

# Package ‘foba’

February 14, 2012

**Version** 0.1

**Date** 2008-10-15

**Title** greedy variable selection

**Author** Tong Zhang <tongz@rci.rutgers.edu>

**Maintainer** Tong Zhang <tongz@rci.rutgers.edu>

**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)

**Repository** CRAN

**Date/Publication** 2008-11-08 09:33:12

## R topics documented:

boston . . . . .	2
foba . . . . .	2
predict.foba . . . . .	4
print.foba . . . . .	6

<b>Index</b>	<b>7</b>
--------------	----------

---

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, inter
```

**Arguments**

<b>x</b>	matrix of predictors
<b>y</b>	response
<b>type</b>	One of "foba", "foba.aggressive", "foba.conservative", "forward", or "backward". The names can be abbreviated to any unique substring. Default is "foba".
<b>steps</b>	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 nu 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 nu 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 nu 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:

<code>coefficients</code>	coefficients of ridge regression solution using <code>selected.variables</code>
<code>intercept</code>	the intercept value
<code>selected.variables</code>	variables with non-zero coefficients

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

<code>fit</code>	the predicted response for the data <code>newx</code>
------------------	---

**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
```

---

<code>print.foba</code>	<i>Print a fitted foba model</i>
-------------------------	----------------------------------

---

**Description**

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

**Usage**

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

**Arguments**

<code>x</code>	A fitted foba object
<code>...</code>	further arguments passed to or from other methods.

**Author(s)**

Tong Zhang

**See Also**

`predict.foba` and `foba`

# Index

- \*Topic **datasets**
  - boston, [2](#)
- \*Topic **methods**
  - predict.foba, [4](#)
  - print.foba, [6](#)
- \*Topic **models**
  - foba, [2](#)
- \*Topic **optimize**
  - foba, [2](#)
- \*Topic **print**
  - print.foba, [6](#)
- \*Topic **regression**
  - foba, [2](#)
  - predict.foba, [4](#)

boston, [2](#)

foba, [2](#)

predict.foba, [4](#)

print.foba, [6](#)