Package 'alphanorm'

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Type Package

Title alpha-norm regularization

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Description An implementation of alpha-norm regulariztaion linear model in R. The alpha-norm penalty has the property of jumping to a sparse solution. This flexible nonconvex regularization problem is solved via cyclic coordinate descent and a proximal operator. It is less aggresive in shrinking coefficients than the l_0 penalty , sparser and less biased than l_1 norm(lasso), which is extremely useful in high-dimensional case and when predictors are highly correlated. Our package also offers the choice of lasso (q=1), it can be useful when the model is not extremely sparse.

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Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

Imports graphics, stats

R topics documented:

`alphanorm-package` *alphanorm: A package for alpha-norm regularization model*

Description

This package fits the alpha-norm regularization path for regression via cyclic coordinate descent and o proximal operator. It is useful in extra sparse and highly correlated model.

Details

The alphanorm package provides five function: `alphanorm`, `coef.alphanorm`, `cv.alphanorm`, `plot.alphanorm` and `predict.alphanorm`

It accepts x and y for regression model and is very flexible in the choice of tuning pararmeters q and lambda. `cv.alphanorm` can help select the best tuning parameters using cross-validation. `plot.alphanorm` can produce the regularization path over a grid of values for lambda.

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References

Feng, Guanhao and Polson, Nicholas G and Wang, Yuexi and Xu, Jianeng, Sparse Regularization in Marketing and Economics (August 20, 2017). Available at SSRN: https://ssrn.com/abstract=3022856

Marjanovic, G. and V. Solo (2014). lq sparsity penalized linear regression with cyclic descent. IEEE Transactions on Signal Processing 62(6), 1464–1475.

`alphanorm` *fit a sparse model with alpha-norm regularization*

Description

Fit a alph-norm model with proximal algorithm and coordinate descent

Usage

```
alphanorm(x, y, lambda = exp(10:-10), q = 0.5, intercept = TRUE,
  tol = 1e-07, T = 500, nlambda = NULL, trace = FALSE)
```

Arguments

x	the design matrix
y	the response vector
lambda	a vector of lambda values, default as exp(10:-10)
q	a numerical value for q, 0<q<=1, with default 0.5
intercept	whether the intercept term should be included, TRUE to be included(default), FALSE not to
tol	tolerence of convergence condition
T	number of maximum iterations for each coefficient
nlambda	number of lambda wanted
trace	print the process

Details

The sequence of models implied by lambda is solved via coordinate descent. The objective function is:

$$J(\beta) = 1/2\text{RSS} + \lambda * \text{penalty}$$

Here the penalty is the l_q norm of coefficients, which is $\sum(|\beta_i|^q), 0 < q <= 1$, when $q = 1$, it is actually same as lasso

Value

An object of S3 class "alphanorm"

x	input design matrix
y	input of response vector
Lambda	input of lambda in the decreasing order
q	input value of q
Coefficient	matrix coefficients
Intercept	non-penalized intercept(if intercept=TRUE), otherwise, NULL
df	number of nonzero coefficients for each value of lambda

References

Feng, Guanhao and Polson, Nicholas G and Wang, Yuexi and Xu, Jianeng, Sparse Regularization in Marketing and Economics (August 20, 2017). Available at SSRN: https://ssrn.com/abstract=3022856

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See Also

predict.alphanorm, coef.alphanorm, cv.alphanorm, and plot.alphanorm methods

Examples

```
x<-matrix(rnorm(100*100),100,100)
# Only the first 10 are true predictors
y<-x[,1:10]%*%rep(1,10)

# Build a alpha-norm model
alphanorm.obj<-alphanorm(x,y,intercept=FALSE)
# Get coefficients
coef(alphanorm.obj)
# Get fitted values
predict(alphanorm.obj)
# Cross-validation to choose q and lambda
cv.alphanorm(x,y,intercept=FALSE)
# Plot coefficient profile according to log-lambda
plot(alphanorm.obj)
```

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coef.alphanorm *Output the coefficients of "alphanorm" object*

Description

Output the coefficients of "alphanorm" object

Usage

```
## S3 method for class 'alphanorm'
coef(alphanorm.obj)
```

Arguments

alphanorm.obj	a fitted "alphanorm" object

Value

coefficients of "alphanorm" object

See Also

alphanorm

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cv.alphanorm *Cross-validation for alpha-norm*

Description

Does k-fold cross-validation for alpha-norm, and return the best lambda and q

Usage

```
cv.alphanorm(x, y, lambda_Tune = exp(10:-10), q_Tune = c(0.1, 0.5, 0.9),
  intercept = TRUE, nfolds = 5, tol = 1e-07, T = 500, trace = FALSE)
```

Arguments

x	design matrix
y	response vector
lambda_Tune	user-supplied lambda sequence
q_Tune	user-supplied q sequence
intercept	whether intercept should be in the model, default to be TRUE
nfolds	number of folds , default to be 5
tol	tolerence of convergence condition
T	number of maximum iterations for each coefficient
trace	print the process of alphanorm

Value

An object of S3 class "cv.alphanorm"

lambda	the values of lambda used in the fits in the decreasing order
q	the values of q used in the fits
cvm	The mean cross-validation error, a matrix of length(q)*length(lambda)
lambda.min	value of lambda that gives minimum cvm
q.min	value of q that gives minimum cvm

See Also

alphanorm

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plot.alphanorm *plot coefficient for a "alphanorm"*

Description

Produce a coefficient profile plot of the coefficient paths for a fitted "alphanorm" object

Usage

```
## S3 method for class 'alphanorm'
plot(alphanorm.obj, xvar = c("lambda"), legend = FALSE)
```

Arguments

alphanorm.obj	fitted "alphanorm" model
xvar	what is on the X-axis. "norm" plots against the L_q-norm of the coefficients, "lambda" against the log-lambda sequence
legend	whether legend should be plotted

See Also

alphanorm

Examples

```
x=matrix(rnorm(100*20),100,20)
y=rnorm(100)
obj1=alphanorm(x,y)
plot(obj1)
plot(obj1,xvar="norm")
```

`predict.alphanorm` *Predict method for alpha-norm fits*

Description

Similar to other predict methods, this function predicts fitted values from a fitted alphanorm model

Usage

```
## S3 method for class 'alphanorm'
predict(alphanorm.obj, newx = NULL)
```

Arguments

`alphanorm.obj`	a fitted alpha-norm model, returned by alphanorm()
`newx`	matrix of new values of x, if NULL, use the x in alphanorm.obj

Value

matrix of fitted values from alpha-norm model

See Also

`alphanorm`, and `cv.alphanorm` methods

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