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Author Andreas Alfons [aut, cre]

Maintainer Andreas Alfons <alfons@ese.eur.nl>

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perryExamples-package *Examples for Integrating Prediction Error Estimation into Regression Models*

Description

Examples for integrating package 'perry' for prediction error estimation into regression models.

Details

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Author(s)

Andreas Alfons [aut, cre]

Maintainer: Andreas Alfons <alfons@ese.eur.nl>

Bundesliga

Austrian Bundesliga football player data

Description

The data set contains information on the market value of midfielders and forwards in the Austrian *Bundesliga*, together with player information and performance measures. The data are collected for the (still ongoing) 2013/14 season, with performance measures referring to competitions on the Austrian level (Bundesliga, Cup) or the European level (UEFA Champions League, UEFA Europa League). Only players with complete information are included in the data set.

Usage

```
data("Bundesliga")
```

Format

A data frame with 123 observations on the following 20 variables.

Player factor; the player's name.

Team factor; the player's team.

MarketValue numeric; the player's market value (in Euros).

Age numeric; the player's age (in years).

Height numeric; the player's height (in cm).

Foreign a dummy variable indicating whether the player is foreign or Austrian.

Forward a dummy variable indicating whether the player is a forward or midfielder.

BothFeet a dummy variable indicating whether the player is equally strong with both feet or has one stronger foot.

AtClub numeric; the number of seasons the player is with his current club (at the upcoming transfer window).

Contract numeric; the remaining number of seasons in the player's contract (at the upcoming transfer window).

Matches numeric; the number of matches in which the player was on the field.

Goals numeric; the number of goals the player scored.

OwnGoals numeric; the number of own goals the player scored.

Assists numeric; the number of assists the player gave.

Yellow numeric; the number of yellow cards the player received.

YellowRed numeric; the number of times the player was sent off with two yellow cards within one game.

Red numeric; the number of times the player was sent off with a red card.

SubOn numeric; the number of times the player was substituted on.

SubOff numeric; the number of times the player was substituted off.

Minutes numeric; the total number of minutes the player was on the field.

Source

The data were scraped from <http://www.transfermarkt.com> on 2014-03-02.

Examples

```
data("Bundesliga")
summary(Bundesliga)
```

ladlasso

LAD-lasso with penalty parameter selection

Description

Fit LAD-lasso models and select the penalty parameter by estimating the respective prediction error via (repeated) K -fold cross-validation, (repeated) random splitting (also known as random subsampling or Monte Carlo cross-validation), or the bootstrap.

Usage

```
ladlasso(
  x,
  y,
  lambda,
  standardize = TRUE,
  intercept = TRUE,
  splits = foldControl(),
  cost = mape,
  selectBest = c("hastie", "min"),
  seFactor = 1,
  ncores = 1,
  cl = NULL,
  seed = NULL,
  ...
)
```

```
ladlasso.fit(x, y, lambda, standardize = TRUE, intercept = TRUE, ...)
```

Arguments

<code>x</code>	a numeric matrix containing the predictor variables.
<code>y</code>	a numeric vector containing the response variable.
<code>lambda</code>	for <code>ladlasso</code> , a numeric vector of non-negative values to be used as penalty parameter. For <code>ladlasso.fit</code> , a single non-negative value to be used as penalty parameter.
<code>standardize</code>	a logical indicating whether the predictor variables should be standardized to have unit MAD (the default is <code>TRUE</code>).
<code>intercept</code>	a logical indicating whether a constant term should be included in the model (the default is <code>TRUE</code>).
<code>splits</code>	an object giving data splits to be used for prediction error estimation (see perryTuning).
<code>cost</code>	a cost function measuring prediction loss (see perryTuning for some requirements). The default is to use the mean absolute prediction error (see cost).
<code>selectBest, seFactor</code>	arguments specifying a criterion for selecting the best model (see perryTuning). The default is to use a one-standard-error rule.
<code>ncores, cl</code>	arguments for parallel computing (see perryTuning).
<code>seed</code>	optional initial seed for the random number generator (see .Random.seed and perryTuning).
<code>...</code>	for <code>ladlasso</code> , additional arguments to be passed to the prediction loss function <code>cost</code> . For <code>ladlasso.fit</code> , additional arguments to be passed to rq.fit.lasso .

Value

For `ladlasso`, an object of class "perryTuning", see [perryTuning](#)). It contains information on the prediction error criterion, and includes the final model with the optimal tuning parameter as component `finalModel`.

For `ladlasso.fit`, an object of class `ladlasso` with the following components:

`lambda` numeric; the value of the penalty parameter.

`coefficients` a numeric vector containing the coefficient estimates.

`fitted.values` a numeric vector containing the fitted values.

`residuals` a numeric vector containing the residuals.

`standardize` a logical indicating whether the predictor variables were standardized to have unit MAD.

`intercept` a logical indicating whether the model includes a constant term.

`muX` a numeric vector containing the medians of the predictors.

`sigmaX` a numeric vector containing the MADs of the predictors.

`muY` numeric; the median of the response.

`call` the matched function call.

Author(s)

Andreas Alfons

References

Wang, H., Li, G. and Jiang, G. (2007) Robust regression shrinkage and consistent variable selection through the LAD-lasso. *Journal of Business & Economic Statistics*, **25**(3), 347–355.

See Also

[perryTuning](#), [rq.fit.lasso](#)

Examples

```
## load data
data("Bundesliga")
Bundesliga <- Bundesliga[, -(1:2)]
f <- log(MarketValue) ~ Age + I(Age^2) + .
mf <- model.frame(f, data=Bundesliga)
x <- model.matrix(terms(mf), mf)[, -1]
y <- model.response(mf)

## set up repeated random splits
splits <- splitControl(m = 40, R = 10)

## select optimal penalty parameter
lambda <- seq(40, 0, length.out = 20)
fit <- ladlasso(x, y, lambda = lambda, splits = splits, seed = 2014)
fit

## plot prediction error results
plot(fit, method = "line")
```

lasso

*Lasso with penalty parameter selection***Description**

Fit lasso models and select the penalty parameter by estimating the respective prediction error via (repeated) K -fold cross-validation, (repeated) random splitting (also known as random subsampling or Monte Carlo cross-validation), or the bootstrap.

Usage

```
lasso(
  x,
  y,
  lambda = seq(1, 0, length.out = 50),
  mode = c("fraction", "lambda"),
  standardize = TRUE,
  intercept = TRUE,
  splits = foldControl(),
  cost = rmspe,
  selectBest = c("hastie", "min"),
  seFactor = 1,
  ncores = 1,
  cl = NULL,
  seed = NULL,
  ...
)

lasso.fit(
  x,
  y,
  lambda = seq(1, 0, length.out = 50),
  mode = c("fraction", "lambda"),
  standardize = TRUE,
  intercept = TRUE,
  ...
)
```

Arguments

<code>x</code>	a numeric matrix containing the predictor variables.
<code>y</code>	a numeric vector containing the response variable.
<code>lambda</code>	for <code>lasso</code> , a numeric vector of non-negative values to be used as penalty parameter. For <code>lasso.fit</code> , a single non-negative value to be used as penalty parameter.
<code>mode</code>	a character string specifying the type of penalty parameter. If "fraction", <code>lambda</code> gives the fractions of the smallest value of the penalty parameter that

	sets all coefficients to 0 (hence all values of <code>lambda</code> should be in the interval <code>[0,1]</code> in that case). If " <code>lambda</code> ", <code>lambda</code> gives the grid of values for the penalty parameter directly.
<code>standardize</code>	a logical indicating whether the predictor variables should be standardized to have unit variance (the default is <code>TRUE</code>).
<code>intercept</code>	a logical indicating whether a constant term should be included in the model (the default is <code>TRUE</code>).
<code>splits</code>	an object giving data splits to be used for prediction error estimation (see perryTuning).
<code>cost</code>	a cost function measuring prediction loss (see perryTuning for some requirements). The default is to use the root mean squared prediction error (see cost).
<code>selectBest, seFactor</code>	arguments specifying a criterion for selecting the best model (see perryTuning). The default is to use a one-standard-error rule.
<code>ncores, cl</code>	arguments for parallel computing (see perryTuning).
<code>seed</code>	optional initial seed for the random number generator (see .Random.seed and perryTuning).
<code>...</code>	for <code>lasso</code> , additional arguments to be passed to the prediction loss function <code>cost</code> . For <code>lasso.fit</code> , additional arguments to be passed to lars .

Value

For `lasso`, an object of class "`perryTuning`", see [perryTuning](#). It contains information on the prediction error criterion, and includes the final model with the optimal tuning parameter as component `finalModel`.

For `lasso.fit`, an object of class `lasso` with the following components:

`lambda` numeric; the value of the penalty parameter.

`coefficients` a numeric vector containing the coefficient estimates.

`fitted.values` a numeric vector containing the fitted values.

`residuals` a numeric vector containing the residuals.

`standardize` a logical indicating whether the predictor variables were standardized to have unit variance.

`intercept` a logical indicating whether the model includes a constant term.

`muX` a numeric vector containing the means of the predictors.

`sigmaX` a numeric vector containing the standard deviations of the predictors.

`mu` numeric; the mean of the response.

`call` the matched function call.

Author(s)

Andreas Alfons

References

Tibshirani, R. (1996) Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society, Series B*, **58**(1), 267–288.

See Also

[perryTuning](#), [lars](#)

Examples

```
## load data
data("Bundesliga")
Bundesliga <- Bundesliga[, -(1:2)]
f <- log(MarketValue) ~ Age + I(Age^2) + .
mf <- model.frame(f, data=Bundesliga)
x <- model.matrix(terms(mf), mf)[, -1]
y <- model.response(mf)

## set up repeated random splits
splits <- splitControl(m = 40, R = 10)

## select optimal penalty parameter
fit <- lasso(x, y, splits = splits, seed = 2014)
fit

## plot prediction error results
plot(fit, method = "line")
```

perry-methods

Resampling-based prediction error for fitted models

Description

Estimate the prediction error of a fitted model via (repeated) K -fold cross-validation, (repeated) random splitting (also known as random subsampling or Monte Carlo cross-validation), or the bootstrap. Methods are available for least squares fits computed with `lm` as well as for the following robust alternatives: MM-type models computed with `lmrob` and least trimmed squares fits computed with `ltsReg`.

Usage

```
## S3 method for class 'lm'
perry(
  object,
  splits = foldControl(),
  cost = rmspe,
  ncores = 1,
  cl = NULL,
```



```

    seed = NULL,
    ...
)

## S3 method for class 'lmrob'
perry(
  object,
  splits = foldControl(),
  cost = rtmspe,
  ncores = 1,
  cl = NULL,
  seed = NULL,
  ...
)

## S3 method for class 'lts'
perry(
  object,
  splits = foldControl(),
  fit = c("reweighted", "raw", "both"),
  cost = rtmspe,
  ncores = 1,
  cl = NULL,
  seed = NULL,
  ...
)

```

Arguments

object	the fitted model for which to estimate the prediction error.
splits	an object of class "cvFolds" (as returned by cvFolds) or a control object of class "foldControl" (see foldControl) defining the folds of the data for (repeated) K -fold cross-validation, an object of class "randomSplits" (as returned by randomSplits) or a control object of class "splitControl" (see splitControl) defining random data splits, or an object of class "bootSamples" (as returned by bootSamples) or a control object of class "bootControl" (see bootControl) defining bootstrap samples.
cost	a cost function measuring prediction loss. It should expect the observed values of the response to be passed as the first argument and the predicted values as the second argument, and must return either a non-negative scalar value, or a list with the first component containing the prediction error and the second component containing the standard error. The default is to use the root mean squared prediction error for the "lm" method and the root trimmed mean squared prediction error for the "lmrob" and "lts" methods (see cost).
ncores	a positive integer giving the number of processor cores to be used for parallel computing (the default is 1 for no parallelization). If this is set to NA, all available processor cores are used.

<code>cl</code>	a parallel cluster for parallel computing as generated by makeCluster . If supplied, this is preferred over <code>ncores</code> .
<code>seed</code>	optional initial seed for the random number generator (see .Random.seed). Note that also in case of parallel computing, resampling is performed on the manager process rather than the worker processes. On the parallel worker processes, random number streams are used and the seed is set via clusterSetRNGStream .
<code>...</code>	additional arguments to be passed to the prediction loss function <code>cost</code> .
<code>fit</code>	a character string specifying for which fit to estimate the prediction error. Possible values are "reweighted" (the default) for the prediction error of the reweighted fit, "raw" for the prediction error of the raw fit, or "both" for the prediction error of both fits.

Value

An object of class "perry" with the following components:

<code>pe</code>	a numeric vector containing the estimated prediction errors. For the "lm" and "lmrob" methods, this is a single numeric value. For the "lts" method, this contains one value for each of the requested fits. In case of more than one replication, those are average values over all replications.
<code>se</code>	a numeric vector containing the estimated standard errors of the prediction loss. For the "lm" and "lmrob" methods, this is a single numeric value. For the "lts" method, this contains one value for each of the requested fits.
<code>reps</code>	a numeric matrix containing the estimated prediction errors from all replications. For the "lm" and "lmrob" methods, this is a matrix with one column. For the "lts" method, this contains one column for each of the requested fits. However, this is only returned in case of more than one replication.
<code>splits</code>	an object giving the data splits used to estimate the prediction error.
<code>y</code>	the response.
<code>yHat</code>	a list containing the predicted values from all replications.
<code>call</code>	the matched function call.

Note

The perry methods extract the data from the fitted model and call [perryFit](#) to perform resampling-based prediction error estimation.

Author(s)

Andreas Alfons

See Also

[perryFit](#)

Examples

```
## load data
data("Bundesliga")
n <- nrow(Bundesliga)

## fit linear model
Bundesliga$logMarketValue <- log(Bundesliga$MarketValue)
fit <- lm(logMarketValue ~ Contract + Matches + Goals + Assists,
          data=Bundesliga)

## perform K-fold cross-validation
perry(fit, foldControl(K = 5, R = 10), seed = 1234)

## perform random splitting
perry(fit, splitControl(m = n/3, R = 10), seed = 1234)

## perform bootstrap prediction error estimation
# 0.632 estimator
perry(fit, bootControl(R = 10, type = "0.632"), seed = 1234)
# out-of-bag estimator
perry(fit, bootControl(R = 10, type = "out-of-bag"), seed = 1234)
```

ridge

Ridge regression with penalty parameter selection

Description

Fit ridge regression models and select the penalty parameter by estimating the respective prediction error via (repeated) K -fold cross-validation, (repeated) random splitting (also known as random subsampling or Monte Carlo cross-validation), or the bootstrap.

Usage

```
ridge(
  x,
  y,
  lambda,
  standardize = TRUE,
  intercept = TRUE,
  splits = foldControl(),
  cost = rmspe,
  selectBest = c("hastie", "min"),
  seFactor = 1,
  ncores = 1,
  cl = NULL,
  seed = NULL,
  ...
)
```

```
ridge.fit(x, y, lambda, standardize = TRUE, intercept = TRUE, ...)
```

Arguments

<code>x</code>	a numeric matrix containing the predictor variables.
<code>y</code>	a numeric vector containing the response variable.
<code>lambda</code>	a numeric vector of non-negative values to be used as penalty parameter.
<code>standardize</code>	a logical indicating whether the predictor variables should be standardized to have unit variance (the default is TRUE).
<code>intercept</code>	a logical indicating whether a constant term should be included in the model (the default is TRUE).
<code>splits</code>	an object giving data splits to be used for prediction error estimation (see perryTuning).
<code>cost</code>	a cost function measuring prediction loss (see perryTuning for some requirements). The default is to use the root mean squared prediction error (see cost).
<code>selectBest, seFactor</code>	arguments specifying a criterion for selecting the best model (see perryTuning). The default is to use a one-standard-error rule.
<code>ncores, cl</code>	arguments for parallel computing (see perryTuning).
<code>seed</code>	optional initial seed for the random number generator (see .Random.seed and perryTuning).
<code>...</code>	for <code>ridge</code> , additional arguments to be passed to the prediction loss function <code>cost</code> . For <code>ridge.fit</code> , additional arguments are currently ignored.

Value

For `ridge`, an object of class "perryTuning", see [perryTuning](#). It contains information on the prediction error criterion, and includes the final model with the optimal tuning parameter as component `finalModel`.

For `ridge.fit`, an object of class `ridge` with the following components:

<code>lambda</code>	a numeric vector containing the values of the penalty parameter.
<code>coefficients</code>	a numeric vector or matrix containing the coefficient estimates.
<code>fitted.values</code>	a numeric vector or matrix containing the fitted values.
<code>residuals</code>	a numeric vector or matrix containing the residuals.
<code>standardize</code>	a logical indicating whether the predictor variables were standardized to have unit variance.
<code>intercept</code>	a logical indicating whether the model includes a constant term.
<code>muX</code>	a numeric vector containing the means of the predictors.
<code>sigmaX</code>	a numeric vector containing the standard deviations of the predictors.
<code>muY</code>	numeric; the mean of the response.
<code>call</code>	the matched function call.

Author(s)

Andreas Alfons

References

Hoerl, A.E. and Kennard, R.W. (1970) Ridge regression: biased estimation for nonorthogonal problems. *Technometrics*, **12**(1), 55–67.

See Also

[perryTuning](#)

Examples

```
## load data
data("Bundesliga")
Bundesliga <- Bundesliga[, -(1:2)]
f <- log(MarketValue) ~ Age + I(Age^2) + .
mf <- model.frame(f, data=Bundesliga)
x <- model.matrix(terms(mf), mf)[, -1]
y <- model.response(mf)

## set up repeated random splits
splits <- splitControl(m = 40, R = 10)

## select optimal penalty parameter
lambda <- seq(600, 0, length.out = 50)
fit <- ridge(x, y, lambda = lambda, splits = splits, seed = 2014)
fit

## plot prediction error results
plot(fit, method = "line")
```

TopGearMPG

Top Gear fuel consumption data

Description

The data set contains information on fuel consumption of cars featured on the website of the popular BBC television show *Top Gear*, together with car information and performance measures. Only cars with complete information are included in the data set.

Usage

```
data("TopGearMPG")
```

Format

A data frame with 255 observations on the following 11 variables.

Maker factor; the car maker.

Model factor; the car model.

Type factor; the exact model type.

MPG numeric; the combined fuel consumption (urban + extra urban; in miles per gallon).

Cylinders numeric; the number of cylinders in the engine.

Displacement numeric; the displacement of the engine (in cc).

BHP numeric; the power of the engine (in bhp).

Torque numeric; the torque of the engine (in lb/ft).

Acceleration numeric; the time it takes the car to get from 0 to 62 mph (in seconds).

TopSpeed numeric; the car's top speed (in mph).

Weight numeric; the car's curb weight (in kg).

Source

The data were scraped from <http://www.topgear.com/uk/> on 2014-02-24.

Examples

```
data("TopGearMPG")
plot(TopGearMPG[, -(1:3)])
```

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