Package ‘admmDensestSubmatrix’

October 31, 2019

Type Package

Title Alternating Direction Method of Multipliers to Solve Dense Dubmatrix Problem

Version 0.1.0

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Description Solves the problem of identifying the densest submatrix in a given or sampled binary matrix, Bombina et al. (2019) [arXiv:1904.03272].

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Depends R (>= 3.5.0)

Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Suggests knitr, rmarkdown

VignetteBuilder knitr

Imports Rdpack, utils, stats

RdMacros Rdpack

NeedsCompilation no

Repository CRAN

Date/Publication 2019-10-31 16:20:02 UTC

R topics documented:

densub .................................................... 2
mat_shrink ................................................ 3
plantedsubmatrix ....................................... 3

Index 5
Description

Iteratively solves the convex optimization problem using ADMM.

Usage

densub(G, m, n, tau = 0.35, gamma = 6/(sqrt(m * n) * (q - p)),
    opt_tol = 1e-04, maxiter, quiet = TRUE)

Arguments

- **G**: sampled binary matrix
- **m**: number of rows in dense submatrix
- **n**: number of columns in dense submatrix
- **tau**: penalty parameter for equality constraint violation
- **gamma**: $l_1$ regularization parameter
- **opt_tol**: stopping tolerance in algorithm
- **maxiter**: maximum number of iterations of the algorithm to run
- **quiet**: toggles between displaying intermediate statistics

Details

\[
\min |X|_* + \gamma |Y|_1 + 1_{\Omega(W)}(W) + 1_{\Omega(Q)}(Q) + 1_{\Omega(Z)}(Z)
\]

s.t. $X - Y = 0, X = W, X = Z$,

where $\Omega(W), \Omega(Q), \Omega(Z)$ are the sets: $\Omega(W) = \text{Win} \mathbb{R}^{M \times N}|e^T We = mn$

$\Omega(Q) = \text{Qin} \mathbb{R}^{M \times N}|\text{ProjectionofQonnotN} = 0$

$\Omega(Z) = \text{Zin} \mathbb{R}^{M \times N}|Z_{i,j} <= 1\forall(i,j)\text{in} M \times N$

$1_S$ is the indicator function of the set $S$ in $\mathbb{R}^{M \times N}$ such that $1_S(X) = 0$ if $X$ in $S$ and +infinity otherwise

Value

Rank one matrix with $mn$ nonzero entries, matrix $Y$ that is used to count the number of disagreements between $G$ and $X$
\textit{mat\_shrink} \quad \textit{Soft thresholding operator.}

\textbf{Description}

Applies the shrinkage operator for singular value thresholding.

\textbf{Usage}

\texttt{mat\_shrink(K, \tau)}

\textbf{Arguments}

\begin{itemize}
  \item \texttt{K} \quad \text{matrix}
  \item \texttt{\tau} \quad \text{regularization parameter}
\end{itemize}

\textbf{Value}

Matrix

\textbf{Examples}

\texttt{mat\_shrink(matrix(c(1,0,0,0,1,1,1,1,1), nrow=3, ncol=3, byrow=TRUE),0.35)}

\textit{plantedsubmatrix} \quad \textit{Sample matrix}

\textbf{Description}

Generates binary \((M, N)\) - matrix sampled from dense \((m, n)\) - submatrix.

\textbf{Usage}

\texttt{plantedsubmatrix(M, N, m, n, p, q)}

\textbf{Arguments}

\begin{itemize}
  \item \texttt{M} \quad \text{number of rows in sampled matrix}
  \item \texttt{N} \quad \text{number of rows in sampled matrix}
  \item \texttt{m} \quad \text{number of rows in dense submatrix}
  \item \texttt{n} \quad \text{natural number used to calculate number of rows in dense submatrix}
  \item \texttt{p} \quad \text{density outside planted submatrix}
  \item \texttt{q} \quad \text{density inside planted submatrix}
\end{itemize}
Details

Let $U^*$ and $V^*$ be $m$ and $n$ index sets. For each $i$ in $U^*$, $j$ in $V^*$ we let $a_{ij} = 1$ with probability $q$ and 0 otherwise. For each remaining $ij$ we set $a_{ij} = 1$ with probability $p < q$ and take $a_{ij} = 0$ otherwise.

Value

Matrix $G$ sampled from the planted dense $(mn)$-submatrix model, dense sumbatrix $X_0$, matrix $Y_0$ used to count the number of disagreements between $G$ and $X_0$

Examples

plantedsubmatrix(10,10,1,2,0.25,0.75)
Index

densub, 2
mat_shrink, 3
plantedsubmatrix, 3