Package 'svdvisual'

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Type Package

Title SVD visualization tools

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Depends lattice

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Description Some visualization tools based on Singular Value Decomposition

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svdvisual-package *SVD Visualization Package*

Description

This package provides a full spectrum of many useful visualization tools associated with SVD related methodology.

Details

Package:	svdvisual
Type:	Package
Version:	1.1
Date:	2013-12-15
License:	GPL

Author(s)

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References

Zhang, L., Marron, J.S., Shen, H. and Zhu, Z. (2007) Singular Value Decomposition and Its Visualization, Journal of Computational and Graphical Statistics.

See Also

lattice

columnmean *Column mean matrix*

Description

This function returns the column mean matrix of an input matrix

Usage

```
columnmean(x)
```

Arguments

x	The input matrix. Make sure this is a matrix object

Details

This function calculates the mean of each column within the input matrix. If the matrix has dimension m x n, this function will return a m x n matrix, where each column has the same result, the average of the n elements in the corresponding column in the input matrix.

Value

The column mean matrix

Author(s)

Yao Wang (wang1150@purdue.edu); Lingsong Zhang (lingsong@purdue.edu)

See Also

See Also in svd, apply, rowmean, doublemean, overallmean.

Examples

```
#generate a random matrix
x<-matrix(rnorm(100), nrow=20);

#calculate the column mean matrix
y<-columnmean(x);
y
```

---

doublemean *Double mean matrix*

Description

This function returns the double mean matrix of an input matrix

Usage

```
doublemean(x)
```

Arguments

x	The input matrix. Make sure this is a matrix object

Details

This function calculates the mean of each row, each column and the overall mean within the input matrix. If the matrix has dimension m x n, this function will return a m x n matrix, where each cell is the sum of the row mean and the column mean, subtract by the overall mean.

Let X be the $m \times n$ input matrix, x_{ij} is the i, j cell within it. Let D be the resulting matrix of this program, and d_{ij} as the corresponding cell. Let

$$r_i = \frac{1}{n}\sum_{j=1}^{n} x_{ij}, c_j = \frac{1}{m}\sum_{i=1}^{m} x_{ij}, o = \frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n} x_{ij}.$$

Then

$$d_{ij} = r_i + c_j - o;$$

Value

The double mean matrix

Author(s)

Yao Wang (wang1150@purdue.edu); Lingsong Zhang (lingsong@purdue.edu)

See Also

See Also in svd, apply, columnmean, rowmean, overallmean.

Examples

```
#generate a random matrix
x<-matrix(rnorm(100), nrow=20);

#calculate the row mean matrix
y<-doublemean(x);
y
```

`matrixrank` *Rank of a Matrix*

Description

This function returns the rank of an input matrix

Usage

```
matrixrank(x, tolerance = 1e-08)
```

Arguments

x	The input matrix. Make sure this is a matrix object
tolerance	The tolerance of the numerical zeros. All singular values whose absolute value is smaller than the tolerance will be treated as zero.

Details

This function identifies the singular values, and count the number of such values significant away from 0. The result is the rank of the input matrix.

Value

The rank of the input matrix.

Author(s)

Lingsong Zhang (lingsong@purdue.edu)

See Also

See Also in svd.

Examples

```
#generate a random matrix
x<-matrix(rnorm(100), nrow=20);

#calculate the rank of this matrix
y<-matrixrank(x);
y
```

---

overallmean *Global mean matrix*

Description

This function returns the global mean matrix of an input matrix

Usage

```
overallmean(x)
```

Arguments

x	The input matrix. Make sure this is a matrix object

Details

This function calculates the mean of all cells within the input matrix. If the matrix has dimension m x n, this function will return a m x n matrix, where each cell has the same result, as the average of the mn elements in the corresponding input matrix.

Value

The overall mean matrix

Author(s)

Yao Wang (wang1150@purdue.edu); Lingsong Zhang (lingsong@purdue.edu)

See Also

See Also in svd, apply, columnmean, doublemean, rowmean.

Examples

```
#generate a random matrix
x<-matrix(rnorm(100), nrow=20);

#calculate the row mean matrix
y<-overallmean(x);
y
```

---

rowmean *Row mean matrix*

Description

This function returns the row mean matrix of an input matrix

Usage

```
rowmean(x)
```

Arguments

x	The input matrix. Make sure this is a matrix object

Details

This function calculates the mean of each row within the input matrix. If the matrix has dimension m x n, this function will return a m x n matrix, where each row has the same result, and the average of the n elements in the corresponding row in the input matrix.

Value

The row mean matrix

Author(s)

Yao Wang (wang1150@purdue.edu); Lingsong Zhang (lingsong@purdue.edu)

See Also

See Also in svd, apply, columnmean, doublemean, overallmean.

Examples

```
#generate a random matrix
x<-matrix(rnorm(100), nrow=20);

#calculate the row mean matrix
y<-rowmean(x);
y
```

---

svd3dplot *The SVD three dimensional plots: surface plot and/or image plot for SVD decomposition*

Description

This function provides surface or image plot for singular value decomposition method. The plot includes several subplots for the following components: original data, cumulative approximation matrix, residual matrix, and several rank 1 SVD components.

Usage

```
svd3dplot(data, ncomp = 3, irow=F, icol=F, isurface = T, iimage = F,
      xlab = "Column", ylab = "Row", zlab = "", ...)
```

Arguments

data	The input data matrix
ncomp	The number of components to calculate. The default value is 3. If the specified number is larger than the rank of the matrix, this option will automatically be set to the rank of the matrix minus one. When either irow and icol is specified as TRUE, the output will include a mean matrix, and ncomp-1 SVD component of the demeaned matrix.
irow	a logical number. If irow and icol both are TRUE, this program will calculate a doublemean. The resulting SVD will be based on the demeaned matrix (i.e., removing the double mean). If only irow is TRUE, this program will calculate a rowmean, and the resulting SVD will be based on the corresponding demeaned matrix (i.e., removing the row mean).

icol	a logical number. If irow and icol both are TRUE, this program will calculate a doublemean. The resulting SVD will be based on the demeaned matrix (i.e., removing the double mean). If only icol is TRUE, this program will calculate a columnmean, and the resulting SVD will be based on the corresponding demeaned matrix (i.e., removing the column mean).
isurface	Whether the surface plot will be generated. The default value is TRUE.
iimage	Whether the image plot will be generated. The default value is FALSE.
xlab	The xlab option for the plots. The default value is Column.
ylab	The ylab option for the plots. The default value is Row.
zlab	The zlab option for the plots. The default value is empty.
...	other related ploting options for wireframe or levelplot in the trellis plot.

Value

The code will generate either a surface plot or an image plot for the individual SVD components, the original data, the approximation data and the residual data.

Author(s)

Lingsong Zhang (lingsong@purdue.edu)

References

See detailed explanation of this visualizaiton in \ Zhang, L., Marron, J. S., Shen, H. and Zhu, Z. (2007), Singular Value Decomposition and Its Visualization, Journal of Computational and Graphical Statistics.

See Also

See Also as svd, wireframe, and levelplot.

Examples

```
#generate a random sample
#generate a random matrix
x<-matrix(rnorm(100), nrow=20);

#generate a surface plot
svd3dplot(x);

#generate an image plot
svd3dplot(x, iimage=TRUE);
```

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