Package 'eikosograms'

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Type Package

Title The Picture of Probability

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URL https://github.com/rwoldford/eikosograms

Description An eikosogram (ancient Greek for probability picture) divides the unit square into rectangular regions whose areas, sides, and widths, represent various probabilities associated with the values of one or more categorical variates.
Rectangle areas are joint probabilities, widths are always marginal (though possibly joint margins, i.e. marginal joint distributions of two or more variates), and heights of rectangles are always conditional probabilities.
Eikosograms embed the rules of probability and are useful for introducing elementary probability theory, including axioms, marginal, conditional, and joint probabilities, and their relationships (including Bayes theorem as a completely trivial consequence).
They are markedly superior to Venn diagrams for this purpose, especially in distinguishing probabilistic independence, mutually exclusive events, coincident events, and associations.
They also are useful for identifying and understanding conditional independence structure.
As data analysis tools, eikosograms display categorical data in a manner similar to Mosaic plots, especially when only two variates are involved (the only case in which they are essentially identical, though eikosograms purposely disallow spacing between rectangles).
Unlike Mosaic plots, eikosograms do not alternate axes as each new categorical variate (beyond two) is introduced.
Instead, only one categorical variate, designated the ``response", presents on the vertical axis and all others, designated the ``conditioning" variates, appear on the horizontal.
In this way, conditional probability appears only as height and marginal probabilities as widths.
The eikosogram is therefore much better suited to a response model analysis (e.g. logistic model) than is a Mosaic plot.
Mosaic plots are better suited to log-linear style modelling as in discrete multivariate analysis.

Of course, eikosograms are also suited to discrete multivariate analysis with each variate in turn appearing as the response.
This makes it better suited than Mosaic plots to discrete graphical models based on conditional independence graphs (i.e. ``Bayesian Networks'' or ``BayesNets'').
The eikosogram and its superiority to Venn diagrams in teaching probability is described in W.H. Cherry and R.W. Oldford (2003) <https://math.uwaterloo.ca/~rwoldfor/papers/eikosograms/paper.pdf>,
its value in exploring conditional independence structure and relation to graphical and log-linear models
is described in R.W. Oldford (2003) <https://math.uwaterloo.ca/~rwoldfor/papers/eikosograms/independence/paper.pdf>,
and a number of problems, puzzles, and paradoxes that are easily explained with eikosograms are given in
R.W. Oldford (2003) <https://math.uwaterloo.ca/~rwoldfor/papers/eikosograms/examples/paper.pdf>.

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R topics documented:

eikos . . . 3
eikos.default . . . 4
eikos.formula . . . 6
eikos_data . . . 8
eikos_legend . . . 9
eikos_x_labels . . . 9
eikos_x_probs . . . 10
eikos_y_labels . . . 11
eikos_y_probs . . . 11

Index **13**

eikos *Generic method for creating an eikosogram*

Description

Generic method for creating an eikosogram

Usage

```
eikos(y, x = NULL, data = NULL, marginalize = NULL, main = "",
  main_size = 16, ylabs = TRUE, ylab_rot = 0, yname_size = 12,
  yvals_size = 12, yaxs = TRUE, yprobs = NULL, yprobs_size = 8,
  xlabs = TRUE, xlab_rot = 0, xname_size = 12, xvals_size = 12,
  xaxs = TRUE, xprobs = NULL, xprobs_size = 8, vertical_xprobs = TRUE,
  ispace = list(bottom = 8, left = 2, top = 2, right = 5), legend = FALSE,
  col = NULL, bottomcol = "steelblue", topcol = "snow2", lcol = "black",
  draw = TRUE, newpage = TRUE, lock_aspect = TRUE)
```

Arguments

y	Either the name of a variable in the data set (eikos.default), or a formula of such variables (eikos.formula).
x	name(s) of any conditional variable(s) (horizontal axis). Should be null if formula given.
data	data frame or table
marginalize	variable(s) to marginalize on, or NULL if none. Marginalized variables still appear in plot.
main	title of plot
main_size	font size of title (in points)
ylabs	logical, whether y labels should appear or not.
ylab_rot	rotation of y labels
yname_size	font size of vertical axis names (in points)
yvals_size	font size of labels for values of y variable (in points)
yaxs	logical, whether y axis should appear or not.
yprobs	probabilities to be shown on y-axis. NULL if they should be calculated from the data.
yprobs_size	font size of labels for horizontal probabilities (in points)
xlabs	logical, whether x labels should appear or not.
xlab_rot	rotation of x labels
xname_size	font size of horizontal axis names (in points)
xvals_size	font size of labels for values of x variables (in points)
xaxs	logical, whether x axis should appear or not.

xprobs	probabilities to be shown on x-axis. NULL if they should be calculated from the data.
xprobs_size	font size of labels for horizontal probabilities (in points)
vertical_xprobs	logical, whether probabilities on x axis should be rotated vertically.
ispace	list of four items (bottom, left, top, right) indicating the margins separating the text around the diagram. Each value is a positive integer giving a measure in "points".
legend	logical, whether to include legend
col	a vector of colours to match the response values. If NULL (the default), the colours are constructed as a smooth transition from ‘bottomcol‘ to ‘topcol‘ via ‘grDevices::colorRampPalette
bottomcol	bottom colour
topcol	top colour
lcol	colour of lines
draw	logical, whether to draw eikosogram.
newpage	logical, whether to draw on a newpage.
lock_aspect	logical, whether to force entire plot to 1:1 aspect ratio.

See Also

eikos.default

eikos.formula

Examples

```
eikos("Hair", "Eye", data=HairEyeColor, legend = TRUE)
eikos(gear ~ cyl, data = mtcars)
eikos(Admit ~  Gender + Dept, data = UCBAdmissions,
      yaxs = FALSE, xaxs = FALSE,
      lock_aspect = FALSE,
      xlab_rot = 90, xvals_size = 8,
      ispace = list(bottom = 15))
```

---

eikos.default *Create a new eikosogram*

Description

Return a grid graphic object (grob) and draw an eikosogram if draw = TRUE.

Usage

```
## Default S3 method:
eikos(y, x = NULL, data = NULL, marginalize = NULL,
  main = "", main_size = 16, ylabs = TRUE, ylab_rot = 0,
  yname_size = 12, yvals_size = 12, yaxs = TRUE, yprobs = NULL,
  yprobs_size = 8, xlabs = TRUE, xlab_rot = 0, xname_size = 12,
  xvals_size = 12, xaxs = TRUE, xprobs = NULL, xprobs_size = 8,
  vertical_xprobs = TRUE, ispace = list(bottom = 8, left = 2, top = 2, right
  = 5), legend = FALSE, col = NULL, bottomcol = "steelblue",
  topcol = "snow2", lcol = "black", draw = TRUE, newpage = TRUE,
  lock_aspect = TRUE)
```

Arguments

y	Either the name of a variable in the data set (eikos.default), or a formula of such variables (eikos.formula).
x	name(s) of any conditional variable(s) (horizontal axis). Should be null if formula given.
data	data frame or table
marginalize	variable(s) to marginalize on, or NULL if none. Marginalized variables still appear in plot.
main	title of plot
main_size	font size of title (in points)
ylabs	logical, whether y labels should appear or not.
ylab_rot	rotation of y labels
yname_size	font size of vertical axis names (in points)
yvals_size	font size of labels for values of y variable (in points)
yaxs	logical, whether y axis should appear or not.
yprobs	probabilities to be shown on y-axis. NULL if they should be calculated from the data.
yprobs_size	font size of labels for horizontal probabilities (in points)
xlabs	logical, whether x labels should appear or not.
xlab_rot	rotation of x labels
xname_size	font size of horizontal axis names (in points)
xvals_size	font size of labels for values of x variables (in points)
xaxs	logical, whether x axis should appear or not.
xprobs	probabilities to be shown on x-axis. NULL if they should be calculated from the data.
xprobs_size	font size of labels for horizontal probabilities (in points)
vertical_xprobs	logical, whether probabilities on x axis should be rotated vertically.

ispace	list of four items (bottom, left, top, right) indicating the margins separating the text around the diagram. Each value is a positive integer giving a measure in "points".
legend	logical, whether to include legend
col	a vector of colours to match the response values. If NULL (the default), the colours are constructed as a smooth transition from ‘bottomcol‘ to ‘topcol‘ via ‘grDevices::colorRampPalette
bottomcol	bottom colour
topcol	top colour
lcol	colour of lines
draw	logical, whether to draw eikosogram.
newpage	logical, whether to draw on a newpage.
lock_aspect	logical, whether to force entire plot to 1:1 aspect ratio.

Examples

```
eikos("Hair", "Eye", data=HairEyeColor, legend = TRUE)
eikos("Hair", "Eye", data=HairEyeColor,
      legend = TRUE, ylabs = FALSE,
      yname_size = 16, yvals_size = 8)
eikos("Hair", "Eye", data=HairEyeColor,
      legend = TRUE, ylabs = FALSE,
      yprobs = seq(0.2, 1, .2))
eikos("Eye", "Hair", data=HairEyeColor, yprobs = seq(0,1,0.25),
      yname_size = 20, xname_size = 20,
      col = c("sienna4", "steelblue", "darkkhaki", "springgreen3"),
      lcol = "grey10",
      lock_aspect = FALSE)
```

---

eikos.formula *Draw eikosogram using a formula to identify response and conditioning variates*

Description

Draw eikosogram using a formula to identify response and conditioning variates

Usage

```
## S3 method for class 'formula'
eikos(y, x = NULL, data = NULL, marginalize = NULL,
  main = "", main_size = 16, ylabs = TRUE, ylab_rot = 0,
  yname_size = 12, yvals_size = 12, yaxs = TRUE, yprobs = NULL,
  yprobs_size = 8, xlabs = TRUE, xlab_rot = 0, xname_size = 12,
  xvals_size = 12, xaxs = TRUE, xprobs = NULL, xprobs_size = 8,
```

```
vertical_xprobs = TRUE, ispace = list(bottom = 8, left = 2, top = 2, right
= 5), legend = FALSE, col = NULL, bottomcol = "steelblue",
topcol = "snow2", lcol = "black", draw = TRUE, newpage = TRUE,
lock_aspect = TRUE)
```

Arguments

y	Either the name of a variable in the data set (eikos.default), or a formula of such variables (eikos.formula).
x	name(s) of any conditional variable(s) (horizontal axis). Should be null if formula given.
data	data frame or table
marginalize	variable(s) to marginalize on, or NULL if none. Marginalized variables still appear in plot.
main	title of plot
main_size	font size of title (in points)
ylabs	logical, whether y labels should appear or not.
ylab_rot	rotation of y labels
yname_size	font size of vertical axis names (in points)
yvals_size	font size of labels for values of y variable (in points)
yaxs	logical, whether y axis should appear or not.
yprobs	probabilities to be shown on y-axis. NULL if they should be calculated from the data.
yprobs_size	font size of labels for horizontal probabilities (in points)
xlabs	logical, whether x labels should appear or not.
xlab_rot	rotation of x labels
xname_size	font size of horizontal axis names (in points)
xvals_size	font size of labels for values of x variables (in points)
xaxs	logical, whether x axis should appear or not.
xprobs	probabilities to be shown on x-axis. NULL if they should be calculated from the data.
xprobs_size	font size of labels for horizontal probabilities (in points)
vertical_xprobs	logical, whether probabilities on x axis should be rotated vertically.
ispace	list of four items (bottom, left, top, right) indicating the margins separating the text around the diagram. Each value is a positive integer giving a measure in "points".
legend	logical, whether to include legend
col	a vector of colours to match the response values. If NULL (the default), the colours are constructed as a smooth transition from ‘bottomcol‘ to ‘topcol‘ via ‘grDevices::colorRampPalette

bottomcol	bottom colour
topcol	top colour
lcol	colour of lines
draw	logical, whether to draw eikosogram.
newpage	logical, whether to draw on a newpage.
lock_aspect	logical, whether to force entire plot to 1:1 aspect ratio.

Examples

```
eikos(Eye ~ Hair + Sex, data=HairEyeColor)
eikos(Hair ~ ., data=HairEyeColor,
      yaxs = FALSE, ylabs = FALSE,
      legend = TRUE,
      col = c("black", "sienna4",
              "orangered", "lightgoldenrod" ))
eikos(Hair ~ ., data=HairEyeColor, xlab_rot = 30,
      yprobs = seq(0.1, 1, 0.1),
      yvals_size = 10,
      xvals_size = 8,
      ispace = list(bottom = 10),
      bottomcol = "grey30", topcol = "grey70",
      lcol = "white")
eikos(Hair ~ ., data=HairEyeColor, xlab_rot = 30,
      marginalize = "Eye",
      yvals_size = 10,
      xvals_size = 8,
      ispace = list(bottom = 10),
      bottomcol = "grey30", topcol = "grey70",
      lcol = "white")
eikos(Hair ~ ., data=HairEyeColor, xlab_rot = 30,
      marginalize = c("Eye", "Sex"),
      yvals_size = 10,
      xvals_size = 8,
      ispace = list(bottom = 10),
      bottomcol = "grey30", topcol = "grey70",
      lcol = "white")
```

---

eikos_data *Create eikosogram data frame*

Description

Eikos helper function used to convert data.

Usage

```
eikos_data(y, x, data, marginalize = NULL)
```

Arguments

y	response variable.
x	conditional variables.
data	data frame or table to be converted.
marginalize	name of variable to marginalize on, NULL if none.

---

eikos_legend *Create eikosogram legend*

Description

Eikos helper function used to create legend.

Usage

```
eikos_legend(labels, title = NULL, yname_size = 12, yvals_size = 12, col,
  margin = unit(2, "points"), lcol = "black")
```

Arguments

labels	labels to be included in legend
title	if non-NULL a string to give as the legend title
yname_size	font size of vertical axis names (in points)
yvals_size	font size of labels for values of y variable (in points)
col	colours od
margin	unit specifying margin between legend entries
lcol	line colour

---

eikos_x_labels *eikos helper function. Returns grob with x axis labels.*

Description

eikos helper function. Returns grob with x axis labels.

Usage

```
eikos_x_labels(x, data, margin = unit(10, "points"), xname_size = 12,
  xvals_size = 10, lab_rot = 0)
```

Arguments

x	vector of conditional variables
data	data frame from eikos_data.
margin	unit specifying margin
xname_size	font size for x axis variable names (in points)
xvals_size	font size of labels for values of x variables (in points)
lab_rot	integer indicating the rotation of the label, default is horizontal

Value

gList with x labels and x-axis names as grob frames.

---

eikos_x_probs *Create grob with eikosogram x-axis probabilities*

Description

Creates x axis grob to be placed on eikosogram. Called by eikos functions.

Usage

```
eikos_x_probs(data, xprobs = NULL, xprobs_size = 8, margin = unit(2,
  "points"), rotate = TRUE)
```

Arguments

data	data frame from eikos_data object
xprobs	vector of probabilities to be shown. NULL if they should be calculated from the data.
xprobs_size	font size of labels for horizontal probabilities (in points)
margin	unit specifying margin between y axis and eikosogram
rotate	logical, whether probabilities should be rotated vertically.

Value

textGrob with x-axis probabilities.

eikos_y_labels *eikos helper function. Returns grob with y axis labels.*

Description

eikos helper function. Returns grob with y axis labels.

Usage

```
eikos_y_labels(y, data, margin = unit(2, "points"), yname_size = 12,
  yvals_size = 10, lab_rot = 0)
```

Arguments

y	response variable
data	data frame from eikos_data.
margin	unit specifying margin
yname_size	font size for y axis variable names (in points)
yvals_size	font size of labels for values of y variable (in points)
lab_rot	integer indicating the rotation of the label, default is horizontal

Value

gList with x labels and x-axis names as grob frames.

grobFrame with response variable labels and axis text

eikos_y_probs *Create grob with eikosogram y-axis probabilities*

Description

Creates y axis grob to be placed on eikosogram. Called by eikos functions.

Usage

```
eikos_y_probs(data, yprobs, yprobs_size = 8, margin = unit(2, "points"))
```

Arguments

data	data frame from eikos_data object
yprobs	vector of probabilities to be shown. NULL if they should be calculated from the data.
yprobs_size	font size of labels for horizontal probabilities (in points)
margin	unit specifying margin between y axis and eikosogram

Value

textGrob with y-axis probabilities.

Index

eikos, 3
eikos.default, *4*, 4
eikos.formula, *4*, 6
eikos_data, 8
eikos_legend, 9
eikos_x_labels, 9
eikos_x_probs, 10
eikos_y_labels, 11
eikos_y_probs, 11