Package ‘CCPlotR’

March 1, 2024

Title  Plots For Visualising Cell-Cell Interactions
Version 1.0.0
Description CCPlotR is an R package for visualising results from tools that predict cell-cell interactions from single-cell RNA-seq data. These plots are generic and can be used to visualise results from multiple tools such as Liana, CellPhoneDB, NATMI etc.
Imports plyr, tidyr, dplyr, ggplot2, forcats, ggraph, igraph, scatterpie, circlize, ComplexHeatmap, tibble, grid, ggbump, stringr, ggtext, ggh4x, patchwork, RColorBrewer, scales, viridis, grDevices, graphics, stats, methods
URL https://github.com/Sarah145/CCPlotR
BugReports https://github.com/Sarah145/CCPlotR/issues
License MIT + file LICENSE
Encoding UTF-8
LazyData false
Roxygen list(markdown = TRUE)
RoxygenNote 7.2.3
Suggests knitr, rmarkdown, BiocStyle, testthat (>= 3.0.0)
VignetteBuilder knitr
biocViews SingleCell, Network, Visualization, CellBiology, SystemsBiology
Config/testthat/edition 3
git_url https://git.bioconductor.org/packages/CCPlotR
git_branch RELEASE_3_18
git_last_commit 560c3de
git_last_commit_date 2023-10-24
Repository Bioconductor 3.18
Date/Publication 2024-03-01
Author Sarah Ennis [aut, cre] (<https://orcid.org/0000-0001-6100-8573>), Pilib Ó Broin [aut], Eva Szegedzi [aut]
Maintainer Sarah Ennis <ennissarah94@gmail.com>
R topics documented:

cc_arrow ................................................................. 2
cc_circos ............................................................... 3
cc_dotplot ............................................................... 4
cc_heatmap .............................................................. 5
cc_network .............................................................. 6
cc_sigmoid .............................................................. 7
paletteMartin .......................................................... 7
toy_data ................................................................. 8
toy_exp ................................................................. 9

Description

This function plots interactions between a pair of cell types

Usage

cc_arrow(
  cc_df,
  cell_types = NULL,
  option = "A",
  n_top_ints = 15,
  exp_df = NULL,
  colours = setNames(paletteMartin(n = 2), cell_types),
  palette = "BuPu"
)

Arguments

cc_df A dataframe with columns 'source', 'target', 'ligand', 'receptor' and 'score'. See toy_data for example.
cell_types A vector of which two cell types to plot.
option Either 'A' or 'B'. Option A will plot the top n_top_ints interactions between cell_types and their scores. Option B will plot the top n_top_ints interactions between cell_types, their scores and the expression of the ligand/receptor genes in the sender/receiver cell types.
n_top_ints The number of top interactions to plot.
exp_df A dataframe containing the mean expression values for each ligand/receptor in each cell type. See toy_exp for an example. Only required for option B.
colours A named vector of colours for each cell type. Default is paletteMartin(), a colourblind-friendly palette. Only used for option A.
palette Which colour palette to use to show the mean expression. Should be one of the RColorBrewer sequential palettes. Only used for option B.

Value
Returns a plot generated with the ggplot2 package

Examples

```r
data(toy_data, toy_exp, package = 'CCPlotR')
cc_arrow(toy_data, cell_types = c("B", "CD8 T"), colours = c("B" = "hotpink", "CD8 T" = "orange"))
cc_arrow(toy_data,
    cell_types = c("NK", "CD8 T"), option = "B", exp_df = toy_exp,
    n_top_ints = 10, palette = "OrRd"
)
```

---

**cc_circos**  
*Circos Plot Function*

**Description**
This function creates a circos plot

**Usage**

```r
c_circos(
    cc_df,
    option = "A",
    n_top_ints = 15,
    exp_df = NULL,
    cell_cols = NULL,
    palette = "BuPu",
    cex = 1,
    show_legend = TRUE,
    scale = FALSE,
    ...
)
```

**Arguments**

- `cc_df` A dataframe with columns 'source', 'target', 'ligand', 'receptor' and 'score'. See toy_data for example.
- `option` Either 'A', 'B' or 'C'. Option A will plot the number of interactions between pairs of cell types, option B will plot the top n_top_ints interactions and their scores. Option C will plot the top n_top_ints interactions, their scores and the mean expression of the ligands/receptors in the sending/receiver cell types.
- `n_top_ints` The number of top interactions to plot. Only required for options B and C.
exp_df A dataframe containing the mean expression values for each ligand/receptor in each cell type. See toy_exp for an example. Only required for option C.
cell_cols A named vector of colours for each cell type. Default uses paletteMartin(), a colourblind-friendly palette.
palette Which colour palette to use to show the mean expression. Should be one of the RColorBrewer sequential palettes.
cex Determines text size
show_legend TRUE or FALSE - whether to add legend or not. Only required for options B and C.
scale TRUE or FALSE - whether to scale each sector to same width. Only required for options B and C.
... Additional parameters passed to chordDiagram function.

Value
Returns a chord diagram generated by the circlize R package

Examples

data(toy_data, toy_exp, package = 'CCPlotR')
cc_circos(toy_data)
cc_circos(toy_data, option = "B", n_top_ints = 10, cex = 0.5)
cc_circos(toy_data,
  option = "C", n_top_ints = 15, exp_df = toy_exp,
  cell_cols = c("B" = "hotpink", "NK" = "orange", "CD8 T" = "cornflowerblue"),
  palette = "PuRd", cex = 0.5
)

cc_dotplot Dotplot Function

Description
This function plots a dotplot

Usage
cc_dotplot(cc_df, option = "A", n_top_ints = 30)

Arguments
cc_df A dataframe with columns 'source', 'target', 'ligand', 'receptor' and 'score'. See toy_data for example.
option Either 'A', 'B', 'CellPhoneDB' or 'Liana'. Option A will plot the number of interactions between pairs of cell types, option B will plot the top n_top_ints interactions and their scores. The 'CellPhoneDB' and 'Liana' options will generate a dotplot in the style of these popular tools.
n_top_ints The number of top interactions to plot. Only required for option B.
**cc_heatmap**

**Value**

Returns a plot generated with the ggplot2 package

**Examples**

data(toy_data, package = 'CCPlotR')
cc_dotplot(toy_data)
cc_dotplot(toy_data, option = "B", n_top_ints = 10)
cc_dotplot(toy_data, option = "Liana", n_top_ints = 15)

data(toy_data, package = 'CCPlotR')
cc_heatmap(toy_data)
cc_heatmap(toy_data, option = "B", n_top_ints = 10)
cc_heatmap(toy_data, option = "CellPhoneDB")

---

### cc_heatmap

**Heatmap Function**

**Description**

This plots a heatmap

**Usage**

cc_heatmap(cc_df, option = "A", n_top_ints = 30)

**Arguments**

- **cc_df** A dataframe with columns ‘source’, ‘target’, ‘ligand’, ‘receptor’ and ‘score’. See toy_data for example.
- **option** Either ‘A’, ‘B’, ‘CellPhoneDB’ or ‘Liana’. Option A will plot the number of interactions between pairs of cell types, option B will plot the top n_top_ints interactions and their scores. The ‘CellPhoneDB’ and ‘Liana’ options will generate a heatmap in the style of these popular tools.
- **n_top_ints** The number of top interactions to plot. Only required for option B.

**Value**

Returns a plot generated with the ggplot2 package

**Examples**

data(toy_data, package = 'CCPlotR')
cc_heatmap(toy_data)
cc_heatmap(toy_data, option = "B", n_top_ints = 10)
cc_heatmap(toy_data, option = "CellPhoneDB")
Network Plot Function

This function plots a network of representing the number of interactions between cell types.

**Usage**

```r
cc_network(
  cc_df,
  colours = paletteMartin(),
  option = "A",
  n_top_ints = 20,
  node_size = 2.75,
  label_size = 4,
  layout = "kk"
)
```

**Arguments**

- `cc_df`: A dataframe with columns 'source', 'target', 'ligand', 'receptor' and 'score'. See `toy_data` for example.
- `colours`: A vector of colours for each cell type. Default is `paletteMartin()`, a colourblind-friendly palette.
- `option`: Either 'A' or 'B'. Option A will plot the number of interactions between pairs of cell types, option B will plot the top `n_top_ints` interactions and their scores.
- `n_top_ints`: The number of top interactions to plot. Only required for option B.
- `node_size`: Point size for nodes in option B.
- `label_size`: Size for labels in option B.
- `layout`: Algorithm for determining layout in option B. One of 'dh', 'drl', 'fr', 'gem', 'graphopt', 'kk', 'lgl', 'mds', 'nicely'. See iGraph layouts for more details.

**Value**

Returns a plot generated with the `ggplot2` package.

**Examples**

```r
data(toy_data, package = 'CCPlotR')
cc_network(toy_data)
cc_network(toy_data, colours = c("orange", "cornflowerblue", "hotpink"), option = "B")
```
**cc_sigmoid**

_Sigmoid Plot Function_

**Description**

This function plots interactions using the `geom_sigmoid` function from the ggbump R package.

**Usage**

```r
cc_sigmoid(cc_df, n_top_ints = 20, colours = paletteMartin())
```

**Arguments**

- `cc_df`: A dataframe with columns 'source', 'target', 'ligand', 'receptor' and 'score'. See `toy_data` for example.
- `n_top_ints`: The number of top interactions to plot.
- `colours`: A named vector of colours for each cell type. Default is `paletteMartin()`, a colourblind-friendly palette.

**Value**

Returns a plot generated with the ggplot2 package.

**Examples**

```r
data(toy_data, package = 'CCPlotR')
cc_sigmoid(toy_data)
cc_sigmoid(toy_data, colours = c(`B` = "hotpink", `CD8 T` = "orange", `NK` = "cornflowerblue"), n_top_ints = 25)
```

---

**paletteMartin**

_Discrete palette generator_

**Description**

Generate a palette of up to 15 colours. The colours are from the paletteMartin palette in the colorBlindess R package.

**Usage**

```r
paletteMartin(n = 15)
```
Arguments

n  Number of colours to return. Max = 15.

Value

Returns a vector of colours of length n.

Examples

scales::show_col(paletteMartin(n = 9))

toy_data  Toy data for CCPlotR

Description

A toy dataset of ligand-receptor interactions to demonstrate cell-cell interaction plots.

Usage

data(toy_data)

Format

An object of class tbl_df (inherits from tbl, data.frame) with 735 rows and 5 columns.

Value

  toy_data:
  A data frame with 735 rows and 5 columns:
  
  source  Cell type expressing the ligand
  target  Cell type expressing the receptor
  ligand  Ligand
  receptor  Receptor
  score  A score for each interaction e.g. -\log_{10}(aggregate_rank) returned by Liana

Source

This is a modified version of the toy dataset that comes with the Liana R package.
toy_exp

Toy expression data for CCPlotR

Description

A dataframe showing the mean expression values for each ligand and receptor in each cell type.

Usage

data(toy_exp)

Format

An object of class grouped_df (inherits from tbl_df, tbl, data.frame) with 477 rows and 3 columns.

Value

toy_exp:
A data frame with 477 rows and 3 columns:

   cell_type  gene mean_exp
   Cell type Ligand/receptor gene Mean (normalised) expression of ligand/receptor gene in cell type
Index

* datasets
  - toy_data, 8
  - toy_exp, 9
cc_arrow, 2
cc_circos, 3
cc_dotplot, 4
cc_heatmap, 5
cc_network, 6
cc_sigmoid, 7
paletteMartin, 7

toy_data, 8
toy_exp, 9