Package ‘sparsesvd’

Title Sparse Truncated Singular Value Decomposition (from 'SVDLIBC')
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Description Wrapper around the 'SVDLIBC' library for (truncated) singular value decomposition of a sparse matrix.
Currently, only sparse real matrices in Matrix package format are supported.
Depends R (>= 3.0)
Imports Matrix, methods
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URL http://tedlab.mit.edu/~dr/SVDLIBC/, http://wordspace.rforge.r-project.org/
NeedsCompilation yes
LazyData true
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sparsesvd

Singular Value Decomposition of a Sparse Matrix.

Description

Compute the (usually truncated) singular value decomposition (SVD) of a sparse real matrix. This function is a shallow wrapper around the SVDLIBC implementation of Berry’s (1992) single Lanczos algorithm.

Usage

\[
\text{sparsesvd}(M, \text{rank}=0L, \text{tol}=1e^{-15}, \text{kappa}=1e^{-6})
\]

Arguments

- \(M\): a sparse real matrix in \text{Matrix} package format. The preferred format is a \text{dgCMatrix} and other storage formats will automatically be converted if possible.
- \(\text{rank}\): an integer specifying the desired number of singular components, i.e. the rank of the truncated SVD. Specify 0 to return all singular values of magnitude larger than \(\text{tol}\) (default).
- \(\text{tol}\): exclude singular values whose magnitude is smaller than \(\text{tol}\).
- \(\text{kappa}\): accuracy parameter \(\kappa\) of the SVD algorithm (with SVDLIBC default).

Value

The truncated SVD decomposition

\[
M_r = U_r D_r V_r^T
\]

where \(M_r\) is the optimal rank \(r\) approximation of \(M\). Note that \(r\) may be smaller than the requested number \(\text{rank}\) of singular components.

The returned value is a list with components

- \(d\): a vector containing the first \(r\) singular values of \(M\)
- \(u\): a column matrix of the first \(r\) left singular vectors of \(M\)
- \(v\): a column matrix of the first \(r\) right singular vectors of \(M\)

References

http://tedlab.mit.edu/~dr/SVDLIBC/


See Also

\text{svd, sparseMatrix}
Examples

```r
M <- rbind(
  c(20, 10, 15, 0, 2),
  c(10, 5, 8, 1, 0),
  c(0, 1, 2, 6, 3),
  c(1, 0, 0, 10, 5))
M <- Matrix::Matrix(M, sparse=TRUE)
print(M)

res <- sparsesvd(M, rank=2L) # compute first 2 singular components
print(res, digits=3)

M2 <- res$u %*% diag(res$d) %*% t(res$v) # rank-2 approximation
print(M2, digits=1)

print(as.matrix(M) - M2, digits=2) # approximation error
```
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