Package ‘R1magic’

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Type Package

Title Compressive Sampling: Sparse signal recovery utilities

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Depends stats

Description Provides miminization routines and related utilities for compressive sampling. l-1, l-2 and TV (1-D) minimization, DFT basis matrix, sparse signal generator and examples.

License GPL (>= 3)

LazyLoad yes

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Author(s)

Mehmet Suzen Maintainer: Mehmet Suzen <mehmet.suzen@physics.org>

References

Emmanuel Candes, Justin Romberg, and Terence Tao, Robust uncertainty principles: Exact signal reconstruction from highly incomplete frequency information. (IEEE Trans. on Information Theory, 52(2) pp. 489 - 509, February 2006)

Emmanuel Candes and Justin Romberg, Quantitative robust uncertainty principles and optimally sparse decompositions. (Foundations of Comput. Math., 6(2), pp. 227 - 254, April 2006)

David Donoho, Compressed sensing. (IEEE Trans. on Information Theory, 52(4), pp. 1289 - 1306, April 2006)

Examples

```
CompareL1_L2_TV1(100,10,0.1);
```

CompareL1_L2_TV1 — *Compare L1, L2 and TV on a sparse signal.*

Description

Compare L1, L2 and TV on a sparse signal.

Usage

```
CompareL1_L2_TV1(N, M, per)
```

Arguments

`N`	Size of the sparse signal to generate , integer.
`M`	Number of measurements.
`per`	Percentage of spikes.

Author(s)

Mehmet Suzen

DFTMatrix0 — *Generate Discrete Fourier Transform Matrix using DFTMatrixPlain.*

Description

Generate Discrete Fourier Transform Matrix (NxN).

Usage

```
DFTMatrix0(N)
```

Arguments

`N`	Integer value determines the dimension of the square matrix.

Value

It returns a NxN square matrix.

Author(s)

Mehmet Suzen

See Also

DFTMatrixPlain

Examples

```
DFTMatrix0(2)
```

`DFTMatrixPlain` *Generate Plain Discrete Fourier Transform Matrix without the coefficient*

Description

Generate plain Discrete Fourier Transform Matrix (NxN) without a coefficient.

Usage

```
DFTMatrixPlain(N)
```

Arguments

`N`	Integer value defines the dimension of the square plain DFT matrix.

Value

It returns a NxN square matrix.

Author(s)

Mehmet Suzen

Examples

```
DFTMatrixPlain(2)
```

`GaussianMatrix` *Generate Gaussian Random Matrix*

Description

Generate Gaussian Random Matrix (zero mean and standard deviation one.)

Usage

```
GaussianMatrix(N, M)
```

Arguments

`N`	Integer value determines number of rows.
`M`	Integer value determines number of columns.

Value

Returns MxN matrix.

Author(s)

Mehmet Suzen

Examples

```
GaussianMatrix(3,2)
```

`objective1TV` *1-D Total Variation Penalized Objective Function*

Description

1-D Total Variation Penalized Objective Function

Usage

```
objective1TV(x, T, phi, y, lambda)
```

Arguments

`x`	Initial value of the vector to be recovered. Sparse representation of the vector (N x 1 matrix) X=Tx, where X is the original vector
`T`	sparsity bases (N x N matrix)
`phi`	Measurement matrix (M x N).
`y`	Measurement vector (Mx1).
`lambda`	Penalty coefficient.

Value

Returns a vector.

Author(s)

Mehmet Suzen

`objectiveL1` *L-1 Penalized Objective Function*

Description

L-1 Penalized Objective Function

Usage

```
objectiveL1(x, T, phi, y, lambda)
```

Arguments

`x`	Initial value of the vector to be recovered. Sparse representation of the vector (N x 1 matrix) X=Tx, where X is the original vector
`T`	sparsity bases (N x N matrix)
`phi`	Measurement matrix (M x N).
`y`	Measurement vector (Mx1).
`lambda`	Penalty coefficient.

Value

Returns a vector

Author(s)

Mehmet Suzen

References

Emmanuel Candes, Justin Romberg, and Terence Tao, Robust uncertainty principles: Exact signal reconstruction from highly incomplete frequency information. (IEEE Trans. on Information Theory, 52(2) pp. 489 - 509, February 2006)

`objectiveL2` *L-2 Penalized Objective Function*

Description

L-2 Penalized Objective Function

Usage

```
objectiveL2(x, T, phi, y, lambda)
```

Arguments

`x`	Initial value of the vector to be recovered. Sparse representation of the vector (N x 1 matrix) X=Tx, where X is the original vector
`T`	sparsity bases (N x N matrix)
`phi`	Measurement matrix (M x N).
`y`	Measurement vector (Mx1).
`lambda`	Penalty coefficient.

Value

Returns a vector.

Author(s)

Mehmet Suzen

References

Emmanuel Candes, Justin Romberg, and Terence Tao, Robust uncertainty principles: Exact signal reconstruction from highly incomplete frequency information. (IEEE Trans. on Information Theory, 52(2) pp. 489 - 509, February 2006)

`oo` *Frequency expression for DFT*

Description

Frequency expression for DFT

Usage

```
oo(p, omega)
```

Arguments

p	Exponent
omega	Omega expression for DFT

Author(s)

Mehmet Suzen

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solve1TV — *1-D Total Variation Penalized Nonlinear Minimization*

Description

1-D Total Variation Penalized Nonlinear Minimization

Usage

```
solve1TV(phi,y,T,x0,lambda=0.1)
```

Arguments

x0	Initial value of the vector to be recovered. Sparse representation of the vector (N x 1 matrix) X=Tx, where X is the original vector
T	sparsity bases (N x N matrix)
phi	Measurement matrix (M x N).
y	Measurement vector (Mx1).
lambda	Penalty coefficient. Defaults 0.1

Value

Returns nlm object.

Author(s)

Mehmet Suzen

solveL1 — *l1 Penalized Nonlinear Minimization*

Description

l1 Penalized Nonlinear Minimization

Usage

```
solveL1(phi,y,T,x0,lambda=0.1)
```

Arguments

`x0`	Initial value of the vector to be recovered. Sparse representation of the vector (N x 1 matrix) X=Tx, where X is the original vector
`T`	sparsity bases (N x N matrix)
`phi`	Measurement matrix (M x N).
`y`	Measurement vector (Mx1).
`lambda`	Penalty coefficient. Defaults 0.1

Value

Returns nlm object.

Author(s)

Mehmet Suzen

solveL2 — *l2 Penalized Nonlinear Minimization*

Description

l2 Penalized Nonlinear Minimization

Usage

```
solveL2(phi,y,T,x0,lambda=0.1)
```

Arguments

`x0`	Initial value of the vector to be recovered. Sparse representation of the vector (N x 1 matrix) X=Tx, where X is the original vector
`T`	sparsity bases (N x N matrix)
`phi`	Measurement matrix (M x N).
`y`	Measurement vector (Mx1).
`lambda`	Penalty coefficient. Defaults 0.1

Value

Returns nlm object.

Author(s)

Mehmet Suzen

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sparseSignal *Sparse digital signal Generator.*

Description

Sparse digital signal Generator with given thresholds.

Usage

```
sparseSignal(N, s, b = 1, delta = 1e-07, nlev = 0.05, slev = 0.9)
```

Arguments

N	Number of signal components, vector size.
s	Number of spikes, significatn components
b	Signal bandwidth, defaults 1.
delta	Length of discrete distances among components, defaults 1e-7.
nlev	Maximum value of insignificant component, relative to b, defaults to 0.05
slev	Maximum value of significant component, relative to b, defaults to 0.9

Author(s)

Mehmet Suzen

TV1 *1-D total variation of a vector.*

Description

1-D total variation of a vector.

Usage

```
TV1(x)
```

Arguments

x	A vector.

Author(s)

Mehmet Suzen

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