

Package ‘dynplot’

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Type Package

Title Visualising Single-Cell Trajectories

Version 1.1.1

Description Visualise a single-cell trajectory as a graph or dendrogram, as a dimensionality reduction or heatmap of the expression data, or a comparison between two trajectories as a pairwise scatterplot or dimensionality reduction projection. Saelens and Cannoodt et al. (2019) <[doi:10.1038/s41587-019-0071-9](https://doi.org/10.1038/s41587-019-0071-9)>.

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Author Robrecht Cannoodt [aut, cre, cph]

(<<https://orcid.org/0000-0003-3641-729X>>),

Wouter Saelens [aut] (<<https://orcid.org/0000-0002-7114-6248>>)

Maintainer Robrecht Cannoodt <rcannood@gmail.com>

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add_cell_coloring	<i>Add colouring to a set of cells.</i>
-------------------	---

Description

The cells can be coloured by a grouping (clustering), according to a feature (gene expression), closest milestone, or pseudotime from the root of the trajectory.

Usage

```

add_cell_coloring(
  cell_positions,
  color_cells = c("auto", "none", "grouping", "feature", "milestone", "pseudotime"),
  trajectory,
  grouping = NULL,
  groups = NULL,
  feature_oi = NULL,
  expression_source = "expression",
  pseudotime = NULL,
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow"),
  milestones = NULL,
  milestone_percentages = NULL
)

```

Arguments

- | | |
|----------------|---|
| cell_positions | The positions of the cells, represented by a tibble. Must contain column cell_id (character) and may contain columns from, to, pseudotime, depending on the value of color_cells. |
| color_cells | How to color the cells. <ul style="list-style-type: none"> • "auto": Try to figure out how to color cells depending on whether one of the grouping, feature_io, milestones or pseudotime parameters are defined. • "none": Cells are not coloured. • "grouping": Cells are coloured according to a grouping (e.g. clustering). Either the grouping parameter or trajectory\$grouping must be a named character vector. • "feature": Cells are coloured according to the values of a given feature (e.g. gene expression). Either the expression_source parameter or get_expression(trajectory) must be a matrix. Parameter feature_oi must also be defined. • "milestone" (recommended): Cells are coloured according their position in the trajectory. The positioning of the cells are determined by parameter milestone_percentages or else by trajectory\$milestone_percentages. The colours of the milestones can be determined automatically or can be specified by passing a tibble containing character columns milestone_id and color (See add_milestone_coloring() for help in constructing this object). • "pseudotime": Cells are coloured according to the pseudotime value from the root. |
| trajectory | A dynwrap trajectory. |
| grouping | A grouping of the cells (e.g. clustering) as a named character vector. |
| groups | A tibble containing character columns group_id and color. If NULL, this object is inferred from the grouping itself. |
| feature_oi | The name of a feature to use for colouring the cells. |

expression_source	Source of the feature expression, defaults to <code>get_expression(trajectory)</code> .
pseudotime	The pseudotime from the root of the trajectory to the cells as a named numeric vector.
color_milestones	Which palette to use for colouring the milestones <ul style="list-style-type: none"> • auto: Determine colours automatically. If color is already specified in milestones tibble, this will be used. Otherwise, the colour scheme is determined by <code>milestone_palette_list\$auto</code>. • given: The milestones object already contains a column color. • cubeHelix: Use the <code>rje::cubeHelix()</code> palette. • Set3: Use the <code>RColorBrewer::brewer.pal(name = "Set3")</code> palette. • rainbow: Use the <code>grDevices::rainbow()</code> palette.
milestones	Tibble containing the column <code>milestone_id</code> (character). If <code>color_milestones</code> is set to "given", this tibble should also contain a column <code>color</code> (character), containing colour hex codes (e.g. "#123456").
milestone_percentages	The milestone percentages.

Value

A named list with following objects:

- `cell_positions`: The `trajectory$progressions` object with a `color` column added.
- `color_scale`: A ggplot colour scale to add to the downstream ggplot.
- `fill_scale`: A ggplot fill scale to add to the downstream ggplot.
- `color_cells`: The input `color_cells` value, except "auto" will have been replaced depending on which other parameters were passed.

`add_density_coloring` *Color cells using a background density*

Description

Color cells using a background density

Usage

```
add_density_coloring(
  cell_positions,
  color_density = c("none", "grouping", "feature"),
  trajectory,
  grouping = NULL,
  groups = NULL,
  feature_oi = NULL,
```

```

    expression_source = "expression",
    padding = 0.1,
    nbins = 1000,
    bw = 0.2,
    density_cutoff = 0.3,
    density_cutoff_label = density_cutoff/10
  )

```

Arguments

cell_positions The positions of the cells in 2D. Must be a tibble with character column `cell_id` and numeric columns `comp_1` and `comp_2`.

color_density How to color density, can be "none", "grouping", or "feature".

trajectory A dynwrap trajectory.

grouping A grouping of the cells (e.g. clustering) as a named character vector.

groups A tibble containing character columns `group_id` and `color`. If NULL, this object is inferred from the grouping itself.

feature_oi The name of a feature to use for colouring the cells.

expression_source
Source of the feature expression, defaults to `get_expression(trajectory)`.

padding The padding in the edges to the plot, relative to the size of the plot.

nbins Number of bins for calculating the density.

bw Bandwidth, relative to the size of the plot.

density_cutoff Cutoff for density, the lower the larger the areas.

density_cutoff_label
Cutoff for density for labeling, the lower the further way from cells.

Value

A named list with objects:

- **polygon**: A layer to add to the ggplot.
- **scale**: A scale to add to the ggplot.

`add_milestone_coloring`

Add colouring to a set of milestones.

Description

Add colouring to a set of milestones.

Usage

```
add_milestone_coloring(
  milestones = NULL,
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow")
)
```

Arguments

milestones Tibble containing the column `milestone_id` (character). If `color_milestones` is set to "given", this tibble should also contain a column `color` (character), containing colour hex codes (e.g. "#123456").

color_milestones

Which palette to use for colouring the milestones

- `auto`: Determine colours automatically. If `color` is already specified in `milestones` tibble, this will be used. Otherwise, the colour scheme is determined by `milestone_palette_list$auto`.
- `given`: The `milestones` object already contains a column `color`.
- `cubeHelix`: Use the `rje::cubeHelix()` palette.
- `Set3`: Use the `RColorBrewer::brewer.pal(name = "Set3")` palette.
- `rainbow`: Use the `grDevices::rainbow()` palette.

Value

A tibble containing the input character column `milestone_id` and a character column `color` containing colour hex-codes (e.g. "#123456").

dynplot

dynplot: Plotting Single-Cell Trajectories

Description

Visualise a single-cell trajectory as a graph or dendrogram, as a dimensionality reduction or heatmap of the expression data, or a comparison between two trajectories as a pairwise scatterplot or dimensionality reduction projection.

empty_plot	<i>Create an empty plot for spacing</i>
------------	---

Description

Create an empty plot for spacing

Usage

```
empty_plot()
```

Value

An empty ggplot2.

Examples

```
empty_plot()
```

example_bifurcating	<i>An example bifurcating dataset</i>
---------------------	---------------------------------------

Description

An example bifurcating dataset

Usage

```
example_bifurcating
```

Format

An object of class `dynwrap::with_prior` (inherits from `dynwrap::with_expression`, `dynwrap::with_cell_waypoints`, `dynwrap::with_trajectory`, `dynwrap::data_wrapper`, `list`) of length 20.

example_disconnected *An example disconnected dataset*

Description

An example disconnected dataset

Usage

```
example_disconnected
```

Format

An object of class `dynwrap::with_prior` (inherits from `dynwrap::with_expression`, `dynwrap::with_cell_waypoints`, `dynwrap::with_trajectory`, `dynwrap::data_wrapper`, `list`) of length 20.

example_linear *An example linear dataset*

Description

An example linear dataset

Usage

```
example_linear
```

Format

An object of class `dynwrap::with_prior` (inherits from `dynwrap::with_expression`, `dynwrap::with_cell_waypoints`, `dynwrap::with_trajectory`, `dynwrap::data_wrapper`, `list`) of length 20.

example_tree *An example tree dataset*

Description

An example tree dataset

Usage

```
example_tree
```

Format

An object of class `dynwrap::with_prior` (inherits from `dynwrap::with_expression`, `dynwrap::with_cell_waypoints`, `dynwrap::with_trajectory`, `dynwrap::data_wrapper`, `list`) of length 20.

linearise_cells	<i>Prepare a trajectory for linearised visualisation.</i>
-----------------	---

Description

This is an internal function and should probably not be used manually.

Usage

```
linearise_cells(  
  trajectory,  
  margin = 0.05,  
  no_margin_between_linear = TRUE,  
  one_edge = FALSE,  
  equal_cell_width = FALSE  
)
```

Arguments

trajectory	A dynwrap trajectory.
margin	A margin between trajectory segments.
no_margin_between_linear	Whether to add a margin only when a branch occurs.
one_edge	Whether or not to assign each cell to one cell only. This can occur when a cell is on a branching point, or in between multiple edges.
equal_cell_width	Whether or not to space segments according to cell count.

Value

A named list with values:

- `milestone_network`: A linearised version of `trajectory$milestone_network` with extra columns: `add_margin`, `n_margins`, `cumstart`, `cumend`, `edge_id`.
- `progressions`: A linearised version of `trajectory$progressions` with extra columns: `percentage2`, `length`, `directed`, `add_margin`, `n_margins`, `cumstart`, `cumend`, `edge_id`, `cumpercentage`.
- `margin`: The used margin (numeric).

Examples

```
linearise_cells(example_bifurcating)
```

milestone_palette *Get the names of valid color palettes*

Description

Get the names of valid color palettes

Usage

```
milestone_palette(name, n)
```

```
get_milestone_palette_names()
```

Arguments

name The name of the palette. Must be one of "cubeHelix", "Set3", or "rainbow".
n The number of colours to be in the palette.

Value

The names of supported palettes.

Examples

```
get_milestone_palette_names()
```

plot_dendro *Plot a trajectory as a dendrogram*

Description

Plot a trajectory as a dendrogram

Usage

```
plot_dendro(  
  trajectory,  
  color_cells = c("auto", "none", "grouping", "feature", "milestone", "pseudotime"),  
  grouping = NULL,  
  groups = NULL,  
  feature_oi = NULL,  
  expression_source = "expression",  
  pseudotime = NULL,  
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow"),  
  milestones = NULL,  
  milestone_percentages = NULL,
```

```

alpha_cells = 1,
size_cells = 2.5,
border_radius_percentage = 0.1,
diag_offset = 0.05,
y_offset = 0.2,
arrow = grid::arrow(type = "closed")
)

```

Arguments

trajectory	A dynwrap trajectory.
color_cells	How to color the cells. <ul style="list-style-type: none"> • "auto": Try to figure out how to color cells depending on whether one of the grouping, feature_io, milestones or pseudotime parameters are defined. • "none": Cells are not coloured. • "grouping": Cells are coloured according to a grouping (e.g. clustering). Either the grouping parameter or trajectory\$grouping must be a named character vector. • "feature": Cells are coloured according to the values of a given feature (e.g. gene expression). Either the expression_source parameter or get_expression(trajectory) must be a matrix. Parameter feature_oi must also be defined. • "milestone" (recommended): Cells are coloured according their position in the trajectory. The positioning of the cells are determined by parameter milestone_percentages or else by trajectory\$milestone_percentages. The colours of the milestones can be determined automatically or can be specified by passing a tibble containing character columns milestone_id and color (See add_milestone_coloring() for help in constructing this object). • "pseudotime": Cells are coloured according to the pseudotime value from the root.
grouping	A grouping of the cells (e.g. clustering) as a named character vector.
groups	A tibble containing character columns group_id and color. If NULL, this object is inferred from the grouping itself.
feature_oi	The name of a feature to use for colouring the cells.
expression_source	Source of the feature expression, defaults to get_expression(trajectory).
pseudotime	The pseudotime from the root of the trajectory to the cells as a named numeric vector.
color_milestones	Which palette to use for colouring the milestones <ul style="list-style-type: none"> • auto: Determine colours automatically. If color is already specified in milestones tibble, this will be used. Otherwise, the colour scheme is determined by milestone_palette_list\$auto.

- given: The milestones object already contains a column color.
- cubeHelix: Use the `rje::cubeHelix()` palette.
- Set3: Use the `RColorBrewer::brewer.pal(name = "Set3")` palette.
- rainbow: Use the `grDevices::rainbow()` palette.

milestones	Tibble containing the column <code>milestone_id</code> (character). If <code>color_milestones</code> is set to "given", this tibble should also contain a column <code>color</code> (character), containing colour hex codes (e.g. "#123456").
milestone_percentages	The milestone percentages.
alpha_cells	The alpha of the cells
size_cells	The size of the cells
border_radius_percentage	The fraction of the radius that is used for the border
diag_offset	The x-offset (percentage of the edge lengths) between milestones
y_offset	The size of the quasirandom cell spreading in the y-axis
arrow	The type and size of arrow in case of directed trajectories. Set to NULL to remove arrow altogether.

Value

A dendrogram ggplot of the trajectory.

Examples

```
data(example_tree)
plot_dendro(example_tree)
plot_dendro(example_tree, color_cells = "pseudotime")
plot_dendro(
  example_tree,
  color_cells = "grouping",
  grouping = dynwrap::group_onto_nearest_milestones(example_tree)
)
```

plot_dimred

Plot a trajectory in a (given) dimensionality reduction

Description

Plot a trajectory in a (given) dimensionality reduction

Usage

```

plot_dimred(
  trajectory,
  color_cells = c("auto", "none", "grouping", "feature", "milestone", "pseudotime"),
  dimred = ifelse(dynwrap::is_wrapper_with_dimred(trajectory), NA,
    dyndimred::dimred_landmark_mds),
  plot_trajectory = dynwrap::is_wrapper_with_trajectory(trajectory) &&
    !plot_milestone_network,
  plot_milestone_network = FALSE,
  label_milestones = dynwrap::is_wrapper_with_milestone_labelling(trajectory),
  alpha_cells = 1,
  size_cells = 2.5,
  border_radius_percentage = 0.1,
  size_milestones = 6,
  size_transitions = 2,
  hex_cells = ifelse(length(trajectory$cell_ids) > 10000, 100, FALSE),
  grouping = NULL,
  groups = NULL,
  feature_io = NULL,
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow"),
  milestones = NULL,
  milestone_percentages = NULL,
  pseudotime = NULL,
  expression_source = "expression",
  arrow = grid::arrow(type = "closed", length = unit(0.1, "inches")),
  color_density = c("none", "grouping", "feature"),
  padding = 0.1,
  nbins = 1000,
  bw = 0.2,
  density_cutoff = 0.3,
  density_cutoff_label = density_cutoff/10,
  waypoints = dynwrap::select_waypoints(trajectory),
  trajectory_projection_sd = sum(trajectory$milestone_network$length) * 0.05,
  color_trajectory = "none"
)

```

Arguments

trajectory	A dynwrap trajectory.
color_cells	How to color the cells. <ul style="list-style-type: none"> "auto": Try to figure out how to color cells depending on whether one of the grouping, feature_io, milestones or pseudotime parameters are defined. "none": Cells are not coloured. "grouping": Cells are coloured according to a grouping (e.g. clustering). Either the grouping parameter or trajectory\$grouping must be a named character vector.

- "feature": Cells are coloured according to the values of a given feature (e.g. gene expression). Either the `expression_source` parameter or `get_expression(trajecory)` must be a matrix. Parameter `feature_oi` must also be defined.
- "milestone" (recommended): Cells are coloured according their position in the trajectory. The positioning of the cells are determined by parameter `milestone_percentages` or else by `trajectory$milestone_percentages`. The colours of the milestones can be determined automatically or can be specified by passing a tibble containing character columns `milestone_id` and `color` (See `add_milestone_coloring()` for help in constructing this object).
- "pseudotime": Cells are coloured according to the pseudotime value from the root.

`dimred` Can be

- A function which will perform the dimensionality reduction, see `dyndimred::list_dimred_method`
- A matrix with the dimensionality reduction, with cells in rows and dimensions (`comp_1`, `comp_2`, ...) in columns

`plot_trajectory`

Whether to plot the projected trajectory on the dimensionality reduction

`plot_milestone_network`

Whether to plot the projected milestone network on the dimensionality reduction

`label_milestones`

How to label the milestones. Can be TRUE (in which case the labels within the trajectory will be used), "all" (in which case both given labels and `milestone_ids` will be used), a named character vector, or FALSE

`alpha_cells` The alpha of the cells

`size_cells` The size of the cells

`border_radius_percentage`

The fraction of the radius that is used for the border

`size_milestones`

The size of the milestones

`size_transitions`

The size of the trajectory segments

`hex_cells` The number of hexes to use, to avoid overplotting points. Default is FALSE if number of cells ≤ 10000 .

`grouping` A grouping of the cells (e.g. clustering) as a named character vector.

`groups` A tibble containing character columns `group_id` and `color`. If NULL, this object is inferred from the `grouping` itself.

`feature_oi` The name of a feature to use for colouring the cells.

`color_milestones`

Which palette to use for colouring the milestones

- auto: Determine colours automatically. If `color` is already specified in milestones tibble, this will be used. Otherwise, the colour scheme is determined by `milestone_palette_list$auto`.

- given: The milestones object already contains a column color.
- cubeHelix: Use the `rje::cubeHelix()` palette.
- Set3: Use the `RColorBrewer::brewer.pal(name = "Set3")` palette.
- rainbow: Use the `grDevices::rainbow()` palette.

milestones	Tibble containing the column <code>milestone_id</code> (character). If <code>color_milestones</code> is set to "given", this tibble should also contain a column <code>color</code> (character), containing colour hex codes (e.g. "#123456").
milestone_percentages	The milestone percentages.
pseudotime	The pseudotime from the root of the trajectory to the cells as a named numeric vector.
expression_source	Source of the expression
arrow	The type and size of arrow in case of directed trajectories. Set to NULL to remove arrow altogether.
color_density	How to color density, can be "none", "grouping", or "feature".
padding	The padding in the edges to the plot, relative to the size of the plot.
nbins	Number of bins for calculating the density.
bw	Bandwidth, relative to the size of the plot.
density_cutoff	Cutoff for density, the lower the larger the areas.
density_cutoff_label	Cutoff for density for labeling, the lower the further way from cells.
waypoints	The waypoints to use for projecting. Can be generated using <code>dynwrap::select_waypoints()</code> .
trajectory_projection_sd	The standard deviation of the Gaussian kernel to be used for projecting the trajectory. This is in the order of magnitude as the lengths of the <code>milestone_network</code> . The lower, the more closely the trajectory will follow the cells.
color_trajectory	How to color the trajectory, can be "nearest" for coloring to nearest cell, or "none".

Value

A dimensionality reduction ggplot of the data.

Examples

```
data(example_bifurcating)
plot_dimred(example_bifurcating)

# plotting with umap
if (requireNamespace("uwot", quietly = TRUE)) {
  plot_dimred(example_bifurcating, dimred = dyndimred::dimred_umap)
}
```

```

# using a custom dimred
dimred <- dyndimred::dimred_mds(example_bifurcating$expression)
plot_dimred(example_bifurcating, dimred = dimred)

# coloring cells by pseudotime
plot_dimred(example_bifurcating, color_cells = "pseudotime")

# coloring cells by cluster
plot_dimred(
  example_bifurcating,
  color_density = "grouping",
  grouping = dynwrap::group_onto_nearest_milestones(example_bifurcating)
)

```

plot_graph

Plot a trajectory as a graph

Description

Plot a trajectory as a graph

Usage

```

plot_graph(
  trajectory,
  color_cells = c("auto", "none", "grouping", "feature", "milestone", "pseudotime"),
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow"),
  grouping = NULL,
  groups = NULL,
  feature_oi = NULL,
  pseudotime = NULL,
  expression_source = "expression",
  milestones = NULL,
  milestone_percentages = NULL,
  size_trajectory = 3,
  size_milestones = 8,
  alpha_cells = 1,
  size_cells = 2.5,
  border_radius_percentage = 0.1,
  arrow = grid::arrow(length = grid::unit(1, "cm"), type = "closed"),
  label_milestones = dynwrap::is_wrapper_with_milestone_labelling(trajectory),
  plot_milestones = FALSE,
  adjust_weights = FALSE
)

```


Arguments

trajectory	The trajectory as created by <code>infer_trajectory()</code> or <code>add_trajectory()</code>
color_cells	How to color the cells. <ul style="list-style-type: none"> • "auto": Try to figure out how to color cells depending on whether one of the grouping, feature_io, milestones or pseudotime parameters are defined. • "none": Cells are not coloured. • "grouping": Cells are coloured according to a grouping (e.g. clustering). Either the grouping parameter or trajectory\$grouping must be a named character vector. • "feature": Cells are coloured according to the values of a given feature (e.g. gene expression). Either the expression_source parameter or get_expression(trajectory) must be a matrix. Parameter feature_io must also be defined. • "milestone" (recommended): Cells are coloured according their position in the trajectory. The positioning of the cells are determined by parameter milestone_percentages or else by trajectory\$milestone_percentages. The colours of the milestones can be determined automatically or can be specified by passing a tibble containing character columns milestone_id and color (See add_milestone_coloring() for help in constructing this object). • "pseudotime": Cells are coloured according to the pseudotime value from the root.
color_milestones	Which palette to use for colouring the milestones <ul style="list-style-type: none"> • auto: Determine colours automatically. If color is already specified in milestones tibble, this will be used. Otherwise, the colour scheme is determined by milestone_palette_list\$auto. • given: The milestones object already contains a column color. • cubeHelix: Use the rje::cubeHelix() palette. • Set3: Use the RColorBrewer::brewer.pal(name = "Set3") palette. • rainbow: Use the grDevices::rainbow() palette.
grouping	A grouping of the cells (e.g. clustering) as a named character vector.
groups	A tibble containing character columns group_id and color. If NULL, this object is inferred from the grouping itself.
feature_io	The name of a feature to use for colouring the cells.
pseudotime	The pseudotime from the root of the trajectory to the cells as a named numeric vector.
expression_source	Source of the feature expression, defaults to get_expression(trajectory).
milestones	Tibble containing the column milestone_id (character). If color_milestones is set to "given", this tibble should also contain a column color (character), containing colour hex codes (e.g. "#123456").

milestone_percentages The milestone percentages.
size_trajectory The size of the transition lines between milestones.
size_milestones The size of milestones.
alpha_cells The alpha of the cells.
size_cells The size of the cells.
border_radius_percentage The fraction of the radius that is used for the border.
arrow The type and size of arrow in case of directed trajectories. Set to NULL to remove arrow altogether.
label_milestones How to label the milestones. Can be TRUE (in which case the labels within the trajectory will be used), "all" (in which case both given labels and milestone_ids will be used), a named character vector, or FALSE
plot_milestones Whether to plot the milestones.
adjust_weights Whether or not to rescale the milestone network weights

Value

A graph ggplot of a trajectory.

Examples

```

data(example_disconnected)
plot_graph(example_disconnected)
plot_graph(example_disconnected, color_cells = "pseudotime")
plot_graph(
  example_disconnected,
  color_cells = "grouping",
  grouping = dynwrap::group_onto_nearest_milestones(example_disconnected)
)

data(example_tree)
plot_graph(example_tree)

```

plot_heatmap

Plot expression data along a trajectory

Description

NOTE: When using RStudio, the heatmap might not show inside the plot area, but will be visible once you click the 'Zoom' button.

Usage

```
plot_heatmap(
  trajectory,
  expression_source = "expression",
  features_oi = 20,
  clust = "ward.D2",
  margin = 0.02,
  color_cells = NULL,
  milestones = NULL,
  milestone_percentages = trajectory$milestone_percentages,
  grouping = NULL,
  groups = NULL,
  cell_feature_importances = NULL,
  heatmap_type = c("tiled", "dotted"),
  scale = dynutils::scale_quantile,
  label_milestones = TRUE
)
```

Arguments

trajectory	A dynwrap trajectory.
expression_source	Source of the feature expression, defaults to <code>get_expression(trajectory)</code> .
features_oi	The features of interest, either the number of features or a vector giving the names of the different features
clust	The method to cluster the features, or a <code>hclust</code> object
margin	A margin between trajectory segments.
color_cells	How to color the cells. <ul style="list-style-type: none"> • "auto": Try to figure out how to color cells depending on whether one of the grouping, feature_io, milestones or pseudotime parameters are defined. • "none": Cells are not coloured. • "grouping": Cells are coloured according to a grouping (e.g. clustering). Either the grouping parameter or <code>trajectory\$grouping</code> must be a named character vector. • "feature": Cells are coloured according to the values of a given feature (e.g. gene expression). Either the <code>expression_source</code> parameter or <code>get_expression(trajectory)</code> must be a matrix. Parameter <code>feature_oi</code> must also be defined. • "milestone" (recommended): Cells are coloured according their position in the trajectory. The positioning of the cells are determined by parameter <code>milestone_percentages</code> or else by <code>trajectory\$milestone_percentages</code>. The colours of the milestones can be determined automatically or can be specified by passing a tibble containing character columns <code>milestone_id</code> and <code>color</code> (See <code>add_milestone_coloring()</code> for help in constructing this object).

- "pseudotime": Cells are coloured according to the pseudotime value from the root.

milestones	Tibble containing the column milestone_id (character). If color_milestones is set to "given", this tibble should also contain a column color (character), containing colour hex codes (e.g. "#123456").
milestone_percentages	The milestone percentages.
grouping	A grouping of the cells (e.g. clustering) as a named character vector.
groups	A tibble containing character columns group_id and color. If NULL, this object is inferred from the grouping itself.
cell_feature_importances	The importances of every feature in every cell, as returned by <code>dynfeature::calculate_cell_feature_</code>
heatmap_type	The type of heatmap, either tiled or dotted
scale	Whether to rescale the expression, can be a function or boolean
label_milestones	How to label the milestones. Can be TRUE (in which case the labels within the trajectory will be used), "all" (in which case both given labels and milestone_ids will be used), a named character vector, or FALSE

Value

A heatmap ggplot of an expression dataset with trajectory.

Examples

```
data(example_bifurcating)
plot_heatmap(example_bifurcating)
```

plot_linearised_comparison

Compare two trajectories as a pseudotime scatterplot

Description

Compare two trajectories as a pseudotime scatterplot

Usage

```
plot_linearised_comparison(
  traj1,
  traj2,
  reorder = TRUE,
  margin = 0.05,
  reorder_second_by = c("mapping", "optimisation")
)
```

Arguments

traj1	The first trajectory
traj2	The second trajectory
reorder	Whether to reorder the trajectory
margin	A margin between trajectory segments.
reorder_second_by	How to reorder the second trajectory, either by mapping the milestones from both trajectories (mapping), or by trying to correlate the orderings between the two trajectories (optimisation)

Value

A scatterplot comparison ggplot of two linearised trajectories.

Examples

```
data(example_bifurcating)
plot_linearised_comparison(example_bifurcating, example_bifurcating)
```

plot_onedim	<i>Plot a trajectory as a one-dimensional set of connected segments</i>
-------------	---

Description

Plot a trajectory as a one-dimensional set of connected segments

Usage

```
plot_onedim(
  trajectory,
  color_cells = c("auto", "none", "grouping", "feature", "milestone", "pseudotime"),
  grouping = NULL,
  groups = NULL,
  feature_oi = NULL,
  pseudotime = NULL,
  expression_source = "expression",
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow"),
  milestones = NULL,
  milestone_percentages = NULL,
  alpha_cells = 1,
  size_cells = 2.5,
  border_radius_percentage = 0.1,
  orientation = 1,
  margin = 0.05,
  linearised = linearise_cells(trajectory, margin, one_edge = TRUE),
  quasirandom_width = 0.2,
```

```

plot_cells = TRUE,
label_milestones = dynwrap::is_wrapper_with_milestone_labelling(trajjectory),
arrow = grid::arrow(type = "closed")
)

```

Arguments

trajectory	A dynwrap trajectory.
color_cells	How to color the cells. <ul style="list-style-type: none"> • "auto": Try to figure out how to color cells depending on whether one of the grouping, feature_io, milestones or pseudotime parameters are defined. • "none": Cells are not coloured. • "grouping": Cells are coloured according to a grouping (e.g. clustering). Either the grouping parameter or trajectory\$grouping must be a named character vector. • "feature": Cells are coloured according to the values of a given feature (e.g. gene expression). Either the expression_source parameter or get_expression(trajectory) must be a matrix. Parameter feature_io must also be defined. • "milestone" (recommended): Cells are coloured according their position in the trajectory. The positioning of the cells are determined by parameter milestone_percentages or else by trajectory\$milestone_percentages. The colours of the milestones can be determined automatically or can be specified by passing a tibble containing character columns milestone_id and color (See add_milestone_coloring() for help in constructing this object). • "pseudotime": Cells are coloured according to the pseudotime value from the root.
grouping	A grouping of the cells (e.g. clustering) as a named character vector.
groups	A tibble containing character columns group_id and color. If NULL, this object is inferred from the grouping itself.
feature_io	The name of a feature to use for colouring the cells.
pseudotime	The pseudotime from the root of the trajectory to the cells as a named numeric vector.
expression_source	Source of the feature expression, defaults to get_expression(trajectory).
color_milestones	Which palette to use for colouring the milestones <ul style="list-style-type: none"> • auto: Determine colours automatically. If color is already specified in milestones tibble, this will be used. Otherwise, the colour scheme is determined by milestone_palette_list\$auto. • given: The milestones object already contains a column color. • cubeHelix: Use the rje::cubeHelix() palette. • Set3: Use the RColorBrewer::brewer.pal(name = "Set3") palette.

- rainbow: Use the `grDevices::rainbow()` palette.

milestones	Tibble containing the column <code>milestone_id</code> (character). If <code>color_milestones</code> is set to "given", this tibble should also contain a column <code>color</code> (character), containing colour hex codes (e.g. "#123456").
milestone_percentages	The milestone percentages.
alpha_cells	The alpha of the cells
size_cells	The size of the cells
border_radius_percentage	The fraction of the radius that is used for the border
orientation	Whether to plot the connections in the top (1) or bottom (-1)
margin	A margin between trajectory segments.
linearised	The linearised milestone network and progressions
quasirandom_width	The width of the quasirandom cell spreading
plot_cells	Whether to plot the cells
label_milestones	How to label the milestones. Can be TRUE (in which case the labels within the trajectory will be used), "all" (in which case both given labels and <code>milestone_ids</code> will be used), a named character vector, or FALSE
arrow	The type and size of arrow in case of directed trajectories. Set to NULL to remove arrow altogether.

Value

A linearised (non-)linear trajectory.

Examples

```
data(example_linear)
plot_onedim(example_linear)
plot_onedim(example_linear, label_milestones = TRUE)

data(example_tree)
plot_onedim(example_tree)
```

plot_strip	<i>Plot strip</i>
------------	-------------------

Description

Plot strip

Usage

```
plot_strip(traj1, traj2, margin = 0.05, reorder = TRUE)
```

Arguments

traj1	The first trajectory
traj2	The second traj
margin	A margin between trajectory segments.
reorder	Whether to reorder

Value

A scatterplot comparison ggplot of two linearised trajectories.

Examples

```
data(example_bifurcating)
plot_stripe(example_bifurcating, example_bifurcating)
```

plot_topology	<i>Plot the topology of a trajectory</i>
---------------	--

Description

Plot the topology of a trajectory

Usage

```
plot_topology(
  trajectory,
  color_milestones = c("auto", "given", "cubeHelix", "Set3", "rainbow"),
  milestones = NULL,
  layout = NULL,
  arrow = grid::arrow(type = "closed", length = unit(0.4, "cm"))
)
```

Arguments

trajectory A dynwrap trajectory.
 color_milestones

Which palette to use for colouring the milestones

- auto: Determine colours automatically. If color is already specified in milestones tibble, this will be used. Otherwise, the colour scheme is determined by milestone_palette_list\$auto.
- given: The milestones object already contains a column color.
- cubeHelix: Use the rje::cubeHelix() palette.
- Set3: Use the RColorBrewer::brewer.pal(name = "Set3") palette.
- rainbow: Use the grDevices::rainbow() palette.

milestones	Tibble containing the column <code>milestone_id</code> (character). If <code>color_milestones</code> is set to "given", this tibble should also contain a column <code>color</code> (character), containing colour hex codes (e.g. "#123456").
layout	The type of layout to create. See <code>ggraph::ggraph()</code> for more info.
arrow	The type and size of arrow in case of directed trajectories. Set to <code>NULL</code> to remove arrow altogether.

Value

A topology ggplot of a trajectory.

Examples

```
data(example_disconnected)
plot_topology(example_disconnected)
```

```
data(example_tree)
plot_topology(example_tree)
```

```
project_waypoints_coloured
  Project the waypoints
```

Description

Project the waypoints

Usage

```
project_waypoints_coloured(
  trajectory,
  cell_positions,
  edge_positions = NULL,
  waypoints = dynwrap::select_waypoints(trajectory),
  trajectory_projection_sd = sum(trajectory$milestone_network$length) * 0.05,
  color_trajectory = "none"
)
```

Arguments

<code>trajectory</code>	A dynwrap trajectory.
<code>cell_positions</code>	The positions of the cells in 2D. Must be a tibble with character column <code>cell_id</code> and numeric columns <code>comp_1</code> and <code>comp_2</code> .
<code>edge_positions</code>	The positions of the edges.
<code>waypoints</code>	The waypoints to use for projecting. Can be generated using <code>dynwrap::select_waypoints()</code> .
<code>trajectory_projection_sd</code>	The standard deviation of the gaussian kernel.

color_trajectory

How to color the trajectory, can be "nearest" for coloring to nearest cell, or "none".

Value

A named list containing items:

- segments: A tibble containing columns comp_1 (numeric), comp_2 (numeric), waypoint_id (character), milestone_id (character), from (character), to (character) percentage (numeric), group (factor), and arrow (logical).

theme_clean

We like our plots clean

Description

We like our plots clean

Usage

```
theme_clean()
```

Value

A ggplot2 theme.

Examples

```
data(example_bifurcating)
g <- plot_dimred(example_bifurcating)
g + theme_clean()
```

theme_graph

We like our plots clean

Description

We like our plots clean

Usage

```
theme_graph()
```

Value

A ggplot2 theme.

Examples

```
data(example_bifurcating)
g <- plot_dimred(example_bifurcating)
g + theme_graph()
```

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