Package ‘fad’

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Type Package

Title Factor Analysis for Data

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Description Compute maximum likelihood estimators of parameters in a Gaussian factor model using the matrix-free methodology described in Dai et al. (2020) <doi:10.1080/10618600.2019.1704296>. In contrast to the factanal() function from 'stats' package, fad() can handle high-dimensional datasets where number of variables exceed the sample size and is also substantially faster than the EM algorithms.

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URL https://github.com/somakd/fad

BugReports https://github.com/somakd/fad/issues

Encoding UTF-8

Depends R (>= 3.0.2), methods, RSpectra (>= 0.16-0)

Imports Matrix (>= 1.1-0), Rcpp (>= 0.11.5)

LinkingTo Rcpp, RSpectra, RcppEigen

LazyData true

NeedsCompilation yes

Suggests knitr

VignetteBuilder knitr

RoxygenNote 7.1.1

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Factor Analysis for data (high or low dimensional).

Description

Perform fast matrix-free maximum-likelihood factor analysis on a covariance matrix or data matrix, works if number of variables is more than number of observations.

Usage

fad(
  x,
  factors,
  data = NULL,
  covmat = NULL,
  n.obs = NA,
  subset,
  na.action,
  start = NULL,
  scores = c("none", "regression", "Bartlett"),
  rotation = "varimax",
  control = NULL,
  lower = 0.005,
  ...
)

Arguments

x A formula or a numeric matrix or an object that can be coerced to a numeric matrix.
f actors The number of factors to be fitted.
data An optional data frame (or similar: see model.frame), used only if x is a formula. By default the variables are taken from environment(formula).
cov mat A covariance matrix, or a covariance list as returned by cov.wt. Of course, correlation matrices are covariance matrices.
n.obs The number of observations, used if covmat is a covariance matrix.
subset A specification of the cases to be used, if x is used as a matrix or formula.
na.action The na.action to be used if x is used as a formula.
start

NULL or a matrix of starting values, each column giving an initial set of uniquenesses.

scores

Type of scores to produce, if any. The default is none, "regression" gives Thompson's scores, "Bartlett" given Bartlett's weighted least-squares scores. Partial matching allows these names to be abbreviated. Also note that some of the scores-types are not applicable when \( p > n \).

rotation

character. "none" or the name of a function to be used to rotate the factors: it will be called with first argument the loadings matrix, and should return a list with component loadings giving the rotated loadings, or just the rotated loadings. The options included in the package are: varimax, promax, quartimax, equamax.

control

A list of control values:

nstart The number of starting values to be tried if start = NULL. Default 1.

trace logical. Output tracing information? Default FALSE.

opt A list of control values to be passed to optim's control argument.

rotate a list of additional arguments for the rotation function.

lower The lower bound for uniquenesses during optimization. Should be > 0. Default 0.005.

Components of control can also be supplied as named arguments to fad.

Value

An object of class "fad" with components

loadings A matrix of loadings, one column for each factor. The factors are ordered in decreasing order of sums of squares of loadings, and given the sign that will make the sum of the loadings positive. This is of class "loadings"

uniquenesses The uniquenesses computed.

criteria The results of the optimization: the value of the criterion (a linear function of the negative log-likelihood) and information on the iterations used.

factors The argument factors.

dof The number of degrees of freedom of the factor analysis model.

method The method: always "mle".

rotmat The rotation matrix if relevant.

scores If requested, a matrix of scores. napredict is applied to handle the treatment of values omitted by the na.action.

n.obs The number of observations if available, or NA.

call The matched call.

na.action If relevant.

loglik, BIC The maximum log-likelihood and the Bayesian Information Criteria.

See Also

factanal
Examples

```r
set.seed(1234)

## Simulate a 200 x 3 loadings matrix ~i.i.d N(0,1)
L <- matrix(rnorm(200*3),200,3)

## Simulate the uniquenesses i.i.d U(0.2,0.9)
D <- runif(200,0.2,0.9)

## Generate a data matrix of size 50 x 200 with rows ~i.i.d.
## N(0,LL'+diag(D))
X <- tcrossprod(matrix(rnorm(50*3),50,3),L) + matrix(rnorm(50*200),50,200) %*% diag(sqrt(D))

## Fit a factor model with 3 factors:
fit = fad(X,3)

## Print the loadings:
print(fit$loadings)
```

print.fad

Print the Output of Factor Analysis

Description

Prints the output of the fad.

Usage

```r
## S3 method for class 'fad'
print(x, digits = 3, ...)
```

Arguments

- `x`: an object of class fad.
- `digits`: number of decimal places to use in printing uniquenesses and loadings.
- `...`: further arguments to print.

Value

None.
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