

Package ‘FuzzyM’

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Type Package

Title Fuzzy Cognitive Maps Operations

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Description Contains functions for operations with fuzzy cognitive maps using t-norm and s-norm operators. T-norms and S-norms are described by Dov M. Gabbay and George Metcalfe (2007) <doi:10.1007/s00153-007-0047-1>. System indicators are described by Cox, Earl D. (1995) <isbn:1886801010>. Executable examples are provided in the ``inst/examples" folder.

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maxtix_tranz	<i>matrix_tranz</i>
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Description

The maxtix_tranz set of functions is aimed to calculate dissonance, consonance and influence

Usage

```

tnorm_functions

snorm_functions

snorm_functions_reverse

tnorm_functions_reverse

positive_matrix_calc(initmatrix)

transitive_closure(
  positivematrix,
  tnorm,
  snorm,
  snormMatrix,
  gammaTnormMean,
  algaTnorm,
  gammaTnorm,
  piTnorm,
  gammaSnorm,
  piSnorm
)

matrix_transitive_join(matrix, snorm, gammaSnorm, piSnorm)

consonanse_dissonanse(finalmatrix)

cross_consonanse(finalmatrix)

cross_dissonanse(finalmatrix)

cross_positive_influence(finalmatrix)

cross_negative_influence(finalmatrix)

impuls_vector(vector, matrix)

multiply_vector(matrix, vector)

```

```
multiply_matrix(  
  matrix_1,  
  matrix_2,  
  tnorm,  
  snorm,  
  gammaTnormMean,  
  algaTnorm,  
  gammaTnorm,  
  piTnorm,  
  gammaSnorm,  
  piSnorm  
)  
  
maximum_matrix(matrix_1, matrix_2)  
  
ik_pos_maximum(matrix, initMatrix, ipath, jpath)  
  
ik_neg_maximum(matrix, initMatrix, ipath, jpath)  
  
reverse_task(  
  df_matrix,  
  vectorY,  
  tnorm,  
  tnorm_reverse,  
  snorm,  
  snormMatrix,  
  snorm_reverse  
)  
  
direct_task(df_matrix, vectorX, tnorm, snorm, snormMatrix)
```

Arguments

initmatrix	matrix
positivematrix	matrix
tnorm	function
snorm	function
snormMatrix	function
gammaTnormMean	function
algaTnorm	function
gammaTnorm	function
piTnorm	function
gammaSnorm	function
piSnorm	function
matrix	matrix

finalmatrix	matrix
vector	matrix
matrix_1	matrix
matrix_2	matrix
initMatrix	matrix
ipath	vector
jpath	vector
df_matrix	matrix
vectorY	vector
tnorm_reverse	function
snorm_reverse	function
vectorX	vector

Value

eigen values of initmatrix
 positive matrix of initmatrix
 transitive closure of positivematrix
 aggregation function for transitive closure of matrix
 system indicators of finalmatrix
 cross consonance of finalmatrix
 cross dissonance of finalmatrix
 cross positive influence of finalmatrix
 cross negative influence of finalmatrix
 impulse of matrix based on vector
 multiplication of matrix and vector
 multiplication of matrix_1 and matrix_2
 maximum of matrix_1 and matrix_2
 ik walk for matrix based on initMatrix with ipath and jpath
 ik negative walk for matrix based on initMatrix with ipath and jpath
 reverse task solution for df_matrix with vectorY using tnorm, tnorm_reverse, snorm, snormMatrix, snorm_reverse
 direct task solution for df_matrix with vectorX using tnorm, snorm, snormMatrix

 maxtix_tranz_probability

FCM package with functions for matrix probability calculations

Description

The maxtix_tranz_probability set of functions is aimed to calculate maximum matrix based on transitive closure

Usage

```
multiply_matrix_prob(matrix_1, matrix_2)

transitive_closure_prob(positivematrix)

transitive_closure_prob_max(positivematrix)

probability_matrix_transitive(maxmatrix)
```

Arguments

matrix_1	matrix
matrix_2	matrix
positivematrix	matrix
maxmatrix	matrix

Value

multiplication of matrix matrix_1 and matrix_2
 transitive closure of matrix positivematrix
 transitive closure of matrix positivematrix with max function
 joined transitive closure of matrix maxmatrix

 polinomial_eq_dominant

FCM package with functions for matrix manipulations

Description

polinomial_eq_dominant set contains 1 function: reverse task calculation. Each function takes a matrix, vector and t-norm as arguments and returns a solution matrix. The calculation procedure of the function includes a solution existence check and a solution check.

Usage

```
calc_reverse_task(matrix, vector, tnorm, tnorm_reverse, snorm, snorm_reverse)
```

Arguments

matrix	matrix
vector	vector
tnorm	function
tnorm_reverse	function
snorm	function
snorm_reverse	function

Value

solution of polynomial equation of matrix matrix, vector using tnorm, tnorm_reverse, snorm, snorm_reverse

s_norm	<i>s_norm</i>
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Description

s_norm set of functions is aimed to calculate drastic, einstein, algebraic, hamacher products, min and bounded difference S-norms

Usage

```
drastic_sum_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
bounded_sum_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
einstein_sum_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
algebraic_sum_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
hamacher_sum_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
max_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
hamacher_union_operator_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
yager_union_operator_snorm(element1, element2, gammaSnorm, piSnorm)
```

```
snorm_functions
```

```
get_snorm(typeSnorm)
```

Arguments

element1, element2
 paramater
 gammaSnorm, piSnorm, typeSnorm
 norm

Format

An object of class list of length 8.

s_norm_reverse	<i>FCM package with functions for reverse S-norms calculations</i>
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Description

s_norm_reverse set of functions is aimed to calculate drastic, einstein, algebraic, hamacher products, min and bounded difference reverse S-norms

Usage

```
drastic_sum_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
bounded_sum_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
einstein_sum_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
algebraic_sum_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
hamacher_sum_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
max_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
hamacher_union_operator_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
yager_union_operator_snorm_reverse(element1, element2, gammaSnorm, piSnorm)
snorm_functions_reverse
get_snorm_reverse(typeSnorm)
```

Arguments

element1, element2
 paramater
 gammaSnorm, piSnorm, typeSnorm
 norm

Format

An object of class list of length 8.

<i>t_norm</i>	<i>t_norm</i>
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Description

t_norm set of functions is aimed to calculate drastic, einstein, algebraic, hamacher products, min and bounded difference T-norms

Usage

```
min_tnorm(element1, element2, gammaTnormMean, algaTnorm, gammaTnorm, piTnorm)
```

```
hamacher_product_tnorm(
  element1,
  element2,
  gammaTnormMean,
  algaTnorm,
  gammaTnorm,
  piTnorm
)
```

```
algebraic_product_tnorm(
  element1,
  element2,
  gammaTnormMean,
  algaTnorm,
  gammaTnorm,
  piTnorm
)
```

```
einstein_product_tnorm(
  element1,
  element2,
  gammaTnormMean,
  algaTnorm,
  gammaTnorm,
  piTnorm
)
```

```
bounded_difference_tnorm(
  element1,
  element2,
  gammaTnormMean,
  algaTnorm,
```



```
    gammaTnorm,  
    piTnorm  
  )  
  
  drastic_product_tnorm(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  parameterized_mean_intersection_operator_tnorm(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  dubois_intersection_operator_tnorm(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  hamacher_intersection_operator_tnorm(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  yager_intersection_operator_tnorm(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )
```

```
tnorm_functions
get_tnorm(typeTnorm)
```

Arguments

```
element1, element2
                paramater
gammaTnormMean, algaTnorm, gammaTnorm, piTnorm, typeTnorm
                norm
```

Format

An object of class list of length 10.

<i>t_norm_reverse</i>	<i>t_norm_reverse</i>
-----------------------	-----------------------

Description

t_norm_reverse set of functions is aimed to calculate drastic, einstein, algebraic, hamacher products, min and bounded difference reverse T-norms

Usage

```
min_tnorm_reverse(
  element1,
  element2,
  gammaTnormMean,
  algaTnorm,
  gammaTnorm,
  piTnorm
)

hamacher_product_tnorm_reverse(
  element1,
  element2,
  gammaTnormMean,
  algaTnorm,
  gammaTnorm,
  piTnorm
)

algebraic_product_tnorm_reverse(
  element1,
  element2,
```

```
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  einstein_product_tnorm_reverse(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  bounded_difference_tnorm_reverse(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  drastic_product_tnorm_reverse(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  parameterized_mean_intersection_operator_tnorm_reverse(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,  
    piTnorm  
  )  
  
  dubois_intersection_operator_tnorm_reverse(  
    element1,  
    element2,  
    gammaTnormMean,  
    algaTnorm,  
    gammaTnorm,
```

```
    piTnorm
  )

  hamacher_intersection_operator_tnorm_reverse(
    element1,
    element2,
    gammaTnormMean,
    algaTnorm,
    gammaTnorm,
    piTnorm
  )

  yager_intersection_operator_tnorm_reverse(
    element1,
    element2,
    gammaTnormMean,
    algaTnorm,
    gammaTnorm,
    piTnorm
  )

  tnorm_functions_reverse

  get_tnorm_reverse(typeTnorm)
```

Arguments

```
  element1, element2
                paramater
  gammaTnormMean, algaTnorm, gammaTnorm, piTnorm, typeTnorm
                norm
```

Format

An object of class list of length 10.

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