Package ‘MPLikelihoodWB’

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Type Package

Title Modified Profile Likelihood Estimation for Weibull Shape and Regression Parameters

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Description Computing modified profile likelihood estimates for Weibull Shape and Regression Parameters. Modified likelihood estimates are provided.

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**Description**

Makes adjustment of profile likelihood function of parameter of interest in presence of many nuisance parameters under Weibull regression models. Modified profile likelihood technique is developed by extending the Barndorff-Nielsens approach for Weibull regression models. Modified likelihood estimates are provided.

**Details**

A modification to profile likelihood is introduced to overcome from this type of problems. Several adjustments have been proposed to modify the profile likelihood function. In an earlier paper named Conditionality resolutions by Barndorff-Nielsen published in Biometrica (1980, 1983), the construction of ancillary statistics and the expressions for the conditional distribution of the maximum likelihood estimate, was discussed for transformation models and exponential models, with most emphasis on the latter.

The main goal is to obtain adjustment to the profile likelihood function when the parameters of interest are, firstly, shape parameter beta (or, alternatively, kappa) and secondly, regression parameter phi in Weibull regression model, even in presence of collinearity among the covariates. Note that practically correlated covariates are found in many areas of biostatistics including microarray, genetics, medical statistics. The presence of collinearity makes sometimes the estimation and inference procedure problematic and complex and the model as a whole can be found as statistically significant but the individual regression coefficients can not be (e.g. Khan and Shaw (2015)). The modified profile likelihood estimators outperform the profile likelihood estimators in terms of three statistical measures as comparison criterion: mean squared errors, bias and standard errors for weibull shape parameter.

- Package: MPLikelihoodWB
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- Depends: survival

**Author(s)**

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**References**


Examples

```r
# For modified profile likelihood estimation
dat <- data.weibull(n = 40, shape=2, regco=c(2,1.5,3,2.5))
Mprofile.wb(formula=ftime~x1+x2+x3+x4,censor="delta",data=dat)
survreg(Surv(ftime,delta)~x1+x2+x3+x4,data=dat,dist="weibull")

# For random dataset creation
data.weibull(n = 20)
data.weibull(n = 20, shape=1.7, regco=c(2,1,3,4))
data.weibull(n = 20, shape=1.5, ncorvar=4, correlated=TRUE)
```

---

**data.weibull**

*Random data set generating function.*

**Description**

Generate random data set of weibull distributed failure time, covariates and corresponding censoring status with a given shape and a set of regression parameters. Correlated covariates can also be drawn with a given number of correlated covariates.

**Usage**

```r
data.weibull(n, shape = 2, regco = c(1, 3), rcen = 0.25, ncorvar = 3, correlated = FALSE)
```

**Arguments**

- `n`: sample size
- `shape`: value of shape parameter
- `regco`: vector of regression parameters that corresponds to covariates, for correlated = FALSE
- `rcen`: censoring rate
- `ncorvar`: no of correlated covariates, for correlated = TRUE. See details below.
- `correlated`: logical; if true correlated covariates will be generated with a given no of correlated covariates

**Details**

`ncorvar` is non required if correlated = FALSE and `regco` is not required if correlated = TRUE.
Value

Data frame with columns:

ftime lifetime data from weibull distribution
x covariates
delta censoring status, 0 or 1. A value 0 indicates corresponding observation is censored

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

Examples

data.weibull(n = 20)
data.weibull(n = 20, shape=1.7, regco=c(2,1,3,4))
data.weibull(n = 20, shape=1.5, ncorvar=4, correlated=TRUE)

infm.weibul Observed information matrix for fixed regression parameter of interest

Description

Matrix as a component of modifying part of regression parameters: observed information matrix for fixed number of parameter of interest

Usage

infm.weibul(Y, X, sigma, phi, delta, whc)

Arguments

Y log of Weibull distributed failure times
X covariate matrix
sigma given value of scale parameter of extreme value distribution
phi given values of regression parameters of extreme value distribution
delta Censoring status, coded as 0 (censored observation) and 1 (uncensored observation) binary integer variable
whc Set position of regression parameter of interest corresponding predefined covariate matrix. It will take integer value from 1 to number of regression parameters

Value

Symmetric matrix of dimension n x n (n is number of regression parameter).
Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References


See Also

LX.mat.weibull

Examples

dat <- data.weibull(n = 20, shape=2, regco=c(2,1.5,3,2.5))
par=c(1,1,1,1,1,1)
infm.weibul(Y=log(dat$ftime),X=model.matrix(ftime~x1+x2+x3+x4,data=dat),
sigma=2,phi=matrix(par[-1],ncol=1),delta=dat$delta,whc=2)
par=c(1,1,1)
infm.weibul(Y=log(dat$ftime),X=model.matrix(ftime~x1,data=dat),sigma=2,
phi=matrix(par[-1],ncol=1),delta=dat$delta,whc=2)

LX.mat.weibull

Compensating factor for a possible mathematical disturbance

Description

Matrix as a component of modifying part of regression parameters: compensating factor for a possible mathematical disturbance

Usage

LX.mat.weibull(Y, X, sigma, phi, delta, whc)
Arguments

- **Y**: log of Weibull distributed failure times
- **X**: covariate matrix
- **sigma**: given value of scale parameter of extreme value distribution
- **phi**: given values of regression parameters of extreme value distribution
- **delta**: Censoring status, coded as 0(censored observation) and 1(uncensored observation) binary integer variable
- **whc**: Set position of regression parameter of interest corresponding predefined covariate matrix. It will take integer value from 1 to number of regression parameters.

Value

Matrix of dimension n*n (n is number of regression parameter).

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References


See Also

J.inf.weibul

Examples

```r
dat <- data.weibull(n = 20, shape=2, regco=c(2,1.5,3,2.5))
par=c(1,1,1,1,1,1)
LX.mat.weibull(Y=log(dat$ftime),X=model.matrix(ftime~x1+x2+x3+x4,data=dat),
sigma=2,phi=matrix(par[-1],ncol=1),delta=dat$delta,whc=2)
par=c(1,1,1)
LX.mat.weibull(Y=log(dat$ftime),X=model.matrix(ftime~x1,data=dat),sigma=2,
phi=matrix(par[-1],ncol=1),delta=dat$delta,whc=2)
```
**mplik.wb.bi**

*Modified profile likelihood function of Weibull regression parameters*

**Description**

Modified profile likelihood function of Weibull regression parameters. The function considers one regression parameter at a time as parameter of interest and remaining parameters as nuisance parameters. Standard optimization procedures are required to find the estimate of certain regression parameter at a time.

**Usage**

```r
mplik.wb.bi(par, Y, X, delta, whc)
```

**Arguments**

- **par**: Initial value of parameters to be estimated by optimization
- **Y**: Weibull distributed failure times
- **X**: covariate matrix
- **delta**: Censoring status, coded as 0(censored observation) and 1(uncensored observation) binary integer variable
- **whc**: Set position of regression parameter of interest corresponding predefined covariate matrix. It will take integer value from 1 to number of regression parameters.

**Value**

Negative log likelihood of the function at given value of parameters and data. Optimization of this function will produce maximum likelihood estimate of regression parameter of Extreme value distribution. Transformation will be required to obtain estimate of Weibull regression parameter.

**Author(s)**

Mazharul Islam and Hasinur Rahaman Khan

**References**

See Also

mplik.wb.s

Examples

dat <- data.weibull(n = 40, shape=2, regco=c(2,1.5,3,2.5))

mplik.wb.bi(par=c(1,1,1,1,1,1),Y=dat$ftime,X=model.matrix(ftime~x1+x2+x3+x4,data=dat),
delta=dat$delta,whc=2)

mplik.wb.s  Modified profile likelihood function of Weibull shape parameter

Description

Modified profile likelihood function of Weibull shape parameter. The function considers shape parameter as parameter of interest and remaining parameters as nuisance parameters. Standard optimization procedures are required to find the estimate of shape parameter. The estimate will be less biased comparing to existing methods when sample size is considerably small.

Usage

mplik.wb.s(par, Y, X, delta)

Arguments

par  Initial value of parameters to be estimated by optimization
Y  Weibull distributed failure times
X  covariate matrix
delta  Censoring status, coded as 0(censored observation) and 1(uncensored observation) binary integer variable.

Value

Negative log likelihood of the function at given value of parameters and data. Optimization of this function will produce maximum likelihood estimate of scale parameter of Extreme value distribution. Transformation will be required to obtain estimate of Weibull shape parameter.

Author(s)

Mazharul Islam and Hasinur Rahaman Khan
References


See Also

mplik.wb.bi

Examples

dat <- data.weibull(n = 40, shape=2, regco=c(2,1.5,3,2.5))

mplik.wb.s(par=c(1,1,1,1,1,1),Y=dat$ftime,X=model.matrix(ftime~x1+x2+x3+x4,data=dat),
delta=dat$delta)

Mprofile.wb

Modified profile likelihood estimation of Weibull shape and regression parameter

Description

Modified profile likelihood estimation of Weibull shape and regression parameter. The methodology was adopted from 'Conditionality resolutions' which is actually "the construction of ancillary statistics and expressions for the conditional distribution of the maximum likelihood estimate of a statistical model". The result will produce less bias with minimum mean square error; at least for Weibull shape parameter. Performances of profile and modified profile likelihood estimation are differentiable when sample size is reasonably small.

Usage

Mprofile.wb(formula, censor, data, method = "BFGS", initial = 1)

Arguments

formula an object of class "formula".
censor censoring status, coded as 0(censored observation) and 1(uncensored observation) binary integer variable in the data frame.
data data frame of weibull distributed failure time, covariates and censoring variable.
method method under which optimization is performed. Other methods are "Nelder-Mead", "CG", "L-BFGS-B", "SANN", and "Brent".
initial
Initial values of the parameters at which likelihood function will be optimized. Default value is 1 for all parameters. To change initial values input a vector of numeric values with length of number of parameters to be optimized. First initial value is attributed for shape parameter. For example, use vector c(2,3,2,3,4) as initial value for shape and four regression parameters.

Value
The function is a list with atleast the following component:

- Formula: an object of class "formula"
- Coefficients: estimates of the regression parameters
- Scale: estimate of scale parameter

Author(s)
Mazharul Islam and Hasinur Rahaman Khan

References

See Also
optim

Examples
dat <- data.weibull(n = 40, shape=2, regco=c(2,1.5,3,2.5))
Mprofile.wb(formula=ftime~x1+x2+x3+x4,censor="delta",data=dat)
survreg(Surv(ftime,delta)-x1+x2+x3+x4,data=dat,dist="weibull")
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