# Package 'RMoE'

October 14, 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

**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
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LCoorExpP.R
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data-cleveland.R
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**Encoding**  UTF-8

**LazyData**  true

**Roxygen**  list(markdown = TRUE)

**RoxygenNote**  6.1.1

# R **topics documented:**

| RMoE-package | *RMoE: LASSO Regularized Mixture of Experts Models* |
|---|---|

### 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 Regularixed Mixture of Experts;
- LogisticRMoE: Logistic Regularixed Mixture of Experts;
- PoissonRMoE: Poisson Regularixed Mixture of Experts.

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

### Author(s)

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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 | *The Cleveland data set* |
|---|---|

### Description

The Cleveland data set

### Usage

```
cleveland
```

### Format

A data frame with 297 rows and 15 columns.

---

gaussian                          *A simulated gaussian data set*

---

### Description

A simulated gaussian data set

### 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).

## Methods

plot()  Plot method.

---

housing | *The Housing data set*

---

## Description

The Housing data set

## Usage

```
housing
```

## Format

A data frame with 506 rows and 15 columns.

---

ionosphere                          *The Ionosphere data set*

---

### Description

The Ionosphere data set

### Usage

```
ionosphere
```

### Format

A data frame with 351 rows and 35 columns.

---

logistic                            *A simulated logistic data set*

---

### Description

A simulated logistic data set

### 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,...,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).

**Methods**

plot() Plot method.

---

musk1 *The Musk-1 data set*

---

**Description**

The Musk-1 data set

**Usage**

musk1

**Format**

A data frame with 476 rows and 168 columns.

---

poisson *A simulated poisson data set*

---

**Description**

A simulated poisson data set

**Usage**

poisson

**Format**

A data frame with 300 rows and 8 columns.

---

PoissonRMoE *Penalized MLE for the Poisson regularized Mixture of Experts.*

---

**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]

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| | |
|---|---|
| PRMoE-class | *A Reference Class which contains parameters of a PRMoE model.* |

---

## 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).

## Methods

plot() Plot method.

| residential | *The Residential Building data set* |
|---|---|

## Description

The Residential Building data set

## Usage

```
residential
```

## Format

A data frame with 372 rows and 109 columns.

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