Package ‘RankingProject’

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## Description

Functions to generate plots and tables for comparing independently-sampled populations. Companion package to "A Primer on Visualizations for Comparing Populations, Including the Issue of Overlapping Confidence Intervals" by Wright, Klein, and Wieczorek (2019) <DOI:10.1080/00031305.2017.1392359> and "A Joint Confidence Region for an Overall Ranking of Populations" by Klein, Wright, and Wieczorek (2020) <DOI:10.1111/rssc.12402>. See the Intro vignette (html) for an overview and examples: vignette("intro",package = "RankingProject"). See the Primer vignette (pdf) for code which replicates the main figures from the 2019 article: vignette("primer",package = "RankingProject"). See the Joint vignette (pdf) for code which replicates the main figures from the 2020 article: vignette("joint",package = "RankingProject").

## Details

The "comparison" plots are based on figures and S code from Almond et al. (2000). The present package does not contain a direct modification of their S code, but draws inspiration from it. Their script was originally hosted at Statlib at http://stat.cmu.edu/S/comprB and may still be found at Statlib mirrors such as http://ftp.uni-bayreuth.de/math/statlib/S/comprB.

The code for the "columns" plots is directly based on R's stats::heatmap() function, with minor modifications to remove dendrograms and allow the heatmap to be placed inside a larger layout().

## References


RankPlot creates a figure with a plot of ranking data, from among several options for showing uncertainty in the ranked estimates. This function is meant for use within `RankPlotWithTable`, which draws a ranking table aligned with this plot of the data in one combined figure.

Usage

```r
RankPlot(
    est, se, names,
    refName = NULL,
    confLevel = 0.9,
    plotType = c("individual", "difference", "comparison", "columns"),
    tiers = 1,
    GH = FALSE,
    Bonferroni = ifelse(plotType == "individual", "none", "demi"),
    tikzText = FALSE,
    cex = 1,
    tickWidth = NULL,
    rangeFactor = 1.2,
    textPad = 0,
    legendX = "topleft",
    legendY = NULL,
    legendText = NULL,
    lwdReg = 1,
    lwdBold = 3,
    thetaLine = 1,
    xlim = NULL,
    multcomp.type = c("bonferroni", "independence")
)
```

Arguments

- `est`, `se` Vectors containing the point estimate and its standard error for each area.
- `names` Vector containing the name of each area. Abbreviations may be preferable to full names (e.g. "CO" instead of "Colorado") since these names will be displayed directly on the plot.
- `refName` String containing the name of the reference area; must be one of the values in `names`. Required for `plotType = c("difference", "comparison")`. Optional for `plotType = "individual"` (where it only determines the row above/below
RankPlot

which the names are plotted to the right/left of the intervals; if unspecified, defaults to median rank); or for plotType = "columns" (where it selects one column to be highlighted by vertical lines, if specified).

confLevel

Number between 0 and 1: confidence level for individual (uncorrected) hypothesis tests and/or confidence intervals. E.g. with plotType = "individual", confLevel = 0.9 will plot individual 90% confidence intervals. If using GH = TRUE and/or Bonferroni != "none", the Goldstein-Healy and/or Bonferroni/Independence corrections will be applied to the confLevel baseline.

plotType

Which type of ranking plot to use. See vignettes for examples and details.

- "individual" is used for usual individual confidence intervals, with or without Goldstein-Healy adjustment and/or (demi or full) Bonferroni/Independence corrections.
- "difference" shows confidence intervals for the differences between the reference area refName and all other areas.
- "comparison" also compares the reference area refName to all others, but using the "comparison intervals" of Almond et al. (2000).
- "columns" plots a grid of shaded columns, where each column uses shading to report demi-Bonferroni/Independence-corrected significance tests for comparing the reference area (labeled at the bottom of the column) with all other areas.

tiers

Numeric, either 1 for usual confidence intervals, or 2 for two-tiered intervals. 2 can only be used with plotType = "individual", when either GH = TRUE or Bonferroni != "none" or both. In that case, the "inner tiers" run between each interval’s cross-bars, and the "outer tiers" run past the cross-bars all the way to the ends of each interval. One of the tiers will show uncorrected confLevel*100% confidence intervals, and the other tier will show the Goldstein-Healy and/or Bonferroni/Independence adjusted intervals. A legend will show which tier is which; usually Goldstein-Healy alone gives shorter intervals (inner tier), but Bonferroni/Independence corrections make them into longer intervals (outer tier).

GH

Logical, for whether or not to plot adjusted confidence intervals at an "average" confLevel*100% confidence level as in Goldstein and Healy (1995). Can only be used with plotType = "individual".

Bonferroni

Whether and how to correct for multiple comparisons by a Bonferroni or Independence correction to the confidence level of the tests or intervals. "none" performs no correction; "demi" corrects for comparing one reference area to all n-1 other areas; and "full" corrects for comparing all possible choose(n-1,2) pairs of areas. If GH = TRUE, the Goldstein-Healy adjustment is performed first, and any Bonferroni/Independence correction is applied afterwards. Settings "none" and "full" can only be used with plotType = "individual"; all other plot types use the setting "demi". (For now, use the multcomp.type argument to specify whether the correction should rely on Bonferroni (default) or on an assumption of Independence. In the future, this package will be refactored so that the multiple-comparisons arguments are better named!)

tikzText

Logical, for whether or not to format text for tikz plotting.
**Details**

Users may wish to modify this code and write their own plot function, which can be swapped into `figureFunction` within `RankPlotWithTable`. Be aware that `RankPlotWithTable` uses `layout` to arrange the table and plot side-by-side, so `layout` cannot be used within a new `figureFunction`.

See Goldstein and Healy (1995) for details on the "average" confidence level procedure used when `GH = TRUE`. See Almond et al. (2000) for details on the "comparison intervals" procedure.

**References**


See Also

RankPlotWithTable and RankTable.

Examples

```r
# Plot of 90% confidence intervals for differences
# between each state and Colorado, with demi-Bonferroni correction,
# for US states' mean travel times to work, from the 2011 ACS
data(TravelTime2011)
with(TravelTime2011,
  RankPlot(est = Estimate.2dec, se = SE.2dec,
           names = Abbreviation, refName = "CO",
           confLevel = 0.90, cex = 0.6,
           plotType = "difference"))
```

Description

RankPlotWithTable aligns a table of ranking data with a plot of the data, in one combined figure. See RankTable and RankPlot for details about the default table and plot functions, including arguments that can be passed to those functions.

Usage

```r
RankPlotWithTable(
  tableParList,
  plotParList,
  tableFunction = RankTable,
  plotFunction = RankPlot,
  tableWidthProp = 3/8,
  tikzText = FALSE,
  annotRefName = NULL,
  annotRefRank = NULL,
  annotX = 0
)
```

Arguments

- `tableParList` A required named list of arguments that will be passed to `tableFunction` using `do.call()`. The default `tableFunction` is RankTable, which requires at least these four arguments: ranks, names, est, se.
RankPlotWithTable

plotParList A required named list of arguments that will be passed to plotFunction using do.call(). The default plotFunction is RankPlot, which requires at least these three arguments: est, se, names.

tableFunction The function to use for plotting a table of the data on the left-hand side of the layout. Default is RankTable.

plotFunction The function to use for plotting a figure of the data on the right-hand side of the layout. Default is RankPlot.

tableWidthProp A number between 0 and 1, for what proportion of the layout’s width should be used to plot the table. The remaining proportion 1-tableWidthProp is used to plot the figure.

tikzText Logical, formats text for tikz plotting if TRUE.

annotRefName, annotRefRank Optional rank and name of the reference area, for adding an extra annotation below the figure created by plotFunction. Currently centered at 0 on x-axis, so only useful when plotType = "difference". If provided, the list must contain two required named elements (refFullName and refRank, the reference area’s name and rank)

anntX A number, showing where on the x-axis to center the annotation if annotRefName and annotRefRank are not NULL.

Details

Users may write their own table and plot functions to swap into tableFunction and plotFunction. Be aware that RankPlotWithTable uses layout to arrange the table and plot side-by-side, so layout cannot be used within either tableFunction or plotFunction. This can also cause trouble for using the lattice package within plotFunction.

See Also

RankPlot and RankTable.

Examples

# Table with plot of individual 90% confidence intervals
# for US states' mean travel times to work, from the 2011 ACS data(TravelTime2011)
tableParList <- with(TravelTime2011,
  list(ranks = Rank, names = State,
       est = Estimate.2dec, se = SE.2dec,
       placeType = "State"))
plotParList <- with(TravelTime2011,
  list(est = Estimate.2dec, se = SE.2dec,
       names = Abbreviation,
       confLevel = .90, plotType = "individual", cex = 0.6))
RankPlotWithTable(tableParList = tableParList,
                   plotParList = plotParList)

# Illustrating the use of annotRefName and annotRefRank:
# Table with plot of 90% confidence intervals for differences
# between each state and Colorado, with demi-Bonferroni correction
plotParList$plotType <- "difference"
plotParList$refName <- "CO"
RankPlotWithTable(tableParList = tableParList, 
    plotParList = plotParList, annotRefName = "Colorado", 
    annotRefRank = TravelTime2011$Rank[which(TravelTime2011$Abbreviation == "CO")])

## RankTable

*Figure containing a table of ranking data.*

**Description**

`RankTable` creates a figure with a table of ranking data. This may not look very good plotted on its own. Rather, it is meant for use within `RankPlotWithTable`, which draws this table aligned with a plot of the data in one combined figure.

**Usage**

```r
RankTable(
  ranks,
  names,
  est,
  se,
  placeType = "State",
  col1 = 0.15,
  col2 = 0.6,
  col3 = 0.85,
  col4 = 1,
  textPos = 2,
  titleCex = 0.9,
  titleLift = 1.5,
  contentCex = 0.7,
  columnsPlotRefLine = NULL,
  tikzText = FALSE
)
```

**Arguments**

- `ranks` Vector containing the rank of each area.
- `names` Vector containing the name of each area.
- `est, se` Vectors containing the point estimate and its standard error for each area. See vignettes for examples of using `formatC` to turn the numeric estimates or SEs into strings, for printing with a consistent number of decimal places.
- `placeType` String, naming the type of places or units being ranked.
col1, col2, col3, col4
Numeric values between 0 and 1, showing where each column’s right-hand-side endpoint is along the table’s width. In other words, colJ should be the fraction of the table’s total width at which the Jth column should end, if using default of right-aligned columns (unless textPos != 2). Use col4 = 1 unless you want the table to be narrower than the space available, or unless you switch to centered or left-aligned columns.

textPos Passed to pos argument of text. Default of 2 ensures each column of text is right-justified.

titleCex Character expansion factor for column titles.

titleLift Numeric value for how many row-heights to raise column titles above top row of column contents.

contentCex Character expansion factor for column contents (all column text except the titles).

columnsPlotRefLine Optional numeric value. If not NULL, how many row-heights below bottom row of column contents to print the phrase ”Reference State:” (or ”Reference <placeType>:”) as a label for bottom row of columns plot.

tikzText Logical, for whether or not to format text for tikz plotting.

Details
This function is currently hardcoded to give a table with four columns, with given column names. Users may wish to modify this code and write their own table function, which can be swapped into tableFunction within RankPlotWithTable. Be aware that RankPlotWithTable uses layout to arrange the table and plot side-by-side, so layout cannot be used within a new tableFunction.

See Also
RankPlotWithTable and RankPlot.

Examples
# Table of US states' mean travel times to work, from the 2011 ACS
data(TravelTime2011)
# Just as inside RankPlotWithTable(),
# we have to set par(xpd=TRUE)
# and adjust the plotting margins
oldpar <- par(no.readonly = TRUE)
oldmar <- par("mar")
par(xpd=TRUE, mar=c(oldmar[1],0,oldmar[3],0))
with(TravelTime2011,
  RankTable(ranks = Rank, names = State,
            est = Estimate.2dec, se = SE.2dec,
            placeType = "State"))
par(oldpar)
TravelTime2011

Mean travel times to work, from 2011 ACS.

Description

A dataset containing the estimated mean travel time (in minutes) to work of workers 16 years and over who did not work at home (henceforth "mean travel time to work"), and its estimated standard error, for each of the 51 states (including Washington, D.C.), from the 2011 American Community Survey.

Usage

TravelTime2011

Format

A data frame with 51 rows and 7 variables:

- **Rank**: state rank, by estimated mean travel time, where 1 is lowest travel time and 51 is highest
- **State**: full name of the state
- **Estimate.2dec**: estimated mean travel time, in minutes
- **SE.2dec**: estimated standard error of the estimated mean travel time, in minutes
- **Abbreviation**: postal abbreviation of the state
- **Region**: factor variable for geographic region of the state: Northeast, South, Midwest, West, Pacific
- **FIPS**: Federal Information Processing Standard (FIPS) code of the state; may be useful for linking with other datasets

Source

https://www.census.gov/

TravelTime2011.1dec

Mean travel times to work, from 2011 ACS, rounded to 1 decimal place.

Description

A dataset containing the estimated mean travel time (in minutes) to work of workers 16 years and over who did not work at home (henceforth "mean travel time to work"), and its estimated Margin of Error at the 90% confidence level, for each of the 51 states (including Washington, D.C.), from the 2011 American Community Survey.

Usage

TravelTime2011.1dec
Format

A data frame with 51 rows and 7 variables:

- **Rank**: state rank, by estimated mean travel time, where 1 is lowest travel time and 51 is highest
- **State**: full name of the state
- **Estimate.1dec**: estimated mean travel time, in minutes
- **MOE.1dec**: estimated Margin of Error (at the 90% confidence level) of the estimated mean travel time, in minutes
- **Abbreviation**: postal abbreviation of the state
- **Region**: factor variable for geographic region of the state: Northeast, South, Midwest, West, Pacific
- **FIPS**: Federal Information Processing Standard (FIPS) code of the state; may be useful for linking with other datasets

Details

Due to rounding, some ranks are tied in this version of the data. Also note that this dataset reports Margins of Error (MoEs) instead of standard errors.

Source

https://www.census.gov/
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