Package 'dbMC'

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Title Confidence Interval for Matrix Completion via De-Biased Estimator

Version 1.0.0

Description Implements the de-biased estimator for low-rank matrix completion and provides confidence intervals for entries of interest. See: by Chen et al. (2019) <doi:10.1073/pnas.1910053116>, Mai (2021) <doi:10.48550/arXiv.2103.11749>.

Imports softImpute

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Encoding UTF-8

RoxygenNote 7.1.1

Suggests rmarkdown, knitr

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

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Contents

CI_mc *compute the confidence intervals (CIs) from the de-biased estimator*

Description

This function returns a CI for an entries of interest with a significant level alpha

Usage

```
CI_mc(i, j, alpha = 0.05, missfrac, X.db, est_rank, sigma2 = 1)
```

Arguments

i	the row index of the interest entry X_i,j
j	the row index of the interest entry X_i,j
alpha	confidence level, default is 0.05
missfrac	the missing proportion in the underlying matrix. It is the total of missing entries over total entries.
X.db	the de-biased estimated matrix from the 'dbmc' function.
est_rank	the (estimated) low-rank of the underlying matrix or the rank of the de-biased estimator.
sigma2	the noise-variance level.

Value

CI confidence interval.

(i,j) the location of the entry at i-th row and j-th column.

v.ij the estimated variance of the limiting Gaussian distribution.

References

Chen et al (2019). Inference and uncertainty quantification for noisy matrix completion. PNAS, 116(46), 22931-22937.

dbmc *de-biased estimator*

Description

de-biased low-rank matrix completion estimator

This function compute a de-biased estimator from a rank-r matrix completion using the algorithms from the package "softImpute".

Usage

```
dbmc(x, ximp, entries_miss, est_rank)
```

Arguments

x	the initial matrix with missing entries
ximp	an imputed matrix, output from the package "softImpute".
entries_miss	the missing indices
est_rank	the rank of the matrix x, or the estimated rank from the package "softImpute".

Value

x.db the de-baised estimation matrix.

References

Chen et al (2019). Inference and uncertainty quantification for noisy matrix completion. PNAS, 116(46), 22931-22937.

Examples

```
# simulated data
require(softImpute)
n = 100
p = 100
J = 2  # the true low-rank
np = n*p
sig2 = 1
missfrac = 0.5
# xtrue is the underlying matrix that we do not know and want to recover it
xtrue = matrix(rnorm(n*J),n,J)%*%matrix(rnorm(J*p),J,p)
# generating missing entries locations
imiss = sample(np,np*missfrac,replace=FALSE)
# xna is the observed matrix with missing entries
xna = xtrue + matrix(rnorm(np, sd = sig2),nr = n,nc = p)
xna[imiss] = NA
lamda = 2.5*sig2*sqrt(n*p)
```

```
# note that we only have xna as our initial data
# first, fit a softImpute method
fit1 = softImpute(xna, type = 'als')
# complete the matrix by a softImpute method
ximp = complete(xna,fit1)
mean((ximp - xtrue)^2);rankMatrix(ximp,.1)[1]
# now, de-biased the softImpute method
x.db = dbmc(x = xna,
            ximp = ximp,
            entries_miss = imiss,
            est_rank = 2)
mean((x.db - xtrue)^2);rankMatrix(x.db,.1)[1]
```

P_Omega *projection onto observation set*

Description

This function returns a matrix where the missing entries are replaced by 0 s.

Usage

```
P_Omega(a, entri)
```

Arguments

a	a matrix.
entri	missing entries location.

Value

Return a matrix whose its missing entries are replaced by 0 s.

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