

Package ‘joinpointR’

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Type Package

Title Tidy Tools for Joinpoint Regression Models

Version 1.1.0

Description Provides tools to fit joinpoint regression models with a log-linear specification by levels of a categorical variable. The package acts as a wrapper around the 'segmented' package, facilitating model fitting, selection, and interpretation. It includes functions to estimate the Annual Percent Change (APC) and the Average Annual Percent Change (AAPC), along with their 95% confidence intervals, and to generate formatted summary tables and plots of results.

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Encoding UTF-8

Imports dplyr, purrr, tidyr, tibble, ggplot2, segmented, scales, flextable, rlang, stringr, stats, officer, forcats, cols4all

URL <https://github.com/datos-ine/joinpointR>

BugReports <https://github.com/datos-ine/joinpointR/issues>

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get_aapc	<i>Average Annual Percent Change (AAPC)</i>
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Description

Estimates the Average Annual Percent Change (AAPC) and its corresponding 95% confidence interval for one or more regression models. Optionally, statistical significance can be displayed using significance stars instead of confidence intervals.

Usage

```
get_aapc(mods, digits = 1, show_ci = TRUE, dec = ".")
```

Arguments

mods	A joinpoint regression model, a list of joinpoint regression models returned by <code>model_jp()</code> , or linear regression models (lm objects).
digits	Integer. Number of decimal places used to display the results.
show_ci	Logical. If TRUE, displays the 95% confidence interval. If FALSE, displays significance stars.
dec	Character. Decimal separator to use (". " or ", ").

Value

A tibble with one row per model containing the estimated AAPC and either its 95% confidence interval or significance stars.

Author(s)

Tamara Ricardo

Examples

```
# Load example data
data(hiv_data)

# Fit joinpoint models
mods <- model_jp(
  data = hiv_data,
  value = "hiv_rate",
  time = "year",
  group = "region",
  k = 2,
  test = TRUE
)

# AAPC with 95% confidence intervals
get_aapc(mods, digits = 1, show_ci = TRUE, dec = ".")

# AAPC with significance stars
get_aapc(mods, show_ci = FALSE)

# AAPC for a single model
get_aapc(mods$Central)
```

get_apc

Annual Percent Change by Segment

Description

Calculates the Annual Percent Change (APC) and corresponding 95% confidence intervals for each segment of one or more joinpoint regression models.

Usage

```
get_apc(mods, digits = 1, dec = ".")
```

Arguments

mods	A joinpoint regression model or a list of joinpoint regression models returned by <code>model_jp()</code> .
digits	Integer. Number of decimal places used to display the results.
dec	Character. Decimal separator to use (e.g. "." or ",").

Value

A tibble with one row per segment and the variables group, segment, apc, lower, and upper, where lower and upper correspond to the limits of the 95%

Author(s)

Tamara Ricardo

Examples

```
# Load example data
data(hiv_data)

# Fit joinpoint models
mods <- model_jp(
  data = hiv_data,
  value = "hiv_rate",
  time = "year",
  group = "region",
  k = 2,
  test = TRUE
)

# APC and 95% confidence intervals for all models
get_apc(mods, digits = 1, dec = ".")

# APC and 95% confidence intervals for a single model
get_apc(mods$Central)
```

gg_jpoint

Plot Joinpoint Regression Models

Description

Creates a ggplot showing observed values, fitted joinpoint regression lines, and optional joinpoints.

Usage

```
gg_jpoint(
  mods,
  obs = TRUE,
  psize = 2.5,
  ptr = 0.75,
  jp = TRUE,
  facets = c("wrap", "grid", "none"),
  ncol = 4,
  cb = TRUE,
  cbpal = c("viridis", "managua", "plasma", "roma", "vanimo", "algae", "arches2",
    "glasgow", "tokyo", "blue_fluoride")
)
```

Arguments

mods	A list of joinpoint regression models returned by <code>model_jp()</code> .
obs	Logical. If TRUE, observed data points are displayed.
psize	Numeric. Size of the observed data points.
ptr	Numeric. Transparency level of the observed data points (0-1).
jp	Logical. If TRUE, joinpoints are displayed as vertical dashed lines.
facets	Character. Determines the facet layout: "none" for a single panel, "wrap" for faceting by group, or "grid" for faceting by group and subgroup.
ncol	Numeric. Number of columns to display when <code>facets = "wrap"</code> .
cb	Logical. If TRUE, a colorblind-friendly palette is used.
cbpal	Character. Name of the colorblind-friendly palette to use. See Details.

Details

Available colorblind-friendly palettes from the `cols4all` package include:

Diverging palettes:

- "managua"
- "plasma"
- "roma"
- "vanimo"
- "viridis"

Sequential palettes:

- "algae"
- "arches2"
- "blue_fluoride"
- "glasgow"
- "tokyo"

Value

A ggplot object showing observed values, fitted joinpoint regression lines, and optional joinpoints.

Examples

```
# Load example data
data(hiv_data)

# Fit the joinpoint models
mods <- model_jp(
  data = hiv_data,
  value = hiv_rate,
  time = year,
```

```

    group = c("region", "sex"),
    k = 2,
    test = TRUE
  )

  # Plot results
  gg_jpoint(mods, obs = TRUE, jp = TRUE, facets = "wrap")

  # Facet by group and subgroup
  gg_jpoint(mods, obs = TRUE, jp = TRUE, facets = "grid")

  # Single panel without joinpoints
  gg_jpoint(mods, jp = FALSE, facets = "none")

  # Use a different colorblind-friendly palette
  gg_jpoint(
    mods,
    obs = TRUE,
    jp = TRUE,
    facets = "grid",
    cb = TRUE,
    cbpal = "managua"
  )

  # Use default ggplot2 palette (can be changed using `scale_color_`)
  gg_jpoint(
    mods,
    cb = FALSE
  )

```

hiv_data

Simulated HIV rates

Description

Simulated annual HIV rates by region and sex from 2010 to 2025.

Usage

```
hiv_data
```

Format

A data frame with 160 rows and 4 variables:

year Calendar year.

region Geographic region.

sex Sex ("Male" or "Female").

hiv_rate Simulated HIV rate.

Source

Simulated data.

 jp_to_ft

Summary Flextable for Joinpoint Regression Models

Description

Creates a flextable object from the output of `summary_jp()`, displaying the number of joinpoints, time periods, Annual Percent Change (APC) with 95% confidence intervals, and Average Annual Percent Change (AAPC) with statistical significance.

Usage

```
jp_to_ft(tab, digits = 1, lan = c("en", "es"))
```

Arguments

tab	A tibble returned by <code>summary_jp()</code> .
digits	Integer. Number of decimal places used to display the results.
lan	Character. Output language: "en" (English) or "es" (Spanish).

Value

A flextable object containing summary statistics for the joinpoint regression models.

Author(s)

Tamara Ricardo

Examples

```
# Load example data
data(hiv_data)

# Fit the joinpoint models
mods <- model_jp(
  data = hiv_data,
  value = hiv_rate,
  time = year,
  group = c("region", "sex")
)

# Generate a flextable summary
tab <- summary_jp(mods, digits = 1)
jp_to_ft(tab)

# Change table language
jp_to_ft(tab, lan = "es")
```

model_jp

*Joinpoint Regression Models by Groups***Description**

Fits segmented linear regression models by groups for age-standardized rates using joinpoint regression. Models can be fitted using either a stepwise selection procedure based on the Bayesian Information Criterion (BIC) or a fixed number of joinpoints. Internally, the function calls `segmented::selgmented()` or `segmented::segmented()` and applies a log transformation to the response variable.

Usage

```
model_jp(
  data,
  value,
  time,
  group,
  k = 2,
  min_dist = 3,
  step = TRUE,
  test = TRUE
)
```

Arguments

<code>data</code>	A data frame containing age-standardized rates.
<code>value</code>	Response variable.
<code>time</code>	Time variable.
<code>group</code>	Names of one or more grouping variables.
<code>k</code>	Maximum number of joinpoints to estimate.
<code>min_dist</code>	Minimum number of observations required per segment. Defaults to 3 to prevent joinpoints from being too close.
<code>step</code>	Logical. If TRUE, uses a stepwise procedure to select the number of joinpoints based on BIC. If FALSE, fits a model with a fixed number of joinpoints specified by <code>k</code> .
<code>test</code>	Logical. If TRUE, tests differences in slope t-values during the stepwise selection procedure. Only used when <code>step = TRUE</code> .

Details

The National Cancer Institute (NCI) recommends the following maximum number of joinpoints according to the length of the time series (Kim et al., 2000):

- 0–6 time points: 0 joinpoints.
- 7–11 time points: 1 joinpoint.

- 12–16 time points: 2 joinpoints.
- 17–21 time points: 3 joinpoints.
- 22–26 time points: 4 joinpoints.
- 27–31 time points: 5 joinpoints.
- 32–36 time points: 6 joinpoints.
- 37 or more time points: 7 joinpoints.

Value

A named list of joinpoint regression models by group.

Author(s)

Tamara Ricardo

References

Kim HJ, Fay MP, Feuer EJ, Midthune DN (2000). "Permutation Tests for Joinpoint Regression with Applications to Cancer Rates." *Statistics in Medicine*, 19(3), 335–351. doi:10.1002/(sici)1097-0258(20000215)19:3<335::aid-sim336>3.0.co;2-z.

Muggeo, V.M.R., Adelfio, G. (2011). Efficient change point detection in genomic sequences of continuous measurements. *Bioinformatics*, 27, 161–166.

Muggeo, Vito. (2020). Selecting number of breakpoints in segmented regression: implementation in the R package segmented. 10.13140/RG.2.2.12891.39201.

Examples

```
# Load example data
data("hiv_data")

# Check group levels
levels(hiv_data$region)

# Fit models
mods <- model_jp(data = hiv_data, value = hiv_rate, time = year, group = c("region", "sex"),
  k = 2, min_dist = 3, step = TRUE, test = TRUE)

# Show the output of the first model by calling its index
mods[[1]]

# Same output will be obtained when calling model name
mods$Central
```

summary_jp

*Summary Tables for Joinpoint Regression Models***Description**

Generates summary tables for one or more joinpoint regression models, including the number of joinpoints (JP), time periods, Annual Percent Change (APC) with 95% confidence intervals, and Average Annual Percent Change (AAPC) with statistical significance.

Usage

```
summary_jp(mods, digits = 1, dec = c(".", ","))
```

Arguments

mods	A list of models returned by <code>model_jp()</code> .
digits	Integer. Number of decimal places used to display the results.
dec	Character. Decimal separator to use (e.g. "." or ",").

Value

A tibble with one row per segment containing the grouping variable(s), number of joinpoints (JP), time period(s), APC and its 95% confidence interval, and AAPC with significance stars.

Author(s)

Tamara Ricardo

Examples

```
# Load example data
data(hiv_data)

# Fit joinpoint models
mods <- model_jp(
  data = hiv_data,
  value = hiv_rate,
  time = year,
  group = "region"
)

# Summarize models
summary_jp(mods, digits = 1, dec = ".")
```

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