

Package ‘membershipfunction’

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Type Package

Title Membership Fuzzy Functions classes

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Description Diferente Membership Fuzzy Functions classes are modeled.
MembershipFunction is the ancestral virtual S4 class with the heirs BellMF,GaussianMF and NormalizedGaussianMF.

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Depends methods

Collate ‘MembershipFunction.R’ ‘MembershipFunction-getset.R’ ‘MembershipFunction-print.R’ ‘MembershipFunction-show.R’ ‘BellMF.R’ ‘GaussianMF.R’ ‘NormalizedGaussianMF.R’ ‘MembershipFunction-derivateMF.R’ ‘MembershipFunction-evaluateMF.R’

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 BellMF-class

Bell Membership Function S4 class

Description

Represent a concrete Bell shaped Membership Function S4 class with parameters a, b, c. Slots inherited of MembershipFunction class and related functions (show, print, derivateMF, evaluateMF, [and [<-).

Details

parameters named numeric vector with parameters of Membership Function

nParameters integer with the number of parameters for validity check

name character with the description of the membership funtion

expression expression object just to display purpouses

Note

derivateMF, evaluateMF are extended. Prototype is defined and validityis inherited.

See Also

[GaussianMF-class](#) and [NormalizedGaussianMF-class](#)

Examples

```
#BellMF example I
bell <- new(Class="BellMF")#A bell membership function with default prototype (a=1, b=1,c=0)
bell
evaluateMF(object=bell, x=0)#The membership of x in the bell, should be 1
derivateMF(object=bell, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=bell, x=0, i="a")#The derivate of the first parameter at x, should be also 0
#BellMF example II
bell2 <- new(Class="BellMF",parameters=c(a=4,b=1,c=-10))#A bell membership function with parameters (a=4,b=1,c=-10)
bell2
evaluateMF(object=bell2, x=0)#The membership of x in the bell, should be 0.137931
derivateMF(object=bell2, x=0, i=1)#The derivate of the first parameter at x, should be 0.05945303
derivateMF(object=bell2, x=0, i="a")#The derivate on "a" at x=0, should be 0.05945303
```

derivateMF	derivateMF <i>derivate membership function</i>
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Description

Derivate de membership of x with respect to i of MembershipFunction object heirs.

Usage

```
## S4 method for signature 'MembershipFunction'
derivateMF(object, x, i)

## S4 method for signature 'BellMF'
derivateMF(object, x, i)

## S4 method for signature 'GaussianMF'
derivateMF(object, x, i)

## S4 method for signature 'NormalizedGaussianMF'
derivateMF(object, x, i)
```

Arguments

object	MembershipFunction class heirs
x	numeric of the MembershipFunction to be evaluated
i	index of the ith parameter to partially derivate

Value

numeric with the value obtained from the ith derivative at x

See Also

[MembershipFunction-class](#) and [evaluateMF](#)

Examples

```
#BellMF example I
bell <- new(Class="BellMF")#A bell membership function with default prototype (a=1, b=1,c=0)
bell
evaluateMF(object=bell, x=0)#The membership of x in the bell, should be 1
derivateMF(object=bell, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=bell, x=0, i="a")#The derivate of the first parameter at x, should be also 0
#BellMF example II
bell2 <- new(Class="BellMF",parameters=c(a=4,b=1,c=-10))#A bell membership function with parameters (a=4,b=1,c=-10)
bell2
evaluateMF(object=bell2, x=0)#The membership of x in the bell, should be 0.137931
derivateMF(object=bell2, x=0, i=1)#The derivate of the first parameter at x, should be 0.05945303
```

```

derivateMF(object=bell2, x=0, i="a")#The derivate on "a" at x=0, should be 0.05945303
#GaussianMF example I
gaussian <- new(Class="GaussianMF")#A gaussian membership function with default prototype (mu=0, sigma=1)
gaussian
evaluateMF(object=gaussian, x=0)#The membership of x in the gaussian, should be 1/sqrt(2*pi) = 0.3989423
derivateMF(object=gaussian, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=gaussian, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#GaussianMF example II
gaussian2 <- new(Class="GaussianMF",parameters=c(mu=0,sigma=1))#A gaussian membership function with paramateres (
gaussian2
evaluateMF(object=gaussian2, x=0)#The membership of x in the gaussian, should be 1/sqrt(2*pi) = 0.3989423
derivateMF(object=gaussian2, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=gaussian2, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#NormalizedGaussianMF example I
normalizedGaussian <- new(Class="NormalizedGaussianMF")#A normalized gaussian membership function with default pa
normalizedGaussian
evaluateMF(object=normalizedGaussian, x=0)#The derivate of the first parameter at x, should be 1
derivateMF(object=normalizedGaussian, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=normalizedGaussian, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#NormalizedGaussianMF example II
normalizedGaussian2 <- new(Class="NormalizedGaussianMF",parameters=c(mu=0,sigma=1))#A normalized gaussian member
normalizedGaussian2
evaluateMF(object=normalizedGaussian2, x=0)#The derivate of the first parameter at x, should be 1
derivateMF(object=normalizedGaussian2, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=normalizedGaussian2, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0

```

evaluateMF

evaluateMF *evaluate membership*

Description

Evaluate de membership of x to the object MembershipFunction hiers.

Usage

```
## S4 method for signature 'MembershipFunction'
evaluateMF(object, x)
```

```
## S4 method for signature 'BellMF'
evaluateMF(object, x)
```

```
## S4 method for signature 'GaussianMF'
evaluateMF(object, x)
```

```
## S4 method for signature 'NormalizedGaussianMF'
evaluateMF(object, x)
```

Arguments

object	MembershipFunction class heirs
x	numeric of the MembershipFunction to be evaluated

Value

0 <= numeric <=1 with the obtained membership value

See Also

[MembershipFunction-class](#) and [derivateMF](#)

Examples

```
#BellMF example I
bell <- new(Class="BellMF")#A bell membership function with default prototype (a=1, b=1,c=0)
bell
evaluateMF(object=bell, x=0)#The membership of x in the bell, should be 1
derivateMF(object=bell, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=bell, x=0, i="a")#The derivate of the first parameter at x, should be also 0
#BellMF example II
bell2 <- new(Class="BellMF",parameters=c(a=4,b=1,c=-10))#A bell membership function with parameters (a=4,b=1,c=-10)
bell2
evaluateMF(object=bell2, x=0)#The membership of x in the bell, should be 0.137931
derivateMF(object=bell2, x=0, i=1)#The derivate of the first parameter at x, should be 0.05945303
derivateMF(object=bell2, x=0, i="a")#The derivate on "a" at x=0, should be 0.05945303
#GaussianMF example I
gaussian <- new(Class="GaussianMF")#A gaussian membership function with default prototype (mu=0, sigma=1)
gaussian
evaluateMF(object=gaussian, x=0)#The membership of x in the gaussian, should be 1/sqrt(2*pi) = 0.3989423
derivateMF(object=gaussian, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=gaussian, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#GaussianMF example II
gaussian2 <- new(Class="GaussianMF",parameters=c(mu=0,sigma=1))#A gaussian membership function with paramateres (mu=0,sigma=1)
gaussian2
evaluateMF(object=gaussian2, x=0)#The membership of x in the gaussian, should be 1/sqrt(2*pi) = 0.3989423
derivateMF(object=gaussian2, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=gaussian2, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#NormalizedGaussianMF example I
normalizedGaussian <- new(Class="NormalizedGaussianMF")#A normalized gaussian membership function with default prototype (mu=0, sigma=1)
normalizedGaussian
evaluateMF(object=normalizedGaussian, x=0)#The derivate of the first parameter at x, should be 1
derivateMF(object=normalizedGaussian, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=normalizedGaussian, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#NormalizedGaussianMF example II
normalizedGaussian2 <- new(Class="NormalizedGaussianMF",parameters=c(mu=0,sigma=1))#A normalized gaussian membership function with paramateres (mu=0,sigma=1)
normalizedGaussian2
evaluateMF(object=normalizedGaussian2, x=0)#The derivate of the first parameter at x, should be 1
derivateMF(object=normalizedGaussian2, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=normalizedGaussian2, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
```

extract-methods	<i>Modify membership function parameters</i>
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Description

Get/set membership function parameters. Usage: object[i] or object[i]<- value

Arguments

object	MembershipFunction class heirs
i	numeric or character to access parameters vector [i]
value	numeric parameter/s values
drop	For matrices and arrays. If TRUE the result is coerced to the lowest possible dimension (see the examples). This only works for extracting elements, not for the replacement. See drop for further details.

Value

numeric	parameter/s in the case of object[i]
object	MembershipFunction object in the case of object[i]<- value

See Also

[MembershipFunction-class](#)

GaussianMF-class	<i>GaussianMF Membership Function S4 class</i>
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Description

Represent a concrete GaussianMF shaped Membership Function S4 class with parameters mu, sigma. Slots inherited of MembershipFunction class and related functions (show, print, derivateMF, evaluateMF, [and [<-).

Details

parameters named numeric vector with parameters of Membership Function
nParameters integer with the number of parameters for validity check
name character with the description of the membership function
expression expression object just to display purposes

Note

derivateMF, evaluateMF are extended. Prototype is defined and validity is inherited.

See Also

[BellMF-class](#) and [NormalizedGaussianMF-class](#)

Examples

```
#GaussianMF example I
gaussian <- new(Class="GaussianMF")#A gaussian membership function with default prototype (mu=0, sigma=1)
gaussian
evaluateMF(object=gaussian, x=0)#The membership of x in the gaussian, should be 1/sqrt(2*pi) = 0.3989423
derivateMF(object=gaussian, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=gaussian, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#GaussianMF example II
gaussian2 <- new(Class="GaussianMF",parameters=c(mu=0,sigma=1))#A gaussian membership function with paramateres (
gaussian2
evaluateMF(object=gaussian2, x=0)#The membership of x in the gaussian, should be 1/sqrt(2*pi) = 0.3989423
derivateMF(object=gaussian2, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=gaussian2, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
```

MembershipFunction-class

MembershipFunction S4 class

Description

Represent a generic virtual S4 MembershipFunction class, for fuzzy further redefinition. The actual subclasses availables are GaussianMF, NormalizedGaussianMF, BellMF

Details

parameters named numeric vector with parameters of Membership Function

nParameters integer with the number of parameters for validity check

name character with the description of the membership funtion

expression expression object just to display purpouses

Note

validity: nParameters == length(parameters) and parameters != NA and names(parameters)!="".
 show/print: generic output of the object. "[", "[<-": getter and setter of the parameters values.
 evaluateMF: return membership value at x. derivateMF: return the derivate membership at x.

See Also

[BellMF-class](#), [GaussianMF-class](#) or [NormalizedGaussianMF-class](#)

NormalizedGaussianMF-class

NormalizedGaussianMF Membership Function S4 class

Description

Represent a concrete NormalizedGaussianMF shaped [0,1] Membership Function S4 class with parameters mu, sigma. Slots inherited of MembershipFunction class and related functions (show, print, derivateMF, evaluateMF, [and [<-).

Details

parameters named numeric vector with parameters of Membership Function

nParameters integer with the number of parameters for validity check

name character with the description of the membership funtion

expression expression object just to display purpouses

Note

derivateMF, evaluateMF are extended. Prototype is defined and validityis inherited.

See Also

[BellMF-class](#) and [GaussianMF-class](#)

Examples

```
#NormalizedGaussianMF example I
normalizedGaussian <- new(Class="NormalizedGaussianMF")#A normalized gaussian membership function with default pa
normalizedGaussian
evaluateMF(object=normalizedGaussian, x=0)#The derivate of the first parameter at x, should be 1
derivateMF(object=normalizedGaussian, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=normalizedGaussian, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
#NormalizedGaussianMF example II
normalizedGaussian2 <- new(Class="NormalizedGaussianMF",parameters=c(mu=0,sigma=1))#A normalized gaussian member
normalizedGaussian2
evaluateMF(object=normalizedGaussian2, x=0)#The derivate of the first parameter at x, should be 1
derivateMF(object=normalizedGaussian2, x=0, i=1)#The derivate of the first parameter at x, should be 0
derivateMF(object=normalizedGaussian2, x=0, i="mu")#The derivate on "mu" parameter at x, should be 0
```

<code>print,MembershipFunction-method</code>
<i>Print a MembershipFunction object</i>

Description

Generic Print Method for MembershipFunction class and descendants. Usage: `print(x, ...)`

Arguments

- `x` MembershipFunction class object
- `...` not used but included for generic print comparitibility

Value

console output of the object

See Also

[MembershipFunction-class](#)

<code>show,MembershipFunction-method</code>
<i>Show a MembershipFunction object</i>

Description

Generic display method for MembershipFunction class and its descendants. Usage: `show(object)`

Arguments

- `object` MembershipFunction class object

Value

console output of the object

See Also

[MembershipFunction-class](#)

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