Overview of the ugomquantreg package

Description

The **ugomquantreg** package implements the probability density function, quantile function, cumulative distribution function and random number generation function for unit-Gompertz distribution parameterized as a function of its $\tau$-th quantile, $0 < \tau < 1$. Some function are written in C++ using **Rcpp**.

Details

- **ammonia**: Ammonia oxidized to acid nitric data set.
- **bodyfat**: Body fat data set.
- **UGOM**: For quantile modeling (con/in)ditional on covariate(s).

Author(s)

Josmar Mazucheli <jmazucheli@gmail.com>
Bruna Alves <pg402900@uem.br>

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ammonia          Ammonia oxidized to acid nitric data set

Description

The data come from experiments with a plant where ammonia is oxidized to acid nitric.

Usage

data(ammonia, package = "ugomquantreg")

Format

A data-frame with 21 observations and 4 columns:

- **stackloss**: the percentage of ammonia lost.
- **airflow**: the air flow to the plant.
- **watertemp**: the cooling water inlet temperature.
- **acidconc**: the acid concentration.

Author(s)

Josmar Mazucheli <jmazucheli@gmail.com>
Bruna Alves <pg402900@uem.br>
bodyfat

Source

https://support.sas.com/rnd/app/stat/examples/BayesQuantile/quantile.htm

References


Examples

data(ammonia, package = "ugomquantreg")

library(gamlss)

tau <- 0.50
fit.logit <- gamlss(stackloss ~ airflow + watertemp + acidconc, data = ammonia, family = UGOM(sigma.link="identity"))

tau <- 0.50
fit.probit <- gamlss(stackloss ~ airflow + watertemp + acidconc, data = ammonia, family = UGOM(mu.link = "probit", sigma.link = "log"))

fittaus <- lapply(c(0.10, 0.25, 0.50, 0.75, 0.90), function(Tau){
  tau <<- Tau;
  gamlss(stackloss ~ airflow + watertemp + acidconc, data = ammonia, family = UGOM(mu.link = "logit", sigma.link = "log"))
})
sapply(fittaus, coef)

bodyfat

Percentage of body fat data set

Description

The body fat percentage of individuals assisted in a public hospital in Curitiba, Paraná, Brazil.

Usage

data(bodyfat, package = "ugomquantreg")

Format

A data-frame with 298 observations and 9 columns:

- ARMS: arms fat percentage.
• LEGS: legs fat percentage.
• BODY: body fat percentage.
• ANDROID: android fat percentage.
• GYNECOID: ginecoid fat percentage.
• AGE: age of individuals.
• BMI: body mass index.
• SEX: 1 for female, 2 for male.
• IPAQ: 0 for IPAQ = sedentary, 1 for IPAQ = insufficiently active and 2 for IPAQ = active.

Author(s)
Josmar Mazucheli <jmazucheli@gmail.com>
Bruna Alves <pg402900@uem.br>

Source

References

Examples
data(bodyfat, package = "ugomquantreg")
library(gamlss)

tau <- 0.50
fit.logit <- gamlss(ARMS ~ AGE + I(BMI / 100) + as.factor(SEX) + as.factor(IPAQ),
data = bodyfat, family = UGOM(mu.link = "logit", sigma.link = "log"))

tau <- 0.50;
fit.probit <- gamlss(ARMS ~ AGE + I(BMI / 100) + as.factor(SEX) + as.factor(IPAQ),
data = bodyfat, family = UGOM(mu.link = "probit", sigma.link = "log"))
The unit-Gompertz distribution - quantile parameterization

Description
The function UGOM() define the unit-Gompertz distribution for a gamlss.family object to be used in GAMLSS fitting. UGOM() has the \( \tau \)-th quantile equal to the parameter mu and sigma as the shape parameter. The functions dUGOM, pUGOM, qUGOM and rUGOM define the density, distribution function, quantile function and random generation for unit-Gompertz distribution.

Usage

dUGOM(x, mu, sigma, tau = 0.5, log = FALSE)
pUGOM(q, mu, sigma, tau = 0.5, lower.tail = TRUE, log.p = FALSE)
qUGOM(p, mu, sigma, tau = 0.5, lower.tail = TRUE, log.p = FALSE)
rUGOM(n, mu, sigma, tau = 0.5)

UGOM(mu.link = "logit", sigma.link = "log")

Arguments

x, q     vector of quantiles on the (0,1) interval.
mu       vector of quantile parameter values.
sigma    vector of shape parameter values.
tau      the \( \tau \)-th fixed quantile in [d-p-q-r]-UGOM function.
log, log.p logical; If TRUE, probabilities p are given as log(p).
lower.tail logical; If TRUE, (default), \( P(X \leq x) \) are returned, otherwise \( P(X > x) \).
p         vector of probabilities.
n         the number of observations. If length(n) > 1, the length is taken to be the number required.
mu.link   the mu link function with default logit.
sigma.link the sigma link function with default logit.

Details

Probability density function

\[
f(x | \mu, \sigma, \tau) = \left( \frac{\log (\tau)}{1 - \mu^{-\sigma}} \right) \sigma x^{-(1+\sigma)} \exp \left( \frac{\log (\tau)}{1 - \mu^{-\sigma}} (1 - x^{-\sigma}) \right)
\]

Cumulative distribution function

\[
F(x | \mu, \sigma, \tau) = \exp \left( \frac{\log (\tau)}{1 - \mu^{-\sigma}} (1 - x^{-\sigma}) \right)
\]
Mean
\[ E(X) = \left( \frac{\log(\tau)}{1 - \mu^{-\sigma}} \right)^{\frac{1}{\sigma}} \exp \left( \frac{\log(\tau)}{1 - \mu^{-\sigma}} \right) \Gamma \left( \frac{\sigma - 1}{\sigma}, \frac{1}{\sigma} \log(\tau) \right) \]

where \( 0 < (x, \mu) < 1 \), \( \mu \) is, for a fixed and known value of \( \tau \), the \( \tau \)-th quantile, \( \sigma \) is the shape parameter and \( \Gamma(a, b) \) is the upper incomplete gamma function.

Value

\( \text{UGOM()} \) return a \text{gamlss.family} \ object which can be used to fit a unit-Gompertz distribution by \text{gamlss()} \ function.

Note

Note that for \( \text{UGOM()} \), \( \mu \) is the \( \tau \)-th quantile and \( \sigma \) a shape parameter. The \text{gamlss} \ function is used for parameters estimation.

Author(s)

Josmar Mazucheli <jmazucheli@gmail.com>
Bruna Alves <pg402900@uem.br>

References


Examples

```r
set.seed(123)
x <- rUGOM(n = 1000, mu = 0.50, sigma = 1.69, tau = 0.50)
R <- range(x)
S <- seq(from = R[1], to = R[2], length.out = 1000)

hist(x, prob = TRUE, main = 'unit-Gompertz')
lines(S, dUGOM(x = S, mu = 0.50, sigma = 1.69, tau = 0.50), col = 2)
```
plot(ecdf(x))
lines(S, pUGOM(q = S, mu = 0.50, sigma = 1.69, tau = 0.50), col = 2)

plot(quantile(x, probs = S), type = "l")
lines(qUGOM(p = S, mu = 0.50, sigma = 1.69, tau = 0.50), col = 2)

library(gamlss)
set.seed(123)
data <- data.frame(y = rUGOM(n = 100, mu = 0.5, sigma = 2.0, tau = 0.5))

tau <- 0.50
fit <- gamlss(y ~ 1, data = data, family = UGOM)

set.seed(123)
n <- 100
x <- rbinom(n, size = 1, prob = 0.5)
etta <- 0.5 + 1 * x;
mu <- 1 / (1 + exp(-etta));
sigma <- 1.5;
y <- rUGOM(n, mu, sigma, tau = 0.5)
data <- data.frame(y, x)

tau <- 0.50
fit <- gamlss(y ~ x, data = data, family = UGOM(mu.link = "logit", sigma.link = "log"))
Index

* datasets
  ammonia, 2
  bodyfat, 3
ammonia, 2
bodyfat, 2
bodyfat, 3
dUGOM (UGOM), 5
gamlss, 6
pUGOM (UGOM), 5
qUGOM (UGOM), 5
rUGOM (UGOM), 5
UGOM, 2
ugomquantreg-package, 2