

Package ‘forestly’

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Title Interactive Forest Plot

Version 0.1.4

Description Interactive forest plot for clinical trial safety analysis using 'metalite', 'reactable', 'plotly', and Analysis Data Model (ADaM) datasets. Includes functionality for adverse event filtering, incidence-based group filtering, hover-over reveals, and search and sort operations. The workflow allows for metadata construction, data preparation, output formatting, and interactive plot generation.

License GPL (>= 3)

URL <https://merck.github.io/forestly/>,
<https://github.com/Merck/forestly>

BugReports <https://github.com/Merck/forestly/issues>

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ae_forestly	<i>Display interactive forest plot</i>
-------------	--

Description

Display interactive forest plot

Usage

```
ae_forestly(
  outdata,
  display_soc_toggle = TRUE,
  display_diff_toggle = FALSE,
  filter = c("prop", "n"),
  filter_label = NULL,
  filter_range = NULL,
  ae_label = NULL,
  width = 1400,
```

```

    max_page = NULL,
    download_button = FALSE
  )

```

Arguments

outdata An outdata object created by `format_ae_forestly()`.

display_soc_toggle A boolean value to display SOC toggle button.

display_diff_toggle A boolean value to display risk difference toggle button.

filter A character value of the filter variable.

filter_label A character value of the label for slider bar.

filter_range A numeric vector of length 2 for the range of the slider bar.

ae_label A character value of the label for criteria. If NULL (default), the range is automatically calculated from the data. If only one value is provided, it will be used as the maximum and minimum will be 0.

width A numeric value of width of the table in pixels.

max_page A numeric value of max page number shown in the table.

download_button A logical value to display download button.

Value

An AE forest plot saved as a `shiny.tag.list` object.

Examples

```

adsl <- forestly_adsl[1:100, ]
adae <- forestly_adae[1:100, ]
if (interactive()) {
  meta_forestly(
    dataset_adsl = adsl,
    dataset_adae = adae,
  ) |>
  prepare_ae_forestly() |>
  format_ae_forestly() |>
  ae_forestly()
}

```

background_panel	<i>Add background for creating plot with customized color</i>
------------------	---

Description

Creates colored background for panels of rainfall or forest plot.

Usage

```
background_panel(  
  g,  
  background_color = c("#69B8F7", "#FFFFFF"),  
  background_alpha = 0.3  
)
```

Arguments

g A ggplot object for adding colored background.

background_color A vector of colors that defines the color for the plot background. Default is `c("#69B8F7", "#FFFFFF")`, which are pastel blue and white. The colors will be recycled.

background_alpha Opacity of a geom. Default is 0.3.

Value

Plot as a colored background to add panels for rainfall or forest plot.

Examples

```
library(ggplot2)  
  
df <- data.frame(  
  study = c("S1", "S2", "S3", "S4", "S5", "S6", "S7"),  
  item = as.factor(1:7),  
  effect = c(-.4, -.25, -.1, .1, .15, .2, .3),  
  lower = c(-.43, -.29, -.17, -.02, .04, .17, .27),  
  upper = c(-.37, -.21, -.03, .22, .24, .23, .33)  
)  
  
ggplot(data = df) |>  
  background_panel(background_color = c("grey", "white"), background_alpha = 0.4) +  
  geom_point(aes(y = item, x = effect)) +  
  geom_errorbar(aes(y = item, x = effect, xmin = lower, xmax = upper), width = 0.4) +  
  scale_y_discrete(name = "", breaks = 1:nrow(df), labels = df$study)
```

forestly_adae	<i>An adverse event dataset</i>
---------------	---------------------------------

Description

A dataset containing the adverse event information of a clinical trial following the CDISC ADaM standard.

Usage

```
forestly_adae
```

Format

A data frame with 736 rows and 56 variables.

Details

Definition of each variable can be found at <https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>.

Source

<https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>

forestly_adae_3grp	<i>An adverse event dataset</i>
--------------------	---------------------------------

Description

A dataset containing the adverse event information of a clinical trial following the CDISC ADaM standard.

Usage

```
forestly_adae_3grp
```

Format

A data frame with 1191 rows and 56 variables.

Details

Definition of each variable can be found at <https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>.

Source

<https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>

forestly_adsl	<i>A subject level demographic dataset</i>
---------------	--

Description

A dataset containing the demographic information of a clinical trial following the CDISC ADaM standard.

Usage

forestly_adsl

Format

A data frame with 170 rows and 49 variables.

Details

Definition of each variable can be found at <https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>.

Source

<https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>

forestly_adsl_3grp	<i>A subject level demographic dataset</i>
--------------------	--

Description

A dataset containing the demographic information of a clinical trial following the CDISC ADaM standard.

Usage

forestly_adsl_3grp

Format

A data frame with 254 rows and 49 variables.

Details

Definition of each variable can be found at <https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>.

Source

<https://github.com/phuse-org/phuse-scripts/tree/master/data/adam/cdisc>

format_ae_forestly *Format outdata for interactive forest plot*

Description

Format outdata for interactive forest plot

Usage

```
format_ae_forestly(  
  outdata,  
  display = c("n", "prop", "fig_prop", "fig_diff"),  
  digits = 1,  
  width_term = 200,  
  width_fig = 320,  
  width_n = 40,  
  width_prop = 60,  
  width_diff = 80,  
  footer_space = 90,  
  prop_range = NULL,  
  diff_range = NULL,  
  color = NULL,  
  ae_col_header = NULL,  
  diff_label = "Treatment <- Favor -> Placebo",  
  diff_col_header = NULL,  
  diff_fig_header = NULL  
)
```

Arguments

outdata	An outdata object created by prepare_ae_forestly() .
display	A character vector of measurement to be displayed. <ul style="list-style-type: none">• n: Number of subjects with AE.• prop: Proportion of subjects with AE.• total: Total columns.• diff: Risk difference.
digits	A number of digits after decimal point to be displayed for proportion and risk difference.

width_term	Width in px for AE term column.
width_fig	Width in px for proportion and risk difference figure.
width_n	Width in px for "N" columns.
width_prop	Width in px for "(%)" columns.
width_diff	Width in px for risk difference columns.
footer_space	Space in px for footer to display legend.
prop_range	A vector of lower and upper limit of x-axis for proportion figure.
diff_range	A vector of lower and upper limit of x-axis for risk difference figure.
color	A vector of colors for analysis groups. Default value supports up to 4 groups.
ae_col_header	Column header for adverse events item columns. If NULL (default) and "par" specified in components from prepare_ae_forestly(), uses "Adverse Event". If NULL and "soc" specified in components from prepare_ae_forestly(), uses "System Organ Class" for "soc".
diff_label	x-axis label for risk difference.
diff_col_header	Column header for risk difference table columns. If NULL (default), uses "Risk Difference (%) vs. Reference Group".
diff_fig_header	Column header for risk difference figure. If NULL (default), uses "Risk Difference (%) + 95% CI vs. Reference Group".

Value

An outdata object.

Examples

```

adsl <- forestly_adsl[1:100, ]
adae <- forestly_adae[1:100, ]
meta_forestly(
  dataset_adsl = adsl,
  dataset_adae = adae
) |>
  prepare_ae_forestly() |>
  format_ae_forestly()

```

meta_forestly

Create metadata for interactive forest plot

Description

Create metadata for interactive forest plot

Usage

```
meta_forestly(  
  dataset_adsl,  
  dataset_adae,  
  population_term = "apat",  
  observation_term = "safety",  
  parameter_term = "any;rel",  
  population_subset,  
  observation_subset,  
  treatment_group = "TRTA"  
)
```

Arguments

`dataset_adsl` ADSL source dataset.

`dataset_adae` ADAE source dataset.

`population_term`
A character value of population term name.

`observation_term`
A character value of observation term name.

`parameter_term` A character value of parameter term name.

`population_subset`
An unquoted condition for selecting the populations from ADSL dataset.

`observation_subset`
An unquoted condition for selecting the observations from ADAE dataset.

`treatment_group`
A character value of treatment group name.

Value

A metalite object.

Examples

```
meta_forestly(  
  forestly_adsl,  
  forestly_adae,  
  population_term = "apat",  
  observation_term = "safety",  
  parameter_term = "any;rel"  
)
```

plot_dot

*Dot plot***Description**

Create a dot plot by item. For instance, this could be used to create AEs incidence plot by Preferred Term and treatment group, as part of a rainfall plot.

Usage

```
plot_dot(
  tbl,
  prop_cols = c("prop_1", "prop_2"),
  y_var,
  label,
  x_breaks = NULL,
  color = NULL,
  shape = NULL,
  title = "AE (%)",
  background_color = c("#69B8F7", "#FFFFFF"),
  background_alpha = 0.3,
  theme = theme_panel(show_text = TRUE, show_ticks = TRUE),
  legend_nrow = 1
)
```

Arguments

tbl	A data frame selected from input data set to display on this plot. y and x variables are required.
prop_cols	A character vector of proportion columns to be used for a plot.
y_var	A character string that specifies a variable to be displayed on the y-axis.
label	A character vector of labels for each treatment group. The control group label should be specified as the last element of the vector.
x_breaks	A numeric vector for x-axis breaks. Default is NULL, which uses a default ggplot2 x-axis breaks presentation.
color	Color for each treatment group.
shape	Shape for each treatment group. Default is circle and square. Input values could be either a character or numeric value, For details, see https://ggplot2.tidyverse.org/articles/ggplot2-specs.html .
title	Panel title. Default is "AE (%)".
background_color	Plot background color. Default is c("#69B8F7", "#FFFFFF"), which are pastel blue and white. The value of this argument is used as input for the background_color argument in <code>background_panel()</code> .

background_alpha	Opacity of the background. Default is 0.3. The value of this argument is the input for background_alpha argument in <code>background_panel()</code> .
theme	Panel theme, including the y-axis text, ticks, and plot margin. Default is <code>theme_panel(show_text = TRUE, show_ticks = TRUE)</code> . For more details, refer to theme_panel .
legend_nrow	Integer, the number of rows for a legend display. Must be smaller than or equal to the number of the treatment groups. To omit the legend, set this to NULL. Default is 1.

Value

AEs incidence plot by item and treatment group.

Examples

```

forestly_ads1$TRTA <- factor(
  forestly_ads1$TRT01A,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)
forestly_adae$TRTA <- factor(
  forestly_adae$TRTA,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)

meta <- meta_forestly(
  dataset_ads1 = forestly_ads1,
  dataset_adae = forestly_adae,
  population_term = "apat",
  observation_term = "wk12",
  parameter_term = "any;rel;ser"
) |>
  prepare_ae_forestly() |>
  format_ae_forestly()

meta_any <- meta$tbl[1:20, ] |> dplyr::filter(parameter == "any")
meta_any |>
  plot_dot("name", prop_cols = c("prop_1", "prop_2"), label = c("Treatment", "Placebo"))

```

plot_errorbar

Plot to display risk difference

Description

Create a plot to display risk difference for each item.

Usage

```
plot_errorbar(
  tbl,
  ci_cols = c("diff_1", "lower_1", "upper_1"),
  y_var,
  errbar_width = 0.4,
  color = NULL,
  shape = NULL,
  label,
  x_breaks = NULL,
  grp_abbrev = "paired",
  favor_direction = "negative",
  vline = NULL,
  line_type = 1,
  title = "Risk Diff. + 95% CI \n (Percentage Points)",
  background_color = c("#69B8F7", "#FFFFFF"),
  background_alpha = 0.3,
  theme = theme_panel(show_text = TRUE, show_ticks = TRUE),
  legend_nrow = 1
)
```

Arguments

tbl	A data frame selected from input data set to display on this plot. y and x variables are required.
ci_cols	A character vector of columns for a risk difference to be used for a plot. Need 3 columns, risk difference, lower bound, and upper bound.
y_var	A character string that specifies a variable to be displayed on the y-axis.
errbar_width	A numeric value to define the error bar width. Default is 0.4. Value of this argument will be a half length of the error bar, for example, <code>errbar_width = 0.2</code> means half of the error bar width is 0.2 unit length. If <code>y = 4</code> , the error bar will range from <code>y = 3.8</code> to <code>y = 4.2</code> .
color	Color for each treatment group.
shape	Shape for each treatment group. Default is circle and square. Input values could be either a character or numeric value, For details, see https://ggplot2.tidyverse.org/articles/ggplot2-specs.html .
label	A character vector of labels for each treatment group. The control group label should be specified as the last element of the vector.
x_breaks	A numeric vector for x-axis breaks. Default is NULL, which uses a default ggplot2 x-axis breaks presentation.
grp_abbrev	A character vector for displaying the treatment groups on a favor bar. If <code>grp_abbrev = "paired"</code> , treatment label on the error bar will be the same as in the <code>label</code> argument. If <code>grp_abbrev = "none"</code> , the error bar will not be shown. Also, for customized terms, users can provide an alternative vector of treatment labels. Default is "paired".

favor_direction	The position of a favor label under the condition "comparison is treatment – control". For AEs, favor_direction should be "negative"; for efficacy, favor_direction should be "positive".
vline	Vertical reference line position. Default is NULL. Users can define one or multiple numeric values in a vector as a reference line position.
line_type	Reference line type. Default is solid line. Users can define one or multiple line types in a vector (can be numeric such as 1, 2, 3 or character such as "solid", "dashed"). The values will be recycled and the order will be consistent with the argument vline.
title	Plot title. Default is "Risk Diff. + 95% CI \\n (Percentage Points)".
background_color	Plot background color. Default is c("#69B8F7", "#FFFFFF"), which are pastel blue and white. The value of this argument is used as input for the background_color argument in <code>background_panel()</code> .
background_alpha	Opacity of the background. Default is 0.3. The value of this argument is the input for background_alpha argument in <code>background_panel()</code> .
theme	Panel theme, including the y-axis text, ticks, and plot margin. Default is <code>theme_panel(show_text = TRUE, show_ticks = TRUE)</code> . For more details, refer to <code>theme_panel</code> .
legend_nrow	Integer, the number of rows for a legend display. Must be smaller than or equal to the number of the treatment groups. To omit the legend, set this to NULL. Default is 1.

Value

A risk difference plot for each item.

Examples

```

forestly_adsl$TRTA <- factor(
  forestly_adsl$TRT01A,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)
forestly_adae$TRTA <- factor(
  forestly_adae$TRTA,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)

meta <- meta_forestly(
  dataset_adsl = forestly_adsl,
  dataset_adae = forestly_adae,
  population_term = "apat",
  observation_term = "wk12",
  parameter_term = "any;rel;ser"
) |>
prepare_ae_forestly() |>

```

```

format_ae_forestly()

meta_any <- meta$tbl[1:20, ] |> dplyr::filter(parameter == "any")
meta_any |>
  dplyr::select(name, diff_1, lower_1, upper_1) |>
  plot_errorbar(
    y_var = "name",
    ci_cols = c("diff_1", "lower_1", "upper_1"),
    label = c("Treatment", "Placebo")
  )

```

```
prepare_ae_forestly Prepare datasets for interactive forest plot
```

Description

Prepare datasets for interactive forest plot

Usage

```

prepare_ae_forestly(
  meta,
  population = NULL,
  observation = NULL,
  parameter = NULL,
  components = "par",
  reference_group = NULL,
  ae_listing_display = c("USUBJID", "SITEID", "SEX", "RACE", "AGE", "ASTDY", "AESER",
    "AEREL", "AEACN", "AEOUT", "ADURN", "ADURU"),
  ae_listing_unique = FALSE
)

```

Arguments

meta	A metadata object created by metalite.
population	A character value of population term name. The term name is used as key to link information.
observation	A character value of observation term name. The term name is used as key to link information.
parameter	A character value of parameter term name. The term name is used as key to link information.
components	A character vector of components name.
reference_group	An integer to indicate reference group. Default is 2 if there are 2 groups, otherwise, the default is 1.
ae_listing_display	A vector of name of variables used to display on AE listing table.

ae_listing_unique

A logical value to display only unique records on AE listing table.

Value

An outdata object.

Examples

```
adsl <- forestly_adsl[1:100, ]
adae <- forestly_adae[1:100, ]
meta_forestly(
  dataset_adsl = adsl,
  dataset_adae = adae
) |>
  prepare_ae_forestly()
```

rtf_static_forestly *Output static forest plot*

Description

Output static forest plot

Usage

```
rtf_static_forestly(
  outdata,
  plot_calls,
  source,
  parameter = "any",
  n_rows = 25,
  orientation = "portrait",
  fig_size = c(6, 6),
  title = c("analysis", "observation", "population"),
  footnotes = NULL,
  text_font_size = 9,
  path_outdata = tempfile(fileext = ".Rdata"),
  path_outtable = tempfile(fileext = ".rtf")
)
```

Arguments

outdata	An outdata object created by <code>format_ae_forestly()</code> .
plot_calls	A list or vector of function calls.
source	A character value of the data source.
parameter	A character value of parameter term name.

n_rows	An integer value of the number of rows per page in a plot.
orientation	Orientation in 'portrait' or 'landscape'.
fig_size	A numeric vector of length 2 of figure width and height. The length should be 2 (width, height). The unit is inch.
title	Term "analysis", "observation" and "population") for collecting title from meta-data or a character vector of table titles.
footnotes	A character vector of table footnotes.
text_font_size	Text font size. To vary text font size by column, use numeric vector with length of vector equal to number of columns displayed e.g. c(9,20,40).
path_outdata	A character string of the outdata path.
path_outtable	A character string of the outtable path.

Value

RTF file and source dataset for baseline characteristic table.

Examples

```

forestly_adsl$TRTA <- factor(
  forestly_adsl$TRT01A,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)
forestly_adae$TRTA <- factor(
  forestly_adae$TRTA,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)
outdata <- meta_forestly(
  dataset_adsl = forestly_adsl[1:40, ],
  dataset_adae = forestly_adae[1:40, ]
) |>
prepare_ae_forestly()|>
format_ae_forestly()

p1 <- substitute(
  plot_dot(
    tbl,
    prop_cols = c("prop_1", "prop_2"),
    y_var = "name",
    label = c("Treatment", "Placebo")
  )
)
p2 <- substitute(
  plot_errorbar(
    tbl,
    ci_cols = c("diff_1", "lower_1", "upper_1"),
    y_var = "name",
    label = c("Treatment", "Placebo"),
  )
)

```

```

      legend_nrow = NULL,
      theme = theme_panel(show_ticks = FALSE, show_text = FALSE)
    )
  )
  p3 <- substitute(
    table_panel(
      tbl,
      n_cols = c("n_1", "n_2"),
      prop_cols = c("prop_1", "prop_2"),
      y_var = "name",
      theme = theme_panel(show_ticks = FALSE, show_text = FALSE),
      x_label = c("Treatment \n n(%)", "Placebo \n n(%)")
    )
  )
  outdata |> rtf_static_forestly(
    plot_calls = c(p1, p2, p3),
    source = "Source: [CDISCPilot: adam-ads1; adae]",
    path_outdata = tempfile(fileext = ".Rdata"),
    path_outtable = tempfile(fileext = ".rtf")
  )

```

table_panel

Create table panel ggplot2 object for rainfall or forest plot

Description

Creates a table panel ggplot2 object for rainfall or forest plot.

Usage

```

table_panel(
  tbl,
  n_cols = c("n_1", "n_2"),
  prop_cols = c("prop_1", "prop_2"),
  y_var,
  x_label = NULL,
  text_color = NULL,
  text_size = 8,
  text_format_by = "column",
  background_color = c("#69B8F7", "#FFFFFF"),
  theme = theme_panel(show_ticks = TRUE, show_text = TRUE),
  background_alpha = 0.3
)

```

Arguments

tbl A data frame to be displayed in this table.

n_cols A character vector of columns for subject count to be used for a plot.

prop_cols	A character vector of proportion columns to be used for a plot.
y_var	A string of a variable name from tbl for the y axis variable.
x_label	Labels displayed on the top of table for each column of table. Default is NULL, variable name will display as label.
text_color	Defines colors to display each treatment group.
text_size	Numeric font size for data on each column. Default is 8 for each column.
text_format_by	An option for formatting a data by columns or rows. Default is "column" and text color will be varied by column. If text_format_by = "row", then text color will be varied by row. If text_format_by = "group", then text color will be varied by treatment group.
background_color	Color for the plot background. Default is c("#69B8F7", "#FFFFFF") which are pastel blue and white. The value of this argument will be the input value for the background_color argument in background_panel() .
theme	Controls display of y axis text, ticks and plot margin. By default, theme_panel(show_text = TRUE, show_ticks = TRUE) is used. Users are suggested to use theme_panel() .
background_alpha	Opacity of the background. Default is 0.3. The value of this argument will be the input value for the background_alpha argument in background_panel() .

Value

A ggplot2 object for table panel.

Examples

```

forestly_adsl$TRTA <- factor(
  forestly_adsl$TRT01A,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)
forestly_adae$TRTA <- factor(
  forestly_adae$TRTA,
  levels = c("Xanomeline Low Dose", "Placebo"),
  labels = c("Low Dose", "Placebo")
)

meta <- meta_forestly(
  dataset_adsl = forestly_adsl,
  dataset_adae = forestly_adae,
  population_term = "apat",
  observation_term = "wk12",
  parameter_term = "any;rel;ser"
) |>
  prepare_ae_forestly() |>
  format_ae_forestly()

meta_any <- meta$tbl[1:20, ] |> dplyr::filter(parameter == "any")

```

```
meta_any |>
  table_panel(y_var = "name")
```

theme_panel	<i>Theme function for plot with multiple panels</i>
-------------	---

Description

Specifies theme for a plot with multiple panels.

Usage

```
theme_panel(show_text = TRUE, show_ticks = TRUE)
```

Arguments

`show_text` A logical value that controls text display on the y axis. Default is TRUE.
`show_ticks` A logical value that controls ticks display on the y axis. Default is TRUE.

Value

Theme for a specific panel.

Examples

```
library(ggplot2)

p <- ggplot(mpg, aes(displ, hwy, colour = class)) +
  geom_point()

p
p + theme_panel()
```

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