

Package ‘SimiCviz’

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Type Package

Title Visualization Tools for Gene Regulatory Network Analysis

Version 0.99.2

Description Visualization and export utilities for SimiC and SimiCPipeline outputs. The package focuses on importing SimiC-style results (e.g., weights, AUC metrics) from pickle/CSV files, processing and generating publication-ready plots (networks, heatmaps, distributions) and tables saved into a reproducible, ordered directory hierarchy.

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LazyData false

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Imports methods, stats, BiocParallel, viridisLite, utils, Matrix, graphics, SummarizedExperiment, colorspace, gridExtra, ggplot2, dplyr, tibble, tidyr, reshape2, scales, reticulate (>= 1.45.0)

Suggests knitr, rmarkdown, BiocStyle, testthat (>= 3.0.0)

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<code>.compute_cell_auc</code>	<i>Compute AUC for a single cell</i>
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Description

Compute AUC for a single cell

Usage

```
.compute_cell_auc(  
  expr_row,  
  weight_df,  
  target_norm,  
  sort_by,  
  select_top_k = NULL,  
  percent_of_target = 1  
)
```

Arguments

<code>expr_row</code>	expression values for target genes (vector)
<code>weight_df</code>	weight data.frame subset for this cell's label (columns: tf, target, weight)
<code>target_norm</code>	precomputed Euclidean norm of target expression (vector)
<code>sort_by</code>	sorting criterion ("expression" or "weight")
<code>select_top_k</code>	keep only top K targets per TF (NULL = all)
<code>percent_of_target</code>	percentage of targets to use (0-1)

Value

named vector of AUC scores (one per TF)

<code>.ensure_genes_x_cells_format</code>	<i>Validate expression matrix is in genes x cells format</i>
---	--

Description

Strictly enforces that expression matrix is in genes x cells format with column names matching cell identifiers in `cell_labels`.

Usage

```
.ensure_genes_x_cells_format(expr_mat, cell_labels)
```

Arguments

<code>expr_mat</code>	expression matrix
<code>cell_labels</code>	data.frame with cell identifiers in 'cell' column

Value

expression matrix (genes x cells) with validated dimensions

`.make_weight_barplot` *Render a single weight barplot on a ggplot*

Description

Render a single weight barplot on a ggplot

Usage

```
.make_weight_barplot(
  df,
  gene_name,
  gene_type,
  col_map,
  top_n = NULL,
  allowed_genes = NULL
)
```

Arguments

<code>df</code>	long-format data.frame (already subsetting) with columns: <code>gene</code> , <code>weight</code> , <code>label_name</code>
<code>gene_name</code>	character
<code>gene_type</code>	character; "tf" or "target"
<code>col_map</code>	named character vector of colours (keyed by <code>label_name</code>)
<code>top_n</code>	integer or NULL; keep only top N partners by mean abs weight
<code>allowed_genes</code>	character vector or NULL; restrict partner genes to this set

Value

ggplot object

`.plot_weights_paginated`
Shared paginated weight barplot engine

Description

Shared paginated weight barplot engine

Usage

```
.plot_weights_paginated(
  x,
  gene_names = NULL,
  gene_type = c("tf", "target"),
  labels = NULL,
  top_n = NULL,
  allowed_targets = NULL,
  grid = c(4L, 1L),
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 16,
  height = NULL
)
```

Arguments

<code>x</code>	SimiCvizExperiment
<code>gene_names</code>	character vector or NULL (all genes of that type)
<code>gene_type</code>	"tf" or "target"
<code>labels</code>	integer vector of labels (default: all)
<code>top_n</code>	integer or NULL; max partners shown per gene (TF mode only)
<code>allowed_targets</code>	character vector or NULL; restrict targets to this set (TF mode only; use to pass pre-filtered target lists)
<code>grid</code>	integer vector <code>c(nrow, ncol)</code> per page; NULL = single page
<code>save</code>	logical
<code>filename</code>	PDF filename
<code>out_dir</code>	output directory
<code>width, height</code>	page dimensions in inches

Value

Invisibly, list of page grobs.

`.subset_auc_for_label` *Subset collected AUC for a specific label*

Description

Subset collected AUC for a specific label

Usage

```
.subset_auc_for_label(x, label)
```

<code>.weights_to_long</code>	<i>Convert weight list to long-format data frame</i>
-------------------------------	--

Description

Convert weight list to long-format data frame

Usage

```
.weights_to_long(x)
```

Arguments

<code>x</code>	<code>SimiCvizExperiment</code>
----------------	---------------------------------

Value

data.frame with columns: tf, target, weight, label, label_name

<code>AUCProcessor</code>	<i>Initialize AUCProcessor</i>
---------------------------	--------------------------------

Description

Initialize AUCProcessor

Usage

```
AUCProcessor(
  weights,
  expression,
  cell_labels,
  qc_type = NULL,
  qc_threshold = 0.7,
  adj_r2_list = NULL,
  n_cores = 1,
  backend = "sequential"
)
```

Arguments

<code>weights</code>	list with weight matrices per label (if simic input) or data.frame with columns: tf, target, weight, label, tf (if data.frame input). <code>adj_p_val</code> (optional, for p-value filtering <code>'qc_type' = "p_value"</code>).
<code>expression</code>	expression matrix (cells x cells) or path to file. IMPORTANT: Expression must be in genes x cells format (genes as rows, cells as columns), matching Seurat/SingleCellExperiment conventions.
<code>cell_labels</code>	data.frame with cell-to-label mapping

qc_type	character type of quality metric. Values: "adj_r2" or other column name (pvalue, adj_p_val, etc.) provided in weights in data.frame format. If "adj_r2", targets with R2 below threshold are filtered out. If other (i.e. "p_value"), targets with qc_metric above threshold are filtered out.
qc_threshold	threshold for filtering targets based on qc_metric (default: 0.7 for R2).
adj_r2_list	(optional) A list of R2 values per label per Only used if weights are provided in list format qc_type is "adj_r2".
n_cores	number of cores for parallelization (default: 1)
backend	parallelization backend ("sequential", "multicore", "multisession")

Value

A [AUCProcessor](#) object with initialized slots.

Examples

```
weight_path <- system.file("extdata", "example_weights.csv",
                           package = "SimiCviz")
weights_df <- read_weights_csv(weight_path)
expression_mat_path <- system.file("extdata",
                                   file.path("inputFiles", "example_expression.pickle"),
                                   package = "SimiCviz")
cell_labels_path <- system.file("extdata",
                                file.path("inputFiles", "disease_stage_annotation.csv"),
                                package = "SimiCviz")
cell_labels <- load_cell_labels(cell_labels_path, header = TRUE, sep = ",")

AS_processor <- AUCProcessor(weights = weights_df,
                             expression = expression_mat_path,
                             cell_labels = cell_labels,
                             qc_type = "adj_p_val",
                             qc_threshold = 0.05, # Filter targets above
                             n_cores = 2,
                             backend = "multisession")
```

AUCProcessor-class *AUCProcessor class*

Description

Efficient calculator for TF activity scores (AUC) based on GRN weights and cell-specific expression.

Usage

```
## S4 method for signature 'AUCProcessor'
show(object)
```

Arguments

object A [AUCProcessor](#) object.

Value

An object of class AUCProcessor with slots for weights, expression, and computed AUC scores.

Slots

weights list with weight matrices per label (TFs x targets)
 expression data.frame or matrix (genes x cells)
 cell_labels data.frame with columns 'cell' and 'label'
 target_ids character vector of target gene IDs
 tf_ids character vector of TF gene IDs
 auc_results matrix to store computed activity scores (cells x TFs)
 parallel_params list with parallelization settings

Examples

```
# Initialize an AUCProcessor object
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30)))),
                    "1" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30)))))
cell_labels <- data.frame(cell= c("Cell1", "Cell2"), label = c("0", "1"))
expr <- matrix(rnorm(60), nrow=2, byrow = FALSE,
              dimnames = list(c("Cell1", "Cell2"),paste0("Gene", 1:30)))

processor <- AUCProcessor(weights = weights_list,
                          expression = expr,
                          cell_labels = cell_labels)
```

auc_list_to_df

Collect per-label AUC matrices using cell labels

Description

Given a list of AUC matrices (one per label) and a cell-labels data.frame, subsets each matrix to include only the cells belonging to that label and collects them into a single data.frame. This is a helper function to transform raw per-label AUC outputs into the "collected" format used by SimiCvizExperiment@auc.

Usage

```
auc_list_to_df(auc_list, cell_labels_df)
```

Arguments

auc_list Named list of AUC matrices (cells × TFs). Names should correspond to label identifiers (e.g. "0", "1").

cell_labels_df A data.frame with columns cell and label, as returned by [load_cell_labels](#).

Value

A data.frame with cells in rows and TFs in columns, containing the activity scores for the specific labels.

Examples

```
# Example usage with per-label AUC matrices
auc_list <- list("0" = matrix(rnorm(100), nrow = 10,
                             dimnames = list(paste0("cell_", 1:10),
                                             paste0("TF", 1:10))),
               "1" = matrix(rnorm(100), nrow = 10,
                             dimnames = list(paste0("cell_", 1:10),
                                             paste0("TF", 1:10))))
cell_labels_df <- data.frame(cell = paste0("cell_", 1:10),
                             label = c(rep(0, 5), rep(1, 5)))
collected_auc <- auc_list_to_df(auc_list, cell_labels_df)
```

calculate_activity_scores

Calculate activity scores from SimiCvizExperiment weights

Description

Efficiently computes TF activity scores for all cells using label-specific GRNs. Avoids redundant computation by calculating only for each cell's corresponding label.

Usage

```
calculate_activity_scores(
  simic,
  expression = NULL,
  adj_r2_threshold = NULL,
  sort_by = "expression",
  select_top_k = NULL,
  percent_of_target = 1,
  n_cores = 1,
  backend = "sequential",
  verbose = TRUE
)
```

Arguments

simic	SimiCvizExperiment object with weights and expression data
expression	expression matrix (cells x genes). If NULL, uses data from metadata or file path if available.
adj_r2_threshold	minimum adjusted R2 for target filtering (default: 0.7)
sort_by	sorting criterion ("expression", "weight", or "adj_r2")
select_top_k	keep only top K targets per TF (NULL = all)

percent_of_target	percentage of targets to use (0-1)
n_cores	number of cores for parallelization (1 = sequential)
backend	parallelization backend ("sequential", "multicore", "multisession")
verbose	print progress messages

Value

SimiCvizExperiment with computed AUC scores added to @auc slot

Examples

```
# Generate minimal example data
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30)))),
                    "1" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30))))))
cell_labels <- data.frame(cell= c("Cell1", "Cell2"), label = c("0", "1"))
simic <- SimiCvizExperiment(weights = weights_list, cell_labels = cell_labels)
expr <- matrix(rnorm(60), nrow=2, byrow = FALSE,
              dimnames = list(c("Cell1", "Cell2"),paste0("Gene", 1:30)))
simic <- calculate_activity_scores(simic,
                                expression = expr,
                                sort_by = "expression",
                                n_cores = 2,
                                backend ="multicore")
```

calculate_dissimilarity

Calculate dissimilarity scores across phenotype labels

Description

Compares per-cell TF activity-score distributions between phenotype labels using a histogram-based MinMax divergence.

Usage

```
calculate_dissimilarity(
  x,
  labels = NULL,
  cell_groups = NULL,
  n_breaks = 100L,
  verbose = TRUE
)
```

Arguments

x	A SimiCvizExperiment object.
labels	Integer vector of label keys or character vector of label display names to compare (default: all labels). Mixing types is allowed.
cell_groups	Optional named list mapping group names to character vectors of cell identifiers.
n_breaks	Number of histogram bins (default 100).
verbose	Logical; print progress messages (default TRUE).

Value

A data.frame with TFs as rows, sorted by score (descending).

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
dis_score <- calculate_dissimilarity(simic)
```

calculate_ecdf_auc	<i>Calculate ECDF AUC</i>
--------------------	---------------------------

Description

Calculates the area under the empirical cumulative distribution function.

Usage

```
calculate_ecdf_auc(
  x,
  tf_names = NULL,
  labels = NULL,
  integration_range = c(0, 1),
  percentile = 0.5
)
```

Arguments

x	A SimiCvizExperiment object.
tf_names	Optional TF identifiers to evaluate. Defaults to all TFs in collected AUC data.
labels	Optional labels to evaluate. Accepts label ids or label names.
integration_range	Numeric vector of length 2 defining lower and upper bounds for integration.
percentile	Percentile used to compute the auxiliary AUC50/x_at_p50 metrics.

Value

A data.frame with one row per TF and per-label ECDF-derived metrics.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds", package = "SimiCviz"))
ecdf_metrics <- calculate_ecdf_auc(simic, tf_names = c("MEF2D", "SATB1"))
head(ecdf_metrics)
```

compute_auc

Compute activity scores for an object

Description

S4 generic for computing TF activity scores (AUC-like metrics).

Usage

```
compute_auc(object, ...)
```

Arguments

object An object that implements a compute_auc method.

... Additional method-specific arguments.

Value

Object with computed activity scores.

Examples

```
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
  dimnames = list(paste0("TF", 1:3),
    paste0("Gene", 1:30)))),
  "1" = as.data.frame(matrix(rnorm(90), nrow = 3,
  dimnames = list(paste0("TF", 1:3),
    paste0("Gene", 1:30))))))
cell_labels <- data.frame(cell= c("Cell1", "Cell2"), label = c("0", "1"))
expr <- matrix(rnorm(60), nrow=2, byrow = FALSE,
  dimnames = list(c("Cell1", "Cell2"),paste0("Gene", 1:30)))

processor <- AUCProcessor(weights = weights_list,
  expression = expr,
  cell_labels = cell_labels)
processor <- compute_auc(processor, sort_by = "expression")
```

 compute_auc,AUCProcessor-method

Compute activity scores for all cells

Description

Efficiently calculates TF activity scores for each cell using its corresponding label-specific GRN. Uses BiocParallel for parallelization.

Usage

```
## S4 method for signature 'AUCProcessor'
compute_auc(
  object,
  sort_by = "expression",
  select_top_k = NULL,
  percent_of_target = 1,
  verbose = TRUE
)
```

Arguments

object	A AUCProcessor object.
sort_by	sorting criterion ("expression" or "weight")
select_top_k	keep only top K targets per TF (NULL = use all)
percent_of_target	percentage of targets to use (0-1)
verbose	print progress messages

Value

A [AUCProcessor](#) object with computed scores in the auc_results slot.

 export_SimiCviz_csv *Export SimiCvizExperiment tables to CSV*

Description

Exports weights and AUC tables into an organized directory structure:

data/weights weights tables

data/auc AUC tables (collected cells × TF format)

Usage

```
export_SimiCviz_csv(x, out_dir, prefix = "SimiCviz", overwrite = FALSE)
```

Arguments

x [SimiCvizExperiment](#) object.
 out_dir root output directory.
 prefix filename prefix (default: "SimiCviz").
 overwrite logical; overwrite existing files.

Value

Invisibly, a list of file paths.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
export_SimiCviz_csv(simic, out_dir = tempdir(), prefix = "simic_export")
```

get_auc	<i>Extract activity scores from an object</i>
---------	---

Description

S4 generic for retrieving computed TF activity scores.

Usage

```
get_auc(object, ...)
```

Arguments

object An object that implements a get_auc method.
 ... Additional method-specific arguments.

Value

Extracted activity scores.

Examples

```
#' # Generate minimal example data
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30)))),
                    "1" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30))))))
cell_labels <- data.frame(cell= c("Cell1", "Cell2"), label = c("0", "1"))
set.seed(123)
expr <- matrix(rnorm(60), nrow=2, byrow = FALSE,
              dimnames = list(c("Cell1", "Cell2"),paste0("Gene", 1:30)))

processor <- AUCProcessor(weights = weights_list,
                        expression = expr,
```

```

                                cell_labels = cell_labels)
processor <- compute_auc(processor, sort_by = "expression")
auc_scores <- get_auc(processor)
head(auc_scores)
#           TF1           TF2           TF3
# Cell11 0.5308869 0.5307807 0.5618426
# Cell12 0.5752393 0.5399460 0.5304443

```

get_auc,AUCProcessor-method

Get computed activity scores

Description

Get computed activity scores

Usage

```

## S4 method for signature 'AUCProcessor'
get_auc(object, format = "wide")

```

Arguments

object	A AUCProcessor object.
format	Output format: "wide" for cells x TF table, or "long" for long format with columns cell, tf, score, and label.

Value

A data.frame with activity scores in the requested format.

get_tf_network

Extract stacked TF-target weight matrix across labels

Description

For a given TF, extracts the regulatory weight for every target gene in each label. Targets whose adjusted R^2 falls below `r2_threshold` in a given label receive NA (analogous to Python's `get_TF_network(..., stacked=TRUE)`).

Usage

```
get_tf_network(x, tf_name, labels = NULL, r2_threshold = NULL)
```

Arguments

x	A <code>SimiCvizExperiment</code> object.
tf_name	Character; name of the transcription factor.
labels	Integer vector of labels to include (default: all).
r2_threshold	Numeric or NULL. If non-NULL, weights for targets with adjusted R^2 below this value are set to NA.

Value

A data.frame with target genes as rows and one column per label (named by label_names).

Examples

```
# Example usage
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
network <- get_tf_network(simic, c("MEF2D"),
                          labels = c(0, 1),
                          r2_threshold = 0.7)

print(network)
```

is.SimiCvizExperiment *Check if object is a SimiCvizExperiment*

Description

Tests whether an object is of class SimiCvizExperiment.

Usage

```
is.SimiCvizExperiment(x)
```

Arguments

x An object to test.

Value

Logical, TRUE if x is a SimiCvizExperiment.

Examples

```
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                  dimnames = list(paste0("TF", 1:3),
                                                                  paste0("Gene", 1:30)))),
                    "1" = as.data.frame(matrix(rnorm(90), nrow = 3),
                                                  dimnames = list(paste0("TF", 1:3),
                                                                  paste0("Gene", 1:30))))

simic <- SimiCvizExperiment(weights = weights_list)
is.SimiCvizExperiment(simic) # should return TRUE
```

load_cell_labels	<i>Load cell-to-label mapping</i>
------------------	-----------------------------------

Description

Reads or constructs a two-column `data.frame` (`cell`, `label`) from various input formats.

Usage

```
load_cell_labels(x, ...)
```

Arguments

<code>x</code>	One of: character (length 1) Path to a CSV / TSV file. If the file has columns named <code>cell</code> and <code>label</code> they are used directly. Otherwise the first column is treated as <code>cell</code> and the second as <code>label</code> . A single-column file (or headerless file with one field) is treated as a label-only vector — see next bullet. character / integer / numeric vector A vector of labels, one per cell, in the same order as rows of the AUC matrix. Cell IDs are generated as <code>cell_1</code> , <code>cell_2</code> , named vector Names are used as cell IDs and values as labels. data.frame Must contain columns <code>cell</code> and <code>label</code> , or exactly two columns (first = <code>cell</code> , second = <code>label</code>).
<code>...</code>	Additional arguments passed to file readers when <code>x</code> is a path.

Value

A `data.frame` with columns `cell` (`character`) and `label` (`integer`), sorted by `cell`.

Examples

```
cell_labels_path <- system.file("extdata",
                                file.path("inputFiles", "disease_stage_annotation.csv"),
                                package = "SimiCviz")
cell_labels <- load_cell_labels(cell_labels_path, header = TRUE, sep = ",")
head(cell_labels)
#           cell category label
# 1 AGGGTGATCTGAGGGA-1-NBM-10.138P      NBM      0
# 2 CCTAGCTTCTCCAACC-1-NBM-1.138P      NBM      0
# 3 ATTACTCTCGTGGTCG-1-NBM-10.138P      NBM      0
# 4 TAAGAGAAGCCGCCTA-1-NBM-8.138P      NBM      0
# 5 GATCGATTGAGAGGTG-1-NBM-8.138P      NBM      0
# 6 ACATCAGGTCGCGGTT-1-NBM-10.138P      NBM      0
```

load_collected_auc	<i>Load a collected AUC CSV into a data.frame</i>
--------------------	---

Description

Reads a cells $\times$ TF CSV file (as written by internal function `.save_collected_auc` or `SimiCPipeline`). This is the canonical import for any GRN method that produces per-cell TF activity scores.

Usage

```
load_collected_auc(file, ...)
```

Arguments

<code>file</code>	Path to a CSV file with cells in rows and TFs in columns.
<code>...</code>	Additional arguments passed to read.csv .

Value

A data.frame with cell IDs as row names.

Examples

```
auc_file <- system.file("extdata",
  file.path("outputSimic/example_simic_auc_collected.csv"),
  package = "SimiCviz")
auc_df <- load_collected_auc(auc_file)
```

load_expression_matrix

Load expression matrix from various sources /file formats Allowed formats:

- *CSV file*
 - *h5ad file*
 - *rds file (Seurat or SingleCellExperiment object)*
 - *matrix or data.frame in R*
-

Description

Load expression matrix from various sources /file formats Allowed formats:

- CSV file
- h5ad file
- rds file (Seurat or SingleCellExperiment object)
- matrix or data.frame in R

Usage

```
load_expression_matrix(expression)
```

Arguments

expression file path, matrix, or data.frame

Value

expression matrix

Examples

```
expression_mat_path <- system.file("extdata",
                                   file.path("inputFiles", "example_expression.pickle"),
                                   package = "SimiCviz")
expression_mat <- load_expression_matrix(expression_mat_path)
```

load_from_csv	<i>Create a SimiCvizExperiment from CSV files</i>
---------------	---

Description

Create a SimiCvizExperiment from CSV files

Usage

```
load_from_csv(
  weights_file,
  auc_file = NULL,
  cell_labels_file = NULL,
  meta = list()
)
```

Arguments

weights_file CSV with weights (long format: tf, target, weight, and optionally label).
 auc_file optional CSV with AUC metrics (collected cells × TF format).
 cell_labels_file optional CSV with cell labels (required columns: cell, label).
 meta optional named list with metadata.

Value

[SimiCvizExperiment](#) object.

Examples

```
# Example usage with CSV files
weight_path <- system.file("extdata", "example_weights.csv",
                           package = "SimiCviz")
auc_path <- system.file("extdata", "example_auc.csv",
                        package = "SimiCviz")
cell_labels_path <- system.file("extdata",
                                file.path("inputFiles", "disease_stage_annotation.csv"),
                                package = "SimiCviz")
simic <- load_from_csv(weights_file = weight_path,
                      auc_file = auc_path,
                      cell_labels_file = cell_labels_path,
                      meta = list(run_name = "example_run"))
is.SimiCvizExperiment(simic) # TRUE
```

load_SimiCPipeline	Create a SimiCvizExperiment from SimiCPipeline output path
--------------------	--

Description

Loads weights and AUC data following this priority chain for AUC:

1. Collected CSV (cells $\times$ TF, all labels merged) load_collected_auc
2. Per-label pickle $\rightarrow$ collect $\rightarrow$ save CSV read_auc_pickle $\rightarrow$ auc_list_to_df $\rightarrow$.save_collected_auc (internal)

Usage

```
load_SimiCPipeline(
  project_dir,
  run_name = NULL,
  lambda1 = NULL,
  lambda2 = NULL,
  meta = list()
)
```

Arguments

project_dir	root directory of a SimiCPipeline project.
run_name	name of the run experiment.
lambda1	L1 regularization parameter.
lambda2	L2 regularization parameter.
meta	optional named list with metadata.

Details

The canonical AUC format stored in `SimiCvizExperiment@auc` is always a single data.frame with cells in rows and TFs in columns (the "collected" format), compatible with any GRN method producing per-cell TF activity scores.

Value

`SimiCvizExperiment` object.

Examples

```
# simic_full <- load_SimiCPipeline(
#   project_dir = "path/to/simic_run",
#   run_name    = "example",
#   lambda1     = "0.01",
#   lambda2     = "0.001")
```

`plot_auc_cumulative` *Plot AUC cumulative (ECDF) curves by label*

Description

Plot AUC cumulative (ECDF) curves by label

Usage

```
plot_auc_cumulative(
  x,
  tf_names = NULL,
  labels = NULL,
  alpha = 0.8,
  rug = FALSE,
  grid = c(4L, 2L),
  percentile = 0.5,
  include_table = TRUE,
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 14,
  height = NULL
)
```

Arguments

<code>x</code>	A <code>SimiCvizExperiment</code> object.
<code>tf_names</code>	Optional TF identifiers to plot. Defaults to all available.
<code>labels</code>	Optional labels to include.
<code>alpha</code>	Line transparency for ECDF curves.
<code>rug</code>	Logical; draw rug marks at the x-axis.
<code>grid</code>	Integer vector <code>c(nrow, ncol)</code> for page layout.
<code>percentile</code>	Percentile used in ECDF summary metrics.
<code>include_table</code>	Logical; add ECDF metrics table below each panel.
<code>save</code>	Logical; save to PDF.
<code>filename</code>	Output filename when <code>save = TRUE</code> .
<code>out_dir</code>	Output directory when <code>save = TRUE</code> .
<code>width, height</code>	Output page dimensions.

Value

Invisibly, a list of grobs/plots.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds", package = "SimiCviz"))
plot_auc_cumulative(
  simic,
  tf_names = c("MEF2D", "SATB1"),
  rug = TRUE,
  grid = c(1L, 2L)
)
```

plot_auc_distributions

Plot AUC density distributions by label

Description

Plot AUC density distributions by label

Usage

```
plot_auc_distributions(
  x,
  tf_names = NULL,
  labels = NULL,
  fill = TRUE,
  alpha = 0.5,
  bw_adjust = 1,
  rug = FALSE,
  grid = c(4L, 2L),
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 14,
  height = NULL
)
```

Arguments

x	A SimiCvizExperiment object.
tf_names	Optional TF identifiers to plot. Defaults to all available.
labels	Optional labels to include.
fill	Logical; if TRUE, draw filled densities.
alpha	Density transparency.
bw_adjust	Bandwidth adjustment passed to density estimation.
rug	Logical; draw rug marks.

grid	Integer vector <code>c(nrow, ncol)</code> for page layout. Use <code>NULL</code> for a single auto-sized page.
save	Logical; save to PDF.
filename	Output filename when <code>save = TRUE</code> .
out_dir	Output directory when <code>save = TRUE</code> .
width, height	Output page dimensions.

Value

Invisibly, a list of ggplot objects.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds", package = "SimiCviz"))
plot_auc_distributions(
  simic,
  tf_names = c("MEF2D", "SATB1"),
  fill      = TRUE,
  alpha     = 0.6,
  bw_adjust = 1/8,
  rug       = TRUE,
  grid      = c(1L, 2L)
)
```

plot_auc_heatmap	<i>Plot mean AUC heatmap by TF and label</i>
------------------	--

Description

Plot mean AUC heatmap by TF and label

Usage

```
plot_auc_heatmap(
  x,
  tf_names = NULL,
  labels = NULL,
  top_n = NULL,
  cmap = "cividis",
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 10,
  height = NULL
)
```

Arguments

x	A SimiCvizExperiment object.
tf_names	Optional TF identifiers to plot. Defaults to all available.
labels	Optional labels to include.
top_n	Optional number of TFs to keep by dynamic range.
cmap	Colour map specification passed to internal palette helpers.
save	Logical; save to PDF.
filename	Output filename when save = TRUE.
out_dir	Output directory when save = TRUE.
width, height	Output page dimensions.

Value

Invisibly, the ggplot object.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds", package = "SimiCviz"))
plot_auc_heatmap(simic, top_n = 5)
```

```
plot_auc_summary_statistics
```

Plot AUC summary statistics

Description

Plot AUC summary statistics

Usage

```
plot_auc_summary_statistics(
  x,
  labels = NULL,
  high_threshold = 0.5,
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 14,
  height = 10
)
```

Arguments

x	A SimiCvizExperiment object.
labels	Optional labels to include.
high_threshold	Threshold used to count highly active TFs.
save	Logical; save to PDF.
filename	Output filename when save = TRUE.
out_dir	Output directory when save = TRUE.
width, height	Output page dimensions.

Value

Invisibly, a named list of plot objects.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds", package = "SimiCviz"))
plot_auc_summary_statistics(simic)
```

```
plot_dissimilarity_heatmap
```

Plot dissimilarity heatmap

Description

Displays a heatmap of TF regulatory dissimilarity scores, optionally broken down by cell group. Uses **ggplot2** tile geometry.

Usage

```
plot_dissimilarity_heatmap(
  x,
  top_n = NULL,
  sort_by = NULL,
  dissim_df = NULL,
  cmap = NULL,
  show_values = TRUE,
  save = FALSE,
  out_dir = getwd(),
  filename = NULL,
  width = NULL,
  height = NULL,
  ...
)
```

Arguments

x	A SimiCvizExperiment object.
top_n	Integer; number of top TFs to display (default: all).
sort_by	Column name to sort TFs by. Default: "MinMax_score" (no groups) or "mean_score" (groups).
dissim_df	Optional pre-computed dissimilarity data.frame. If NULL, calculate_dissimilarity is called internally.
cmap	Colour palette specification. Can be: • A viridis palette name: "viridis", "magma", "plasma", "inferno", or "cividis" (requires viridisLite). • A single colour string (gradient from white to that colour). • A character vector of 2+ colours for a custom gradient. • NULL (default): built-in viridis-like gradient.
show_values	Logical; annotate cells with numeric values (default TRUE).

save	Logical; save the plot to a PDF file (default TRUE).
out_dir	Output directory for the PDF (default: working directory).
filename	Custom filename (default: auto-generated).
width, height	PDF dimensions in inches.
...	Additional arguments passed to calculate_dissimilarity.

Value

Invisibly, a list with plot (the ggplot object) and data (the dissimilarity data.frame).

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
plot_dissimilarity_heatmap(simic, top_n = 20)
plot_dissimilarity_heatmap(simic, top_n = 5, cmap = "magma")
plot_dissimilarity_heatmap(simic, cmap = c("white", "red", "darkred"),
                           show_values = FALSE)
```

plot_r2_distribution *Plot adjusted R² distributions*

Description

Plots histograms of adjusted R² values per label, similar to the Python SimiCVisualization\$plot_r2_distribution.

Usage

```
plot_r2_distribution(
  adjusted_r_squared,
  x = NULL,
  labels = NULL,
  threshold = 0.7,
  grid = NULL,
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 10,
  height = NULL
)
```

Arguments

adjusted_r_squared

A **named list** of numeric vectors, one per label. Names must be label identifiers (e.g. "0", "1", ...). This metric is specific to SimiC's regression step; other methods may not produce it, so it is kept as an explicit input rather than extracted from the experiment object.

x	Optional SimiCvizExperiment object used solely to resolve display names and colors for labels. If NULL, default "Label i" naming and a built-in palette are used.
labels	Optional vector of labels to plot (subset of names(adjusted_r_squared)). Defaults to all.
threshold	Numeric R ² threshold line and summary-statistic cutoff (default 0.7).
grid	Optional numeric vector of length 2: c(nrow, ncol). If NULL, one label per row is used.
save	logical; save to PDF (default FALSE).
filename	PDF filename (default "R2_distributions.pdf").
out_dir	output directory (default getwd()).
width, height	page dimensions in inches (defaults 10 x 5*nrow).

Value

Called for side effects (plots). Returns invisible(NULL).

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
plot_r2_distribution(simic@meta$adjusted_r_squared, simic,
                    grid = c(2, 2))
plot_r2_distribution(simic@meta$adjusted_r_squared, simic,
                    threshold = 0.9, labels = c(0, 1))
```

plot_target_weights	<i>Plot weight barplots for target genes</i>
---------------------	--

Description

For each target gene, shows a grouped bar chart of incoming regulatory weights from all TFs, coloured by phenotype label. Mirrors SimiCVisualization.plot_target_weights from the Python package.

Usage

```
plot_target_weights(
  x,
  target_names = NULL,
  labels = NULL,
  grid = c(4L, 1L),
  top_n = NULL,
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 12,
  height = NULL
)
```

Arguments

x	SimiCvizExperiment
target_names	character vector of targets to plot (default: all)
labels	integer or character vector of labels (default: all)
grid	integer vector c(nrow, ncol) per page (default c(4, 1)). Set NULL for a single page.
top_n	Optional integer. Currently accepted for API compatibility; ignored in target mode.
save	logical; save to PDF (default FALSE)
filename	PDF filename (default "target_weights.pdf")
out_dir	output directory (default getwd())
width, height	page dimensions in inches

Value

Invisibly, a list of page grobs.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
plot_target_weights(simic,
                    target_names = c("CD79A", "IGHM"),
                    labels = c(0, 1), grid = c(2, 1))
```

plot_tf_network_heatmap

Plot heatmap of a TF regulatory network across phenotypes

Description

Displays a heatmap showing the regulatory weights of a single transcription factor across its top target genes, with one column per phenotype label. Targets that fail the adjusted- R^2 filter are shown as grey cells labelled " $< R^2$ threshold", mirroring the Python SimiCVisualization.plot_tf_network_heatmap() method.

Usage

```
plot_tf_network_heatmap(
  x,
  tf_name,
  labels = NULL,
  top_n = 10L,
  r2_threshold = NULL,
  cmap = c("blue", "white", "red"),
  show_values = TRUE,
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
```

```

    width = NULL,
    height = NULL
  )

```

Arguments

<code>x</code>	A <code>SimiCvizExperiment</code> object.
<code>tf_name</code>	Character; name of the transcription factor to plot.
<code>labels</code>	Integer or character vector of labels to include (default: all).
<code>top_n</code>	Integer; number of top target genes to display, ranked by maximum absolute weight across labels (default: 10).
<code>r2_threshold</code>	Numeric or NULL. Targets with adjusted R^2 below this value receive NA and are rendered as grey tiles. Passed to <code>.get_tf_network()</code> .
<code>cmap</code>	Colour palette specification, identical to plot_dissimilarity_heatmap . Recommended diverging palettes such as "RdBu_r" (red-white-blue, reversed) or a two-colour vector like <code>c("blue", "white", "red")</code> . Default: <code>c("blue", "white", "red")</code> .
<code>show_values</code>	Logical; annotate each cell with its weight or "< R^2 threshold" text (default TRUE).
<code>save</code>	Logical; save the plot to a PDF file (default TRUE).
<code>filename</code>	Custom filename (default: auto-generated from <code>tf_name</code>).
<code>out_dir</code>	Output directory for the PDF (default: working directory).
<code>width, height</code>	PDF dimensions in inches (auto-calculated if NULL).

Value

Invisibly, a list with components:

plot The ggplot object.

data The (filtered) data.frame of weights used for the plot.

Examples

```

simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
plot_tf_network_heatmap(simic, "SATB1")

# Custom palette and top targets
plot_tf_network_heatmap(simic, "E2F4", top_n = 15,
                        cmap = c("white", "red", "darkred"),
                        r2_threshold = 0.7)

# Only specific labels, no saving
plot_tf_network_heatmap(simic, "MEF2D", labels = c(0, 2),
                        show_values = FALSE)

```

plot_tf_weights	<i>Plot weight barplots for transcription factors</i>
-----------------	---

Description

For each TF, shows a grouped bar chart of regulatory weights across all target genes, coloured by phenotype label. Mirrors SimiCVisualization.plot_tf_weights from the Python package.

Usage

```
plot_tf_weights(
  x,
  tf_names = NULL,
  labels = NULL,
  top_n = 50L,
  allowed_targets = NULL,
  grid = c(4L, 1L),
  save = FALSE,
  filename = NULL,
  out_dir = getwd(),
  width = 16,
  height = NULL
)
```

Arguments

x	SimiCvizExperiment
tf_names	character vector of TFs to plot (default: all)
labels	integer or character vector of labels (default: all)
top_n	integer; show only the top N targets by mean absolute weight (default 50). Applied after allowed_targets filtering.
allowed_targets	character vector or NULL; restrict targets to this pre-filtered set before applying top_n. Useful for passing targets that pass an external significance filter.
grid	integer vector c(nrow, ncol) per page (default c(4, 1)). Set NULL for a single page.
save	logical; save to PDF (default FALSE)
filename	PDF filename (default "TF_weights.pdf")
out_dir	output directory (default getwd())
width, height	page dimensions in inches

Value

Invisibly, a list of page grobs.

Examples

```
simic <- readRDS(system.file("extdata", "simic_full.rds",
                             package = "SimiCviz"))
plot_tf_weights(simic, tf_names = c("MEF2D", "SATB1"),
                top_n = 20, grid = c(2, 1))
```

read_auc_csv	<i>Read SimiC-style AUC results from CSV (compatibility)</i>
--------------	--

Description

Read SimiC-style AUC results from CSV (compatibility)

Usage

```
read_auc_csv(file, ...)
```

Arguments

file	path to a CSV file containing AUC metrics. Expected columns include at least cell, tf, and score.
...	additional arguments passed to <code>utils::read.csv()</code> .

Value

data.frame with AUC metrics.

Examples

```
auc_path <- system.file("extdata", "example_auc.csv",
                        package = "SimiCviz")
auc_df <- read_auc_csv(auc_path)
```

read_auc_pickle	<i>Read SimiCPipeline output AUC matrices (pickle file)</i>
-----------------	---

Description

Returns a list of matrices (one per label), each with cells in rows and TFs in columns.

Usage

```
read_auc_pickle(file)
```

Arguments

file	path to a pickle file containing per-label AUC matrices.
------	--

Value

A named list of data.frames / matrices (one per label).

Examples

```
# This file does not exist in the package due to size constrains, but if you have a SimiCPipeline output, you can

# auc_file <- system.file("extdata",paste0("outputSimic/example_simic_wAUC.pickle"))
# auc_list <- read_auc_pickle(auc_file)
```

read_pickle	<i>Read pickle files</i>
-------------	--------------------------

Description

Read pickle files

Usage

```
read_pickle(file)
```

Arguments

file path to the pickle file

Value

object containing the contents of the pickle file

Examples

```
weights_file <- system.file("extdata",
                             file.path("outputSimic/example_simic_weights.pickle"),
                             package = "SimiCviz")
simic_weights <- read_pickle(weights_file)
```

read_weights_csv	<i>Read Long-style TF-target weights from CSV (compatibility)</i>
------------------	---

Description

Read Long-style TF-target weights from CSV (compatibility)

Usage

```
read_weights_csv(file, ...)
```

Arguments

file path to a CSV file containing TF-target weights. Expected minimal columns: tf, target, weight. Additional columns such as label, etc. are preserved.

... additional arguments passed to `utils::read.csv()`.

Value

data.frame with weights.

Examples

```
weight_path <- system.file("extdata", "example_weights.csv",
                           package = "SimiCviz")
weights_df <- read_weights_csv(weight_path)
head(weights_df)
#      tf target    weight label
# 1 MEF2D  RPLP1 -0.7501612      0
# 2  E2F4  RPLP1  0.0000000      0
# 3 SATB1  RPLP1  0.0000000      0
# 4  IRF1  RPLP1 -0.8536968      0
# 5  ATF6  RPLP1 -2.6133661      0
# 6   JUN  RPLP1  0.0000000      0
```

read_weights_pickle	<i>Read SimiCPipeline output weights (pickle file)</i>
---------------------	--

Description

Read SimiCPipeline output weights (pickle file)

Usage

```
read_weights_pickle(file)
```

Arguments

file path to the pickle file containing SimiC weights.

Value

A list of length n_labels (phenotypes) with GRN weight matrices (TFs x targets).

Examples

```
weights_file <- system.file("extdata",
                           file.path("outputSimic/example_simic_weights.pickle"),
                           package = "SimiCviz")
simic_weights <- read_weights_pickle(weights_file)
```

setCellLabels	<i>Set or update cell-to-label mapping</i>
---------------	--

Description

Set or update cell-to-label mapping

Usage

```
setCellLabels(x, cell_labels)
```

Arguments

x SimiCvizExperiment.
cell_labels Any format accepted by [load_cell_labels](#).

Value

Modified SimiCvizExperiment object.

Examples

```
wt <- data.frame(tf      = c("TF1", "TF2"),
                 target = c("Gene1", "Gene2"),
                 weight = c(0.5, 0.8),
                 label  = c(0, 1)
                )
simic <- SimiCvizExperiment(weights = wt)

cell_labels <- data.frame(cell = c("Cell1", "Cell2"),
                          label = c(0, 1))
simic <- setCellLabels(simic, cell_labels)
```

setLabelNames	<i>Set or update label names and colors</i>
---------------	---

Description

Validates that the provided vectors match the number of labels in cell_labels (preferred) or weights.

Usage

```
setLabelNames(x, label_names, colors = NULL)
```

Arguments

x SimiCvizExperiment.
label_names named character vector mapping labels to display names.
colors optional named character vector mapping labels to colors.

Value

Modified SimiCvizExperiment object.

Examples

```
wt <- data.frame(tf      = c("TF1", "TF2"),
                 target = c("Gene1", "Gene2"),
                 weight  = c(0.5, 0.8),
                 label   = c(0, 1)
                )
cell_labels <- data.frame(cell = c("Cell1", "Cell2"),
                          label = c(0, 1)
                         )
simic <- SimiCvizExperiment(weights = wt, cell_labels = cell_labels)
simic <- setLabelNames(simic,
                       label_names = c("control", "treated"),
                       colors = c("#e0e0e0", "#a8c8ff"))
```

SimiCviz

SimiCviz: Visualization and Activity Score analysis of Gene Regulatory Networks

Description

SimiCviz provides utilities to:

- Read SimiC or SimiCPipeline output tables from CSV and pickle files.
- Organize weights, AUCs, and metadata into a coherent object.
- Visualize regulatory networks and performance metrics.
- Compute and visualize regulatory dissimilarity across phenotypes (see [calculate_dissimilarity](#) and [plot_dissimilarity_heatmap](#)).
- Export plots (PDF) and processed data tables (CSV) into a reproducible directory hierarchy.

Details

The package is designed to be lightweight and focused on visualization, leaving modeling and inference to SimiCPipeline itself.

Author(s)

Maintainer: Irene Marín-Goñi <imarin.4@alumni.unav.es> ([ORCID](#))

See Also

Useful links:

- <https://github.com/ML4BM-Lab/SimiCviz>
- Report bugs at <https://github.com/ML4BM-Lab/SimiCviz/issues>

SimiCvizExperiment	<i>Construct a SimiCvizExperiment object</i>
--------------------	--

Description

Construct a SimiCvizExperiment object

Usage

```
SimiCvizExperiment(
  weights = NULL,
  auc = NULL,
  cell_labels = NULL,
  label_names = NULL,
  colors = NULL,
  meta = list()
)
```

Arguments

weights	list with weight matrices and adjusted R ² .
auc	optional list containing AUC data. The preferred format is <code>list(collected = df)</code> where <code>df</code> is a <code>cells × TF</code> <code>data.frame</code> . A plain <code>data.frame</code> is automatically wrapped into this structure. This canonical format is compatible with any GRN method that produces per-cell TF activity scores.
cell_labels	optional <code>data.frame</code> or vector with cell-to-label mapping. If a plain vector is provided (no cell ids), it must be in the same row order as the AUC matrix.
label_names	optional named character vector mapping labels to display names. Length must match the number of unique labels in <code>cell_labels</code> (if provided) or <code>weights</code> .
colors	optional named character vector mapping labels to colors. Same length requirement as <code>label_names</code> .
meta	optional list of additional metadata.

Value

An object of class "SimiCvizExperiment".

Examples

```
# Create a minimal SimiCvizExperiment with weights
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
  dimnames = list(paste0("TF", 1:3),
    paste0("Gene", 1:30)))),
  "1" = as.data.frame(matrix(rnorm(90), nrow = 3),
    dimnames = list(paste0("TF", 1:3),
      paste0("Gene", 1:30))))
simic <- SimiCvizExperiment(weights = weights_list)
```

SimiCvizExperiment-class

SimiCvizExperiment class

Description

Lightweight S4 container for SimiC visualization data.

Usage

```
## S4 method for signature 'SimiCvizExperiment'
show(object)
```

Arguments

object A [SimiCvizExperiment](#) object.

Value

An object of class `SimiCvizExperiment` with initialized slots.

Slots

`weights` list with weight matrices and adjusted R^2 per label.

`auc` list containing the collected AUC data. The canonical element is `$collected`: a data.frame with cells in rows, TFs in columns, and an optional label column. This format is shared across all GRN methods that produce per-cell TF activity scores.

`cell_labels` data.frame with columns `cell` (character) and `label` (integer). Provides the mapping between cell identifiers and phenotype labels. Required for label-specific AUC visualizations.

`tf_ids` character vector of TF identifiers.

`target_ids` character vector of target gene identifiers.

`label_names` named character vector mapping integer labels to display names.

`colors` named character vector mapping integer labels to colors.

`meta` list with arbitrary metadata.

Examples

```
# Create a SimiCvizExperiment from weights and AUC data
weights_list <- list("0" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30)))),
                    "1" = as.data.frame(matrix(rnorm(90), nrow = 3,
                                                dimnames = list(paste0("TF", 1:3),
                                                                paste0("Gene", 1:30))))))
cell_labels <- data.frame(cell= c("Cell1", "Cell2"), label = c("0", "1"))
simic <- SimiCvizExperiment(weights = weights_list, cell_labels = cell_labels)
```

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