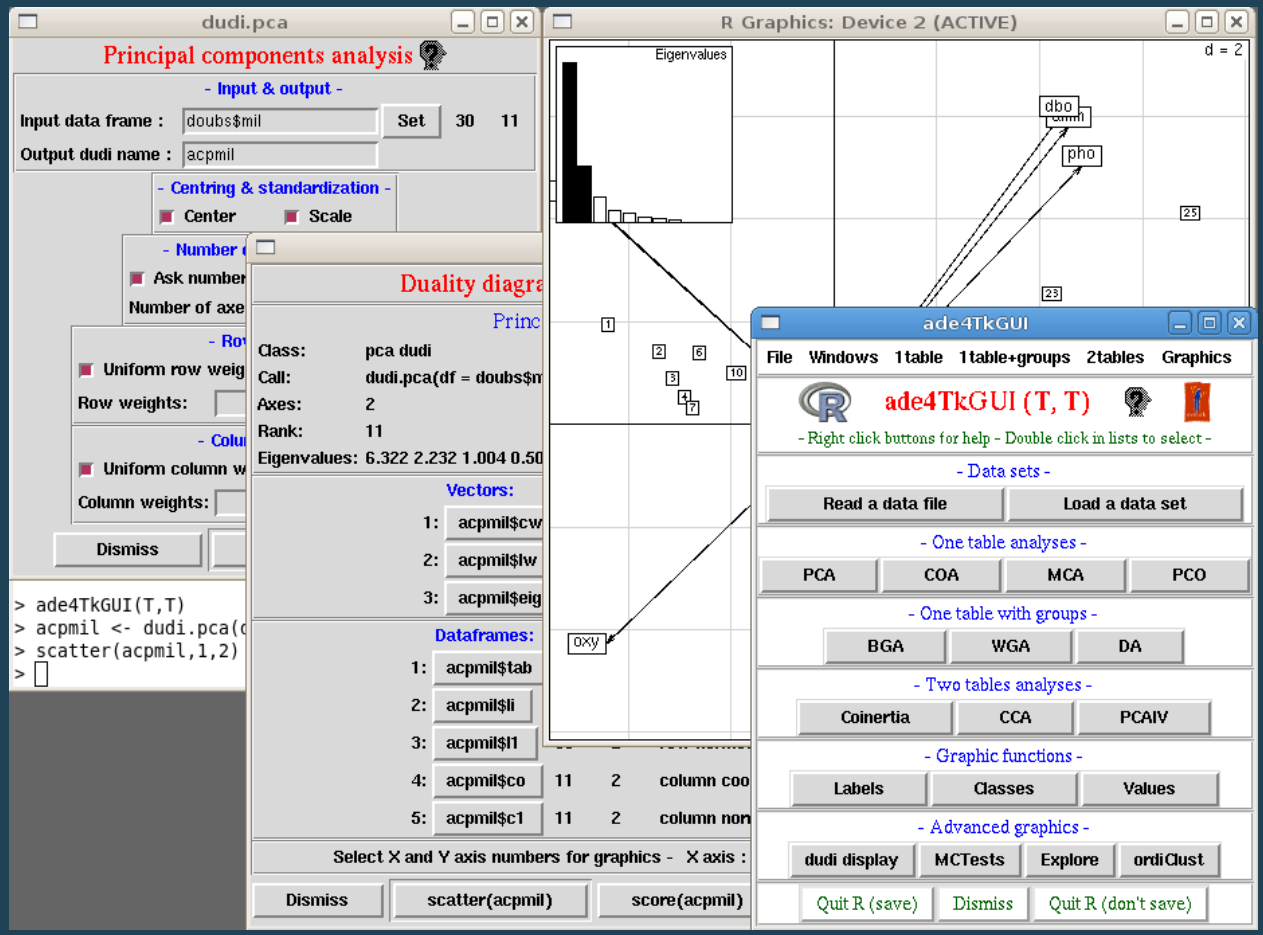
Module 1

- Environmental variables
  - Quantitative variables → Principal Component Analysis (`dudi.pca`)
  - Categorical variables → Multiple Correspondence Analysis (`dudi.acm`)
  - Mix of both → Hill-Smith Analysis (`dudi.hillsmith`)
- Species table
  - Contingency table → Correspondence Analysis (`dudi.coa`)
  - Distance matrix → Principal Coordinates Analysis (`dudi.pco`)

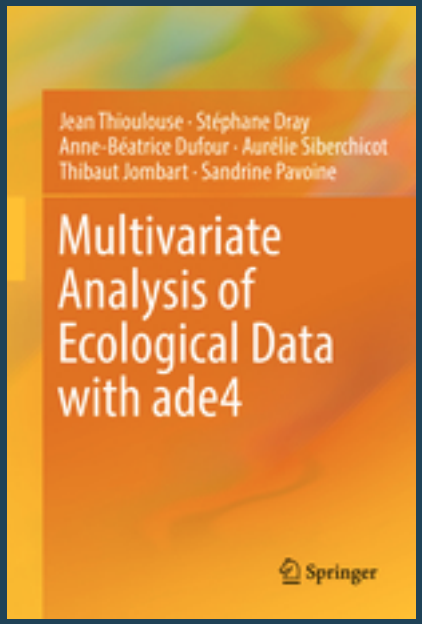
Packages

- `ade4` to run the analyses
- `adegraphics` to represent results
- `rgl` to understand multivariate methods in interactive 3D

ade4TkGUI


dudi.pca
Principal components analysis
- Input & output -
Input data frame :
doubs$mil
Set
30
11
Output dudi name :
acpmil
- Centring & standardization -
Center
Scale
Ask number
Number of axe
Uniform row weig
Row weights:
Uniform column w
Column weights:
Dismiss
> ade4TkGUI(T,T)
> acpmil <- dudi.pca(
> scatter(acpmil,1,2)
Duality diagra
Princ
Class: pca dudi
Call: dudi.pca(df = doubs$m
Axes: 2
Rank: 11
Eigenvalues: 6.322 2.232 1.004 0.50
Vectors:
1: acpmil$cw
2: acpmil$lw
3: acpmil$eig
Dataframes:
1: acpmil$tab
2: acpmil$li
3: acpmil$l1
4: acpmil$co
5: acpmil$c1
column coo
column nor
Select X and Y axis numbers for graphics - X axis :
Dismiss
scatter(acpmil)
score(acpmil)
R Graphics: Device 2 (ACTIVE)
Eigenvalues
d = 2
dbo
pho
oxy
ade4TkGUI
File Windows 1table 1table+groups 2tables Graphics
ade4TkGUI (T, T)
- Right click buttons for help - Double click in lists to select -
- Data sets -
Read a data file
Load a data set
- One table analyses -
PCA
COA
MCA
PCO
- One table with groups -
BGA
WGA
DA
- Two tables analyses -
Coinertia
CCA
PCAIV
- Graphic functions -
Labels
Classes
Values
- Advanced graphics -
dudi display
MCTests
Explore
ordiClust
Quit R (save)
Dismiss
Quit R (don't save)

Resources



- Mailing list:

  http://listes.univ-lyon1.fr/wws/info/adelist

- Development:

  https://github.com/sdray/ade4

- Courses (in French):

  http://pbil.univ-lyon1.fr/R/enseignement.html