

Package ‘rrlda’

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Type Package

Title Robust Regularized Linear Discriminant Analysis

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Depends pcaPP, mvoutlier, glasso, matrixcalc

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

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NeedsCompilation no

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predict.rlda *Class Prediction for rlda objects*

Description

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

Usage

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

Arguments

object	An object of class "rlda".
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 <- 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
```

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

x	Matrix or data.frame of observations.
grouping	Grouping variable. A vector of numeric values ≥ 1 is recommended. Length has to correspond to nrow(x).
prior	Vector of prior probabilities for each group. If not supplied the priors are computed from the data.
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
nssamples	Number of start samples to be user for iterated estimations.
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

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

prior	Vector of prior probabilities.
counts	Number of observations for each group.
means	Estimated mean vectors for each group.
covi	Estimated (common) inverse covariance matrix.
lev	Levels. Corresponds to the groups.

n	Number of observations.
h	Number of observations included in the computations (see robustness parameter alpha).
bic	Adapted bic value. Can be used for optimal selection of lambda
loglik	The maximized (log-)likelihood value.
df	Degrees of freedom of the estimated inverse covariance matrix.
subs	An index vector specifying the data subset used (see robustness parameter alpha).

Examples

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

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