Package ‘fanc’

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Title Penalized Likelihood Factor Analysis via Nonconvex Penalty
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Depends Matrix
Suggests ellipse, tcltk
Description 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.
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fanc (penalized maximum likelihood factor analysis via nonconvex penalties)

Description

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

Usage

fanc(x, factors, n.obs, rho, gamma, cor.factor=FALSE, normalize=TRUE,
       normalize.penalty=FALSE, covmat, type="MC", 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 con-
sidered. Default is "FALSE".
normalize         If "TRUE", each variable is normalized, otherwise it is left alone.
normalize.penalty If "TRUE", the penalty term for each variable has a weight so that the loading
                    matrix is normalized.
rho               The values of rho. It can be a scalar or a matrix.
gamma             The values of gamma. It must be a vector.
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.
type              Type of penalty. If "MC", the MC penalty is used. If "prenet", the prenet
                    penalty is used. Default is "MC".
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 op-
                   erator.
max.rho           Maximum value of rho.
max.gamma         A maximum value of gamma (excludes Inf.).
\texttt{fanc}

\begin{itemize}
\item \texttt{min.gamma} A minimum value of gamma.
\item \texttt{eta} A tuning parameter used for preventing the occurrence of improper solutions. eta must be non-negative.
\item \texttt{ncand.initial} The number of candidates of initial values of factor loadings.
\item \texttt{ncand.initial.prenet} The number of candidates of initial values for prenet penalty. Because the prenet penalty is unstable when rho is large, \texttt{ncand.initial.prenet} must be large. Default is 1000.
\item \texttt{maxit.em} A maximum number of iterations for EM algorithm.
\item \texttt{maxit.cd} A maximum number of iterations for coordinate descent algorithm.
\item \texttt{maxit.bfgs} A maximum number of iterations for BFGS algorithm used in the update of factor correlation.
\item \texttt{maxit.initial} A maximum number of iterations for choosing the initial values.
\item \texttt{start} Type of start. If "cold", the initial value of factor loadings is randomly chosen for each tuning parameter, which can be slow.
\item \texttt{Delta} A proportion of maximum value of rho to minimum value of rho, i.e., \texttt{rho.min=Delta*rho.max}.
\item \texttt{min.uniquevar} A minimum value of unique variances.
\item \texttt{tol.em} A positive scalar giving the tolerance at which the parameter in EM is considered close enough to zero to terminate the algorithm.
\item \texttt{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.
\item \texttt{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.
\item \texttt{min.rhozero} If "TRUE", the minimum value of "rho" is zero.
\item \texttt{zita} A value of hyper-parameter of factor correlation.
\item \texttt{progress} If "TRUE", the progress for each tuning parameter is displayed.
\item \texttt{openmp} If "TRUE", the parallel computation via OpenMP is executed.
\item \texttt{num.threads} The number of threads of the openmp. Only used when openmp is "TRUE".
\item \texttt{gamma.ebic} The value of gamma used in the extended BIC
\end{itemize}

\textbf{Value}

- \texttt{loadings} factor loadings
- \texttt{uniquenesses} unique variances
- \texttt{Phi} factor correlation
- \texttt{rho} rho
- \texttt{AIC} AIC
- \texttt{BIC} BIC
- \texttt{CAIC} CAIC
- \texttt{df} degrees of freedom (number of non-zero parameters for the lasso estimation)
- \texttt{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)
Description

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

Usage

gammaL scores=falseL dfNmethod=BactiveBI

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 free-
dom 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

factor analysis model,
Statistics and Computing, in press
See Also

fanc and plot.fanc objects.

plot.fanc

plot the solution path from a "fanc" object.

Description

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

Usage

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

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 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

```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
- **uniquennesses**: 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.
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