

Package ‘rrlda’

February 20, 2015

Version 1.1

Type Package

Title Robust Regularized Linear Discriminant Analysis

Date 2011-09-18

Author Moritz Gschwandtner, Peter Filzmoser, Christophe Croux,
Gentiane Haesbroeck

Maintainer Moritz Gschwandtner <moritz.gschwandtner@chello.at>

Depends pcaPP, mvoutlier, glasso, matrixcalc

Description This package offers methods to perform robust regularized
linear discriminant analysis.

License GPL (>= 3)

Repository CRAN

Date/Publication 2012-06-09 16:50:10

NeedsCompilation no

R topics documented:

| | |
|-------------------------|---|
| predict.rrlda | 1 |
| rrest | 2 |
| rrlda | 3 |

| | |
|--------------|----------|
| Index | 6 |
|--------------|----------|

| | |
|---------------|---|
| predict.rrlda | <i>Class Prediction for rrlda objects</i> |
|---------------|---|

Description

Computes class predictions for new data based on a given rrlda object.

Usage

```
## S3 method for class 'rrlda'
predict(object, x, ...)
```

Arguments

| | |
|--------|--|
| object | An object of class "rrlda". |
| x | New data for which the classes are to predict |
| ... | Argument used by generic function predict(object, x, ...). |

Details

Based on the estimated inverse covariance matrix and the mean of each group (stored in object), discriminant values are computed. An observations is classified as group k, if the corresponding discriminant value is a minimum.

Value

| | |
|-----------|--|
| class | Class prediction for each observation. |
| posterior | Discriminant values. |

Examples

```
data(iris)
x <- iris[,1:4]
rr <- rrllda(x, grouping=as.numeric(iris[,5]), lambda=0.2, hp=0.75) ## perform rrllda
pred <- predict(rr, x) ## predict
table(as.numeric(pred$class), as.numeric(iris[,5])) ## show errors
```

| | |
|-------|---|
| rrest | <i>Robust Regularized Estimator (RegMCD) for location and inverse scatter</i> |
|-------|---|

Description

Computes the Robust Regularized Estimator for location and inverse scatter.

Usage

```
rrest(data, lambda=0.5, hp=0.75, thresh=0.0001, maxit=10, penalty="L2")
```

Arguments

| | |
|---------|--|
| data | Matrix or data.frame of observations |
| lambda | Penalty parameter which controls the sparseness of the resulting inverse scatter matrix. Default is 0.5 |
| hp | Robustness parameter which specifies the amount of observations to be included in the computations. Default is 0.75 |
| thresh | Threshold value controlling the convergence of the iterative algorithm. Default is 0.0001. In most cases this argument does not have to be supplied. |
| maxit | Maximum number of iterations of the algorithm. Default is 10. |
| penalty | Type of penalty to be applied. Possible values are "L1" and "L2". |

Details

The Robust Regularized Estimator computes a sparse inverse covariance matrix of the given observations by maximization of a penalized likelihood function. The sparseness is controlled by a penalty parameter lambda. Possible outliers are dealt with by a robustness parameter alpha which specifies the amount of observations for which the likelihood function is maximized.

Value

| | |
|-------------|---|
| mean | The resulting location estimate. |
| covi_nocons | The resulting inverse covariance estimate. |
| subset | An index vector specifying the data subset used (see robustness parameter alpha). |
| objective | The maximized objective value. |
| loglik | The maximized (log-)likelihood value. |
| niter | The number of iterations |

Examples

```
x <- cbind(rnorm(100), rnorm(100), rnorm(100)) # use first group only
rr <- rrest(x, lambda=0.2, hp=0.75)
solve(rr$covi) ## estimated cov matrix
```

rrlda

Robust Regularized Linear Discriminant Analysis

Description

Performs Robust Regularized Linear Discriminant Analysis.

Usage

```
rrlda(x, grouping, prior=NULL, lambda=0.5, hp=0.75, nssamples=30, maxit=50, penalty="L2")
```

Arguments

| | |
|------------------------|---|
| <code>x</code> | Matrix or data.frame of observations. |
| <code>grouping</code> | Grouping variable. A vector of numeric values ≥ 1 is recommended. Length has to correspond to <code>nrow(x)</code> . |
| <code>prior</code> | Vector of prior probabilities for each group. If not supplied the priors are computed from the data. |
| <code>lambda</code> | Penalty parameter which controls the sparseness of the resulting inverse scatter matrix. Default is 0.5 |
| <code>hp</code> | Robustness parameter which specifies the amount of observations to be included in the computations. Default is 0.75 |
| <code>nssamples</code> | Number of start samples to be user for iterated estimations. |
| <code>maxit</code> | Maximum number of iterations of the algorithm. Default is 10. |
| <code>penalty</code> | Type of penalty to be applied. Possible values are "L1" and "L2". |

Details

Performs Robust Regularized Discriminant Analysis using a sparse estimation of the inverse covariance matrix. The sparseness is controlled by a penalty parameter `lambda`. Possible outliers are dealt with by a robustness parameter `alpha` which specifies the amount of observations for which the likelihood function is maximized.

Value

An object of class "rrlda" is returned which can be used for class prediction (see `predict()`). `prior=prior`, `counts=counts`, `means=means`, `cov=covm`, `covi=covi`, `lev=lev`, `n=n`, `h=h`, `bic=bic`, `loglik=loglik`, `nonnuls=nonnuls`, `subs=est$subset`

| | |
|---------------------|---|
| <code>prior</code> | Vector of prior probabilities. |
| <code>counts</code> | Number of observations for each group. |
| <code>means</code> | Estimated mean vectors for each group. |
| <code>covi</code> | Estimated (common) inverse covariance matrix. |
| <code>lev</code> | Levels. Corresponds to the groups. |
| <code>n</code> | Number of observations. |
| <code>h</code> | Number of observations included in the computations (see robustness parameter <code>alpha</code>). |
| <code>bic</code> | Adapted bic value. Can be used for optimal selection of <code>lambda</code> |
| <code>loglik</code> | The maximized (log-)likelihood value. |
| <code>df</code> | Degrees of freedom of the estimated inverse covariance matrix. |
| <code>subs</code> | An index vector specifying the data subset used (see robustness parameter <code>alpha</code>). |

Examples

```
data(iris)
x <- iris[,1:4]
rr <- rlda(x, grouping=as.numeric(iris[,5]), lambda=0.2, hp=0.75) ## perform rlda
pred <- predict(rr, x) ## predict
table(as.numeric(pred$class), as.numeric(iris[,5])) ## show errors
```

Index

*Topic **file**

predict.rlda, 1

rrest, 2

rlda, 3

predict (predict.rlda), 1

predict.rlda, 1

rrest, 2

rlda, 3