

# Package ‘corclass’

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**Type** Package

**Title** Correlational Class Analysis

**Version** 0.1

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**Description** Perform a correlational class analysis of the data, resulting in a partition of the data into separate modules.

**License** GPL-2

**Depends** igraph

**Suggests** Cairo

**NeedsCompilation** no

**Repository** CRAN

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corclass-package

*Correlational Class Analysis package*

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**Description**

This package implements the Correlational Class Analysis methodology described by Boutyline (under review). The correlational class analysis of a survey dataset produces a partition of the population into separate modules. This is done in four steps:

1. Create a matrix  $G$  of absolute row correlations. This is the network adjacency matrix.
2. Set statistically insignificant correlations to 0 to reduce noise.
3. Use `igraph`'s `leading.eigenvector.community` to partition this network into modules.
4. Return an object describing the resulting class assignments (as well as the separate data frames describing the individual modules.)

CCA substantially improves the accuracy of the Relational Class Analysis (RCA) algorithm proposed by Goldberg (2011). See Boutyline (under review) for details.

**Details**

Package:	corclass
Type:	Package
Version:	0.1
Date:	2013-11-25
License:	GPL

The main function is `cca`. `plot.cca` plots the modules produced by `cca`. Sample data can be accessed via `data(cca.example)`.

**Author(s)**

Written and maintained by Andrei Boutyline, <[andrei.boutyline@gmail.com](mailto:andrei.boutyline@gmail.com)>.

**References**

Boutyline, Andrei. Under review. "Correlational Class Analysis Draws a More Accurate Map (Comment on Goldberg)." Working paper available from [www.ocf.berkeley.edu/~andrei](http://www.ocf.berkeley.edu/~andrei).

**See Also**

This package makes heavy use of [igraph](#).  
The CCA algorithm is an improvement of [RCA](#).

## Examples

```
data(cca.example)
res1 <- cca(cca.example)
plot(res1, 1)
```

---

cca

*Main function for CCA.*

---

## Description

Perform a correlational class analysis of the data, resulting in a partition of the data into separate modules. This consists of four steps:

1. Create a matrix G of absolute row correlations. This is the network adjacency matrix.
2. Set statistically insignificant correlations to 0 to reduce noise.
3. Use igraph's `leading.eigenvector.community` to partition this network into modules.
4. Return an object describing the resulting class assignments (as well as the separate data frames describing the individual modules.)

## Usage

```
cca(dtf, filter.significance = TRUE, filter.value = 0.01,
    zero.action = c("drop", "ownclass"), verbose = TRUE)
```

## Arguments

<code>dtf</code>	The data frame containing the variables of interest.
<code>filter.significance</code>	Significance filtering sets "insignificant" ties to 0 to decrease noise and increase stability. Simulation results show that this greatly increases accuracy in many settings. Set <code>filter.significance = FALSE</code> to disable this.
<code>filter.value</code>	Minimum significance cutoff. Absolute row correlations below this value will be set to 0.
<code>zero.action</code>	What to do with 0-variance rows before partitioning the graph. If <code>zero.action</code> is "drop", CCA drop rows with 0 variance from the analyses (default). If <code>zero.action</code> is "ownclass", the correlations between 0-variance rows and all other rows is set to 0, and the correlations between all pairs of 0-var rows are set to 1. This effectively creates a "zero class".
<code>verbose</code>	Whether to print details of what CCA is doing to the screen.

**Value**

membership	The class assignments produced by CCA.
cormat	The row correlation matrix that was partitioned by CCA. It has a "dtf" attribute which holds the dataframe. Note that, if 0-variance were dropped, they will be excluded from the dataframe as well as the correlation matrix. The "zeros" attribute which holds the indexes of the dropped rows.
modules	For convenience, the dataframe is separated into the modules found by the algorithm. A separate dataframe for each module <i>i</i> can be found in <code>modules[[i]]\$dtf</code> . The matrix of column correlations are in <code>modules[[i]]\$cormat</code> . <code>modules[[i]]\$degenerate</code> indicates whether this module contains undefined. Note that these modules can be plotted via the S3 plot method. See example below.

**Author(s)**

Andrei Boutyline, <[andrei.boutyline@gmail.com](mailto:andrei.boutyline@gmail.com)>.

**References**

Boutyline, Andrei. Under review. "Correlational Class Analysis Draws a More Accurate Map (Comment on Goldberg)." Working paper available from [www.ocf.berkeley.edu/~andrei](http://www.ocf.berkeley.edu/~andrei).

**See Also**

[plot.cca](#)

**Examples**

```
data(cca.example)
res1 <- cca(cca.example) # with igraph 0.7, this should find 3 classes of sizes 218 391 144.
plot(res1, 1) # plot them
plot(res1, 2)
plot(res1, 3)

print(round(res1$modules[[1]]$cormat, 2)) # examine the correlation matrix for the 1st module
print(summary(res1$modules[[1]]$dtf)) # look at its variable ranges
plot(res1, 1, bw = TRUE) # Plot it again in a more journal-friendly format.

# now let's try setting the filter value too high
res2 <- cca(cca.example, filter.value = 0.001)
# With igraph 0.7, the above now finds 17 classes
#   of sizes 216 1 1 371 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2
# The small isolate classes can either be dropped manually, or by increasing filter.value
```

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`cca.example`*Sample data for Correlational Class Analysis.*

---

**Description**

A randomly generated sample dataset for correlational class analysis, created using the approach described in Boutyline (under review). `rownames(cca.example)` contain the true schematic class membership for each row. Every row belonging to one schematic class was created from noisy linear transformations of the same vector.

**Usage**

```
data(cca.example)
```

**Format**

The format is: `num [1:754, 1:10] 4 7 4 7 4 4 7 3 9 8 ... - attr(*, "dimnames")=List of 2 ..$ : chr [1:754] "1" "1" "1" "1" ... ..$ : NULL`

**Source**

Boutyline, Andrei. Under review. "Correlational Class Analysis Draws a More Accurate Map (Comment on Goldberg)." Working paper available from [www.ocf.berkeley.edu/~andrei](http://www.ocf.berkeley.edu/~andrei).

**Examples**

```
data(cca.example)
res1 <- cca(cca.example)
```

---

`plot.cca`*Plotting function for CCA modules.*

---

**Description**

Plot a CCA-produced module as a network diagram. The network nodes are survey variables (columns), and the ties are their correlations. Red (or dashed) ties represent negative correlations. This is a convenience function wrapping `igraph`'s graphing functionality. Writing to a file is done via the Cairo package.

**Usage**

```
## S3 method for class 'cca'
plot(x, module.index, cutoff = 0.05, LAYOUT = layout.kamada.kawai,
     drop.neg.ties.for.layout = TRUE, bw = FALSE, main = NULL, file = NULL, ...)
```

**Arguments**

<code>x</code>	The cca object returned by <a href="#">cca</a> .
<code>module.index</code>	Index of module to plot, between 1 and <code>length(x\$modules)</code> .
<code>cutoff</code>	Minimum absolute column correlation to plot.
<code>LAYOUT</code>	If this is a function, it is assumed to be one of the layout routines from <code>igraph</code> (or something that returns data in the same format). Otherwise, it is assumed to be the layout returned by such a function.
<code>drop.neg.ties.for.layout</code>	Whether to drop negative ties for the purpose of layout. This may be necessary because some layout algorithms do not work if negative ties are present. Note that the negative ties are only dropped for the purposes of layout. They will still be included in the actual plot.
<code>bw</code>	Whether to print in color for screen viewing ( <code>FALSE</code> ), or in b&w with dashed lines for negative ties for a journal manuscript ( <code>TRUE</code> ).
<code>main</code>	Caption at the top of the graph. If <code>NULL</code> , the module number is used as the caption.
<code>file</code>	If a filename is provided, the graph is saved as a pdf with that filename. Note that this requires the Cairo package.
<code>...</code>	Unused.

**Value**

If the `LAYOUT` parameter is a layout function, then the return value is the static layout generated by this function (this allows the same exact layout to be reproduced in the future—see example below). Otherwise, it is the same static layout that was passed to `plot.cca`.

**Author(s)**

Andrei Boutyline, <andrei.boutyline@gmail.com>

**See Also**

[cca](#)

**Examples**

```
data(cca.example)
res1 <- cca(cca.example) # with igraph 0.7, this should find 3 classes of sizes 218 391 144.
plot(res1, 1) # plot the first module
plot(res1, 2) # plot the second module
plot(res1, 3) # plot the third module

plot(res1, 1, bw = TRUE) # check out first module in black and white
plot(res1, 1, LAYOUT = layout.fruchterman.reingold) # try a different layout algorithm

# example of saving a fixed layout
layout1 <- plot(res1, 1) # try out a layout ...
```

```
layout1 <- plot(res1, 1) # ... try again
layout1 <- plot(res1, 1) # ... until one looks good
plot(res1, 1, LAYOUT = layout1, file = "module1.pdf") # now save it to a file
```

---

print.cca                      *Print description of CCA results.*

---

## Description

Prints a concise description of CCA results, including module membership counts. Reports if any of the modules are degenerate.

## Usage

```
## S3 method for class 'cca'
print(x, ...)
```

## Arguments

x	The cca object returned by <a href="#">cca</a> .
...	Unused.

## Author(s)

Andrei Boutyline, <[andrei.boutyline@gmail.com](mailto:andrei.boutyline@gmail.com)>

## See Also

[plot.cca](#), [cca](#)

## Examples

```
data(cca.example)
res1 <- cca(cca.example)
print(res1)
```

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