

Package ‘foba’

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Title greedy variable selection

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Depends R (>= 2.0.0)

Description foba is a package that implements forward, backward, and foba sparse learning algorithms for ridge regression, described in the paper “Adaptive Forward-Backward Greedy Algorithm for Learning Sparse Representations”.

License GPL (>= 2)

NeedsCompilation no

Repository CRAN

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| | |
|--------|------------------------------------|
| boston | <i>Partial Boston Housing data</i> |
|--------|------------------------------------|

Description

The full data have 506 samples with 14 variables. The MEDV is the target variable. This version contains only the first 50 samples.

Format

The list boston contains the following components:

x a 50 x 13 matrix, corresponding to the variables except MEDV

y a 50 dimensional vector, corresponding to the MEDV variable

Source

The full data is available from the UCI Repository Of Machine Learning Databases at <http://www.ics.uci.edu/~mllearn/MLRepository.html>

References

D. Harrison and D.L. Rubinfeld, "Hedonic prices and the demand for clean air", J. Environ. Economics & Management, vol.5, 81-102, 1978.

| | |
|------|---|
| foba | <i>Greedy variable selection for ridge regression</i> |
|------|---|

Description

Variable Selection for Ridge Regression using Forward Greedy, Backward Greedy, and Adaptive Forward-Backward Greedy (FoBa) Methods

Usage

```
foba(x,y, type=c("foba", "foba.aggressive", "foba.conservative", "forward", "backward"), steps=0, inte
```

Arguments

| | |
|------------------|---|
| x | matrix of predictors |
| y | response |
| type | One of "foba", "foba.aggressive", "foba.conservative", "forward", or "backward". The names can be abbreviated to any unique substring. Default is "foba". |
| steps | Number of greedy (forward+backward) steps. Default is the number of variables for forward and backward, and twice the number of variables for foba. |
| intercept | If TRUE, an intercept is included in the model (and not penalized), otherwise no intercept is included. Default is TRUE. |
| nu | In range (0,1): controls how likely to take a backward step (more likely when nu is larger). Default is 0.5. |
| lambda | Regularization parameter for ridge regression. Default is 1e-5. |

Details

FoBa for least squares regression is described in [Tong Zhang (2008)]. This implementation supports ridge regression. The "foba" method takes a backward step when the ridge penalized risk increase is less than ν times the ridge penalized risk reduction in the corresponding backward step. The "foba.conservative" method takes a backward step when the risk increase is less than ν times the smallest risk reduction in all previous forward steps. The "foba.aggressive" method takes a backward step when the cumulative risk changes in backward step is less than ν times the changes in the forward steps.

Value

A "foba" object is returned, which contains the following components:

| | |
|-------|--|
| call | The function call resulting to the object |
| type | Which variable selection method is used |
| path | The variable selection path: a sequence of variable addition/deletions |
| beta | Coefficients (ridge regression solution) at each step with selected features |
| meanx | Zero if intercept=FALSE, and the mean of x if intercept=TRUE |
| meany | Zero if intercept=FALSE, and the mean of y if intercept=TRUE |

Author(s)

Tong Zhang

References

Tong Zhang (2008) "Adaptive Forward-Backward Greedy Algorithm for Learning Sparse Representations", Rutgers Technical Report (long version).

Tong Zhang (2008) "Adaptive Forward-Backward Greedy Algorithm for Sparse Learning with Linear Models", NIPS'08 (short version).

See Also

print.foba and predict.foba methods for foba

Examples

```
data(boston)

model.foba <- foba(boston$x,boston$y,steps=20)
print(model.foba)

model.foba.a <- foba(boston$x,boston$y,type="foba.a",steps=20) # Can use abbreviations
print(model.foba.a)

model.for <- foba(boston$x,boston$y,type="for",steps=20)
print(model.for)
```

```
model.back <- foba(boston$x,boston$y,type="back") # Use only first 20 variables
print(model.back)
```

predict.foba

Make predictions or extract coefficients from a fitted foba model

Description

foba() returns a path of variable addition and deletion. predict.foba() allows one to extract a prediction, or coefficients at any desired sparsity level.

Usage

```
predict.foba(object, newx, k, type=c("fit","coefficients"),...)
```

Arguments

| | |
|--------|--|
| object | A fitted foba object. |
| newx | If type="fit", then newx should be the x values at which the fit is required. If type="coefficients", then newx can be omitted. |
| k | The sparsity level. That is, the number of selected variables for the fitted model. |
| type | If type="fit", predict returns the fitted values. If type="coefficients", predict returns the coefficients. Abbreviations allowed. |
| ... | further arguments passed to or from other methods. |

Details

FoBa for least squares regression is described in [Tong Zhang (2008)]. This implementation supports ridge regression.

Value

Return either a "coefficients" object or a "fitted value" object, at the desired sparsity level.

A coefficients object is a list containing the following components:

| | |
|--------------------|--|
| coefficients | coefficients of ridge regression solution using selected.variables |
| intercept | the intercept value |
| selected.variables | variables with non-zero coefficients |

A "fitted value" object contains the following additional component:

| | |
|-----|--|
| fit | the predicted response for the data newx |
|-----|--|

Author(s)

Tong Zhang

References

Tong Zhang (2008) "Adaptive Forward-Backward Greedy Algorithm for Learning Sparse Representations", Rutgers Technical Report (long version).

Tong Zhang (2008) "Adaptive Forward-Backward Greedy Algorithm for Sparse Learning with Linear Models", NIPS'08 (short version).

See Also

print.foba and foba

Examples

```
data(boston)

model <- foba(boston$x,boston$y,s=20,nu=0.9)

### make predictions at the values in x, at sparsity level 5

py <- predict(model, boston$x, k=5, type="fit")

print(paste("mean squared error =", mean((py$fit-boston$y)^2)))

### extract the coefficient vector at sparsity level 5
coef <- predict(model, k=5, type="coef")
print("top five variables:")
coef$selected.variables
```

`print.foba`*Print a fitted foba model*

Description

print.foba() prints the variable selection path of a foba object.

Usage

```
print.foba(x, ...)
```

Arguments

| | |
|-----|--|
| x | A fitted foba object |
| ... | further arguments passed to or from other methods. |

Author(s)

Tong Zhang

See Also

predict.foba and foba

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