

Package ‘longclust’

July 22, 2025

Type Package

Title Model-Based Clustering and Classification for Longitudinal Data

Version 1.5

Date 2023-12-21

Author Paul D. McNicholas [aut, cre] (ORCID:
<<https://orcid.org/0000-0002-2482-523X>>),
K. Raju Jampani [aut] (May to Dec 2012),
Sanjeena Subedi [aut] (ORCID: <<https://orcid.org/0000-0002-2462-7786>>)

Maintainer Paul D. McNicholas <mcnicholas@math.mcmaster.ca>

Suggests mvtnorm

Depends R (>= 4.3.0)

Description Clustering or classification of longitudinal data based on a mixture of multivariate t or Gaussian distributions with a Cholesky-decomposed covariance structure. Details in McNicholas and Murphy (2010) <[doi:10.1002/cjs.10047](https://doi.org/10.1002/cjs.10047)> and McNicholas and Subedi (2012) <[doi:10.1016/j.jspi.2011.11.026](https://doi.org/10.1016/j.jspi.2011.11.026)>.

License GPL (>= 2)

LazyLoad yes

Repository CRAN

NeedsCompilation yes

Date/Publication 2023-12-21 17:40:02 UTC

Contents

longclust-package	2
longclustEM	2
plot.longclust	4
print.longclust	5
summary.longclust	6

Index	8
--------------	----------

longclust-package *Model-Based Clustering and Classification for Longitudinal Data*

Description

This is a package for clustering or classification of longitudinal data based on a mixture of multivariate t or Gaussian distributions with a Cholesky-decomposed covariance structure.

Details

Package: longclust
Type: Package
Version: 1.5
Date: 2023-12-21
License: GPL-2 or GPL-3
LazyLoad: yes

This package contains the function [longclustEM](#).

Author(s)

P. D. McNicholas, K.R. Jampani and S. Subedi
Maintainer: Paul McNicholas <mcnicholas@math.mcmaster.ca>

See Also

Details, examples, and references are given under [longclustEM](#).

longclustEM *Model-Based Clustering and Classification for Longitudinal Data*

Description

Carries out model-based clustering or classification using multivariate t or Gaussian mixture models with Cholesky decomposed covariance structure. EM algorithms are used for parameter estimation and the BIC is used for model selection.

Usage

```
longclustEM(x, Gmin, Gmax, class=NULL, linearMeans = FALSE,  
modelSubset = NULL, initWithKMeans = FALSE, criteria = "BIC",  
equalDF = FALSE, gaussian=FALSE, userseed=1004)
```

Arguments

<code>x</code>	A matrix or data frame such that rows correspond to observations and columns correspond to variables.
<code>Gmin</code>	A number giving the minimum number of components to be used.
<code>Gmax</code>	A number giving the maximum number of components to be used.
<code>class</code>	If NULL then model-based clustering is performed. If a vector with length equal to the number of observations, then model-based classification is performed. In this latter case, the <i>i</i> th entry of <code>class</code> is either zero, indicating that the component membership of observation <i>i</i> is unknown, or it corresponds to the component membership of observation <i>i</i> .
<code>linearMeans</code>	If TRUE, then means are modelled using linear models.
<code>modelSubset</code>	A vector of strings giving the models to be used. If set to NULL, all models are used.
<code>initWithKMeans</code>	If TRUE, the components are initialized using k-means algorithm.
<code>criteria</code>	A string that denotes the criteria used for evaluating the models. Its value should be "BIC" or "ICL".
<code>equalDF</code>	If TRUE, the degrees of freedom of all the components will be the same.
<code>gaussian</code>	If TRUE, a mixture of Gaussian distributions is used in place of a mixture of t-distributions.
<code>userseed</code>	The random number seed to be used.

Value

<code>Gbest</code>	The number of components for the best model.
<code>zbest</code>	A matrix that gives the probabilities for any data element to belong to any component in the best model.
<code>nubest</code>	A vector of <code>Gbest</code> integers, that give the degrees of freedom for each component in the best model.
<code>mubest</code>	A matrix containing the means of the components for the best model (one per row).
<code>Tbest</code>	A list of <code>Gbest</code> matrices, giving the T matrices of the components for the best model.
<code>Dbest</code>	A list of <code>Gbest</code> matrices, giving the D matrices of the components for the best model.

Author(s)

Paul D. McNicholas, K. Raju Jampani and Sanjeena Subedi

References

- Paul D. McNicholas and T. Brendan Murphy (2010). Model-based clustering of longitudinal data. *The Canadian Journal of Statistics* **38**(1), 153-168.
- Paul D. McNicholas and Sanjeena Subedi (2012). Clustering gene expression time course data using mixtures of multivariate t-distributions. *Journal of Statistical Planning and Inference* **142**(5), 1114-1127.

Examples

```

library(mvtnorm)
m1 <- c(23,34,39,45,51,56)
S1 <- matrix(c(1.00, -0.90, 0.18, -0.13, 0.10, -0.05, -0.90,
1.31, -0.26, 0.18, -0.15, 0.07, 0.18, -0.26, 4.05, -2.84,
2.27, -1.13, -0.13, 0.18, -2.84, 2.29, -1.83, 0.91, 0.10,
-0.15, 2.27, -1.83, 3.46, -1.73, -0.05, 0.07, -1.13, 0.91,
-1.73, 1.57), 6, 6)
m2 <- c(16,18,15,17,21,17)
S2 <- matrix(c(1.00, 0.00, -0.50, -0.20, -0.20, 0.19, 0.00,
2.00, 0.00, -1.20, -0.80, -0.36,-0.50, 0.00, 1.25, 0.10,
-0.10, -0.39, -0.20, -1.20, 0.10, 2.76, 0.52, -1.22,-0.20,
-0.80, -0.10, 0.52, 1.40, 0.17, 0.19, -0.36, -0.39, -1.22,
0.17, 3.17), 6, 6)
m3 <- c(8, 11, 16, 22, 25, 28)
S3 <- matrix(c(1.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
1.00, -0.20, -0.64, 0.26, 0.00, 0.00, -0.20, 1.04, -0.17,
-0.10, 0.00, 0.00, -0.64, -0.17, 1.50, -0.65, 0.00, 0.00,
0.26, -0.10, -0.65, 1.32, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 1.00), 6, 6)
m4 <- c(12, 9, 8, 5, 4 ,2)
S4 <- diag(c(1,1,1,1,1,1))
data <- matrix(0, 40, 6)
data[1:10,] <- rmvnorm(10, m1, S1)
data[11:20,] <- rmvnorm(10, m2, S2)
data[21:30,] <- rmvnorm(10, m3, S3)
data[31:40,] <- rmvnorm(10, m4, S4)
clus <- longclustEM(data, 3, 5, linearMeans=TRUE)
summary(clus)
plot(clus,data)

```

plot.longclust

Plots the components of the model.

Description

Displays a series of two plots, one containing all the components in different colors, and one containing subplots one per each component.

Usage

```

## S3 method for class 'longclust'
plot(x, data, ...)

```

Arguments

x	An object of type longclust returned by longclustEM.
data	The data matrix used in computing clus.
...	Default arguments.

Author(s)

Paul D. McNicholas, K. Raju Jampani and Sanjeena Subedi

Examples

```
library(mvtnorm)
m1 <- c(23,34,39,45,51,56)
S1 <- matrix(c(1.00, -0.90, 0.18, -0.13, 0.10, -0.05, -0.90,
1.31, -0.26, 0.18, -0.15, 0.07, 0.18, -0.26, 4.05, -2.84,
2.27, -1.13, -0.13, 0.18, -2.84, 2.29, -1.83, 0.91, 0.10,
-0.15, 2.27, -1.83, 3.46, -1.73, -0.05, 0.07, -1.13, 0.91,
-1.73, 1.57), 6, 6)
m2 <- c(16,18,15,17,21,17)
S2 <- matrix(c(1.00, 0.00, -0.50, -0.20, -0.20, 0.19, 0.00,
2.00, 0.00, -1.20, -0.80, -0.36,-0.50, 0.00, 1.25, 0.10,
-0.10, -0.39, -0.20, -1.20, 0.10, 2.76, 0.52, -1.22,-0.20,
-0.80, -0.10, 0.52, 1.40, 0.17, 0.19, -0.36, -0.39, -1.22,
0.17, 3.17), 6, 6)
m3 <- c(8, 11, 16, 22, 25, 28)
S3 <- matrix(c(1.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 1.00,
-0.20, -0.64, 0.26, 0.00, 0.00, -0.20, 1.04, -0.17, -0.10,
0.00, 0.00, -0.64, -0.17, 1.50, -0.65, 0.00, 0.00, 0.26, -0.10,
-0.65, 1.32, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 1.00), 6, 6)
m4 <- c(12, 9, 8, 5, 4 ,2)
S4 <- diag(c(1,1,1,1,1,1))
data <- matrix(0, 40, 6)
data[1:10,] <- rmvnorm(10, m1, S1)
data[11:20,] <- rmvnorm(10, m2, S2)
data[21:30,] <- rmvnorm(10, m3, S3)
data[31:40,] <- rmvnorm(10, m4, S4)
clus <- longclustEM(data, 3, 5, linearMeans=TRUE)
plot(clus,data)
```

print.longclust

Brief overview of the longclust object

Description

Prints the number of components, probably matrix, degrees of freedom and the component means of the computed best model.

Usage

```
## S3 method for class 'longclust'
print(x, ...)
```

Arguments

x An object of type longclust, computed by longclustEM.
... Default Arguments

Author(s)

Paul D. McNicholas, K. Raju Jampani and Sanjeena Subedi

Examples

```

library(mvtnorm)
m1 <- c(23,34,39,45,51,56)
S1 <- matrix(c(1.00, -0.90, 0.18, -0.13, 0.10, -0.05, -0.90,
1.31, -0.26, 0.18, -0.15, 0.07, 0.18, -0.26, 4.05, -2.84,
2.27, -1.13, -0.13, 0.18, -2.84, 2.29, -1.83, 0.91, 0.10,
-0.15, 2.27, -1.83, 3.46, -1.73, -0.05, 0.07, -1.13, 0.91,
-1.73, 1.57), 6, 6)
m2 <- c(16,18,15,17,21,17)
S2 <- matrix(c(1.00, 0.00, -0.50, -0.20, -0.20, 0.19, 0.00, 2.00,
0.00, -1.20, -0.80, -0.36,-0.50, 0.00, 1.25, 0.10, -0.10, -0.39,
-0.20, -1.20, 0.10, 2.76, 0.52, -1.22,-0.20, -0.80, -0.10, 0.52,
1.40, 0.17, 0.19, -0.36, -0.39, -1.22, 0.17, 3.17), 6, 6)
m3 <- c(8, 11, 16, 22, 25, 28)
S3 <- matrix(c(1.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 1.00,
-0.20, -0.64, 0.26, 0.00, 0.00, -0.20, 1.04, -0.17, -0.10, 0.00,
0.00, -0.64, -0.17, 1.50, -0.65, 0.00, 0.00, 0.26, -0.10, -0.65,
1.32, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 1.00), 6, 6)
m4 <- c(12, 9, 8, 5, 4 ,2)
S4 <- diag(c(1,1,1,1,1,1))
data <- matrix(0, 40, 6)
data[1:10,] <- rmvnorm(10, m1, S1)
data[11:20,] <- rmvnorm(10, m2, S2)
data[21:30,] <- rmvnorm(10, m3, S3)
data[31:40,] <- rmvnorm(10, m4, S4)
clus <- longclustEM(data, 3, 5, linearMeans=TRUE)
print(clus)

## The function is currently defined as
function (tch, ...)
{
  cat("Number of Clusters:", tch$Gbest, "\n")
  cat("z:\n")
  print(tch$zbest)
  cat("\n")
  for (g in 1:tch$Gbest) {
    cat("Cluster: ", g, "\n")
    cat("v: ", tch$nubest[g], "\n")
    cat("mean:", tch$mubest[g, ], "\n\n")
  }
}

```

Description

Prints all the items in the object.

Usage

```
## S3 method for class 'longclust'  
summary(object, ...)
```

Arguments

object An object of type longclust, returned by longclustEM.
... Default arguments.

Author(s)

Paul D. McNicholas, K. R. Jampani and Sanjeena Subedi

Examples

```
library(mvtnorm)  
m1 <- c(23,34,39,45,51,56)  
S1 <- matrix(c(1.00, -0.90, 0.18, -0.13, 0.10, -0.05, -0.90,  
1.31, -0.26, 0.18, -0.15, 0.07, 0.18, -0.26, 4.05, -2.84,  
2.27, -1.13, -0.13, 0.18, -2.84, 2.29, -1.83, 0.91, 0.10,  
-0.15, 2.27, -1.83, 3.46, -1.73, -0.05, 0.07, -1.13, 0.91,  
-1.73, 1.57), 6, 6)  
m2 <- c(16,18,15,17,21,17)  
S2 <- matrix(c(1.00, 0.00, -0.50, -0.20, -0.20, 0.19, 0.00,  
2.00, 0.00, -1.20, -0.80, -0.36,-0.50, 0.00, 1.25, 0.10,  
-0.10, -0.39, -0.20, -1.20, 0.10, 2.76, 0.52, -1.22,-0.20,  
-0.80, -0.10, 0.52, 1.40, 0.17, 0.19, -0.36, -0.39, -1.22,  
0.17, 3.17), 6, 6)  
m3 <- c(8, 11, 16, 22, 25, 28)  
S3 <- matrix(c(1.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,  
1.00, -0.20, -0.64, 0.26, 0.00, 0.00, -0.20, 1.04, -0.17,  
-0.10, 0.00, 0.00, -0.64, -0.17, 1.50, -0.65, 0.00, 0.00,  
0.26, -0.10, -0.65, 1.32, 0.00, 0.00, 0.00, 0.00, 0.00,  
0.00, 1.00), 6, 6)  
m4 <- c(12, 9, 8, 5, 4 ,2)  
S4 <- diag(c(1,1,1,1,1,1))  
data <- matrix(0, 40, 6)  
data[1:10,] <- rmvnorm(10, m1, S1)  
data[11:20,] <- rmvnorm(10, m2, S2)  
data[21:30,] <- rmvnorm(10, m3, S3)  
data[31:40,] <- rmvnorm(10, m4, S4)  
clus <- longclustEM(data, 3, 5, linearMeans=TRUE)  
summary(clus)
```

Index

`longclust` (`longclust-package`), [2](#)

`longclust-package`, [2](#)

`longclustEM`, [2](#), [2](#)

`plot.longclust`, [4](#)

`print.longclust`, [5](#)

`summary.longclust`, [6](#)