Package 'kfda'

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Type Package

Title Kernel Fisher Discriminant Analysis

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Description Kernel Fisher Discriminant Analysis (KFDA) is performed using Kernel Principal Component Analysis (KPCA) and Fisher Discriminant Analysis (FDA).
There are some similar packages. First, 'lfda' is a package that performs Local Fisher Discriminant Analysis (LFDA) and performs other functions.
In particular, 'lfda' seems to be impossible to test because it needs the label information of the data in the function argument. Also, the 'ks' package has a limited dimension, which makes it difficult to analyze properly.
This package is a simple and practical package for KFDA based on the paper of Yang, J., Jin, Z., Yang, J. Y., Zhang, D., and Frangi, A. F. (2004) <DOI:10.1016/j.patcog.2003.10.015>.

License GPL-3

Encoding UTF-8

LazyData yes

Repository CRAN

URL https://github.com/ainsuotain/kfda

Depends R (>= 3.0.0), kernlab, MASS

NeedsCompilation no

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R topics documented:

kfda *Kernel Fisher Discriminant Analysis (KFDA)*

Description

Train the trainData using KFDA. Basically, we run KFDA using Gaussian kernel. Returns trained KFDA object.

Usage

```
kfda(trainData = data, kernel.name = "rbfdot", kpar.sigma = 0.001, threshold = 1e-05)
```

Arguments

trainData	an optional data frame or matrix containing the variables in the model. In particular, the last column of the data frame should contain the target value.
kernel.name	the kernel function used in training and predicting. This parameter is fixed in the rbfdot(Gaussian kernel).
kpar.sigma	hyper-parameter of selected kernel. sigma inverse kernel width for the Gaussian kernel function "rbfdot".
threshold	the value of the eigenvalue under which principal components are ignored (only valid when features = 0). (default : 1e-05).

Details

Train the trainData using KFDA. Basically, we run KFDA using Gaussian kernel. Returns trained KFDA object. Since this function performs KFDA with the appropriate combination of kpca and lda, the following values can show the result of each function.

Value

An object of class kfda.

kpca.train	An object of class "kpca". It has results of kpca function. (seekpca (in package **kernlab**))
lda.rotation.train	The result of applying LDA, After KPCA is performed on trainData.
LDs	A dataframe of linear discriminants of LDA.
label	A vector of class label of trainData.

Note

This package is an early version and will be updated in the future.

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References

Yang, J., Jin, Z., Yang, J. Y., Zhang, D., and Frangi, A. F. (2004) <DOI:10.1016/j.patcog.2003.10.015>. Essence of kernel Fisher discriminant: KPCA plus LDA. *Pattern Recognition*, 37(10): 2097-2100.

See Also

kpca (in package **kernlab**) lda (in package **MASS**) kfda.predict

Examples

```
# data input
data(iris)

# data separation
idx <- sample(1:dim(iris)[1], round(dim(iris)[1]*0.7))
trainData <- iris[idx, ]

# training KFDA model
kfda.model <- kfda(trainData = trainData, kernel.name = "rbfdot")

# structure of kfda.model
str(kfda.model)
```

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kfda.predict *Predict Method for Kernel Fisher Discriminant Analysis (KFDA) fit*

Description

Test the testData using KFDA. This function is used after training phase is performed using the kfda function.

Usage

```
kfda.predict(object = obj, testData = data)
```

Arguments

object	An R object of class kfda.
testData	an optional data frame or matrix containing the variables in the model. In particular, the order of variables in the data frame must be the same as trainData, and the target value must be removed in advance.

Details

Since this function inherits KPCA and LDA, various learning can be possible by adjusting the hyper-parameters of each function.

Value

The result of performing testData on the KFDA model.

class	A class label of testData.
posterior	A posterior probabilities for the classes.
x	The scores of testData on up to kfda discriminant variables.

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References

Yang, J., Jin, Z., Yang, J. Y., Zhang, D., and Frangi, A. F. (2004) <DOI:10.1016/j.patcog.2003.10.015>. Essence of kernel Fisher discriminant: KPCA plus LDA. *Pattern Recognition*, 37(10): 2097-2100.

See Also

kfda

Examples

```
# data input
data(iris)

# data separation
idx <- sample(1:dim(iris)[1], round(dim(iris)[1]*0.7))
trainData <- iris[idx, ]
testData <- iris[-(idx), -dim(iris)[2]]
testData.Label <- iris[-(idx), dim(iris)[2]]

# training KFDA model
kfda.model <- kfda(trainData = trainData, kernel.name = "rbfdot")

# testing new(test)data by KFDA model
pre <- kfda.predict(object = kfda.model, testData = testData)

# plotting
plot(kfda.model$LDs, col = kfda.model$label, pch = 19, main = "Plot for KFDA")
points(pre$x, col = pre$class, cex = 2)
legend("topleft", legend = c("trainData","testData"), pch = c(19,1))

# prediction result
table(pre$class, (testData.Label))
```

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