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Title Flexible Parametric Accelerated Hazards Models

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Description Flexible parametric Accelerated Hazards (AH) regression models in overall and relative survival frameworks with 13 distinct Baseline Distributions. The AH Model can also be applied to lifetime data with crossed survival curves. Any user-defined parametric distribution can be fitted, given at least an R function defining the cumulative hazard and hazard rate functions. See Chen and Wang (2000) <doi:10.1080/01621459.2000.10474236>, and Lee (2015) <doi:10.1007/s10985-015-9349-5> for more details.

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AEHMLE *Relative Survival AH model.*

Description

The flexible parametric accelerated excess hazards (AEH) model's maximum likelihood estimation, log-likelihood, and information criterion. Baseline hazards:NGLL, GLL, KW,EW, MLL, PGW, GG, MKW, Log-logistic, Weibull, Log-normal, Burr-XII, and Gamma

Usage

```
AEHMLE(
  init,
  time,
  delta,
  n,
  basehaz,
  z,
  hp.obs,
  method = "Nelder-Mead",
  maxit = 1000,
  log = FALSE
)
```

Arguments

`init`	: initial points for optimisation
`time`	: survival times
`delta`	: vital indicator (0-alive,1 - dead)
`n`	: The number of the observations of the data set
`basehaz`	: baseline hazard structure including baseline (NGLLAEH,GLLAEH,EWAEH,KWAEH,MLLAEH, PGWAEH,GGAEH,MKWAEH,LLAEH,WAEH,GAEH, LNAEH,BXIIAEEH)
`z`	: design matrix for covariates (p x n), p >= 1
`hp.obs`	: population hazards (for uncensored individuals)
`method`	:"nlminb" or a method from "optim"
`maxit`	:The maximum number of iterations. Defaults to 1000
`log`	:log scale (TRUE or FALSE)

Format

By default the function calculates the following values:

- AIC: Akaike Information Criterion;
- CAIC: Consistent Akaikes Information Criterion;

- BIC: Bayesian Information Criterion;
- BCAIC: Bozdogan's Consistent Akaike Information Criterion;
- HQIC: Hannan-Quinn information criterion;
- par: maximum likelihood estimates;
- Value: value of the likelihood function;
- Convergence: 0 indicates successful completion and 1 indicates that the iteration limit maxit.

Value

a list containing the output of the optimisation (OPT) and the information criterion including (AIC, BIC, CAIC, BCAIC, and HQIC).

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
data(bmt)
time<-bmt$Time
delta<-bmt$Status
z<-bmt$TRT
AEHMLE(init = c(1.0,0.5,1.0,0.5),time = time,delta = delta,n=nrow(z),
basehaz = "GLLAEH",z = z,hp.obs=0.6,method = "Nelder-Mead",
maxit = 1000)
```

AHMLE *Overall Survival AH model.*

Description

The flexible parametric accelerated hazards (AH) model's maximum likelihood estimation, log-likelihood, and information criterion. Baseline hazards: NGLL, GLL,KW, EW, MLL, PGW, GG, MKW, Log-logistic, Weibull, Log-normal, Burr-XII, and Gamma

Usage

```
AHMLE(
  init,
  time,
  delta,
  n,
  basehaz,
  z,
  method = "Nelder-Mead",
  maxit = 1000,
  log = FALSE
)
```

Arguments

init	: initial points for optimisation
time	: survival times
delta	: vital indicator (0-alive,1 - dead,)
n	: The number of the observations of the data set
basehaz	: baseline hazard structure including baseline (NGLLAH,GLLAH,EWAH,KWAH,MLLAH,PGWAH,GG MKWAH,LLAH,WAH,GAH,LNAH,BXIIAH)
z	: design matrix for covariates (p x n), p >= 1
method	:"nlminb" or a method from "optim"
maxit	:The maximum number of iterations. Defaults to 1000
log	:log scale (TRUE or FALSE)

Format

By default the function calculates the following values:

- AIC: Akaike Information Criterion;
- CAIC: Consistent Akaikes Information Criterion;
- BIC: Bayesian Information Criterion;
- BCAIC: Bozdogan's Consistent Akaike Information Criterion;
- HQIC: Hannan-Quinn information criterion;
- par: maximum likelihood estimates;
- Value: value of the likelihood function;
- Convergence: 0 indicates successful completion and 1 indicates that the iteration limit maxit.

Details

The function AHMLE returns MLE estimates and information criterion.

Value

a list containing the output of the optimisation (OPT) and the information criterion including (AIC, BIC, CAIC, BCAIC, and HQIC).

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
#Example #1
data(ipass)
time<-ipass$time
delta<-ipass$status
z<-ipass$arm
AHMLE(init = c(1.0,1.0,1.0,0.5),time = time,delta = delta,n=nrow(z),
basehaz = "GLLAH",z = z,method = "Nelder-Mead",
maxit = 1000)

#Example #2
data(bmt)
time<-bmt$Time
delta<-bmt$Status
z<-bmt$TRT
AHMLE(init = c(1.0,1.0,1.0,0.5),time = time,delta = delta,n=nrow(z),
basehaz = "GLLAH",z = z,method = "Nelder-Mead",
maxit = 1000)

#Example #3
data("e1684")
time<-e1684$FAILTIME
delta<-e1684$FAILCENS
TRT<-e1684$TRT
AGE<-e1684$TRT
z<-as.matrix(cbind(scale(TRT), scale(AGE) ))
AHMLE(init = c(1.0,1.0,1.0,0.5,0.75),time = time,delta = delta,n=nrow(z),
basehaz = "GLLAH",z = z,method = "Nelder-Mead",maxit = 1000)

#Example #4
data("LeukSurv")
time<-LeukSurv$time
delta<-LeukSurv$cens
age<-LeukSurv$age
wbc<-LeukSurv$wbc
tpi<-LeukSurv$tpi
z<-as.matrix(cbind(scale(age), scale(tpi),scale(wbc) ))
AHMLE(init = c(1.0,1.0,1.0,1.0,0.5,0.65,0.85),time = time,delta = delta,n=nrow(z),
basehaz = "NGLLAH",z = z,method = "Nelder-Mead",maxit = 1000)
```

---

bmt *Bone Marrow Transplant (bmt) data set*

Description

Bone marrow transplant study which is widely used in the hazard-based regression models

Format

There were 46 patients in the allogeneic treatment and 44 patients in the autologous treatment group

- Time: time to event
- Status: censor indicator, 0 for censored and 1 for uncensored
- TRT: 1 for autologous treatment group; 0 for allogeneic treatment group

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Robertson, V. M., Dickson, L. G., Romond, E. H., & Ash, R. C. (1987). Positive antiglobulin tests due to intravenous immunoglobulin in patients who received bone marrow transplant. Transfusion, 27(1), 28-31.

CHBXII *Burr-XII (BXII) Cumulative Hazard Function.*

Description

Burr-XII (BXII) Cumulative Hazard Function.

Usage

```
CHBXII(t, kappa, alpha)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter

Value

the value of the BXII cumulative hazard function

Author(s)

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Examples

```
t=runif(10,min=0,max=1)
CHBXII(t=t, kappa=0.5, alpha=0.35)
```

CHEW *Exponentiated Weibull (EW) Cumulative Hazard Function.*

Description

Exponentiated Weibull (EW) Cumulative Hazard Function.

Usage

```
CHEW(t, lambda, kappa, alpha)
```

Arguments

t	: positive argument
lambda	: scale parameter
kappa	: shape parameter
alpha	: shape parameter

Value

the value of the EW cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Rubio, F. J., Remontet, L., Jewell, N. P., & Belot, A. (2019). On a general structure for hazard-based regression models: an application to population-based cancer research. Statistical methods in medical research, 28(8), 2404-2417.

Examples

```
t=runif(10,min=0,max=1)
CHEW(t=t, lambda=0.9, kappa=0.5, alpha=0.75)
```

CHG *Gamma (G) Cumulative Hazard Function.*

Description

Gamma (G) Cumulative Hazard Function.

Usage

```
CHG(t, shape, scale)
```

Arguments

t	: positive argument
shape	: shape parameter
scale	: scale parameter

Value

the value of the G cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
CHG(t=t, shape=0.85, scale=0.5)
```

CHGG *Generalised Gamma (GG) Cumulative Hazard Function.*

Description

Generalised Gamma (GG) Cumulative Hazard Function.

Usage

```
CHGG(t, kappa, alpha, eta)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter

Value

the value of the GG cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
CHGG(t=t, kappa=0.5, alpha=0.35, eta=0.9)
```

CHGLL *Generalized Log-logistic (GLL) cumulative hazard function.*

Description

Generalized Log-logistic (GLL) cumulative hazard function.

Usage

```
CHGLL(t, kappa, alpha, eta)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter

Value

the value of the GLL cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Muse, A. H., Mwalili, S., Ngesa, O., Almalki, S. J., & Abd-Elmougod, G. A. (2021). Bayesian and classical inference for the generalized log-logistic distribution with applications to survival data. Computational intelligence and neuroscience, 2021.

Examples

```
t=runif(10,min=0,max=1)
CHGLL(t=t, kappa=0.5, alpha=0.35, eta=0.9)
```

CHKW *Kumaraswamy Weibull (KW) Cumulative Hazard Function.*

Description

Kumaraswamy Weibull (KW) Cumulative Hazard Function.

Usage

```
CHKW(t, alpha, kappa, eta, zeta)
```

Arguments

t	: positive argument
alpha	: scale parameter
kappa	: shape parameter
eta	: shape parameter
zeta	: shape parameter

Value

the value of the KW cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
CHKW(t=t, alpha=0.35, kappa=0.5, eta=1.20, zeta=1.5)
```

CHLL *Log-logistic (LL) Cumulative Hazard Function.*

Description

Log-logistic (LL) Cumulative Hazard Function.

Usage

```
CHLL(t, kappa, alpha)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter

Value

the value of the LL cumulative hazard function

Author(s)

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Examples

```
t=runif(10,min=0,max=1)
CHLL(t=t, kappa=0.5, alpha=0.35)
```

CHLN *Lognormal (LN) Cumulative Hazard Function.*

Description

Lognormal (LN) Cumulative Hazard Function.

Usage

```
CHLN(t, kappa, alpha)
```

Arguments

t	: positive argument
kappa	: meanlog parameter
alpha	: sdlog parameter

Value

the value of the LN cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
CHLN(t=t, kappa=0.75, alpha=0.95)
```

CHMKW *Modified Kumaraswamy Weibull (MKW) Cumulative Hazard Function.*

Description

Modified Kumaraswamy Weibull (MKW) Cumulative Hazard Function.

Usage

```
CHMKW(t, alpha, kappa, eta)
```

Arguments

t	: positive argument
alpha	: Inverse scale parameter
kappa	: shape parameter
eta	: shape parameter

Value

the value of the MKW cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
CHMKW(t=t,alpha=0.35, kappa=0.7, eta=1.4)
```

CHMLL *Modified Log-logistic (MLL) cumulative hazard function.*

Description

Modified Log-logistic (MLL) cumulative hazard function.

Usage

```
CHMLL(t, kappa, alpha, eta)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter

Value

the value of the MLL cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Kayid, M. (2022). Applications of Bladder Cancer Data Using a Modified Log-Logistic Model. Applied Bionics and Biomechanics, 2022.

Examples

```
t=runif(10,min=0,max=1)
CHMLL(t=t, kappa=0.75, alpha=0.5, eta=0.9)
```

CHNGLL *New Generalized Log-logistic (GLL) cumulative hazard function.*

Description

New Generalized Log-logistic (GLL) cumulative hazard function.

Usage

```
CHNGLL(t, kappa, alpha, eta, zeta)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
zeta	: shape parameter

Value

the value of the NGLL cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Hassan Muse, A. A new generalized log-logistic distribution with increasing, decreasing, unimodal and bathtub-shaped hazard rates: properties and applications, in Proceedings of the Symmetry 2021 - The 3rd International Conference on Symmetry, 8–13 August 2021, MDPI: Basel, Switzerland, doi:10.3390/Symmetry2021-10765.

Examples

```
t=runif(10,min=0,max=1)
CHNGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, zeta=1.4)
```

CHPGW *Power Generalised Weibull (PGW) cumulative hazard function.*

Description

Power Generalised Weibull (PGW) cumulative hazard function.

Usage

```
CHPGW(t, kappa, alpha, eta)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter

Value

the value of the PGW cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Alvares, D., & Rubio, F. J. (2021). A tractable Bayesian joint model for longitudinal and survival data. Statistics in Medicine, 40(19), 4213-4229.

Examples

```
t=runif(10,min=0,max=1)
CHPGW(t=t, kappa=0.5, alpha=1.5, eta=0.6)
```

CHW *Weibull (W) Cumulative Hazard Function.*

Description

Weibull (W) Cumulative Hazard Function.

Usage

```
CHW(t, kappa, alpha)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter

Value

the value of the W cumulative hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
CHW(t=t, kappa=0.75, alpha=0.5)
```

dexpweibull *Exponentiated Weibull (EW) Probability Density Function.*

Description

Exponentiated Weibull (EW) Probability Density Function.

Usage

```
dexpweibull(t, lambda, kappa, alpha, log = FALSE)
```

Arguments

t	: positive argument
lambda	: scale parameter
kappa	: shape parameter
alpha	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the EW probability density function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
dexpweibull(t=t, lambda=0.6,kappa=0.5, alpha=0.45, log=FALSE)
```

---

dggamma *Generalised Gamma (GG) Probability Density Function.*

Description

Generalised Gamma (GG) Probability Density Function.

Usage

```
dggamma(t, kappa, alpha, eta, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the GG probability density function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
dggamma(t=t, kappa=0.5, alpha=0.35, eta=0.9,log=FALSE)
```

---

e1684 *Melanoma data set*

Description

Eastern Cooperative Oncology Group (ECOG) data used for modeling hazard-based regression models

Format

A data frame with 284 observations on the following 5 variables.

- TRT: 0=control group, 1=IFN treatment group
- FAILTIME: observed relapse-free time
- FAILCENS: relapse-free censor indicator
- AGE:continuous variable, which is centered to the mean
- SEX: 0 for male, 1 fopr female

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Kirkwood, J. M., Manola, J., Ibrahim, J., Sondak, V., Ernstoff, M. S., & Rao, U. (2004). A pooled analysis of eastern cooperative oncology group and intergroup trials of adjuvant high-dose interferon for melanoma. Clinical Cancer Research, 10(5), 1670-1677.

hBXII *Burr-XII (BXII) Hazard Function.*

Description

Burr-XII (BXII) Hazard Function.

Usage

```
hBXII(t, kappa, alpha, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the BXII hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hBXII(t=t, kappa=0.85, alpha=0.45,log=FALSE)
```

hEW *Exponentiated Weibull (EW) Hazard Function.*

Description

Exponentiated Weibull (EW) Hazard Function.

Usage

```
hEW(t, lambda, kappa, alpha, log = FALSE)
```

Arguments

t	: positive argument
lambda	: scale parameter
kappa	: shape parameter
alpha	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the EW hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Khan, S. A. (2018). Exponentiated Weibull regression for time-to-event data. Lifetime data analysis, 24(2), 328-354.

Examples

```
t=runif(10,min=0,max=1)
hEW(t=t, lambda=0.9, kappa=0.5, alpha=0.75, log=FALSE)
```

---

hG *Gamma (G) Hazard Function.*

Description

Gamma (G) Hazard Function.

Usage

```
hG(t, shape, scale, log = FALSE)
```

Arguments

t	: positive argument
shape	: shape parameter
scale	: scale parameter
log	:log scale (TRUE or FALSE)

Value

the value of the G hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hG(t=t, shape=0.5, scale=0.85,log=FALSE)
```

---

hGG *Generalised Gamma (GG) Hazard Function.*

Description

Generalised Gamma (GG) Hazard Function.

Usage

```
hGG(t, kappa, alpha, eta, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the GG hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Agarwal, S. K., & Kalla, S. L. (1996). A generalized gamma distribution and its application in reliabilty. Communications in Statistics-Theory and Methods, 25(1), 201-210.

Examples

```
t=runif(10,min=0,max=1)
hGG(t=t, kappa=0.5, alpha=0.35, eta=0.9,log=FALSE)
```

---

hGLL *Generalized Log-logistic (GLL) hazard function.*

Description

Generalized Log-logistic (GLL) hazard function.

Usage

```
hGLL(t, kappa, alpha, eta, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the GLL hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Muse, A. H., Mwalili, S., Ngesa, O., Alshanbari, H. M., Khosa, S. K., & Hussam, E. (2022). Bayesian and frequentist approach for the generalized log-logistic accelerated failure time model with applications to larynx-cancer patients. Alexandria Engineering Journal, 61(10), 7953-7978.

Examples

```
t=runif(10,min=0,max=1)
hGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, log=FALSE)
```

hKW *Kumaraswamy Weibull (KW) Hazard Function.*

Description

Kumaraswamy Weibull (KW) Hazard Function.

Usage

```
hKW(t, alpha, kappa, eta, zeta, log = FALSE)
```

Arguments

t	: positive argument
alpha	: scale parameter
kappa	: shape parameter
eta	: shape parameter
zeta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the KW hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Cordeiro, G. M., Ortega, E. M., & Nadarajah, S. (2010). The Kumaraswamy Weibull distribution with application to failure data. Journal of the Franklin Institute, 347(8), 1399-1429.

Examples

```
t=runif(10,min=0,max=1)
hKW(t=t, alpha=0.35, kappa=0.5, eta=1.20, zeta=1.5, log=FALSE)
```

hLL *Log-logistic (LL) Hazard Function.*

Description

Log-logistic (LL) Hazard Function.

Usage

```
hLL(t, kappa, alpha, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the LL hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hLL(t=t, kappa=0.5, alpha=0.35,log=FALSE)
```

hLN *Lognormal (LN) Hazard Function.*

Description

Lognormal (LN) Hazard Function.

Usage

```
hLN(t, kappa, alpha, log = FALSE)
```

Arguments

t	: positive argument
kappa	: meanlog parameter
alpha	: sdlog parameter
log	:log scale (TRUE or FALSE)

Value

the value of the LN hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hLN(t=t, kappa=0.5, alpha=0.75,log=FALSE)
```

---

hMKW *Modified Kumaraswamy Weibull (MKW) Hazard Function.*

Description

Modified Kumaraswamy Weibull (MKW) Hazard Function.

Usage

```
hMKW(t, alpha, kappa, eta, log = FALSE)
```

Arguments

t	: positive argument
alpha	: inverse scale parameter
kappa	: shape parameter
eta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the MKW hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Khosa, S. K. (2019). Parametric Proportional Hazard Models with Applications in Survival analysis (Doctoral dissertation, University of Saskatchewan).

Examples

```
t=runif(10,min=0,max=1)
hMKW(t=t, alpha=0.35, kappa=0.7, eta=1.4, log=FALSE)
```

---

hMLL *Modified Log-logistic (MLL) hazard function.*

Description

Modified Log-logistic (MLL) hazard function.

Usage

```
hMLL(t, kappa, alpha, eta, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the MLL hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hMLL(t=t, kappa=0.75, alpha=0.5, eta=0.9,log=FALSE)
```

hNGLL *New Generalized Log-logistic (GLL) hazard function.*

Description

New Generalized Log-logistic (GLL) hazard function.

Usage

```
hNGLL(t, kappa, alpha, eta, zeta, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
zeta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the NGLL hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hNGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, zeta=1.4, log=FALSE)
```

hPGW *Power Generalised Weibull (PGW) hazard function.*

Description

Power Generalised Weibull (PGW) hazard function.

Usage

```
hPGW(t, kappa, alpha, eta, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the PGW hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hPGW(t=t, kappa=0.5, alpha=1.5, eta=0.6,log=FALSE)
```

---

hW *Weibull (W) Hazard Function.*

Description

Weibull (W) Hazard Function.

Usage

```
hW(t, kappa, alpha, log = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
log	:log scale (TRUE or FALSE)

Value

the value of the w hazard function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
hW(t=t, kappa=0.75, alpha=0.5,log=FALSE)
```

---

ipass *IRESSA Pan-Asia Study (IPASS) data set*

Description

Argyropoulos and Unruh (2015) published reconstructed IPASS clinical trial data. Despite being reconstructed, this data set retains all of the features shown in references, as well as full access to the observations from this clinical trial.The database spans the months of March 2006 to April 2008.The study's main goal is to compare gefitinib to carboplatin/paclitaxel doublet chemotherapy as first-line treatment in terms of progression-free survival (in months) in selected non-small-cell lung cancer (NSCLC) patients.

Format

A data frame with 1217 rows and 3 variables:

- time: progression free survival (in months)
- status: failure indicator (1 - failure; 0 - otherwise)
- arm: (1 - gefitinib; 0 - carboplatin/paclitaxel doublet chemotherapy)

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Argyropoulos, C. and Unruh, M. L. (2015). Analysis of time to event outcomes in randomized controlled trials by generalized additive models. PLOS One 10, 1-33.

LeukSurv *The Leukemia Survival Data*

Description

A dataset on the survival of acute myeloid leukemia in 1,043 pateietns, first analyzed by Henderson et al. (2002). It is of interest to investigate possible spatial variation in survival after accounting for known subject-specific prognostic factors, which include age, sex, white blood cell count (wbc) at diagnosis, and the Townsend score (tpi) for which higher values indicates less affluent areas. Both exact residential locations of all patients and their administrative districts (24 districts that make up the whole region) are available.

Format

A data frame with 1043 rows and 9 variables:

- time: survival time in days
- cens: right censoring status 0=censored, 1=dead
- xcoord: coordinates in x-axis of residence
- ycoord: coordinates in y-axis of residence
- age: age in years
- sex:male=1 female=0
- wbc:white blood cell count at diagnosis, truncated at 500
- tpi: the Townsend score for which higher values indicates less affluent areas
- district:administrative district of residence

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

References

Henderson, R., Shimakura, S., and Gorst, D. (2002), Modeling spatial variation in leukemia survival data, *Journal of the American Statistical Association*, 97(460), 965-972.

---

pexpweibull *Exponentiated Weibull (EW) Cumulative Distribution Function.*

Description

Exponentiated Weibull (EW) Cumulative Distribution Function.

Usage

```
pexpweibull(t, lambda, kappa, alpha, log.p = FALSE)
```

Arguments

t	: positive argument
lambda	: scale parameter
kappa	: shape parameter
alpha	: shape parameter
log.p	:log scale (TRUE or FALSE)

Value

the value of the EW cumulative distribution function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
pexpweibull(t=t, lambda=0.65,kappa=0.45, alpha=0.25, log.p=FALSE)
```

---

pggamma *Generalised Gamma (GG) Cumulative Distribution Function.*

Description

Generalised Gamma (GG) Cumulative Distribution Function.

Usage

```
pggamma(t, kappa, alpha, eta, log.p = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log.p	:log scale (TRUE or FALSE)

Value

the value of the GG cumulative distribution function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
pggamma(t=t, kappa=0.5, alpha=0.35, eta=0.9,log.p=FALSE)
```

sggamma *Generalised Gamma (GG) Survival Function.*

Description

Generalised Gamma (GG) Survival Function.

Usage

```
sggamma(t, kappa, alpha, eta, log.p = FALSE)
```

Arguments

t	: positive argument
kappa	: scale parameter
alpha	: shape parameter
eta	: shape parameter
log.p	:log scale (TRUE or FALSE)

Value

the value of the GG survival function

Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Mutua Kilai, <abdisalam.hassan@amoud.edu.so>

Examples

```
t=runif(10,min=0,max=1)
sggamma(t=t, kappa=0.5, alpha=0.35, eta=0.9,log.p=FALSE)
```

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