Package 'PowerfulMaxEigenpair'

January 7, 2020

Type Package

Title Powerful Algorithm for Maximal Eigenpair

Version 0.1.1

Date 2020-01-07

Author Yueshuang Li <liyueshuang@mail.bnu.edu.cn> and Xiaojun Mao <maoxj@fudan.edu.cn>

Maintainer Xiaojun Mao <maoxj@fudan.edu.cn>

Description An implementation for using powerful algorithm to compute the maximal eigenpair of Hermitizable tridiagonal matrices in R. It provides two algorithms to find the maximal and the next to maximal eigenpairs under the tridiagonal matrix. Besides, it also provides two auxiliary algorithms to generate tridiagonal matrix and solve the linear equation by Thomas algorithm. Several examples are included in the vignettes to illustrate the usage of the functions.

License MIT + file LICENSE

URL http://github.com/mxjki/PowerfulMaxEigenpair

BugReports http://github.com/mxjki/PowerfulMaxEigenpair/issues

Depends R (>= 3.6.0), stats, formatR

Encoding UTF-8

RoxygenNote 6.1.1

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

Repository CRAN

Date/Publication 2020-01-07 09:30:02 UTC

R topics documented:

`powerful.maxeig.tri` *Tridiagonal matrix maximal eigenpair*

Description

Calculate the maximal eigenpair for the tridiagonal matrix by Thomas algorithm.

Usage

```
powerful.maxeig.tri(a, b, C, digit.thresh = 6)
```

Arguments

`a`	The lower diagonal vector.
`b`	The upper diagonal vector.
`C`	The main diagonal vector.
`digit.thresh`	The precise level of output results.

Value

A list of eigenpair object are returned, with components z, v and $iter$.

`z`	The approximating sequence of the maximal eigenvalue.
`v`	The approximating eigenfunction of the corresponding eigenvector.
`iter`	The number of iterations.

Examples

```
nn = 8
a = c(1:(nn - 1))^2
b = c(1:(nn - 1))^2
C = c(b[1], a[1:(nn - 2)] + b[2:(nn - 1)], a[nn - 1] + nn^2)
powerful.maxeig.tri(a, b, C, digit.thresh = 6)
```

powerful.seceig.tri *Tridiagonal matrix next to the maximal eigenpair*

Description

Calculate the next to maximal eigenpair for the tridiagonal matrix by Thomas algorithm.

Usage

```
powerful.seceig.tri(a, b, digit.thresh = 6)
```

Arguments

a	The lower diagonal vector.
b	The upper diagonal vector.
digit.thresh	The precise level of output results.

Value

A list of eigenpair object are returned, with components z, v and $iter$.

z	The approximating sequence of the maximal eigenvalue.
v	The approximating eigenfunction of the corresponding eigenvector.
iter	The number of iterations.

Examples

```
nn = 8
a = c(1:(nn - 1))^2
b = c(1:(nn - 1))^2
powerful.seceig.tri(a, b, digit.thresh = 6)
```

PowerfulMaxEigenpair *PowerfulMaxEigenpair: A package for computating the maximal eigenpair for a matrix.*

Description

The PowerfulMaxEigenpair package provides some auxillary functions and five categories of important functions: tridiag, thomas.tri.sol, powerful.maxeig.tri and powerful.seceig.tri.

PowerfulMaxEigenpair functions

tridiag: generate tridiagonal matrix Q based on three input vectors.

thomas.tri.sol: construct the solution of linear equation (-Q-zI)w=v.

powerful.maxeig.tri: calculate the maximal eigenpair for the tridiagonal matrix by Thomas algorithm.

powerful.seceig.tri: calculate next to the maximal eigenpair for the tridiagonal matrix by Thomas algorithm.

`thomas.tri.sol` *Solve the linear equation (-Q-zI)w=v.*

Description

Construct the solution of linear equation (-Q-zI)w=v.

Usage

```
thomas.tri.sol(Q, v, z)
```

Arguments

Q	The given tridiagonal matrix.
v	The column vector on the right hand of equation.
z	The Rayleigh shift.

Value

A solution sequence w to the equation (-Q-zI)w=v.

Examples

```
nn = 8
a = c(1:(nn - 1))^2
b = c(1:(nn - 1))^2
C = c(b[1], a[1:(nn - 2)] + b[2:(nn - 1)], a[nn - 1] + nn^2)
Q = tridiag(b, a, -C)
zstart = 6
thomas.tri.sol(Q, z=zstart, v=rep(1,dim(Q)[1]))
```

`tridiag` *Tridiagonal matrix*

Description

Generate tridiagonal matrix Q based on three input vectors.

Usage

```
tridiag(upper, lower, main)
```

Arguments

`upper`	The upper diagonal vector.
`lower`	The lower diagonal vector.
`main`	The main diagonal vector.

Value

A tridiagonal matrix is returned.

Examples

```
a = c(1:7)^2
b = c(1:7)^2
c = -c(1:8)^2
tridiag(b, a, c)
```

Index