Package ‘EBEN’

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Type Package

Title Empirical Bayesian Elastic Net

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Description Provides the Empirical Bayesian Elastic Net for handling multicollinearity in generalized linear regression models. As a special case of the 'EBglmnet' package (also available on CRAN), this package encourages a grouping effects to select relevant variables and estimate the corresponding non-zero effects.

License GPL

Depends R (>= 2.10)

NeedsCompilation yes

Repository CRAN

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EBEN-package

Empirical Bayesian Elastic Net (EBEN)

Description

Fast EBEN algorithms.
EBEN implements a normal and generalized gamma hierarchical priors.
( ** ) Two parameters (alpha, lambda) are equivalent with elastic net priors.
( ** ) When parameter alpha = 1, it is equivalent with EBlasso-NE (normal + exponential)
Two models are available for both methods:
( ** ) General linear regression model.
( ** ) Logistic regression model.
Multi-collinearity:
( ** ) for group of high correlated or collinear variables: EBEN identifies the group of variables
estimates their effects together.
( ** ) group of variables can be selected together.
*Epistasis (two-way interactions) can be included for all models/priors
*model implemented with memory efficient c code.
*LAPACK/BLAS are used for most linear algebra computations.

Details

Package: EBEN
Type: Package
Version: 4.6
Date: 2015-10-06
License: gpl

Author(s)

Anhui Huang

References

key algorithms:
trait locus mapping. BMC Bioinformatics 12, 211.
trait locus mapping. BMC genetics 14(1):5.
locus mapping. Heredity 10.1038/hdy.2014.79
Other publications:
Huang, A., E. Martin, et al. (2014). "Detecting genetic interactions in pathway-based genome-wide

BASIS

An Example Data File for the Gauss Model

Description

This is a 1000x481 sample feature matrix

Usage

data(BASIS)

Format

The format is: int [1:1000, 1:481] 0 -1 0 0 1 0 1 0 1 0 ...

Details

The data was simulated on a 2400cM chromosome, each column corresponded to an even spaced QTL

Source


Examples

data(BASIS)
EBelasticNet.Binomial

BASISbinomial  An Example Data File for the Binomial Model

Description
This is a 500x481 sample feature matrix

Usage
data(BASISbinomial)

Format
The format is: int [1:500, 1:481] 0 -1 0 0 0 0 -1 -1 0 1 ...

Details
The data was simulated on a 2400cM chromosome, each column corresponded to an even spaced QTL

Source

Examples
data(BASISbinomial)

EBelasticNet.Binomial  The EB Elastic Net Algorithm for Binomial Model with Normal-Gamma(NG) Prior Distribution

Description
Generalized linear regression, normal-Gxponential (NG) hierarchical prior for regression coefficients

Usage
EBelasticNet.Binomial(BASIS, Target, lambda, alpha,Epis = "no",verbose = 0)
Arguments

BASIS     sample matrix; rows correspond to samples, columns correspond to features
Target    Class label of each individual, TAKES VALUES OF 0 OR 1
lambda    Hyperparameter controls degree of shrinkage; can be obtained via Cross Validation; lambda>0
alpha     Hyperparameter controls degree of shrinkage; can be obtained via Cross Validation; 0<alpha<1
Epis      "yes" or "no" for including two-way interactions
verbose   0 or 1; 1: display message; 0 no message

Details

If Epis="yes", the program adds two-way interaction of K*(K-1)/2 more columns to BASIS

Value

weight    the none-zero regression coefficients:
           col1,col2 are the indices of the bases(main if equal);
           col3: coefficient value;
           col4: posterior variance;
           col5: t-value;
           col6: p-value
logLikelihood log likelihood from the final regression coefficients
WaldScore  Wald Score
Intercept  Intercept
lambda     the hyperparameter; same as input lambda
alpha      the hyperparameter; same as input alpha

Author(s)

Anhui Huang; Dept of Electrical and Computer Engineering, Univ of Miami, Coral Gables, FL

References

Huang A, Xu S, Cai X: Empirical Bayesian LASSO-logistic regression for multiple binary trait

Examples

library(EBEN)
data(BASISbinomial)
data(yBinomial)
#reduce sample size to speed up the running time
n = 50;
k = 100;
N = length(yBinomial);
set = sample(N,n);
EBelasticNet.BinomialCV

Cross Validation (CV) Function to Determine Hyperparameter of the
EB_Elastic Net Algorithm for Binomial Model with Normal-Gamma
(NG) Prior Distribution

Description

Hyperparameter controls degree of shrinkage, and is obtained via Cross Validation (CV). This program calculates the maximum lambda that allows one non-zero basis; and performs a search down to 0.001*lambda_max at even steps. (20 steps)

Usage

EBelasticNet.BinomialCV(BASIS, Target, nFolds, Epis = "no",foldId)

Arguments

BASIS sample matrix; rows correspond to samples, columns correspond to features
Target Class label of each individual, TAKES VALUES OF 0 OR 1
nFolds number of n-fold cv
Epis "yes" or "no" for including two-way interactions
foldId random assign samples to different folds

Details

If Epis='yes", the program adds two-way interaction K*(K-1)/2 more columns to BASIS

Value

CrossValidation
    col1: hyperparameter; col2: loglikelihood mean; standard ERROR of nfold
    mean log likelihood
    Lmbda_optimal the optimal hyperparameter as computed
    Alpha_optimal the optimal hyperparameter as computed

Author(s)

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References


Examples

```r
library(EBEN)
data(BASISbinomial)
data(yBinomial)
#reduce sample size to speed up the running time
n = 50;
k = 100;
N = length(yBinomial);
set.seed(1)
set = sample(N,n);
BASIS = BASISbinomial[set,1:k];
y = yBinomial[set];
nFolds = 3
CV = EBelasticNet.BinomialCV(BASIS, y, nFolds = 3,Epis = "no")
```

EBELasticNet.Gaussian  The EB Elastic Net Algorithm for Gaussian Model

Description

General linear regression, normal-Gamma (NG) hierarchical prior for regression coefficients

Usage

```r
EBELasticNet.Gaussian(BASIS, Target, lambda, alpha,Epis = "no",verbose = 0)
```

Arguments

- **BASIS**: sample matrix; rows correspond to samples, columns correspond to features
- **Target**: Response each individual
- **lambda**: Hyperparameter controls degree of shrinkage; can be obtained via Cross Validation; lambda>0
- **alpha**: Hyperparameter controls degree of shrinkage; can be obtained via Cross Validation; 0<alpha<1
- **Epis**: "yes" or "no" for including two-way interactions
- **verbose**: 0 or 1; 1: display message; 0 no message
Details

If Epis="yes", the program adds two-way interaction of K*(K-1)/2 more columns to BASIS

Value

<table>
<thead>
<tr>
<th>weight</th>
<th>the none-zero regression coefficients:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>col1,col2 are the indices of the bases(main if equal);</td>
</tr>
<tr>
<td></td>
<td>col3: coefficient value;</td>
</tr>
<tr>
<td></td>
<td>col4: posterior variance;</td>
</tr>
<tr>
<td></td>
<td>col5: t-value;</td>
</tr>
<tr>
<td></td>
<td>col6: p-value</td>
</tr>
</tbody>
</table>

WaldScore Wald Score

Intercept Intercept

lambda the hyperparameter; same as input lambda

alpha the hyperparameter; same as input alpha

Author(s)

Anhui Huang; Dept of Electrical and Computer Engineering, Univ of Miami, Coral Gables, FL

References


Examples

```r
library(EBEN)
data(BASIS)
data(y)
n = 50;
k = 100;
BASIS = BASIS[1:n,1:k];
y = y[1:n];
Blup = EBelasticNet.Gaussian(BASIS, y, lambda = 0.0072, alpha = 0.95, Epis = "no", verbose = 0)
betas = Blup$weight
betal
```
Description

Hyperparameter controls degree of shrinkage, and is obtained via Cross Validation (CV). This program calculates the maximum lambda that allows one non-zero basis; and performs a search down to 0.0001*lambda_max at even steps. (20 steps)

Usage

EBelasticNet.GaussianCV(Basis, Target, nFolds, Epis = "no", foldId)

Arguments

- **Basis**: sample matrix; rows correspond to samples, columns correspond to features
- **Target**: Response each individual
- **nFolds**: number of n-fold cv
- **Epis**: "yes" or "no" for including two-way interactions
- **foldId**: random assign samples to different folds

Details

If Epis="yes", the program adds two-way interaction K*(K-1)/2 more columns to BASIS

Value

- **CrossValidation**: 
  - col1: hyperparameter; col2: loglikelihood mean; standard ERROR of nfold mean log likelihood
- **lambda_optimal**: the optimal hyperparameter as computed
- **Alpha_optimal**: the optimal hyperparameter as computed

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References


Examples

```r
library(EBEN)
data(Basis)
data(y)
# reduce sample size to speed up the running time
n = 50;
k = 100;
Basis = Basis[1:n,1:k];
y = y[1:n];
CV = EBelasticNet.GaussianCV(Basis, y, nFolds = 3, Epis = "no")
```
**y**  
*Sample Response Data for Gaussian Model*

**Description**  
Corresponding to the response of BASIS

**Usage**  
```
data(y)
```

**Format**  
The format is: num [1:1000, 1] 113.5 97.1 116.6 96.7 105.5 ...

**Source**  

**Examples**  
```
data(y)
```

---

**yBinomial**  
*Sample Variable Data for Binomial Model*

**Description**  
Corresponding to the class label of BASISbinomial

**Usage**  
```
data(yBinomial)
```

**Format**  
The format is: int [1:500, 1] 1 1 1 1 1 1 1 1 1 1 ...

**Source**  

**Examples**  
```
data(BASISbinomial)
```
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