Package ‘sglg’

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Type Package

Title Fitting Semi-Parametric Generalized log-Gamma Regression Models

Version 0.2.6

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Description Set of tools to fit a linear multiple or semi-parametric regression
models with the possibility of non-informative random right or left censoring.
Under this setup, the localization parameter of the response variable distribution is modeled by using linear multiple regression
or semi-parametric functions, whose non-parametric components may be approximated
by natural cubic spline or P-
splines. The supported distribution for the model error is a generalized log-
gamma distribution which includes
the generalized extreme value and standard normal distributions as important special cases. Inference is based on likelihood, penalized likelihood and bootstrap methods.
Lastly, some numerical and graphical devices for diagnostic of the fitted models are offered.

Depends R (>= 3.1.0)

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

Suggests testthat

Imports Formula, survival, methods, stats, AdequacyModel, ggplot2,
plotly, moments, gridExtra, pracma, progress, Rcpp, plot3D,
magrittr, TeachingSampling

NeedsCompilation no

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Repository CRAN

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Contents

`ballbearing` *Ball-bearing times*

Description

A data set of ball-bearing failure times.

Usage

```
ballbearing
```

Format

A data set with 23 observations.

ball-bearing 23 failure times (each measurement in 106 revolutions).

Source

Andrew G. Glen (2017) On the Inverse Gamma as a Survival Distribution. Journal of Quality Technology. 43(2)158-166.

`bootglg` *Bootstrap inference for a generalized log-gamma regression*

Description

`bootglg` is used to generate parametric bootstrap inference, such as, estimated standard errors and approximate confidence intervals for a generalized log-gamma regression.

Usage

```
bootglg(formula, data, B = 500, alpha = 0.05, type = "normal", plt_den = FALSE)
```

Arguments

`formula`	a symbolic description of the systematic component of the model to be fitted.
`data`	data.frame, contains the variables in the formula object.
`B`	integer, represents the number of bootstrap replications. Default value is 500.
`alpha`	numeric, represents a confidence level for the bootstrap intervals. Default value is 0.05.

type
: character, indicates the type of bootstrap confidence interval for the estimated parameters. The options are: 'normal', 't_student' or 'bootstrap_t'. These intervals used the bootstrap estimated standard error of the ML estimates of the parameters. Other kind of bootstrap intervals are the percentile-type intervals. We offer the option 'BCa'. It is a bias-corrected and accelerated percentile interval. The default value for the 'type' argument is 'normal'.

plt_den
: boolean value, to request a density-type plot of the bootstrap estimates. Default value is FALSE.

Value

`ml_estimates` is a vector of maximum likelihood estimates associated with the coefficients of linear structure, scale, and shape parameters.

`boot_mean_estimates` is a vector of mean of the bootstrap estimates associated with the coefficients of linear structure, scale, and shape parameters.

`boot_bias_estimates` is a vector of bootstrap estimate of bias associated with the coefficients of linear structure, scale, and shape estimators.

`boot_sd_estimates` is a vector of bootstrap standard errors of the estimates associated with the coefficients of linear structure, scale, and shape estimators.

`type` indicates the type of confidence intervals.

`intervals` array of the confidence intervals of the coefficients of linear structure, scale, and shape.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Cardozo C. A., Paula G. and Vanegas L. sglg: An R package to fit semi-parametric generalized log-gamma regression models. In preparation.

Efron B and Tibshirani R (1993). An introduction to the Bootstrap. Chapman & Hall, Inc.

Examples

```
#####################################################################################################
set.seed(1)
n <- 250
x1 <- rnorm(n,mean=3)
t_beta  <- 1.2
t_sigma <- 0.5
t_lambda <- 1
error <- rglg(n, 0, t_sigma, t_lambda)
y1 <- t_beta*x1 + error
data <- data.frame(y1, x1)
# The following examples are based on 50 bootstrap replications.
# A 90% bootstrap confidence interval with the method 'normal'.
bootglg(y1 ~ x1 - 1, data = data, type='normal', B = 50, alpha = 0.1)
# A 95% bootstrap confidence interval with the method 't_student'.
```

```
bootglg(y1 ~ x1 - 1, data = data, type='t_student', B = 50)
# A 95% bootstrap confidence interval with the method 'bootstrap_t'.
bootglg(y1 ~ x1 - 1, data = data, type='bootstrap_t', B = 50)
# A 98% bootstrap confidence interval with the method 'BCa'.
#bootglg(y1 ~ x1 - 1, data = data, type='BCa', B = 50, alpha = 0.02)
##################################################################################################
```

`claims` *Personal Injury Insurance Claims*

Description

A dataset containing personal injury insurance claims made in Australia from January 1998 to June 1999.

Usage

```
claims
```

Format

A data frame with 769 rows and 4 variables:

amount amount of paid money by an insurance policy or claim size, in Australian dollars

legrep with legal representation or not

month month of occurrence of the accident

optime operational time in percentage with range 0 to 100

Source

de Jong P, Heller GZ (2008) Generalized linear models for insurance data. Cambridge University Press, Cambridge

---

`coef.sglg` *coef.sglg*

Description

coef.sglg extracts and display the estimated coefficients associated to the location parameter from a model from an object of class 'sglg'.

Usage

```
## S3 method for class 'sglg'
coef(object, ...)
```

Arguments

`object`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg() function.
`...`	other arguments.

---

cweight_scheme — *case-weight scheme*

Description

cweight_scheme extracts from a object of class sglg the local influence measures and displays their graphs versus the index of the observations.

Usage

```
cweight_scheme(model, ...)
```

Arguments

`model`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg().
`...`	other arguments.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
rows <- 100
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 1
t_lambda <- 1
set.seed(8142031)
x1 <- rbinom(rows, 1, 0.5)
x2 <- runif(columns, 0, 1)
X <- cbind(x1,x2)
error <- rglg(rows, 0, 1, t_lambda)
y1 <- X %*%t_beta + t_sigma * error
```

```
data.example <- data.frame(y1,X)
fit1 <- glg(y1 ~ x1 + x2 - 1,data=data.example)
cweight_scheme(fit1)
```

---

deBoor2 *Build the basis matrix and the penalty matrix of cubic B-spline basis.*

Description

deBoor builds the basis matrix and penalty matrix to approximate a smooth function using cubic B-spline cubic.

Usage

```
deBoor2(t, knots)
```

Arguments

t	a vector of values.
knots	a set of internal knot.

Value

nknot number of knots.

knots set of knots.

N basis matrix.

K penalty matrix.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
set.seed(1)
t_1 <- runif(120)
range(t_1)
t_2 <- t_1 + 2  #runif(120,2,3)
range(t_2)
knot <- 10
dB1 <- deBoor2(t_1,knot)
dB2 <- deBoor2(t_2,knot)
dB1$knots
```

```
dB2$knots
plot(0,0,xlim=c(-0.5,3.5))
points(dB1$knots,rep(0,length(dB1$knots)),pch=20)
delta <- dB2$knots[1] - dB1$knots[1]
points(dB2$knots-delta,rep(0,length(dB2$knots)),pch=2,col= 'blue')
dB1$K
dB2$K
zeros <- vector()
plot(t_1,dB1$N[,1],pch=20)
for(j in 1:knot){
points(t_1,dB1$N[,j],pch=20,col=j)
zeros[j] <- sum(dB1$N[,j]==0)
}
zeros/120
cond_tNN <- vector()
KnotS <- 3:50
for(j in KnotS){
dB1 <- deBoor2(t_1,j)
print(dB1$knots[2]- dB1$knots[1])
min_max <- range(eigen(t(dB1$N)%*%dB1$N)$values)
cond_tNN[j-2] <- min_max[1]/min_max[2]
}
cond_tNN
plot(KnotS,cond_tNN,pch=20,ylim=c(0,0.07))
```

`deviance_residuals` *Deviance Residuals for a Generalized Log-gamma Regression Model*

Description

`deviance_residuals` is used to generate deviance residuals for a generalized log-gamma regression model.

Usage

```
deviance_residuals(object, ...)
```

Arguments

`object`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg().
`...`	other arguments.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
# Example 1
n <- 300
error <- rglg(n,0,1,1)
y <- 0.5 + error
fit <- glg(y~1,data=as.data.frame(y))
deviance_residuals(fit)
# Example 2
n <- 300
error <- rglg(n,0,1,1)
x <- runif(n,-3,3)
y <- 0.5 +  2*x + error
fit <- glg(y~x,data=data.frame(y,x))
deviance_residuals(fit)
```

---

dglg — *Density distribution function for a generalized log-gamma variable*

Description

`dglg` is used to calculate the density distribution function of a generalized log-gamma variable at x.

Usage

```
dglg(x, location, scale, shape)
```

Arguments

`x`	numeric, a real number.
`location`	numeric, represent the location parameter of a generalized log-gamma distribution. Default value is 0.
`scale`	numeric, represent the scale parameter of a generalized log-gamma distribution. Default value is 1.
`shape`	numeric, represent the shape parameter of a generalized log-gamma distribution. Default value is 1.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
x <- seq(-7,4.5,length=100)
dglg(x,location=0,scale=1,shape=1)
plot(x,dglg(x,location=0,scale=1,shape=1),type="l",xlab="x",ylab="Density",col='red')
abline(h=0)
```

---

dk_order_glg — *Density Probability Distribution of a K-th Order Statistic from a Generalized Log-gamma Distribution*

Description

dk_order_glg is used to obtain the density probability distribution of the k-th order statistic from a generalized log-gamma distribution.

Usage

```
dk_order_glg(x, mu = 0, sigma = 1, lambda = 1, k, n)
```

Arguments

x	numeric, represents a real value.
mu	numeric, represents the location parameter. Default value is 0.
sigma	numeric, represents the scale parameter. Default value is 1.
lambda	numeric, represents the shape parameter. Default value is 1.
k	numeric, represents the K-th smallest value from a sample.
n	numeric, represents the size of the sample of the generalized log-gamma distribution.

Value

A list of values of the density probability function of the k-th order statistic from a generalized log-gamma distribution.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>.

References

Gentle, J, Computational Statistics, First Edition. Springer - Verlag, 2009.

Naradajah, S. and Rocha, R. (2016) Newdistns: An R Package for New Families of Distributions, Journal of Statistical Software.

Examples

```
# The density probability distribution of 10-th order statistics at 0
# from a random sample of extreme value distribution with n=20.
dk_order_glg(0,0,1,1,k=10,n=20)
```

`entropy` *Tool to calculate the entropy for a generalized log-gamma distribution.*

Description

`entropy` is used to obtain the entropy for a generalized log-gamma distribution.

Usage

```
entropy(mu, sigma, lambda)
```

Arguments

`mu`	numeric, represent the location parameter of a generalized log-gamma distribution. Default value is 0.
`sigma`	numeric, represent the scale parameter of a generalized log-gamma distribution. Default value is 1.
`lambda`	numeric, represent the shape parameter of a generalized log-gamma distribution. Default value is 1.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
entropy(0,1,-1)    # Extreme value type I distribution, maximum case.
entropy(0,1,1)     # Extreme value type I distribution, minimum case.
entropy(0,1,0.077) # Standard normal distribution.
```

envelope.sglg *envelope.sglg*

Description

Build a Normal probability plot with simulated envelope for a deviance-type residuals in semiparametric or multiple linear generalized log-gamma regression models.

Usage

```
envelope.sglg(fit, Rep)
```

Arguments

fit	an object of the class sglg. This object is returned from the call to glg(), sglg().
Rep	a positive integer. This is the number of replications on which to build the simulated envelope. Default is Rep=50.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Ortega, E., Paula, G. A. and Bolfarine, H. (2008) Deviance residuals in generalized log-gamma regression models with censored observations. Journal of Statistical Computation and Simulation, 78, 747-764.

Examples

```
rows <- 120
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 0.5
t_lambda <- 1
set.seed(8142031)
x1 <- rbinom(rows, 1, 0.5)
x2 <- runif(columns, 0, 1)
X <- cbind(x1,x2)
error <- rglg(rows, 0, 1, t_lambda)
y1 <- X %*%t_beta + t_sigma * error
data.example <- data.frame(y1,X)
fit <- glg(y1 ~ x1 + x2 - 1,data=data.example)
envelope.sglg(fit,Rep=50)
```

`fitted.sglg` *Extract Fitted Values*

Description

fitted.sglg extracts the fitted values from a model from an object of class 'sglg'.

Usage

```
## S3 method for class 'sglg'
fitted(object, ...)
```

Arguments

`object`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg() function.
`...`	other arguments.

`glg` *Fitting multiple linear Generalized Log-gamma Regression Models*

Description

glg is used to fit a multiple linear regression model suitable for analysis of data sets in which the response variable is continuous, strictly positive, and asymmetric. In this setup, the location parameter of the response variable is explicitly modeled by a linear function of the parameters.

Usage

```
glg(
  formula,
  data,
  shape = 0.75,
  Tolerance = 1e-07,
  Maxiter = 5000,
  format = "complete",
  envelope = FALSE
)
```

Arguments

formula	a symbolic description of the systematic component of the model to be fitted.
data	a data frame with the variables in the model.
shape	an optional value for the shape parameter of the error distribution of a generalized log-gamma distribution. Default value is 0.2.
Tolerance	an optional positive value, which represents the convergence criterion. Default value is 1e-07.
Maxiter	an optional positive integer giving the maximal number of iterations for the estimating process. Default value is 1e04.
format	an optional string value that indicates if you want a simple or a complete report of the estimating process. Default value is 'complete'.
envelope	an optional and internal logical value that indicates if the glg function will be employed for build an envelope plot. Default value is 'FALSE'.

Value

mu a vector of parameter estimates associated with the location parameter.

sigma estimate of the scale parameter associated with the model.

lambda estimate of the shape parameter associated with the model.

interval estimate of a 95% confidence interval for each estimate parameters associated with the model.

Deviance the deviance associated with the model.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
set.seed(2026)
n <- 250
x1 <- rnorm(n, mean=2.5, sd=1)
x2 <- runif(n, 0, 1)
X <- cbind(x1,x2)
t_beta  <- c(0.5, 2)
t_sigma <- 1

######################
#                    #
```

```
# Extreme value case #
#                    #
######################

t_lambda <- -1
error <- rglg(n, 0, 1, t_lambda)
y1 <- X %*%t_beta + t_sigma*error
data.example <- data.frame(y1,X)
fit <- glg(y1 ~ x1 + x2 - 1, data=data.example)
# Some typical S3 methods
logLik(fit)
summary(fit)
coef(fit)
vcov(fit)
deviance_residuals(fit)
fitted(fit)
#############################
#                           #
# Normal case: A limit case #
#                           #
#############################
# When the parameter lambda goes to zero the GLG tends to a normal distribution.
set.seed(2025)
y2 <- X %*%t_beta + rnorm(n)
data2 <- data.frame(y2, X)
fit2 <- glg(y2 ~ x1 + x2 - 1,data=data2)
fit2$condition
fit2$scores
fit2$llglg
fit2$AIC
coef(fit2)
fit2$sigma
fit2$lambda
############################################
#                                          #
#  A comparison with a normal linear model #
#                                          #
############################################

fit3 <- lm(y1 ~ x1 + x2 - 1,data=data.example)
coefficients(fit3)
logLik(fit3)
AIC(fit3)
```

`gnfit` *gnfit*

Description

This function provides some useful statistics to assess the quality of fit of generalized log-gamma probabilistic model, including the statistics Cramer-von Mises and Anderson-Darling. It can also calculate other goodness of fit such as Hannan-Quin Information Criterion and Kolmogorov-Smirnov test.

Usage

```
gnfit(starts, data)
```

Arguments

`starts`	numeric vector. Initial parameters to maximize the likelihood function
`data`	numeric vector. A sample of a generalized log-gamma distribution.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
## Not run:
set.seed(1)
# The size of the sample must be median or large to obtain a good estimates
n <- 100
sample <- rglg(n,location=0,scale=0.5,shape=0.75)
# This step takes a few minutes.
result <- gnfit(starts=c(0.1,0.75,1),data=sample)
result

## End(Not run)
```

`Gu` *Tool to build the basis matrix and the penalty matrix of natural cubic splines.*

Description

`Gu` builds the basis matrix and penalty matrix to approximate a smooth function using natural cubic splines based on the Gu basis form.

Usage

```
Gu(t, knot)
```

Arguments

`t`	the covariate.
`knot`	a integer value that represent the number of knots of the natural cubic spline.

Value

nknot number of knots.

knots set of knots.

N basis matrix.

K penalty matrix.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Wood, S. (2006) Generalized additive models: An R introduction. Chapman and Hall.

Carlos Alberto Cardozo Delgado. Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
t <- runif(1000)
knot <- 6
N_gu <- Gu(t,knot)
```

`logLik.sglg` *Extract Log-Likehood*

Description

logLik.sglg extracts log-likehood from a model from an object of class 'sglg'.

Usage

```
## S3 method for class 'sglg'
logLik(object, ...)
```

Arguments

`object`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg() function.
`...`	other arguments.

lss — *Measures of location, scale and shape measures for a generalized log-gamma distribution*

Description

`lss` is used to obtain the mean, median, mode, variance, coefficient of variation, skewness and kurtosis for a generalized log-gamma distribution.

Usage

```
lss(mu = 0, sigma = 1, lambda = 1)
```

Arguments

`mu`	numeric, represents the location parameter of a generalized log-gamma distribution. Default value is 0.
`sigma`	numeric, represents the scale parameter of a generalized log-gamma distribution. Default value is 1.
`lambda`	numeric, represents the shape parameter of a generalized log-gamma distribution. Default value is 1.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

National Institute of Standards and Technology, NIST. Engineering Statistics Handbook. https://www.itl.nist.gov/div898/hand

Examples

```
lss(0,1,-1)    # Extreme value type I distribution, maximum case.
lss(0,1,1)     # Extreme value type I distribution, minimum case.
lss(0,1,0.01) # Standard normal distribution.
```

moors_lss *Measures of location, scale, and shape based on quantile measures for a generalized log-gamma distribution*

Description

moors_lss is used to obtain the median, the half interquartile range and the quantile coefficient of skewness and kurtosis for a generalized log-gamma distribution.

Usage

```
moors_lss(mu = 0, sigma = 1, lambda = 1)
```

Arguments

mu	numeric, represents the location parameter of a generalized log-gamma distribution. Default value is 0.
sigma	numeric, represents the scale parameter of a generalized log-gamma distribution. Default value is 1.
lambda	numeric, represents the shape parameter of a generalized log-gamma distribution. Default value is 1.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

J. J. A. Moors (1988), A quantile alternative for kurtosis. The Statistician.

Examples

```
moors_lss(mu = 0,sigma = 1,lambda = -1)   # Extreme value type I distribution, maximum case.
moors_lss(mu = 0,sigma = 1,lambda = 1)    # Extreme value type I distribution, minimum case.
moors_lss(mu = 0,sigma = 1,lambda = 0.05) # Standard normal distribution.
```

mrl_gg *Mean Residual Lifetime Function for a Generalized Gamma Distribution*

Description

mrl_gg is used to obtain the value of the mean residual lifetime function of a generalized gamma distribution at a positive value.

Usage

```
mrl_gg(x = 1, mu = 0, sigma = 1, lambda = 1)
```

Arguments

x	numeric, represent a vector of positive values. Default value is 1.
mu	numeric, represents the location parameter of a generalized gamma distribution. Default value is 0.
sigma	numeric, represents the scale parameter of a generalized gamma distribution. Default value is 1.
lambda	numeric, represents the shape parameter of a generalized gamma distribution. Default value is 1.

Value

A numeric value of the mean residual lifetime of a generalized gamma distribution.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph.D. thesis. Sao Paulo University.

Jerald F. Lawless (2003). Statistical Models and Methods for Lifetime Data. Second Edition. John-Wiley & Sons

Examples

```
mrl_gg(x=0,mu=0,sigma=2,lambda=1) # Extreme value type I distribution, maximum case.
```

`order_glg` *Random Sampling of K-th Order Statistics from a Generalized Log-gamma Distribution*

Description

`order_glg` is used to obtain a random sample of the K-th order statistics from a generalized log-gamma distribution.

Usage

```
order_glg(size, mu, sigma, lambda, k, n, alpha = 0.05)
```

Arguments

`size`	numeric, represents the size of the sample.
`mu`	numeric, represents the location parameter. Default value is 0.
`sigma`	numeric, represents the scale parameter. Default value is 1.
`lambda`	numeric, represents the shape parameter. Default value is 1.
`k`	numeric, represents the K-th smallest value from a sample.
`n`	numeric, represents the size of the sample to compute the order statistic from.
`alpha`	numeric, (1 - alpha) represents the confidence of an interval for the population median of the distribution of the k-th order statistic. Default value is 0.05.

Value

A list with a random sample of order statistics from a generalized log-gamma distribution, the value of its join probability density function evaluated in the random sample and a (1 - alpha) confidence interval for the population median of the distribution of the k-th order statistic.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>.

References

Gentle, J, Computational Statistics, First Edition. Springer - Verlag, 2009.

Naradajah, S. and Rocha, R. (2016) Newdistns: An R Package for New Families of Distributions, Journal of Statistical Software.

Examples

```
# A random sample of size 10 of order statistics from a Extreme Value Distribution.
order_glg(10,0,1,1,1,50)
## Not run:  # A small comparison between two random sampling methods of order statistics
# Method 1
m <- 10
output <- rep(0,m)
order_sample <- function(m,n,k){
for(i in 1:m){
sample <- rglg(n)
order_sample <- sort(sample)
output[i] <- order_sample[k]
}
return(output)
}
N <- 10000
n <- 200
k <- 100
system.time(order_sample(N,n,k))
sample_1 <- order_sample(N,n,k)
par(mfrow=c(1,2))
hist(sample_1)
summary(sample_1)
# Method 2
system.time(order_glg(N,0,1,1,k,n))
sample_2 <- order_glg(N,0,1,1,k,n)$sample
hist(sample_2)
summary(sample_2)

## End(Not run)
```

`pglg` *Cumulative distribution function for a generalized log-gamma variable*

Description

pglg is used to calculate the cumulative distribution function of a generalized log-gamma variable at x.

Usage

```
pglg(x, location, scale, shape)
```

Arguments

`x`	numeric, a vector of real values.
`location`	numeric, represents the location parameter of a generalized log-gamma distribution. Default value is 0.

scale	numeric, represents the scale parameter of a generalized log-gamma distribution. Default value is 1.
shape	numeric, represents the shape parameter of a generalized log-gamma distribution. Default value is 1.

Value

A vector with the same size of x with the cumulative probability values of a generalized log-gamma distribution.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
x <- runif(3,-1,1)
pglg(sort(x),location=0, scale=1, shape=1)
```

---

pk_order_glg — *Cumulative Probability Distribution of a K-th Order Statistic from a Generalized Log-gamma Distribution*

Description

pk_order_glg is used to obtain the cumulative probability distribution of the k-th order statistic from a generalized log-gamma distribution.

Usage

```
pk_order_glg(x, mu = 0, sigma = 1, lambda = 1, k, n)
```

Arguments

x	numeric, represents a real value.
mu	numeric, represents the location parameter. Default value is 0.
sigma	numeric, represents the scale parameter. Default value is 1.
lambda	numeric, represents the shape parameter. Default value is 1.
k	numeric, represents the K-th smallest value from a sample.
n	numeric, represents the size of the sample of the generalized log-gamma distribution.

Value

A list of values of the cumulative probability function of the k-th order statistic from a generalized log-gamma distribution.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>.

References

Gentle, J, Computational Statistics, First Edition. Springer - Verlag, 2009.

Naradajah, S. and Rocha, R. (2016) Newdistns: An R Package for New Families of Distributions, Journal of Statistical Software.

Examples

```
# The cumulative probability distribution of 10-th order statistics at 0
# from a random sample of extreme value distribution with n=20.
pk_order_glg(0,0,1,1,k=10,n=20)
```

---

plotnpc — *Plotting a natural cubic splines or P-splines.*

Description

`plotnpc` displays a graph of a fitted nonparametric effect, either natural cubic spline or P-spline, from an object of class sglg.

Usage

```
plotnpc(fit, conf_lev, cband = FALSE)
```

Arguments

`fit`	an object of the class sglg. This object is returned from the call to sglg() or ssurvglg().
`conf_lev`	is the confidence level of the asymptotic confidence band. Default value is 0.05.
`cband`	is a boolean value. It indicates if the plot will contain confidence band or not. Default value is FALSE.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Eilers P.H.C. and Marx B.D. (1996). Flexible smoothing with B-splines and penalties. Statistical Science. 11, 89-121.

Wood, S. (2017). Additive generalized models: An R introduction. Chapman and Hall.

Examples

```
set.seed(1)
rows<- 300
t_beta <- c(0.5,2)
t_sigma <- 0.5
t_lambda <- 1
x1 <- runif(rows,-3,3)
x2 <- rnorm(rows,mean=2.5,sd=0.5)
X <- cbind(x1,x2)
t <- as.matrix(seq(0.01,0.99,length=rows))
colnames(t) <- "t"
f_t <- cos(4*pi*t)
error <- rglg(rows,0,1,t_lambda)
y <- X %*%t_beta + f_t + t_sigma*error
colnames(y) <- "y"
data <- data.frame(y,X,t)
fit1 <- sglg(y ~ x1 + x2 - 1, npc=t, data=data, basis = "deBoor", Knot= 5, alpha0=0.1)
# The adjusted (black) non-linear component
plotnpc(fit1)
plotnpc(fit1,conf_lev=0.02,cband=TRUE)
fit2 <- sglg(y ~ x1 + x2 - 1, npc=t, data=data, basis = "Gu", Knot= 5, alpha0=0.001)
# The adjusted (black) non-linear component
plotnpc(fit2,conf_lev=0.02,cband=TRUE)
```

---

plotsurv.sglg — *Plot simultaneously the Kaplan-Meier and parametric estimators of the survival function.*

Description

`plotsurv.sglg` is used to plot simultaneously the Kaplan-Meier and parametric estimators of the survival function.

Usage

```
plotsurv.sglg(fit)
```

Arguments

`fit`	an object of the class sglg. This object is returned from the call to survglg() or ssurvglg().

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos A. Cardozo, G. Paula and L. Vanegas. Semi-parametric accelerated failure time models with generalized log-gamma erros. In preparation.

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
require(survival)
n  <- 240
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 1
t_lambda <- 1
set.seed(8142031)
x1 <- rbinom(n, 1, 0.5)
x2 <- runif(columns, 0, 1)
X <- cbind(x1,x2)
s         <- t_sigma^2
a         <- 1/s
t_ini1    <- exp(X %*% t_beta) * rgamma(n, scale = s, shape = a)
cens.time <- rweibull(n, 0.6, 14)
delta1     <- ifelse(t_ini1 > cens.time, 1, 0)
obst1 <- t_ini1
obst1[delta1==1] <- cens.time[delta1==1]
data <- data.frame(obst1,delta1,X)
lambda <- shape(Surv(log(obst1),delta1) ~ x1 + x2 - 1, data=data, interval=c(0.85,0.95), step=0.01)
fit3 <- survglg(Surv(log(obst1),delta1) ~ x1 + x2 - 1, data=data, shape=lambda)
plotsurv.sglg(fit3)
```

---

qglg — *Quantile function for a generalized log-gamma distribution*

Description

qglg is used to calculate the quantile function of a generalized log-gamma variable at x.

Usage

```
qglg(x, location, scale, shape)
```

Arguments

x	numeric, a vector with values between 0 and 1.
location	numeric, represents the location parameter of a generalized log-gamma distribution. Default value is 0.
scale	numeric, represents the scale parameter of a generalized log-gamma distribution. Default value is 1.
shape	numeric, represents the shape parameter of a generalized log-gamma distribution. Default value is 1.

Value

A vector with the same size of x with the quantile values of a generalized log-gamma distribution.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
# Calculating the quartiles of a glg(0,1,-1) distribution
x <- c(0.25, 0.5, 0.75)
qglg(x, location = 0, scale = 1, shape = -1)
```

quantile_sglg *Quantile Residuals for a Generalized Log-gamma Regression Model*

Description

quantile_sglg is used to generate quantile residuals for a generalized log-gamma regression model.

Usage

```
quantile_sglg(fit)
```

Arguments

fit	is an object sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg().

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
# Example 1
n <- 400
set.seed(4)
error <- rglg(n,0,0.5,1)
y <- as.data.frame(0.5 + error)
names(y) <- "y"
fit_0 <- glg(y~1,data=y)
fit_0$mu
fit_0$sigma
fit_0$lambda
quantile_sglg(fit_0)
# Example 2
n <- 500
set.seed(6)
error <- rglg(n,0,0.5,1)
x1 <- runif(n,-1,1)
beta <- c(0.5,2)
y <- cbind(1,x1)%*%beta + error
data <- data.frame(y=y,x1=x1)
fit_1 <- glg(y~x1,data=data)
fit_1$mu
fit_1$sigma
fit_1$lambda
quantile_sglg(fit_1)
```

`residuals.sglg` *Extract Model Residuals*

Description

residuals.sglg extracts the deviance-type residuals for a model from an object of class 'sglg'.

Usage

```
## S3 method for class 'sglg'
residuals(object, ...)
```

Arguments

`object`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg() function.
`...`	other arguments.

response_scheme *response scheme*

Description

response_scheme.sglg extracts from a object of class sglg the local influence measures and displays their graphs versus the index of the observations.

Usage

```
response_scheme(model, ...)
```

Arguments

model	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg().
...	other arguments.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
rows <- 100
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 1
t_lambda <- 1
set.seed(8142031)
x1 <- rbinom(rows, 1, 0.5)
x2 <- runif(columns, 0, 1)
X <- cbind(x1,x2)
error <- rglg(rows, 0, 1, t_lambda)
y1 <- X %*%t_beta + t_sigma * error
data.example <- data.frame(y1,X)
fit1 <- glg(y1 ~ x1 + x2 - 1,data=data.example)
response_scheme(fit1)
```

rglg *Random number generation for a generalized log-gamma distribution*

Description

`rglg` is used to generate random numbers for a generalized log-gamma distribution.

Usage

```
rglg(n, location, scale, shape)
```

Arguments

`n`	numeric, size of the random sample.
`location`	numeric, represents the location parameter of a generalized log-gamma distribution. Default value is 0.
`scale`	numeric, represents the scale parameter of a generalized log-gamma distribution. Default value is 1.
`shape`	numeric, represents the shape parameter of a generalized log-gamma distribution. Default value is 1.

Value

A vector of size n with the generalized log-gamma random values.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
u <- rglg(200, location = 0, scale = 1, shape = 1)
hist(u)
```

sglg *Fitting semi-parametric generalized log-gamma regression models*

Description

sglg is used to fit a semi-parametric regression model suitable for analysis of data sets in which the response variable is continuous, strictly positive, and asymmetric. In this setup, the location parameter of the response variable is explicitly modeled by semi-parametric functions, whose non-parametric components may be approximated by natural cubic splines or cubic P-splines.

Usage

```
sglg(
  formula,
  npc,
  basis,
  data,
  shape = 0.2,
  method,
  alpha0,
  Knot,
  Tolerance = 1e-06,
  Maxiter = 1000,
  format = "complete"
)
```

Arguments

formula	a symbolic description of the systematic component of the model to be fitted. See details for further information.
npc	a matrix with the nonparametric variables of the systematic part of the model to be fitted. Must be included the names of each variables.
basis	a name of the cubic spline basis to be used in the model. Supported basis include deBoor and Gu basis which are a B-spline basis and a natural cubic spline basis, respectively.
data	an optional data frame, list containing the variables in the model.
shape	an optional value for the shape parameter of the error distribution of a generalized log-gamma distribution. Default value is 0.2.
method	There are two possibles algorithms to estimate the parameters. The default algorithm is 'FS' Fisher-Scoring, the other option is 'GSFS' an adequate combination between the block matrix version of non-linear Gauss-Seidel algorithm and Fisher-Scoring algorithm.
alpha0	is a vector of positive values for the smoothing parameters alpha. Default vector with 1 in each entry.
Knot	is a vector of the number of knots in each non-linear component of the model.

Tolerance	an optional positive value, which represents the convergence criterion. Default value is 5e-05.
Maxiter	an optional positive integer giving the maximal number of iterations for the estimating process. Default value is 1e03.
format	an optional string value that indicates if you want a simple or a complete report of the estimating process. Default value is 'complete'.

Value

mu a vector of parameter estimates associated with the location parameter.

sigma estimate of the scale parameter associated with the model.

lambda estimate of the shape parameter associated with the model.

interval estimate of a 95% confidence interval for each estimate parameters associated with the model.

Deviance the deviance associated with the model.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
set.seed(1)
rows<- 300
t_beta <- c(0.5,2)
t_sigma <- 0.5
t_lambda <- 1
x1 <- runif(rows,-3,3)
x2 <- rnorm(rows,mean=2.5,sd=0.5)
X <- cbind(x1,x2)
t <- as.matrix(seq(0.01,0.99,length=rows))
colnames(t) <- "t"
f_t <- cos(4*pi*t)
error <- rglg(rows,0,1,t_lambda)
y <- X %*%t_beta + f_t + t_sigma*error
colnames(y) <- "y"
data <- data.frame(y,X,t)
fit1 <- sglg(y ~ x1 + x2 - 1, npc = t, data = data, basis = "deBoor", alpha0 = 0.1)
logLik(fit1)
quantile_sglg(fit1)
fit2 <- sglg(y ~ x1 + x2 - 1, npc=t, data=data, basis = "Gu", alpha0=0.001)
logLik(fit2)
quantile_sglg(fit2)
coef(fit2)
```

```
##################################################
# An example with two non-parametric components #
##################################################################################
#set.seed(2)
#t_2 <- as.matrix(seq(2,4,length=rows))
#colnames(t_2) <- 't_2'
#f_t_2 <- exp(t_2)
#error <- rglg(rows,0,1,t_lambda)
#y_2 <- X %*%t_beta + f_t + f_t_2 + t_sigma*error
#colnames(y_2) <- 'y_2'
#data2 <- data.frame(y_2,X,t,t_2)
#npcs <- cbind(t,t_2)
#fit3 <- sglg(y_2 ~ x1 + x2 - 1, npc = npcs, data = data2, alpha0 = c(0.45,0.65))
#logLik(fit3)
##################################################################################
```

`shape` *shape*

Description

Tool that supports the estimation of the shape parameter in semi-parametric or multiple linear accelerated failure time model with generalized log-gamma errors under the presence of censored data. The estimation is based on the profiled likelihood function for the shape parameter of the model.

Usage

```
shape(formula, npc, data, interval, semi = FALSE, step = 0.05)
```

Arguments

`formula`	a symbolic description of the systematic component of the model to be fitted.
`npc`	a data frame with potential nonparametric variables of the systematic part of the model to be fitted.
`data`	a data frame which contains the variables in the model.
`interval`	an optional numerical vector of length 2. In this interval is the maximum likelihood estimate of the shape parameter of the model. By default is [0.05,1.5].
`semi`	a logical value. TRUE means that the model has a non-parametric component. By default is FALSE.
`step`	an optional positive value. This parameter represents the length of the step of the partition of the interval parameter. By default is 0.05.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph. D. thesis. Sao Paulo University.

Examples

```
rows  <- 200
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 1
t_lambda <- 1
set.seed(8142031)
x1 <- rbinom(rows, 1, 0.5)
x2 <- runif(rows, 0, 1)
X <- cbind(x1,x2)
s         <- t_sigma^2
a         <- 1/s
t_ini1    <- exp(X %*% t_beta) * rweibull(rows, scale = s, shape = a)
cens.time <- rweibull(rows, 0.75, 20)
delta     <- ifelse(t_ini1 > cens.time, 1, 0)
obst1 = t_ini1
obst1[delta==1] <- cens.time[delta==1]
example <- data.frame(obst1,delta,X)
lambda <- shape(Surv(log(obst1),delta) ~ x1 + x2 - 1, data=example)
lambda
# To obtain even better estimates we can change the interval and/or step options
shape(Surv(log(obst1),delta) ~ x1 + x2 - 1, data=example, interval=c(0.945,0.97), step=0.001)
```

---

smoothp *smoothp*

Description

Tool that supports the selection of the smoothing parameters in semi-parametric generalized log-gamma models. The selection is based on the AIC, BIC, or Generalized Cross Validation methods.

Usage

```
smoothp(formula, npc, data, method = "PAIC", basis, interval, step)
```

Arguments

formula	a symbolic description of the systematic component of the model to be fitted.
npc	a data frame with potential nonparametric variables of the systematic part of the model to be fitted.
data	a data frame which contains the variables in the model.

method	There are three possible criteria to estimate the smoothing parameters: Penalized Akaike Criterion 'PAIC', Penalized Bayesian Criterion 'PBIC' and Generalized Cross Validation 'GCV'. The default method is 'PAIC'.
basis	a name of the cubic spline basis to be used in the model. Supported basis include deBoor and Gu basis.
interval	an optional numerical vector of length 2. In this interval is the maximum likelihood estimate of the shape parameter of the model. By default is [0.1,2].
step	an optional positive value. This parameter represents the length of the step of the partition of the interval parameter. By default is 0.2.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph.D. thesis. Sao Paulo University.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
set.seed(1)
rows<- 150
t_beta <- c(0.5,2)
t_sigma <- 0.5
t_lambda <- 1
x1 <- runif(rows,-3,3)
x2 <- rbinom(rows,1,0.5)
X <- cbind(x1,x2)
t <- as.matrix(seq(0.01,0.99,length=rows))
colnames(t) <- "t"
f_t <- cos(4*pi*t)
error <- rglg(rows,0,1,t_lambda)
y <- X %*%t_beta + f_t + t_sigma*error
colnames(y) <- "y"
data <- data.frame(y,X,t)
fit1 <- sglg(y ~ x1 + x2 - 1,npc=t,data=data,basis = "deBoor",alpha0=1)
fit1$AIC
# We can get (probably) better values of alpha with the function smoothp
smoothp(y ~ x1 + x2 - 1,npc=t,data=data,basis = "deBoor")
fit2 <- sglg(y ~ x1 + x2 - 1,npc=t,data=data,basis = "Gu",alpha0=0.5)
fit2$BIC
# Again using the smooth function
smoothp(y ~ x1 + x2 - 1,npc=t,data=data,basis = "Gu",method='PBIC')
#################################################
# An example with two non-parametric components #
#################################################
set.seed(2)
```

```
t_2 <- as.matrix(rnorm(rows,sd=0.5))
colnames(t_2) <- 't_2'
f_t_2 <- exp(t_2)
error <- rglg(rows,0,1,t_lambda)
y_2 <- X %*%t_beta + f_t + f_t_2 + t_sigma*error
colnames(y_2) <- 'y_2'
data2 <- data.frame(y_2,X,t,t_2)
npcs <- cbind(t,t_2)
# Some intuition about the best alpha values
smoothp(y ~ x1 + x2 - 1,npc=npcs,data=data, method='GCV')
```

---

ssurvglg *Fitting semi-parametric generalized log-gamma regression models under the presence of right censored data.*

Description

ssurvglg is used to fit a semi-parametric regression model in which the response variable is continuous, strictly positive, asymmetric and there are right censored observations. In this setup, the location parameter of the logarithm of the variable is explicitly modeled by semi-parametric functions, whose nonparametric components may be approximated by natural cubic splines or cubic P-splines.

Usage

```
ssurvglg(formula, npc, basis, data, shape, alpha0, Maxiter, Tolerance)
```

Arguments

formula	a symbolic description of the systematic component of the model to be fitted. See details for further information.
npc	a data frame with potential nonparametric variables of the systematic part of the model to be fitted.
basis	a name of the cubic spline basis to be used in the model. Supported basis include deBoor and Gu basis which are a B-spline basis and a natural cubic spline basis, respectively.
data	an optional data frame, list containing the variables in the model.
shape	an optional value for the shape parameter of the model.
alpha0	is a vector of initial values for the smoothing parameter alpha.
Maxiter	an optional positive integer giving the maximal number of iterations for the estimating process. Default value is 1e03.
Tolerance	an optional positive value, which represents the convergence criterion. Default value is 1e-04.

Value

mu a vector of parameter estimates associated with the location parameter.

sigma estimate of the scale parameter associated with the model.

lambda estimate of the shape parameter associated with the model.

interval estimate of a 95% confidence interval for each estimate parameters associated with the model.

Deviance the deviance associated with the model.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos A. Cardozo, G. Paula and L. Vanegas. Semi-parametric accelerated failure time models with generalized log-gamma erros: Censored case. In preparation.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
require(survival)
rows    <- 150
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 0.5
t_lambda <- 1
set.seed(8142030)
x1 <- rbinom(rows, 1, 0.5)
x2 <- runif(rows, 0, 1)
X <- cbind(x1,x2)
t_knot1 <- 6
ts1 <- seq(0, 1, length = t_knot1)
t_g1 <- 0.4 * sin(pi * ts1)
BasisN <- function(n, knot) {
N <- matrix(0, n, knot)
m <- n/knot
block <- rep(1,m)
for (i in 1:knot) {
   l <- (i - 1) * m + 1
 r <- i * m
  N[l:r, i] <- block }
return(N)
 }
s_N1 <- BasisN(rows, length(ts1))
x3 <- s_N1 %*% ts1
colnames(x3) <- 'x3'
sys       <- X %*% t_beta + s_N1%*%t_g1
t_ini1    <- exp(sys) * rweibull(rows,1/t_sigma,1)
```

```
cens.time <- rweibull(rows, 1.5, 14)
delta     <- ifelse(t_ini1 > cens.time, 1, 0)
obst1 = t_ini1
for(i in 1:rows) {
   if (delta[i] == 1) {
       obst1[i] = cens.time[i]
      }
}
d_example <- data.frame(obst1, delta, X, x3)
fit4 <- ssurvglg(Surv(log(obst1),delta)~ x1 + x2 - 1,npc=x3,data = d_example,shape=0.9)
summary(fit4)
```

---

summary.sglg   *summary.sglg*

Description

summary.sglg extracts displays the summary of the fitted model including parameter estimates, associated (approximated) standard errors and goodness-of-fit statistics from a model from an object of class 'sglg'.

Usage

```
## S3 method for class 'sglg'
summary(object, ...)
```

Arguments

object	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg() function.
...	other arguments.

---

survglg   *Fitting linear generalized log-gamma regression models under the presence of right censored data.*

Description

survglg is used to fit a multiple linear regression model in which the response variable is continuous, strictly positive, asymmetric and there are right censored observations. In this setup, the location parameter of the logarithm of the response variable is modeled by a linear model of the parameters.

Usage

```
survglg(formula, data, shape, Maxiter = 1000, Tolerance = 1e-06)
```

Arguments

formula	a symbolic description of the systematic component of the model to be fitted. See details for further information.
data	an optional data frame, list containing the variables in the model.
shape	an optional value for the shape parameter of the model.
Maxiter	an optional positive integer giving the maximal number of iterations for the estimating process. Default value is 1000.
Tolerance	an optional positive value, which represents the convergence criterion. Default value is 1e-05.

Value

mu a vector of parameter estimates associated with the location parameter.

sigma estimate of the scale parameter associated with the model.

lambda estimate of the shape parameter associated with the model.

interval estimate of a 95% confidence interval for each estimate parameters associated with the model.

Deviance the deviance associated with the model.

Author(s)

Carlos Alberto Cardozo Delgado <cardozorpackages@gmail.com>

References

Carlos A. Cardozo, G. Paula and L. Vanegas. Semi-parametric accelerated failure time models with generalized log-gamma errors. In preparation.

Cardozo C.A., Paula G., and Vanegas L. (2022). Generalized log-gamma additive partial linear models with P-spline smoothing. Statistical Papers.

Examples

```
require(survival)
rows  <- 200
columns <- 2
t_beta  <- c(0.5, 2)
t_sigma <- 1
set.seed(8142031)
x1 <- rbinom(rows, 1, 0.5)
x2 <- runif(rows, 0, 1)
X <- cbind(x1,x2)
s         <- t_sigma^2
a         <- 1/s
t_ini1    <- exp(X %*% t_beta) * rweibull(rows, scale = s, shape = a)
cens.time <- rweibull(rows, 0.75, 20)
delta1     <- ifelse(t_ini1 > cens.time, 1, 0)
obst1 <- t_ini1
```

```
obst1[delta1==1] <- cens.time[delta1==1]
data.example <- data.frame(obst1,delta1,X)
fit3 <- survglg(Surv(log(obst1),delta1) ~ x1 + x2 - 1, data=data.example, shape = 1)
fit3$condition
fit3$scores
summary(fit3)
# We can obtain the logLik (in the exp scale) from
fit3$llgg
delta2 = 1 - delta1
fit4 <- survreg(Surv(obst1,delta2) ~ x1 + x2 - 1, data=data.example, dist = 'weibull')
summary(fit4)
```

---

survival_gg *Survival, Hazard, and Cumulative Hazard functions for a Generalized Gamma Distribution*

Description

survival_gg is used to obtain the value of survival, hazard, and cumulative hazard functions of a generalized gamma distribution at a positive value.

Usage

```
survival_gg(x, mu, sigma, lambda)
```

Arguments

x	numeric, represent a vector of positive values. Default value is 1.
mu	numeric, represents the location parameter of a generalized gamma distribution. Default value is 0.
sigma	numeric, represents the scale parameter of a generalized gamma distribution. Default value is 1.
lambda	numeric, represents the shape parameter of a generalized gamma distribution. Default value is 1.

Value

A list of three vectors, survival, hazard, and cumulative hazard values of a generalized gamma distribution.

Author(s)

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References

Carlos Alberto Cardozo Delgado, Semi-parametric generalized log-gamma regression models. Ph.D. thesis. Sao Paulo University.

Jerald F. Lawless (2003). Statistical Models and Methods for Lifetime Data. Second Edition. John-Wiley & Sons

Examples

```
survival_gg(0.0001,0,1,1) # Extreme value type I distribution, maximum case.
times <- seq(0.05,7,by=0.05)
plot(times, survival_gg(times,0,1,1)$survival_value,type='l')
plot(times, survival_gg(times,0,1,1)$hazard_value,type='l')
plot(times, survival_gg(times,0,1,1)$cumulative_hazard_value,type='l')
```

---

t_lambda *######################### # # # Extreme value case # # # #########################*

Description

######################### # # # Extreme value case # # # #########################

Usage

```
t_lambda
```

Format

An object of class `numeric` of length 1.

---

vcov.sglg *vcov.sglg*

Description

vcov.sglg extracts the estimated variance and covariance matrix associated to parameters from a model from an object of class 'sglg'.

Usage

```
## S3 method for class 'sglg'
vcov(object, ...)
```

Arguments

`object`	an object of the class sglg. This object is returned from the call to glg(), sglg(), survglg() or ssurvglg() function.
`...`	other arguments.

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