

aheatmap: a Powerful Annotated Heatmap Engine

Package *NMF* - Version 0.21

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Abstract

This vignette showcases the main features of the annotated heatmap engine implemented by the function `aheatmap`. This engine is a highly enhanced modification of the function `pheatmap` from the *pheatmap* package¹, and provides convenient and quick ways of producing high quality and customizable annotated heatmaps. Currently this function is part of the package *NMF*, but will most probably eventually constitute a separate package on its own.

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1 Overview

The development of the function `aheatmap` started as modification of the function `pheatmap` from the *pheatmap* package². The initial objective was to improve and increase its capabilities, as well as defining a simplified interface that was more consistent with the R core function `heatmap`. It is evolving into a general, flexible, powerful and easy to use engine for drawing annotated heatmaps.

The function `aheatmap` has many advantages compared to other heatmap functions such as `heatmap`, `gplots::heatmap2`, `heatmap.plus::heatmap.plus`, or `pheatmap`:

- Annotations: unlimited number of annotation tracks can be added to *both* columns and rows, with automated colouring for categorical and numeric variables.
- Compatibility with both base and grid graphics: the function can be directly called in drawing contexts such as `grid`, `mflow` or `layout`. We believe that this is a feature many R users will enjoy, and that is strictly impossible with base heatmaps.
- Legends: default automatic legend and colouring;
- Customisation: clustering methods, annotations, colours and legend can all be customised, even separately for rows and columns;

¹<http://cran.r-project.org/package=pheatmap>

²<http://cran.r-project.org/package=pheatmap>

- Convenient interface: many arguments provide multiple ways of specifying their value(s), which speeds up developping/writing and reduce the amount of code required to generate customised plots (e.g. see ??).
- Aesthetics: the heatmaps look globally cleaner, the image and text components are by default well proportioned relatively to each other, and all fit within the graphic device – if not set to an unreasonably small size.

2 Components

Annotated heatmaps essentially use **grid** graphics³, composing the global picture by putting together the following components (or viewports in **grid** language):

dendrograms clusters and order columns/rows;

annotations are additional *tracks* that provide extra information about each column/row according to some associated auxiliary data;

data matrix , i.e. the heatmap itself, shown as coloured cells;

labels associates each column/row with some textual information;

legends such as value scales or color code used for the data matrix or annotations;

other information like main title, sub-title, extra information pane.

Section 2 shows a diagram of two possible grid layout that combined the above listed components into a complete annotated heatmap.

3 Annotation tracks

4 Dendrograms

5 Column/row ordering

6 Colours

7 Labels

8 Legends

9 Session Info

- R version 3.0.3 (2014-03-06), x86_64-pc-linux-gnu
- Locale: LC_CTYPE=en_US.UTF-8, LC_NUMERIC=C, LC_TIME=en_US.UTF-8, LC_COLLATE=en_US.UTF-8, LC_MONETARY=en_US.UTF-8, LC_MESSAGES=en_US.UTF-8, LC_PAPER=en_US.UTF-8, LC_NAME=C, LC_ADDRESS=C, LC_TELEPHONE=C, LC_MEASUREMENT=en_US.UTF-8, LC_IDENTIFICATION=C
- Base packages: base, datasets, graphics, grDevices, methods, parallel, stats, utils

³Except for drawing dendrograms, which are plotted using the proven and well optimised base function `plot.dendrogram`.

```
# default layout
aheatmap_layout()
# alternative layout
aheatmap_layout("amld | dlma")
```

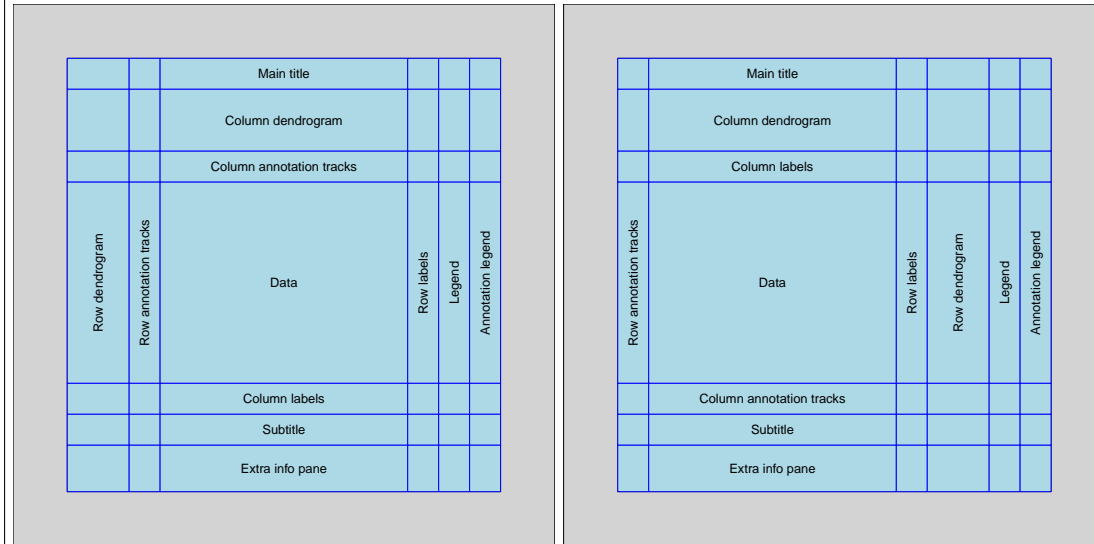


Figure 1: Grid layout diagram of annotated heatmaps: (left) default layout and (right) an alternative layout, with separate specification for rows and columns – passed as a single string.

- Other packages: BH 1.51.0-4, bigmemory 4.4.6, bigmemory.sri 0.1.2, Biobase 2.22.0, BiocGenerics 0.8.0, cluster 1.15.1, knitr 1.5, NMF 0.21, pkgmaker 0.21, registry 0.2, rngtools 1.2.4, synchronicity 1.1.2
- Loaded via a namespace (and not attached): codetools 0.2-8, colorspace 1.2-4, dichromat 2.0-0, digest 0.6.4, doParallel 1.0.8, evaluate 0.5.1, foreach 1.4.1, formatR 0.10, ggplot2 0.9.3.1, grid 3.0.3, gridBase 0.4-7, gtable 0.1.2, highr 0.3, iterators 1.0.6, labeling 0.2, MASS 7.3-30, munsell 0.4.2, plyr 1.8.1, proto 0.3-10, RColorBrewer 1.0-5, Rcpp 0.11.0, reshape2 1.2.2, scales 0.2.3, stringr 0.6.2, tools 3.0.3, xtable 1.7-3