Package 'MVQuickGraphs'

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Type Package

Title Quick Multivariate Graphs

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Author Douglas Whitaker

Maintainer Douglas Whitaker <douglas.whitaker@msvu.ca>

Description Functions used for graphing in multivariate contexts. These functions are designed to support produce reasonable graphs with minimal input of graphing parameters. The motivation for these functions was to support students learning multivariate concepts and R - there may be other functions and packages better-suited to practical data analysis. For details about the ellipse methods see Johnson and Wichern (2007, ISBN:9780131877153).

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Contents

bvNormalContour *Bivariate Normal Contour Ellipse*

Description

Draws a contour of constant density at the (1-alpha)100% level for a bivariate normal distribution using the eigendecomposition of the covariance matrix. This is likely more interesting for learning about the bivariate normal distribution than as a practical tool, for which other functions already exist (e.g. link[graphics]{contour}).

Usage

```
bvNormalContour(mu = c(0,0), Sigma=NULL, eig=NULL, xl = NULL, yl = NULL,
axes = TRUE, center = FALSE, lim.adj = 0.02, alpha = 0.05, ...)
```

Arguments

mu	a vector giving the mean of the bivariate normal distribution. This is the center of the ellipse.
Sigma	a matrix giving the covariance matrix of the bivariate normal distribution. Either Sigma or eig must be specified.
eig	the eigenvalues and eigenvectors of the covariance matrix. This should be of the same form as the output of eigen, namely a list with two components: values and vectors. It is assumed that the largest eigenvalue is given first. Either Sigma or eig must be specified.
xl	a vector giving the lower and upper limits of the x-axis for plotting. If xl = NULL (default), then reasonable values are computed automatically.
yl	a vector giving the lower and upper limits of the y-axis for plotting. If yl = NULL (default), then reasonable values are computed automatically.
axes	logical. If axes = TRUE (default) then the major and minor axes of the ellipse are plotted.
center	logical. If axes = TRUE then the center of the ellipse is indicated with a point and dashed lines are drawn to the x-axis and y-axis.
lim.adj	a value giving an adjustment to the x-axis and y-axis limits computed if either xl = NULL or yl = NULL. Essentially this is a way to have some coarse control over these limits for quick graphing: positive values will increase the distance between the upper and lower limits (making the ellipse appear smaller) while negative values will decrease the distance (and make the ellipse appear larger).
alpha	a value giving the value of alpha to be used when computing the contour. Contours are drawn at the 1-alpha level.
...	other arguments to be passed to the graphing functions.

Value

None

References

Johnson, R. A., & Wichern, D. W. (2007). Applied multivariate statistical analysis (6th ed). Pearson Prentice Hall.

Examples

```
mu <- c(-1,8)
Sigma <- matrix(c(3,2,2,4), ncol = 2)
# Draw a 90% contour
bvNormalContour(mu = mu, Sigma = Sigma, alpha = 0.10)
```

---

confidenceEllipse *Bivariate Normal Confidence Ellipse*

Description

Draws a (1-alpha)100% confidence ellipse (two dimensional) for a multivariate normal distribution using the eigendecomposition of the covariance matrix.

Usage

```
confidenceEllipse(X.mean = c(0,0), eig, n, p,
xl = NULL, yl = NULL,
axes = TRUE, center = FALSE,
lim.adj = 0.02,
alpha = 0.05,
...)
```

Arguments

X.mean	a column matrix giving the mean of the two dimensions of the p-dimensional multivariate normal distribution.
eig	the eigenvalues and eigenvectors of the covariance matrix. This should be of the same form as the output of eigen, namely a list with two components: values and vectors. It is assumed that the largest eigenvalue is given first.
n	the number of observations.
p	the number of dimensions of the multivariate normal distribution. (The resulting graph will always be a two-dimensional confidence region for the two dimensions of a p-dimensional multivaraite normal distribution under consideration.)
xl	a vector giving the lower and upper limits of the x-axis for plotting. If xl = NULL (default), then reasonable values are computed automatically.
yl	a vector giving the lower and upper limits of the y-axis for plotting. If yl = NULL (default), then reasonable values are computed automatically.
axes	logical. If axes = TRUE (default) then the major and minor axes of the ellipse are plotted.

center	logical. If axes = TRUE then the center of the ellipse is indicated with a point and dashed lines are drawn to the x-axis and y-axis.
lim.adj	a value giving an adjustment to the x-axis and y-axis limits computed if either xl = NULL or yl = NULL. Essentially this is a way to have some coarse control over these limits for quick graphing: positive values will increase the distance between the upper and lower limits (making the ellipse appear smaller) while negative values will decrease the distance (and make the ellipse appear larger).
alpha	a value giving the value of alpha to be used when computing the contour. Contours are drawn at the 1-alpha level.
...	other arguments to be passed to the graphing functions.

Value

None

References

Johnson, R. A., & Wichern, D. W. (2007). Applied multivariate statistical analysis (6th ed). Pearson Prentice Hall.

Examples

```
# 90% Confidence Ellipse for Reading and Vocab from ability.cov
x.bar <- ability.cov$center[5:6]
Sigma <- ability.cov$cov[5:6,5:6]
n <- ability.cov$n.obs
p <- length(ability.cov$center)

confidenceEllipse(X.mean = x.bar,
                  eig = eigen(Sigma),
                  n = n, p = p,
                  alpha = 0.10)
```

`eigenEllipseHelper` *Helper Function for other Ellipse-from-Eigendecomposition Functions*

Description

Helper function for graphing ellipses from eigendecompositions. This function is used by bvNormalContour and confidenceEllipse. Essentially this is a wrapper for draw.ellipse that also calculates appropriate x-axis and y-axis limits to make graphing an ellipse easier (because the entire ellipse should be visible without any work on the user's part to specify the limits).

Usage

```
eigenEllipseHelper(mu, lengths, angle, xl, yl, lim.adj, axes, center, ...)
```

Arguments

mu	column matrix giving the coordinates for the cener of the ellipse.
lengths	vector giving the major and minor axis lengths.
angle	angle of rotation (in radians).
xl	x-axis limits. If xl = NULL then these are computed automatically.
yl	y-axis limits. If yl = NULL then these are computed automatically.
lim.adj	a value giving an adjustment to the x-axis and y-axis limits computed if either xl = NULL or yl = NULL.
axes	logical. If axes = TRUE, then the major and minor axes are graphed.
center	logical. If axes = TRUE then the center of the ellipse is indicated with a point and dashed lines are drawn to the x-axis and y-axis.
...	other arguments to be passed to the graphing functions.

Value

None

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plot4in1 *Plot 4-in-1*

Description

Generates a 2x2 panel graph including four residual diagnostic plots as is popular in some other statistics packages. This was initially written to support students learning R for the first time in a regression modeling course. plot4in1 generates four commonly-used residual diagnostic plots that can be used to assess the linear regression assumptions and ensures a consistent, reasonably-pleasing graphical style across each plot.

Usage

```
plot4in1(out, type="Regular", PP=TRUE, pch=19, col="steelblue", cex=1.2, ...)
```

Arguments

out	the output of the lm function (an object of class "lm"). The components of greatest importance from this object are residuals (perhaps passed to rstandard of rstudent, depending on type) and fitted.values.
type	the type of residuals to be used. There are three possible values: "Regular", "Standardized", and "Studentized". Using type = "Regular" results in untransformed residuals being used, type = "Standardized" uses standardized residuals (computed using rstandard), and type = "Studentized" uses externally studentized residuals (computed using rstudent).

PP	logical. If PP = TRUE, a Normal Percentile Plot (P-P Plot) is displayed in the top-left panel. If PP = FALSE, a Normal Quantile Plot (Q-Q Plot) is displayed in the top-left panel.
pch	symbol to be used in plotting. pch = 19 is a filled circle (see par).
col	color of symbol specified in pch to be used in graphing. The default is "steelblue" (see par).
cex	character expansion value, used to adjust the size of the symbol specified in pch. The default value is cex = 1.2 (see par).
...	other arguments to be passed to the graphing functions.

Details

plot4in1 creates a 2 by 2 panel using par(mfrow = c(2,2)) and then generates four residual diagnostic plots: a Percentile-Percentile (or Quantile-Quantile plot if PP = FALSE), a scatterplot of the fitted.values against the residuals, a histogram of the residuals, and scatterplot of the residuals against their order, overplotted.

Value

None

See Also

influence.measures for more information about standardized (rstandard) and studentized (rstudent) residuals; qqnorm for more information about the Quantile-Quanitle (Q-Q) plot; par for information about the graphical parameters.

Examples

```
out <- lm(Girth ~ Volume, data = trees)
plot4in1(out)
```

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