Package 'gamlss.ggplots'

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Description Plotting functions for Generalised Additive Models for Location Scale and Shape.

Title Plotting Generalised Additive Model for Location, Scale and Shape

LazyLoad yes

Version 1.0-0

Date 2022-02-06

Depends R (>= 3.5.0), gamlss.dist, gamlss (>= 4.3.3), ggplot2, gamlss.foreach

Imports methods, ggridges, ellipse

Suggests glmnet

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gamlss.ggplots-package *Plotting Generalised Additive Model for Location, Scale and Shape*

Description

Plotting functions for Generalised Additive Models for Location Scale and Shape.

Details

The DESCRIPTION file:

Package:	gamlss.ggplots
Description:	Plotting functions for Generalised Additive Models for Location Scale and Shape.
Title:	Plotting Generalised Additive Model for Location, Scale and Shape
LazyLoad:	yes
Version:	1.0-0
Date:	2022-02-06
Depends:	R (>= 3.5.0), gamlss.dist, gamlss (>= 4.3.3), ggplot2, gamlss.foreach
Imports:	methods, ggridges, ellipse
Suggests:	glmnet
Author:	Mikis Stasinopoulos <d.stasinopoulos@londonmet.ac.ukg>, Bob Rigby, Fernanda De Bastiani, Julian M
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Index of help topics:

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gamlss.ggplots-package
                        Plotting Generalised Additive Model for
                        Location, Scale and Shape
model_GAIC              Plotting GAIC for GAMLSS models
moment_bucket           Moment bucket plot
moment_gray_half        Functions to create the background for the
                        bucket plots
resid_index             A residual plot against the index of
                        observations
```

The following convention has been used to name the functions:

`fitted_NAME`: plots concerning fitted values from a single fitted model

`resid_NAME`: plots concerning residuals from a single fitted model

`predict_NAME`: plots concerning prediction values from a single fitted model usually having `newdata` option.

`model_NAME`: plots concerning different fitted models

where `NAME` refer to different characteristics.

Author(s)

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Maintainer: Mikis Stasinopoulos <d.stasinopoulos@londonmet.ac.uk>

References

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Rigby, R. A., Stasinopoulos, D. M., Heller, G. Z., and De Bastiani, F. (2019) *Distributions for modeling location, scale, and shape: Using GAMLSS in R*, Chapman and Hall/CRC, doi: 10.1201/9780429298547. An older version can be found in https://www.gamlss.com/.

Stasinopoulos D. M. Rigby R.A. (2007) Generalized additive models for location scale and shape (GAMLSS) in R. *Journal of Statistical Software*, Vol. **23**, Issue 7, Dec 2007, doi: 10.18637/jss.v023.i07.

Stasinopoulos D. M., Rigby R.A., Heller G., Voudouris V., and De Bastiani F., (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*, Chapman and Hall/CRC. doi: 10.1201/b21973

Stasinopoulos, M. D., Rigby, R. A., and De Bastiani F., (2018) GAMLSS: a distributional regression approach, *Statistical Modelling*, Vol. **18**, pp, 248-273, SAGE Publications Sage India: New Delhi, India.

(see also https://www.gamlss.com/).

See Also

`gamlss`, `gamlss.family`

Examples

```
library(gamlss)
m1 <- gamlss(y~pb(x), data=abdom)
resid_index(m1)
```

centile_bucket *Centile bucket plot*

Description

A bucket plot is a graphical way to check the skewness and kurtosis of a continuous variable or the residuals of a fitted GAMLSS model. It plots the centile skewness (tail or central) and transformed centile kurtosis of the variable (or residuals) together with a cloud of points obtained using a non-parametric bootstrap from the original variable (or residuals). It also provides a graphical way of performing a Monte Carlo simulation test on whether the centile skewness and transformed centile kurtosis of the variable of interest are simultaneously equal to zero.

There are two function here:

i) `cenlile_bucket()` for a single bucket plot. Note that `model_cen_bucket()` and `centile_bucket()` are synonymous.

ii) `centile_bucket_wrap()` for multiple bucket plots cut according to terms in the model.

Usage

```
centile_bucket(x, ..., type = c("tail", "central"), weights = NULL,
       no_bootstrap = 99, col_bootstrap = hcl.colors(length.obj,
       palette = "Set 2"), alpha_bootstrap = 1, text_to_show = NULL,
       cex_text = 5, col_text = "black", colour_bucket = FALSE,
       line_width = 0.5, sim_test = FALSE, no_sim_test = 1000,
       col_sim_test = gray(0.7), alpha_sim_test = 0.1, seed_test = 1234)

model_cent_bucket(x, ..., type = c("tail", "central"), weights = NULL,
       no_bootstrap = 99, col_bootstrap = hcl.colors(length.obj,
       palette = "Set 2"), alpha_bootstrap = 1, text_to_show = NULL,
       cex_text = 5, col_text = "black", colour_bucket = FALSE,
       line_width = 0.5, sim_test = FALSE, no_sim_test = 1000,
       col_sim_test = gray(0.7), alpha_sim_test = 0.1, seed_test = 1234)


centile_bucket_wrap(x, ..., type = c("tail", "central"), weights = NULL,
      xvar = NULL, n_inter = 4, no_bootstrap = 99,
      col_bootstrap = hcl.colors(length.obj, palette = "Set 2"),
      alpha_bootstrap = 1, text_to_show = NULL, check_overlap_text = FALSE,
      cex_text = 5, col_text = "black", colour_bucket = FALSE,
      line_width = 0.5, sim_test = FALSE, no_sim_test = 1000,
      col_sim_test = gray(0.7), alpha_sim_test = 0.1, seed_test = 1234)
```

Arguments

x	x should be a continuous vector of a GAMLSS fitted model.
...	for more that one continuous vectors or fitted models

type	whether "tail" of "central" skewness and kurtosis
weights	if priors weights are needed
no_bootstrap	the number of bootstrap samples for the cloud around the point of skewness and kurtosis.
col_bootstrap	The colour of the bootstrap samples
alpha_bootstrap	The transparency parameter of the bootstrap samples.
text_to_show	what text to show in the plots, default the names of vectors or models
cex_text	the character size of the text
col_text	the colour of the text
colour_bucket	whether colour or gray lines in the bucket
line_width	the line width
sim_test	whether to Monde Carlo simulation is needed to check the null hypothesis that there is no centile skewness and transformed centile kurtosis in the sample.
no_sim_test	The number of simulation for the test
col_sim_test	the colour used for displaying the Monde Carlo test values
alpha_sim_test	The transparency parameter of the Monde Carlo samples.
seed_test	A seed value for the Monde Carlo simulation.
xvar	the x term
n_inter	how many intervals needed
check_overlap_text	whether to check overlapping text

Details

More details about centile bucket plots is given in De Bastiani *et al.* (2022)

Value

A plot displaying the centile skewness and transformed centile kurtosis of the sample or residual of a model.

Note

The bucket plot provides an additional residual diagnostic tool that can be used for fitted model checking, alongside other diagnostic tools, for example worm plots, and Q (and Z) statistics.

Author(s)

Mikis Stasinopoulos, <d.stasinopoulos@londonmet.ac.uk>, Bob Rigby <r.rigby@londonmet.ac.uk> and Fernanda De Bastiani

References

De Bastiani, F., Stasinopoulos, D. M., Rigby, R. A., Heller, G. Z., and Lucas A. (2022) Bucket Plot: A Visual Tool for Skewness and Kurtosis Comparisons. To be published.

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Rigby, R. A., Stasinopoulos, D. M., Heller, G. Z., and De Bastiani, F. (2019) *Distributions for modeling location, scale, and shape: Using GAMLSS in R*, Chapman and Hall/CRC. doi: 10.1201/9780429298547 An older version can be found in https://www.gamlss.com/.

Stasinopoulos D. M. Rigby R.A. (2007) Generalized additive models for location scale and shape (GAMLSS) in R. *Journal of Statistical Software*, Vol. **23**, Issue 7, Dec 2007, doi: 10.18637/jss.v023.i07.

Stasinopoulos D. M., Rigby R.A., Heller G., Voudouris V., and De Bastiani F., (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*, Chapman and Hall/CRC. doi: 10.1201/b21973

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(see also https://www.gamlss.com/).

See Also

wp,Q.stats

Examples

```
m1 <- gamlss(R~pb(Fl)+pb(A), data=rent, family=GA)
centile_bucket(m1)
## Not run:
centile_bucket_wrap(m1, xvar=rent$A)

## End(Not run)
```

---

model_GAIC *Plotting GAIC for GAMLSS models*

Description

The function `model_GAIC()` is similar to the function `GAIC.scaled()` of the package **gamlss**. It produces, [for a given set of different fitted models or for a table produced by `chooseDist()`], the scaled Akaike values (see Burnham and Anderson (2002) section 2.9 for a similar concept of the GAIC weights. The plot of the GAIC's should not be interpreted as posterior probabilities of models given the data but can be used for model selection purpose since they produce a scaled ranking of the model using their relative importance i.e. from the worst to the best model.

The function `model_GAIC_lollipop()` is almost identical to `model_GAIC()` but the result is a lollipop plot.

Usage

```
model_GAIC(object, ..., k = 2, c = FALSE, plot = TRUE,
       which = 1, diff.dev = 1000, text.to.show = NULL,
       col = "rosybrown", width = 0.9, horiz = TRUE,
       scale = c("[0,1]","[max,min]"), title)

model_GAIC_lollipop(object, ..., k = 2, c = FALSE, plot = TRUE,
       which = 1, diff.dev = 1000, text.to.show = NULL,
       col = "rosybrown", width = 0.9, horiz = TRUE,
       scale = c("[0,1]", "[max,min]"), order.val = TRUE, title)
```

Arguments

`object`	a set of `gamlss` fitted model(s) or a matrix table produced by `chooseDist()`.
`...`	it allows several GAMLSS object to be compared using a GAIC
`k`	the penalty with default k=2
`c`	whether the corrected AIC, i.e. AICc, should be used, note that it applies only when `k=2`
`plot`	whether to plot with default equal `TRUE`
`which`	which column of GAIC table to plot
`diff.dev`	this argument applies only a matrix table produced by `chooseDist()` and prevents models with a difference in deviance greater than `diff.dev` from the 'best' model to be considered (or plotted).
`text.to.show`	if NULL, `model_GAIC()` shows the model names otherwise the character in this list (the length of which should be equal to the length of models)
`col`	The colour of the bars
`width`	the width of the bars
`horiz`	whether to plot the bars horizontally (default) or vertically
`scale`	the scale of the plot, `"[0,1]"` plots the AIC's from the worst to the best models in a scale from [0,1]. `"[max,min]"` plots the AIC's from the worst model to the best model but in the original scale of the AIC's
`title`	if different title is needed
`order.val`	whether to order the models from the best to the worst

Details

The option allow the AIC to be plotted from worst to best on a $[0, 1]$ scale using the formula i.e. $(AIC_w - AIC_m)/(AIC_w - AIC_b))$ where the AIC_w and AIC_b are the worst and best AIC, respectively, and AIC_m is the AIC of the current model. If the option `scale` is set to`[max,min]` the difference $(AIC_w - AIC_m)$ is plotted.

Value

It returns a bar plot using package **ggplot2**.

Author(s)

Mikis Stasinopoulos <d.stasinopoulos@londonmet.ac.uk>, Bob Rigby and Fernanda De Bastiani

References

Burnham K. P. and Anderson D. R (2002). *Model Selection and Multimodel Inference A Practical Information-Theoretic Approach*, Second Edition, Springer-Verlag New York, Inc.

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Rigby, R. A., Stasinopoulos, D. M., Heller, G. Z., and De Bastiani, F. (2019) *Distributions for modeling location, scale, and shape: Using GAMLSS in R*, Chapman and Hall/CRC. An older version can be found in https://www.gamlss.com/.

Stasinopoulos D. M. Rigby R.A. (2007) Generalized additive models for location scale and shape (GAMLSS) in R. *Journal of Statistical Software*, Vol. **23**, Issue 7, Dec 2007, https://www.jstatsoft.org/v23/i07/.

Stasinopoulos D. M., Rigby R.A., Heller G., Voudouris V., and De Bastiani F., (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*, Chapman and Hall/CRC.

(see also https://www.gamlss.com/).

See Also

GAIC.scaled

Examples

```
data(abdom)
m1 <-  gamlss(y~x, family=NO, data=abdom)
m2 <-  gamlss(y~x, sigma.fo=~x, family=NO, data=abdom)
m3 <-  gamlss(y~pb(x), sigma.fo=~x, family=NO, data=abdom)
m4 <-  gamlss(y~pb(x), sigma.fo=~pb(x), family=NO, data=abdom)

model_GAIC(m1,m2, m3, m4)

MT <- chooseDist(m3)
model_GAIC(MT)
model_GAIC(MT, which=2)
model_GAIC_lollipop(m1,m2, m3, m4)
```

---

moment_bucket *Moment bucket plot*

Description

A bucket plot is a graphical way to check the skewness and kurtosis of a continuous variable or the residuals of a fitted GAMLSS model. It plots the transformed moment skewness and transformed moment kurtosis of the variable (or residuals) together with a cloud of points obtained using a non-parametric bootstrap from the original variable (or residuals). It also provides a graphical way of performing the Jarque-Bera test (JarqueandBera,1980).

There are two function here:

i) `moment_bucket()` for a single bucket plot. Note that `model_mom_bucket()` and `moment_bucket()` are synonymous.

ii) `moment_bucket_wrap()` for multiple bucket plots cut according to terms in the model.

Usage

```
moment_bucket(x, ..., weights = NULL, no_bootstrap = 99,
           col_bootstrap = hcl.colors(length.obj, palette = "Set 2"),
           alpha_bootstrap = 1, text_to_show = NULL,
           cex_text = 5, col_text = "black", colour_bucket = FALSE,
           line_width = 0.5, col_JB_test = gray(.7), alpha_JB_test = .1)

model_mom_bucket(x, ..., weights = NULL, no_bootstrap = 99,
          col_bootstrap = hcl.colors(length.obj, palette = "Set 2"),
          alpha_bootstrap = 1, text_to_show = NULL,
          cex_text = 5, col_text = "black", colour_bucket = FALSE,
          line_width = 0.5, col_JB_test = gray(.7), alpha_JB_test = .1)

moment_bucket_wrap(x, ..., weights = NULL, xvar = NULL, n_inter = 4,
          no_bootstrap = 99,
          col_bootstrap = hcl.colors(length.obj, palette = "Set 2"),
          alpha_bootstrap = 1, text_to_show = NULL,
          check_overlap_text = FALSE, cex_text = 5,
          col_text = "black", colour_bucket = FALSE,
          col_JB_test = gray(.7), alpha_JB_test = .1)
```

Arguments

`x`	x should be a continuous vector of a GAMLSS fitted model.
`...`	this for more that one continuous vectors or fitted models
`weights`	if priors weights are needed
`no_bootstrap`	the number of bootstrap samples for the cloud around the point of skewness and kurtosis.
`col_bootstrap`	The colour of the bootstrap samples
`alpha_bootstrap`	The transparency parameter of the bootstrap samples.
`text_to_show`	what text to show in the plots, default the names of vectors ot models

cex_text	the character size of the text
col_text	the colour of the text
colour_bucket	whether colour or gray lines in the bucket
line_width	the line width
xvar	the x term
n_inter	how many intervals needed
check_overlap_text	whether to check overlapping text
col_JB_test	the colour for the Jarque-Bera test
alpha_JB_test	the transparency constant for the Jarque-Bera test

Value

A plot displaying the transformed moment skewness and transformed moment kurtosis of the sample or residual of a model.

Note

The bucket plot provides an additional residual diagnostic tool that can be used for fitted model checking, alongside other diagnostic tools, for example worm plots, and Q (and Z) statistics.

Author(s)

Mikis Stasinopoulos, <d.stasinopoulos@londonmet.ac.uk>, Bob Rigby <r.rigby@londonmet.ac.uk> and Fernanda De Bastiani

References

De Bastiani, F., Stasinopoulos, D. M., Rigby, R. A., Heller, G. Z., and Lucas A. (2022) Bucket Plot: A Visual Tool for Skewness and Kurtosis Comparisons. To be published.

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Rigby, R. A., Stasinopoulos, D. M., Heller, G. Z., and De Bastiani, F. (2019) *Distributions for modeling location, scale, and shape: Using GAMLSS in R*, Chapman and Hall/CRC. doi: 10.1201/9780429298547 An older version can be found in https://www.gamlss.com/.

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(see also https://www.gamlss.com/).

See Also

wp,Q.stats

Examples

```
m1 <- gamlss(R~pb(Fl)+pb(A), data=rent, family=GA)
moment_bucket(m1)
moment_bucket_wrap(m1, xvar=rent$A)
```

---

moment_gray_half *Functions to create the background for the bucket plots*

Description

The functions plot the moment transformed skewness and moment transformed kurtosis of five important 4-parameter distributions in GAMLSS.

Usage

```
moment_gray_half(legend = FALSE)

moment_gray_both(line_width = 1)

moment_colour_half(legend = TRUE)

moment_colour_both(legend = TRUE, line_width = 1)

centile_colour_half(type = c("tail", "central"), legend = TRUE,
                    line_width = 1)

centile_colour_both(type = c("tail", "central"), legend = TRUE,
                    line_width = 1)

centile_gray_both(type = c("tail", "central"), legend = TRUE,
                  line_width = 0.5)
```

Arguments

legend	whether legend is required
line_width	line width
type	whether to plot 'tail' or 'central' skewness and kurtosis.

Details

The functions are described in Rigby *et al* (2019)

Value

A plot is created.

Note

The functions are use by the bucket plot function `model_mom_bucket()` to create the background of the bucket plots.

Author(s)

Mikis Stasinopoulos, Bob Rigby and Fernanda de Bastiani

References

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Rigby, R. A., Stasinopoulos, D. M., Heller, G. Z., and De Bastiani, F. (2019) *Distributions for modeling location, scale, and shape: Using GAMLSS in R*, Chapman and Hall/CRC. doi: 10.1201/9780429298547 An older version can be found in https://www.gamlss.com/.

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Stasinopoulos D. M., Rigby R.A., Heller G., Voudouris V., and De Bastiani F., (2017) *Flexible Regression and Smoothing: Using GAMLSS in R*, Chapman and Hall/CRC. doi: 10.1201/b21973

(see also https://www.gamlss.com/).

See Also

momentSK, centileSK

Examples

```
moment_gray_half()
moment_gray_both()
moment_colour_half()
moment_colour_both()

centile_colour_both()
centile_gray_both()
centile_colour_half()
```

resid_index *A residual plot against the index of observations*

Description

The function `resid_index()` is plotting the residuals of a GAMLSS fitted model (or any other suitable standardised residual) against the observation number index.

The function `resid_fv()` plots the residuals against fitted values for `mu`. The function `resid_xvar()` plots the residuals against an explanatory term.

The function `resid_plots()` produces a plot similar to the one that the function `plot()` produce for a GAMLSS model in package **gamlss**. This is, four plots: a) `resid_index()`(b) `resid_fv()`, (c) `resid_density()` and (d) `resid_qqplot()`.

Residuals above (or below) certain specified value are identified.

Usage

```
resid_index(obj, resid, plot = TRUE, value = 2, title, annotate = TRUE,
           no.lines = FALSE)
resid_fv(obj, resid, plot = TRUE, value = 2, title, annotate = TRUE)

resid_plots(obj, theme = c("original", "ts", "new", "ecdf"), value = 3)

resid_xvar(obj, xvar, plot = TRUE, value = 2, title, annotate = TRUE)
```

Arguments

`obj`	a GAMLSS object
`resid`	or any other suitable standardised residual vector.
`xvar`	a continuous explanatory variable
`plot`	whether to plot the result
`value`	the cut off value for the identification of very large or very small residuals
`annotate`	whether the threshold annotation should appear or not
`title`	a title of the plot if needed
`theme`	what type of plots should `resid_plots()` used : "original" is like using `plot.gamlss()`, "ts" is like using `plot.gamlss(,ts="TRUE")` (not implemented yet), "new" it uses (a) `resid_index()`, (b) `resid_density()`, (c) `resid_wp()` and (d) `resid_dtop()`.
`no.lines`	this option allows to hide the horizontal lines so the resulting gg-plot can be used later with say `facet_wrap()` see example

Value

A plot of the residuals is returned.

Author(s)

Mikis Stasinopoulos <d.stasinopoulos@londonmet.ac.uk>, Bob Rigby and Fernanda De Bastiani

References

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape,(with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Rigby, R. A., Stasinopoulos, D. M., Heller, G. Z., and De Bastiani, F. (2019) *Distributions for modeling location, scale, and shape: Using GAMLSS in R*, Chapman and Hall/CRC, doi: 10.1201/9780429298547. An older version can be found in https://www.gamlss.com/.

Stasinopoulos D. M. Rigby R.A. (2007) Generalized additive models for location scale and shape (GAMLSS) in R. *Journal of Statistical Software*, Vol. **23**, Issue 7, Dec 2007, doi: 10.18637/jss.v023.i07.

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(see also https://www.gamlss.com/).

See Also

gamlss, plot.gamlss

Examples

```
data(rent)
r1<-gamlss(R~pb(Fl)+pb(A)+H+loc,family=GA,data=rent)
resid_index(r1)
resid_fv(r1)
resid_xvar(r1, A)
resid_plots(r1)
resid_index(r1, no.lines=TRUE)+facet_wrap(~ cut_number(rent$A, 6))
```

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resid_xvar *(*resid_index*)*, 13

wp, *6*, *11*