Package 'causalverse'

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Title Causality in Clarity

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Maintainer The package maintainer <mikenguyen.contact@gmail.com>

Description CausalVerse: An R toolkit expediting causal research & analysis. Streamlines complex methodologies, empowering users to unveil causal relationships with precision. Your go-to for insightful causality exploration..

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Encoding UTF-8

Roxygen list(markdown = TRUE)

RoxygenNote 7.2.3

Suggests knitr,
rmarkdown,
testthat (>= 3.0.0)

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Imports ggplot2 (>= 3.4.2),
ggthemes (>= 4.2.4),
tidyverse (>= 2.0.0),
lubridate (>= 1.9.2),
rio (>= 0.5.29),
xtable (>= 1.8.4),
dplyr (>= 1.1.1),
tidyr (>= 1.3.0),
scales (>= 1.2.1),
gridExtra (>= 2.3),
systemfit (>= 1.1.30),
Hotelling (>= 1.0.8),
MatchIt (>= 4.5.4),
rlang (>= 1.1.1),
fixest (>= 0.11.1),
stats (>= 4.2.3),
PanelMatch (>= 2.0.1),
doParallel (>= 1.0.17),
foreach (>= 1.5.2)

VignetteBuilder knitr

R topics documented:

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ama_export_fig	*Function to export a figure with custom settings*

Description

This function exports a ggplot2 figure to a given path. It exports both an archived version with the current date and a current version without a date. The function supports exporting to PDF and JPG formats.

Usage

```
ama_export_fig(figure, filename, filepath, width = 7, height = 7)
```

Arguments

figure	A ggplot2 object.
filename	A character string specifying the filename without the extension.
filepath	A character string specifying the directory to save the file.
width	The width of the image in inches (default is 7 inches).
height	The height of the image in inches (default is 7 inches).

Examples

```
## Not run:
test_plot <- ggplot(mpg, aes(x=displ, y=hwy)) + geom_point()  # Create a ggplot2 plot
filename <- "sample_plot"  # Define a filename
filepath <- tempdir()  # Define a path using a temporary directory
ama_export_fig(test_plot, filename, filepath)  # Call the ama_export_fig function

## End(Not run)
```

---

ama_export_tab   *Function to export a table with AMA style*

Description

This function exports the provided table in both Excel (`.xlsx`) and LaTeX (`.tex`) formats. The table is archived with the current date in the filename for the Excel version, while the LaTeX version is saved with just the specified filename.

Usage

```
ama_export_tab(table, filename, filepath, caption = NULL)
```

Arguments

table	A data frame or matrix.
filename	A character string specifying the filename without the extension.
filepath	A character string specifying the directory to save the file.
caption	A character string specifying the caption for the table.

Examples

```
## Not run:
data(mtcars)  # Load the mtcars dataset
ama_export_tab(mtcars[1:5, 1:5], "sample_table", tempdir(), "Sample Caption for mtcars")

## End(Not run)
```

---

ama_labs   *Custom Label Formatting for ggplot2: American Marketing Associa-*
                               tion Style

Description

This function provides custom label formatting for ggplot2 based on the guidelines set by the American Marketing Association.

Usage

```
ama_labs(
  title = NULL,
  subtitle = NULL,
  caption = NULL,
  x = NULL,
  y = NULL,
  fill = NULL,
  color = NULL,
  ...
)
```

Arguments

`title`	Plot title.
`subtitle`	Plot subtitle.
`caption`	Plot caption.
`x`	X-axis label.
`y`	Y-axis label.
`fill`	Fill legend title.
`color`	Color legend title.
`...`	Additional arguments to be passed to `ggplot2::labs()`.

Value

Modified labels for a ggplot2 plot.

Examples

```
## Not run:
library(ggplot2)
ggplot(mtcars, aes(mpg, wt)) + geom_point() +
ama_labs(title = "Sample Plot") +
ama_theme()

## End(Not run)
```

---

ama_scale_color	*Custom Color Scale for ggplot2: American Marketing Association Style*

Description

This function provides a custom color scale for ggplot2 plots based on the guidelines set by the American Marketing Association.

Usage

```
ama_scale_color(
  use_color = FALSE,
  palette_name = "OkabeIto",
  grayscale_limits = c(0.2, 0.8)
)
```

Arguments

`use_color`	Logical. If TRUE, uses color, otherwise uses grayscale.
`palette_name`	Character. Name of the color palette to use.
`grayscale_limits`	
	Numeric vector. Limits for the grayscale gradient.

Value

A color scale for a ggplot2 plot.

Examples

```
## Not run:
library(ggplot2)
ggplot(mtcars, aes(mpg, wt, color = gear)) + geom_point(size = 4) + ama_scale_color()

## End(Not run)
```

---

ama_scale_fill	*Custom Fill Scale for ggplot2: American Marketing Association Style*

Description

This function provides a custom fill scale for ggplot2 plots based on the guidelines set by the American Marketing Association.

Usage

```
ama_scale_fill(
  use_color = FALSE,
  palette_name = "OkabeIto",
  grayscale_limits = c(0.2, 0.8)
)
```

Arguments

use_color	Logical. If TRUE, uses color, otherwise uses grayscale.
palette_name	Character. Name of the color palette to use.
grayscale_limits	
	Numeric vector. Limits for the grayscale gradient.

Value

A fill scale for a ggplot2 plot.

Examples

```
## Not run:
library(ggplot2)
ggplot(mtcars, aes(mpg, wt, fill = gear)) +
geom_point(shape = 21, size = 4) +
ama_scale_fill()

## End(Not run)
```

---

ama_theme   *Custom Theme for ggplot2: American Marketing Association Style*

Description

This function provides a custom theme for ggplot2 following the guidelines set by the American Marketing Association.

Usage

```
ama_theme(
  base_size = 16,
  base_family = "sans",
  title_size = ggplot2::rel(1.2),
  axis_title_size = ggplot2::rel(1.2),
  legend_title_size = ggplot2::rel(0.6),
  legend_text_size = ggplot2::rel(0.6),
  axis_text_size = ggplot2::rel(1),
  ...
)
```

Arguments

base_size	Base font size.
base_family	Font family. Use "sans" for Arial and "serif" for Times New Roman.
title_size	Title font size as a relative value.
axis_title_size	
	Axis title font size as a relative value.
legend_title_size	
	Legend title font size as a relative value.
legend_text_size	
	Legend text font size as a relative value.
axis_text_size	Axis text font size as a relative value.
...	Additional theme elements to be passed to `ggplot2::theme()`.

Value

A ggplot2 theme.

Examples

```
## Not run:
library(ggplot2)
# Using Arial font
ggplot(mtcars, aes(mpg, wt)) + geom_point() + ama_theme()
# Using Times New Roman font
ggplot(mtcars, aes(mpg, wt)) + geom_point() + ama_theme(base_family = "serif")

## End(Not run)
```

balance_scatter_custom

Custom function to visualize the balance between treatment and control groups

Description

Custom function to visualize the balance between treatment and control groups

Usage

```
balance_scatter_custom(
  matched_set_list,
  set.names = NULL,
  show.legend = TRUE,
  legend.title = "Type",
  legend.position = "right",
  xlim = c(0, 0.8),
  ylim = c(0, 0.8),
  main = "Standardized Mean Difference of Covariates",
  pchs = NULL,
  dot.size = NULL,
  covariates,
  data,
  x.axis.label = "Before Refinement",
  y.axis.label = "After Refinement",
  theme_use = causalverse::ama_theme(),
  ...
)
```

Arguments

matched_set_list
> List of matched sets

set.names
> Vector of names for matched sets. Defaults to NULL.

show.legend
> Boolean to determine if legend should be shown. Defaults to TRUE.

legend.title
> Legend title. Defaults to "Type".

legend.position
> Position of legend. Defaults to "right".

xlim
> Vector defining x-axis limits. Defaults to c(0, 0.8).

ylim
> Vector defining y-axis limits. Defaults to c(0, 0.8).

main
> Main title for the plot. Defaults to "Standardized Mean Difference of Covariates".

pchs
> Plot characters. Defaults to NULL.

dot.size
> Size of dots in the scatter plot. Defaults to NULL.

covariates
> Covariates for calculating balance.

data
> Dataset for balance calculation.

x.axis.label	x-axis label. Defaults to "Before Refinement".
y.axis.label	y-axis label. Defaults to "After Refinement".
theme_use	Custom theme that follows ggplots2. Defaults to causalverse::ama_theme().
...	Additional arguments passed to the labs() function

Value

ggplot object

Examples

```
## Not run:
library(PanelMatch)
# Maha 4-year lag, up to 5 matches
PM.results.maha.4lag.5m <- PanelMatch::PanelMatch(
    lag = 4,
    time.id = "year",
    unit.id = "wbcode2",
    treatment = "dem",
    refinement.method = "mahalanobis",
    data = PanelMatch::dem,
    match.missing = TRUE,
    covs.formula = ~ I(lag(tradewb, 1:4)) + I(lag(y, 1:4)),
    size.match = 5,
    qoi = "att",
    outcome.var = "y",
    lead = 0:4,
    forbid.treatment.reversal = FALSE,
    use.diagonal.variance.matrix = TRUE
)

# Maha 4-year lag, up to 10 matches
PM.results.maha.4lag.10m <- PanelMatch::PanelMatch(
    lag = 4,
    time.id = "year",
    unit.id = "wbcode2",
    treatment = "dem",
    refinement.method = "mahalanobis",
    data = PanelMatch::dem,
    match.missing = TRUE,
    covs.formula = ~ I(lag(tradewb, 1:4)) + I(lag(y, 1:4)),
    size.match = 10,
    qoi = "att",
    outcome.var = "y",
    lead = 0:4,
    forbid.treatment.reversal = FALSE,
    use.diagonal.variance.matrix = TRUE
)

# Using the function
balance_scatter_custom(
    matched_set_list = list(PM.results.maha.4lag.5m$att, PM.results.maha.4lag.10m$att),
    set.names = c("Maha 4 Lag 5 Matches", "Maha 4 Lag 10 Matches"),
    data = dem,
    covariates = c("y", "tradewb")
)
```

```
  ## End(Not run)
```

---

plot_coef_par_trends   *Plot Coefficients of Parallel Trends*

Description

This function generates coefplots or iplots based on fixest outputs, allowing the user to visualize interaction coefficients with ease.

Usage

```
plot_coef_par_trends(
  data,
  dependent_vars,
  time_var,
  unit_treatment_status,
  unit_id_var,
  plot_type = "coefplot",
  combined_plot = TRUE,
  legend_position = "bottomleft",
  legend_title = "Legend Title",
  legend_args = list(),
  plot_args = list()
)
```

Arguments

data	Data frame containing the data to be used in the model.
dependent_vars	Named list of dependent variables to model and their respective labels.
time_var	Name of the time variable in the data.
unit_treatment_status	
	Name of the treatment status variable.
unit_id_var	Name of the unit identification variable.
plot_type	Type of plot to generate. Either "coefplot" or "iplot".
combined_plot	Logical indicating whether to combine plots for all dependent variables.
legend_position	
	Position of the legend on the plot.
legend_title	Title for the legend.
legend_args	List of additional arguments to customize the legend.
plot_args	List of additional arguments to customize the plot.

Value

A plot visualizing interaction coefficients.

Examples

```
## Not run:
library(fixest)
data("base_did")

# Sample call to the function:
plot_coef_par_trends(
  data = base_did,
  dependent_vars = c(y = "Outcome 1", x1 = "Outcome 2"),
  time_var = "period",
  unit_treatment_status = "treat",
  unit_id_var = "id",
  plot_type = "coefplot",
  combined_plot = TRUE,
  plot_args = list(main = "Interaction coefficients Plot"),
  legend_title = "Metrics",
  legend_position = "bottomleft"
)

plot_coef_par_trends(
  data = base_did,
  dependent_vars = c(y = "Outcome 1", x1 = "Outcome 2"),
  time_var = "period",
  unit_treatment_status = "treat",
  unit_id_var = "id",
  plot_type = "coefplot",
  combined_plot = FALSE
)

## End(Not run)
```

---

plot_covariate_balance_pretrend
                    Plot Covariate Balance Over Pre-Treatment Period

---

Description

This function visualizes the covariate balance over the pre-treatment period. It's particularly designed for outputs from methods like PanelMatch.

Usage

```
plot_covariate_balance_pretrend(
  balance_data,
  y_limits = c(-1, 1),
  theme_use = causalverse::ama_theme(),
  xlab = "Time to Treatment",
  ylab = "Balance (in SD unit)",
  main_title = "Covariate Balance Over Pre-Treatment Period",
  legend_title = "Covariate",
  show_legend = TRUE,
  ...
)
```

Arguments

`balance_data`	A matrix containing the covariate balance data over the pre-treatment period.
`y_limits`	A numeric vector of length 2 defining the y-axis limits.
`theme_use`	A ggplot2 theme. By default, it uses `causalverse::ama_theme()`.
`xlab`	A string indicating the label for the x-axis.
`ylab`	A string indicating the label for the y-axis.
`main_title`	A string for the main title of the plot.
`legend_title`	A string for the legend title.
`show_legend`	A logical; if TRUE, the legend is displayed, otherwise, it's hidden.
`...`	Additional arguments passed to the ggplot labs.

Value

A ggplot2 object.

Examples

```
## Not run:
  balance_data_sample <- matrix(rnorm(20), nrow = 5)
  plot_covariate_balance_pretrend(balance_data_sample)

## End(Not run)
```

```
plot_density_by_treatment
```
Plot Density by Treatment

Description

This function creates a list of ggplot density plots for specified variables by treatment groups.

Usage

```
plot_density_by_treatment(
  data,
  var_map,
  treatment_var,
  show_legend = TRUE,
  theme_use = ggplot2::theme_minimal(),
  ...
)
```

Arguments

`data`	A data frame containing the variables to plot and a treatment variable.
`var_map`	A named list mapping the column names in the data to display names for plotting.
`treatment_var`	A named vector where the name is the treatment column in the data and the value is the legend title.
`show_legend`	A logical value indicating whether to show the legend. Defaults to TRUE.
`theme_use`	ggplot2 theme. Defaults to `ggplot2::theme_minimal()`.
`...`	Additional arguments to be passed to `geom_density`.

Value

A list of ggplot objects for each variable in `var_map`.

Examples

```
## Not run:
data(mtcars)
data <- mtcars %>%
  dplyr::select(mpg, cyl) %>%
  dplyr::rowwise() %>%
  dplyr::mutate(treatment = sample(c(0,1), 1, replace = TRUE)) %>%
  dplyr::ungroup()

plots <- plot_density_by_treatment(
  data = data,
  var_map = list("mpg" = "Var 1",
                 "cyl" = "Var 2"),
  treatment_var = c("treatment" = "Treatment Name\nin Legend")
)

## End(Not run)
```

---

plot_PanelEstimate   *Plot Estimated Effects of Treatment Over Time*

Description

This function takes an object (result of PanelEstimate or similar) and plots its estimates over time.

Usage

```
plot_PanelEstimate(
  pe.object,
  ylab = "Estimated Effect of Treatment",
  xlab = "Time Since Treatment",
  main = "Estimated Effects of Treatment Over Time",
  ylim = NULL,
  theme_use = causalverse::ama_theme(),
  ...
)
```

Arguments

`pe.object`	The object with the estimation results.
`ylab`	The y-axis label.
`xlab`	The x-axis label.
`main`	The main title for the plot.
`ylim`	The limits for the y-axis.
`theme_use`	The theme to use for the plot. Defaults to causalverse::ama_theme().
`...`	Additional parameters to pass to labs() function.

Value

A ggplot object with the desired plot.

Examples

```
## Not run:
PM.results.ps.weight <- PanelMatch(lag = 4, time.id = "year", unit.id = "wbcode2",
                                   treatment = "dem", refinement.method = "ps.weight",
                                data = dem, match.missing = FALSE, listwise.delete = TRUE,
                                 covs.formula = ~ I(lag(tradewb, 1:4)) + I(lag(y, 1:4)),
                                   size.match = 5, qoi = "att", outcome.var = "y",
                                   lead = 0:4, forbid.treatment.reversal = FALSE)

PE.results <- PanelEstimate(sets = PM.results.ps.weight,
                            data = dem,
                            se.method = "bootstrap",
                            number.iterations = 1000,
                            confidence.level = .95)

plot_PanelEstimate(PE.results)

## End(Not run)
```

`plot_par_trends`	*Plot Parallel Trends*

Description

Plots parallel trends for given metrics.

Usage

```
plot_par_trends(
  data,
  metrics_and_names,
  treatment_status_var,
  time_var,
  conf_level = 0.95,
  non_negative = FALSE,
  display_CI = TRUE,
```

```
  output_format = "plot",
  smoothing_method = NULL,
  title_prefix = "Parallel Trends for",
  theme_use = causalverse::ama_theme()
)
```

Arguments

`data`	A data frame containing the data to plot.
`metrics_and_names`	
	A named list of metrics to plot.
`treatment_status_var`	
	The variable indicating treatment status.
`time_var`	The variable indicating time.
`conf_level`	Confidence level for confidence intervals (default is 0.95).
`non_negative`	Logical; if TRUE, sets negative lower confidence bounds to 0.
`display_CI`	Logical; if TRUE, displays confidence intervals.
`output_format`	Format of the output; "plot" returns a list of ggplots, "data.frame" returns a data frame.
`smoothing_method`	
	Method to use for smoothing; NULL means no smoothing.
`title_prefix`	A character string specifying the prefix for the plot title (default is "Parallel Trends for").
`theme_use`	Custom theme that follows ggplots2

Value

A list of ggplot objects or a data frame.

Examples

```
## Not run:
library(tidyverse)
data <- expand.grid(entity = 1:100, time = 1:10) %>%
  dplyr::arrange(entity, time) %>%
  dplyr::mutate(
    treatment = ifelse(entity <= 50, "Treated", "Control"),
    outcome1 = 0.5 * time + rnorm(n(), 0, 2) + ifelse(treatment == "Treated", 0, 0),
    outcome2 = 3 + 0.3 * time + rnorm(n(), 0, 1) + ifelse(treatment == "Treated", 0, 2)
  )
results <- plot_par_trends(
  data = data,
  metrics_and_names = list(outcome1 = "Outcome 1", outcome2 = "Outcome 2"),
  treatment_status_var = "treatment",
  time_var = list(time = "Time"),
  smoothing_method = "loess"
)
library(gridExtra)
gridExtra::grid.arrange(grobs = results, ncol = 1)

## End(Not run)
```

plot_treat_time   *Plot number of treated units over time or return a dataframe.*

Description

Plot number of treated units over time or return a dataframe.

Usage

```
plot_treat_time(
  data,
  time_var,
  unit_treat,
  outlier_method = "iqr",
  show_legend = FALSE,
  theme_use = causalverse::ama_theme(),
  legend_title = "Point Type",
  legend_labels = c("Regular", "Outlier"),
  regular_size = 3,
  outlier_size = 5,
  regular_color = "black",
  outlier_color = "red",
  regular_shape = 16,
  outlier_shape = 17,
  title = "Random Time Assignment",
  xlab = "Time",
  ylab = "Number of Treated Units",
  output = "plot",
  ...
)
```

Arguments

data	Dataframe containing data.
time_var	Time variable for aggregating the number of treated units.
unit_treat	Variable indicating if the unit was treated in a specific time period.
outlier_method	Method for outlier detection ("iqr" or "z-score").
show_legend	Logical indicating whether to show legend.
theme_use	ggplot2 theme to use.
legend_title	Title for legend.
legend_labels	Labels for regular and outlier points.
regular_size	Size of regular points.
outlier_size	Size of outlier points.
regular_color	Color of regular points.
outlier_color	Color of outlier points.
regular_shape	Shape of regular points.
outlier_shape	Shape of outlier points.

title	Plot title.
xlab	X-axis label.
ylab	Y-axis label.
output	Type of output ("plot" or "dataframe").
...	Additional arguments to pass to ggplot2::labs.

Value

ggplot2 object or dataframe.

Examples

```
# Example usage:
## Not run:
data <- data.frame(time = c(1,1,2,2,3,3), treat = c(0,1,1,1,0,0))
plot_treat_time(data, time_var = time, unit_treat = treat)
plot_treat_time(data, time_var = time, unit_treat = treat, output = "dataframe")

## End(Not run)
```

---

plot_trends_across_group

Custom Faceted Line Plot with Optional Standard Error

Description

This function generates a faceted line plot for a given dataset, allowing the user to specify the x-axis, y-axis, grouping variable, and facet variable. Additionally, users can include standard errors and customize labels.

Usage

```
plot_trends_across_group(
  data,
  x_var,
  y_var,
  grouping_var,
  facet_var,
  se = NULL,
  include_legend = TRUE,
  title = "Dependent Variable across Years by Group and Industry",
  x_label = "Year",
  y_label = "Dependent Variable",
  theme = causalverse::ama_theme(),
  ...
)
```

Arguments

data	A data frame containing the data to be plotted.
x_var	A character string specifying the x-axis variable.
y_var	A character string specifying the y-axis variable.
grouping_var	A character string specifying the grouping variable.
facet_var	A character string specifying the facet variable.
se	A character string specifying the standard error variable, or NULL (default) if not provided.
include_legend	Logical. If TRUE, includes the legend, otherwise it does not.
title	Character string specifying the main plot title.
x_label	Character string specifying the x-axis label.
y_label	Character string specifying the y-axis label.
theme	A ggplot2 theme. Defaults to ama_theme.
...	Additional arguments passed to labs.

Value

A ggplot object.

Examples

```
## Not run:
# Create a small sample dataset
sample_data <- data.frame(
  year = rep(2001:2005, each = 2),
  dependent_variable = rnorm(10, mean = 50, sd = 10),
  group = rep(c("treated", "control"), times = 5),
  industry = rep(c("Tech", "Healthcare"), each = 5)
)

# Use the function
plot_trends_across_group(data = sample_data,
                         x_var = "year",
                         y_var = "dependent_variable",
                         grouping_var = "group",
                         facet_var = "industry",
                         title = "Sample Title")

## End(Not run)
```

Index