Package 'isoSurv'

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Type Package

Title Isotonic Regression on Survival Analysis

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Author Yunro Chung [aut, cre]

Maintainer Yunro Chung <yunro.chung@asu.edu>

Description Nonparametric estimation on survival analysis under order restrictions. It estimates monotone increasing or decreasing covariate effects in the proportional hazards model. Yunro Chung et al. (2018) <doi:10.1093/biomet/asx064>.

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isoSurv-package *Isotonic Regression on Survival Analysis*

Description

Nonparametric estimation on survival analysis under order restrictions

Details

Package:	isoph
Type:	Package
Version:	0.2.0
Date:	2021-3-22
License:	GPL (>= 2)

Author(s)

Yunro Chung [aut,cre] Maintainer: Yunro Chung <yunro.chung@asu.edu>

References

Yunro Chung, Anastasia Ivanova, Michael G. Hudgens, Jason P. Fine (2018), Partial likelihood estimation of isotonic proportional hazards models, Biometrika, 105(1), 133-148. doi:10.1093/biomet/asx064

disoph *Fit Double Isotonic Proportional Hazards Model*

Description

Nonparametric full likleihood estimation of monotone baseline hazard and covariate effect functions in the proportional hazards model.

Usage

```
disoph(formula, bshape, data, maxiter, eps)
```

Arguments

formula	a formula object: response ~ iso(covariate1). The response must be survival outcome using the Surv function in the survival package. The iso(covariate1,shape="increasing",K="median" is for isotonic estimation of covariate1 with shape="increasing" (or "decreasing") direction and K="median" anchor.

bshape	direnction of the baseline hazard function (bshape="increasing" or "decreasing").
data	data.frame includes variables named in the formula argument.
maxiter	maximum number of iteration (default is 10^4).
eps	stopping convergence criteria (default is 10^-3).

Details

The disoph function estimates $\lambda 0$ and ψ based on the full likelihood under the isotonic proportional hazards model, defined as

$$\lambda(t|z) = \lambda 0(t) exp(\psi(z)),$$

where $\lambda 0$ is an isotonic baseline hazard function and ψ is an isotonic function. One point has to be fixed with $\psi(K) = 0$, where K is an anchor point. A direction of $\lambda 0$ is defined as monotone increasing or monotone decreasing in t. A direction of ψ is defined as monotone increasing or monotone decreasing in z. Back-and-forth iterative pool adjacent violators algorithm is used to maximize the full likelihood.

Value

A list of class fisoph:

iso.bh	data.frame with $time$ and estimated $\lambda 0$.
iso.cov	data.frame with z and estimated ψ.
conv	algorithm convergence status.
iter	total number of iterations.
Zk	anchor satisfying estimated $\psi(Zk)$=0.
shape.bh	order restriction on $\lambda 0$.
shape.cov	order restriction on ψ.

Author(s)

Yunro Chung [auth, cre]

References

Yunro Chung, Double Isotonic Proportional Hazards Models with Monotone Baseline Hazard and Covariate Effect Functions. In preparation.

Examples

```
test1=data.frame(
  time=  c(2, 5, 1, 7, 9, 5, 3, 6, 8, 9, 7, 4, 5, 2, 8),
  status=c(0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1),
  z=     c(2, 1, 1, 3, 5, 6, 7, 9, 3, 0, 2, 7, 3, 9, 4)
)

disoph.fit1=disoph(Surv(time, status)~iso(z,shape="inc"),bshape="inc",data=test1)
plot(disoph.fit1)
```

iso *Attributions of isotonic covariate effect*

Description

InternalIt attributes the covariate with respect to the name, direction and anchor constrain.

Usage

```
iso(z, shape, K)
```

Arguments

z	a univariate covariate.
shape	a direction of z (shape="increasing" or "decreasing") (default is "$increasing$").
K	an anchor point (default is NA for the median anchor).

Details

Internal function. The iso function attributes the covariate z for its name, shape direction and anchor.

Value

The value z with attribution of its name, shape and K.

Author(s)

Yunro Chung [cre]

isoph *Fit Isotonic Proportional Hazards Model*

Description

Nonparametric partial likelihood estimation of a monotone covariate effect in the proportional hazards model.

Usage

```
isoph(formula, data, maxiter, eps)
```

Arguments

formula	a formula object: response ~ iso(covariate1)+covariate2+.... The response must be survival outcome using the Surv function in the survival package. The iso(covariate1,shape="increasing is for isotonic estimation of covariate1 with shape="increasing" (or "decreasing") direction and K="median" anchor.
data	data.frame includes variables named in the formula argument.
maxiter	maximum number of iteration (default is 10^4).
eps	stopping convergence criteria (default is 10^-3).

Details

The isoph function estimates ψ and β based on the partial likelihood under the isotonic proportional hazards model, defined as

$$\lambda(t|z,w) = \lambda 0(t) exp(\psi(z) + \beta w),$$

where $\lambda 0$ is a baseline hazard function, ψ is an isotonic function, z is a univariate variable, w is a q by 1 dimensional covariate vector and β is a 1 by q dimensional regression parameter. One point has to be fixed with $\psi(K) = 0$, where K is an anchor point. A direction of ψ is defined as monotone increasing or monotone decreasing in z. Pseudo iterative convex minorant algorithm is used to maximize the partial likelihood.

Value

A list of class isoph:

iso.cov	data.frame with z and estimated ψ.
beta	estimated β.
conv	algorithm convergence status.
iter	total number of iterations.
Zk	anchor satisfying estimated $\psi(Zk)$=0. See the formular argument above.
shape	order restriction on ψ. See the formular argument above.

Author(s)

Yunro Chung [aut, cre]

References

Yunro Chung, Anastasia Ivanova, Michael G. Hudgens, Jason P. Fine, Partial likelihood estimation of isotonic proportional hazards models, Biometrika. 2018, 105 (1), 133-148. doi:10.1093/biomet/asx064

Examples

```
# test1
test1=data.frame(
  time=  c(2, 5, 1, 7, 9, 5, 3, 6, 8, 9, 7, 4, 5, 2, 8),
  status=c(0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1),
  z=     c(2, 1, 1, 3, 5, 6, 7, 9, 3, 0, 2, 7, 3, 9, 4)
```

```
)

isoph.fit1 = isoph(Surv(time, status)~iso(z,shape="inc"),data=test1)
plot(isoph.fit1)

# test2
test2=data.frame(
  time=  c(2, 5, 1, 7, 9, 5, 3, 6, 8, 9, 7, 4, 5, 2, 8),
  status=c(0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1),
  z=     c(2, 1, 1, 3, 5, 6, 7, 9, 3, 0, 2, 7, 3, 9, 4),
  trt=   c(1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 0)
)

isoph.fit2 = isoph(Surv(time, status)~iso(z,shape="inc")+trt, data=test2)
plot(isoph.fit2)
```

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