

Package ‘RMoE’

October 17, 2019

Type Package

Title LASSO Regularized Mixture of Experts Models

Version 0.1.0

Description Regularized Mixture of Experts models using the Lasso penalty.

The main reference is the following one:

Huynh, B. T. (2019) <arXiv:1907.06994>.

URL <https://github.com/fchamroukhi/HDME>

BugReports <https://github.com/fchamroukhi/HDME/issues>

License GPL (>= 3)

Depends R (>= 2.10)

Imports methods,

stats,
graphics,
MASS,
base,
plot3D,
doParallel,
foreach

Suggests knitr,

rmarkdown

Collate RMoE-package.R

Pik.R
GEstep.R
Obj.R
SoTh.R
CoorLQk.R
GPMstep.R
GSMstep.R
GLOG.R
GBIC.R
GWrite.R
Fs.R
CoorGateP1.R
CoorGateP.R
GRMoE-class.R
GaussRMoE.R

LPi.R
 LEstep.R
 Lfk.R
 LCoorExpP1.R
 LCoorExpP.R
 LPMstep.R
 LLOG.R
 LBIC.R
 LWrite.R
 LRMoe-class.R
 LogisticRMoe.R
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 PCoorExpP.R
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 data-gaussian.R
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VignetteBuilder knitr

Encoding UTF-8

LazyData true

Roxygen list(markdown = TRUE)

RoxygenNote 6.1.1

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RMoE-package	<i>RMoE: LASSO Regularized Mixture of Experts Models</i>
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Description

RMoE is a package containing regularized Mixture of Experts models using the Lasso penalty.

RMoE contains the following Regularized Mixture-of-Experts models:

- GaussianRMoE: Gaussian Regularized Mixture of Experts;
- LogisticRMoE: Logistic Regularized Mixture of Experts;
- PoissonRMoE: Poisson Regularized Mixture of Experts.

To learn more about RMoE, start with the vignettes: `browseVignettes(package = "RMoE")`

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References

Huynh B. T., Chamroukhi F. 2019. *Estimation and Feature Selection in Mixtures of Generalized Linear Experts Models*. <https://arxiv.org/abs/1907.06994>.

See Also

Useful links:

- <https://github.com/fchamroukhi/HDME>
- Report bugs at <https://github.com/fchamroukhi/HDME/issues>

cleveland	<i>The Cleveland data set</i>
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Description

The Cleveland data set described on the website UC Irvine Machine Learning Repository.

Usage

cleveland

Format

A data frame with 297 rows and 15 columns.

Source

<https://archive.ics.uci.edu/ml/datasets/heart+Disease>

gaussian	<i>A simulated gaussian data set</i>
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Description

A simulated gaussian data set. True parameters for this data set are given by:

- Exp.1 = (0,0,1.5,0,0,0,1);
- Exp.2 = (0,1,-1.5,0,0,2,0);
- Gate = (1,2,0,0,-1,0,0);
- Sigma = 1.

Usage

gaussian

Format

A data frame with 300 rows and 8 columns.

GaussRMoE

*Penalized MLE for the regularized Mixture of Experts.***Description**

This function provides a penalized MLE for the regularized Mixture of Experts (MoE) model corresponding with the penalty parameters Lambda, Gamma.

Usage

```
GaussRMoE(Xm, Ym, K, Lambda, Gamma, option = FALSE, verbose = FALSE)
```

Arguments

Xm	Matrix of explanatory variables. Each feature should be standardized to have mean 0 and variance 1. One must add the column vector (1,1,...,1) for the intercept variable.
Ym	Vector of the response variable. For the Gaussian case Y should be standardized. For multi-logistic model Y is numbered from 1 to R (R is the number of labels of Y).
K	Number of experts ($K > 1$).
Lambda	Penalty value for the experts.
Gamma	Penalty value for the gating network.
option	Optional. option = TRUE: using proximal Newton-type method; option = FALSE: using proximal Newton method.
verbose	Optional. A logical value indicating whether or not values of the log-likelihood should be printed during EM iterations.

Value

GaussRMoE returns an object of class [GRMoE](#).

See Also

[GRMoE](#)

GRMoE-class

*A Reference Class which contains parameters of a GRMoE model.***Description**

GRMoE contains all the parameters of a Gaussian Regularized Mixture-of-Experts.

Fields

- X The matrix data for the input.
- Y Vector of the response variable.
- d Numeric. Number of explanatory variables (including the intercept variable).
- n Numeric. Length of the response/output vector Y.
- K Number of expert classes.
- Lambda Penalty value for the expert part.
- Gamma Penalty value for the gating network.
- wk Parameters of the gating network. Matrix of dimension $(K - 1, d)$, with d the number of explanatory variables (including the intercept).
- betak Regressions coefficients for each expert. Matrix of dimension (d, K) .
- sigma Numeric. The standard deviation.
- loglik Numeric. Observed-data log-likelihood of the GRMoE model.
- storedloglik Numeric vector. Stored values of the log-likelihood at each EM iteration.
- BIC Numeric. Value of BIC (Bayesian Information Criterion).
- Cluster Numeric. Clustering label for each observation.

Methods

- plot() Plot method.

housing	<i>The Housing data set</i>
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Description

The Housing data set described on the website UC Irvine Machine Learning Repository. The value MEDV/sd(MEDV) is considered as the predictor variable.

Usage

```
housing
```

Format

A data frame with 506 rows and 15 columns.

Source

<https://archive.ics.uci.edu/ml/machine-learning-databases/housing>

ionosphere	<i>The Ionosphere data set</i>
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Description

The Ionosphere data set described on the website UC Irvine Machine Learning Repository.

Usage

ionosphere

Format

A data frame with 351 rows and 35 columns.

Source

<https://archive.ics.uci.edu/ml/datasets/ionosphere>

logistic	<i>A simulated logistic data set</i>
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Description

A simulated logistic data set. True parameters for this data set are given by:

- Exp.1 = (0,-1,2,0,0,1.5,0);
- Exp.2 = (0,1,0,0,-2,0,0);
- Gate = (1,0,0,1,0,0,-1.5).

Usage

logistic

Format

A data frame with 300 rows and 8 columns.

LogisticRMoE

Penalized MLE for the logistic regularized Mixture of Experts.

Description

This function provides a penalized MLE for the logistic regularized Mixture of Experts (MoE) model corresponding with the penalty parameters Lambda, Gamma.

Usage

```
LogisticRMoE(Xmat, Ymat, K, Lambda, Gamma, option = FALSE,
             verbose = FALSE)
```

Arguments

Xmat	Matrix of explanatory variables. Each feature should be standardized to have mean 0 and variance 1. One must add the column vector (1,1,...,1) for the intercept variable.
Ymat	Vector of the response variable. For the Gaussian case Y should be standardized. For multi-logistic model Y is numbered from 1 to R (R is the number of labels of Y).
K	Number of experts ($K > 1$).
Lambda	Penalty value for the experts.
Gamma	Penalty value for the gating network.
option	Optional. option = TRUE: using proximal Newton-type method; option = FALSE: using proximal Newton method.
verbose	Optional. A logical value indicating whether or not values of the log-likelihood should be printed during EM iterations.

Value

LogisticRMoE returns an object of class [LRMoE](#).

See Also

[LRMoE](#)

LRMoE-class

A Reference Class which contains parameters of a LRMoE model.

Description

LRMoE contains all the parameters of a Logistic Regularized Mixture-of-Experts.

Fields

- X The matrix data for the input.
- Y Vector of the response variable.
- d Numeric. Number of explanatory variables (including the intercept variable).
- n Numeric. Length of the response/output vector Y.
- R Numeric. Maximum value of Y.
- K Number of expert classes.
- Lambda Penalty value for the expert part.
- Gamma Penalty value for the gating network.
- wk Parameters of the gating network. Matrix of dimension $(K - 1, d)$, with d the number of explanatory variables (including the intercept).
- eta Values of the regression coefficients for each level $r = 1, \dots, R$. Array of dimension $(K, R - 1, d)$.
- loglik Numeric. Observed-data log-likelihood of the LRMoe model.
- storedloglik Numeric vector. Stored values of the log-likelihood at each EM iteration.
- BIC Numeric. Value of BIC (Bayesian Information Criterion).
- Cluster Numeric vector. Clustering label for each observation.

Methods

- plot() Plot method.

musk1	<i>The Musk-1 data set</i>
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Description

The Musk-1 data set described on the website UC Irvine Machine Learning Repository.

Usage

```
musk1
```

Format

A data frame with 476 rows and 168 columns.

Source

[https://archive.ics.uci.edu/ml/datasets/Musk+\(Version+1\)](https://archive.ics.uci.edu/ml/datasets/Musk+(Version+1))

poisson	<i>A simulated poisson data set</i>
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Description

A simulated poisson data set. True parameters for this data set are given by:

- Exp.1 = (0,1,0,-2,0,1.5,0);
- Exp.2 = (0,0,2,0,-1,0,0);
- Gate = (1,0,0,1,0,-1.5,0).

Usage

```
poisson
```

Format

A data frame with 300 rows and 8 columns.

PoissonRMoE	<i>Penalized MLE for the Poisson regularized Mixture of Experts.</i>
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Description

This function provides a penalized MLE for the Poisson regularized Mixture of Experts (MoE) model corresponding with the penalty parameters Lambda, Gamma.

Usage

```
PoissonRMoE(Xmat, Ymat, K, Lambda, Gamma, option = FALSE,
             verbose = TRUE)
```

Arguments

Xmat	Matrix of explanatory variables. Each feature should be standardized to have mean 0 and variance 1. One must add the column vector (1,1,...,1) for the intercept variable.
Ymat	Vector of the response variable. For the Gaussian case Y should be standardized. For multi-logistic model Y is numbered from 1 to R (R is the number of labels of Y).
K	Number of experts ($K > 1$).
Lambda	Penalty value for the experts.
Gamma	Penalty value for the gating network.
option	Optional. option = TRUE: using proximal Newton-type method; option = FALSE: using proximal Newton method.
verbose	Optional. A logical value indicating whether or not values of the log-likelihood should be printed during EM iterations.

Value

PoissonRMoE returns an object of class [PRMoE](#).

See Also

[PRMoE](#)

PRMoE-class	<i>A Reference Class which contains parameters of a PRMoE model.</i>
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Description

PRMoE contains all the parameters of a Poisson Regularized Mixture-of-Experts.

Fields

- X The matrix data for the input.
- Y Vector of the response variable.
- d Numeric. Number of explanatory variables (including the intercept variable).
- n Numeric. Length of the response/output vector Y.
- K Number of expert classes.
- Lambda Penalty value for the expert part.
- Gamma Penalty value for the gating network.
- wk Parameters of the gating network. Matrix of dimension $(K - 1, d)$, with d the number of explanatory variables (including the intercept).
- betak Regressions coefficients for each expert. Matrix of dimension (d, K) .
- loglik Numeric. Observed-data log-likelihood of the PRMoE model.
- storedloglik Numeric vector. Stored values of the log-likelihood at each EM iteration.
- BIC Numeric. Value of BIC (Bayesian Information Criterion).
- Cluster Numeric vector. Clustering label for each observation.

Methods

- plot() Plot method.

`residential`*The Residential Building data set*

Description

The Residential Building data set described on the website UC Irvine Machine Learning Repository. The V-9 variable is used as the predictor variable.

Usage`residential`**Format**

A data frame with 372 rows and 109 columns.

Source

<http://archive.ics.uci.edu/ml/datasets/Residential+Building+Data+Set>

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