Package ‘fanc’

March 27, 2015

Type Package
Title Penalized Likelihood Factor Analysis via Nonconvex Penalty
Version 1.23
Date 2015-03-18
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Depends Matrix
Suggests RGtk2, tcltk, matlab
Description An R package “fanc” computes the penalized maximum
likelihood estimates of factor loadings and unique variances
for various tuning parameters. The pathwise coordinate descent
along with EM algorithm is used. This package also includes a
new graphical tool which outputs path diagram, goodness-of-fit
indices and model selection criteria for each regularization
parameter. The user can change the regularization parameter by
manipulating scrollbars, which is helpful to find a suitable
value of regularization parameter.
License GPL (>= 2)
URL http://link.springer.com/article/10.1007%2Fs11222-014-9458-0,
http://www.sciencedirect.com/science/article/pii/S0167947314001510,
http://www.keihirose.com
Repository CRAN
Date/Publication 2015-03-27 17:18:56
NeedsCompilation yes

R topics documented:

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Description

This package computes the solution path of penalized maximum likelihood estimates via MC+ penalties.

Usage

fanc(x, factors, n.obs, cor.factor=FALSE, normalize = TRUE, rho.max, covmat, control=list())

Arguments

x A data matrix.
factors The number of factors.
cor.factor An indicator of the factor correlation. If "TRUE", the factor correlation is considered. Default is "FALSE".
normalize If "TRUE", each variable is normalized, otherwise it is left alone.
rho.max Maximum value of rho.
covmat A covariance matrix, which is needed if the data matrix "x" is not available.
n.obs The number of observations, which is needed to calculate the model selection criteria and goodness-of-fit indices when the data matrix "x" is not available.
control A list of control parameters. See 'Details'.

Details

The control argument is a list that can supply any of the following components:

length.rho Candidates of tuning parameters which is used for grid search of reparametrization of MC+.
length.gamma A length of tuning parameter which controls sparsenesses. For each rho, gamma=Inf yields soft threshold operator (i.e., lasso penalty) and gamma=+1 produces hard threshold operator.
max.gamma A maximum value of gamma (excludes Inf.).
min.gamma A minimum value of gamma.
eta A tuning parameter used for preventing the occurrence of improper solutions. eta must be non-negative.
ncand.initial The number of candidates of initial values of factor loadings.
maxit.em A maximum number of iterations for EM algorithm.
maxit.cd  A maximum number of iterations for coordinate descent algorithm.
maxit.bfgs  A maximum number of iterations for BFGS algorithm used in the update of factor
correlation.
maxit.initial A maximum number of iterations for choosing the initial values.
start  Type of start. If "cold", the initial value of factor loadings is randomly chosen for each
tuning parameter, which can be slow.
Delta  A proportion of maximum value of rho to minimum value of rho, i.e., rho.min=Delta*rho.max.
min.uniquevar  A minimum value of unique variances.
tol.em  A positive scalar giving the tolerance at which the parameter in EM is considered close
enough to zero to terminate the algorithm.
tol.cd  A positive scalar giving the tolerance at which the factor loadings in coordinate descent is
considered close enough to zero to terminate the algorithm.
tol.bfgs  A positive scalar giving the tolerance at which the factor correlation in BFGS algorithm
is considered close enough to zero to terminate the algorithm.
min.rhozero  If "TRUE", the minimum value of "rho" is zero.
zita  A value of hyper-parameter of factor correlation.
progress  If "TRUE", the progress for each tuning parameter is displayed.
opernp  If "TRUE", the parallel computation via OpenMP is executed.
um.threads  The number of threads of the openmp. Only used when openmp is "TRUE",
gamma.ebic  The value of gamma used in the extended BIC

Value

loadings  factor loadings
uniquenesses  unique variances
Phi  factor correlation
rho  rho
AIC  AIC
BIC  BIC
CAIC  CAIC
df  degrees of freedom (number of non-zero parameters for the lasso estimation)
criteria  values of AIC, BIC and CAIC
goodness.of.fit  values of GFI and AGFI
gamma  a value of gamma
Npflag  If the number of observation is larger than the number of variables, 1, otherwise
0.
factors  the number of factors
cor.factor  An indicator of the factor correlation
x  data matrix
convergence  indicator of convergence of EM algorithm, coordinate descent and BFGS. If all
of these variables are 0, the algorithm has been converged
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References

See Also
out and plot.fanc objects.

Examples
# generate data
set.seed(0)
loadings0 <- matrix(c(rep(0.8,5),rep(0.5),rep(0.5),rep(0.8,5)),10,2)
common.factors0 <- matrix(rnorm(50*2),50,2)
unique.factors0 <- matrix(rnorm(50*10, sd=sqrt(0.36)),50,10)
x <- common.factors0 %*% t(loadings0) + unique.factors0

# fit data
fit <- fanc(x,2)
fit2 <- fanc(x,2,cor.factor=TRUE) # factor correlation is estimated

# print candidates of gamma and rho
print(fit)

# output for fixed tuning parameters
out(fit, rho=0.1, gamma=Inf)

# select a model via model selection criterion
select(fit, criterion="BIC", gamma=Inf)

# plot solution path
# plot(fit)

out
output from a "fanc" object for fixed value of gamma.

Description
This functions give us the loadings from a "fanc" object for fixed value of gamma.

Usage
out(x, rho, gamma, scores=FALSE, df.method="reparametrization")
Arguments

- **x**: Fitted "fanc" model object.
- **gamma**: The value of gamma.
- **rho**: The value of rho.
- **scores**: Logical flag for outputting the factor scores. Default is FALSE.
- **df.method**: Two types of degrees of freedom are supported. If "reparametrization", the degrees of freedom of the MC+ are reparametrized based on the degrees of freedom of the lasso. If "active", the degrees of freedom of are the number of nonzero parameters.

Value

- **loadings**: factor loadings
- **uniquenesses**: unique variances
- **Phi**: factor correlation
- **scores**: factor scores
- **df**: degrees of freedom (number of non-zero parameters for the lasso estimation)
- **criteria**: values of AIC, BIC and CAIC
- **goodness.of.fit**: values of GFI and AGFI
- **rho**: a value of rho
- **gamma**: a value of gamma

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References


See Also

fanc and plot.fanc objects.
plot.fanc

plot the solution path from a "fanc" object.

Description

This function plots the solution paths from a "fanc" object for fixed value of gamma.

Usage

```r
## S3 method for class 'fanc'
plot(x, Window.Height=500, type=NULL, df.method="reparametrization", ...)
```

Arguments

- `x`: Fitted "fanc" model object.
- `Window.Height`: A window height. The default is 500.
- `type`: Two plot types are supported. If "path", the path diagram is depicted. If "heatmap", the heatmap is depicted.
- `df.method`: Two types of degrees of freedom are supported. If "reparametrization", the degrees of freedom of the MC+ are reparametrized based on the degrees of freedom of the lasso. If "active", the degrees of freedom of are the number of nonzero parameters.
- `...`: Other graphical parameters to plot

Value

 NULL

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References


See Also

fanc and out objects.
**select**  
*select from a "fanc" object for fixed value of gamma.*

**Description**

This function gives us the loadings from a "fanc" object for fixed value of gamma.

**Usage**

```r
select(x, criterion=c("BIC","AIC","CAIC","EBIC"),
       gamma, scores=FALSE, df.method="active")
```

**Arguments**

- **x**: Fitted "fanc" model object.
- **criterion**: The criterion by which to select the tuning parameter rho. One of "AIC", "BIC", "CAIC", or "EBIC". Default is "BIC".
- **gamma**: The value of gamma.
- **scores**: Logical flag for outputting the factor scores. Default is FALSE.
- **df.method**: Two types of degrees of freedom are supported. If "active", the degrees of freedom are the number of nonzero parameters. If "reparametrization", the degrees of freedom of the MC+ are reparametrized based on the degrees of freedom of the lasso.

**Value**

- **loadings**: factor loadings
- **uniquenesses**: unique variances
- **Phi**: factor correlation
- **scores**: factor scores
- **df**: degrees of freedom (number of non-zero parameters for the lasso estimation)
- **criteria**: values of AIC, BIC and CAIC
- **goodness.of.fit**: values of GFI and AGFI
- **rho**: a value of rho
- **gamma**: a value of gamma

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See Also

fanc and plot.fanc objects.
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