Package 'SplitReg'

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Type Package

Title Split Regularized Regression

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Maintainer Anthony Christidis <anthony.christidis@stat.ubc.ca>

Description Functions for computing split regularized estimators defined in Christidis, Lakshmanan, Smucler and Zamar (2019) <doi:10.48550/arXiv.1712.03561>. The approach fits linear regression models that split the set of covariates into groups. The optimal split of the variables into groups and the regularized estimation of the regression coefficients are performed by minimizing an objective function that encourages sparsity within each group and diversity among them. The estimated coefficients are then pooled together to form the final fit.

License GPL (>= 2)

Biarch true

Imports Rcpp (>= 0.12.12)

LinkingTo Rcpp, RcppArmadillo

Suggests testthat, glmnet, MASS

NeedsCompilation yes

RoxygenNote 7.3.2

Author Anthony Christidis [aut, cre],
     Ezequiel Smucler [aut],
     Ruben Zamar [aut]

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Contents

coef.cv.SplitReg   *Extract coefficients from a cv.SplitReg object.*

Description

Extract coefficients from a cv.SplitReg object.

Usage

```
## S3 method for class 'cv.SplitReg'
coef(object, index = object$index_opt, ...)
```

Arguments

object	Fitted cv.SplitReg object.
index	Indices indicating values of lambda_S at which to extract coefficients. Defaults to the optimal value.
...	Additional arguments for compatibility.

Value

A vector of coefficients

See Also

[cv.SplitReg](#)

Examples

```
library(MASS)
set.seed(1)
beta <- c(rep(5, 5), rep(0, 45))
Sigma <- matrix(0.5, 50, 50)
diag(Sigma) <- 1
x <- mvrnorm(50, mu = rep(0, 50), Sigma = Sigma)
y <- x %*% beta + rnorm(50)
fit <- cv.SplitReg(x, y, num_models=2)
split.coefs <- coef(fit)
```

| cv.SplitReg | *Split Regularized Regression algorithm with a sparsity and diversity penalty.* |

Description

Computes a split regularized regression estimator. The sparsity and diversity penalty parameters are chosen automatically.

Usage

```
cv.SplitReg(
  x,
  y,
  num_lambdas_sparsity = 100,
  num_lambdas_diversity = 100,
  alpha = 1,
  num_models = 10,
  tolerance = 1e-08,
  max_iter = 1e+05,
  num_folds = 10,
  num_threads = 1
)
```

Arguments

x	Design matrix.
y	Response vector.
num_lambdas_sparsity	
	Length of the grid of sparsity penalties.
num_lambdas_diversity	
	Length of the grid of diversity penalties.
alpha	Elastic Net tuning constant: the value must be between 0 and 1. Default is 1 (Lasso).
num_models	Number of models to build.
tolerance	Tolerance parameter to stop the iterations while cycling over the models.
max_iter	Maximum number of iterations before stopping the iterations while cycling over the models.
num_folds	Number of folds for cross-validating.
num_threads	Number of threads used for parallel computation over the folds.

Details

Computes a split regularized regression estimator with num_models (G) models, defined as the linear models $\boldsymbol{\beta}^1, \ldots, \boldsymbol{\beta}^G$ that minimize

$$\sum_{g=1}^{G} \left(\frac{1}{2n} \|\mathbf{y} - \mathbf{X}\boldsymbol{\beta}^g\|^2 + \lambda_S \left(\frac{(1-\alpha)}{2} \|\boldsymbol{\beta}^g\|_2^2 + \alpha \|\boldsymbol{\beta}\|_{\mathbf{1}} \right) + \frac{\lambda_D}{2} \sum_{h \neq g} \sum_{j=1}^{p} |\beta_j^h \beta_j^g| \right),$$

over grids for the penalty parameters λ_S and λ_D that are built automatically. Larger values of λ_S encourage more sparsity within the models and larger values of λ_D encourage more diversity among them. If $\lambda_D = 0$, then all of the models are equal to the Elastic Net regularized least squares estimator with penalty parameter λ_S. Optimal penalty parameters are found by num_folds cross-validation, where the prediction of the ensemble is formed by simple averaging. The predictors and the response are standardized to zero mean and unit variance before any computations are performed. The final output is in the original scales.

Value

An object of class cv.SplitReg, a list with entries

betas	Coefficients computed over the path of penalties for sparsity; the penalty for diversity is fixed at the optimal value.
intercepts	Intercepts for each of the models along the path of penalties for sparsity.
index_opt	Index of the optimal penalty parameter for sparsity.
lambda_sparsity_opt	
	Optimal penalty parameter for sparsity.
lambda_diversity_opt	
	Optimal penalty parameter for diversity.
lambdas_sparsity	
	Grid of sparsity parameters.
lambdas_diversity	
	Grid of diversity parameters.
cv_mse_opt	Optimal CV MSE.
call	The matched call.

See Also

predict.cv.SplitReg, coef.cv.SplitReg

Examples

```
library(MASS)
set.seed(1)
beta <- c(rep(5, 5), rep(0, 45))
Sigma <- matrix(0.5, 50, 50)
diag(Sigma) <- 1
x <- mvrnorm(50, mu = rep(0, 50), Sigma = Sigma)
y <- x %*% beta + rnorm(50)
```

```
fit <- cv.SplitReg(x, y, num_models=2)
coefs <- predict(fit, type="coefficients")
```

---

predict.cv.SplitReg   *Make predictions from a cv.SplitReg object.*

Description

Make predictions from a cv.SplitReg object, similar to other predict methods.

Usage

```
## S3 method for class 'cv.SplitReg'
predict(
  object,
  newx,
  index = object$index_opt,
  type = c("response", "coefficients"),
  ...
)
```

Arguments

object	Fitted cv.SplitReg object.
newx	Matrix of new values of x at which prediction are to be made. Ignored if type is "coefficients".
index	Indices indicating values of lambda_S at which to predict. Defaults to the optimal value.
type	Either "response" for predicted values or "coefficients" for the estimated coefficients.
...	Additional arguments for compatibility.

Value

Either a matrix with predictions or a vector of coefficients

See Also

[predict.cv.SplitReg](#)

Examples

```
library(MASS)
set.seed(1)
beta <- c(rep(5, 5), rep(0, 45))
Sigma <- matrix(0.5, 50, 50)
diag(Sigma) <- 1
x <- mvrnorm(50, mu = rep(0, 50), Sigma = Sigma)
y <- x %*% beta + rnorm(50)
fit <- cv.SplitReg(x, y, num_models=2)
x.new <- mvrnorm(50, mu = rep(0, 50), Sigma = Sigma)
split.predictions <- predict(fit, newx = x.new, type="response")
```

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