

Package: plasso (via r-universe)

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Type Package

Title Cross-Validated Post-Lasso

Version 0.1.3

Description Provides tools for cross-validated Lasso and Post-Lasso estimation. Built on top of the 'glmnet' package by Friedman, Hastie and Tibshirani (2010) <[doi:10.18637/jss.v033.i01](https://doi.org/10.18637/jss.v033.i01)>, the main function `plasso()` extends the standard 'glmnet' output with coefficient paths for Post-Lasso models, while `cv.plasso()` performs cross-validation for both Lasso and Post-Lasso models and different ways to select the penalty parameter λ as discussed in Knaus (2021) <[doi:10.1111/rssa.12623](https://doi.org/10.1111/rssa.12623)>.

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VignetteBuilder knitr

Encoding UTF-8

URL <https://github.com/MCKnaus/plasso>

BugReports <https://github.com/MCKnaus/plasso/issues>

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coef.cv.plasso	<i>Extract coefficients from a <code>cv.plasso</code> object</i>
----------------	--

Description

Extract coefficients for both Lasso and Post-Lasso from a `cv.plasso` object.

Usage

```
## S3 method for class 'cv.plasso'
coef(object, ..., s = c("optimal", "all"), se_rule = 0)
```

Arguments

object	<code>cv.plasso</code> object
...	Pass generic <code>coef</code> options
s	Determines whether coefficients are extracted for all values of lambda ("all") or only for the optimal lambda ("optimal") according to the specified standard error-rule.
se_rule	If equal to 0, predictions from cross-validated MSE minimum (default). Negative values go in the direction of smaller models, positive values go in the direction of larger models (e.g. <code>se_rule=-1</code> creates the standard 1SE rule). This argument is not used for <code>s="all"</code> .

Value

List object containing coefficients for both the Lasso and Post-Lasso models respectively.

lasso	Sparse <code>dgCMatrix</code> with Lasso coefficients
plasso	Sparse <code>dgCMatrix</code> with Post-Lasso coefficients

Examples

```

# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit cv.plasso to the data
p.cv = plasso::cv.plasso(X,y)
# get estimated coefficients along whole lambda sequence
coefs = coef(p.cv, s="all")
head(coefs$plasso)
# get estimated coefficients for optimal lambda value according to 1-standard-error rule
coef(p.cv, s="optimal", se_rule=-1)

```

coef.plasso

Extract coefficients from a [plasso](#) object

Description

Extract coefficients for both Lasso and Post-Lasso from a [plasso](#) object.

Usage

```

## S3 method for class 'plasso'
coef(object, ..., s = NULL)

```

Arguments

object	plasso object
...	Pass generic coef options
s	If Null, coefficients are returned for all lambda values. If a value is provided, the closest lambda value of the plasso object is used.

Value

List object containing coefficients that are associated with either all values along the lambda input sequence or for one specifically given lambda value for both the Lasso and Post-Lasso models respectively.

lasso	Sparse dgCMatrix-class object with Lasso coefficients
plasso	Sparse dgCMatrix-class object with Post-Lasso coefficients

Examples

```

# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit plasso to the data
p = plasso::plasso(X,y)
# get estimated coefficients along whole lambda sequence
coefs = coef(p)
head(coefs$plasso)
# get estimated coefficients for specific lambda approximation
coef(p, s=0.05)

```

cv.plasso

Cross-Validated Lasso and Post-Lasso

Description

`cv.plasso` uses the `glmnet` package to estimate the coefficient paths and cross-validates least squares Lasso AND Post-Lasso.

Usage

```
cv.plasso(x, y, w = NULL, kf = 10, parallel = FALSE, ...)
```

Arguments

x	Matrix of covariates (number of observations times number of covariates matrix)
y	Vector of outcomes
w	Vector of weights
kf	Number of folds in k-fold cross-validation
parallel	Set as TRUE for parallelized cross-validation. Default is FALSE.
...	Pass <code>glmnet</code> options

Value

cv.plasso object (using a list structure) including the base `glmnet` object and cross-validation results (incl. optimal Lambda values) for both Lasso and Post-Lasso model.

call	the call that produced this
lasso_full	base <code>glmnet</code> object
kf	number of folds in k-fold cross-validation
cv_MSE_lasso	cross-validated MSEs of Lasso model (for every iteration of k-fold cross-validation)

cv_MSE_plasso	cross-validated MSEs of Post-Lasso model (for every iteration of k-fold cross-validation)
mean_MSE_lasso	averaged cross-validated MSEs of Lasso model
mean_MSE_plasso	averaged cross-validated MSEs of Post-Lasso model
ind_min_l	index of MSE optimal lambda value for Lasso model
ind_min_pl	index of MSE optimal lambda value for Post-Lasso model
lambda_min_l	MSE optimal lambda value for Lasso model
lambda_min_pl	MSE optimal lambda value for Post-Lasso model
names_l	Names of active variables for MSE optimal Lasso model
names_pl	Names of active variables for MSE optimal Post-Lasso model
coef_min_l	Coefficients for MSE optimal Lasso model
coef_min_pl	Coefficients for MSE optimal Post-Lasso model
x	Input matrix of covariates
y	Matrix of outcomes
w	Matrix of weights

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit cv.plasso to the data
p.cv = plasso::cv.plasso(X,y)
# get basic summary statistics
print(summary(p.cv, default=FALSE))
# plot cross-validated MSE curves and number of active coefficients
plot(p.cv, legend_pos="bottomleft")
# get coefficients at MSE optimal lambda value for both Lasso and Post-Lasso model
coef(p.cv)
# get coefficients at MSE optimal lambda value according to 1-standard-error rule
coef(p.cv, se_rule=-1)
# predict fitted values along whole lambda sequence
pred = predict(p.cv, s="all")
head(pred$plasso)
```

 plasso

Lasso and Post-Lasso

Description

`plasso` implicitly estimates a Lasso model using the `glmnet` package and additionally estimates coefficient paths for a subsequent Post-Lasso model.

Usage

```
plasso(x, y, w = NULL, ...)
```

Arguments

<code>x</code>	Matrix of covariates (number of observations times number of covariates matrix)
<code>y</code>	Vector of outcomes
<code>w</code>	Vector of weights
<code>...</code>	Pass <code>glmnet</code> options

Value

List including base `glmnet` (i.e. Lasso) object and Post-Lasso coefficients.

<code>call</code>	the call that produced this
<code>lasso_full</code>	base <code>glmnet</code> object
<code>beta_plasso</code>	matrix of coefficients for Post-Lasso model stored in sparse column format
<code>x</code>	Input matrix of covariates
<code>y</code>	Matrix of outcomes
<code>w</code>	Matrix of weights

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit plasso to the data
p = plasso::plasso(X,y)
# plot coefficient paths for Post-Lasso model
plot(p, lasso=FALSE, xvar="lambda")
# plot coefficient paths for Lasso model
plot(p, lasso=TRUE, xvar="lambda")
# get coefficients for specific lambda approximation
coef(p, s=0.05)
# predict fitted values along whole lambda sequence
```

```
pred = predict(p)
head(pred$plasso)
```

```
plot.cv.plasso      Plot of cross-validation curves
```

Description

Plot of cross-validation curves.

Usage

```
## S3 method for class 'cv.plasso'
plot(
  x,
  ...,
  legend_pos = c("bottomright", "bottom", "bottomleft", "left", "topleft", "top",
    "topright", "right", "center"),
  legend_size = 0.5,
  lasso = FALSE
)
```

Arguments

x	<code>cv.plasso</code> object
...	Pass generic <code>plot</code> options
legend_pos	Legend position. Only considered for joint plot (<code>lass=FALSE</code>).
legend_size	Font size of legend
lasso	If set as True, only the cross-validation curve for the Lasso model is plotted. Default is False.

Value

Plots the cross-validation curves for both Lasso and Post-Lasso models (incl. upper and lower standard deviation curves) for a fitted `cv.plasso` object.

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit cv.plasso to the data
p.cv = plasso::cv.plasso(X,y)
# plot cross-validated MSE curves and number of active coefficients
plot(p.cv, legend_pos="bottomleft")
```

plot.plasso *Plot coefficient paths*

Description

Plot coefficient paths of (Post-) Lasso model.

Usage

```
## S3 method for class 'plasso'
plot(x, ..., lasso = FALSE, xvar = c("norm", "lambda", "dev"), label = FALSE)
```

Arguments

x	plasso object
...	Pass generic plot options
lasso	If set as True, coefficient paths for Lasso instead of Post-Lasso is plotted. Default is False.
xvar	X-axis variable: norm plots against the L1-norm of the coefficients, lambda against the log-lambda sequence, and dev against the percent deviance explained.
label	If TRUE, label the curves with variable sequence numbers

Value

Produces a coefficient profile plot of the coefficient paths for a fitted [plasso](#) object.

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit plasso to the data
p = plasso::plasso(X,y)
# plot coefficient paths for Post-Lasso model
plot(p, lasso=FALSE, xvar="lambda")
# plot coefficient paths for Lasso model
plot(p, lasso=TRUE, xvar="lambda")
```

predict.cv.plasso *Predict after cross-validated (Post-) Lasso*

Description

Prediction for cross-validated (Post-) Lasso.

Usage

```
## S3 method for class 'cv.plasso'
predict(
  object,
  ...,
  newx = NULL,
  type = c("response", "coefficients"),
  s = c("optimal", "all"),
  se_rule = 0
)
```

Arguments

object	Fitted <code>cv.plasso</code> model object
...	Pass generic <code>predict</code> options
newx	Matrix of new values for x at which predictions are to be made. If no value is supplied, x from fitting procedure is used. This argument is not used for <code>type="coefficients"</code> .
type	Type of prediction required. "response" returns fitted values, "coefficients" returns beta estimates.
s	Determines whether prediction is done for all values of lambda ("all") or only for the optimal lambda ("optimal") according to the standard error-rule.
se_rule	If equal to 0, predictions from cross-validated MSE minimum (default). Negative values go in the direction of smaller models, positive values go in the direction of larger models (e.g. <code>se_rule=-1</code> creates the standard 1SE rule). This argument is not used for <code>s="all"</code> .

Value

List object containing either fitted values or coefficients for both the Lasso and Post-Lasso models respectively.

lasso	Matrix with Lasso predictions or coefficients
plasso	Matrix with Post-Lasso predictions or coefficients

Examples

```

# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit cv.plasso to the data
p.cv = plasso::cv.plasso(X,y)
# predict fitted values along whole lambda sequence
pred = predict(p.cv, s="all")
head(pred$plasso)
# predict fitted values for optimal lambda value (according to cross-validation)
pred_optimal = predict(p.cv, s="optimal")
head(pred_optimal$plasso)
# predict fitted values for new feature set X
X_new = head(X, 10)
pred_new = predict(p.cv, newx=X_new, s="optimal")
pred_new$plasso
# get estimated coefficients along whole lambda sequence
coefs = predict(p.cv, type="coefficients", s="all")
head(coefs$plasso)
# get estimated coefficients for optimal lambda value according to 1-standard-error rule
predict(p.cv, type="coefficients", s="optimal", se_rule=-1)

```

predict.plasso

Predict for (Post-) Lasso models

Description

Prediction for (Post-) Lasso models.

Usage

```

## S3 method for class 'plasso'
predict(
  object,
  ...,
  newx = NULL,
  type = c("response", "coefficients"),
  s = NULL
)

```

Arguments

object Fitted [plasso](#) model object
 ... Pass generic [predict](#) options

newx	Matrix of new values for x at which predictions are to be made. If no value is supplied, x from fitting procedure is used. This argument is not used for type="coefficients".
type	Type of prediction required. "response" returns fitted values, "coefficients" returns beta estimates.
s	If Null, prediction is done for all lambda values. If a value is provided, the closest lambda value of the <code>plasso</code> object is used.

Value

List object containing either fitted values or coefficients for both the Lasso and Post-Lasso models associated with all values along the lambda input sequence or for one specifically given lambda value.

lasso	Matrix with Lasso predictions or coefficients
plasso	Matrix with Post-Lasso predictions or coefficients

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit plasso to the data
p = plasso::plasso(X,y)
# predict fitted values along whole lambda sequence
pred = predict(p)
head(pred$plasso)
# get estimated coefficients for specific lambda approximation
predict(p, type="coefficients", s=0.05)
```

```
print.cv.plasso      Print cross-validated (Post-) Lasso model
```

Description

Printing main insights from cross-validated (Post-) Lasso model.

Usage

```
## S3 method for class 'cv.plasso'
print(x, ..., digits = max(3, getOption("digits") - 3))
```

Arguments

x `cv.plasso` object
 ... Pass generic `print` options
 digits Integer, used for number formatting

Value

Prints basic statistics for different lambda values of a fitted `plasso` object, i.e. cross-validated MSEs for both Lasso and Post-Lasso model as well as the number of active variables.

```
print.plasso                    Print (Post-) Lasso model
```

Description

Printing main insights from (Post-) Lasso model.

Usage

```
## S3 method for class 'plasso'
print(x, ..., digits = max(3, getOption("digits") - 3))
```

Arguments

x `plasso` object
 ... Pass generic `print` options
 digits Integer, used for number formatting

Value

Prints `glmnet`-like output.

```
print.summary.cv.plasso                    Print summary of (Post-) Lasso model
```

Description

Prints summary information of `cv.plasso` object

Usage

```
## S3 method for class 'summary.cv.plasso'
print(x, ..., digits = max(3L, getOption("digits") - 3L))
```

Arguments

x	Summary of plasso object (either of class <code>summary.cv.plasso</code> or <code>summary</code>)
...	Pass generic R <code>print</code> options
digits	Integer, used for number formatting

Value

Prints information from `summary.cv.plasso` object into console.

<code>summary.cv.plasso</code>	<i>Summary of cross-validated (Post-) Lasso model</i>
--------------------------------	---

Description

Summary of cross-validated (Post-) Lasso model.

Usage

```
## S3 method for class 'cv.plasso'
summary(object, ..., default = FALSE)
```

Arguments

object	<code>cv.plasso</code> object
...	Pass generic <code>summary</code> summary options
default	TRUE for <code>glmnet</code> -like summary output, FALSE for more specific summary information

Value

For specific summary information: `summary.cv.plasso` object (using list structure) containing optimal lambda values and associated MSEs for both cross-validated Lasso and Post-Lasso model. For default: `summaryDefault` object.

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit cv.plasso to the data
p.cv = plasso::cv.plasso(X,y)
# get informative summary statistics
print(summary(p.cv, default=FALSE))
# set default=TRUE for standard summary statistics
print(summary(p.cv, default=TRUE))
```

summary.plasso	<i>Summary of (Post-) Lasso model</i>
----------------	---------------------------------------

Description

Summary of (Post-) Lasso model.

Usage

```
## S3 method for class 'plasso'
summary(object, ...)
```

Arguments

object	plasso object
...	Pass generic summary summary options

Value

Default [summary](#) object

toeplitz	<i>Simulated 'Toeplitz' Data</i>
----------	----------------------------------

Description

Simulated data from a DGP with an underlying causal relationship between covariates X and the target y . The covariates matrix X consists of 10 variables whose effect size on target y is defined by the vector $c(1, -0.83, 0.67, -0.5, 0.33, -0.17, 0, \dots, 0)$ with the first six effect sizes decreasing in absolute terms continuously from 1 to 0 and alternating in their sign. The true causal effect of all other covariates is 0. The variables in X follow a normal distribution with mean zero while the covariance matrix follows a Toeplitz matrix. The target y is then a linear transformation of X plus a vector of standard normal random variables (i.e. error term). (See vignette for more details.)

Usage

```
data(toeplitz)
```

Format

An object of class `standardGeneric` of length 1.

Examples

```
# load toeplitz data
data(toeplitz)
# extract target and features from data
y = as.matrix(toeplitz[,1])
X = toeplitz[,-1]
# fit cv.plasso to the data
p.cv = plasso::cv.plasso(X,y)
```

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