### Package ‘CoxRidge’

February 27, 2015

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<th>Package</th>
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<td>Title</td>
<td>Cox Models with Dynamic Ridge Penalties</td>
</tr>
<tr>
<td>Version</td>
<td>0.9.2</td>
</tr>
<tr>
<td>Date</td>
<td>2015-02-12</td>
</tr>
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<tr>
<td>Description</td>
<td>A package for fitting Cox models with penalized ridge-type partial likelihood. The package includes functions for fitting simple Cox models with all covariates controlled by a ridge penalty. The weight of the penalty is optimised by using a REML type-algorithm. Models with time varying effects of the covariates can also be fitted. Some of the covariates may be allowed to be fixed and thus not controlled by the penalty. There are three different penalty functions, ridge, dynamic and weighted dynamic. Time varying effects can be fitted without the need of an expanded dataset.</td>
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<tr>
<td>Depends</td>
<td>survival,splines</td>
</tr>
<tr>
<td>LazyLoad</td>
<td>yes</td>
</tr>
<tr>
<td>License</td>
<td>GPL (&gt;= 2)</td>
</tr>
<tr>
<td>Repository</td>
<td>CRAN</td>
</tr>
<tr>
<td>NeedsCompilation</td>
<td>no</td>
</tr>
<tr>
<td>Date/Publication</td>
<td>2015-02-27 12:09:03</td>
</tr>
</tbody>
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Description

Fits penalized Cox models using ridge penalties and a REML-type algorithm for optimization. The methods can be applied also to non-proportional hazards models where some or all of the covariates can be modelled with time varying effects.

Details

Package: CoxRidge
Type: Package
Version: 0.9.1
Date: 2013-06-20
License: GPL (>= 2)

Author(s)

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References

Perperoglou A.(2013) Cox models with dynamic ridge penalties on time varying effects of the covariates. Statistics in Medicine, to appear

Description

Plots time varying effects of covariates.

Usage

comp.graph(obj, alpha = 0.05, xlab = "time", ylab = "X effect", all.terms = TRUE, variable)
**Arguments**

- `obj`: A `cox.ridge` or `cox.dynamic.ridge` object.
- `alpha`: The alpha level used for confidence bands.
- `xlab`: a title for the x axis
- `ylab`: a title for the y axis
- `all.terms`: When TRUE all time-varying effects variables are plotted.
- `variable`: when all.terms=FALSE you need to specify which variable to be plotted. Use numbers 1,2,3... for first, second, third etc.

**Details**

Confidence bands are computed using the delta method.

**References**


**See Also**

`plot`

**Examples**

```r
data(ova) attach(ova) X <- cbind(karn,diam,figo) X <- apply(X,2,function(x)((x-mean(x))/sqrt(var(x)))) Ft <- cbind(rep(1,nrow(X)),bs(time)) fit <- dynamic.ridge(time,death,X,Ft=Ft,fun="simple") comp.graph(fit,all.terms=FALSE,variable=1) par(mfrow=c(3,1)) comp.graph(fit)
```

---

**Description**

Fits a simple Cox model with a ridge penalty on all covariates. The penalty weight can be optimized using a REML-type likelihood method or be chosen by the user.

**Usage**

```r
cox.ridge(formula, lambda = 1, lambdaFixed = FALSE, eps = 1e-6, data = sys.parent(), iter.max = 200, mon = FALSE)
```
Arguments

formula: a formula object, with the response on the left of a `~` operator, and the terms on the right. The response must be a survival object as returned by the `Surv` function.

lambdaFixed: when TRUE the function does not seek to optimize the penalty weight.

lambda: When lambdaFixed is FALSE lambda is a scalar giving the starting value for the weight of the penalty. When lambdaFixed is true lambda is the chosen weight of the penalty.

eps: a small value. The criterion of convergance.

data: an optional data frame containing the variables named in the formula.

iter.max: maximum number of iterations, default is 200.

mon: when true the function prints out the computed lambda weigh in each iteration.

Value

cox.ridge returns an object of class "cox.ridge". The function print.cox.ridge is used to obtain and print a summary of the results. An object of class "cox.ridge" is a list containing the following components:

call: function call.

coef: the vector of coefficients.

loglik: the penalized log-likelihood of the model.

time: a vector with failure/censoring times.

death: a vector of status indicator.

X: a matrix of covariates.

iter: number of iterations used to maximise likelihood at a fixed lambda.

inter.it: number of iterations used to find optimal lambda.

lambda: optimal weight of the penalty.

hat: the hat matrix at convergance.

hess: the Hessian matrix of second derivatives.

Note

The function at the current form cannot handle missing values. The user has to take prior action with missing values before using this function.

Author(s)

Aris Perperoglou

References

Perperoglou A.(2013) Cox models with dynamic ridge penalties on time varying effects of the covariates. Statistics in Medicine, to appear
See Also

coxph, Dynamic.Ridge

Examples

data(ova)
attach(ova)
X <- cbind(karn,diam,figo)
X <- apply(X,2,function(x)((x-mean(x))/sqrt(var(x))))#standardize covariates
fit <- cox.ridge(Surv(time,death)-X,lambda=1)
fit ##regression coefficients correspond to the standardized covariates

Description

Internal CoxRidge functions.

Details

These are not to be called by the user

Dynamic.Ridge

Fit a Cox model with time dependent effects of the covariates and penalized likelihood.

Description

Fits a Cox model on which some, or all, of the covariates are allowed to have time varying effects. The likelihood is penalized either using a simple ridge penalty on all time varying covariates ("simple") or a dynamic ridge penalty ("dynamic") which includes the used time functions in the penalty. There is also the option for a "weighted" ridge penalty based on the baseline hazard.

Usage

Dynamic.Ridge(time, death, X, R, Ft, lambda = 0, fun = c("dynamic", "weighted","simple"),
eps = 1e-06, iter.max = 200, theta, mon = FALSE, lambdaFixed = FALSE)
Arguments

- **time**: a vector containing failure/censoring times.
- **death**: a vector containing the status indicator.
- **X**: a matrix of time varying covariates.
- **R**: an optional matrix of time fixed covariates. When R is missing then all covariates are assumed to be time varying.
- **Ft**: a matrix containing the time functions. The first column must be constant.
- **lambda**: When lambdaFixed is FALSE lambda is a scalar giving the starting value for the weight of the penalty. When lambdaFixed is true lambda is the chosen weight of the penalty.
- **fun**: "simple", "dynamic", or "weighted": types of penalty.
- **eps**: a small value. The criterion of convergence.
- **iter.max**: maximum number of iterations, default is 200.
- **theta**: an optional matrix of starting values for coefficients of time varying effects.
- **mon**: when true the function prints out the computed lambda weigh in each iteration.
- **lambdaFixed**: when TRUE the function does not seek to optimize the penalty weight.

Value

Dynamic.Ridge returns an object of class "cox.dynamic.ridge" The function print.cox.dynamic.ridge is used to obtain and print a summary of the results. An object of class "cox.dynamic.ridge" is a list containing some the following components:

- **call**: function call.
- **theta**: a matrix of coefficient for the covariates with time varying effects.
- **fixed.coef**: the vector of fixed effects coefficients.
- **loglik**: the penalized log-likelihood of the model.
- **time**: a vector with failure/censoring times.
- **death**: a vector of status indicator.
- **X**: the matrix of time varying covariates.
- **R**: the matrix of fixed covariates.
- **Ft**: the matrix of time functions
- **iter**: number of iterations used to maximise likelihood at a fixed lambda.
- **inter.it**: number of iterations used to find optimal lambda.
- **lambda**: optimal weight of the penalty.
- **Hat**: the hat matrix at convergence.
- **h2**: the non-penalized Hessian matrix of second derivatives.

Note

The function at the current form cannot handle missing values. The user has to take prior action with missing values before using this function.
GBSG

Author(s)
Aris Perperoglou

References
Perperoglou A.(2013) Cox models with dynamic ridge penalties on time varying effects of the covariates. Statistics in Medicine, to appear

See Also
coxph, cox.ridge

Examples
data(GBSG)
attach(GBSG)
X <- cbind(age,grade)
R <- cbind(tumsize,posnodal,prm,esm)
X <- apply(X,2,function(x)((x-mean(x))/sqrt(var(x)))) #standardize covariates
R <- apply(R,2,function(x)((x-mean(x))/sqrt(var(x)))) #standardize covariates
Ft <- cbind(rep(1,nrow(X)),bs(rfst))

# a model with all covariates as time varying, simple penalty
fit.dr <- Dynamic.Ridge(rfst,cens,cbind(X,R),Ft=Ft,lambda=100,fun="simple",lambdaFixed=TRUE)
fit.dr #regression coefficients correspond to the standardized covariates

# a model with all covariates as time varying, weighted penalty
fit.wdr <- Dynamic.Ridge(rfst,cens,cbind(X,R),Ft=Ft,lambda=324,theta=fit.dr$theta,
fun="weighted",mon=TRUE)
fit.wdr #regression coefficients correspond to the standardized covariates

# a model with fixed and time varying covariates
fit.dr <- Dynamic.Ridge(rfst,cens,X,R,Ft,lambda=150,fun="simple",lambdaFixed=TRUE)
fit.dr

GBSG

German Breast Cancer Study Group.

Description
A data frame containing the observations from the GBSG study.

Usage
data(GBSG)
Format

This data frame contains the observations of 686 women:

id  patient id 1...686.
htrat  hormonal therapy, a factor at two levels 0 (no) and 1 (yes).
age  age of the patients in years.
menostat  menopausal status, a factor at two levels 1 (premenopausal) and 2 (postmenopausal).
tumsize  tumor size (in mm).
grade  tumor grade.
posnodal  number of positive nodes.
prm  progesterone receptor (in fmol).
esm  estrogen receptor (in fmol).
rfst  rfst recurrence free survival time (in days).
cens  censoring indicator (0 censored, 1 event).

Source


References

package(mfp)

Examples

data(GBSG)
str(GBSG)

ova     Ovarian cancer data set

Description

Survival times of 358 ovarian cancer patients with information on three covariates, karnofsky status (karn), tumor diameter (diam), figo stage (figo) and patients id.

Usage

data(ova)
Format

A data frame with 358 observations on the following 6 variables.

time  Survival times in days.
dead  Status indicator, 0=censored, 1=death.
karn  Karnofsky status at the start of the follow up.
figo  Figo stage.
diam  Timour diameter.
x  Patient id.

Source


Examples

data(ova)
str(ova)

print.cox.dynamic.ridge

Print a cox.dynamic.ridge object.

Description

Information describing the fitted cox.dynamic.ridge object.

Usage

## S3 method for class 'cox.dynamic.ridge'
print(x,...)

Arguments

x  a cox.dynamic.ridge object.

... optional arguments passed to print.default; see the documentation on that method function.

See Also

Dynamic.Ridge.
Examples

data(GBSG)
attach(GBSG)
X <- cbind(age, grade)
R <- cbind(tumsize, posnodal, prm, esm)
X <- apply(X, 2, function(x) ((x - mean(x))/sqrt(var(x)))) # standardize covariates
R <- apply(R, 2, function(x) ((x - mean(x))/sqrt(var(x)))) # standardize covariates
Ft <- cbind(rep(1, nrow(X)), bs(rfst))

# a model with all covariates as time varying, simple penalty
fit.dr <- Dynamic.Ridge(rfst, cens, cbind(X, R), Ft=Ft, lambda=10, fun="simple", lambdaFixed=TRUE)
fit.dr

print.cox.ridge

Print a cox.ridge object.

Description

Information describing the fitted cox.ridge object.

Usage

## S3 method for class 'cox.ridge'
print(x, ...)

Arguments

x a cox.ridge object.

... optional arguments passed to print.default; see the documentation on that method function.

See Also

cox.ridge.

Examples

data(ova)
attach(ova)
X <- cbind(karn, diam, figo)
X <- apply(X, 2, function(x) ((x - mean(x))/sqrt(var(x)))) # standardize covariates
fit <- cox.ridge(Surv(time, death) ~ X, lambda=1, lambdaFixed=TRUE)
fit # regression coefficients correspond to the standardized covariates
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