

Package ‘MPLikelihoodWB’

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Type Package

Title Modified Profile Likelihood Estimation for Weibull Shape and Regression Parameters

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Author Mazharul Islam and Hasinur Rahaman Khan

Maintainer Hasinur Rahaman Khan <hasinurkhan@gmail.com>

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

Depends survival, MASS, R (>= 3.0.2)

License GPL-2

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MPLikelihoodWB-package

Modified Profile Likelihood Estimation for Weibull Shape and Regression Parameters

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-Nielsen's approach for Weibull regression models in presence of collinearity among covariates. 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 *Biometrika* (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 β (or, alternatively, κ) and secondly, regression parameter ϕ in presence of collinearity among the covariates in Weibull regression model. 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.

| | |
|----------|----------------|
| Package: | MPLikelihoodWB |
| Type: | Package |
| Version: | 1.0 |
| Date: | 2016-1-1 |
| License: | GPL-2 |
| Depends: | survival, MASS |

Author(s)

Mazharul Islam and Hasinur Rahaman Khan Maintainer: Hasinur Rahaman Khan <hasinurkhan@gmail.com>

References

- Barndorff-Nielsen (1980). Conditionality resolutions. *Biometrika*, 67(2), 293-310.
- Barndorff-Nielsen (1983). On a formula for the distribution of the maximum likelihood estimator. *Biometrika*, 70(2), 343-365.

Khan M. H. R. and Shaw J. E. H (2015). Variable selection for survival data with a class of adaptive elastic net techniques. Statistics and Computing, DOI 10.1007/s11222-015-9555-8.

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

Examples

```
# For modified profile likelihood estimation
dat1 <- data.weibull(n=35, nco=5)
mpl.wb<-Mprofile.wb(formula=ftime~x1+x2+x3+x4+x5, censor= "delta", data=dat1)
pl.wb<-survreg(Surv(ftime, delta)~x1+x2+x3+x4+x5, data=dat1, dist="weibull")

# For random dataset creation with given shape
dat2 <- data.weibull.shape(35, nco=5, shape=3)
mpl.wb<-Mprofile.wb(formula=ftime~x1+x2+x3+x4+x5, censor="delta", data=dat2)
pl.wb<-survreg(Surv(ftime, delta)~x1+x2+x3+x4+x5, data=dat2, dist="weibull")

# For correlated data with a given shape
dat3 <- data.weibull.reg(35, ncop=5, shape=2)
```

data.weibull

Random Data Set Generating Function

Description

Generate random data set of weibull distributed failure time, covariates and corresponding censoring status. Covariates are drawn from uniform(0, 1) distribution and the shape parameter is fixed at value 2. All regression parameters are set to 1. The parameters are chosen arbitrarily.

Usage

```
data.weibull(n, nco)
```

Arguments

| | |
|-----|----------------------|
| n | Sample size |
| nco | number of covariates |

Details

The data are generated from weibull distribution.

Value

Data frame of weibull distributed failure time, covariates and censoring variable

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

data.weibull.reg

Examples

```
# For data generated from Weibull distriution
dat.w<-data.weibull(n=35,nco=5)
dat.w
```

| | |
|------------------|---|
| data.weibull.reg | <i>Grnerate Random Dataset with Correlated Covariates</i> |
|------------------|---|

Description

Generate random data set of weibull distributed failure time, covariates and corresponding censoring status. Covariates are drawn from multivariate normal distribution as if they are correlated. All regression parameters have set to 1. All of these have been arbitrarily choosen.

Usage

```
data.weibull.reg(n, ncop, shape)
```

Arguments

| | |
|-------|--------------------------|
| n | sample size |
| ncop | number of covariates |
| shape | value of shape parameter |

Value

Data frame

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References

Khan M. H. R. and Shaw J. E. H (2015). Variable selection for survival data with a class of adaptive elastic net techniques. Statistics and Computing, DOI 10.1007/s11222-015-9555-8.

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

data.weibull

Examples

```
#Generate the data from Weibull model
dat<-data.weibull.reg(n=35,ncop=5,shape=2)
dat
```

| | |
|--------------------|--|
| data.weibull.shape | <i>Generate Random Dataset for A Given Shape Parameter</i> |
|--------------------|--|

Description

Generate random data set of weibull distributed failure time, covariates and corresponding censoring status. Covariates are drawn from uniform(0, 1) distribution. All regression parameters have set to 1. All of these have been arbitrarily choosen.

Usage

```
data.weibull.shape(n, nco, shape)
```

Arguments

| | |
|-------|--------------------------|
| n | sample size |
| nco | number of covariates |
| shape | value of shape parameter |

Value

Data frame

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

data.weibull.reg

Examples

```
dat<-data.weibull.shape(35,nco=5,shape=3)
dat
```

J.inf.weibul

*Observed Information Matrix for Fixed K***Description**

Matrix as a component of modifying part of regression parameters. Observed information matrix for fixed number of parameter of interest k

Usage

```
J.inf.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 for censored observation and 1 for uncensored observation |
| 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 $n \times n$ (n is number of regression parameter)

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References

Barndorff-Nielsen (1980). Conditionality resolutions. *Biometrika*, 67(2), 293-310.

Barndorff-Nielsen (1983). On a formula for the distribution of the maximum likelihood estimator. *Biometrika*, 70(2), 343-365.

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

LX.mat.weibull

Examples

```

dat <- data.weibull(n=35,nco=3) # create dummy data with 3 covariates

par<-c(1,1,1,1,1)

jiw<-J.inf.weibull(Y=log(dat$ftime),X=model.matrix(ftime~x1+x2+x3,data=dat),
sigma=2,phi=matrix(par[-1],ncol=1),delta=dat$delta,whc=2)

jiw

```

LX.mat.weibull

*Compensating Factor for A Possible Mathematical Disturbance***Description**

Matrix as a component of modifying part of regression parameters for 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 for censored observation and 1 for uncensored observation |
| 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 $n \times n$ (n is number of regression parameter).

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References

Barndorff-Nielsen (1980). Conditionality resolutions. *Biometrika*, 67(2), 293-310.

Barndorff-Nielsen (1983). On a formula for the distribution of the maximum likelihood estimator. *Biometrika*, 70(2), 343-365.

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

J.inf.weibul

Examples

```

dat <- data.weibull(n=35,nco=3) # create dummy data with 3 covariates
par<-c(1,1,1,1,1)
lxmw<-LX.mat.weibull(Y=log(dat$ftime),X=model.matrix(ftime~x1+x2+x3,data=dat),
sigma=2,phi=matrix(par[-1],ncol=1),delta=dat$delta,whc=2)
lxmw

```

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

```
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 for censored observation and 1 for uncensored observation |
| 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

- Barndorff-Nielsen (1980). Conditionality resolutions. *Biometrika*, 67(2), 293-310.
- Barndorff-Nielsen (1983). On a formula for the distribution of the maximum likelihood estimator. *Biometrika*, 70(2), 343-365.
- Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

mplik.wb.s

Examples

```
dat <- data.weibull(n=35,nco=3) # create dummy data with 3 covariates
mwbi<-mplik.wb.bi(par=c(1,1,1,1,1),Y=dat$ftime,X=model.matrix(ftime~x1+x2+x3,data=dat),
delta=dat$delta,whc=2)
mwbi
```

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 for censored observation and 1 for uncensored observation |

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

- Barndorff-Nielsen (1980). Conditionality resolutions. *Biometrika*, 67(2), 293-310.
- Barndorff-Nielsen (1983). On a formula for the distribution of the maximum likelihood estimator. *Biometrika*, 70(2), 343-365.
- Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

Examples

```
dat <- data.weibull(n=35,nco=3) # create dummy data with 3 covariates
mws<-mplik.wb.s(par=c(1,1,1,1,1),Y=dat$ftime,X=model.matrix(ftime~x1+x2+x3,data=dat),
delta=dat$delta)
mws
```

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, initial)
```

Arguments

| | |
|---------|--|
| formula | an object of class formula |
| censor | Censoring status, coded as 0 for censored observation and 1 for uncensored observation |
| data | Data frame of weibull distributed failure time, covariates and censoring variable |
| initial | Initial values of the parameters at which likelihood function will be optimized |

Details

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 egression parameters.

Value

| | |
|--------------|--|
| Formula | an object of class formula |
| Coefficients | estimates of the regresion parameters |
| Scale | estimate of scale parameter of Weibull model |

Author(s)

Mazharul Islam and Hasinur Rahaman Khan

References

Barndorff-Nielsen (1983). On a formula for the distribution of the maximum likelihood estimator. *Biometrika*, 70(2), 343-365.

Islam, M. M. and Khan, M. H. R. (2015). Modified profile likelihood estimation for the weibull regression models in survival analysis. Submitted.

See Also

summary.Mprofile.wb

Examples

```
dat3 <- data.weibull.reg(35, ncop=5, shape=2)
mpw<-Mprofile.wb(formula = ftime~x1+x2+x3+x4+x5, censor="delta", data=dat3)
mpw
```

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